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8/23/72



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

***COMMAND/SERVICE
MODULE
SYSTEMS HANDBOOK**

CSM 114 *used on (Apollo 17)*

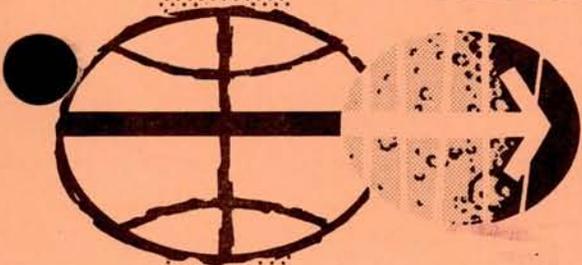
AUGUST 23, 1972

PREPARED BY

FLIGHT CONTROL DIVISION

**MANNED SPACECRAFT CENTER
HOUSTON, TEXAS**

- 1 STANDARDS
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- 5 FUEL CELL/CRYOGENICS SYSTEM
- 6 COMMUNICATIONS SYSTEM
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INDEXING DATA

<u>DATE</u>	<u>OPR</u>	<u>#</u>	<u>T</u>	<u>PGM</u>	<u>SUBJECT</u>	<u>SIGNATOR</u>	<u>LOC</u>
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COMMAND/SERVICE MODULE SYSTEMS HANDBOOK

CSM 114

PREFACE

This document, prepared by the Flight Control Division, NASA, Manned Spacecraft Center, Houston, Texas, with technical support by North American Rockwell (NR) and LTV/Kentron Hawaii, Ltd., reflects the Command/Service Module Systems for S/C 114 and the Lunar Orbit Experiments Systems for Apollo 17 as of August 23, 1972.

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.

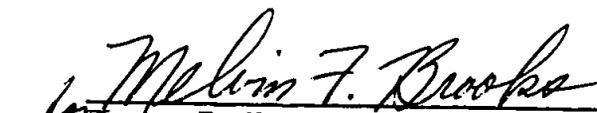
Comments concerning the general contents of this handbook should be directed to FC3/Mr. Fred Whitehead, Jr., NR, Flight Operations Support, 713-483-6206. Comments related to the Lunar Orbits Experiments (Section 12) should be directed to FC9/Mr. Harold M. Draughon, Lunar/Earth Experiments Branch, 713-483-4426.

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Approved by:



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CSM

SYSTEMS HANDBOOK

CSM 114

AUGUST 23, 1972

COMMAND/SERVICE MODULE SYSTEMS HANDBOOK

CSM 114

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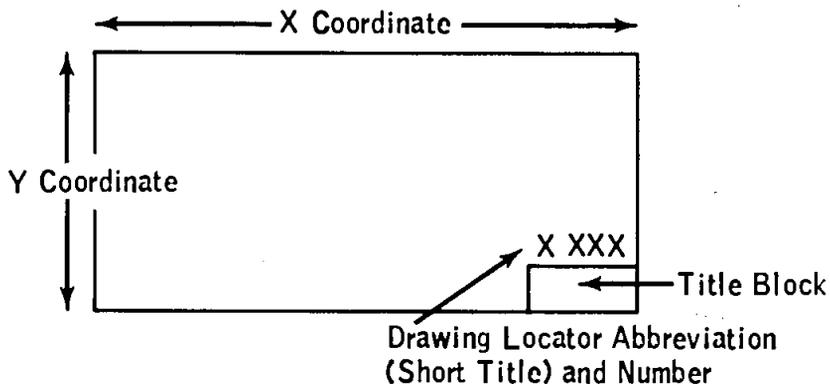
I STANDARDS

STANDARDS

1.1 GENERAL DRAWING INFORMATION

1.1.1 Cross-indexing1.1.1.1 General drawing configuration

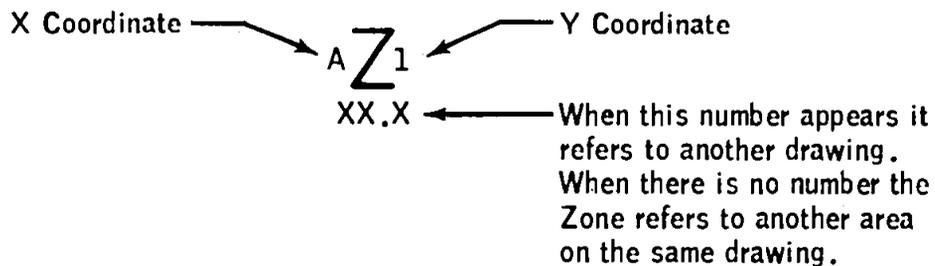
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1.1.1.2 Component location code

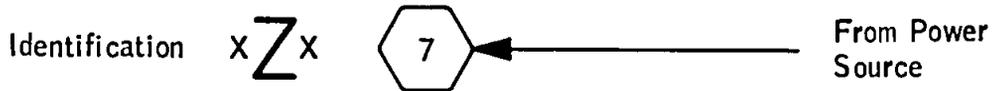
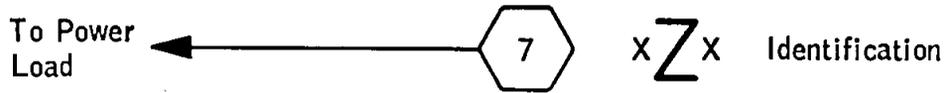
The component location code is used to reference controls (on the control-display figure) and components (on the overview drawing) into the detail system drawings.



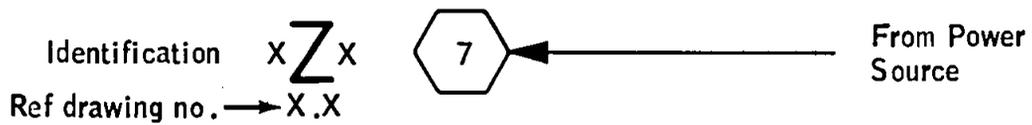
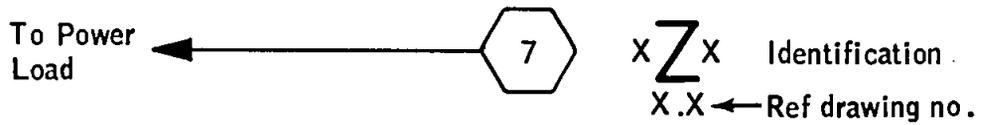
3 - Drawing Locator Number for the given detail subsystem drawing
K - X Coordinate
4 - Y Coordinate

1.1.2 Technical Zone References1.1.2.1 Zone reference

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

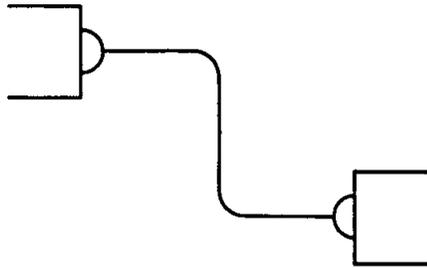


1.1.2.3 Power inter-drawings
(Drawing to drawing)



1.2 LINE LEGEND

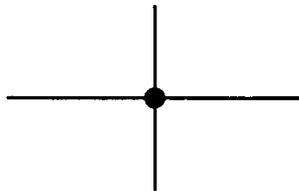
1.2.1 RF Cable



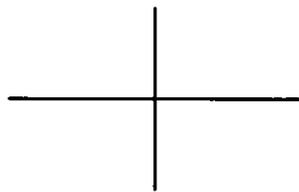
1.2.2 Electrical Line, Power and control



1.2.2.1 Electrical connected



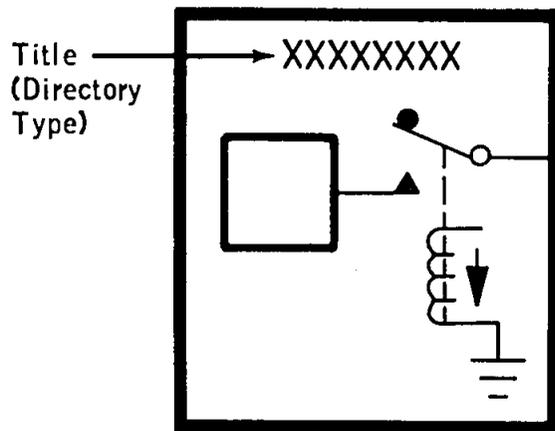
1.2.2.2 Electrical crossover



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



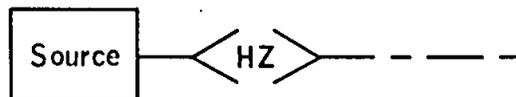
1.2.4.4 Module interface and systems assembly
1/8-inch dashed black line



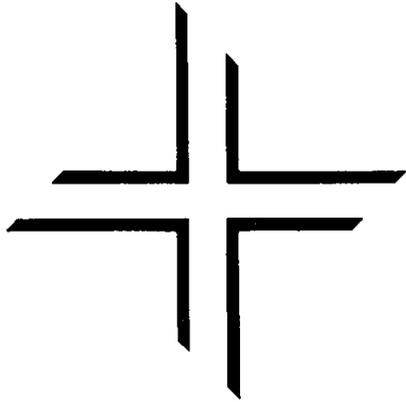
1.2.5 Mechanical Linkage



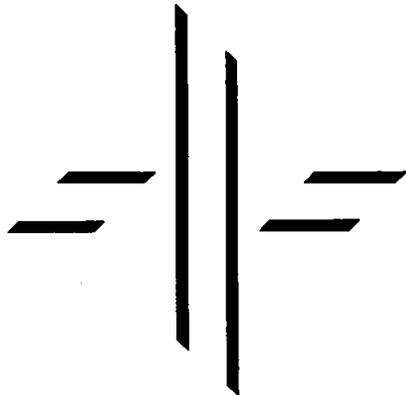
1.2.6 Timing Pulses



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

1.3.2.1 Water



1.3.2.2 Oxygen



1.3.2.3 Nitrogen



1.3.2.4 Helium



1.3.2.5 Primary Coolant



1.3.2.6 Secondary Coolant



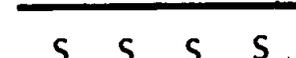
1.3.2.7 Fuel



1.3.2.8 Hydrogen



1.3.2.9 Steam



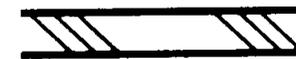
1.3.2.10 Suit Loop



1.3.2.11 Sense Lines



1.3.2.12 Oxidizer

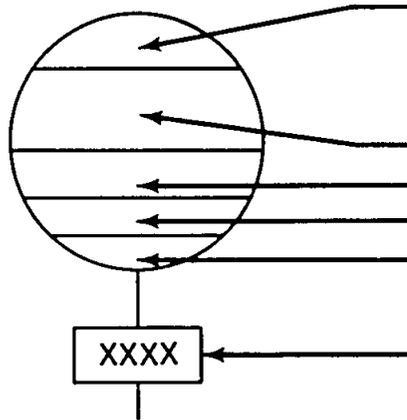


1.3.2.13 Others



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

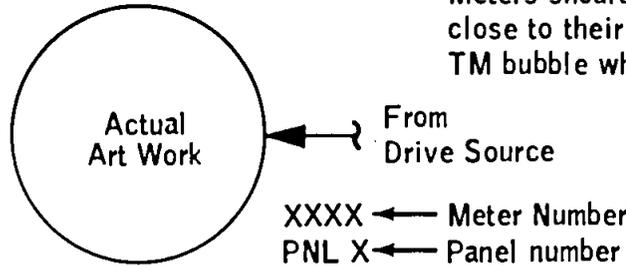
High Bit Sample Rate

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

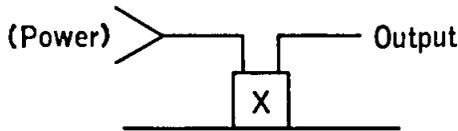
Onboard Meters



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

1.4.3
1.4.3.1

Sensors
Single source

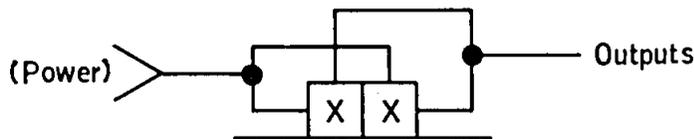


Example: Letter indicates the type:

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

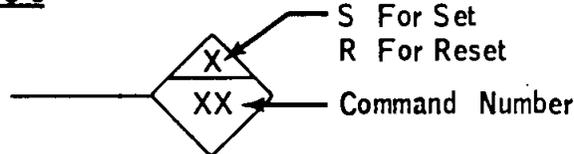
1.4.3.2

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

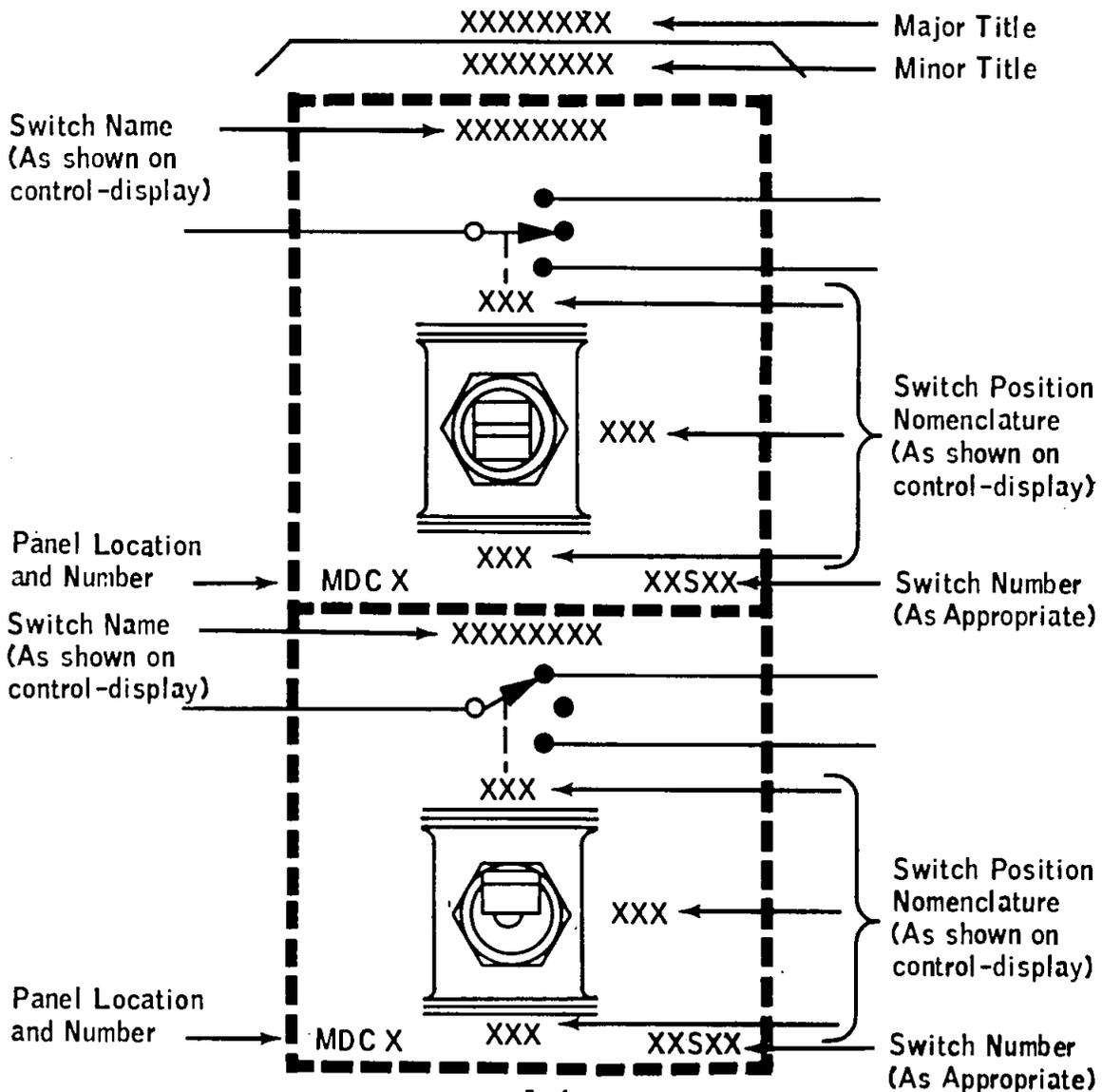
All switches will be shown in the de-energized position (if possible). When a switch has more than one set of contacts, only one set needs to have switch contact nomenclature.

1.5.1.1 Switch nomenclature

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

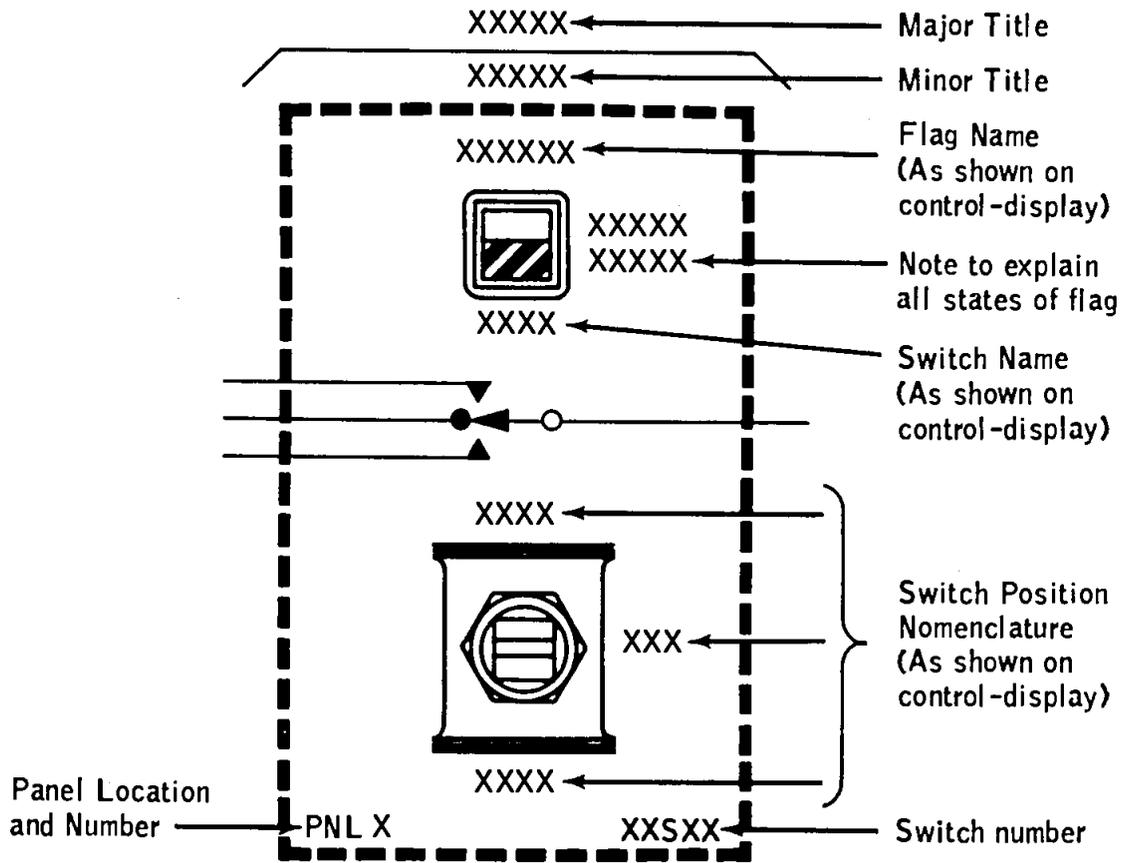
Minor Title: The title given to a sub-group of switches

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

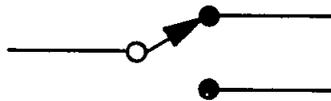


1.5.1.2 Switch controlled flag

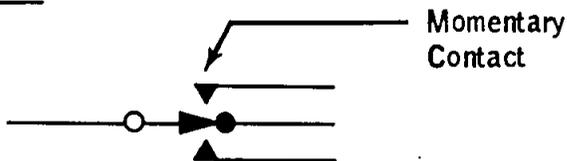
If a flag is directly controlled by a switch, it may be shown in the following manner:



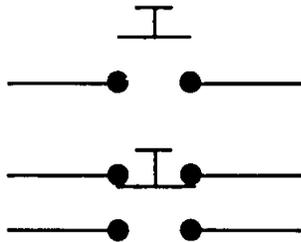
1.5.1.3 Two-position



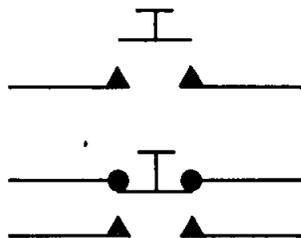
1.5.1.4 Three-position



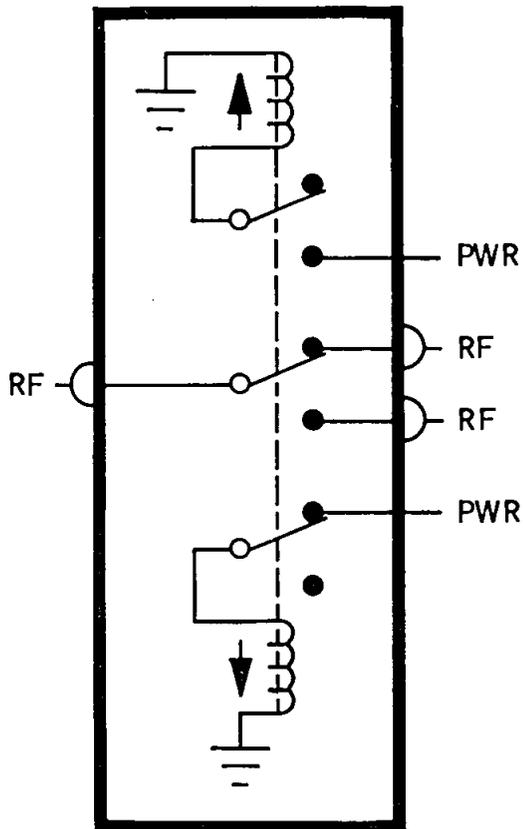
1.5.1.5 Pushbutton
1.5.1.5.1 Latching



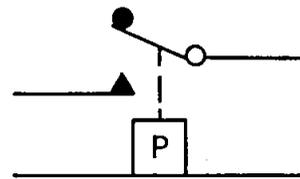
1.5.1.5.2 Momentary



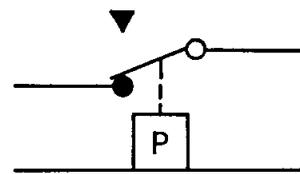
1.5.1.6 Coax



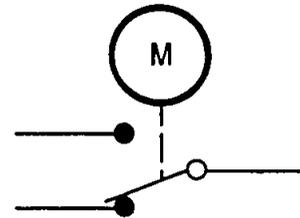
1.5.1.7 Pressure
1.5.1.7.1 Closed decreased pressure



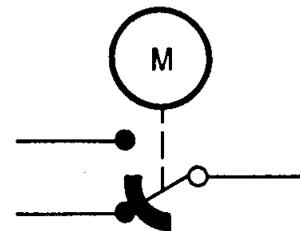
1.5.1.7.2 Closed increased pressure



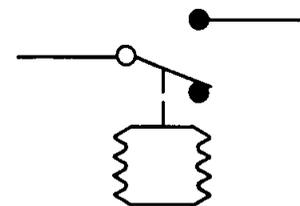
1.5.1.8 Motor
1.5.1.8.1 Break before make



1.5.1.8.2 Make before break



1.5.1.9 Baro

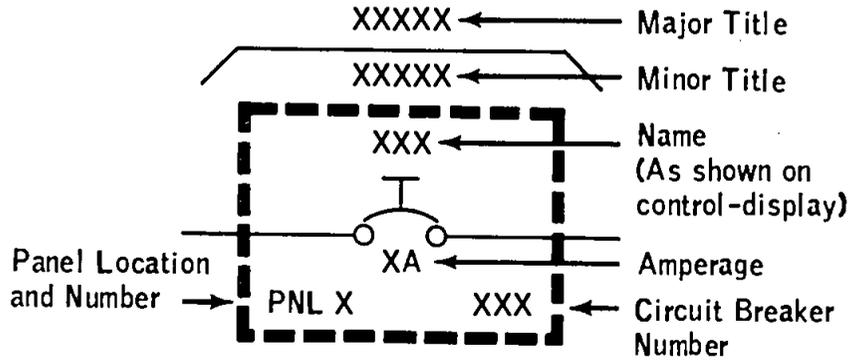


Close XXX psi or altitude
Open XXX psi or altitude

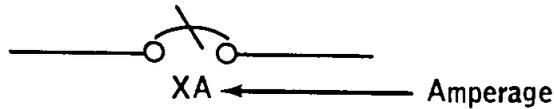
1.5.2 Circuit Breakers

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

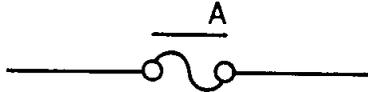


1.5.2.2 Automatic

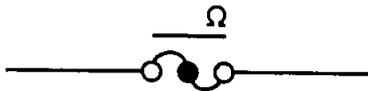


1.5.3 Fuses

1.5.3.1 General

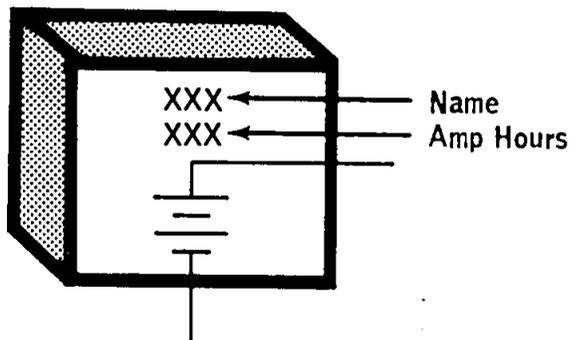


1.5.3.2 Fusistor



1.5.4 Battery

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



1.5.5

Lights

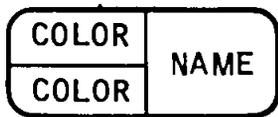
1.5.5.1

Teledights



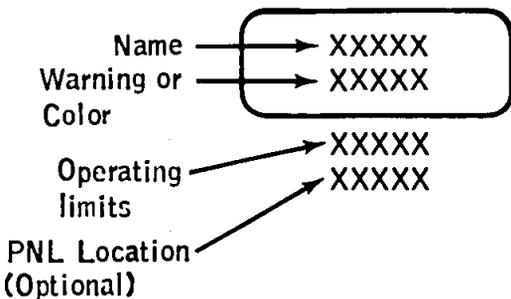
1.5.5.2

Switching



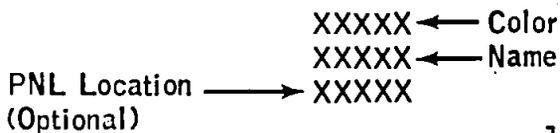
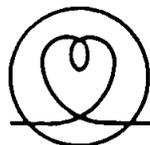
1.5.5.3

Caution and warning



1.5.5.4

Component

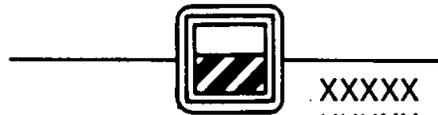


1.5.6

Annunciator Flag

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

XXXX ← Flag Name



Flag Number → XXXXX
Panel Number → XXXXX

XXXXX
XXXXX
XXXXX

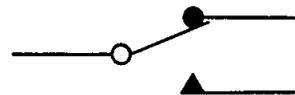
↑
Note to explain all states of flag.

1.5.7

Relays

1.5.7.1

Momentary contact



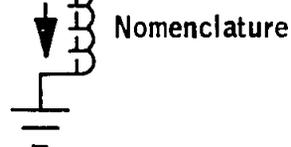
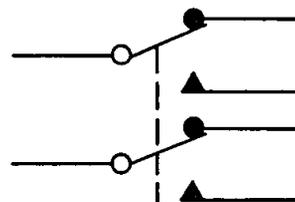
1.5.7.2

Latching contacts



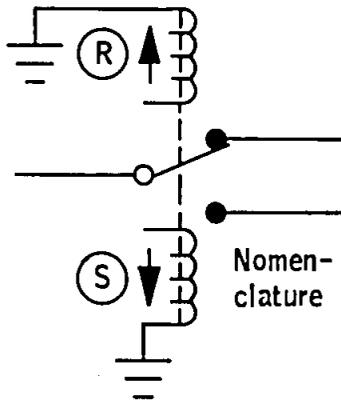
1.5.7.3

Non-Latching relay



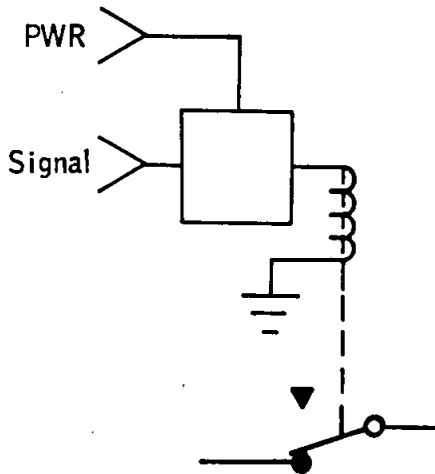
Nomenclature

1.5.7.4 Latching relay

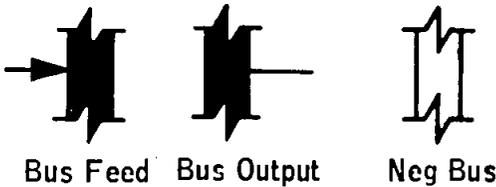


Nomenclature

1.5.8 Relay or Solenoid Driver



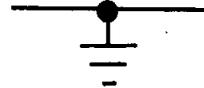
1.5.9
1.5.9.1 Buses Symbol
Length can vary depending on the bus function on a given drawing.



1.5.9.2 Designation
See bus designation list.



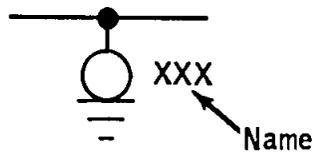
1.5.10
1.5.10.1 Grounds System



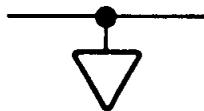
1.5.10.2 Frame



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



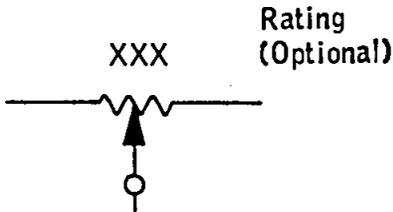
1.5.11.3 Tunnel



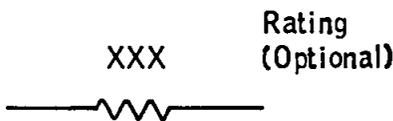
1.5.11.4 Control rectifier (SCR)



1.5.12 Potentiometer



1.5.13 Fixed Resistor



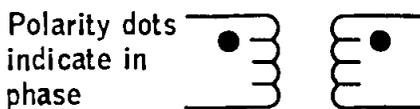
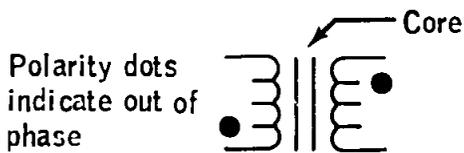
1.5.14 Heater



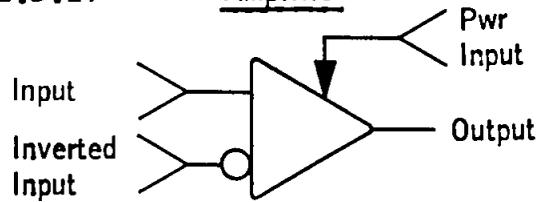
1.5.15 Thermostat



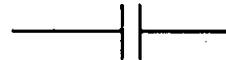
1.5.16 Transformers



1.5.17 Amplifier



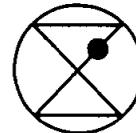
1.5.18 Capacitor



1.5.19 Digital Inverter

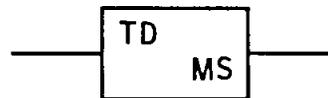


1.5.20 Wire Resolver



- ⊗ = Sine Winding
- = Minus Sine
- = Cosine Winding

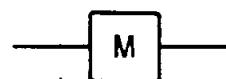
1.5.21 Time Delay



1.5.22 Electrical Filter

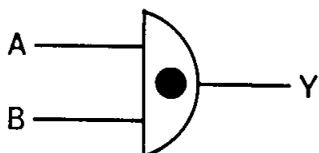


1.5.23 Modulator



1.5.24
1.5.24.1

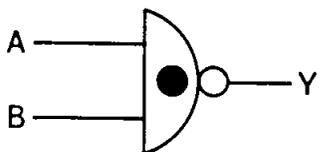
Gates
And



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

1.5.24.2

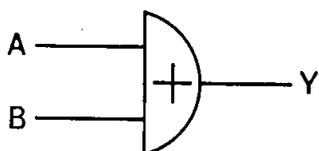
Nand



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

1.5.24.3

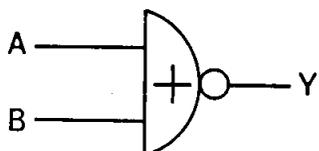
Or



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

1.5.24.4

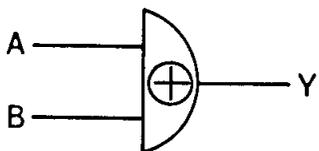
Nor



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

1.5.24.5

Exclusive Or

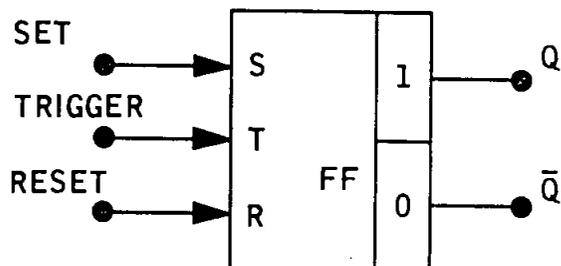


A	B	Y
1	1	0
1	0	1
0	1	1
0	0	0

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

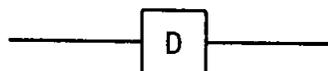
Q and \bar{Q} Change States

R

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

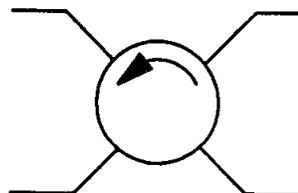
1.5.25

Demodulator

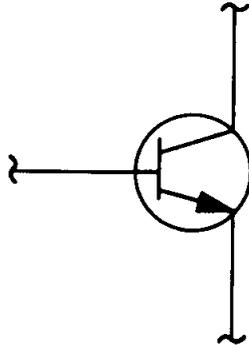


1.5.26

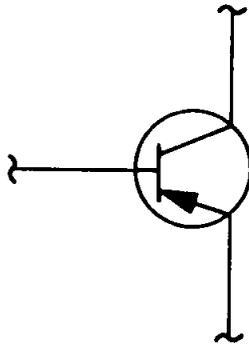
RF Circulator



1.5.27 Transistor
1.5.27.1 NPN

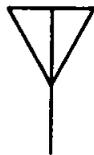


1.5.27.2 PNP

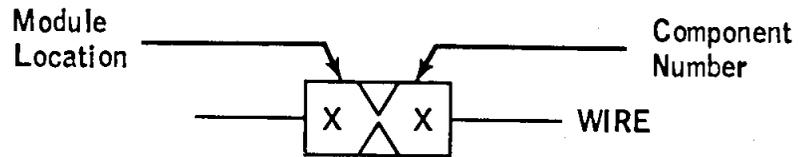


1.5.28 Antenna

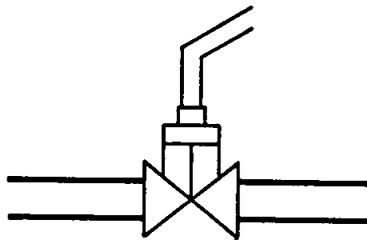
Name
(Type or Function)



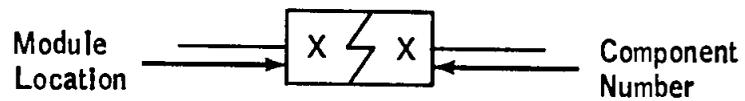
1.6 PYROTECHNIC SYMBOLS
1.6.1 Pyro Guillotine



1.6.2 Pyro Valve with Single Initiator

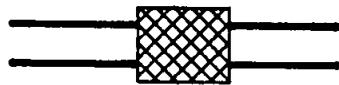


1.6.3 Electrical Circuit Interrupter

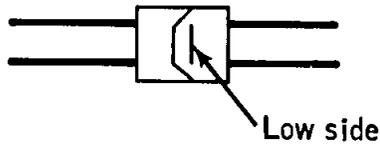


1.7 MECHANICAL SYMBOLS

1.7.1 Mechanical Filter



1.7.2 Burst Diaphragm



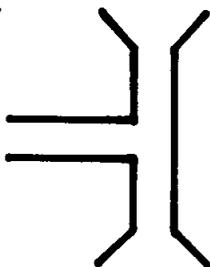
1.7.3 Venturi



1.7.4 Vent



1.7.5 Thrust Neutralized Vent

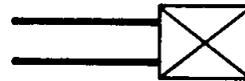


1.7.6 Disconnects

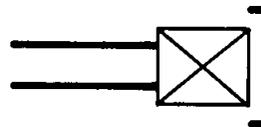
1.7.6.1 Self-sealing



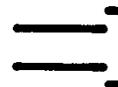
1.7.6.2 Quick



1.7.7 Quick Disconnect Fill and Drain

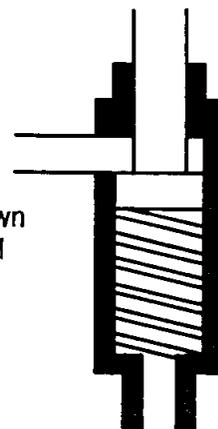


1.7.8 Fill and Drain



1.7.9 Ball Valve Actuator

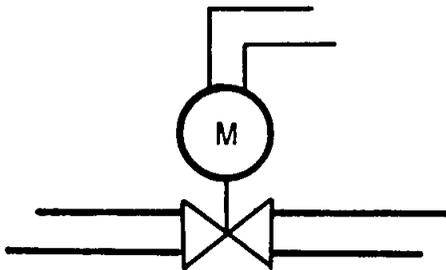
May be shown
in depressed
or partially
depressed
position



1.7.10 Valves



1.7.10.1 Motor Control



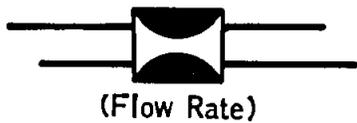
1.7.10.2 Manual Control



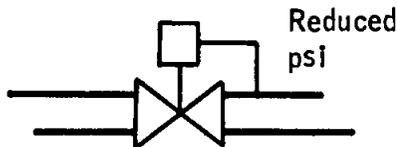
1.7.10.3 Check Valve



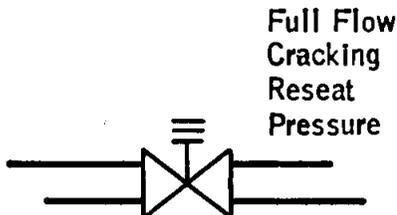
1.7.10.4 Orifice



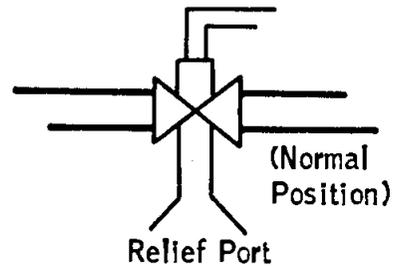
1.7.10.5 Pressure regulator



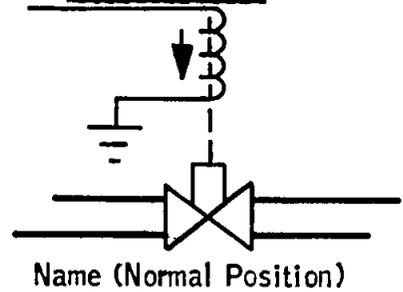
1.7.10.6 Relief Valve



1.7.10.7 Pneumatic controlled valve with line bleed

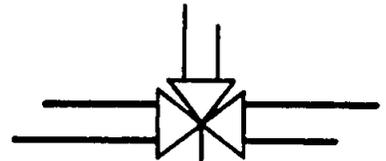


1.7.10.8 Solenoid valve

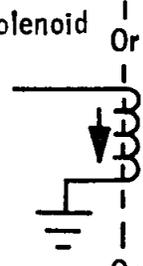


1.7.10.9 Three-way valve

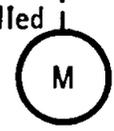
1.7.10.9.1 Manual



1.7.10.9.2 Solenoid



1.7.10.9.3 Motor controlled



1.7.10.10 Ball valve



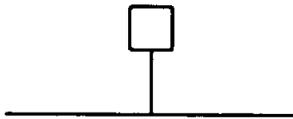
1.8 MISCELLANEOUS SYMBOLS
1.8.1 Drawing Note Reference



