

ASTP

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Command/ Service Module

and Docking Module

SYSTEMS HANDBOOK - CSM 111

AUGUST 1, 1974

Prepared by
FLIGHT CONTROL DIVISION
Flight Operations Directorate



National Aeronautics and Space Administration
LYNDON B. JOHNSON SPACE CENTER
Houston, Texas

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ASTP

COMMAND/SERVICE MODULE AND DOCKING MODULE
SYSTEMS HANDBOOK

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(DOCUMENT CHANGE 2)

PREFACE

This document change (DC) updates the ASTP Command/Service Module and Docking Module Systems Handbook with the first publication of two CM and DM Experiments drawings, and with PCN-1 and PCN-2 level changes, to reflect the CSM and DM Systems as of June 20, 1975.

This preface, the table of contents/item effectivity pages, and all new pages, as well as all changed pages, should be incorporated into the basic document dated August 1, 1974, according to the document change instruction sheet which follows this page.

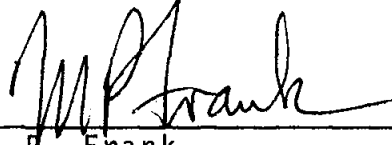
This document change has been prepared by the Flight Control Division, NASA, Lyndon B. Johnson Space Center, Houston, Texas, with technical support by Rockwell International (RI) and LTV/Kentron Hawaii, Ltd.

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 other purposes.

Comments concerning the general contents of this handbook should be directed to CF7/Mr. S. A. Liebergot, 713-483-6191.

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Approved by:



M. P. Frank
Acting Chief, Flight Control Division

ASTP

COMMAND/SERVICE MODULE AND DOCKING MODULE
SYSTEMS HANDBOOK
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DOCUMENT CHANGE INSTRUCTION SHEET

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SECTION 1

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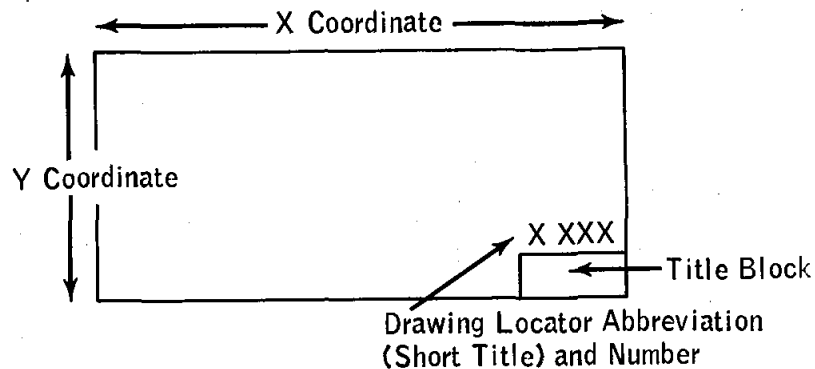
STANDARDS

1.1 GENERAL DRAWING INFORMATION

1.1.1 Cross-indexing

1.1.1.1 General drawing configuration

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



1.1.1.2 Component location code

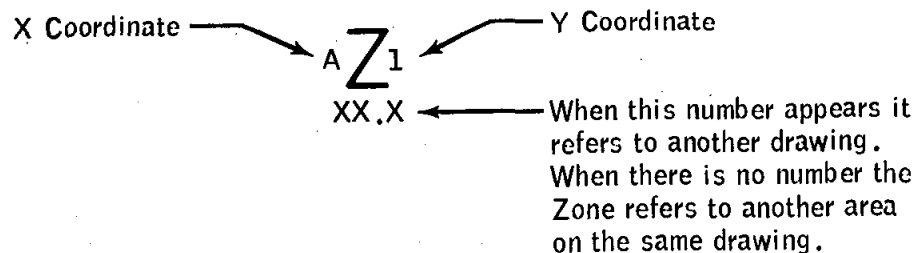
The component location code is used to reference controls (on the control-display figure) and components (on the overview drawing) into the detail system drawings.



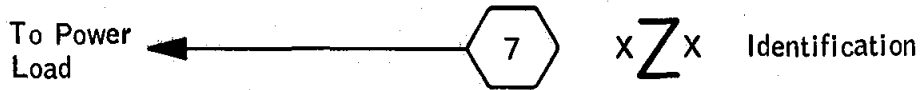
{ 3 - Drawing Locator Number for the given detail subsystem drawing
K - X Coordinate
4 - Y Coordinate

1.1.2 Technical Zone References

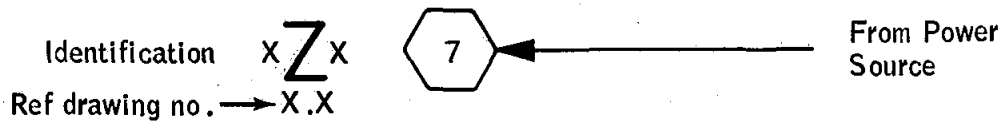
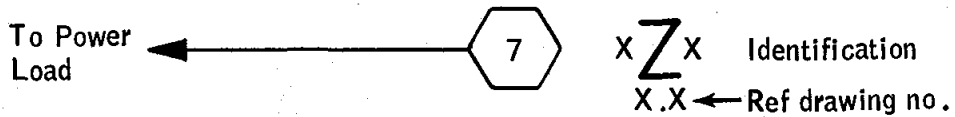
1.1.2.1 Zone reference