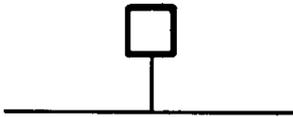
1.8.2 Overview Drawing Instrumentation Legend
1.8.2.1 Automatic control only



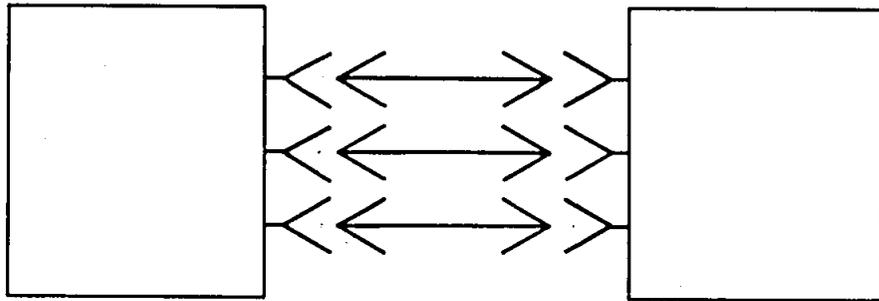
1.8.2.2 PCM only



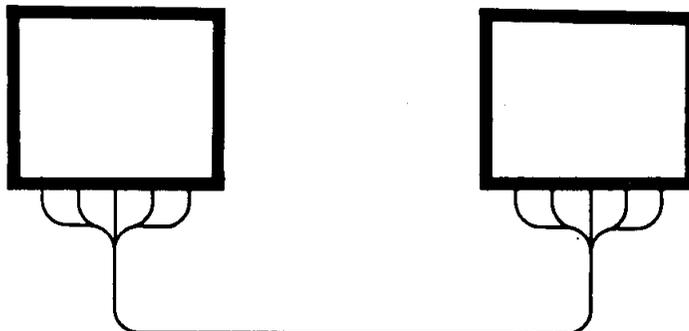
1.8.2.3 PCM and/or onboard display



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

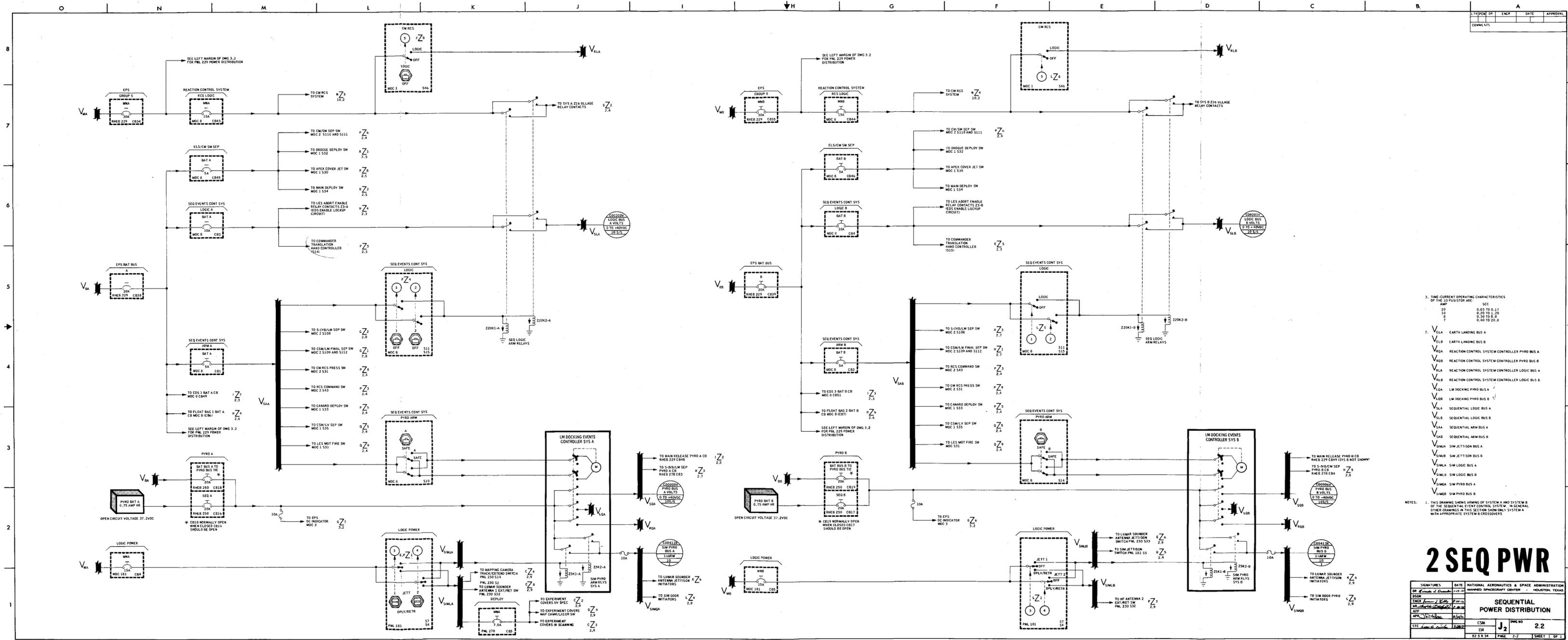
V_{SIMQB} - SIM PYRO BUS B

V_{E1} - EXPERIMENT BUS 1

V_{E2} - EXPERIMENT BUS 2

V_{E3} - EXPERIMENT BUS 3

2 SEQUENTIAL
EVENTS SYSTEM



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

AMP	SEC
25	0.01 TO 0.10
10	0.20 TO 1.00
5	0.50 TO 5.0
2	0.60 TO 20.0

2. VLA EARTH LANDING BUS A
 VLB EARTH LANDING BUS B
 VQA REACTION CONTROL SYSTEM CONTROLLER PYRO BUS A
 VQB REACTION CONTROL SYSTEM CONTROLLER PYRO BUS B
 VRA REACTION CONTROL SYSTEM CONTROLLER LOGIC BUS A
 VRB REACTION CONTROL SYSTEM CONTROLLER LOGIC BUS B
 VSA LM DOCKING PYRO BUS A
 VSB LM DOCKING PYRO BUS B
 VMA SEQUENTIAL LOGIC BUS A
 VMB SEQUENTIAL LOGIC BUS B
 VJA SEQUENTIAL ARM BUS A
 VJB SEQUENTIAL ARM BUS B
 VKA SIM PYRO BUS A
 VKB SIM PYRO BUS B
 VLA SIM LOGIC BUS A
 VLB SIM LOGIC BUS B
 VMA SIM PYRO BUS A
 VMB SIM PYRO BUS B

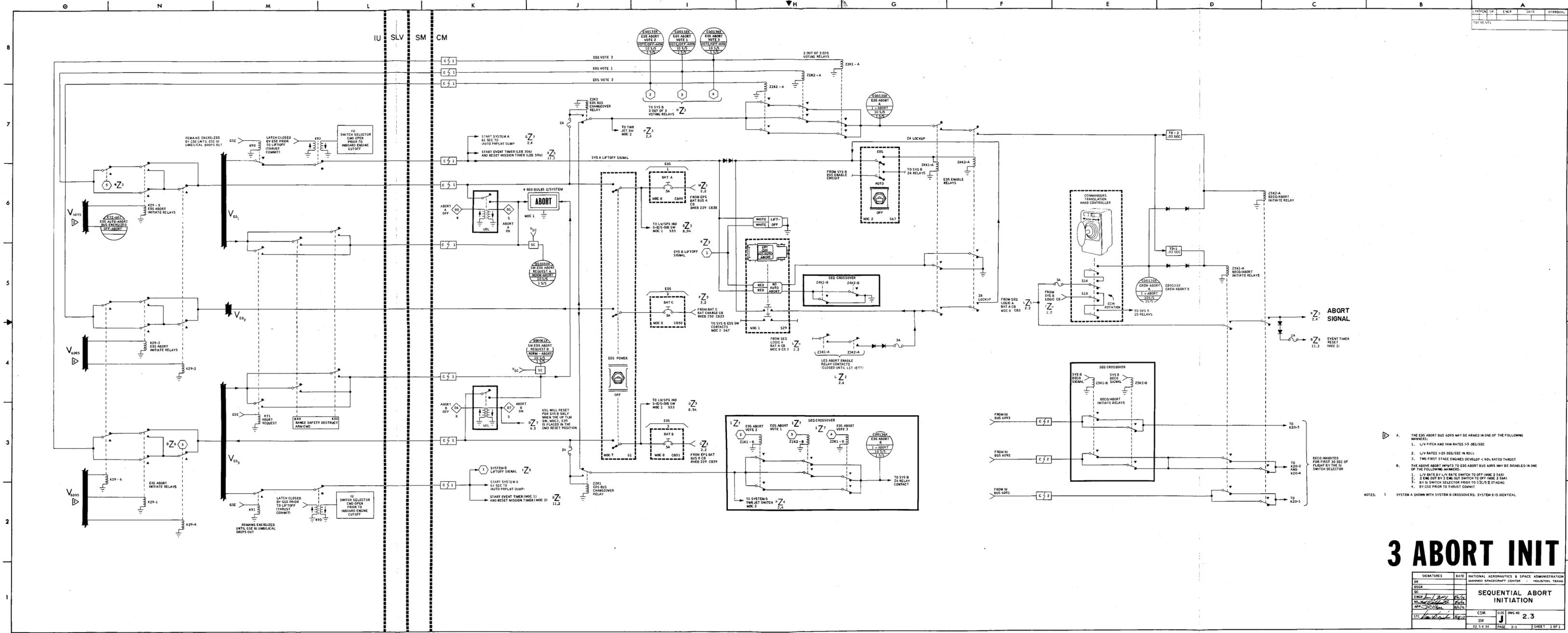
NOTES: 1. THIS DRAWING SHOWS ARMING OF SYSTEM A AND SYSTEM B OF THE SEQUENTIAL EVENT CONTROL SYSTEM. IN GENERAL, OTHER DRAWINGS IN THIS SECTION SHOW ONLY SYSTEM A WITH APPROPRIATE SYSTEM B CROSSOVERS.

2 SEQ PWR

SEQUENTIAL POWER DISTRIBUTION

SIGNATURES	DATE	NATIONAL AERONAUTICS & SPACE ADMINISTRATION
CSM	11M	82-534
DCSR		
ENR		
APP		
STC		

CSM: J2, PWR NO: 2.2, PAGE: 2-3, SHEET: 1 OF 1



3 ABORT INIT

- NOTES:
1. SYSTEM A SHOWN WITH SYSTEM B CROSSOVERS; SYSTEM B IS IDENTICAL
 - A. THE EDS ABORT BUS 6095 MAY BE ARMED IN ONE OF THE FOLLOWING MANNERS:
 1. L/V PITCH AND YAW RATES > 5 DEG/SEC
 2. L/V RATES > 20 DEG/SEC IN ROLL
 3. TWO FIRST STAGE ENGINES DEVELOP < 90% RATED THRUST
 - B. THE ABOVE ABORT INPUTS TO EDS ABORT BUS 6095 MAY BE DISABLED IN ONE OF THE FOLLOWING MANNERS:
 1. L/V RATE BY L/V RATE SWITCH TO OFF (MDC 2 545)
 2. ENG OUT BY 2 ENG OUT SWITCH TO OFF (MDC 2 544)
 3. BY A SWITCH SELECTOR PRIOR TO 3 SEC'S OF ARMING
 4. BY CSE PRIOR TO THRUST COMMIT

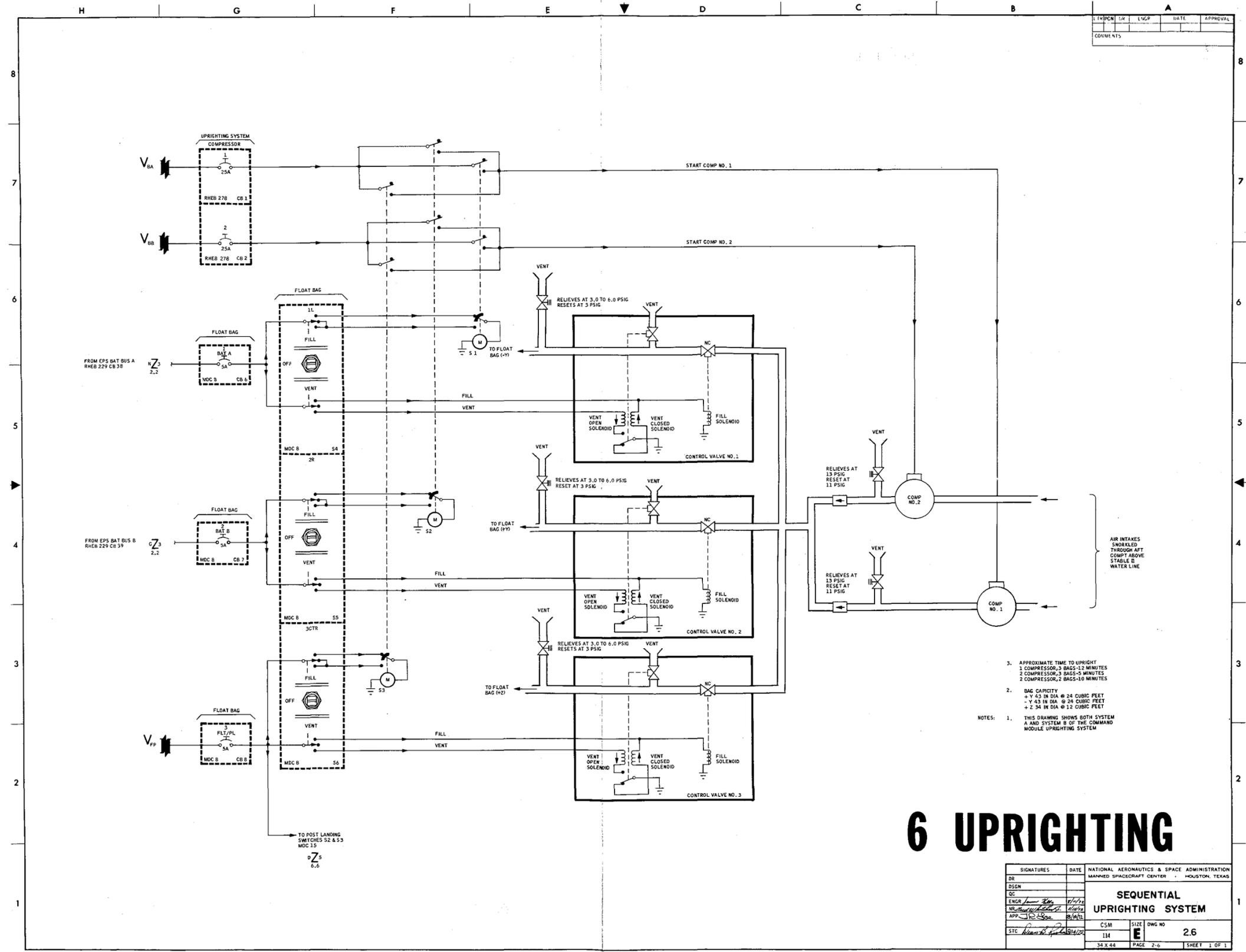
SIGNATURES	DATE	NATIONAL AERONAUTICS & SPACE ADMINISTRATION
DR		MANNED SPACECRAFT CENTER - HOUSTON, TEXAS
DESIGN		
ENGINEER		
TESTER		
QC		
STC		

SEQUENTIAL ABORT INITIATION

CSM SIZE DWS NO 2.3

114 J

02-5334 PAGE 2-3 SHEET 1 OF 1



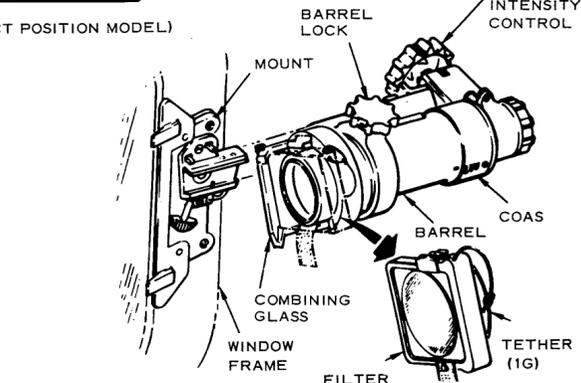
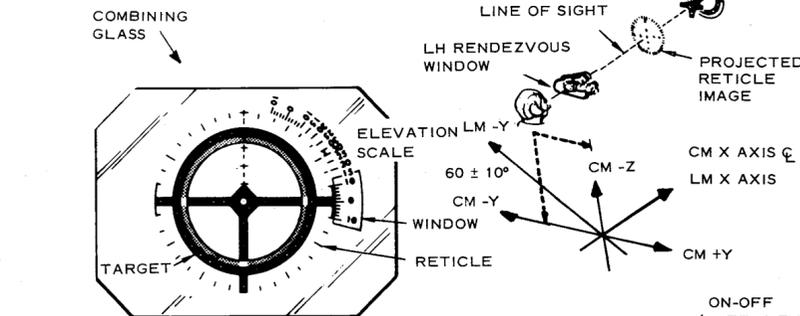
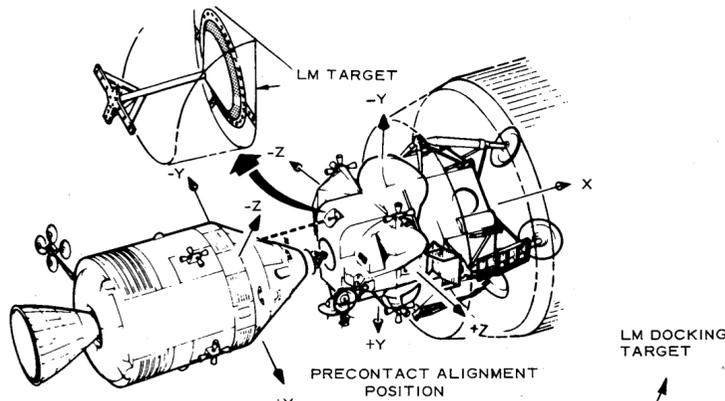
REV	DATE	APPROVAL

- NOTES:
1. THIS DRAWING SHOWS BOTH SYSTEM A AND SYSTEM B OF THE COMMAND MODULE UPRIGHTING SYSTEM
 2. BAG CAPACITY
 - Y 43 IN DIA @ 24 CUBIC FEET
 - Z 36 IN DIA @ 15 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

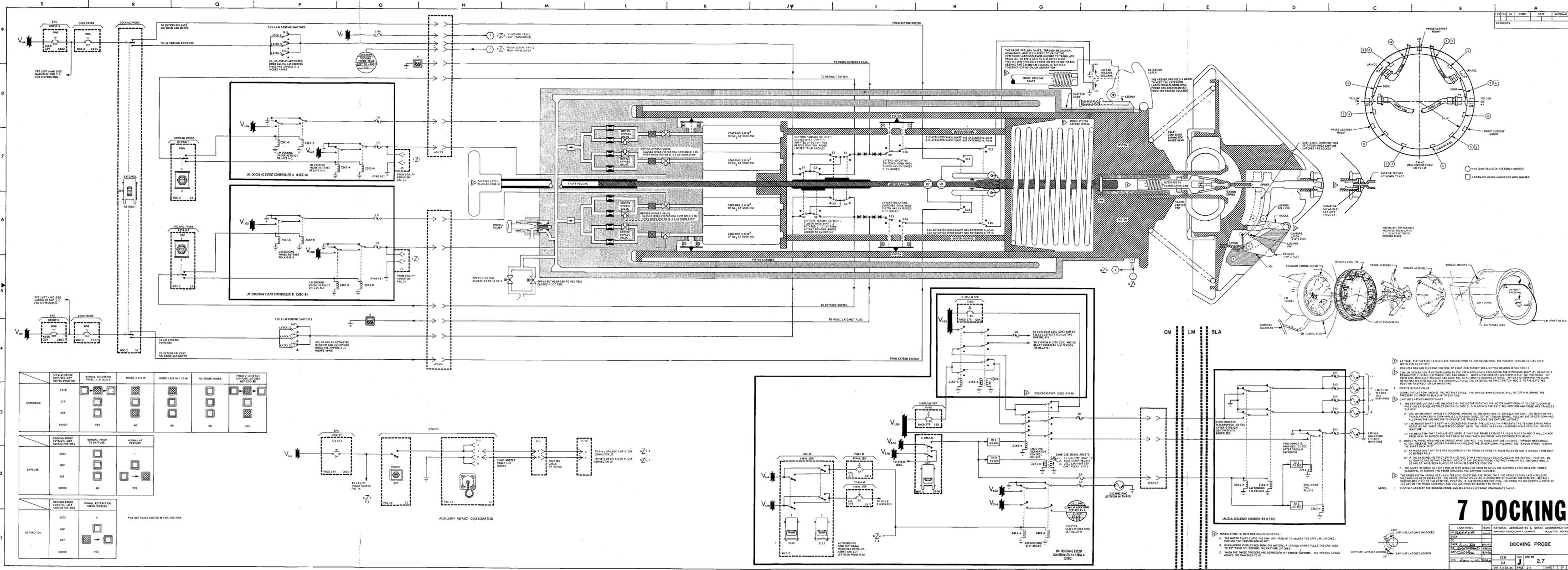
6 UPRIGHTING

SIGNATURES	DATE	NATIONAL AERONAUTICS & SPACE ADMINISTRATION MANNED SPACECRAFT CENTER - HOUSTON, TEXAS
DR		
DC		
ENGR		
APP		
STC		

SEQUENTIAL UPRIGHTING SYSTEM	
CSM	SIZE DWG NO
114	E 2.6
34 x 44	PAGE 2-6 SHEET 1 OF 1



CREWMAN OPTICAL ALIGNMENT SIGHT SYSTEM
APRON ITEM DWG NO. 2.7



EXTENSION	DOCKING PROBE EXTEND/RET SWITCH POSITION	NORMAL EXTENSION PROBE > 10 INCHES	PROBE < 10 INCHES	PROBE 5/8 IN < 10 IN	NO PROBE POWER	PROBE 3/16 IN BIT RELAY CONTACTS W/ILLUSTRATED NOT COCKED
EXTD	[Symbol]	[Symbol]	[Symbol]	[Symbol]	[Symbol]	[Symbol]
RET	[Symbol]	[Symbol]	[Symbol]	[Symbol]	[Symbol]	[Symbol]
SHOCK	[Symbol]	YES	NO	NO	NO	YES

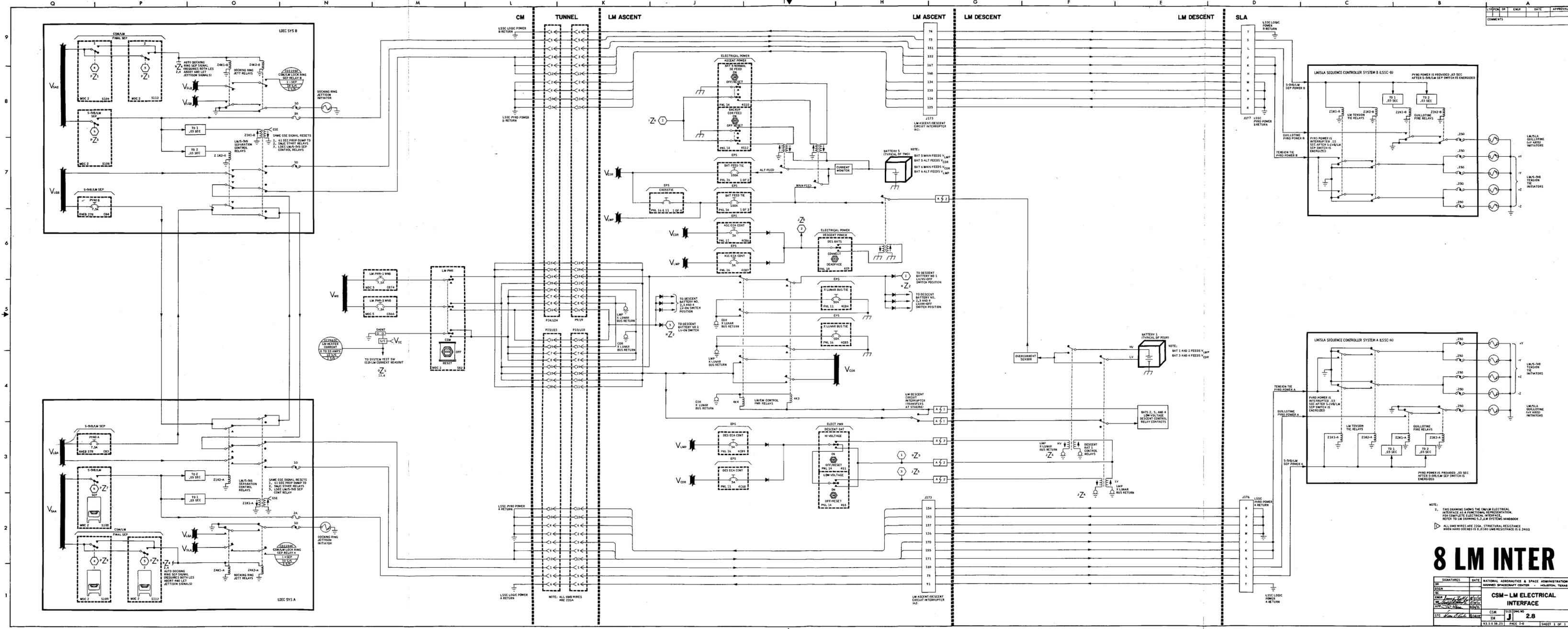
CAPTURE	DOCKING PROBE EXTEND/RET SWITCH POSITION	NORMAL PRIOR TO CAPTURE	NORMAL AT CAPTURE
EXTD	[Symbol]	[Symbol]	[Symbol]
RET	[Symbol]	[Symbol]	[Symbol]
SHOCK	[Symbol]	NO	YES

RETRACTION	DOCKING PROBE EXTEND/RET SWITCH POSITION	NORMAL RETRACTION (BAR COCKED)
EXTD	[Symbol]	[Symbol]
RET	[Symbol]	[Symbol]
SHOCK	[Symbol]	YES

7 DOCKING

DOCKING PROBE

INITIALS	DATE	NATIONAL AERONAUTICS & SPACE ADMINISTRATION
CSM	11/27/68	100-118-213 PAGE 2.7



DATE	ENGR	DR	CHKD	APP'D

COMMENTS

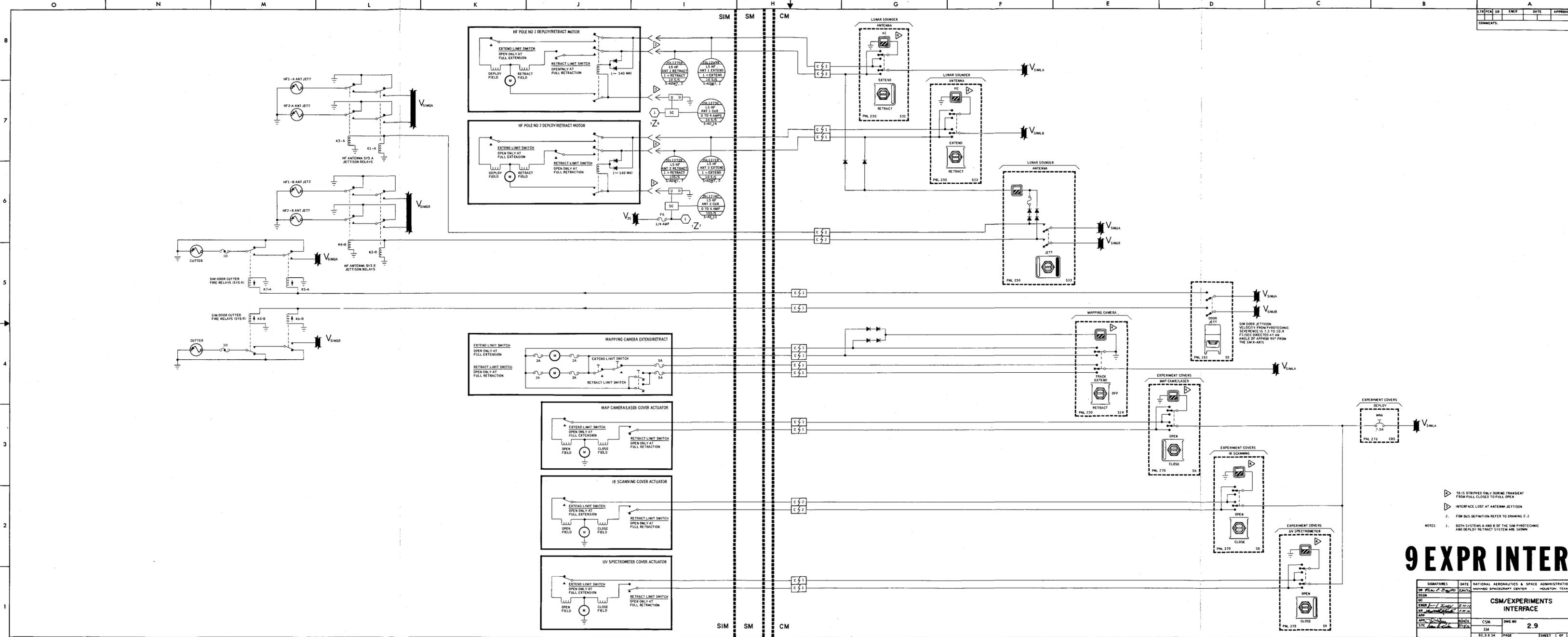
NOTE:
 1. THIS DRAWING SHOWS THE CM/LM ELECTRICAL INTERFACES AS A FUNCTIONAL REPRESENTATION. FOR COMPLETE ELECTRICAL INTERFACES REFER TO LM DRAWING 8-2, LM SYSTEMS HANDBOOK.
 2. ALL WIRE WIRING ARE 22GA. STRUCTURAL RESISTANCE WHEN HARD DOCKED IS 0.2400 UNB.

8 LM INTER

DATE	ENGR	DR	CHKD	APP'D
11/14/68	J. H. BROWN	J. H. BROWN	J. H. BROWN	J. H. BROWN

CSM - LM ELECTRICAL INTERFACE

CM: 114
 DATE: 11/14/68
 PAGE: 2/8
 SHEET: 1 OF 1



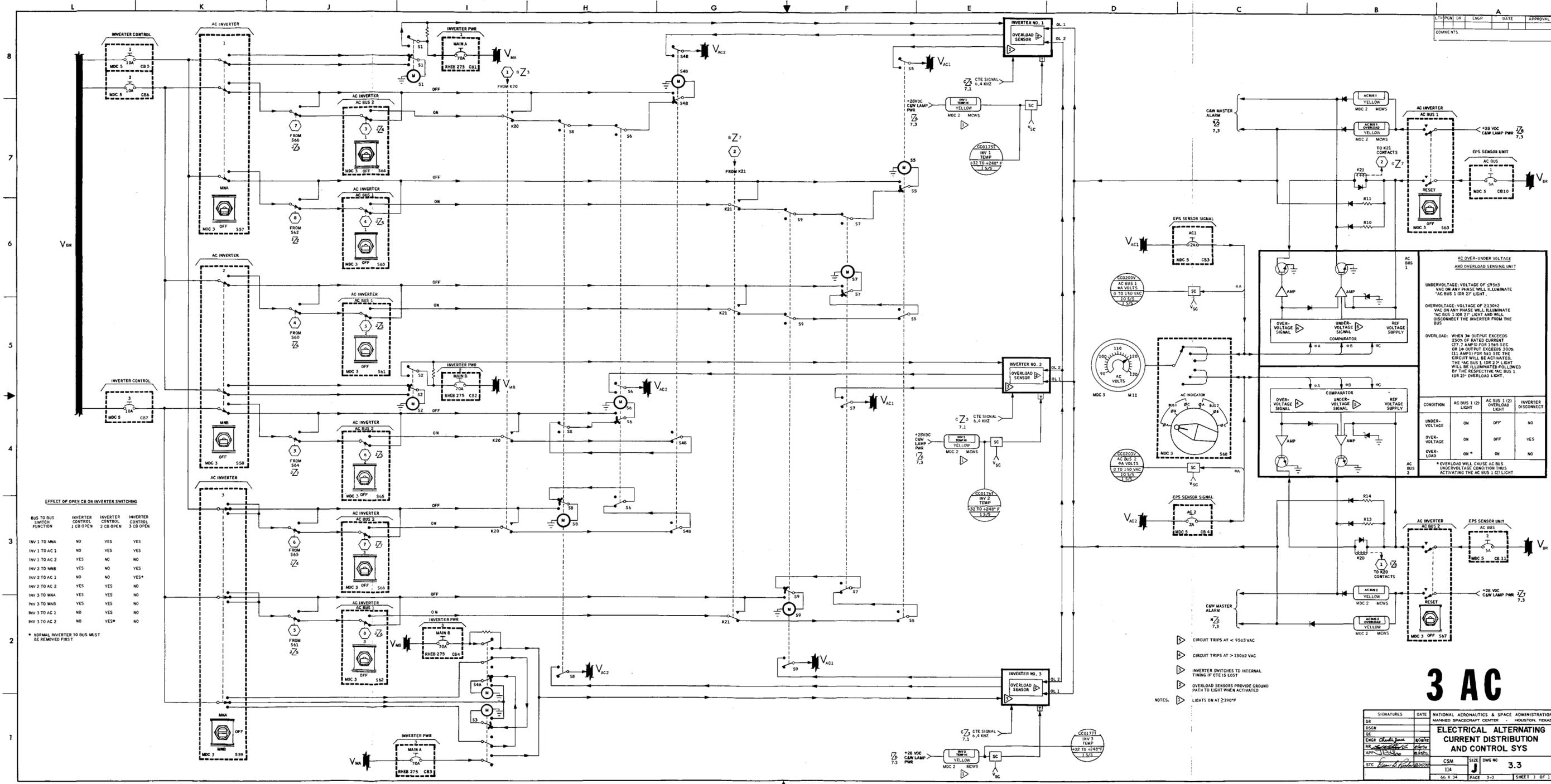
DATE	DR	EMER	DATE	APPROVAL

COMMENTS:

- NOTES:
1. THIS STRIPED ONLY DURING TRANSIENT FROM FULL CLOSED TO FULL OPEN
 2. INTERFACE LOST AT ANTENNA JETTISON
 3. FOR BUS DEFINITION REFER TO DRAWING 2.2
 4. BOTH SYSTEMS A AND B OF THE SIM PHOTOCHIC AND DEPLOY/RETRACT SYSTEM ARE SHOWN

9 EXPR INTER

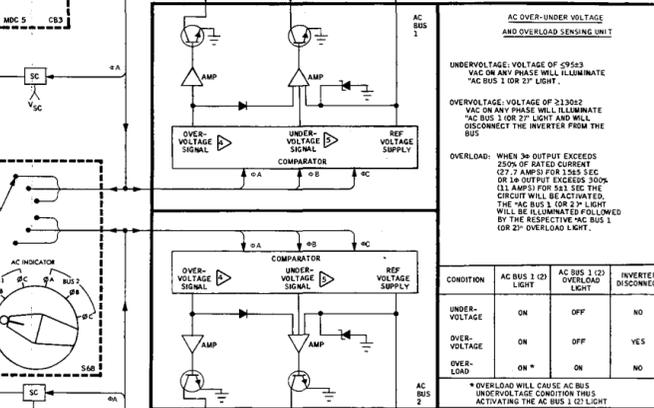
SIGNATURES		DATE		NATIONAL AERONAUTICS & SPACE ADMINISTRATION	
DR	W. A. J. J. J.	DATE	11/10/70	MANNED SPACECRAFT CENTER - HOUSTON, TEXAS	
CC					
EMER					
AP					
STC					
		CSM	SWG NO	2.9	
		114			
		87.5 X 34	PAGE	SHEET 1 OF 1	



EFFECT OF OPEN CB ON INVERTER SWITCHING

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

* NORMAL INVERTER TO BUS MUST BE REMOVED FIRST



3 AC

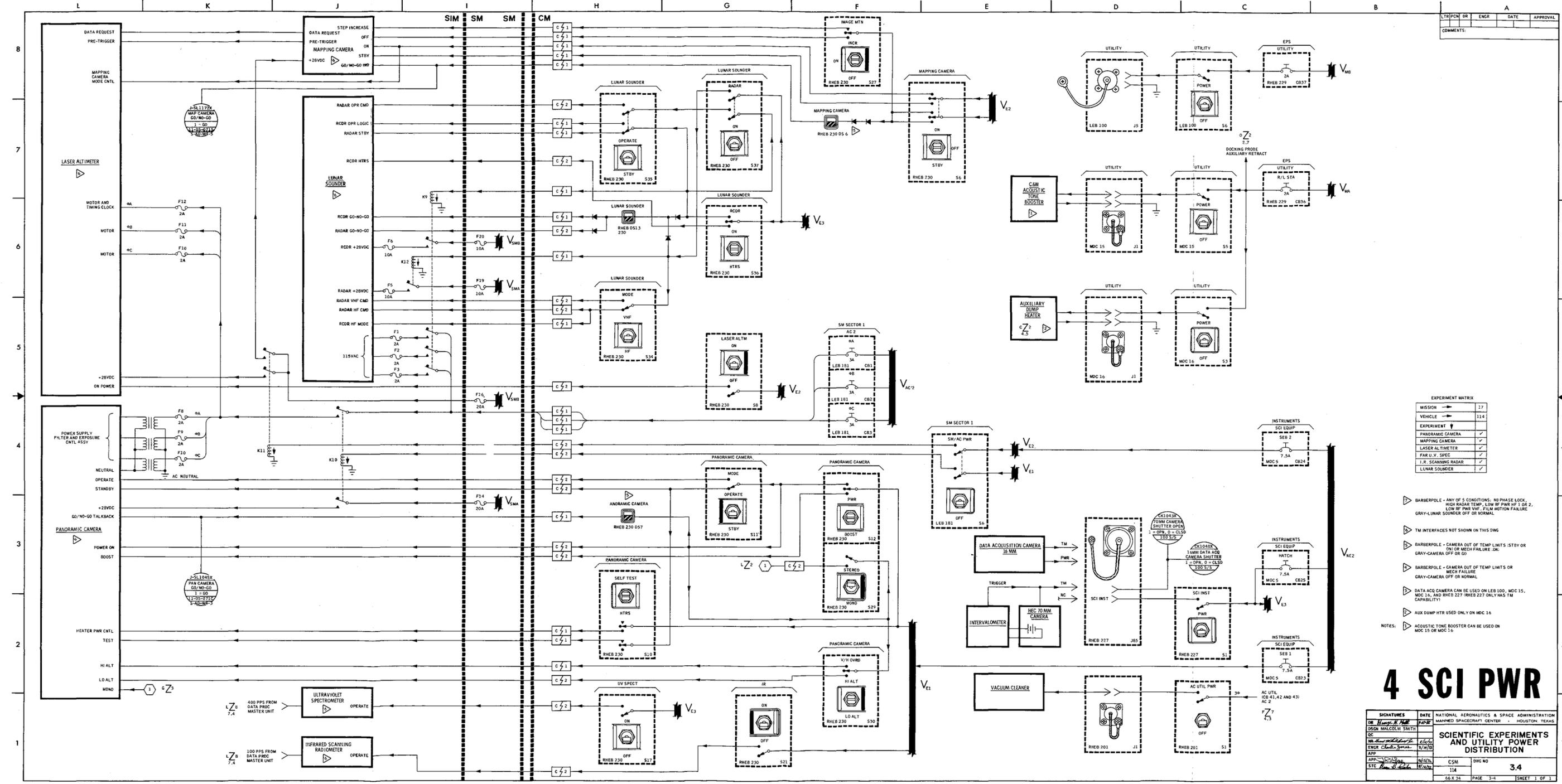
- ▷ CIRCUIT TRIPS AT < 95% VAC
- ▷ CIRCUIT TRIPS AT > 130% VAC
- ▷ INVERTER SWITCHES TO INTERNAL TIMING IF CTE IS LOST
- ▷ OVERLOAD SENSORS PROVIDE GROUND PATH TO LIGHT WHEN ACTIVATED
- ▷ LIGHTS ON AT 2100°F

SIGNATURES	DATE	NATIONAL AERONAUTICS & SPACE ADMINISTRATION	HOUSTON, TEXAS
DR		MANNED SPACECRAFT CENTER	
ESCR			
SC			
ENGR			
APP			
SIC			

ELECTRICAL ALTERNATING CURRENT DISTRIBUTION AND CONTROL SYS

CSM DWG NO 114 J 3.3

66 X 34 PAGE 3-3 SHEET 3 OF 1



TR/PCN	DR	ENGR	DATE	APPROVAL

EXPERIMENT MATRIX	
MISSION	17
VEHICLE	114
EXPERIMENT	SCI LOQP
PANORAMIC CAMERA	✓
MAPPING CAMERA	✓
LASER ALTIMETER	✓
PAR U.V. SPEC	✓
I.R. SCANNING RADAR	✓
LUNAR SOUNDER	✓

- ▷ BARBERPOLE - ANY OF 5 CONDITIONS: NO PHASE LOCK, HIGH RADAR TEMP, LOW RF PWR HF 1 OR 2, LOW RF PWR VHF, FILM MOTION FAILURE, GRAY-LUNAR SOUNDER OFF OR NORMAL
- ▷ TM INTERFACES NOT SHOWN ON THIS DWG
- ▷ BARBERPOLE - CAMERA OUT OF TEMP LIMITS - STBY OR GRAY-CAMERA OFF OR GO
- ▷ BARBERPOLE - CAMERA OUT OF TEMP LIMITS OR MECH FAILURE - GRAY-CAMERA OFF OR NORMAL
- ▷ DATA ACQ CAMERA CAN BE USED ON LEB 100, MDC 15, MDC 16, AND RHEB 227 (RHEB 227 ONLY HAS TM CAPABILITY)
- ▷ ASX DUMP HTR USED ONLY ON MDC 16

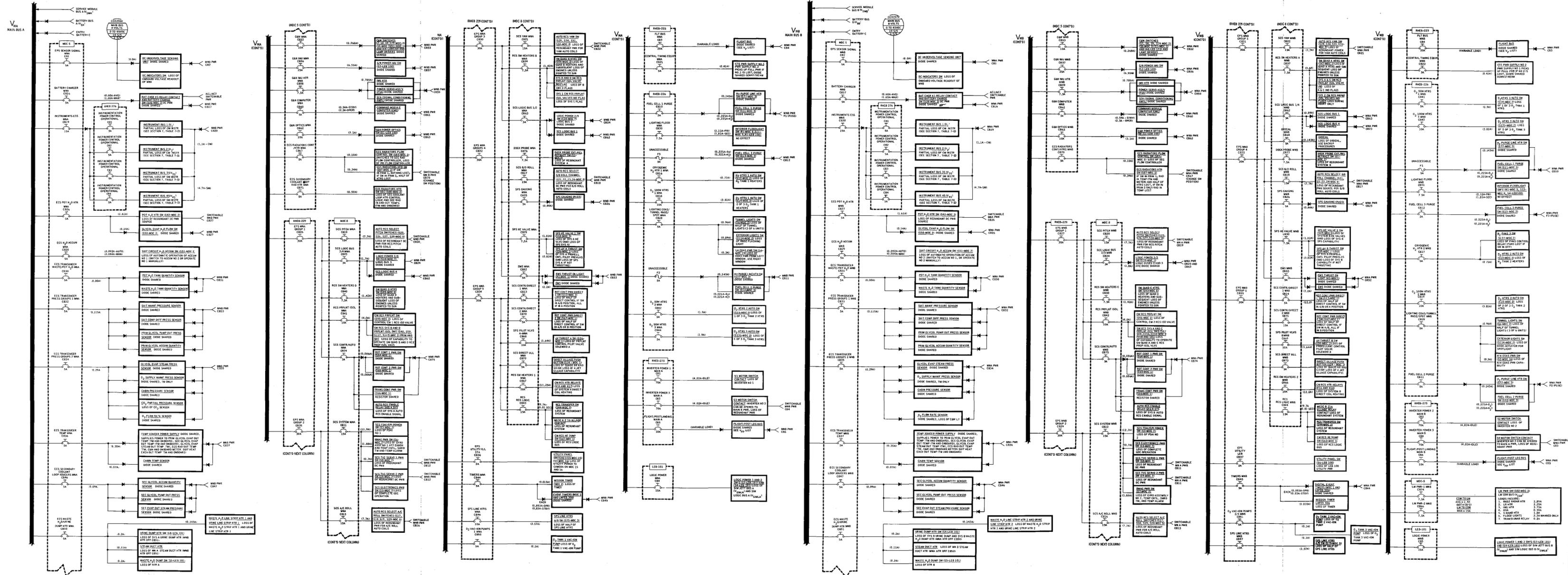
NOTES: ▷ ACOUSTIC TONE BOOSTER CAN BE USED ON MDC 15 OR MDC 16

4 SCI PWR

SIGNATURES	DATE	NATIONAL AERONAUTICS & SPACE ADMINISTRATION
DR: <i>Malcolm W. Smith</i>	10/27/73	MANNED SPACECRAFT CENTER - HOUSTON, TEXAS
DC: <i>Malcolm W. Smith</i>		
ENGR: <i>Charles Symons</i>	10/27/73	
APP: <i>Malcolm W. Smith</i>		
STC: <i>Malcolm W. Smith</i>		

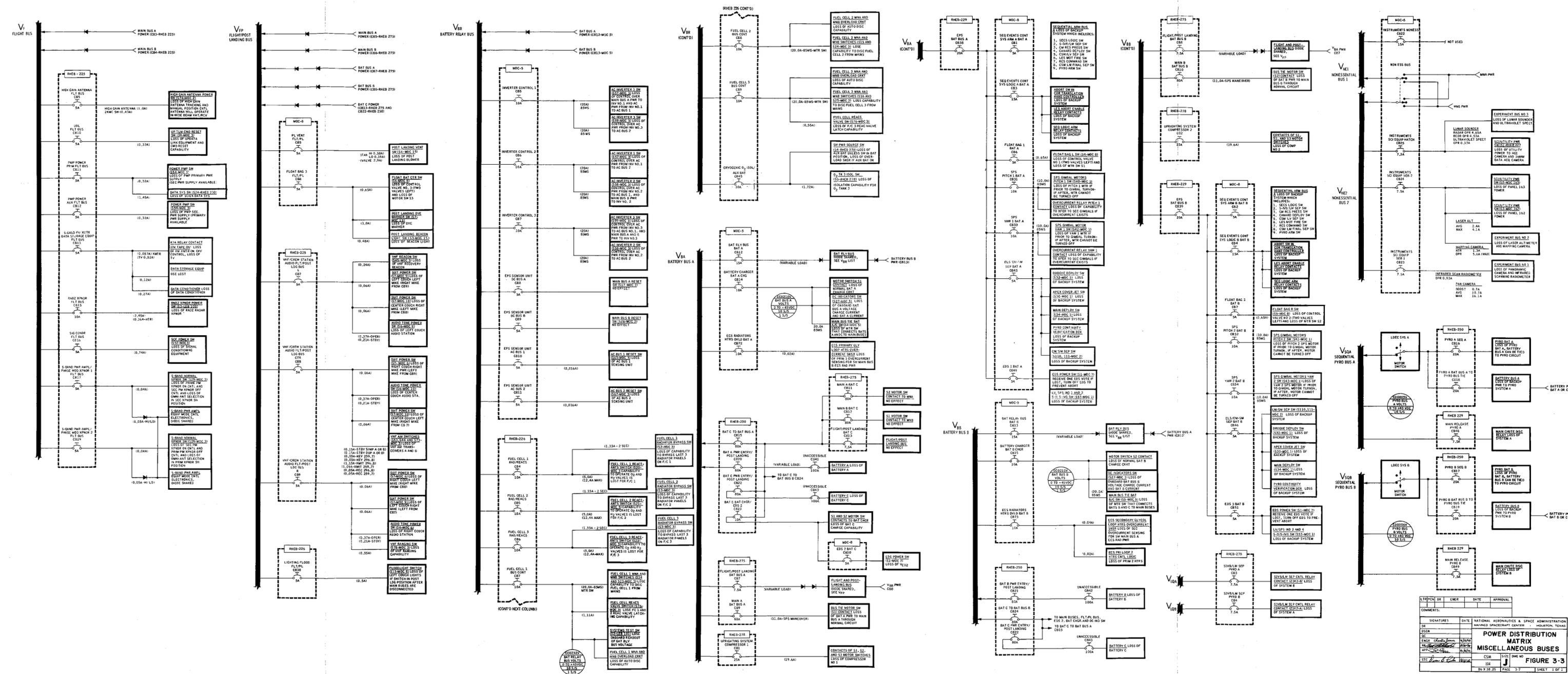
SCIENTIFIC EXPERIMENTS AND UTILITY POWER DISTRIBUTION	
APP: <i>Malcolm W. Smith</i>	CSM DWG NO
STC: <i>Malcolm W. Smith</i>	114
DATE: 10/27/73	PAGE 3-4
SCALE: AS X 3/4	SHEET 1 OF 1

3 ELECTRICAL
SYSTEM



NO.	DESCRIPTION	DATE	BY	CHKD
1	POWER DISTRIBUTION MATRIX	11/18/70	J. J. JONES	J. J. JONES
2	REVISION	11/18/70	J. J. JONES	J. J. JONES
3	REVISION	11/18/70	J. J. JONES	J. J. JONES
4	REVISION	11/18/70	J. J. JONES	J. J. JONES
5	REVISION	11/18/70	J. J. JONES	J. J. JONES
6	REVISION	11/18/70	J. J. JONES	J. J. JONES
7	REVISION	11/18/70	J. J. JONES	J. J. JONES
8	REVISION	11/18/70	J. J. JONES	J. J. JONES
9	REVISION	11/18/70	J. J. JONES	J. J. JONES
10	REVISION	11/18/70	J. J. JONES	J. J. JONES
11	REVISION	11/18/70	J. J. JONES	J. J. JONES
12	REVISION	11/18/70	J. J. JONES	J. J. JONES
13	REVISION	11/18/70	J. J. JONES	J. J. JONES
14	REVISION	11/18/70	J. J. JONES	J. J. JONES
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19	REVISION	11/18/70	J. J. JONES	J. J. JONES
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21	REVISION	11/18/70	J. J. JONES	J. J. JONES
22	REVISION	11/18/70	J. J. JONES	J. J. JONES
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61	REVISION	11/18/70	J. J. JONES	J. J. JONES
62	REVISION	11/18/70	J. J. JONES	J. J. JONES
63	REVISION	11/18/70	J. J. JONES	J. J. JONES
64	REVISION	11/18/70	J. J. JONES	J. J. JONES
65	REVISION	11/18/70	J. J. JONES	J. J. JONES
66	REVISION	11/18/70	J. J. JONES	J. J. JONES
67	REVISION	11/18/70	J. J. JONES	J. J. JONES
68	REVISION	11/18/70	J. J. JONES	J. J. JONES
69	REVISION	11/18/70	J. J. JONES	J. J. JONES
70	REVISION	11/18/70	J. J. JONES	J. J. JONES
71	REVISION	11/18/70	J. J. JONES	J. J. JONES
72	REVISION	11/18/70	J. J. JONES	J. J. JONES
73	REVISION	11/18/70	J. J. JONES	J. J. JONES
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92	REVISION	11/18/70	J. J. JONES	J. J. JONES
93	REVISION	11/18/70	J. J. JONES	J. J. JONES
94	REVISION	11/18/70	J. J. JONES	J. J. JONES
95	REVISION	11/18/70	J. J. JONES	J. J. JONES
96	REVISION	11/18/70	J. J. JONES	J. J. JONES
97	REVISION	11/18/70	J. J. JONES	J. J. JONES
98	REVISION	11/18/70	J. J. JONES	J. J. JONES
99	REVISION	11/18/70	J. J. JONES	J. J. JONES
100	REVISION	11/18/70	J. J. JONES	J. J. JONES

FIGURE 3-1



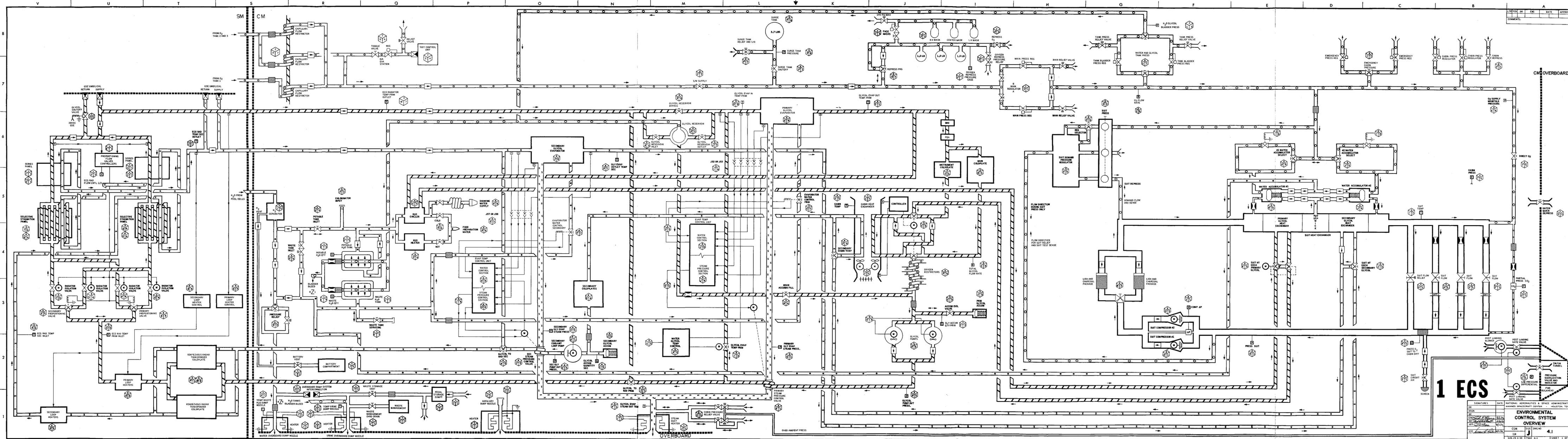
DATE	REVISION	DESCRIPTION
11/18/70	1	ISSUED FOR DESIGN
12/15/70	2	REVISED FOR MANUFACTURING
01/15/71	3	REVISED FOR TESTING
02/15/71	4	REVISED FOR PRODUCTION

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

DATE	REVISION	DESCRIPTION
11/18/70	1	ISSUED FOR DESIGN
12/15/70	2	REVISED FOR MANUFACTURING
01/15/71	3	REVISED FOR TESTING
02/15/71	4	REVISED FOR PRODUCTION

POWER DISTRIBUTION MATRIX MISCELLANEOUS BUSES
 FIGURE 3-3
 SHEET 1 OF 1

4 ENVIRONMENTAL
CONTROL SYS



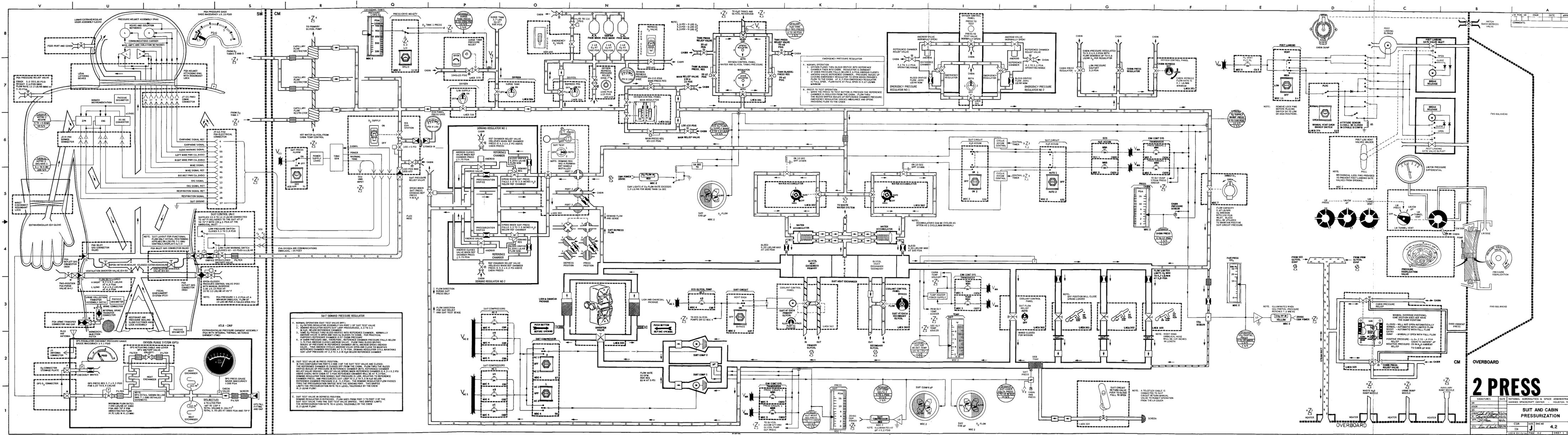
DATE	DR	ENG	DATE	APPROVAL

1 ECS

SIGNATURES		DATE	NATIONAL AERONAUTICS & SPACE ADMINISTRATION MARSHALL SPACEFLIGHT CENTER - HOUSTON, TEXAS	
DR				
DC				
ENGR				
APP				
STC				

ENVIRONMENTAL CONTROL SYSTEM OVERVIEW

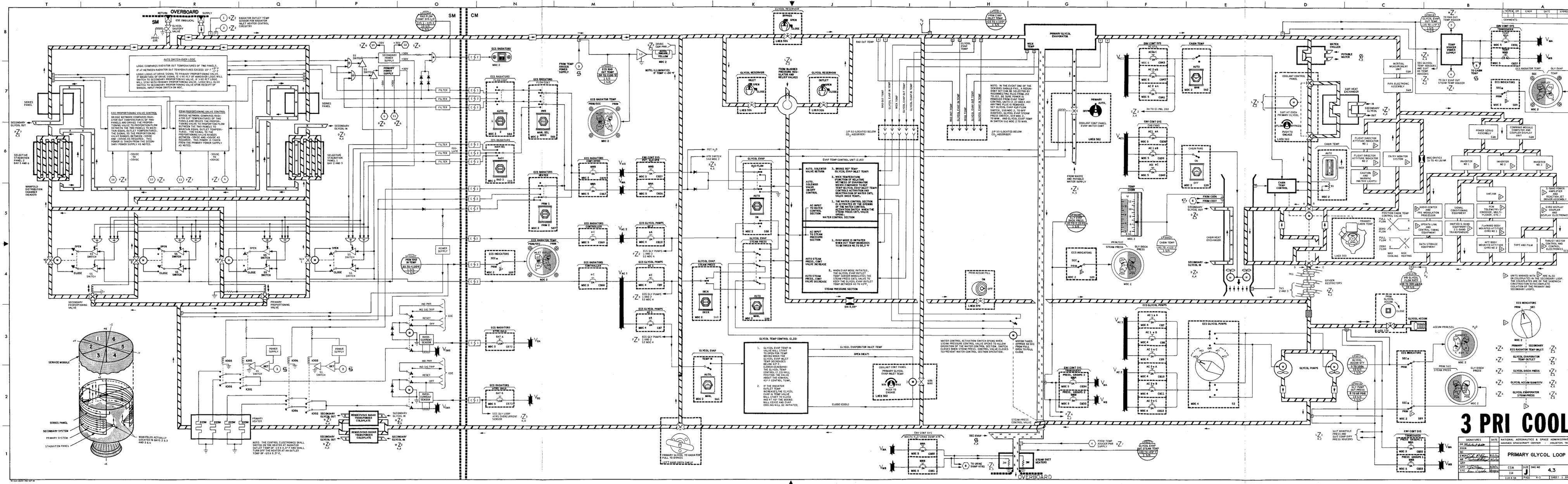
CSM SIZE DWG NO 4.1
118 J
120-25-24 (PAGE 4-1) SHEET 1 OF 1



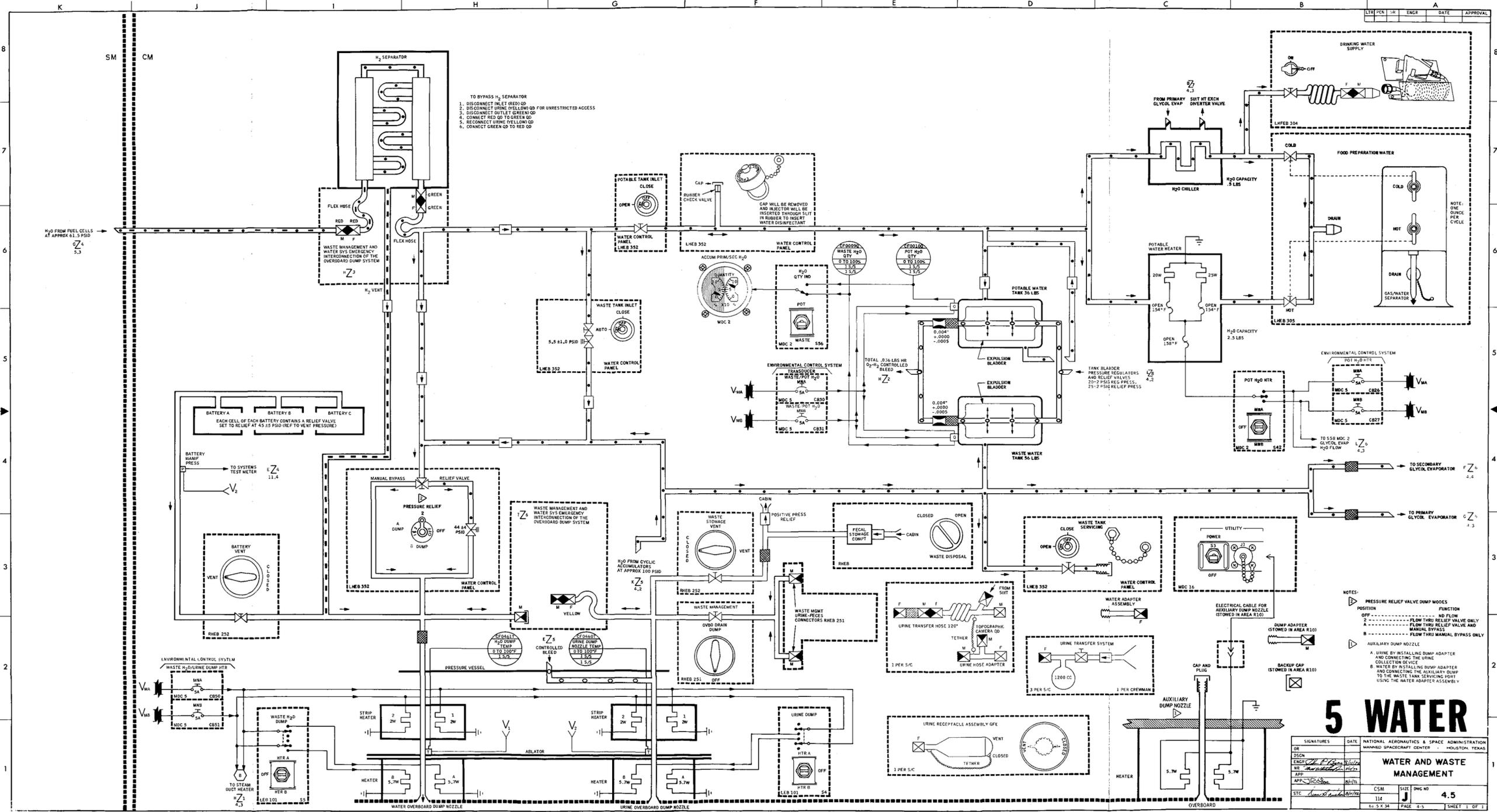
SUIT DEMAND PRESSURE REGULATOR

- NORMAL OPERATION (SUIT TEST VALVE OFF):**
 - Oxygen regulator assembly via part 1 of suit test valve.
 - Demand regulator keeps suit loop pressurized, 2.5 to 3.3 PSIA, below reference chamber.
 - Some O₂ passes thru bleed orifice into reference chamber. Normally aneroid valve opens and O₂ flows to cabin. For practical purposes, reference chamber is at cabin pressure.
 - If cabin pressure and, therefore, reference chamber pressure falls below 3.0 PSIA, aneroid valve closes and O₂ flow to cabin ceases. If O₂ flow to reference chamber pressure falls below 3.0 PSIA, demand regulator still maintains suit loop pressure at 2.5 to 3.3 PSIA below reference chamber.
- SUIT TEST VALVE IN PRESS POSITION:**
 - In this configuration ports 2 and 3 of the suit test valve are closed. The reference chamber is closed off from the cabin. Flow thru the bleed orifice holds 3.0 PSIA in reference chamber. In test position, 3.0 PSIA demand regulator then senses suit pressure is low, relative to reference chamber pressure, and pressurizes suit loop to 2.0 to 3.0 PSIA below reference chamber pressure. The demand regulator flow passes thru the pressurization orifice into the sensing port. This orifice limits the pressurization rate to a level tolerable by the crew in 3 LHR flow.
- SUIT TEST VALVE IN DEPRESS POSITION:**
 - Demand regulator is bypassed. Flow goes from port 3 of the suit test valve thru the suit test valve orifice. This orifice limits the depressurization rate to a level tolerable by the crew in 3 LHR flow.

2 PRESS		SUIT AND CABIN PRESSURIZATION	
DATE	12/23/53	REV	4.2
BY	CSM	CHKD	CSM
APP'D		DATE	
REVISIONS	DATE	REVISIONS	DATE
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	



3 PRI COOL		PRIMARY GLYCOL LOOP	
DATE	11/14/68	DATE	11/14/68
DESIGNED BY	DC	DESIGNED BY	DC
CHECKED BY	DC	CHECKED BY	DC
APP. BY	DC	APP. BY	DC
DATE	11/14/68	DATE	11/14/68
SCALE	AS SHOWN	SCALE	AS SHOWN
SIGNATURES		SIGNATURES	
DATE	11/14/68	DATE	11/14/68
NATIONAL AERONAUTICS & SPACE ADMINISTRATION	HOUSTON, TEXAS	NATIONAL AERONAUTICS & SPACE ADMINISTRATION	HOUSTON, TEXAS
MANAGED SPACECRAFT CENTER		MANAGED SPACECRAFT CENTER	
CSM	114	CSM	114
DWG NO	4.3	DWG NO	4.3
PAGE	4-3	PAGE	4-3
SHEET	1 OF 1	SHEET	1 OF 1

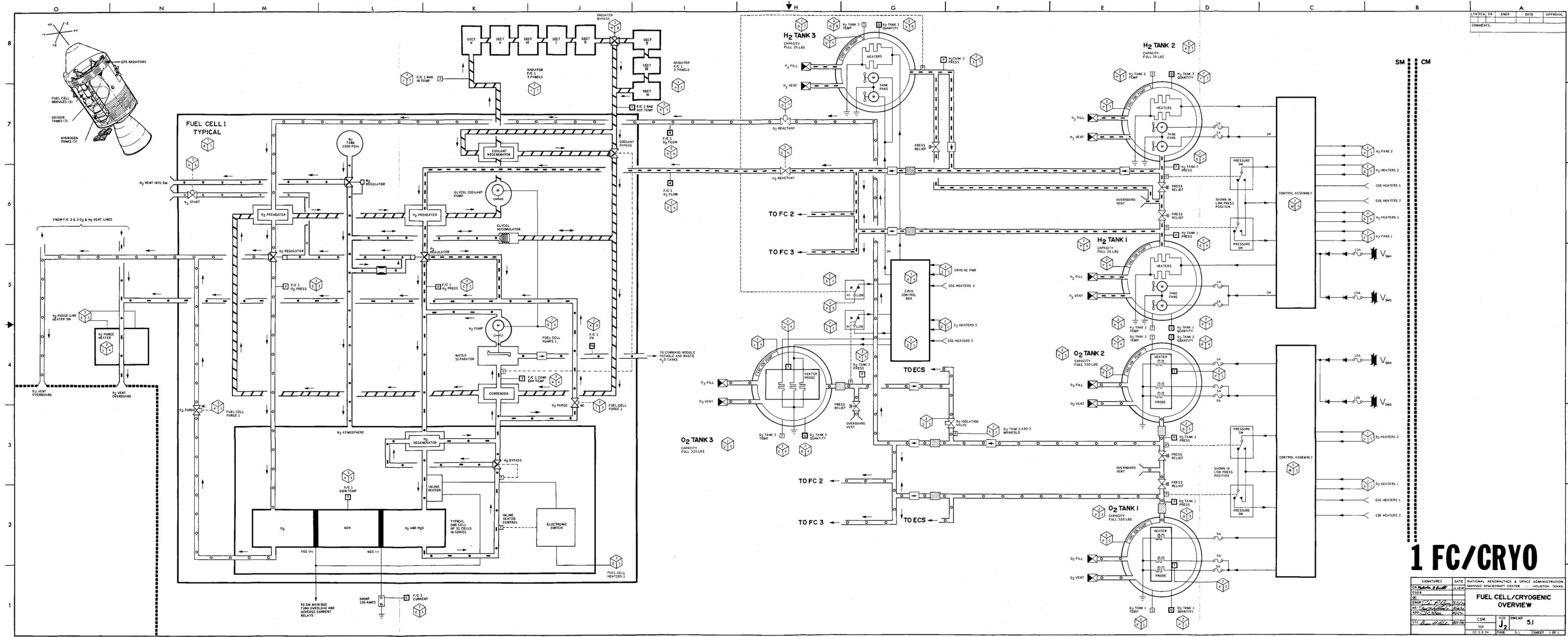


5 WATER

SIGNATURES		DATE		NATIONAL AERONAUTICS & SPACE ADMINISTRATION	
OR				MANNED SPACECRAFT CENTER HOUSTON, TEXAS	
ENGR	<i>[Signature]</i>			WATER AND WASTE MANAGEMENT	
APP	<i>[Signature]</i>			CSM	
STC	<i>[Signature]</i>			SIZE DWC NO 4.5	
				114 J	
				PAGE 4.5 SHEET 1 OF 1	

- NOTES:**
- 1. PRESSURE RELIEF VALVE DUMP MODES
 - 2. POSITION
 - 3. NO FLOW
 - 4. FLOW THRU RELIEF VALVE ONLY
 - 5. FLOW THRU RELIEF VALVE AND MANUAL BYPASS
 - 6. FLOW THRU MANUAL BYPASS ONLY
 - 7. AUXILIARY DUMP NOZZLE
 - 8. WATER BY INSTALLING DUMP ADAPTER AND CONNECTING THE URINE COLLECTION DEVICE
 - 9. WATER BY INSTALLING DUMP ADAPTER AND CONNECTING THE AUXILIARY DUMP TO THE WASTE TANK SERVING POINT USING THE WATER ADAPTER ASSEMBLY

5 FUEL CELL/
CRYOGENICS
SYSTEM

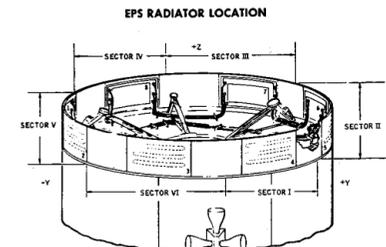
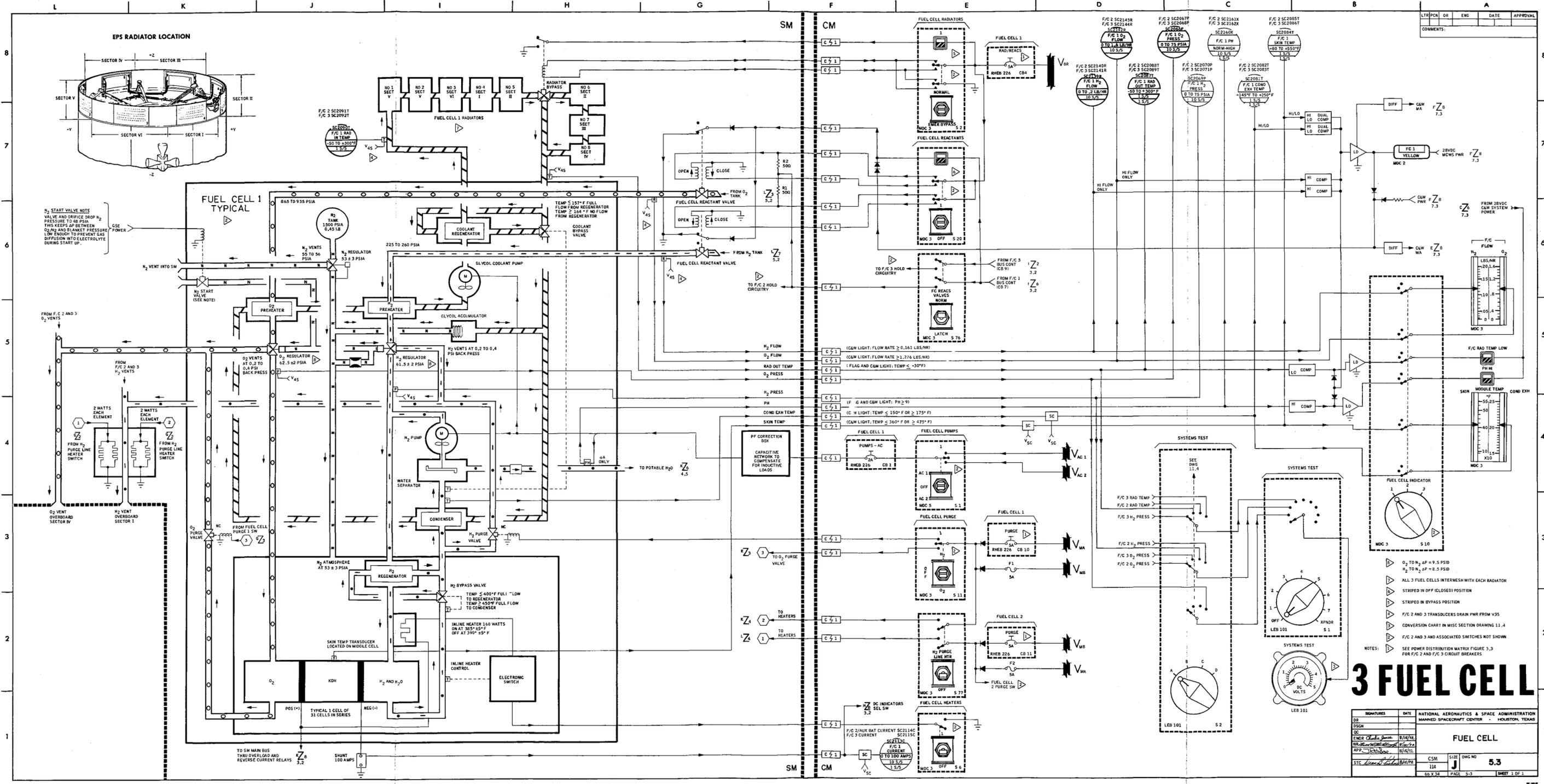


1 FC/CRYO

SIGNATURES	DATE	NATIONAL AERONAUTICS & SPACE ADMINISTRATION
DESIGN		MANHATTAN SPACECRAFT CENTER - HOUSTON, TEXAS
ENGR		
APP		
STC		
CSM		SIZE DWG NO
116	J2	5.1
PAGE 5		SHEET 1 OF 1

DATE	APPROVAL

COMMENTS:



N₂ START VALVE NOTE
 VALVE AND ORIFICE DROP N₂ PRESSURE TO 48 PSIA THIS KEEPS UP BETWEEN O₂ AND BLANKET PRESSURE LOW ENOUGH TO PREVENT GAS DIFFUSION INTO ELECTROLYTE DURING START UP.

FUEL CELL 1 TYPICAL

TYPICAL 1 CELL OF 31 CELLS IN SERIES

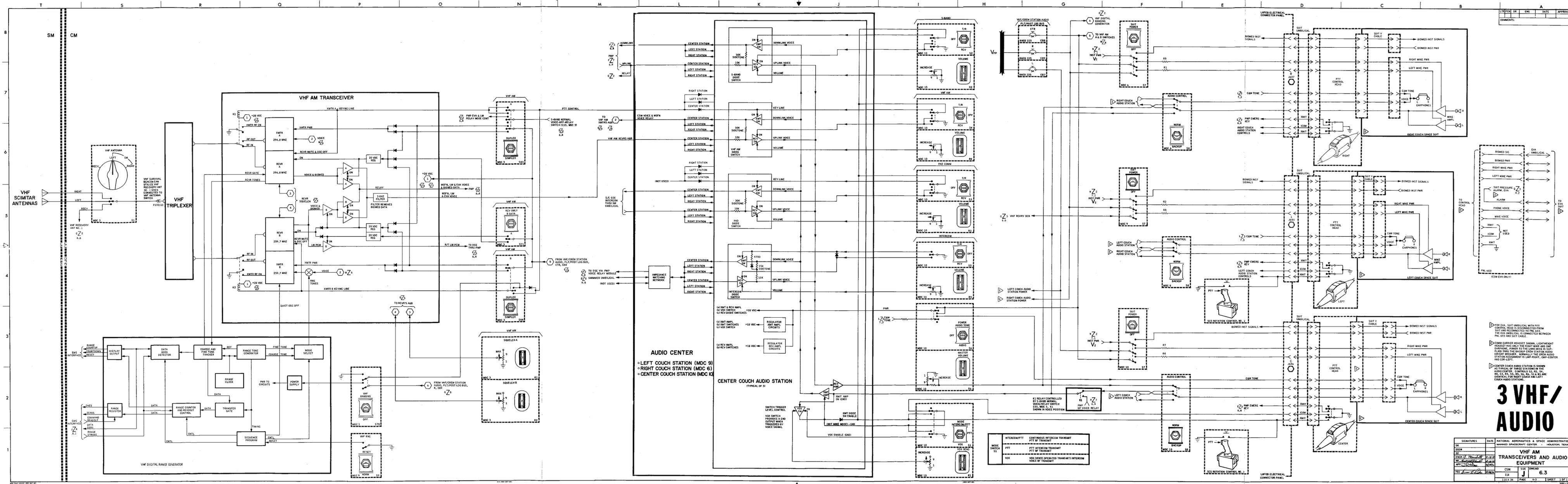
DATE	ENG	DR	APP

COMMENTS:

DATE	2/17/72	DR	W. J. B.	APP	
ENG	W. J. B.	DR	W. J. B.	APP	
DATE	11/1/71	DR	W. J. B.	APP	
ENG	W. J. B.	DR	W. J. B.	APP	

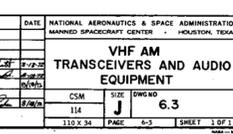
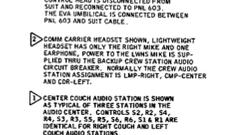
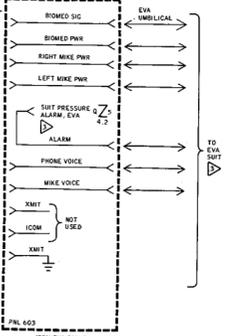
3 FUEL CELL
 SHEET 1 OF 1

6 COMMUNI-
CATIONS
SYSTEM



DESIGN	DATE	APPROVAL
CSM	114	J

COMMENTS:



3 VHF/AUDIO

VHF AM TRANSCIVERS AND AUDIO EQUIPMENT

CSM	SIZE	DWG NO
114	J	6.3

110 X 34 PANE 6.3 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
		Carrier Voice ^(a)	Carrier Voice ^(a)	Carrier Voice ^(a)	Carrier Voice ^(a)	Carrier	Carrier	Carrier	Carrier	Carrier	Carrier	Carrier	Carrier	Carrier	Carrier	Carrier	Carrier	Carrier
Channels Included		51.2-kbps TM	51.2-kbps TM	1.6-kbps TM	1.6-kbps TM	1.6-kbps TM	--	--	1.6-kbps TM	1.6-kbps TM	--	--	--	51.2-kbps TM	--	51.2-kbps TM	51.2-kbps TM	--
		--	PRN	PRN	--	--	--	PRN	--	PRN	--	PRN	--	--	--	PRN	--	--
		--	---	--	--	--	KEY	--	--	--	--	--	--	--	--	--	--	--
FM DOWNLINK MODULATION PROCESS	Modulation Schemes; Subcarrier Characteristics	PRN : PM directly on carrier (2287.5 MHz) Backup Voice ^(a) : PM directly on carrier (2287.5 MHz) Normal Voice ^(a) : 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 ($\Delta\theta$)	PRN ^(a) : ^(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 ^(a) : 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																
FM DOWNLINK MODES AVAILABLE	MODE NUMBER	1	2	3	4	5	6	7	8	9	10	11	12	0				
		1:1 Playback of Recorded Voice, Recorded CSM 51.2-kbps TM and Scientific Data ^(a)	32:1 Playback of Recorded Voice, Recorded CSM 1.6-kbps TM and Scientific Data ^(a)	32:1 Playback of (CSM - Recorded) LM 1.6-kbps TM	TV	Real-time Scientific ^(a)	Real-time 51.2-kbps TM ^(e)	Real-time 1.6-kbps TM ^(e)	Real-time 1.6-kbps TM ^(e)	1:1/32:1 Playback of Scientific Data and Real-time 51.2-kbps TM	1:1/32:1 Playback of Scientific Data and Real-time 1.6-kbps TM	8:1 Playback if (CSM-Recorded) LM 1.6-kbps TM	Real-time Sim Anlg. and Sim 64-kbps TM	Real-time Sim Anlg. and Sim 64-kbps TM.	No Carrier			
FM DOWNLINK MODULATION PROCESS	Modulation Schemes; Subcarrier Characteristics	TV : FM Directly on carrier (2272.5 MHz) Playback LM TM : PCM/FM Playback Voice : FM Directly on carrier (2272.5 MHz) Playback CSM TM ^(e) : PCM/PSK/FM; 1.024 MHz subcarrier bi-phase modulated *90° Scientific Data ^(a) : FM/FM (3 subcarriers) 95 kHz, 125 kHz, 165 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 ^(a) (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 FMP 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.

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)
(1) PM Transponder	1.5 watts dc
(2) FM Transmitter	6.7 watts ac
4. Activation Time	1 minute maximum - PM Receiver, PM Transmitter, and FM Transmitter
5. PM Receiver (Prim/Sec)	
a. Type	Double Conversion Superheterodyne, Phase Lock Loop
b. Frequency (Center)	2106.40625 MHz
c. Phase Lock Tracking Loop	
(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	TBD
(2) Decay	3 seconds (-51 dBm to -127 dBm)
f. Ranging Channel	
(1) Modulation	PM on Carrier
(2) Bandwidth	10 kHz to 1.5 MHz (3 dB)
(3) PRN Bit Rate	992.834 kbs
(4) PRN Clock	992.834 kbs (496.417 kHz square wave)
(5) PRN Code Length	5,456,682 bits (lunar code)
g. High-Gain Antenna Track Channel	
(1) Pointing Error Signal	50 Hz amplitude modulated signal derived from the coherent AGC detector.
(2) Earth Presence Signal	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	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 ampli- fier is operating at the time of transfer.
5. RF Output	
a. PM Output - Prim or Sec Power Amplifier	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
<p>6. RF Input</p> <p> a. PM</p> <p> b. FM</p>	<p>275 to 400 milliwatts</p> <p>100 to 145 milliwatts (For rated output)</p>
<p>7. Under Voltage Protection</p>	<p>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.</p>
<p>8. Special Operating Instructions</p>	<p>Dc power should be applied before ac power and removed after ac power removal to prevent possible damage.</p>

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
	Channels Included	Carrier PRN -- --	Carrier -- Voice --	Carrier -- Voice --	Carrier -- Voice --	Carrier PRN Voice --	Carrier PRN -- Update	Carrier PRN Voice Update	Carrier -- Voice Update	Carrier PRN Backup Voice --	Carrier -- -- --
PM UPLINK MODULATION PROCESS	Modulation Schemes:	PRN : FM 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	NA
	Update	--	--	1.85	--	1.20	1.00	1.10	--		
	Backup Voice	--	--	--	--	--	--	--	1.20		

*All phase deviations have ±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) <ul style="list-style-type: none"> 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) <ul style="list-style-type: none"> 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
11. Scientific Data Channel (Playback) <ul style="list-style-type: none"> a. Response 	<u>Channel</u> 1 95 kHz +7.5% f_o 2 125 kHz +7.5% f_o 3 165 kHz +7.5% f_o 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 <ul style="list-style-type: none"> a. Response 	15 to 90 kHz flat within 1 dB.
13. Uplink Subcarrier Detectors <ul style="list-style-type: none"> a. Up Voice b. Udata 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	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>	<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										
c. Squelch Level	Greater than 35 dB squelch of audio output when threshold is reached.										

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	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	250 milliseconds maximum to reach standby condition.
	20 milliseconds maximum to reach full transmit power from PTT (Key ON)
b. RF Output	5 dBW (average) minimum
c. Transmitter Frequency	XMTR A 296.8 MHz ± 8.90 kHz XMTR B 259.7 MHz ± 7.79 kHz
d. Modulation	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.

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	Adjustable for input from -10 dBm to +10 dBm
b. VOX Attack	Less than 50 milliseconds
c. VOX Release	2 ± 0.7 seconds
8. Intercom Bus	
a. GSE Output	(Not Used)
b. Swimmer Output	For recovery voice to recovery swimmers
c. Tape Recorder	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																															
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UDL STANDBY (ON)	1	0	1	0																															
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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	
	Near Object Scene brightness
	<u>distance</u> <u>(ft-lamberts)</u>
a. Wide-Angle (80 Degrees)	18 in. 1.8 to 530
b. Wide-Angle (160 Degrees)	18 in. 2.2 to 645
c. Telephoto (9 Degrees)	143 ft 32 to 9720
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 $\pm 10^4$ 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	16.2 Vdc from self-contained battery
b. Power	Battery pack life 24 hours in 100% beacon operation
4. Activation Time	No appreciable warm-up period
5. Receiver	
a. Type	Portable, VHF AM Beacon - transceiver with integral microphone, speaker, PTT pushbutton battery, antenna, and test meter
b. Frequency	243 MHz
Sensitivity ($\frac{S + N}{N} = 10 \text{ dB}$)	-97 dBm minimum
6. Transmitter	
a. Frequency	243 MHz
b. RF Output	
(1) Beacon	1.25 watts (peak)
(2) Voice	0.5 watts minimum (unmodulated)
c. Modulation	
(1) Beacon	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
(2) Voice	
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°								
	GAIN WILL BE LESS THAN -24 dB for cones, with solid angles of 20 degrees at the spacecraft nose and SPS nozzle.								
	*Applicable for $\phi = 0^\circ$ to 360°								
6. Power Rating	15 watts of CW RF								

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.- ANTENNA, 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 parabolas, 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="1"> <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>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

ITEM	FUNCTION and/or PARAMETERS
1. Weight	Camera 11.0 pounds Lens 1.3 pounds
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	525 scan lines per frame (2:1 interlace)
b. Frames	30 frames per second
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	<u>Field of View</u> <u>Near Object Distance</u>
a. Zoom Lens (6:1)	7 degrees Focused 24 in. to ∞ 43 degrees Focused 20 in. to ∞
b. f-stops	4.4 to 44 continuously variable
c. Focal Length	25 to 150 mm
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 Switch	
a. Peak	(Bright object in scene)
b. Average	(Uniform scene lighting) 1000:1 light range with AGC
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 Switch	
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 $f_o \pm .2\%$
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 $f_o \pm .2\%$
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 b. Bit Rate c. Modulation d. Type e. Input Level f. Output Filter	1.024 MHz, derived from 512 kHz ref. signal. 51.2 kbps Bi-Phase NRZ-L 0 to 6 Vdc 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 b. Frequency Response c. Input Level	Baseband 300 to 2300 Hz 5.7 volts peak-to-peak
13. Clock Input a. Frequency b. Wave Form c. Input Voltage d. Frequency Stability	512 kHz 50 percent square wave 3 volts peak-to-peak 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

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 \pm 0.8 Vdc
c. Type	NRZ-L
d. Frequency Stability	5 parts in 10 ⁴
6. CSM PCM Output	
a. Bit Rate	51.2 kbps.
b. Level	"1" = 6 \pm 0.6 Vdc
c. Type	"0" = 0 ^{+0.5} _{-0.0} Vdc 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 ± 0.8 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 ± 0.6 Vdc NRZ-L
9. SIM PCM Output a. Bit Rate b. Level c. Type d. Error Rate	64 kbps "1" = 6 ± 0.6 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 ± 0.6 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
IM	1.875 ips	Bit Rate Select Switch	1.6 kbps	60 ips	Tape Recorder IM 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.

TABLE 6-XXV.- DATA CONDITIONER (TRDC)

ITEM	FUNCTION and/or PARAMETERS
1. Weight	4 pounds maximum
2. Cooling	ECS primary glycol loop (cooling not required)
3. Electrical power	
a. Dc voltage	25 to 30 volts
b. Power consumption	5 watts maximum
4. 51.2 kbps PCM Inputs	
a. Bi-phase Space	51,200 ± 768 bits per second synchronous with bi-phase input within ±5 microseconds. Jitter is typically a frequency modulation of the input signal at a 10 Hz to 1250 Hz rate with maximum deviation of ±1% (10 Hz to 50 Hz) and ±2% (50 Hz to 1250 Hz).
b. NRZ-L	
c. Stability	
5. 64 kbps PCM Inputs	
a. Bi-phase Space	64,000 ± 960 bits per second synchronous with bi-phase input within ±5 microseconds. Jitter is typically a frequency modulation of the input signal at a 10 Hz to 1250 Hz rate with maximum deviation of ±1% (10 Hz to 50 Hz) and ±2% (50 Hz to 1250 Hz).
b. NRZ-L	
c. Stability	
6. 51.2 kbps PCM Output	Two buffered time stabilized NRZ-L signals
a. Bit Rate	51,200 ± 768 bits per second
b. Stability (maximum frequency modulation of output signal)	0 to 10 Hz (same as input) 10 Hz to 50 Hz (±1% to ±0.01%) 50 Hz and higher (±0.02%)
c. Bit Error Rate	Less than 10 ⁻⁸ due to data conditioner
d. Bit Time	15.6 microseconds nominal. Rise and fall time less than 2 microseconds between 10 and 90 percent points

TABLE 6-XXV.- DATA CONDITIONER (TRDC) CONCLUDED

ITEM	FUNCTION and/or PARAMETERS
<p>7. 64 kbps PCM Output</p> <p>a. Bit Rate</p> <p>b. Stability (maximum frequency modulation of output signal)</p> <p>c. Bit Error Rate</p> <p>d. Bit Time</p>	<p>Time stabilized NRZ-L signal</p> <p>64,000 ± 960 bits per second</p> <p>0 to 10 Hz (same as input)</p> <p>10 Hz to 50 Hz (+1% to 0.01%)</p> <p>50 Hz and Higher (+0.02%)</p> <p>Bit Error Rate 10⁻⁸ due to data conditioner</p> <p>15.6 microseconds nominal. Rise and fall time less than 2 microseconds between 10 and 90 percent points.</p>
<p>8. Fail Safe</p>	<p>In the event of loss of stable clock lock, input clock lock, or power supply output, the quad redundant fail safe switches will thru put the unconditioned NRZ-L data.</p>
<p>9. Lockup Time</p>	<p>Nominal lockup time before data conditioning occurs is 1 second.</p>

7 INSTRU-
MENTATION

SECTION 7
INSTRUMENTATION

7.1 GENERAL

This section contains instrumentation data for CSM 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 DISPLAY	DIST C&W
			PCM			
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 φA VOLTS	AC	PCM		--	--
CC0203V	AC BUS 2 φA 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		--	--
SL1275T	OPTICAL RC DR FILM PKG TEMP	DBA	PCM		--	--
SPO062T	SPS INJECTOR FLANGE TEMP 2	DBA	PCM		--	--
BS0050P	S-IVB OX TK PRESS A	DA	--		SEL MTR	--
BS0052P	S-IVB FUEL PRESS A	DA	--		SEL MTR	--
BS0051P	S-IVB OX TK PRESS B	DA	--		SEL MTR	--
BS0053P	S-IVB FUEL PRESS B	DA	--		SEL MTR	--

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. V_2 CURRENT LIMITER BOX C28A5 - Concluded

<u>MEAS ID</u>	<u>MEAS DESCRIPTION</u>	<u>FUSE NO.*</u>	<u>PCM</u>	<u>DISPLAY</u>	<u>C&W</u>
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. V_2 CURRENT LIMITER BOX C28A6 (FUSES 10 THROUGH 27)

<u>MEAS ID</u>	<u>MEAS DESCRIPTION</u>	<u>FUSE NO.*</u>	<u>PCM</u>	<u>DISPLAY</u>	<u>C&W</u>
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	--	--
CFO460T	URINE DUMP NOZZLE TEMP	11	PCM	--	--
CRO002P	CM He TK 2 PRESS	20	PCM	SEL MTR	--
CRO004T	CM He TK 2 TEMP	19	PCM	SEL MTR	--
CRO036P	CM He MANIF 2 PRESS	22	PCM	--	C&W
CRO037P	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

<u>MEAS ID</u>	<u>MEAS DESCRIPTION</u>	<u>FUSE NO.*</u>	<u>PCM</u>	<u>DISPLAY</u>	<u>C&W</u>
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	--
SC2088T	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.

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 1	5	PCM	SEL MTR	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	--	--
SP0066P	FU TK PRESS 2	22	PCM	SEL MTR	C&W
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>
SC0069P	O ₂ TK 2/3 MANIF PRESS	11	PCM	--	C&W
SC0070T	O ₂ TK 1 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 (12)			
	SIM CUR LIMITER S28A35	28 (5)			

*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

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>
SR5001P	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>
SCO052P	H ₂ TK 3 PRESS	17	PCM	SEL MTR	--
SCO053P	O ₂ TK 3 PRESS	6	PCM	SEL MTR	--
SCO072T	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, TK PRESS	1	PCM	--	--
SL1204T	SIM TEMP 4, BM1, XS 278, R62	9	PCM	--	--
SL1206T	SIM TEMP 6, BM6, XS 257, R62	5	PCM	--	--
SL1211T	PAN CAMERA N2 LINE IN TEMP	11	PCM	--	--
SL1212T	PAN CAMERA N2 TK 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.

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	MOM BOX TEMP	15	PCM	--	--
SL1217T	SIM TEMP 17, BM6, XS 305, R62	3	PCM	--	--
SL1273C	LS HF ANT 1 MTR CUR	6 (2)		--	--
SL1274C	LS HF ANT 2 MTR CUR	6 (2)	(64 KBPS)	--	--
ST0562T	TLM 2 MASTER UNIT TEMP	29	PCM	--	--
ST0563T	TLM 2 SLAVE UNIT TEMP	30	PCM	--	--
ST0567T	TLM 2 MASTER UNIT 5 VOLT REF.	17 (2)	(64 KBPS)	--	--
ST0568T	TLM 2 SLAVE UNIT 5 VOLT REF.	17 (2)	(64 KBPS)	--	--
SIM BAY	BUFFER AMPLIFIER (S28A33)	20		(SIM BAY TIMING)	

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>
SL1109T	UVS ELECTRONIC TEMP	5	PCM	--	--
SL1202T	SIM TEMP 2, BM 1, XS 221, R62	3	PCM	--	--
SL1220T	SIM TEMP 20, SHELF, XS206.5, R70	10	PCM	--	--
SL1221T	SIM TEMP 21, SHELF, XS236.5, R70	1	PCM	--	--
SL1223T	HF ANT SPRT SH AFT HS TEMP	11	PCM	--	--

4. PANEL 276 CB 4(V_{4S}) INSTRUMENTATION POWER DISTRIBUTIONA. 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	22	PCM	SEL MTR	C&W
SC0039P	H ₂ TK 1 PRESS	5	PCM	METER	C&W
SC0071T	O ₂ TK 2 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>
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.

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	1	PCM	SEL MTR	C&W
SP0017T	LOWER He TANK TEMP	5	PCM	--	--
SP0023H	FU/OX VLV 2 POS	22 (4)	PCM	--	--
SP0025H	FU/OX VLV 4 POS	22 (4)	PCM	--	--
SP0026H	FU/OX VLV 1 POS	22 (4)	--	METER	--
SP0028H	FU/OX VLV 3 POS	22 (4)	--	METER	--
SP0033P	OX TK PRESS 2	6	PCM	SEL MTR	C&W
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 Q 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.

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.

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- 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 WORD 1 - 00000101 WORD 2 - 01111001 WORD 3 - 10110111	3 @ 50 S/S	3 @ 1 S/S
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 HBR - 01100110 LBR - 10011001	1 @ 1 S/S	1 @ 1 S/S
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

*

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

*

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)

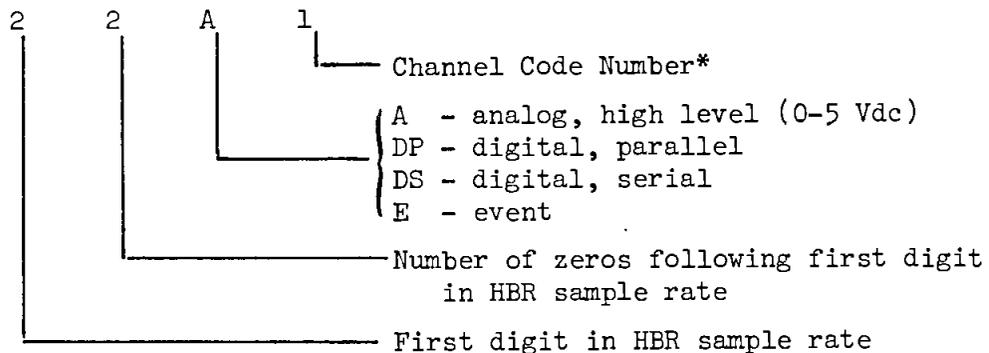
B. The numeric character indicates the telemetry format as follows:

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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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).

*

CSM
S/C 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	DATA RANGE			INST BUS	SIG COND	O/B DISPL	SIG DIST	CSH DHG
				FR -	WD		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}	---	---	---	--

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	5.2	
SC0051Q	O ₂ TK 3 QTY	H2	11A154	05 - 041	125	0	100	PCT	EPS	--	SM	CS	5.2	
SC0052P	H ₂ TK 3 PRESS	H2	11A48	02 - 043	087	0	350	PSIA	V _{3S}	--	SM	CS	5.2	
SC0053P	O ₂ TK 3 PRESS	H2	11A148	05 - 012	064	50	1050	PSIA	V _{3S}	--	SM	CS	5.2	
SC0054T	H ₂ TK 3 TEMP	H2	10A117	39 - 116	160	-425	-200	DEG F	EPS	--	--	--	5.2	
SC0055T	O ₂ TK 3 TEMP	H2	10A84	28 - 116	118	-325	+80	DEG F	EPS	--	--	--	5.2	
SC0069P	O ₂ TK 2/3 MANIF PRESS	H2	11A49	02 - 044	088	50	1050	PSIA	V _{3S}	--	L*	CS	5.2	
SC0070T	O ₂ TK 1 HTR TEMP	H2	10A108	36 - 116	040	-300	+600	DEG F	V _{3S}	--	SM	CS	5.2	
SC0071T	O ₂ TK 2 HTR TEMP	H2	10A111	37 - 116	080	-300	+600	DEG F	V _{4S}	--	SM	CS	5.2	
SC0072T	O ₂ TK 3 HTR TEMP	H2	10A135	45 - 116	175	-300	+600	DEG F	V _{3S}	--	SM	CS	5.2	
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 4A VOLTS	H2	11A147	05 - 011	063	0	150	VAC	V _{SC}	AC	SM*	TSC	3.3	
CC0203V	AC BUS 2 4A 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 - DNG
				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 ₄₅	--	SM	CS	5.3	
SC2067P	FC 2 O ₂ PRESS	H1	11A68	02 - 113	--	0	75	PSIA	V ₃₅	--	SM	CS	5.3	
SC2068P	FC 3 O ₂ PRESS	H1	11A69	02 - 121	--	0	75	PSIA	V ₃₅	--	SM	CS	5.3	
SC2069P	FC 1 H ₂ PRESS	H1	11A70	02 - 122	--	0	75	PSIA	V ₄₅	--	SM	CS	5.3	
SC2070P	FC 2 H ₂ PRESS	H1	11A71	02 - 123	--	0	75	PSIA	V ₃₅	--	SM	CS	5.3	
SC2071P	FC 3 H ₂ PRESS	H1	11A72	02 - 124	--	0	75	PSIA	V ₃₅	--	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 ₄₅	--	SMB*	CS	5.3	
SC2088T	FC 2 RAD OUT TEMP	H2	10A129	43 - 116	095	-50	+300	DEG F	V ₃₅	--	SMB*	CS	5.3	
SC2089T	FC 3 RAD OUT TEMP	H2	10A132	44 - 116	135	-50	+300	DEG F	V ₃₅	--	SMB*	CS	5.3	
SC2090T	FC 1 RAD IN TEMP	H1	10A130	44 - 052	--	-50	+300	DEG F	V ₄₅	--	--	--	5.3	
SC2091T	FC 2 RAD IN TEMP	H1	10A131	44 - 084	--	-50	+300	DEG F	V ₃₅	--	--	--	5.3	
SC2092T	FC 3 RAD IN TEMP	H1	10A67	23 - 052	--	-50	+300	DEG F	V ₃₅	--	--	--	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 ₄₅	--	SM*	CS	5.3	
SC2140R	FC 2 H ₂ FLOW	H1	11A78	03 - 025	--	0	0.2	LB/HR	V ₃₅	--	SM*	CS	5.3	
SC2141R	FC 3 H ₂ FLOW	H1	11A79	03 - 026	--	0	0.2	LB/HR	V ₃₅	--	SM*	CS	5.3	
SC2142R	FC 1 O ₂ FLOW	H1	11A80	03 - 027	--	0	1.6	LB/HR	V ₄₅	--	SM*	CS	5.3	
SC2143R	FC 2 O ₂ FLOW	H1	11A81	03 - 028	--	0	1.6	LB/HR	V ₃₅	--	SM*	CS	5.3	
SC2144R	FC 3 O ₂ FLOW	H1	11A82	03 - 041	--	0	1.6	LB/HR	V ₃₅	--	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	NORM	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 WD	DATA RANGE			INST BUS	SIG COND	O/R DISPL	SIG RST	CSH DWG
				FR	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	EOS	--	--	--	2.3
CD0136X	EDS ABORT B	E2	11E13-4	03 - 065	115			ABORT	EVENT	EOS	--	--	--	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	E2	11E18-1	03 - 098	161			ARM	EVENT	SEQ	--	--	--	2.2
CD0413X	SIM PYRO BUS B	E2	11E18-2	03 - 098	161			ARM	EVENT	SEQ	--	--	--	2.2
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 L'NG
				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	SIG COND	O/B DISPL	SIG DIST	CSH DWG
				FR	WD		LOW	HIGH	UNITS					
CF0001T	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	
CF0003T	SUIT-CABIN DELTA PRESS	H1	11A37	02 - 009	--	-5	+5	IN H ₂ O	V ₂	--	M	CS	4.2	
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	009	50	1050	PSIA	V ₂	--	SM	CS	4.2	
CF0008T	SUIT AIR HK 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	PORTABLE 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	H1	11A25	01 - 090	--	+25	+75	DEG F	ECS	--	SM	CS	4.4	
CF0072Q	SEC GLY ACCUM QUANTITY	H1	11A126	04 - 060	--	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	H1	10A5	02 - 084	--	+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-B	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	TN	CHAN CODE	HBR		LBR WD	DATA RANGE			INST BUS	SIG COND	O/R DISPL	SIG DIST	CSH DMG
				FR	WD		LOW	HIGH	UNITS					
CG0001V	CPTR DIG DATA - 40 BITS	S2	510S1	01	032	009				--	--	--	--	8.1
CG1040V	PIPA + 120 VDC	H1	10A83	28	084	--	+85	+135	VDC	G&N	--	--	--	9.5
CG1110V	TX BIAS 2.5 VDC	H1	11A124	04	058	--	0	5	VDC	G&N	--	--	--	8.4
CG1201V	17U 28 VAC 800HZ	H1	10A91	31	052	--	0	31.1	VRMS	G&N	--	--	--	9.5
CG1331V	3.2 KHZ 28V SUPPLY	H1	10A85	29	052	--	0	31.1	VRMS	G&N	--	--	--	8.5
CG1513X	17U HTR +28 VDC	E2	11E15-2	03	067	141	OFF	STBY	EVENT	G&N	--	--	--	9.5
CG1523X	C/MC 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	M/RAD	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	M/RAD	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	M/RAD	G&N	--	--	--	8.5
CG2300T	PIPA TEMP	H1	10A47	16	084	--	+120	+140	DEG F	G&N	--	--	--	9.5
CG3721V	SHAFT CDU DAC OUT	H1	11A52	02	058	--	-12	+12	VRMS	G&N	--	--	--	8.9
CG3722V	TRUNNION COU OUT	H1	11A53	02	059	--	-12	+12	VRMS	G&N	--	--	--	8.9
CG5040X	C/MC 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 MD	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 GIMBL POS 1 OR 2	H1	12A8	01	- 024	--	-5.0	+5.0	DEG	S&C	--	S'	TSC	8.9
CH3518H	YAW GIMBL POS 1 OR 2	H1	12A10	01	- 046	--	-5.0	+5.0	DEG	S&C	--	S'	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	VOC	S&C	--	--	--	8.9
CH3583V	SCS TVC YAW AUTO CMD	H1	12A13	01	- 053	--	+10	-10	VOC	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	DATA RANGE			INST BUS	SIG COND	O/B DISPL	SIG DIST	CSH DWG
				FR - WD	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	--	--	--	8.8A
CH3593X	FDAI SCALE ERR 50/15	E2	11E8-6	02 - 067	075	OFF	ON	EVENT	S&C	--	--	--	8.8A
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	CNC	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
CH3633X	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	TID	CHAN CODE	HBR		DATA RANGE			IMST BUS	SIG COND	R/E DISPL	SIG DIST	CSH DWG
				FR - WD	LBR HD	LOW	HIGH	UNITS					
CJ0060J	ASTRO 1 EKG AXIS 1	H1	22A3	01 - 007	--	0.1	5	1W	V ₂	--	--	--	--
CJ0061J	ASTRO 2 EKG AXIS 1	H1	22A1	01 - 005	--	0.1	5	1W	V ₂	--	--	--	4.2
CJ0062J	ASTRO 3 EKG AXIS 1	H1	22A2	01 - 006	--	0.1	5	1W	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	--	--	--	4.2
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	C11 X-AXIS ACCEL	H1	12A9	01	- 045	--	-2	+10	G	V ₂	--	--	--	
CK0027A	C11 Y-AXIS ACCEL	H1	51A14	01	- 127	--	-2	+2	G	V ₂	--	--	--	
CK0028A	C11 Z-AXIS ACCEL	H1	51A15	01	- 128	--	-2	+2	G	V ₂	--	--	--	
CK1040X	16 .M DATA ACQ CAMERA SHUTTER OPEN	H1	51A3 &	01	- 031	--	CLOSED	OPEN	EVENT	CAMERA	--	--	--	3.4
CK1043X	70 .M CAMERA SHUTTER OPEN	H1	51A10	01	- 031	--	CLOSED	OPEN	EVENT	CAMERA	--	--	--	3.4
CK1051K	DOSIMETER 1 RADIATION	H1	11A169	05	- 090	--	0	1K	RAD/H	V ₂	--	--	--	
CK1052K	DOSIMETER 2 RADIATION	H1	11A16	01	- 05B	--	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	HPB		LBR WD	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	10A14B	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	--									
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}	--	--	--	12.1	
SL1109T	UVS ELECTRONIC TEMP	H1	11A7	01 - 026	--	-100	+200	DEG F	V _{3S}	--	--	--		
SL1202T	SIM TEMP 2, BM1, XS 221, R62	H1	11A15	01 - 057	--	-100	+200	DEG F	V _{3S}	--	--	--		
SL1204T	SIM TEMP 4, BM1, XS 278, R62	H1	11A122	04 - 049	--	-100	+200	DEG F	V _{3S}	--	--	--		
SL1206T	SIM TEMP 6, BM6, XS 257, R62	H1	11A44	02 - 027	--	-100	+200	DEG F	V _{3S}	--	--	--		

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

MEAS ID	MEAS DESCRIPTION	TM	CHAN CODE	HRB		LBR NO	DATA RANGE			INST BUS	SIG COND	O/B DISPL	SIG DIST	CSH DWG
				FR	WD		LOW	HIGH	UNITS					
SL1211T	PAN CAMERA N2 LINE IN TEMP	H1	11A134	04	091	--	-100	+200	DEG F	V _{3S}	--	--	--	12.1
SL1212T	PAN CAMERA N2 TK TEMP	H1	11A135	04	092	--	-100	+200	DEG F	V _{3S}	--	--	--	12.1
SL1215T	MON BOX TEMP	H1	11A174	05	107	--	-100	+200	DEG F	V _{3S}	--	--	--	
SL1217T	SIM TEMP 17, BM6, XS 305, R62	H1	11A180	05	124	--	-100	+200	DEG F	V _{3S}	--	--	--	
SL1220T	SIM TEMP 20, SHELF, XS 206.5, R70	H1	11A97	03	090	--	-100	+200	DEG F	V _{3S}	--	--	--	
SL1221T	SIM TEMP 21, SHELF, XS 236.5, R70	H1	11A64	02	105	--	-100	+200	DEG F	V _{3S}	--	--	--	
SL1223T	HF ANT SPRT SM AFT HS TEMP	H1	11A99	03	092	--	-100	+200	DEG F	V _{3S}	--	--	--	
SL1250E	CSAR HF 1 RF PWR OUT	H1	10A97	33	052	--	0	0.75.5	VOLT	EXP	--	--	--	
SL1251E	CSAR HF 2 & VHF RF PWR OUT	H1	10A58	20	052	--	0	0.35/1.5/3.5	VOLT	EXP	--	--	--	
SL1255F	CSAR OSC FREQ	H1	10A98	33	084	--	OUTLOCK	LOCK EVENT		EXP	--	--	--	
SL1256T	CSAR TEMP	H2	11A129	04	075	183	0	150	DEG F	EXP	--	--	--	
SL1257V	CSAR HF 1 RCVR GAIN	H2	10A138	46	116	016	65	77	DB	EXP	--	--	--	
SL1258V	CSAR HF 2 & VHF RCVR GAIN	H2	10A120	40	116	200	69/83	81/95	DB	EXP	--	--	--	
SL1261E	CSAR HF 1 SPECULAR & NOISEPWR	H1	12A11	01	047	--	-77/-84	-36/-63	DBM	EXP	--	--	--	
		H2	10A87	29	116	158	-77/-84	-36/-63	DBM	EXP	--	--	--	
SL1262E	CSAR HF 2 & VHF SPEC & NOISE/PWR	H1	12A12	01	048	--	-81/-88/-84	-40/-54/-63	DBM	EXP	--	--	--	
		H2	10A96	32	116	079	-81/-88/-84	-40/-54/-63	DBM	EXP	--	--	--	
SL1275T	OPTICAL RCDR FILM PKG TEMP	H2	11A118	04	041	105	-40	+150	DEG F	VSC	DBA	--	--	
SL1276V	OPTICAL RCDR MODE STATUS	H1	10A92	31	084	--	0	1/2.3/3.4	VOLT	EXP	--	--	--	
SL1277V	OPTICAL RCDR ECHO STATUS	H1	10A95	32	084	--	0	2.4/4.8	VOLT	EXP	--	--	--	
SL1278V	OPTICAL RCDR VIDEO STATUS	H1	11A65	02	106	--	0	7.0	VP-P	EXP	--	--	--	
SL1279Q	OPTICAL RCDR FILM REMAINING	H1	10A55	19	052	--	0	650	FT	EXP	--	--	--	

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

MEAS ID	MEAS DESCRIPTION	TM	CHAN CODE	HBR		DATA RANGE			INST BUS	SIG COND	O/B DISPL	SIG DIST	CSH DMG
				FR - 1D	LBR WD	LOW	HIGH	UNITS					
SP0001P	He TK PRESS	H2	11A10	01 - 041	065	0	5K	PSIA	V _{3S}	--	--	--	9.1
SP0003P**	OX TK PRESS 1	H2	11A11	01 - 042	066	0	250	PSIA	V _{3S}	--	SM*	CS	9.1
SP0006P**	FU TK PRESS 1	H2	11A12	01 - 043	067	0	250	PSIA	V _{4S}	--	SM*	CS	9.1
SP0017T	LOWER He TANK TEMP	H1	10A16	06 - 052	--	-100	+200	DEG F	V _{4S}	--	--	--	9.1
SP0022H	FU/TX VLV 1 POS	H1	11A31	01 - 108	--	0	90	DEG	V _{3S}	--	--	--	9.1
SP0023H	FU/TX VLV 2 POS	H1	11A32	01 - 113	--	0	90	DEG	V _{4S}	--	--	--	9.1
SP0024H	FU/TX VLV 3 POS	H1	11A33	01 - 121	--	0	90	DEG	V _{3S}	--	--	--	9.1
SP0025H	FU/TX VLV 4 POS	H1	11A34	01 - 122	--	0	90	DEG	V _{4S}	--	--	--	9.1
SP0033P**	OX TK PRESS 2	H2	11A11	01 - 042	066	0	250	PSIA	V _{4S}	--	SM*	CS	9.1
SP0045T	ENG VLV BODY TEMP	H1	10A37	13 - 052	--	0	200	DEG F	V _{4S}	--	--	--	9.1
SP0048T	ENG FU FEED LINE TEMP	H1	11A173	05 - 106	--	0	200	DEG F	V _{3S}	--	--	CS	9.1
SP0049T	ENG OX FEED LINE TEMP	H1	10A23	8 - 084	--	0	200	DEG F	V _{4S}	--	--	CS	9.1
SP0054T	OX LINE 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}	--	--	--	9.1
SP0056T	BAY 5 FUEL SUMP TK SURF TEMP	H1	10A139	47 - 052	--	0	150	DEG F	V _{3S}	--	--	--	9.1
SP0057T	FU LINE TEMP	H1	10A59	20 - 064	--	0	200	DEG F	V _{4S}	--	--	--	9.1
SP0058T	BAY 3 OXID STORAGE TK SURF TEMP	H1	10A137	46 - 084	--	0	150	DEG F	V _{4S}	--	--	--	9.1
SP0059T	BAY 6 FUEL STORAGE TK SURF TEMP	H1	10A140	47 - 084	--	0	150	DEG F	V _{4S}	--	--	--	9.1
SP0062T	ENG INJECTOR FLANGE TEMP 2	H1	10A49	17 - 052	--	0	600	DEG F	V _{5C}	--	--	CS	9.1
SP0066P*	FU TK PRESS 2	H2	11A12	01 - 043	067	0	250	PSIA	V _{3S}	--	SM*	CS	9.1
SP0600P	ENG VLV ACT PRESS N ₂ A	H1	10A10	04 - 052	--	0	5K	PSIA	V _{3S}	--	SM*	CS	9.1
SP0601P	ENG VLV ACT PRESS N ₂ B	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
SP0930P	FUEL SM/ENG INTERFACE PRESS	H1	11A152	05 - 027	--	0	300	PSIA	V _{3S}	--	--	--	9.1
SP0931P	OX SM/ENG INTERFACE PRESS	H1	11A161	05 - 059	--	0	300	PSIA	V _{4S}	--	--	--	9.1

**PARAMETERS SP0003P AND SP0006P WILL BE INDIVIDUALLY TIME SHARED WITH PARAMETERS SP0033P AND SP0066P RESPECTIVELY.

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

MEAS ID	MEAS DESCRIPTION	TM	CHAN CODE	HBR		LBR MD	DATA RANGE			INST BUS	SIG COND	O/B DISPL	SIG DIST	CSH DWG
				FR	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	133	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 - 091	--	0	150	DEG F	V _{3S}	--	--	--	10.1	
SR5070T	OXID FEED LINE FILTER B TEMP	H1	11A132	04 - 089	--	0	150	DEG F	V _{4S}	--	--	--	10.1	
SR5071T	OXID FEED LINE FILTER C TEMP	H1	10A2	01 - 034	--	0	150	DEG F	V _{3S}	--	--	--	10.1	
SR5072T	OXID FEED LINE FILTER D TEMP	H1	11A133	04 - 090	--	0	150	DEG F	V _{4S}	--	--	--	10.1	
SR5073T	PRI FUEL TK OUT SURF A TEMP	H1	11A136	04 - 105	--	0	150	DEG F	V _{3S}	--	--	--	10.1	
SR5074T	PRI FUEL TK OUT SURF B TEMP	H1	11A137	04 - 106	--	0	150	DEG F	V _{4S}	--	--	--	10.1	
SR5075T	PRI FUEL TK OUT SURF C TEMP	H1	11A138	04 - 107	--	0	150	DEG F	V _{3S}	--	--	--	10.1	
SR5076T	PRI FUEL TK OUT SURF D TEMP	H1	11A139	04 - 108	--	0	150	DEG F	V _{4S}	--	--	--	10.1	
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 - 099	--	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

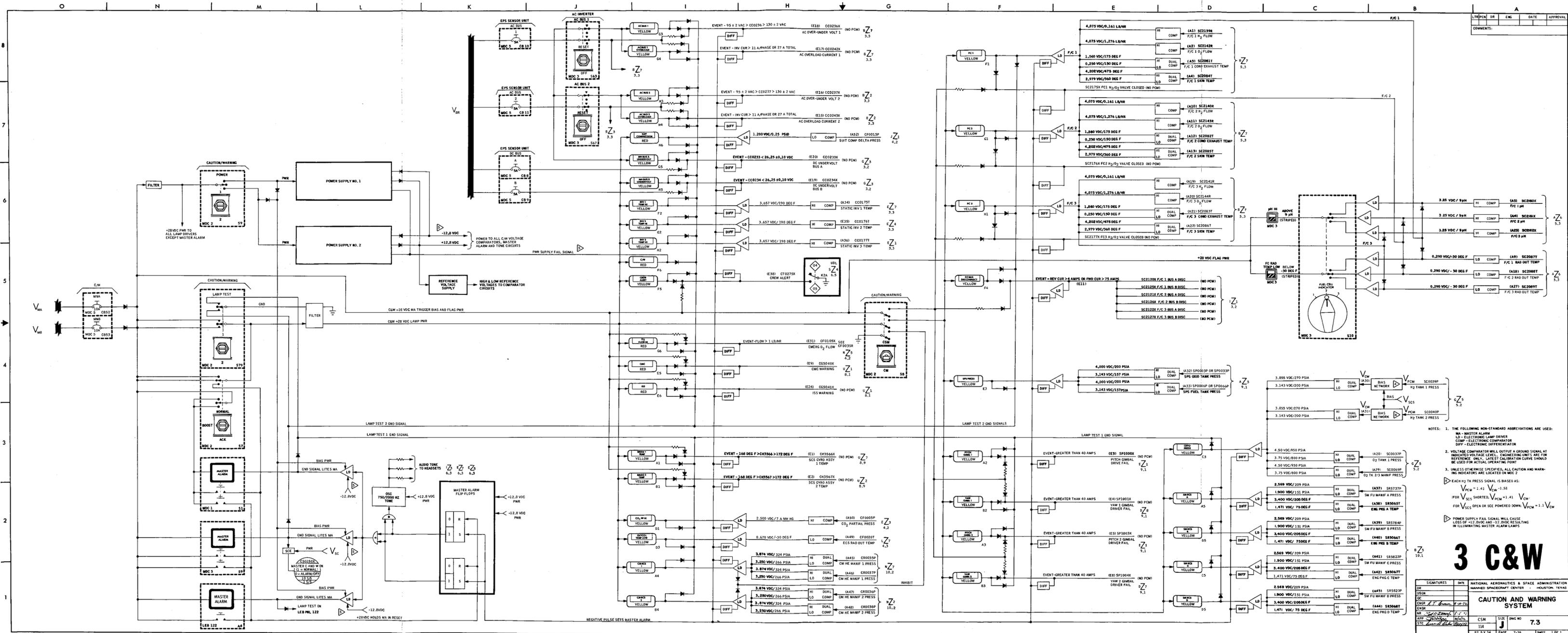
MEAS ID	MEAS DESCRIPTION	TM	CHAN CODE	HBR		LBR WD	DATA RANGE			INST BUS	SIG COND	O/R DISPL	SIG DIST	CSH DWG
				FR - WD			LOW	HIGH	UNITS					
SR5817P	SM He MANF C PRESS	H2	11A46	02 - 041	085	0	400	PSIA	V _{3S}	--	--	--	10.1	
SR5820P	SM OX MANF C PRESS	H1	11A27	01 - 092	--	0	300	PSIA	V _{3S}	--	--	--	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}	--	SM*	CS	10.1	
SR5823P	SM FU MANF D PRESS	H2	11A112	04 - 012	048	0	400	PSIA	V _{4S}	--	SM*	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 HD	DATA RANGE			INST BUS	SIG COMD	O/B DISPL	SIG DIST	CSH DWG
				FR	WD		LOW	HIGH	UNITS					
BS0080X	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	EDS	--	SM	CS	--
CS0220T	DOCKING PROBE TEMP	H1	10A22	08	- 052	--	-100	+300	DEG F	V ₂	--	--	--	2.7

TABLE 7-XVIII.- PCM EQUIPMENT TELEMETRY (51.2 KBPS) - COMMUNICATION AND INSTRUMENTATION

MEAS ID	MEAS DESCRIPTION	TH	CHAM CODE	HBR		DATA RANGE			INST BUS	SIG COND	C/R DISPL	SIG DIST	CSH DWG
				FR - WD	LBR WD	LOW	HIGH	UNITS					
CT0012X	CSE 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	6.2
ST0153H	HIGH GAIN ANT YAW POS	H2	11A120	04 - 043	107	0	360	DEG	HGA	--	M	CS	6.2
CT0161X	HGA BEAMWIDTH SW - HAR	E2	11E9-1	02 - 068	076		HAR	EVENT	HGA	--	--	--	6.2
CT0162X	HGA BEAMWIDTH SW - MED	E2	11E9-2	02 - 068	076		MED	EVENT	HGA	--	--	--	6.2
CT0163X	HGA TRACK SW - AUTO	E2	11E9-7	02 - 068	076		AUTO	EVENT	HGA	--	--	--	6.2
CT0164X	HGA TRACK SW - REACQ	E2	11E9-8	02 - 068	076		REACQ	EVENT	HGA	--	--	--	6.2
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}	--	--	--	



REV	BY	CHK	DATE	APPROVAL

COMMENTS:

- NOTES:
1. THE FOLLOWING NON-STANDARD ABBREVIATIONS ARE USED:
 MA - MASTER ALARM
 LD - ELECTRONIC LAMP DRIVER
 COMP - ELECTRONIC COMPARATOR
 DIFF - ELECTRONIC DIFFERENTIATOR
 2. VOLTAGE COMPARATOR WILL OUTPUT A GROUND SIGNAL AT INDICATED VOLTAGE LEVEL. ENGINEERING UNITS ARE FOR REFERENCE ONLY. LATEST CALIBRATION CURVES SHOULD BE USED FOR ACTUAL OPERATING POINT.
 3. UNLESS OTHERWISE SPECIFIED, ALL CAUTION AND WARNING INDICATORS ARE LOCATED ON MDC 2.
- △ EACH H₂ TX PRESS SIGNAL IS BIASED AS:
 $V_{CW} = 1.41 V_{CN} - 1.58$
 FOR V_{CN} SHORTED, $V_{CW} = 1.41 V_{CN}$
 FOR V_{CN} OPEN OR SENSE POWERED DOWN, $V_{CW} = 1.1 V_{CN}$
- △ POWER SUPPLY FAIL SIGNAL WILL CAUSE LOSS OF +12.8VDC AND +12.8VDC RESULTING IN ILLUMINATING MASTER ALARM LAMPS

3 C&W

CAUTION AND WARNING SYSTEM

REV	BY	CHK	DATE	APPROVAL

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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 programed 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	113
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 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 3 @ 800 S/S
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 MHZ ± 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 TO 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-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 MAX
	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

*

<u>M-AX</u>	Channel AX of master Unit main frame 8-bit analog multiplexer
<u>M-ADX</u>	Channel ADX of master unit addressable serial digital multiplexer
<u>S-AD-WX-Y</u>	Bit Y of discrete word WX of slave unit analog/discrete multiplexer
<u>S-AD-X</u>	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

MEAS ID	MEAS DESCRIPTION	FORMAT		INPUT GATE	INST BUS	DATA RANGE			U/P DISPL	CSH DWG
		SR	FR - UD			LOW	HIGH	UNITS		
J-SL1030V	PAN CAMERA V/H CMD VOLTS	11-01-030	S-A-19	EXP	10.1	20	M/RAD	--	12.1	
J-SL1031X	PAN CAMERA AID SOLENOID	11-05-071F	S-AD-W4-6	EXP	CLOSE	OPEN	EVENT	--	12.1	
J-SL1032T	PAN CAMERA FILM MAG TEMP	10-10-071	S-A-10	EXP	+30	+110	DEG F	--	12.1	
J-SL1033H	PAN CAMERA FRAMING ROLL POS	11-02-030	S-AD-4	EXP	0	47	INCHES	--	12.1	
J-SL1034H	PAN CAMERA SHUTTLE POS	11-03-030	S-A-18	EXP	0	14.38	INCHES	--	12.1	
J-SL1035C	PAN CAMERA LENS TORQUE CUR	11-04-030	S-AD-12	EXP	0	10	AMP	--	12.1	
J-SL1036X	PAN CAMERA CAPPING SHUTTER POS	11-05-071G	S-AD-W4-7	EXP	CLOSE	OPEN	EVENT	--	12.1	
J-SL1037V	PAN CAMERA FMC TACH VOLTS	11-05-030	S-A-26	EXP	0	20	M/RAD/S	--	12.1	
J-SL1030H	PAN CAMERA EXPOSURE CMD	11-06-030	S-A-3	EXP	0	2000	FT L	--	12.1	
J-SL1039T	PAN CAMERA LENS BARREL TEMP	10-09-030	S-A-21	EXP	+75	+105	DEG F	--	12.1	
J-SL1040T	PAN CAMERA FWD LENS TEMP	10-10-030	S-A-29	EXP	+75	+105	DEG F	--	12.1	
J-SL1041T	PAN CAMERA AFT LENS TEMP	10-19-030	S-AD-20	EXP	+75	+105	DEG F	--	12.1	
J-SL1042T	PAN CAMERA MECH TEMP	10-89-030	S-A-4	EXP	+30	+110	DEG F	--	12.1	
J-SL1044H	PAN CAMERA SLIT WIDTH	11-07-053	S-AD-8	EXP	0	0.30	INCH	--	12.1	
J-SL1045X	PAN CAMERA GO/NO GO	11-05-071C	S-AD-W4-3	EXP	NO GO	GO	EVENT	TB	3.4	
J-SL1091V	LASER ALT REG 5.0 VOLTS	11-01-053	S-A-45	EXP	ABSENT	PRESENT	EVENT	--	12.3	
J-SL1092V	LASER ALT PHOTO MULT VOLTS	11-04-053	S-A-43	EXP	0	-1800	VOLTS	--	12.3	
J-SL1093V	LASER ALT PFN VOLTS	11-05-053	S-A-59	EXP	0	+3000	VOLTS	--	12.3	
J-SL1094T	LASER ALT CAVITY TEMP	11-02-053	S-A-53	EXP	-13	+167	DEG F	--	12.3	
J-SL1100K	UVS SPECTRUM COUNT -16 BIT SER	11-02-071	M-A01	EXP	0	65535	C/SMP/L	--		
J-SL1101T	UVS HOUSING TEMP	10-80-072	S-A-2	EXP	-40	+180	DEG F	--		
J-SL1102T	UVS MOTOR TEMP	10-10-072	S-A-13	EXP	-40	+180	DEG F	--		
J-SL1103V	UVS INPUT VOLTAGE	10-20-071	S-A-1	EXP	0	40	VDC	--		
J-SL1104C	UVS INPUT CURRENT	10-70-071	S-A-25	EXP	0	1.0	AMP	--		
J-SL1105V	UVS PHOTOMULTIPLIER HI VOLT	10-90-071	S-A-33	EXP	0	4K	VDC	--		
J-SL1106V	UVS REGULATED VOLTAGE	10-60-072	S-A-57	EXP	0	10	VDC	--		
J-SL1122K	LASER ALT SERIAL DATA, 24 BITS	12-01-011	MFD-1	EXP	40	80	NH	--	12.3	
J-SL1126K	ISR DATA CHAN NO. 1	82-01-007	M-A1	EXP	-460	-163	DEG F	--		
J-SL1127K	ISR DATA CHAN NO. 2	82-01-008	M-A9	EXP	-460	-10	DEG F	--		
J-SL1128K	ISR DATA CHAN NO. 3	82-01-005	M-A25	EXP	-460	+260	DEG F	--		
J-SL1129T	ISR SCAN PRI MIRROR TEMP	10-30-071	S-AD-1	EXP	0	125	DEG F	--		
J-SL1131T	ISR CALIB PATCH TEMP	10-80-071	S-AD-2	EXP	10	110	DEG F	--		
J-SL1132T	ISR DETECTOR TEMP	10-30-072	S-AD-18	EXP	0	110	DEG F	--		

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 DISPL	CHS DWG
		SR - FR - WD			LOW	HIGH	UNITS		
J-SL1134V	ISR BIAS VOLTAGE	11-07-030	S-AD-17	EXP	150	250	VDC	--	
J-SL1135V	ISR CIRCUIT VOLTAGE SUM	10-70-072	S-AD-11	EXP	0	0	VDC	--	
J-SL1160T	METRIC LENS FRONT ELEMENT TEMP	10-69-030	S-A-51	EXP	41	113	DEG F	--	12.2
J-SL1161T	METRIC LENS BARREL TEMP	10-50-030	S-AD-6	EXP	41	113	DEG F	--	12.2
J-SL1162T	STELLAR LENS FRONT ELEMENT TEMP	10-29-030	S-AD-5	EXP	41	113	DEG F	--	12.2
J-SL1163T	MC STELLAR LENS BARREL TEMP	10-30-030	S-A-42	EXP	41	113	DEG F	--	12.2
J-SL1164T	MC SUPPLY CASSETTE TEMP	10-49-030	S-A-58	EXP	41	113	DEG F	--	12.2
J-SL1165X	MC IMAGE MOTION CMD	10-39-030	S-AD-13	EXP	OFF	ON	EVENT	--	12.2
J-SL1166R	METRIC SHUTTER DISC SPEED	10-59-030	S-A-27	EXP	80	1280	RPM	--	12.2
J-SL1168X	MAP CAMERA DEPLOY/FILM CUT	10-60-030	S-AD-14	EXP	CUT	DEPLOY	EVENT	--	12.2
J-SL1172X	MAP CAMERA GO/NO GO	11-05-071E	S-AD-W4-5	EXP	NO GO	GO	EVENT	TB	3.4
J-SL1173X	METRIC FILM MOTION/EXPOSURE	11-08-030	S-A-50	EXP	MOTION	EXPOSE	EVENT	--	12.2
J-SL1176Q	METRIC FILM REMAINING	10-40-030	S-AD-21	EXP	1500	0	FT	--	12.2
J-SL1177X	MC CYCLE RTE/METRIC SHTR CTR EXP	82-01-009B	M-W1-2	EXP		CR/EXP	EVENT	--	12.2
J-SL1180X	IRIG B/PT/DR/AW/STELLAR FILM MOTION	11-05-071H	S-A0-W4-8	EXP		MULTI	EVENT	--	12.2
J-SL1181R	MAP CAMERA V/H INCREASE LEVEL	10-20-030	S-A-34	EXP	12.1	16.1	MRAD/S	--	12.2
J-SL1269X	LS HF ANT 1 DEPLOY	11-07-072A	S-AD-W7-1	EXP		DEPLOY	EVENT	TB	2.9
J-SL1270X	LS HF ANT 1 RETRACT	11-07-072C	S-AD-W7-3	EXP		RETRACT	EVENT	TB	2.9
J-SL1271X	LS HF ANT 2 DEPLOY	11-07-072E	S-AD-W7-5	EXP		DEPLOY	EVENT	TB	2.9
J-SL1272X	LS HF ANT 2 RETRACT	11-07-072G	S-AD-W7-7	EXP		RETRACT	EVENT	TB	2.9
J-SL1273X	LS HF ANT 1 MTR CUR	11-09-053	S-AD-16	V _{3S}	0	4	AMPS	--	2.9
J-SL1274X	LS HF ANT 2 MTR CUR	11-10-053	S-AD-22	V _{3S}	0	4	AMPS	--	2.9

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 DNG
		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	10-30-030		S-A-38	CAI	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)

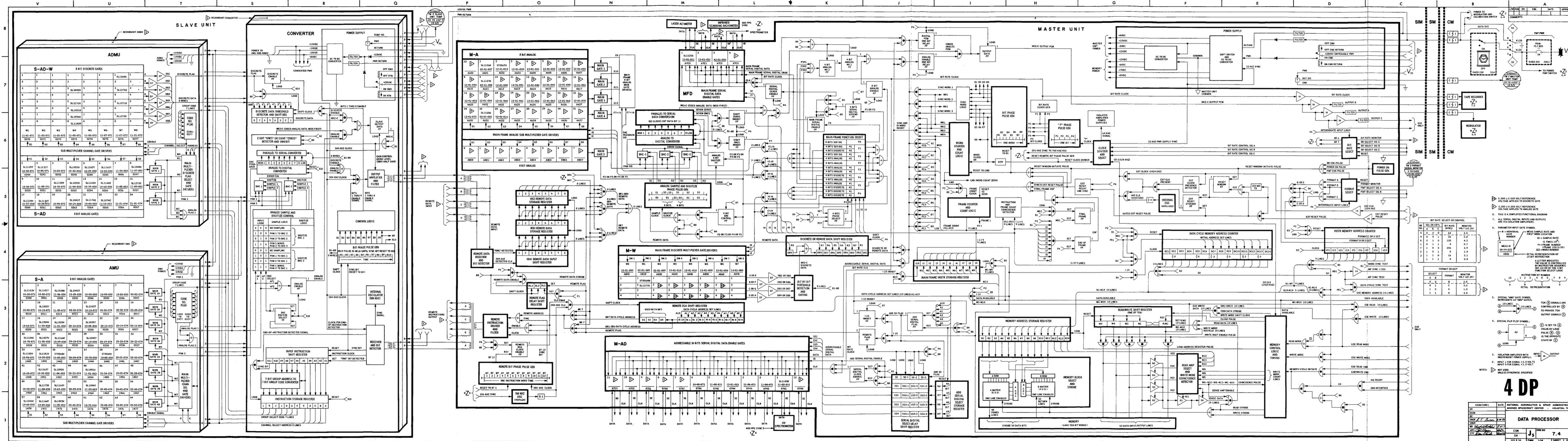
MAIN FRAME FORMAT - WORD LOCATION

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

SUBCOM WORDS FORMAT - FRAME LOCATION

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

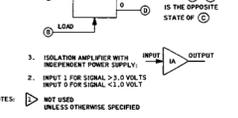
MINIMUM SAMPLE RATE IS 1 SAMPLE PER SECOND
 MINIMUM SAMPLE RATE IS 100 SAMPLES PER SECOND



5. 000 to 1.000 VOLTS REFERENCE VOLTAGE APPLIED TO DISCRETE GATE
3. 360 to 0.500 VOLTS REFERENCE VOLTAGE APPLIED TO ANALOG GATE
- THIS IS A SIMPLIFIED FUNCTIONAL DIAGRAM
- ALL SERIAL DIGITAL INPUTS AND OUTPUTS ARE VIA ISOLATION AMPLIFIERS
- PARAMETER INPUT GATE SYMBOLS
- MEASUREMENT RATE AND FIRST WORD LOCATION
- IS TIMES 10³
- IS TIMES 10⁴
- IS TIMES 10⁵
- IS TIMES 10⁶
- IS TIMES 10⁷
- IS TIMES 10⁸
- IS TIMES 10⁹
- IS TIMES 10¹⁰
- IS TIMES 10¹¹
- IS TIMES 10¹²
- IS TIMES 10¹³
- IS TIMES 10¹⁴
- IS TIMES 10¹⁵
- IS TIMES 10¹⁶
- IS TIMES 10¹⁷
- IS TIMES 10¹⁸
- IS TIMES 10¹⁹
- IS TIMES 10²⁰
- IS TIMES 10²¹
- IS TIMES 10²²
- IS TIMES 10²³
- IS TIMES 10²⁴
- IS TIMES 10²⁵
- IS TIMES 10²⁶
- IS TIMES 10²⁷
- IS TIMES 10²⁸
- IS TIMES 10²⁹
- IS TIMES 10³⁰
- IS TIMES 10³¹
- IS TIMES 10³²
- IS TIMES 10³³
- IS TIMES 10³⁴
- IS TIMES 10³⁵
- IS TIMES 10³⁶
- IS TIMES 10³⁷
- IS TIMES 10³⁸
- IS TIMES 10³⁹
- IS TIMES 10⁴⁰
- IS TIMES 10⁴¹
- IS TIMES 10⁴²
- IS TIMES 10⁴³
- IS TIMES 10⁴⁴
- IS TIMES 10⁴⁵
- IS TIMES 10⁴⁶
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- IS TIMES 10⁴⁸
- IS TIMES 10⁴⁹
- IS TIMES 10⁵⁰
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- IS TIMES 10⁵²
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- IS TIMES 10⁹⁸
- IS TIMES 10⁹⁹
- IS TIMES 10¹⁰⁰

SELECT	FORMAT	MONITOR VOLT (0.2V)
0 0 0	A	2.0
0 0 1	B	2.0
0 1 0	C	4.0
0 1 1	D	0.2
1 0 0	E	4.0
1 0 1	F	1.4
1 1 0	G	1.0
1 1 1	H	0.0

- SPECIAL "AND" GATE SYMBOLS REPRESENTS 10 GATES:
- SPECIAL FLIP FLOP SYMBOLS:
- ISOLATION AMPLIFIER WITH INDEPENDENT POWER SUPPLY:
- INPUT 1 FOR SIGNAL > 0 VOLTS INPUT FOR SIGNAL < 0 VOLTS



4 DP

8 GUIDANCE AND
CONTROL
SYSTEM

MISCELLANEOUS G & C INFORMATION

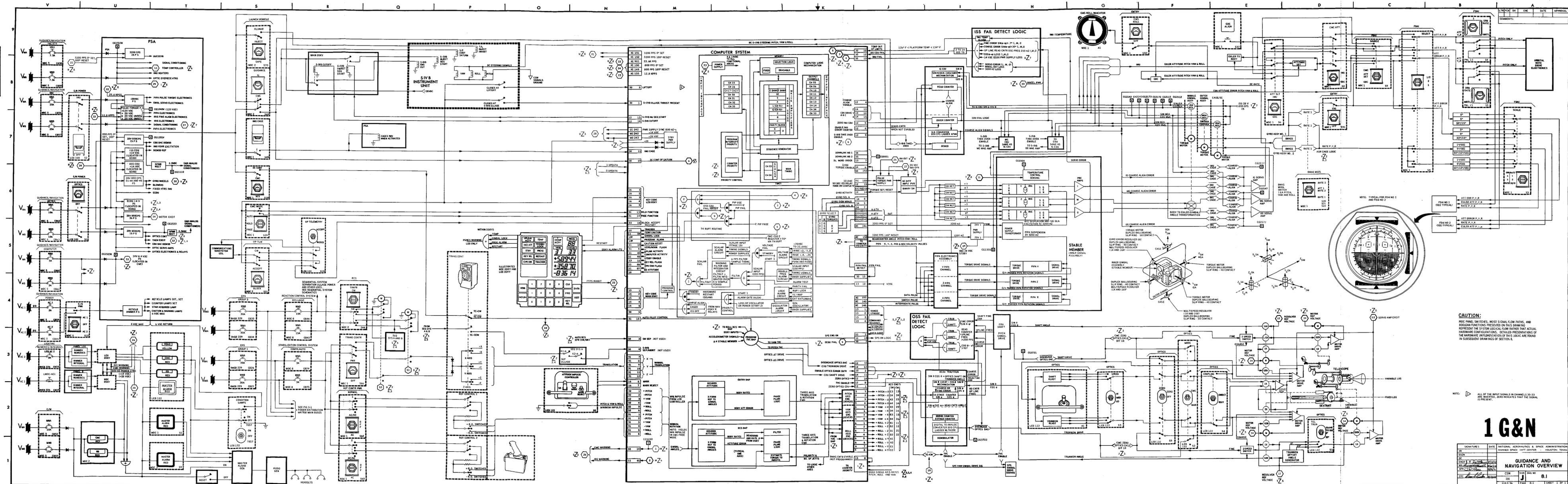
S/C MOTION DESIRED BY THE CREW	CIRCLAR THUMB WHEEL POSITION	ENGINE NOZZLE MOVES TOWARDS THE	THE THRUST VECTOR OF THE ENGINE TOWARDS THE	CIRCLAR POSITION INDICATOR MOVES TO	ACTUATOR TRAVEL
S/C NOSE DOWN (OPTIC)	+ NUMERICAL (UP)	+ Z AXIS OF THE S/C	+ Z AXIS OF THE S/C	+ NUMERICAL	PITCH EXTENDS
S/C NOSE UP (OPTIC)	- NUMERICAL (DOWN)	- Z AXIS OF THE S/C	- Z AXIS OF THE S/C	- NUMERICAL	PITCH RETRACTS
S/C RIGHT (YAW)	+ NUMERICAL (RIGHT)	+ Y AXIS OF THE S/C	+ Y AXIS OF THE S/C	+ NUMERICAL	YAW EXTENDS
S/C LEFT (YAW)	- NUMERICAL (LEFT)	- Y AXIS OF THE S/C	- Y AXIS OF THE S/C	- NUMERICAL	YAW RETRACTS

REC CM SW	COMMAND QUAD	CHANNEL	CHANNEL SWITCH POSITION
C3 13	+ X	A	PITCH
C4 24	- X	A	PITCH
A3 23	- X	A	PITCH
A4 14	+ X	A	PITCH
D3 25	+ X	D	YAW
D4 16	- X	D	YAW
B3 15	- X	B	YAW
B4 26	+ X	B	YAW
B1 13	+ Z	B	ROLL
A1 12	- Z	B	ROLL
D1 21	- Z	D	ROLL
D2 22	+ Z	D	ROLL
A1	+ Y	A	ROLL
A2	- Y	A	ROLL
C1	- Y	C	ROLL
C2	+ Y	C	ROLL

ATT	RATE	ATTITUDE	RATE	ROD	PROPORTIONAL
SW	SW	SW	SW	SW	SW
511	HIGH	15.0°	10.2°/S	10.65% P, P, R	10.65% P, P, R
512	LOW	15.0°	10.2°/S	10.65% P, P, R	10.65% P, P, R
511	HIGH	15.0°	10.2°/S	10.65% P, P, R	10.65% P, P, R
512	LOW	15.0°	10.2°/S	10.65% P, P, R	10.65% P, P, R

FDAI	FDAI	ATTITUDE	TOTAL ATTITUDE	ATTITUDE ERROR	ANGULAR VELOCITY	
SELECT	SW	SET	FDAI 1	FDAI 2	FDAI 1	FDAI 2
1/2	N/A	N/A	IMU	ISS ECU	IMAC 2	IMAC 2
2	CMC	N/A	IMU	ISS ECU	N/A	IMAC 2
3	ATT SET	IMU	IMU	IMU/ISS	N/A	IMAC 2
4	AS	GDC	N/A	GDC	N/A	IMAC 2
5	GDC	N/A	GDC	N/A	IMAC 1	IMAC 2
6	GDC	N/A	GDC	N/A	IMAC 2	N/A

APRON DWG 8.1



CAUTION:
MOC PANEL SWITCHES, MOST SIGNAL PATHS, AND BOGUS FUNCTIONS PREDICTED ON THIS DRAWING REPRESENT THE SYSTEM LOGICAL FLOW RATHER THAN ACTUAL HARDWARE CONFIGURATIONS. DETAILED REPRESENTATIONS OF THE HARDWARE IMPLEMENTATION OF THIS LOGIC ARE FOUND IN SUBSEQUENT DRAWINGS OF SECTION 8.

NOTE: ALL OF THE INPUT SIGNALS IN CHANNELS 30-33 ARE INVERTED. ZERO INDICATES THAT THE SIGNAL IS PRESENT.

SCS SIGNAL AND POWER CODE

CSM
S/C 114

CODE TYPE OR POWER

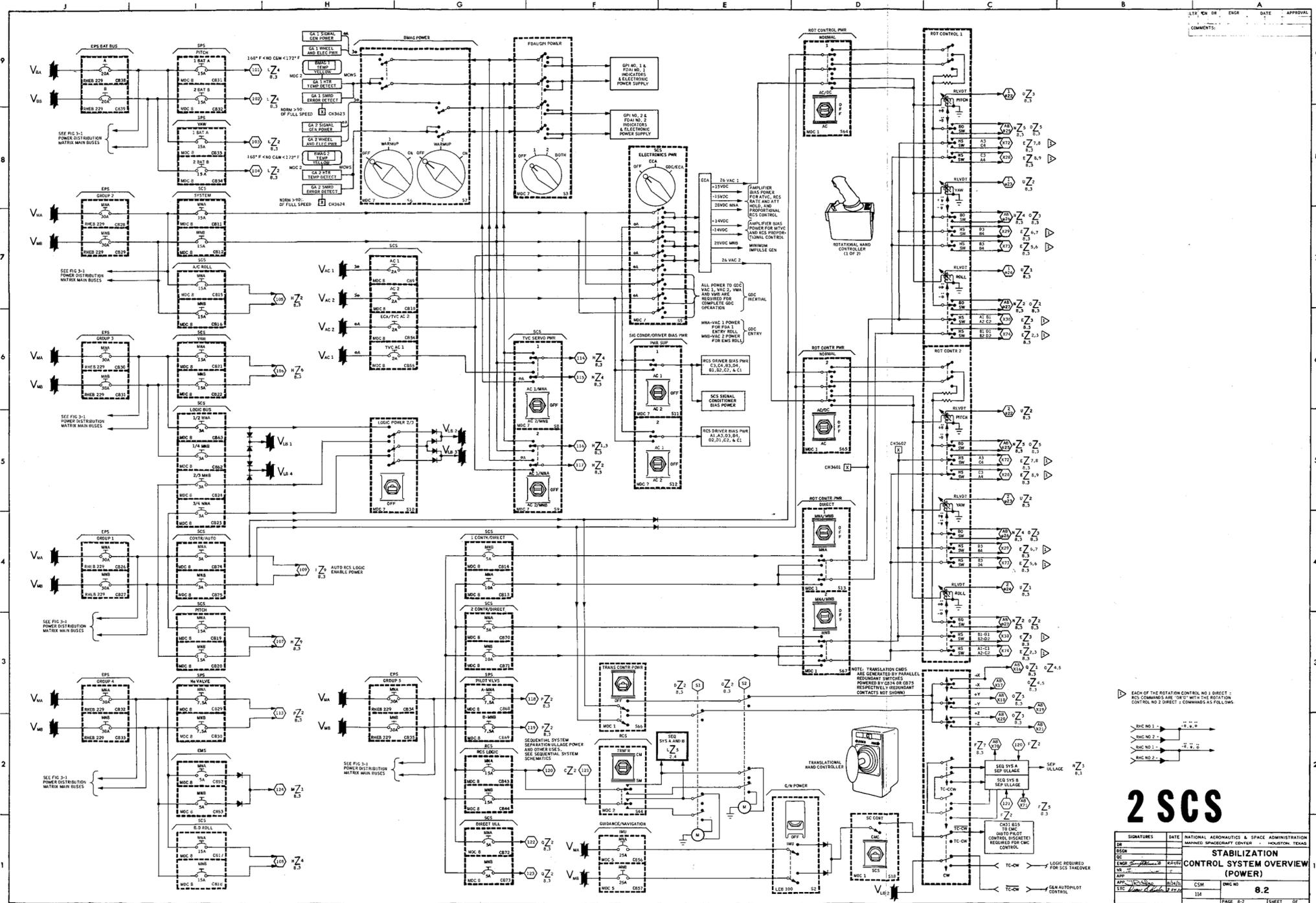
- 01 27.5Vdc
- 02 ±20 Vdc
- 03 10 Vac
- 04 2.2 KHz
- 05 25 Vac
- 06 ±15 Vdc
- 07 ±14.5 Vdc
- 08 400 Hz SPIN MOTOR POWER
- 09 26 Vac 400 Hz REFERENCE
- 10 14 Vdc
- 11 13 Vdc
- 12 -15 Vdc
- 13 +20 Vdc
- 14 ±32 Vdc
- 15 ±32 Vdc
- M 400 Hz 26 V BUS 1 SWITCH 3 OR 800 Hz 0 PHASE IMU
- N 400 Hz 26 Vac BUS 2 SWITCH 3 OR 800 Hz 0 PHASE IMU
- P 400 Hz 26 Vac BUS 2 SWITCH 3 OR 400 Hz 26 Vac BUS 1 SWITCH 6 OR 800 Hz 0 PHASE IMU
- 16 +X TRANSLATION
- 17 -X TRANSLATION
- 18 +Y TRANSLATION
- 19 -Y TRANSLATION
- 20 +Z TRANSLATION
- 21 -Z TRANSLATION
- 22 PITCH RATE COMMAND
- 23 YAW RATE COMMAND
- 24 ROLL RATE COMMAND
- 25 PITCH MIN IMP
- 26 YAW MIN IMP
- 27 ROLL MIN IMP
- 28 PITCH DIRECT (C3-A4)
- 29 YAW DIRECT (D3-B4)
- 30 ROLL DIRECT (B1-D1, B2, D2)
- 31 SCS LOGIC BUS 1
- 32 SCS LOGIC BUS 2
- 33 SCS LOGIC BUS 3
- 34 SCS LOGIC BUS 4
- 35 -4 Vdc
- 36 TRANSLATION CONTROL CLOCKWISE
- 37 SCS CONTROL MODE
- 38 RCS ERROR
- 39 GA1 ac RATE OR ATTITUDE ERROR

Note: Codes 100 and up designate drawing interconnections from 8.2 to 8.3 only.

CODE TYPE OF POWER

- 40 GA2 ac RATE
- 41 dc RATE
- 42 ENGINE ON WITH 1 SECOND DELAYED OFF
- 43 ENGINE ON/OFF 1 SECOND DELAY
- 44 MODE SELECTED SCS
- 45 PITCH GYRO UNCAGE
- 46 YAW GYRO UNCAGE
- 47 ROLL GYRO UNCAGE
- 48 SIG COND POWER ±15.0, -2.5 AND -10 Vdc
- 49 115 V 400 Hz PHASE A
- 50 MODE SELECTED CMC
- 51 PITCH AUTO CNTL DISABLE
- 52 YAW AUTO CNTL DISABLE
- 53 ROLL AUTO CNTL DISABLE
- 54 PITCH ACCEL CMD ENABLE
- 55 YAW ACCEL CMD ENABLE
- 56 ROLL ACCEL CMD ENABLE
- 57 DIRECT ULLAGE PITCH JETS
- 58 DIRECT ULLAGE YAW JETS
- 59 .05g OFF
- 60 GDC EULER
- 61 .05g ON
- R 400/800 CPS OUT PHASE FDAI #1 RESOLVER SIG DEMOD
- S 400/800 CPS OUT PHASE FDAI #2 RESOLVER SIG DEMOD
- T FDAI 1 AND 2 PYR RATE DEMOD REF VOLTAGE 115 V 400 Hz
- 62 26 Vac <90°, 400 Hz REACTION
- 64 A/C ROLL ENGINE POWER CB15 AND CB16, MDC 8
- 65 B/D ROLL REACTION ENGINE POWER CB17 AND CB18, MDC 8
- 66 PITCH REACTION ENGINE POWER CB19 AND CB20, MDC 8
- 67 YAW REACTION ENGINE POWER CB 21 AND CB22, MDC 8
- 68 REACTION ENGINE SOLENOID DRIVER ENABLE POWER CB74 AND CB75, MDC 8 (AUTO RCS)
- 69 RCS LOGIC POWER FROM CB34 AND CB35, PNL 229
- 70 SEQ A SPS THRUST ON LOGIC ENABLE AND SEP ULLAGE
- 71 SEQ B SPS THRUST ON LOGIC ENABLE AND SEP ULLAGE
- 72 PITCH DIRECT (A3-C4)
- 73 YAW DIRECT (B3-D4)
- 74 ROLL DIRECT (A1-C1, A2-C2)

APRON DWG 8.2



2 SCS

SIGNATURES		DATE		NATIONAL AERONAUTICS & SPACE ADMINISTRATION	
DR				HOUSTON, TEXAS	
ESC				MANNED SPACECRAFT CENTER	
GC				STABILIZATION CONTROL SYSTEM OVERVIEW (POWER)	
ENG				CSM	DWG NO
APP				114	8.2
SEC				PAGE 8-2	SHEET 57

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

TABLE 8-II.-- CSM ALARM CODES

<u>ALARM CODE (CODE)</u>	<u>ACTION</u>	<u>TITLE-DESCRIPTION</u>
00110	NONE	<u>NO MARK SINCE LAST MK REJ.</u> - THE PROCESS OF MARKING SETS BIT 10 OF MARK-STAT TO ENABLE A MARK REJECT. IF MARKING IS BEING ACCEPTED BY PROGRAM WHEN MARK REJECT IS ACTIVATED, BIT 10 IF 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. USE MAIN DSKY IF FAILURE VERIFIED.	<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.

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.

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 CON- SIDERED 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 INHIBITS IT WHEN NOT IN USE. WHEN NOT IN USE, AND PROVIDING THE PROGRAM CAUTION IN- HIBIT (BIT 5 IMODES 30) IS RESET, 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>
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 OR SET REFSMMAT FLAG IF ALIGNMENT IS OK.	<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 R02 BOTH, 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.

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 OF FIRST ITERATION</u> - IF ON THE FIRST ITERATION FOR THE PRE-CSE 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.

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 COORDINATES 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 CMOONFLAG (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 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 G&N SSR-1.	<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 SERIALY 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 TABLE 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.

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 COMP ACTY LIGHT IS OUT OR CALL POO 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 POO 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.

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 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, ICDU FAILS CAUSED THE ISS WARNING</u> - WHEN BOTH UNINHIBITED IMU FAIL (IMODES 30 BIT 13) AND ICDU 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 GEN 6.	<u>IMU, ICDU, PIPA FAILS CAUSED ISS 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 S.V.</u> - IF STATE VECTOR POSITION MAGNITUDE BECOMES TOO LOW DUE TO A "BAD" S.V. CAUSING OVERFLOW IN THE INTEGRATION 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 GOTOPPOH.
20607	RECYCLE PROGRAM WITH ADJUSTED INPUT PARAMETERS.	<u>NO SOLUTION FROM TIME THETA OR TIME RADIUS ROUTINE</u> - THESE ROUTINES PROVIDE 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 GOTOPPOH.
20610	RECYCLE PROGRAM AND ADJUSTING.	<u>LAMBDA LESS THAN UNITY</u> - IF THE POSITION VECTOR IS LESS THAN 400,000 FT ABOVE THE PAD RADIUS AT TIG FOR THE RTE MANEUVER, THIS SIGNIFIES THE POSITION VECTOR IS TOO SMALL FOR THE MANEUVER. PROGRAM ALARM WILL BE DISPLAYED, AND PROGRAM WILL PROCEED TO GOTOPPOH.

TABLE 8-II.- CSM ALARM CODES - CONTINUED

<u>ALARM CODE (OCTAL)</u>	<u>ACTION</u>	<u>TITLE-DESCRIPTION</u>
21204	RESELECT PROGRAM UNLESS AVG G IS RUNNING.	<u>NEGATIVE OR ZERO WAITLIST CALL</u> - A FINITE POSITIVE DELAY IS REQUIRED TO SCHEDULE A WAITLIST TASK FOR THE T3RUP ROUTINE TO EXECUTE. A TIME DELAY OF ZERO OR NEGATIVE FOR AN INSERTED TASK IS ILLEGAL AND WILL RESULT IN ABORTING THE TASK.
21206	SAME AS 21204.	<u>SECOND JOB ATTEMPTS TO GO TO SLEEP VIA KEYBOARD AND DIPLAY PROGRAM</u> - 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 GOTOOOH.
21210	RESELECT PROGRAM. DO NOT USE IMU WHILE CMC IS USING IT.	<u>TWO PROGRAMS USING SAME DEVICE AT SAME TIME</u> - IF TWO JOBS TRY TO UTILIZE ANY OF THE STALL ROUTINES OR THE AUTO MA- NEUVER 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 PRO- CEED TO GOTOOOH.
21302	SAME AS 21204.	<u>SORT CALLED WITH NEGATIVE ARGUMENT</u> - 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 SOFT- WARE RESTART IS EXECUTED, AND PROCESSING PROCEEDS TO GOTOOOH.

TABLE 8-II.- CSM ALARM CODES - CONTINUED

<u>ALARM CODE (OCTAL)</u>	<u>ACTION</u>	<u>TITLE-DESCRIPTION</u>
21501	SAME AS 21204	<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	SAME AS 21204	<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 NODOPO1 FLAG (FWI 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	RESELECT EXTENDED VERB OR CONTINUE	<u>DELAY ROUTINE BUSY</u> - THE ROUTINE DELAY JOB 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	SAME AS 31104	<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.

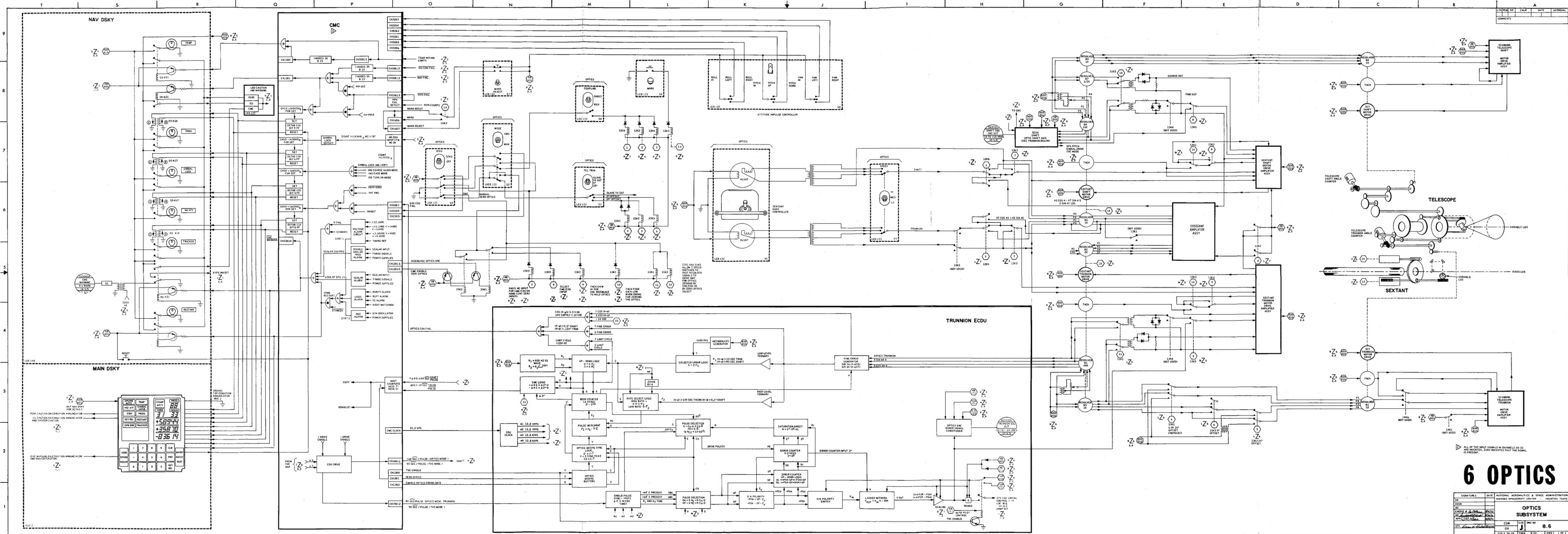
TABLE 8-II.- CSM ALARM CODES - CONCLUDED

<u>ALARM CODE (OCTAL)</u>	<u>ACTION</u>	<u>TITLE-DESCRIPTION</u>
31202	SAME AS 31104.	<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.
31203	SAME AS 31104.	<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 DISPLAYS PROGRAM ALARM.
31211	RESELECT EXTENDED VERB AFTER OPTICS MARKING IS COMPLETED.	<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 GENERATED 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

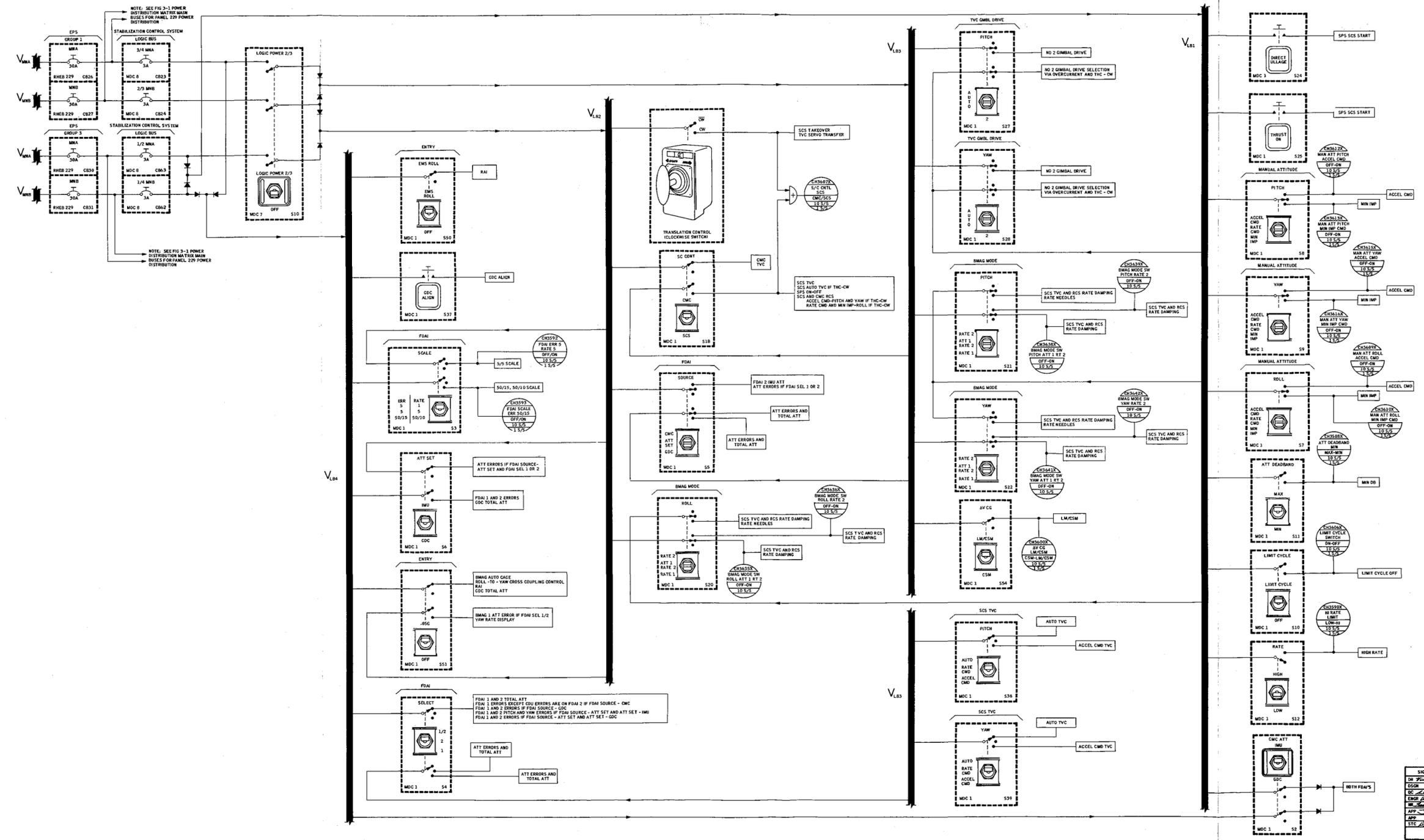
**The OPTICS OPERATE power may be off during an SPS burn. In this case, the shaft and trunion CDU DAC outputs will still be operational because a TVC relay operated during the burn switches the 28V 800 cycle power from the OPTICS 800 cycle source to the ISS 800 cycle source. The 28 Vdc power to the DAC's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



6 OPTICS

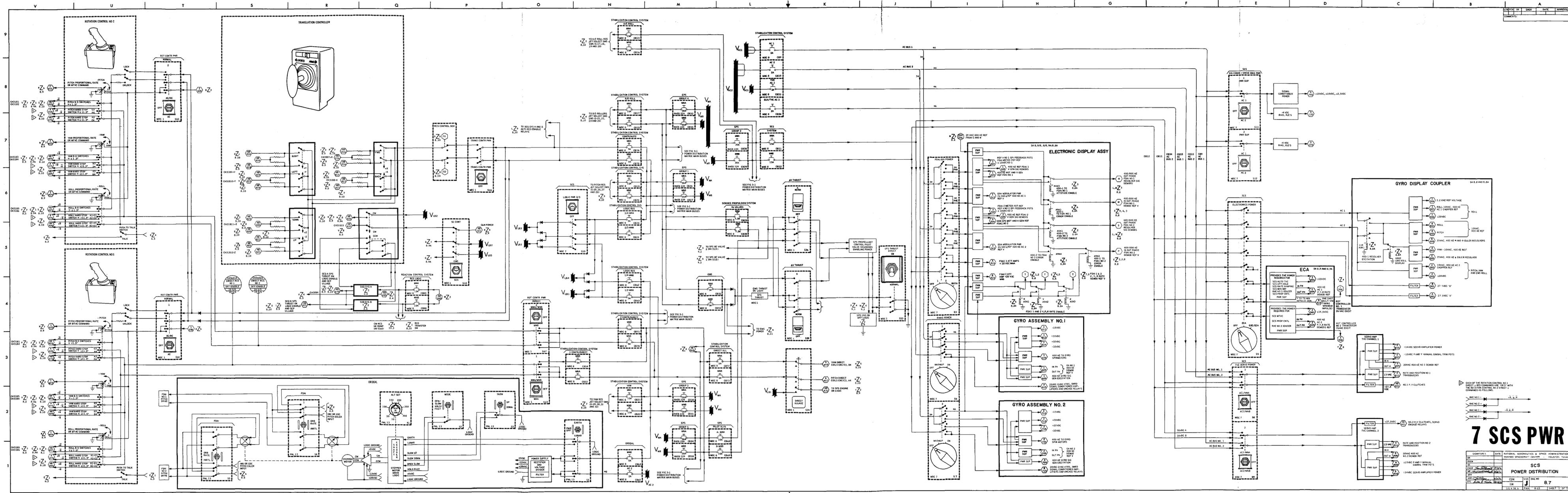
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OPTICS SUBSYSTEM
 CSM 110 8.6
 110 8.6 25 PAGE 8-25 SHEET 1 OF 1



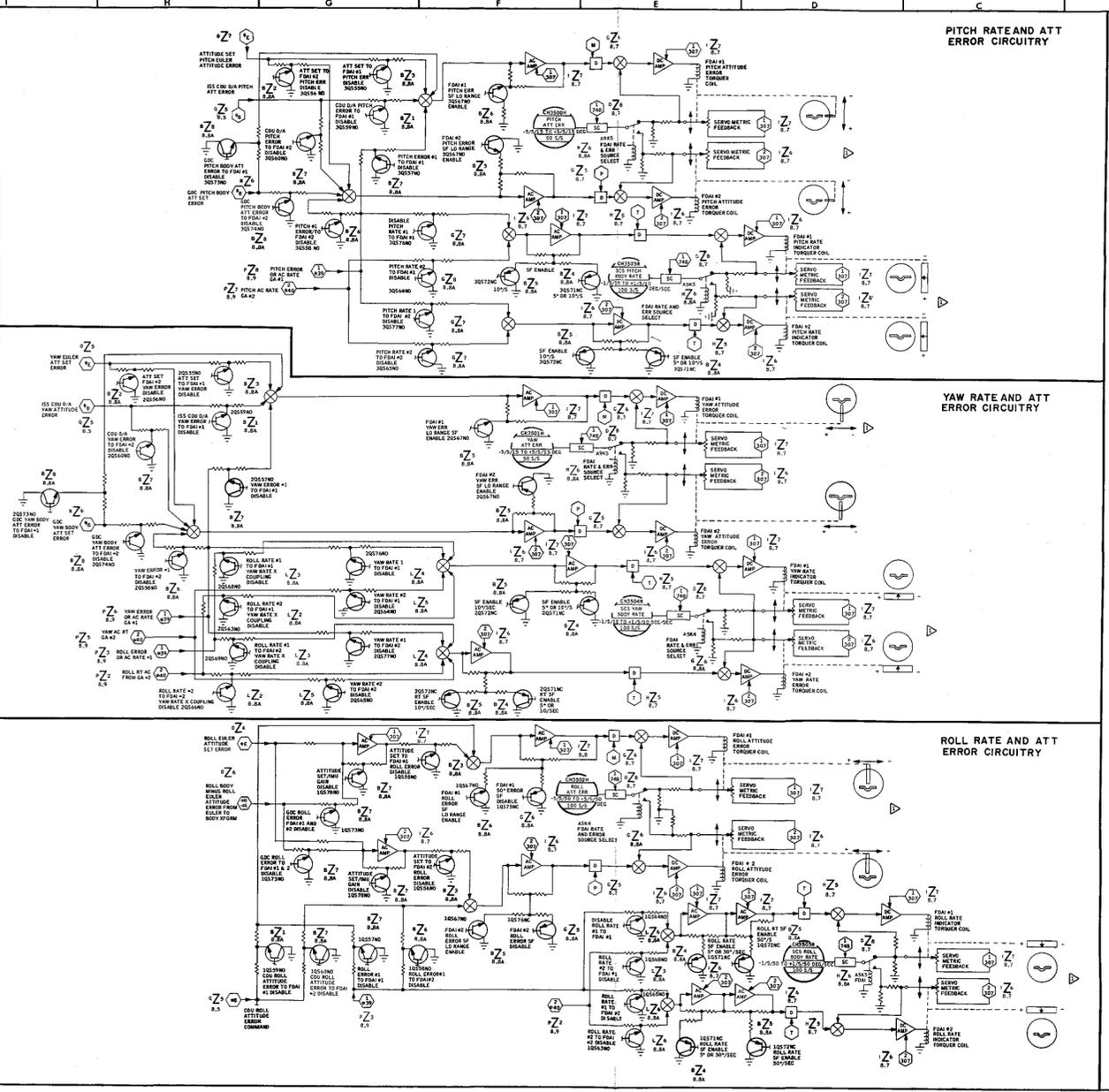
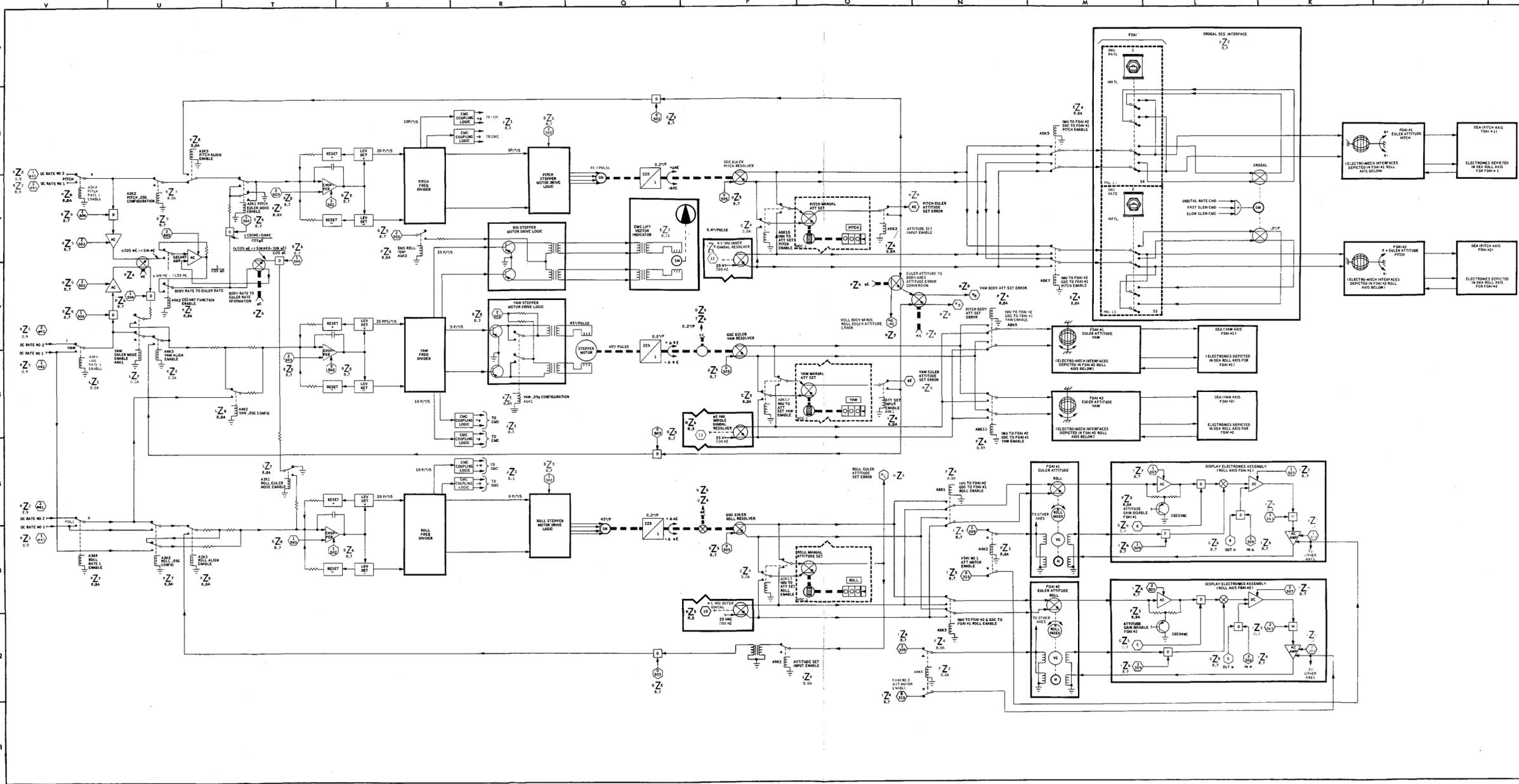
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DR <i>[Signature]</i>	8/27/66	MANNED SPACECRAFT CENTER - HOUSTON, TEXAS
DC <i>[Signature]</i>		
ENG <i>[Signature]</i>		
APP <i>[Signature]</i>		
STC <i>[Signature]</i>		
LOGIC POWER DISTRIBUTION		
APP	CSM	DRG NO
	134	
	35 X 66	PAGE 8-24
		SHEET 1 OF 1

FIGURE 8-1



7 SCS PWR

DATE	REVISION	BY	CHKD	APP'D
14 JUN 68	1	...	...	...
14 JUN 68	2	...	...	...
14 JUN 68	3	...	...	...
14 JUN 68	4	...	...	...
14 JUN 68	5	...	...	...
14 JUN 68	6	...	...	...
14 JUN 68	7	...	...	...
14 JUN 68	8	...	...	...
14 JUN 68	9	...	...	...



ROLL ANGLE VELOCITY
ATTITUDE ERROR
PITCH ANGLE VELOCITY
ATTITUDE ERROR
YAW ANGLE VELOCITY
ATTITUDE ERROR

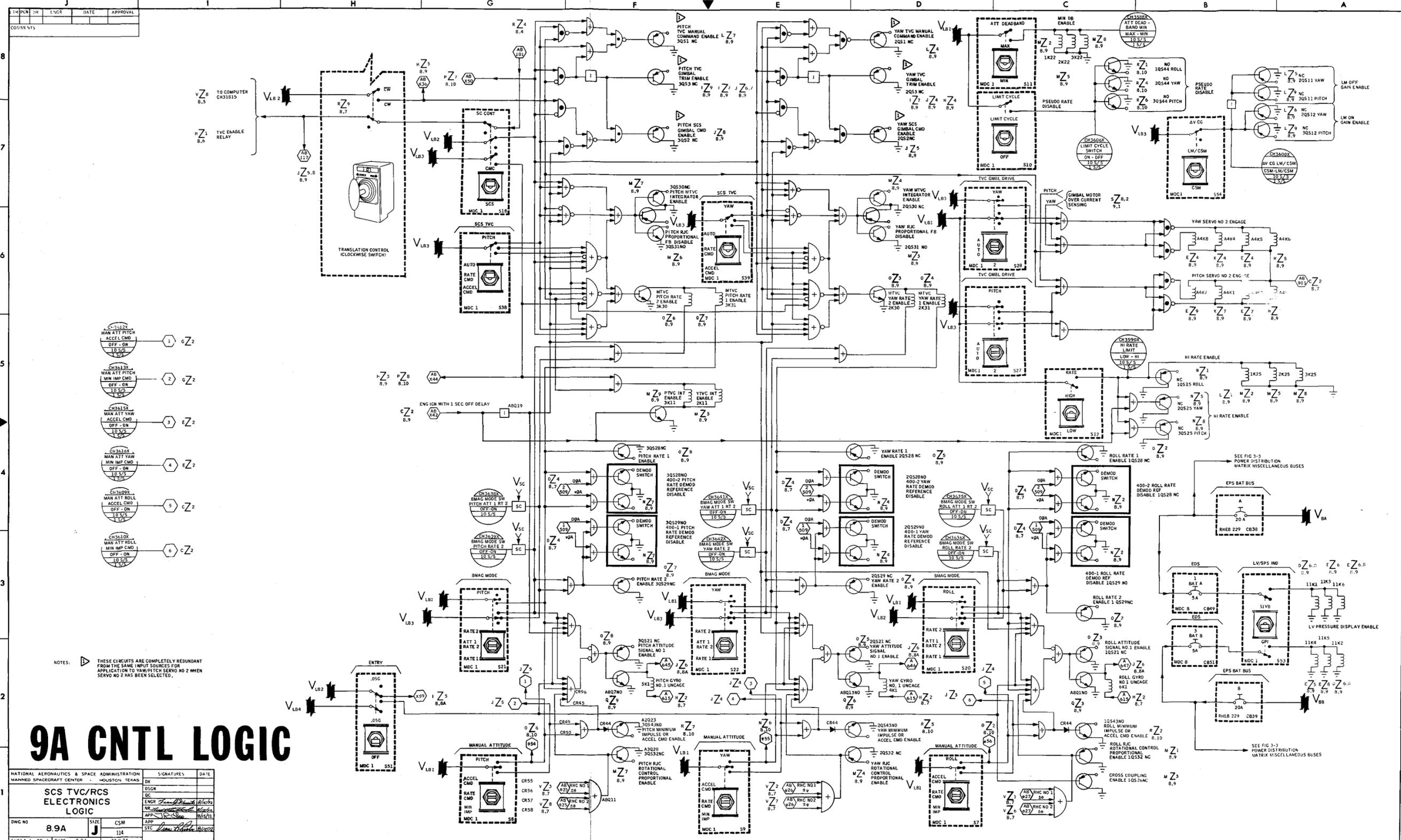
ROLL INDEX
PITCH INDEX
YAW INDEX

1/2 FULL SCALE
1/2 FULL SCALE
1/2 FULL SCALE

NOTE: ALL POLARITIES INDICATE POSITIVE VELOCITY. POSITIVE VELOCITY INDICATES POSITIVE VELOCITY. POSITIVE VELOCITY INDICATES POSITIVE VELOCITY.

8 ATT REF

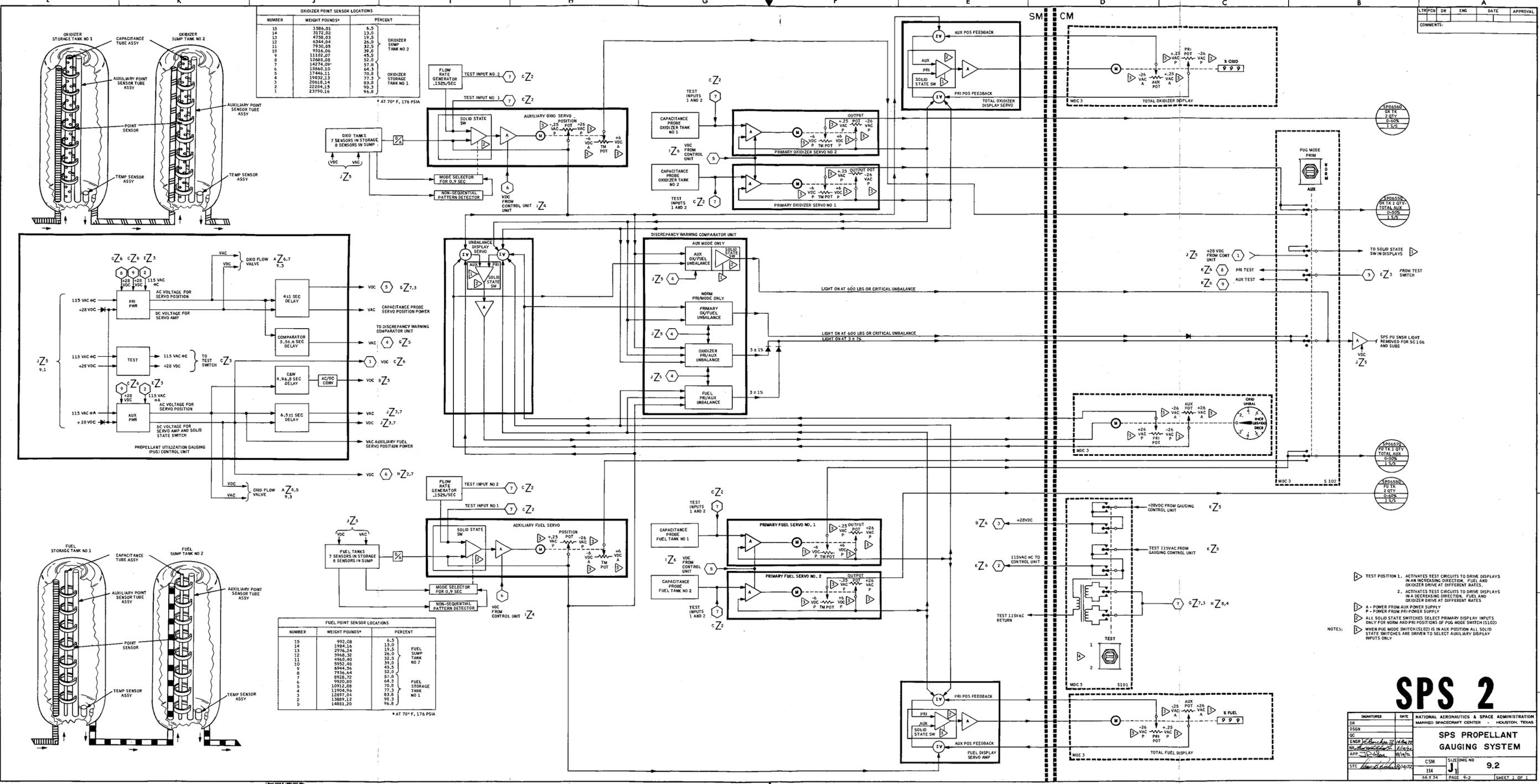
PROJECT	DATE	BY	REVISION
ATTITUDE REFERENCE SUBSYSTEM	1968	...	...
DESIGNED BY	...	...	...
CHECKED BY	...	...	...
APPROVED BY	...	...	...
DATE	...	...	...
SCALE	...	...	...
SIZE	...	...	...
QUANTITY	...	...	...
PRICE	...	...	...



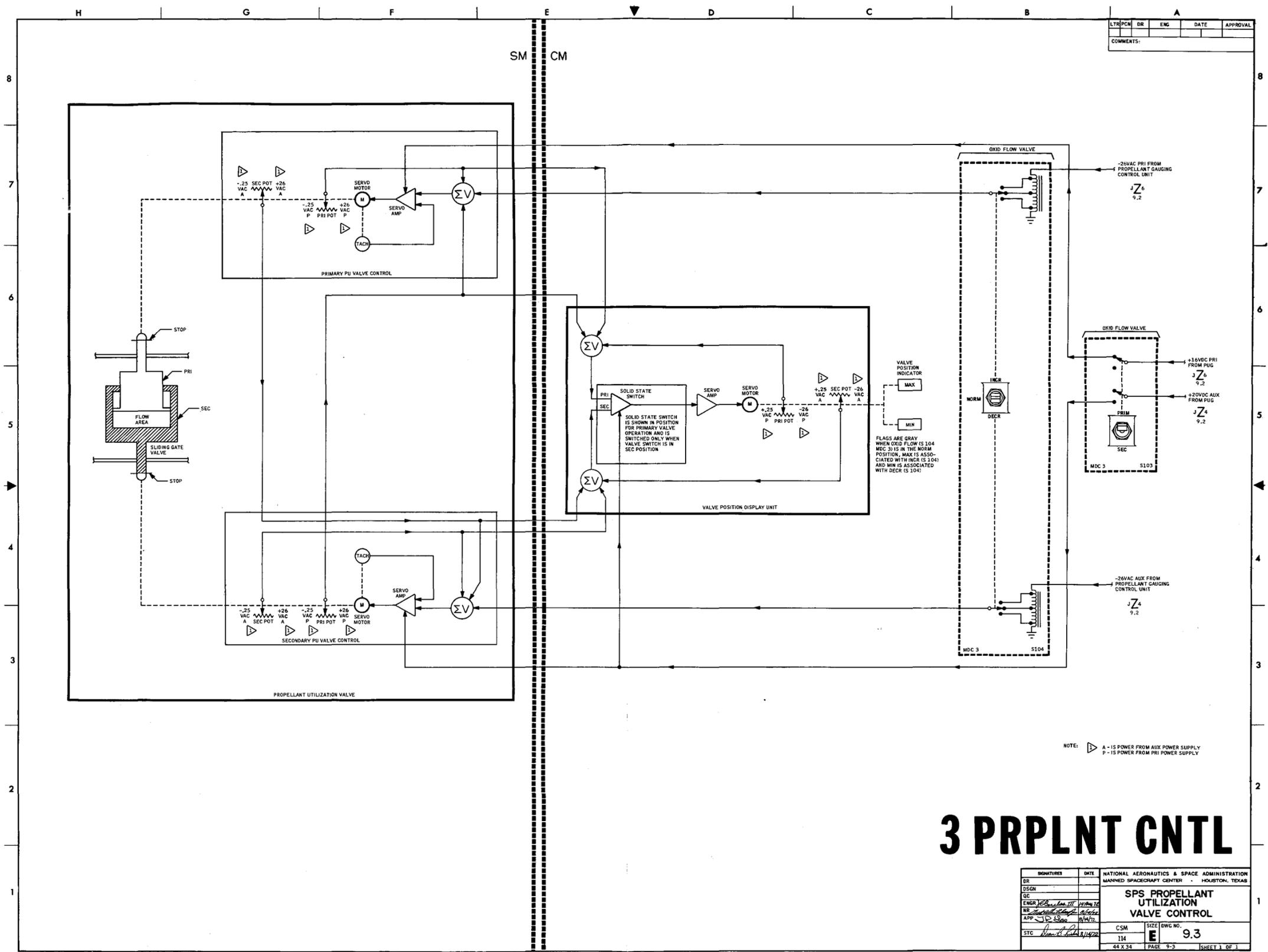
9A CNTL LOGIC

NATIONAL AERONAUTICS & SPACE ADMINISTRATION MANNED SPACECRAFT CENTER - HOUSTON, TEXAS		SIGNATURES		DATE
DR	DR			
DESIGN	DESIGN			
ENGR	ENGR			
NR	NR			
APP	APP			
STP	STP			
DWG NO 8.9A		SIZE J	CSM	
SHEET 1 OF 1		PAGE 8-27	55 X 34	

9 SERVICE
PROPULSION
SYSTEM



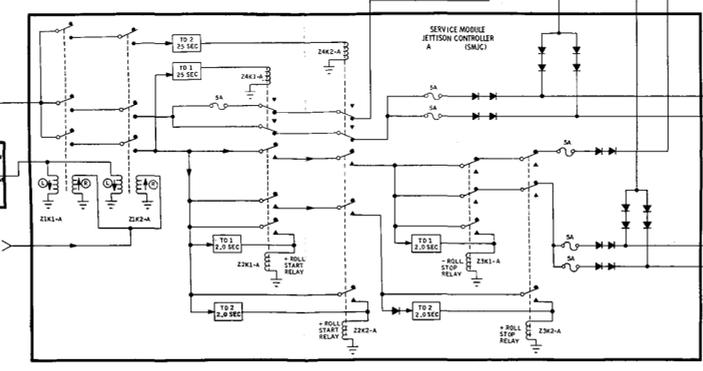
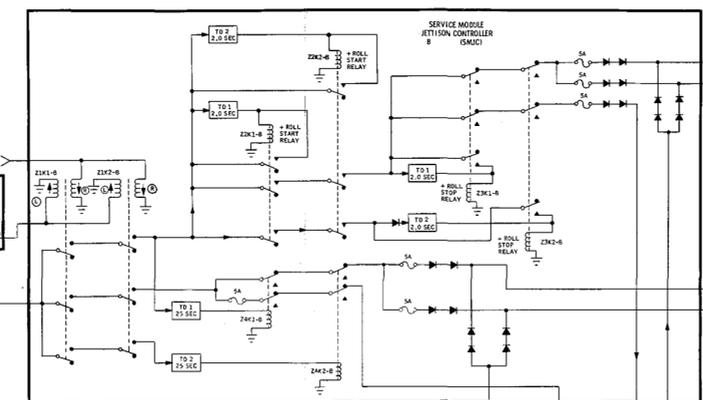
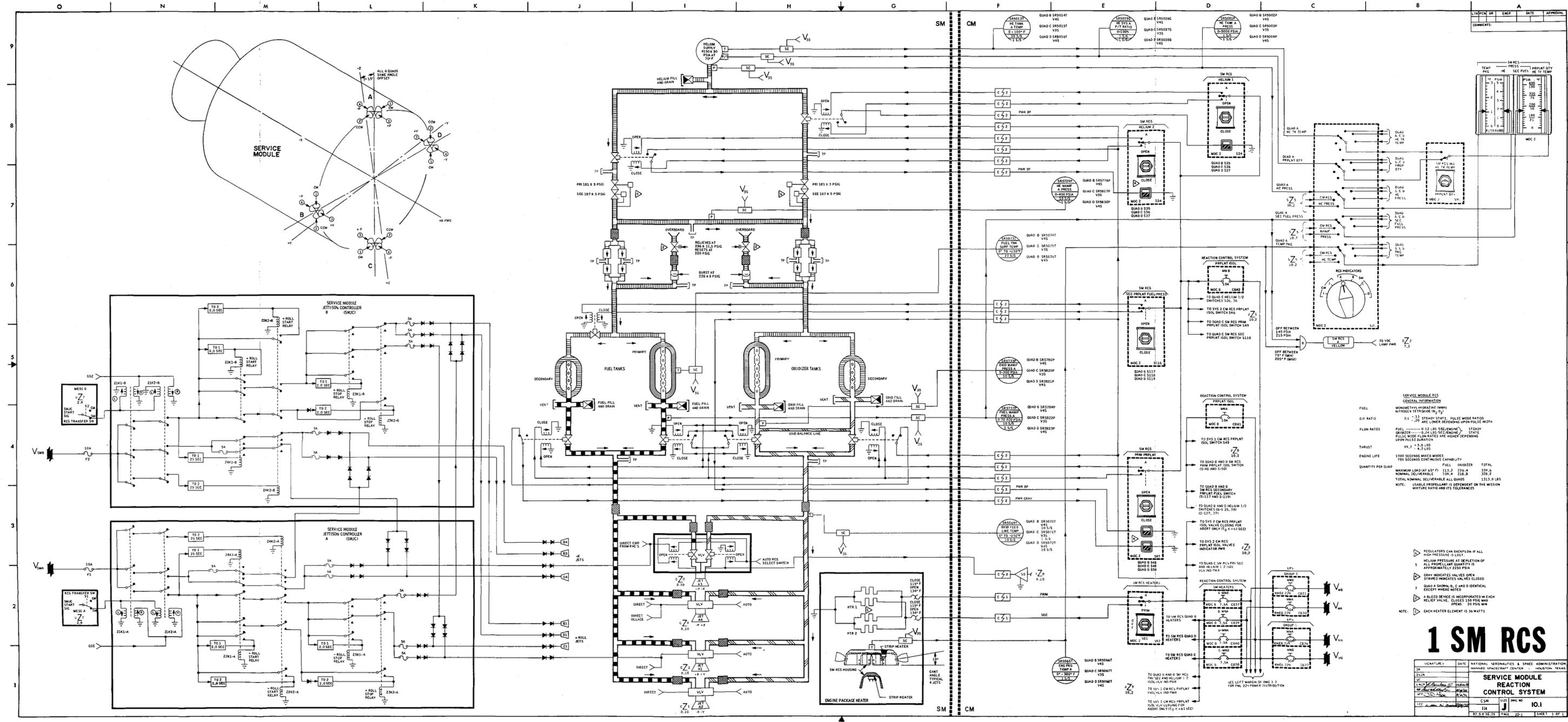
- NOTES:
- TEST POSITION 1. ACTIVATES TEST CIRCUITS TO DRIVE DISPLAYS IN AN INCREASING DIRECTION. FUEL AND OXIDIZER DRIVE AT DIFFERENT RATES.
 - TEST POSITION 2. ACTIVATES TEST CIRCUITS TO DRIVE DISPLAYS IN A DECREASING DIRECTION. FUEL AND OXIDIZER DRIVE AT DIFFERENT RATES.
 - A - POWER FROM AUX POWER SUPPLY
 - P - POWER FROM POWER SUPPLY
 - ALL SOLID STATE SWITCHES SELECT PRIMARY DISPLAY INPUTS ONLY FOR NORM AND PRI POSITIONS OF PUG MODE SWITCH (S102)
 - WHEN PUG MODE SWITCH (S102) IS IN AUX POSITION ALL SOLID STATE SWITCHES ARE DRIVEN TO SELECT AUXILIARY DISPLAY INPUTS ONLY



3 PRPLNT CNTL

SIGNATURES		DATE	NATIONAL AERONAUTICS & SPACE ADMINISTRATION	
DR			MANNED SPACECRAFT CENTER - HOUSTON, TEXAS	
DSGN				
QC				
ENGR	<i>[Signature]</i>	8/14/72		
APP	<i>[Signature]</i>	8/14/72		
STC	<i>[Signature]</i>	8/14/72		
CSM		SIZE	DWG NO.	
114		E	9.3	
44 X 34		PAGE	SHEET 1 OF 1	

10 REACTION
CONTROL
SYSTEM



SERVICE MODULE RCS GENERAL INFORMATION

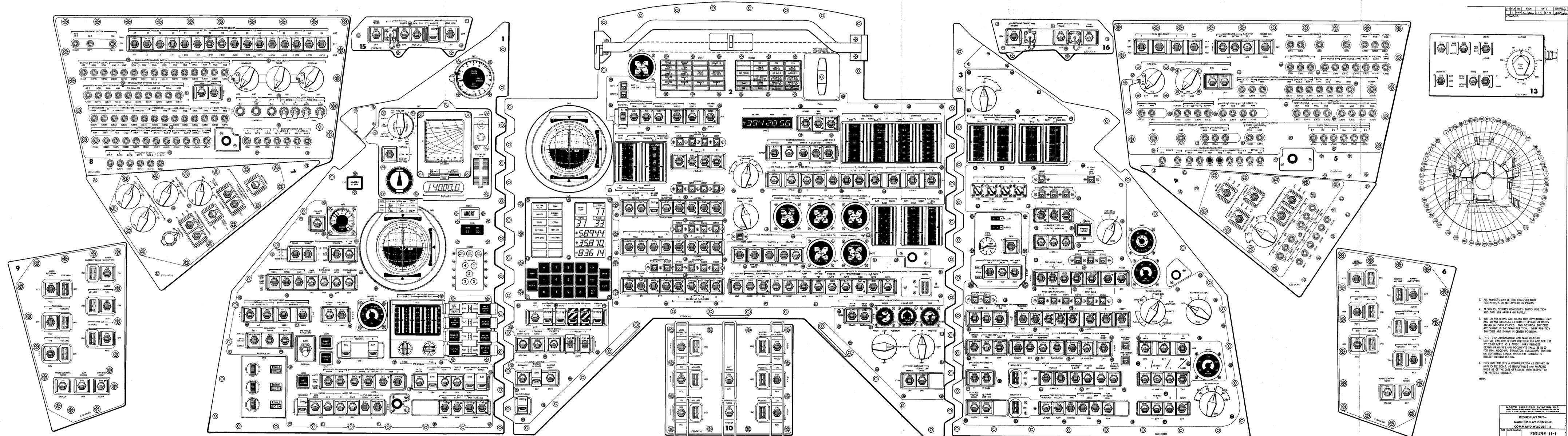
FUEL	MONOMETHYLHYDRAZINE (MMH) WITH 10% DINITROGEN TETROXIDE (N ₂ O ₄)
O/F RATIO	2.1 : 1.33 STEADY STATE, PULSE MODE RATIOS 1.8 : 1.5
FLOW RATES	FUEL 0.32 LB/SEC/ENGINE STEADY OXIDIZER 0.24 LB/SEC/ENGINE STEADY PULSE MODE FLOW RATES ARE HIGHER DEPENDING UPON PULSE DURATION
THRUST	49.7 - 5.8 LBS
ENGINE LIFE	1300 SECONDS MIXED MODES FUEL INJECTOR TOTAL 750 SECONDS CONTINUOUS CAPABILITY
QUANTITY PER QUAD	MAXIMUM LOAD AT 45°F 113.2 226.4 339.6 NOMINAL DELIVERABLE 799.4 328.8 328.2 TOTAL NOMINAL DELIVERABLE ALL QUADS 1313.0 LBS

NOTE: TABLE PERFORMANCE IS DEPENDENT ON THE MISSION PROFILE, RATIO AND VTS TOLERANCES

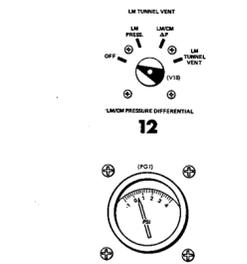
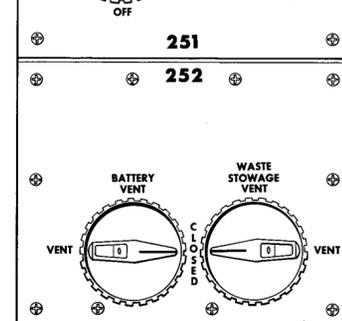
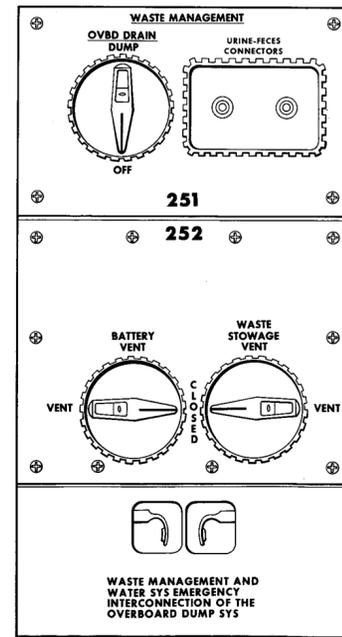
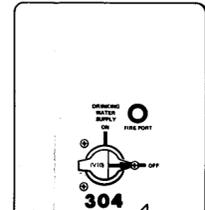
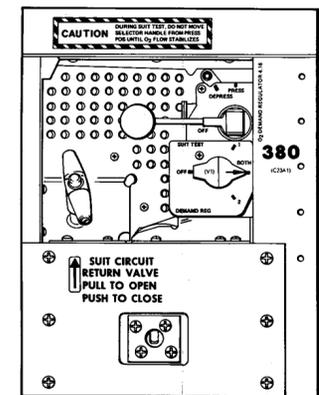
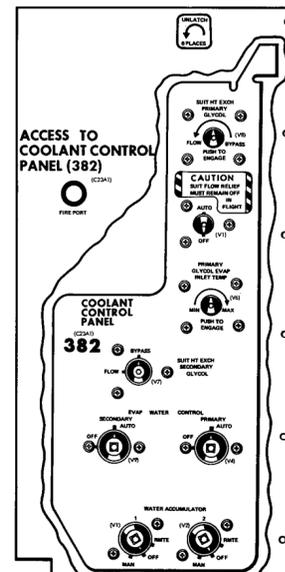
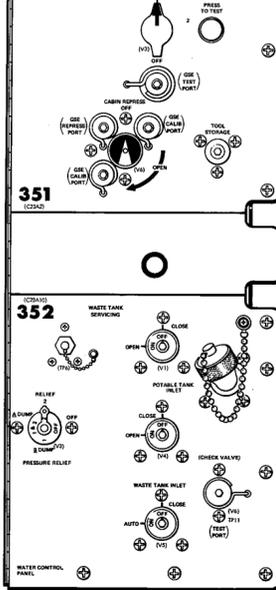
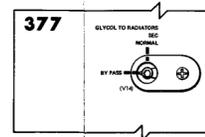
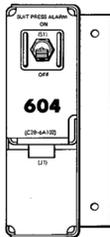
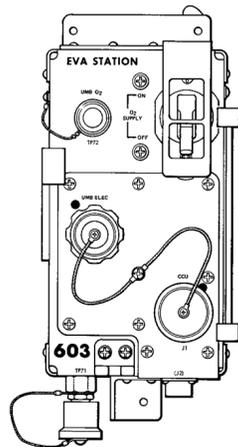
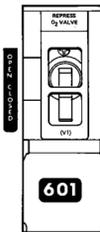
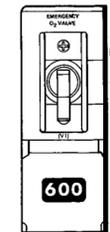
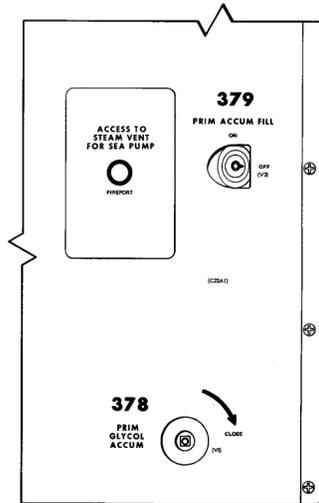
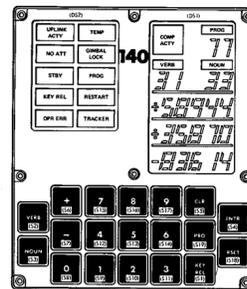
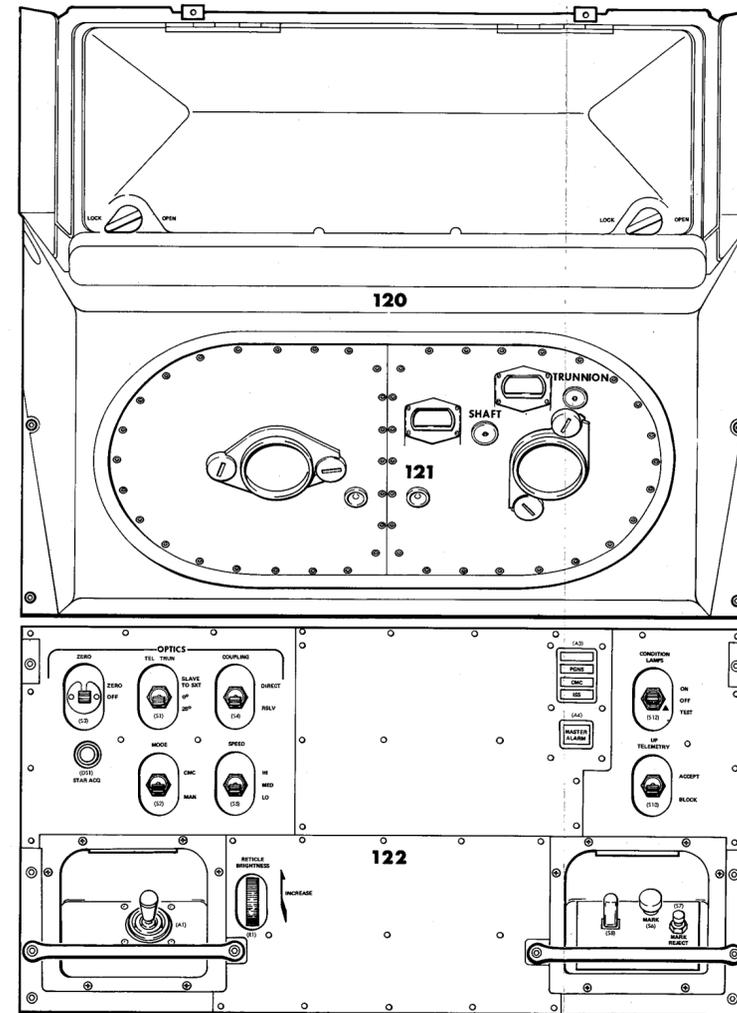
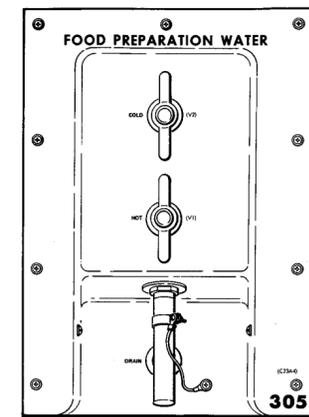
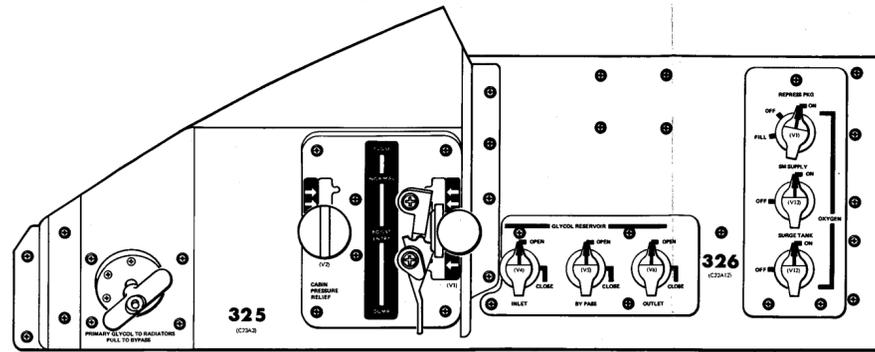
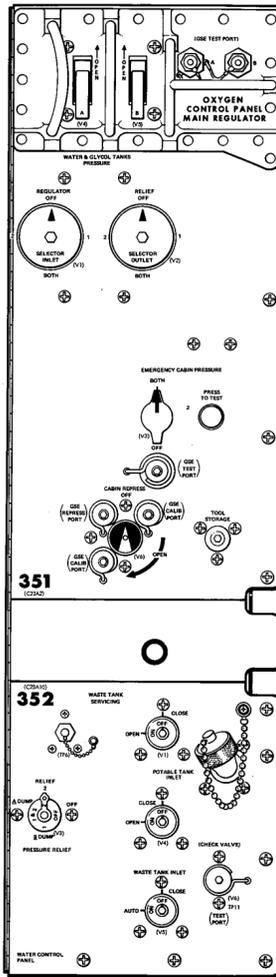
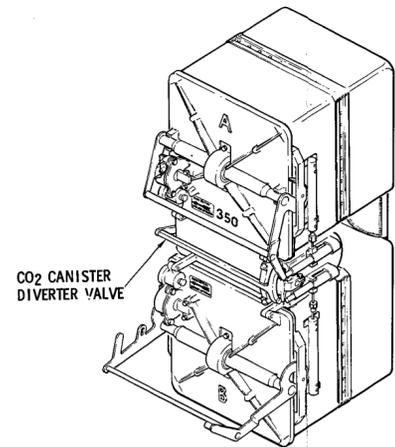
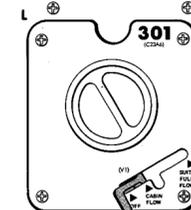
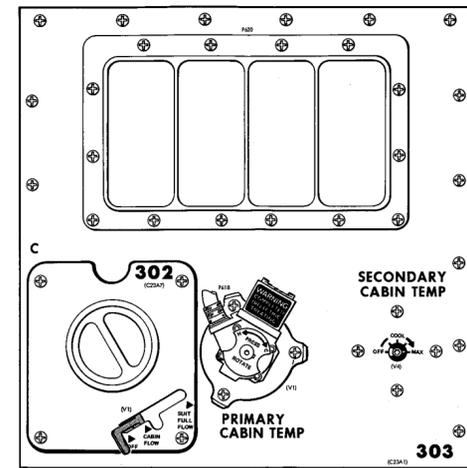
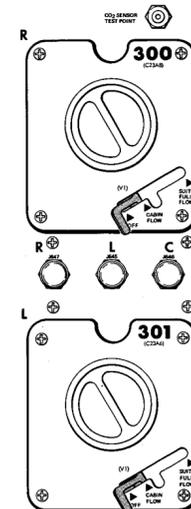
- REGULATORS CAN BACKFLOW IF ALL HIGH PRESSURE IS LOST.
- HELIUM PRESSURE AT THE RELEASE OF ALL PROPELLANT QUANTITY IS APPROXIMATELY 2350 PSIA.
- GRAY INDICATES VALVES OPEN
- STERED INDICATES VALVES CLOSED
- QUAD A HOUSING B, C AND D IDENTICAL EXCEPT WHERE NOTED
- A BLEED DEVICE IS INCORPORATED IN EACH RELIEF VALVE, CLOSED 150 PSIG MAX
- NOTE: EACH HEATER ELEMENT IS 36 WATTS

1 SM RCS

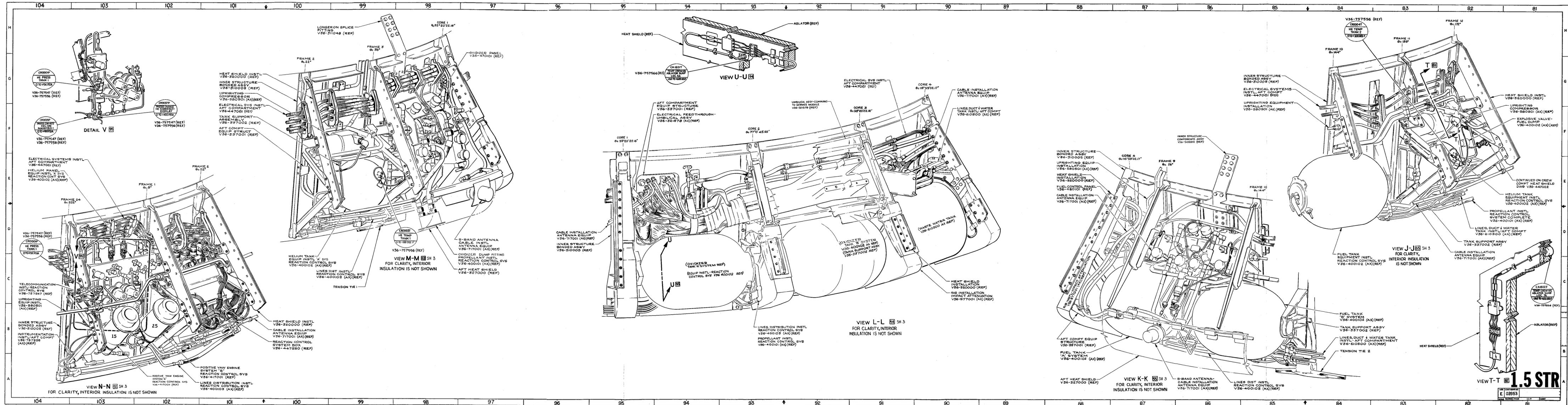
DATE	11/15/68	NATIONAL AERONAUTICS & SPACE ADMINISTRATION
REVISION	1	MANNEE SPACECRAFT CENTER - HOUSTON, TEXAS
SERVICE MODULE REACTION CONTROL SYSTEM		
CSM	NO. 101	SIZE
11A	11A	11A
11A	11A	11A

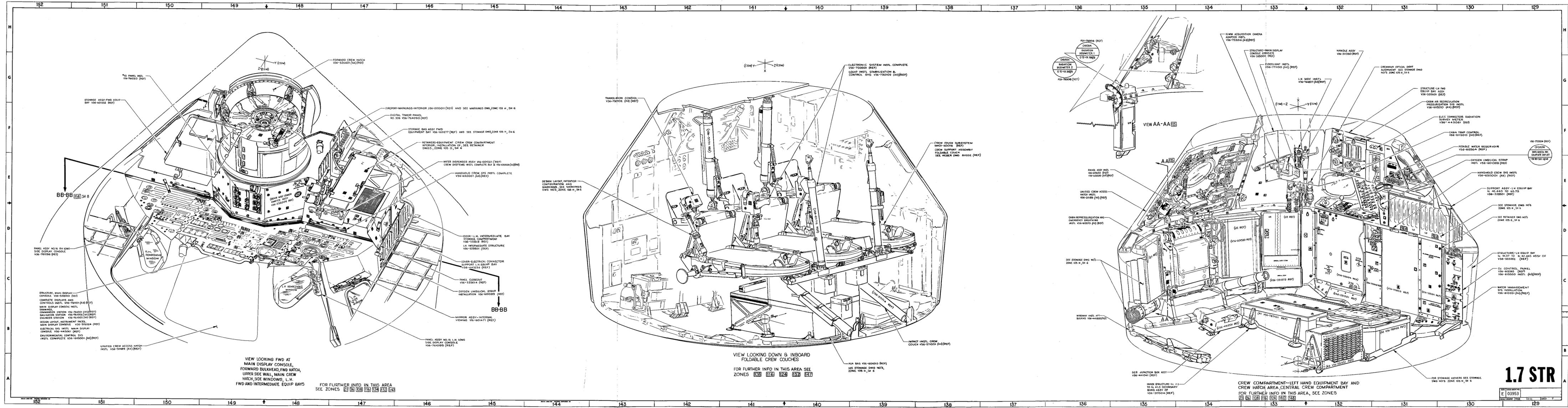


1. THIS DRAWING REFLECTS A CONFIGURATION AS DEFINED BY APPLICABLE SCDS, ASSEMBLY DWGS AND MARKING DWGS AS OF THE DATE OF RELEASE WITH RESPECT TO THE AFFECTED VEHICLES.
2. THIS IS AN ARRANGEMENT AND NOMENCLATURE CONTROL DRAWING FOR DESIGN REQUIREMENTS AND FOR USE BY OTHER DEPTS AS A GUIDE. ONLY RELEASED DESIGN DRAWINGS AND DOCUMENTS SHALL BE USED FOR BVC, MOCK-UP, SIMULATOR, EVALUATOR, TRAINER OR CONTROLLER PANELS WHICH ARE INTENDED TO REFLECT CURRENT DESIGN.
3. SWITCH POSITIONS ARE SHOWN FOR CONVENIENCE ONLY AND DO NOT NECESSARILY REFLECT OPERATING MODES AND/OR MISSION PHASES. TWO POSITION SWITCHES ARE SHOWN IN THE DOWN POSITION. THREE POSITION SWITCHES ARE SHOWN IN CENTER POSITION.
4. W SYMBOL DENOTES MOMENTARY SWITCH POSITION AND DOES NOT APPEAR ON PANELS.
5. ALL NUMBERS AND LETTERS ENCLOSED WITH PARENTHESES DO NOT APPEAR ON PANELS.



DR BY	DEC 75	NORTH AMERICAN AVIATION, INC.
CHK BY		MODELS & FABRICATION DIVISION
APPROVED BY		DESIGN LAYOUT - MAIN DISPLAY CONSOLE, COMMAND MODULE 114
DOC NO	02593	FIGURE 11-1
DATE	12/2/74	PAGE 11-1
		SHEET 1 OF 3





VIEW LOOKING FWD AT MAIN DISPLAY CONSOLE, FORWARD BULKHEAD, FWD HATCH, UPPER SIDE WALL, MAIN CREW HATCH, SIDE WINDOWS, L.H. FWD AND INTERMEDIATE EQUIP BAYS

FOR FURTHER INFO IN THIS AREA SEE ZONES 108 116 124 132 140

VIEW LOOKING DOWN & INBOARD FOLDABLE CREW COUCHES

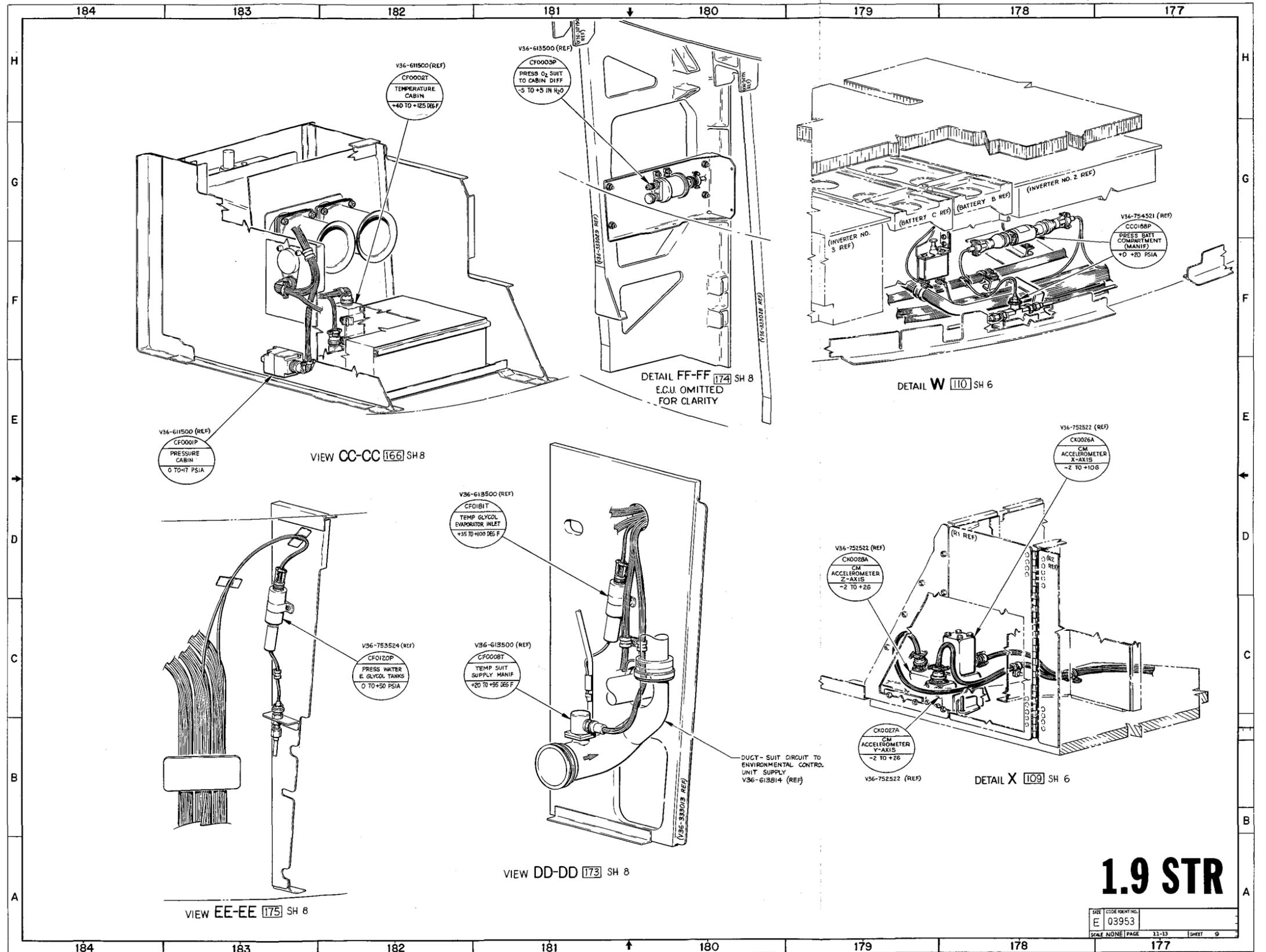
FOR FURTHER INFO IN THIS AREA SEE ZONES 108 116 124 132 140

CREW COMPARTMENT-LEFT HAND EQUIPMENT BAY AND CREW HATCH AREA, CENTRAL CREW COMPARTMENT

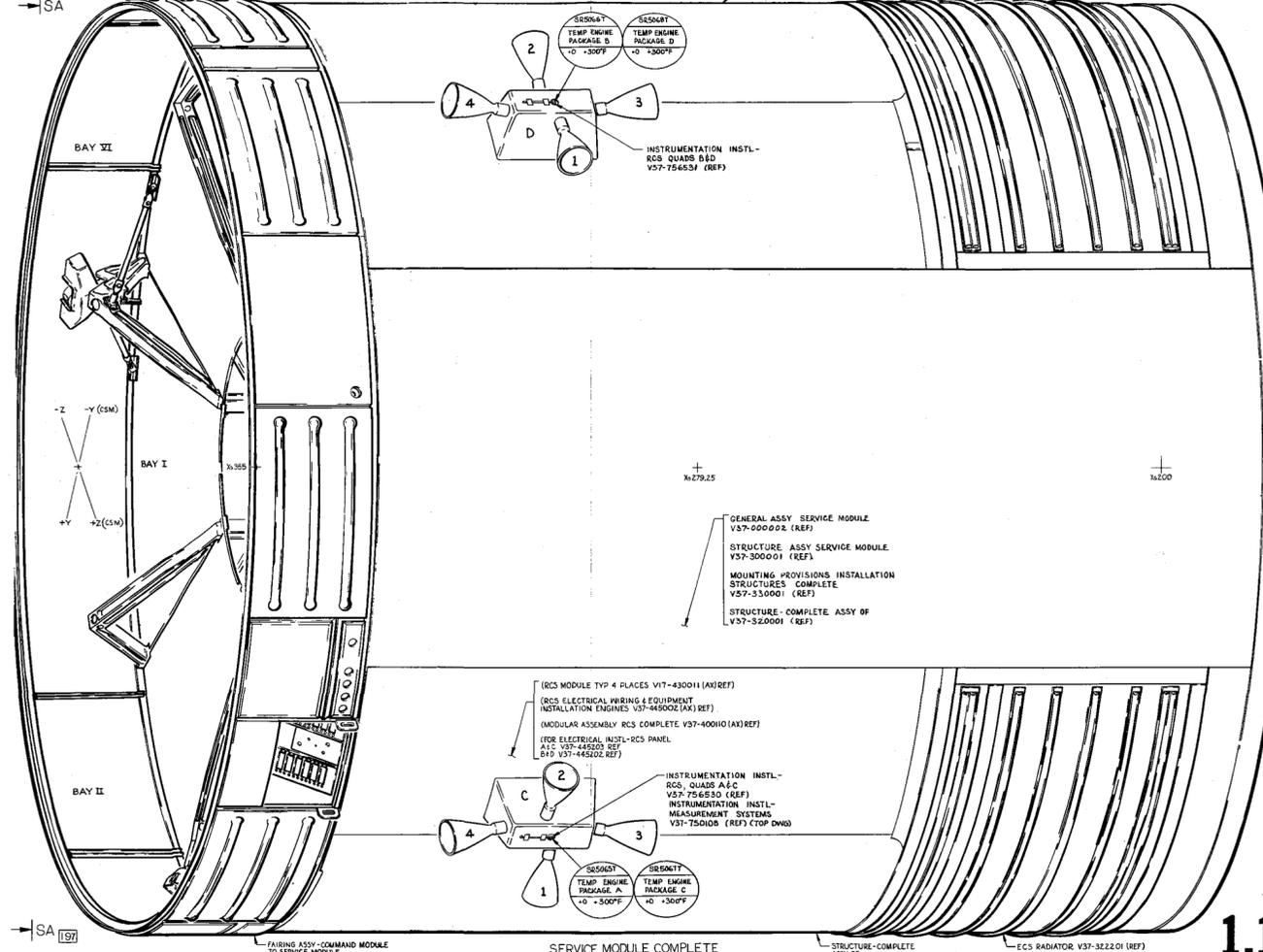
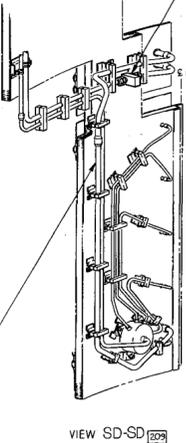
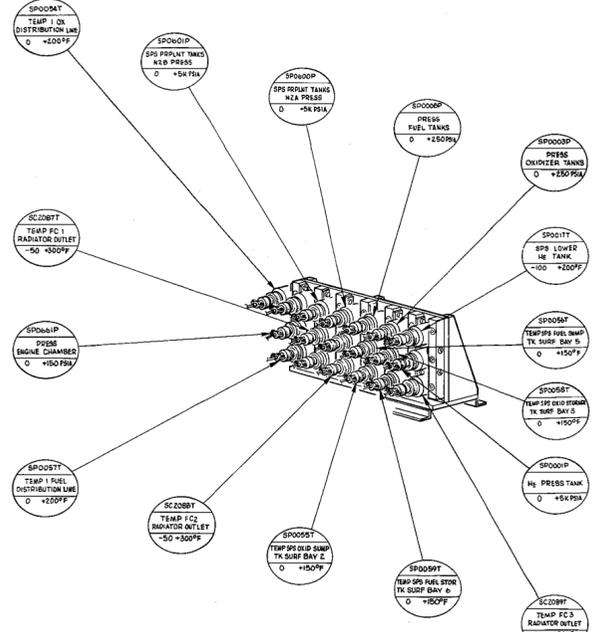
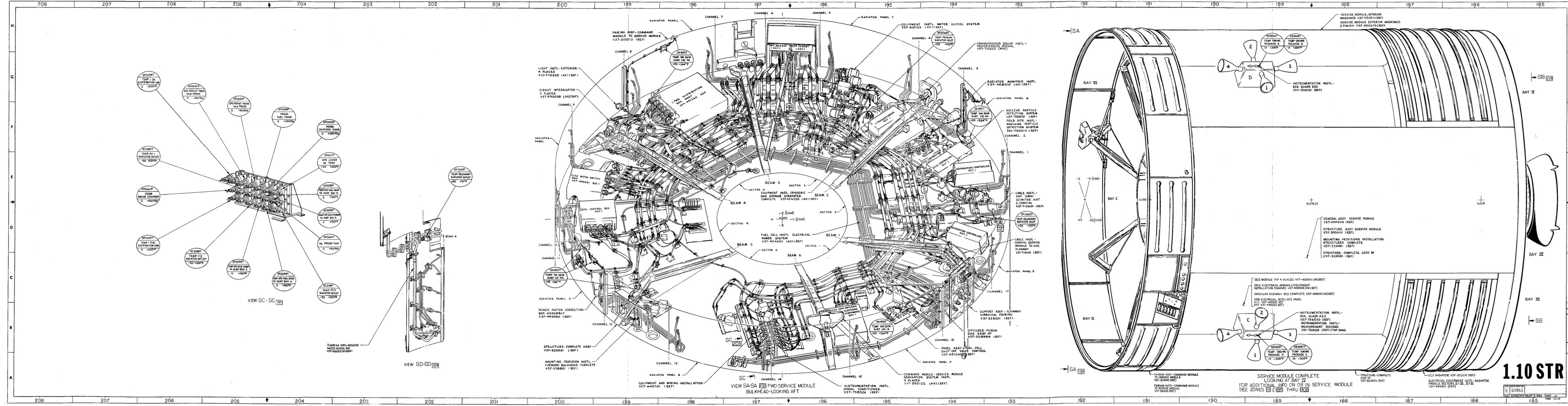
FOR FURTHER INFO IN THIS AREA, SEE ZONES 108 116 124 132 140

1.7 STR

REV 03953
 DATE 15-11-1967

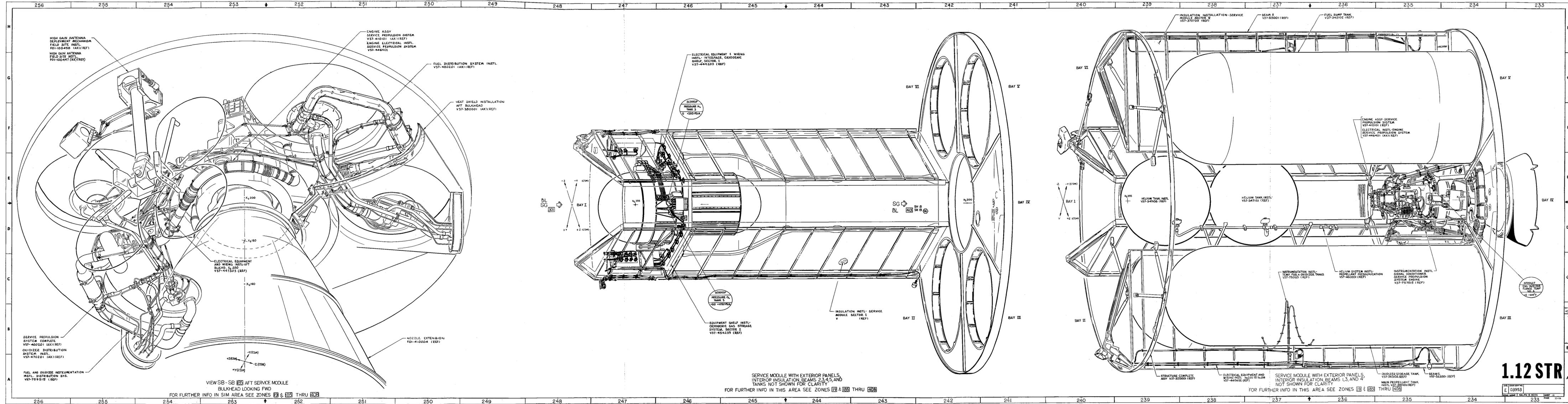


1.9 STR



1.10 STR

03953
 TOTAL NUMBER OF SHEETS: 8 SHEETS
 SHEET NO: 10
 PAGE 11-14



HIGH GAIN ANTENNA DEPLOYMENT MECHANISM FIELD SITE INSTL. F01-10045B (AX)(REF)
 HIGH GAIN ANTENNA FIELD SITE INSTL. F01-100447 (AX)(REF)

ENGINE ASSY SERVICE PROPELLION SYSTEM V37-410101 (AX)(REF)
 ENGINE ELECTRICAL INSTL. SERVICE PROPELLION SYSTEM V37-446401

FUEL DISTRIBUTION SYSTEM INSTL. V37-480201 (AX)(REF)

HEAT SHIELD INSTALLATION AFT BULKHEAD V37-380001 (AX)(REF)

ELECTRICAL EQUIPMENT & WIRING INSTL. INTERSPACE, CRYOGENIC SHELF, SECTOR 1 V37-444203 (REF)

SC0005P PRESSURE H₂ TANK 3 0 -350 PSIA

ELECTRICAL EQUIPMENT AND WIRING INSTL. AFT BULKHEAD, X₂ 200 V37-447303 (REF)

NOZZLE EXTENSION F01-410004 (REF)

EQUIPMENT SHELF INSTL. CRYOGENIC GAS STORAGE SYSTEM, SECTOR 1 V37-454259 (REF)

INSULATION INSTL. SERVICE MODULE SECTOR 1 (REF)

INSULATION INSTALLATION-SERVICE MODULE SECTOR 2 V37-370703 (REF)

BEAM 5 V37-355001 (REF)

FUEL SUMP TANK V37-342102 (REF)

ENGINE ASSY-SERVICE PROPELLION SYSTEM V37-410101 (REF)
 ELECTRICAL INSTL. ENGINE SERVICE PROPELLION SYSTEM V37-446401 (AX)(REF)

HELIUM TANK INSTL. V37-347101 (REF)

HELIUM TANK INSTL. V37-347101 (REF)

INSTRUMENTATION INSTL. TEMP. FUEL & OXIDIZER TANKS V37-750521 (REF)

HELIUM SYSTEM INSTL. PROPELLANT PRESSURIZATION SYSTEM, ENGINE V37-260201 (REF)

INSTRUMENTATION INSTL. SURVIVAL CONDITIONER SERVICE PROPELLION SYSTEM, ENGINE V37-757515 (REF)

SPROCKET TIE RODS FLANGE TEMP -100 ± 100°F

STRUCTURE COMPLETE ASSY V37-320001 (REF)

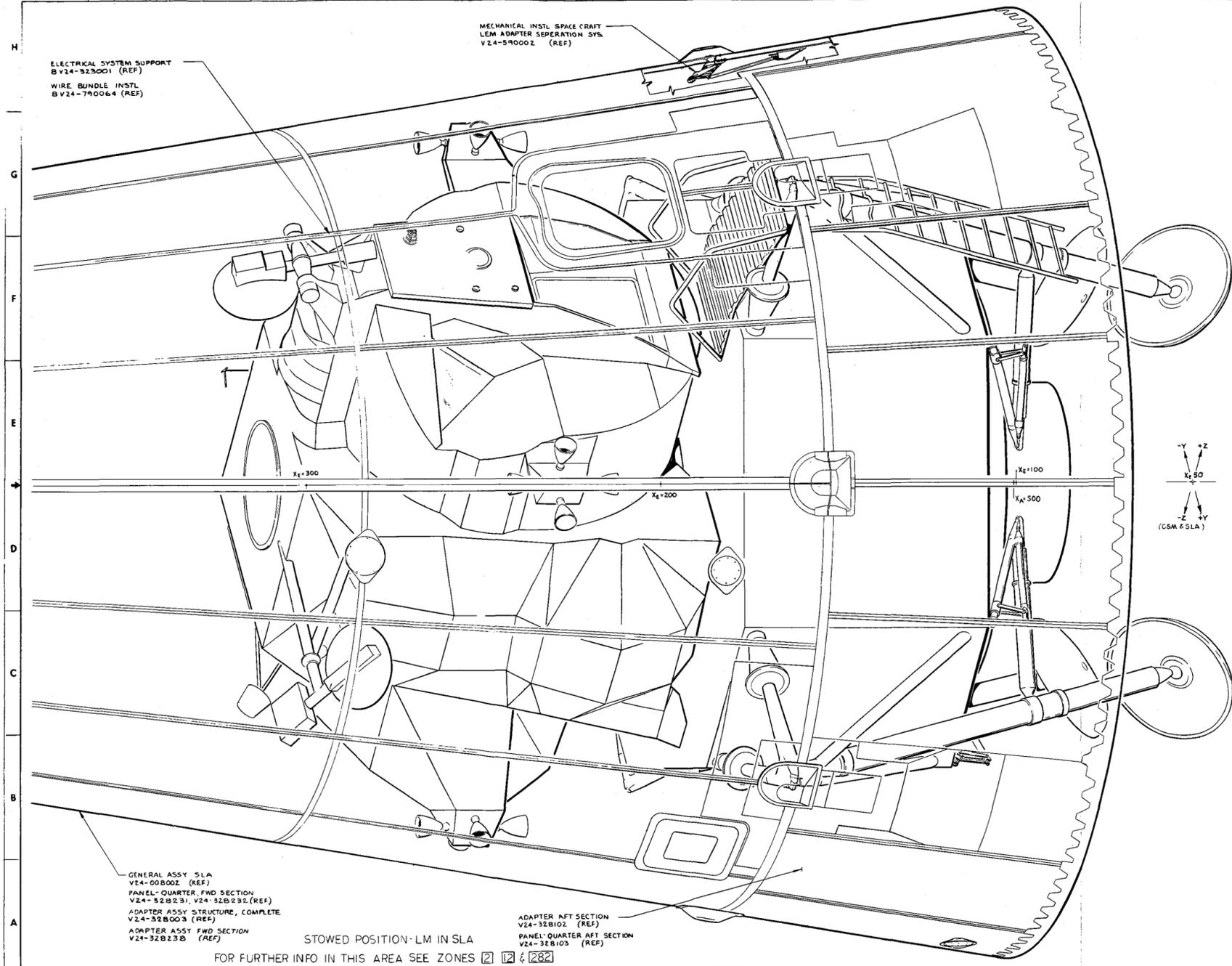
ELECTRICAL EQUIPMENT AND WIRING INSTL. 14600 TO 14650 V37-440602 (REF)

OXIDIZER STORAGE TANK V37-363002 (REF)

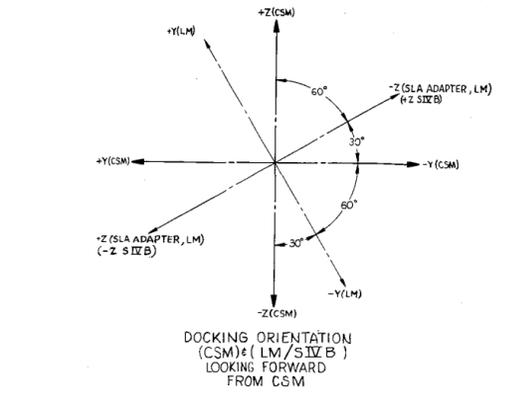
MAIN PROPELLANT TANK INSTL. V37-340101 (REF)

BEAM 1 V37-352001 (REF)

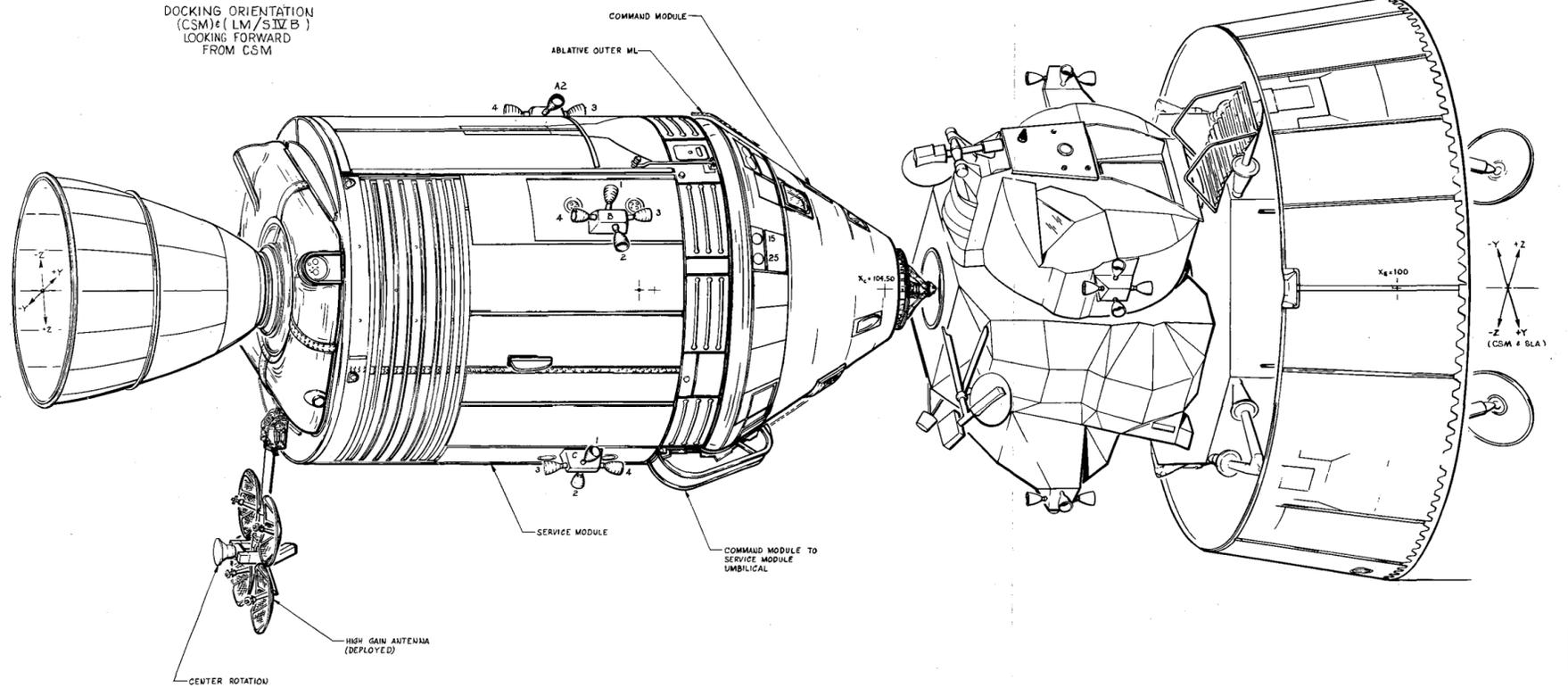
296 295 294 293 292 291 290 289 288 287 286 285 284 283 282 281



STOWED POSITION - LM IN SLA
FOR FURTHER INFO IN THIS AREA SEE ZONES 2, 12, & 282



DOCKING ORIENTATION (CSM) (LM/SIB B) LOOKING FORWARD FROM CSM

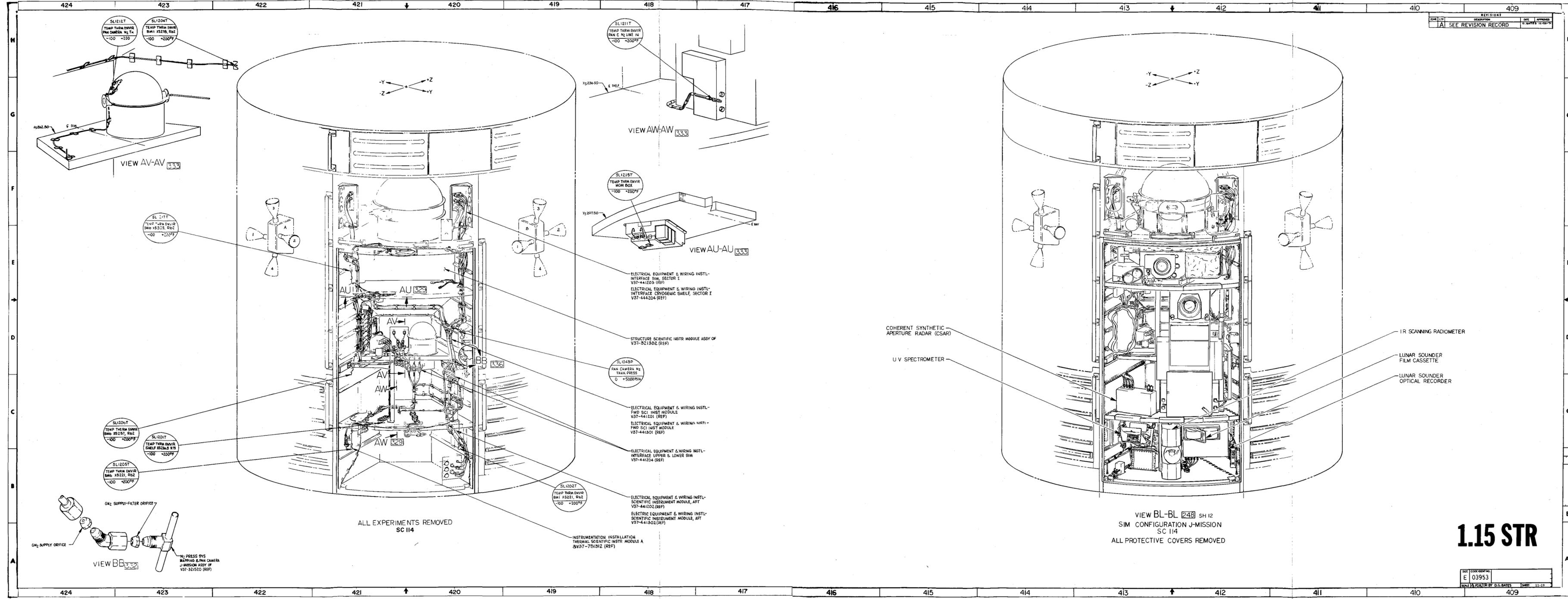


DOCKING - CSM WITH LM/SLA
FOR FURTHER INFO IN THIS AREA SEE ZONES 2, 12, & 282

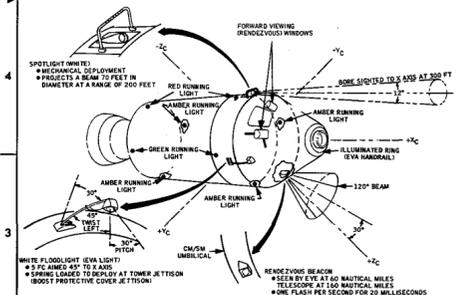
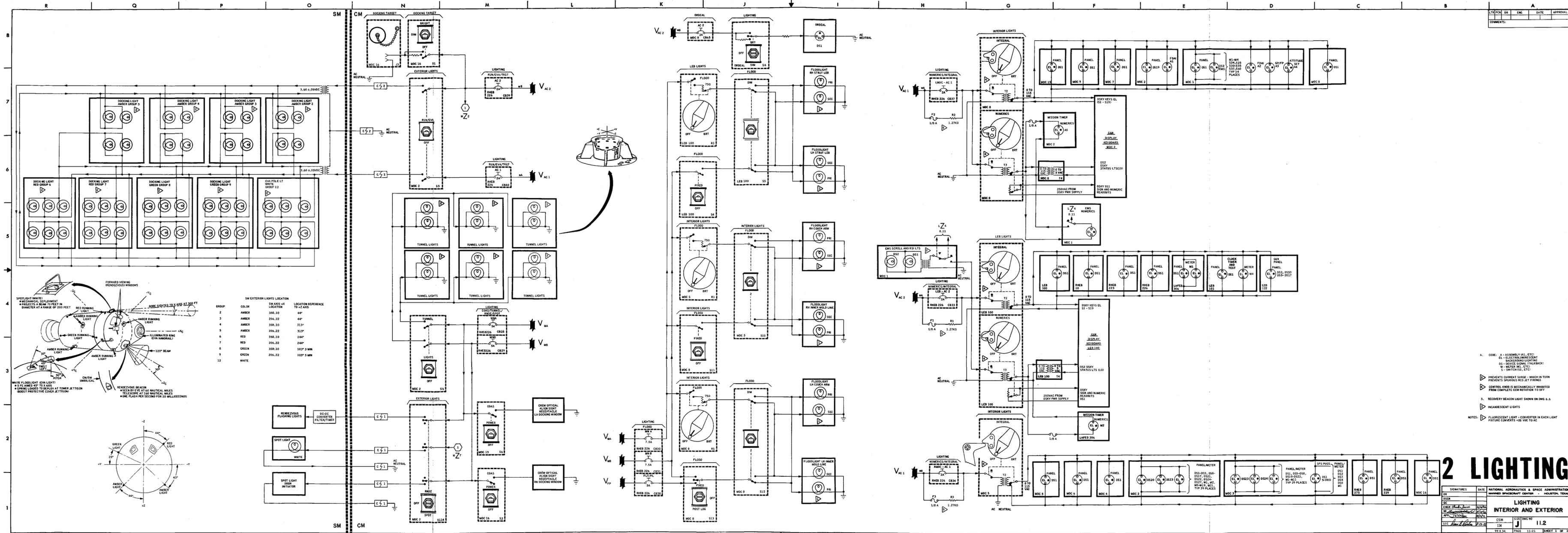
1.14 STR

174 (CODE 0014)
E 03953
SCALE NONE UNIT: DIMENSIONS IN INCHES SHEET 12-18
PAGE 12-18

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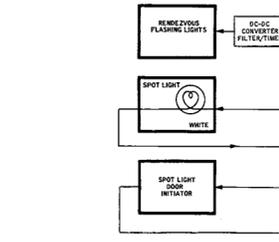


1.15 STR



SM EXTERIOR LIGHTS LOCATION

GROUP	COLOR	SM AXIS 4X LOCATION	LOCATION REFERENCE TO 4Z AXIS
2	AMBER	358.10	44°
3	AMBER	206.22	44°
4	AMBER	358.10	313°
5	AMBER	206.22	313°
6	RED	358.10	244°
7	RED	206.22	244°
8	GREEN	358.10	103° 3 MIN
9	GREEN	206.22	103° 3 MIN
12	WHITE		



LT/PCN	DR	ENG	DATE	APPROVAL

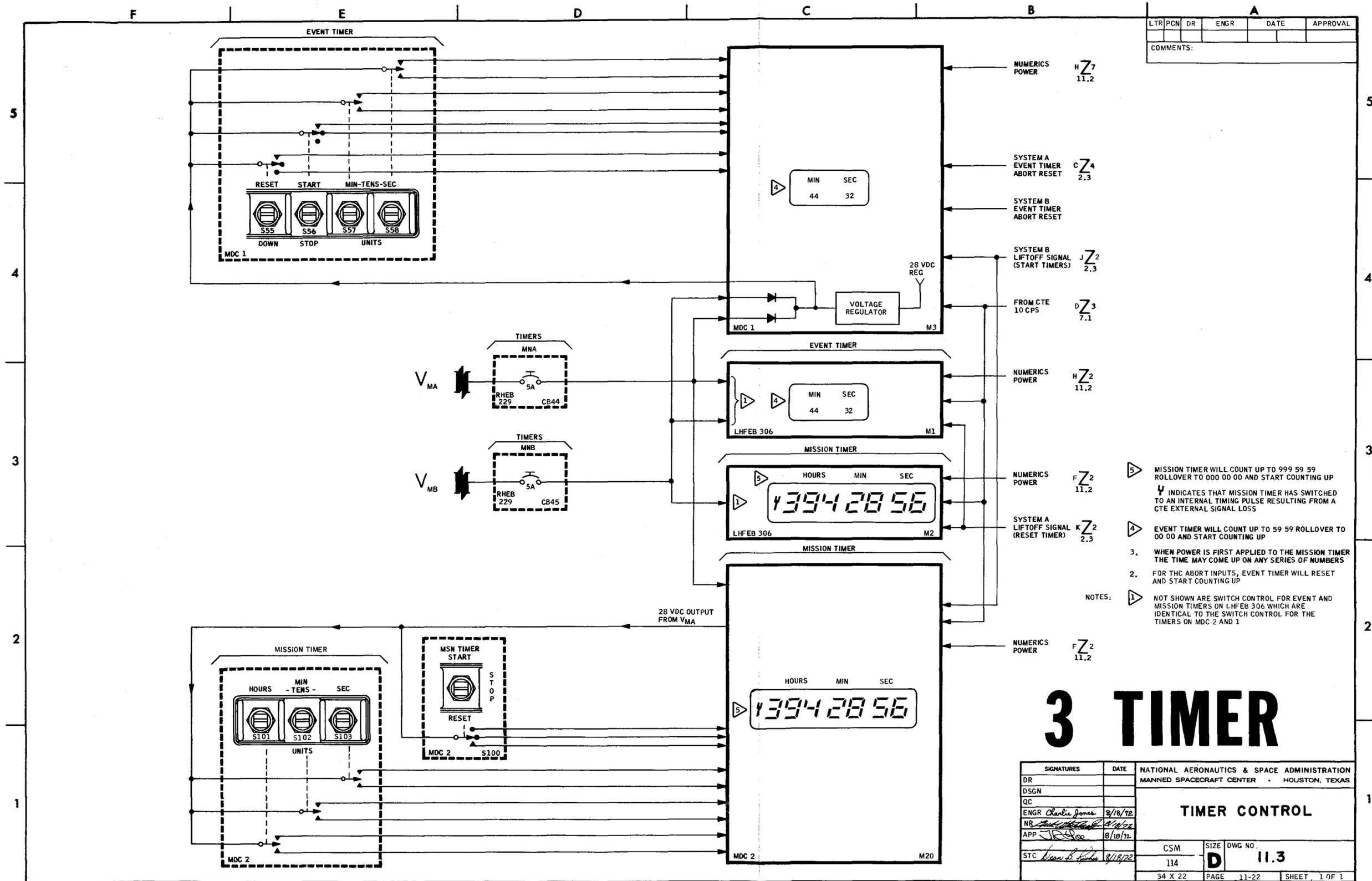
6. CODE: A - ASSEMBLY (ALL ETC)
 EL - ELECTRICAL UNIT
 EL - ELECTRICAL UNIT
 DS - DEVICE SIGNAL (TALKBACK)
 M - METER, ETC
 S - SWITCH (S), ETC
- △ PREVENTS CURRENT SURGE - WHICH IN TURN PREVENTS SPARKS/ARCS SET FIRING
 ▷ CONTROL KNOB IS MECHANICALLY INHIBITED FROM COMPLETE COUNTER ROTATION TO OFF
 3. RECOVER BEACON LIGHT SHOWN ON DWG 6.6
 ▽ INCANDESCENT LIGHT - CONVERTER IN EACH LIGHT FIXTURE CONVERTS +28 VDC TO AC

2 LIGHTING

INTERIOR AND EXTERIOR

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

CSM
 118
 11.2
 11.2
 11.2



LTR	PCN	DR	ENGR	DATE	APPROVAL

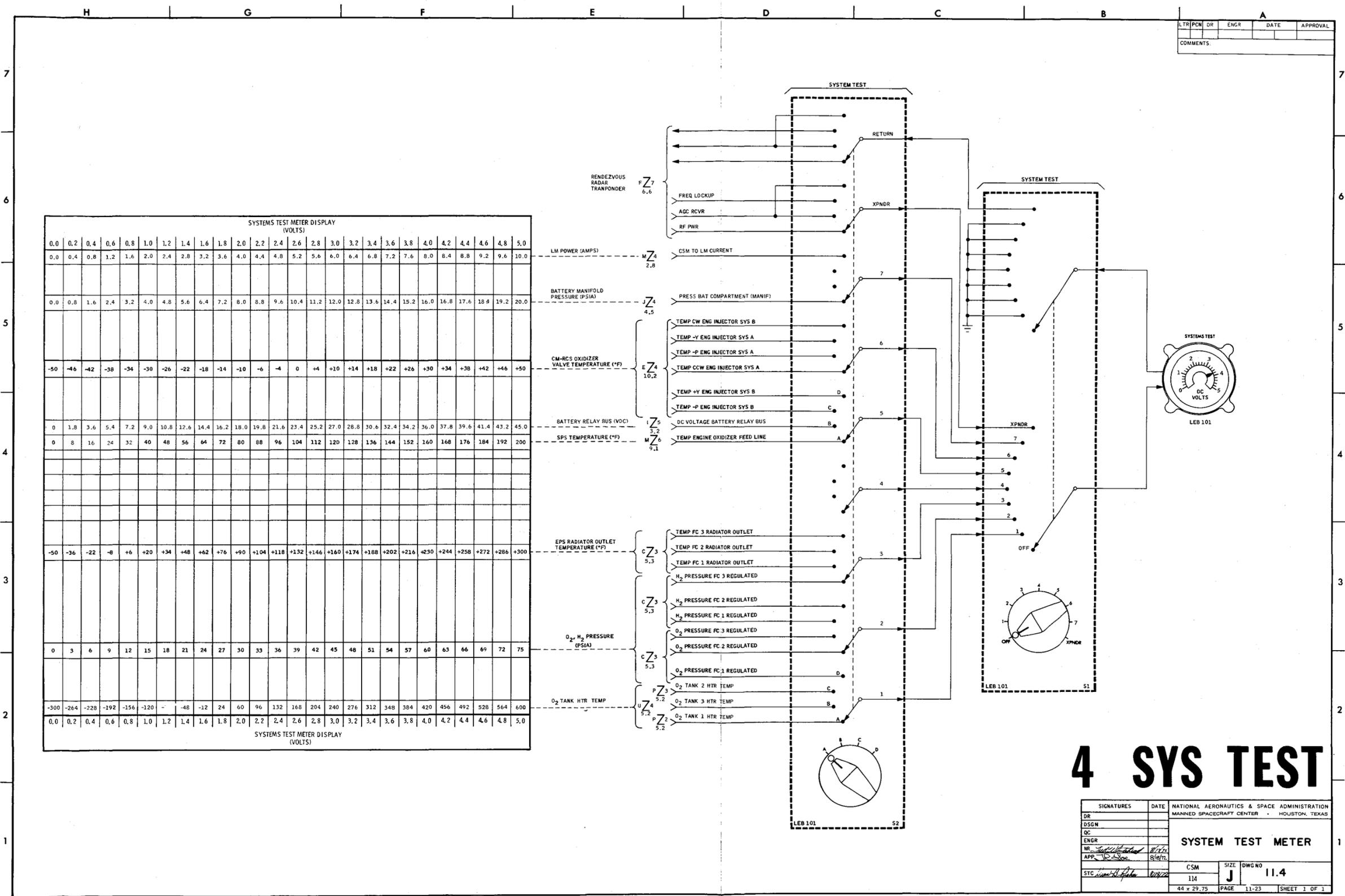
COMMENTS:

- NUMERICS POWER HZ7 11.2
- SYSTEM A EVENT TIMER ABORT RESET CZ4 2.3
- SYSTEM B EVENT TIMER ABORT RESET
- SYSTEM B LIFTOFF SIGNAL (START TIMERS) JZ2 2.3
- FROM CTE 10 CPS DZ3 7.1
- NUMERICS POWER HZ2 11.2
- NUMERICS POWER FZ2 11.2
- SYSTEM A LIFTOFF SIGNAL (RESET TIMER) KZ2 2.3
- NUMERICS POWER FZ2 11.2

- NOTES:
1. NOT SHOWN ARE SWITCH CONTROL FOR EVENT AND MISSION TIMERS ON LHFE 306 WHICH ARE IDENTICAL TO THE SWITCH CONTROL FOR THE TIMERS ON MDC 2 AND 1
 2. FOR THE ABORT INPUTS, EVENT TIMER WILL RESET AND START COUNTING UP
 3. WHEN POWER IS FIRST APPLIED TO THE MISSION TIMER THE TIME MAY COME UP ON ANY SERIES OF NUMBERS
 4. EVENT TIMER WILL COUNT UP TO 59 59 ROLLOVER TO 00 00 AND START COUNTING UP
 5. MISSION TIMER WILL COUNT UP TO 999 59 59 ROLLOVER TO 000 00 00 AND START COUNTING UP

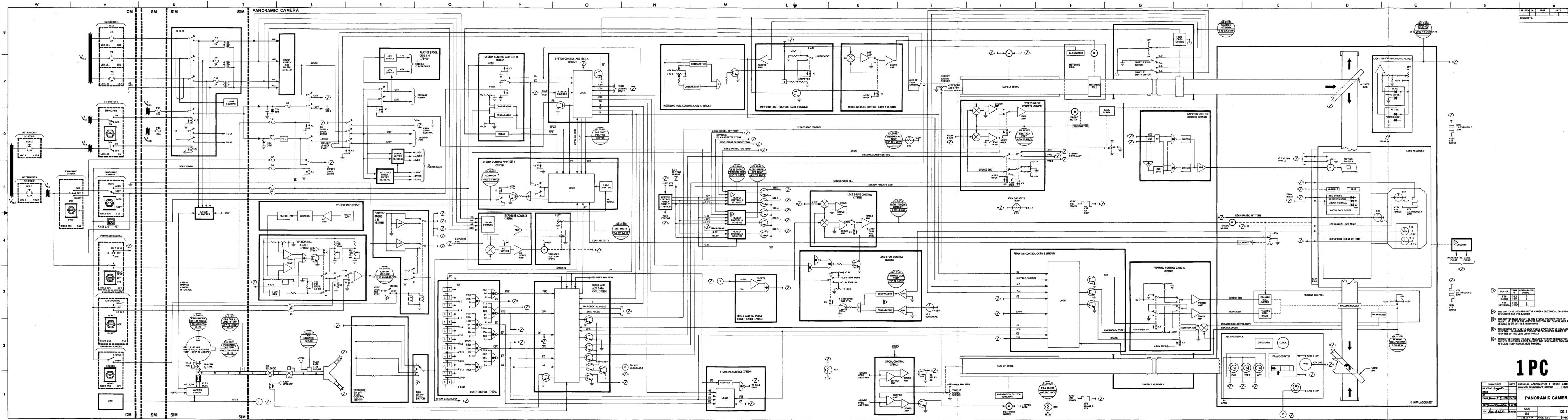
3 TIMER

SIGNATURES	DATE	NATIONAL AERONAUTICS & SPACE ADMINISTRATION MANNED SPACECRAFT CENTER • HOUSTON, TEXAS	
DR		TIMER CONTROL	
DSGN			
QC			
ENGR <i>Charlie Jones</i>	8/18/72		
NR <i>[Signature]</i>	8/18/72		
APP <i>[Signature]</i>	8/18/72	CSM	SIZE DWG NO.
STC <i>[Signature]</i>	8/18/72	114	D 11.3
		34 X 22	PAGE 11-22 SHEET 1 OF 1



4 SYS TEST

SIGNATURES		DATE	NATIONAL AERONAUTICS & SPACE ADMINISTRATION MANNED SPACECRAFT CENTER - HOUSTON, TEXAS	
DR				
DSGN				
QC				
ENGR				
MR	<i>[Signature]</i>	8/17/72		
APP	<i>[Signature]</i>	8/17/72		
STC	<i>[Signature]</i>	8/17/72		
CSM		SIZE	DWG NO	
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44 x 29.75		PAGE	11-23 SHEET 1 OF 1	

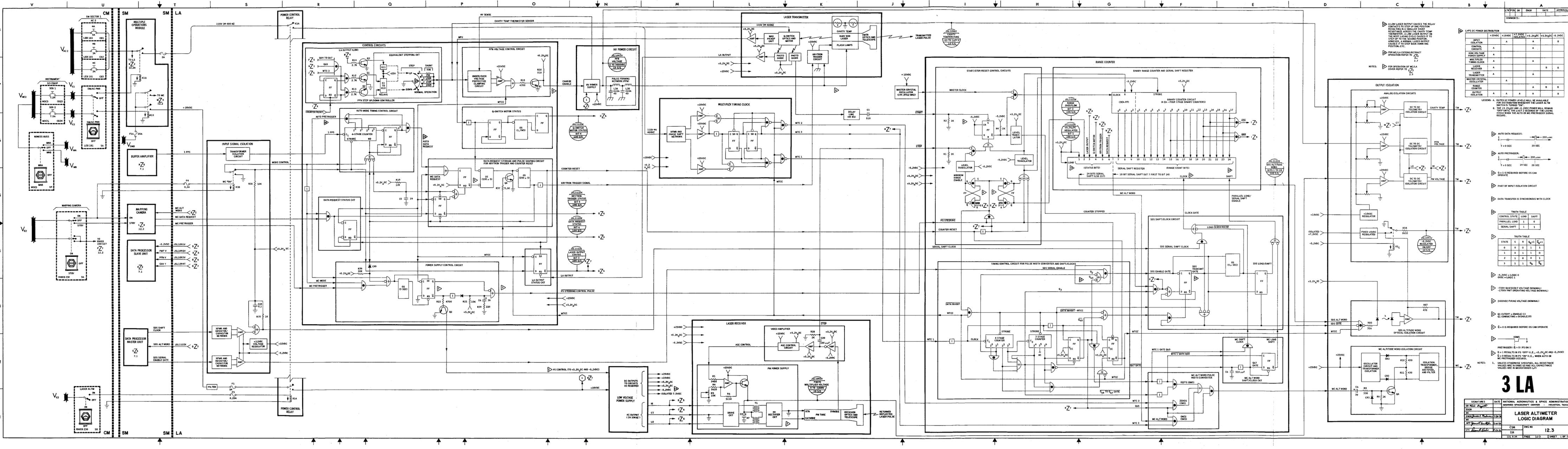


LTN	PCN	OR	ENGR	DATE	APPROVAL

COMMENTS:

1 PC

SIGNATURES	DATE	NATIONAL AERONAUTICS & SPACE ADMINISTRATION
DESIGNER		MANAGED SPACECRAFT DIVISION - HOUSTON, TEXAS
ENGINEER		
TESTER		
INSPECTOR		
DATE	12.11.63	
SCALE	1:1	
TITLE	PANORAMIC CAMERA	
PROJECT	CSM	
WORK CENTER	114	
REVISION	12.11.63	
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DATE	12.11.63	
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FOR		
REVISION		
DATE		
BY		
FOR		



APPROVAL

DATE	ENGR	CHKD	APP'D

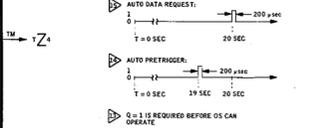
COMMENTS:

FUNCTION	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
INPUT ISOLATION	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
CONTROL CIRCUITS	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
HIGH VOLTAGE POWER SUPPLY	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
MULTIPLEX TIMING	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
LASER TRANSMITTER	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
LASER RECEIVER	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
MULTIPLIER	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
MASTER CRYSTAL OSCILLATOR	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
RANGE COUNTER	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
OUTPUT ISOLATION	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A

LEGEND: A. RATED DC POWER LEVELS WILL BE AVAILABLE FOR DISTRIBUTION WHENEVER THE LASER ALT UNIT IS TURNED "ON".
 B. THE +5.2VDC AND -5.2VDC POWER WILL REMAIN OFF TO THE LASER 2 SECONDS OF THE LASING CYCLE WHEN THE AUTO OR MC PRETRIGGER SIGNAL OCCURS.

NOTES:

- ▶ ALLOW LASER OUTPUT CAUSES THE RELAY CONTACTS TO STAY IN ONE POSITION RESULTING IN A SMALLER SHUNT RESISTANCE ACROSS THE SWIFTY TEMP. THERMISTOR. A LOW SWIFTY TEMP. THERMISTOR CAUSES IT TO STAY IN THE SECOND POSITION. HOWEVER, A NORMAL LASER OUTPUT CAUSES IT TO STEP BACK DOWN ONE POSITION, ETC.
- ▶ FOR OPERATION OF M.C.L.A. COVER REFER TO 2.9



PART OF INPUT ISOLATION CIRCUIT

DATA TRANSFER IS SYNCHRONOUS WITH CLOCK

TRUTH TABLE

CONTROL STATE	LOAD	SHIFT
PARALLEL LOAD	1	0
SERIAL SHIFT	1	1

TRUTH TABLE

STATE	S	R	Q_n	Q_{n+1}
0	0	0	1	1
1	0	1	1	0
2	1	0	0	1
3	1	1	Q_n	Q_n

▶ -5.2VDC = LOGIC 0
 0VDC = LOGIC 1

▶ 720V QUESADY VOLTAGE (NOMINAL)
 1200V PWT OPERATING VOLTAGE (NOMINAL)

▶ 2400VDC FIRING VOLTAGE (NOMINAL)

▶ Q1 CUTOFF = ENABLE (1)
 Q1 CONDUCTING = DISABLE (0)

▶ Q=0 IS REQUIRED BEFORE Q=1 CAN OPERATE

▶ Q=1 RESULTS IN PS "OFF" (I.E., +5.2VDC AND -5.2VDC VALUES ARE IN PS "ON" MODE, WHEN AUTO OR MC PRETRIGGER OCCURS)

▶ PRETRIGGER Q=0 IS PS ON (1)
 Q=0 RESULTS IN PS "OFF" (I.E., +5.2VDC AND -5.2VDC VALUES ARE IN PS "ON" MODE, WHEN AUTO OR MC PRETRIGGER OCCURS)

NOTES:
 1. UNLESS OTHERWISE SPECIFIED, ALL RESISTANCE VALUES ARE IN OHMS AND ALL CAPACITANCE VALUES ARE IN MICROFARADS (μF)

▶ 15VDC = LOGIC 0
 0VDC = LOGIC 1

▶ 720V QUESADY VOLTAGE (NOMINAL)
 1200V PWT OPERATING VOLTAGE (NOMINAL)

▶ 2400VDC FIRING VOLTAGE (NOMINAL)

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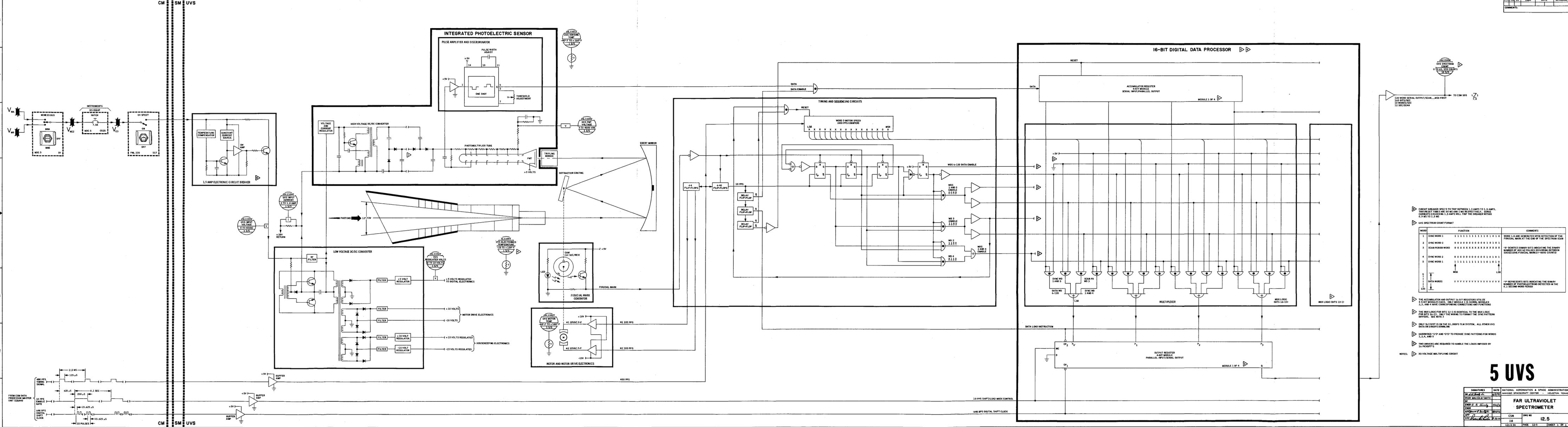
▶ 2400VDC FIRING VOLTAGE (NOMINAL)

▶ Q1 CUTOFF = ENABLE (1)
 Q1 CONDUCTING = DISABLE (0)

▶ Q=0 IS REQUIRED BEFORE Q=1 CAN OPERATE

▶ Q=1 RESULTS IN PS "OFF" (I.E., +5.2VDC AND -5.2VDC VALUES ARE IN PS "ON" MODE, WHEN AUTO OR MC PRETRIGGER OCCURS)

▶ PRETRIGGER Q=0 IS PS ON (1)
 Q=0 RESULTS IN PS "OFF" (I.E., +5.2VDC AND -5.2VDC VALUES ARE IN PS "ON" MODE, WHEN AUTO OR MC PRETRIGGER OCCURS)



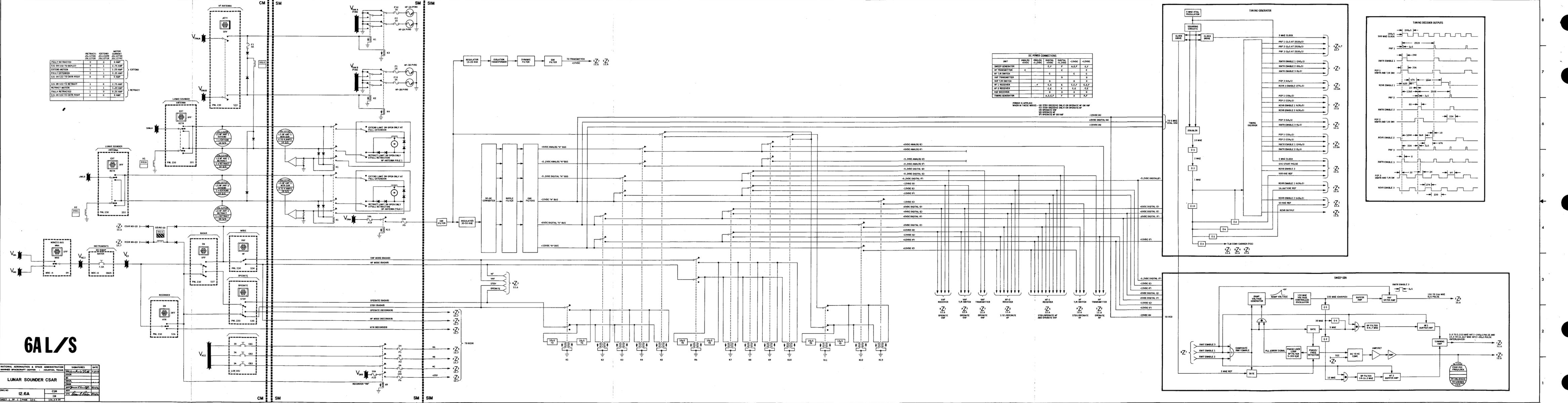
▷ CIRCUIT BREAKER SPEC'D TO TRIP BETWEEN 1.3 AMP TO 1.5 AMPS. TRIP/RESET TIME 2 AMPS TO 1.5 AMPS AND 1 MS RESPECTIVELY. SURGE CURRENTS EXCEEDING 1.5 AMPS WILL TRIP THE BREAKER WITHIN 0.9 MS TO 1.5 MS.
 ▷ UVS SPECTRUM COUNT FORMAT

WORD	FUNCTION	COMMENTS
1	SYNC WORD 1 1 1 1 1 1 1 1 1 1 1 1 0 1 0 1 0	WORD 1-5 ARE GENERATED UPON DETECTION OF THE FIDUCIAL MARK AT THE END OF THE SPECTRUM SCAN
2	SYNC WORD 2 0 0 0 0 0 0 0 0 0 0 0 1 0 1 0 1	
3	SCAN PERIOD WORD 0 0 X X X X X X X X X X X X X X X X	X'S DENOTES BINARY BITS INDICATING THE BINARY NUMBER OF 400 NS PULSES OCCURRING BETWEEN SUCCESSIVE FIDUCIAL MARKS (4-BIT WORD COUNT)
4	SYNC WORD 2 1 1 1 1 1 1 1 1 1 1 1 0 1 0 1 0	
5	SYNC WORD 1 1 1 1 1 1 1 1 1 1 1 1 0 1 0 1 0	
6	DATA WORDS Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y	Y'S REPRESENTS BITS INDICATING THE BINARY NUMBER OF PHOTOELECTRONS DETECTED IN THE 0.1 SECOND WORD PERIOD

▷ THE ACCUMULATOR AND OUTPUT 16-BIT REGISTERS UTILIZE 4-BIT MODULES EACH. ONLY MODULE 1 IS SHOWN. MODULES 2, 3, AND 4 HAVE CORRESPONDING CONNECTIONS AND FUNCTIONS.
 ▷ THE MIX LOGIC FOR BITS 12-11 IS IDENTICAL TO THE MIX LOGIC FOR BITS 14-13. ONLY THE WIRING TO FORMAT THE SYNC PATTERN DIFFERS. SEE NOTE 3.
 ▷ ONLY SL1107T IS ON THE SL128P'S TLM SYSTEM. ALL OTHER UVS DATA ON SL128P'S DOWNLINK.
 ▷ HARDWIRED "1" AND "0" TO PROVIDE SYNC PATTERNS FOR WORDS 1, 2, 3, 4, AND 5.
 ▷ TWO DRIVERS ARE REQUIRED TO HANDLE THE LOADS IMPOSED BY 16 PICADIFFS.
 NOTES: ▷ X5 VOLTAGE MULTIPLYING CIRCUIT

5 UVS

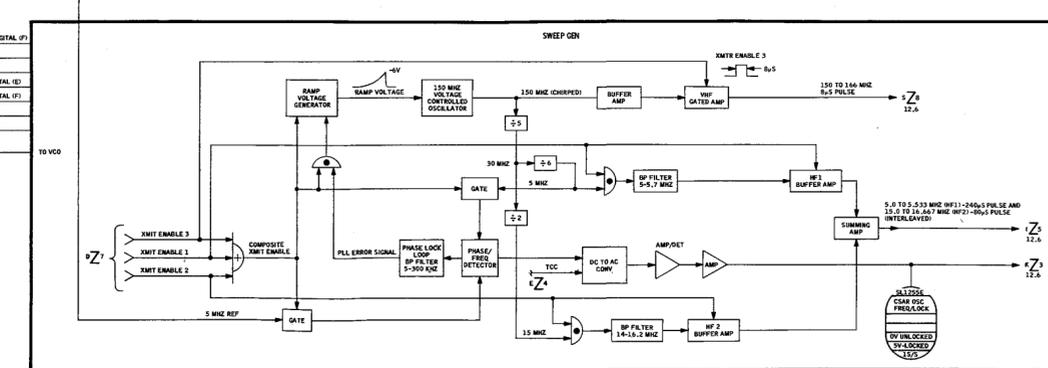
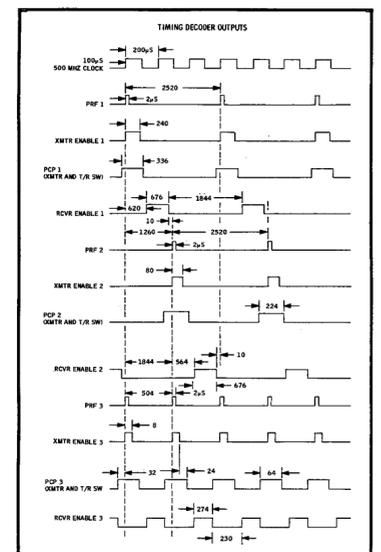
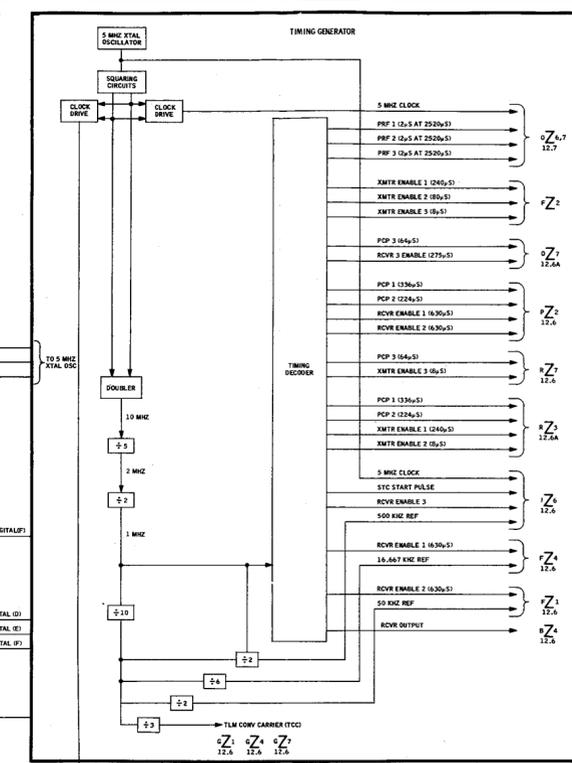
DESIGNED BY	DATE	NATIONAL AERONAUTICS & SPACE ADMINISTRATION
DESIGNED BY	DATE	MANHATTAN SPACEFLIGHT CENTER HOUSTON TEXAS
ENGINEER	DATE	FAR ULTRAVIOLET SPECTROMETER
APPROVED	DATE	
DATE	CSM	OWG NO
	114	12.5
	121 X 54	PAGE 12-3
		SHEET 1 OF 1



	RETRACT	EXTEND	MOTOR CURRENT
FULLY RETRACTED	0	0	0 AMP
532 OR 532 TO DEPLOY	0	1	2.75 AMP
EXTEND MOTION	1	1	1.20 AMP
FULLY EXTENDED	0	1	0.25 AMP
531 OR 532 TO CNTR POSIT	0	0	0 AMP
533 OR 532 TO RETRACT	1	0	2.75 AMP
RETRACT MOTION	1	1	1.20 AMP
FULLY RETRACTED	1	0	0.25 AMP
523 OR 532 TO CNTR POSIT	0	0	0 AMP

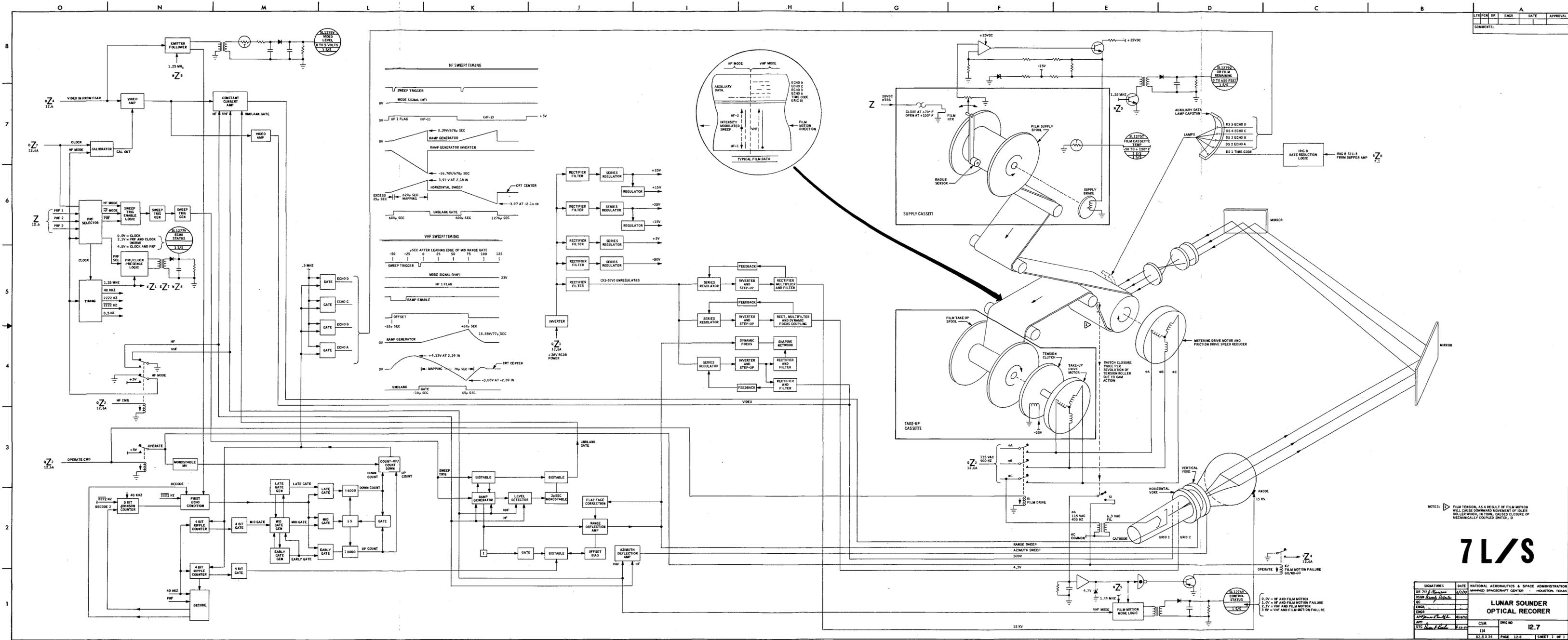
UNIT	ANALOG		DIGITAL		-15VDC	+15VDC
	ANALOG	-15VDC	DIGITAL	-15VDC		
SWEEP GENERATOR						
HF TRANSMITTER	E		F	F	A,E,F	E,F
HF T/R SWITCH			C	C	C	C
VHF TRANSMITTER			D	D	D	D
VHF T/R SWITCH			F	F	C,E,F	C,E,F
HF 1 RECEIVER			C,E	E	C,E	C,E
HF 2 RECEIVER			D	D	D	D
VHF RECEIVER			A,D,C,E,F	F	A	A,F

POWER IS AMPLES WHEN IN THESE MODES - (A) STBY (RECEIVE ONLY) OR OPERATE HF OR VHF (C) STBY (RECEIVE ONLY) OR OPERATE HF (D) OPERATE HF (E) OPERATE HF (F) OPERATE HF OR VHF



6AL/S

NATIONAL AERONAUTICS & SPACE ADMINISTRATION		SIGNATURES		DATE
MANNED SPACEFLIGHT CENTER		HOUSTON, TEXAS		
LUNAR SOUNDER CSAR		APP: [Signature]		12/68
OWB NO	12.6A	CSM	134	STC [Signature]
SHEET 1 OF 2 PAGE 12-6		126.5 X 28		



DATE	APPROVAL

7L/S

SIGNATURES	DATE	NATIONAL AERONAUTICS & SPACE ADMINISTRATION
DR 710 J. ...	11/1/71	MANNED SPACECRAFT CENTER - HOUSTON, TEXAS
DC ...		
ENGR ...		
APP ...		
SYN ...		

LUNAR SOUNDER OPTICAL RECORDER

CSM DWG NO 12.7
114
82.5.3.54 PAGE 12-4 SHEET 1 OF 1

APOLLO

CSH

**COMMAND/
SERVICE
MODULE
SYSTEMS
HANDBOOK**

CSM 114

AUGUST 23, 1972



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