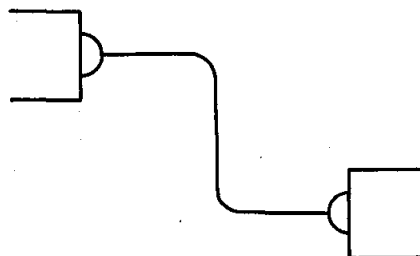
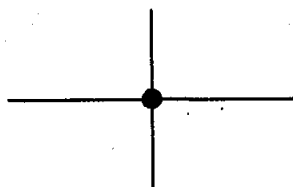
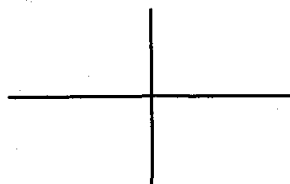
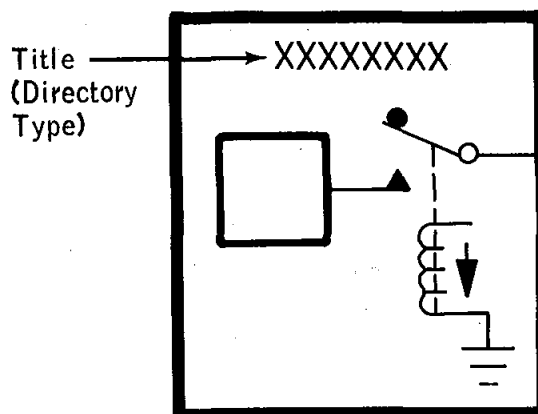
1.1.2.2 Power intra-drawing
(Section to section within the same drawing)



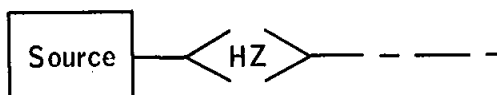
1.1.2.3 Power inter-drawings
(Drawing to drawing)



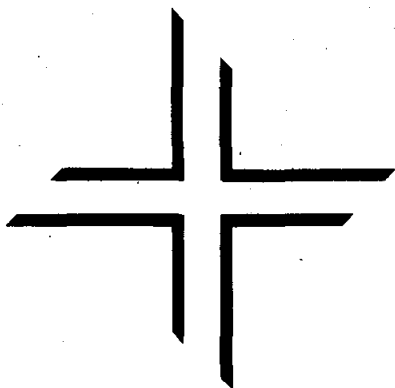
1.2 LINE LEGEND

1.2.1 RF Cable1.2.2 Electrical Line, Power and control1.2.2.1 Electrical connected1.2.2.2 Electrical crossover1.2.3 Directional Flow Arrows1.2.4 Component Enclosures1.2.4.1 Main enclosure
1/16-inch solid black line1.2.4.2 Sub enclosure
1/32-inch solid black line1.2.4.3 Component enclosure with crew (manual control)
1/16-inch dashed black line1.2.4.4 Module interface and systems assembly
1/8-inch dashed black line

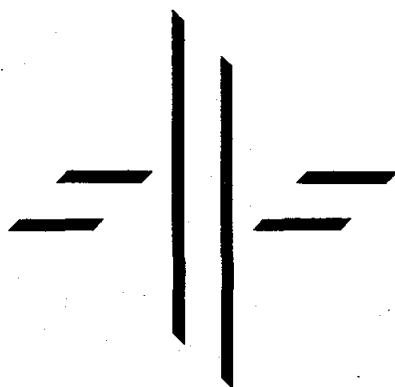
CM ■ ■ SM

1.2.5 Mechanical Linkage1.2.6 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



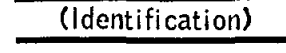
1.3.2.11 Sense Lines



1.3.2.12 Oxidizer



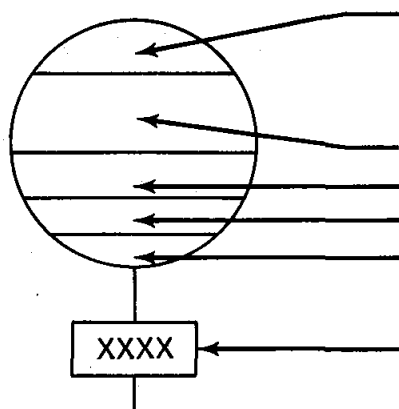
1.3.2.13 Others



(Identification)

1.4
1.4.1

TELEMETRY SYMBOLS
Measurements Telemetered



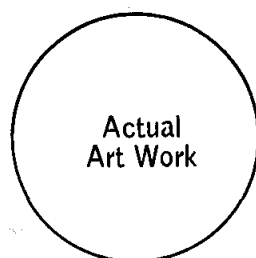
Measurement Number: Should include the letter associating it with the transducer type. Alternate system measurement numbers and PCM codes may appear near the TM bubble.

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

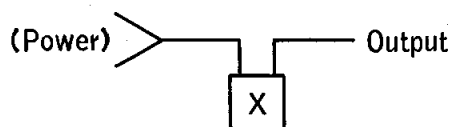


Meters should be placed close to their associated TM bubble wherever possible.

From Drive Source
XXXX ← Meter Number
PNL X ← Panel number

1.4.3
1.4.3.1

Sensors
Single source

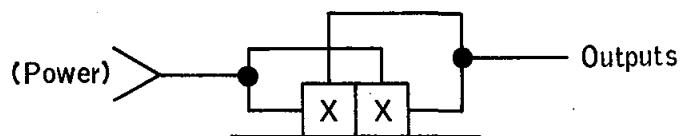


Example: Letter indicates the type:

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

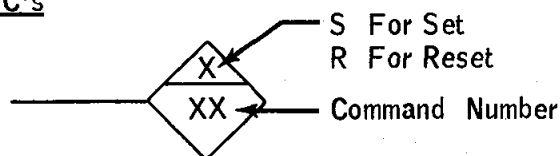
1.4.3.2

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

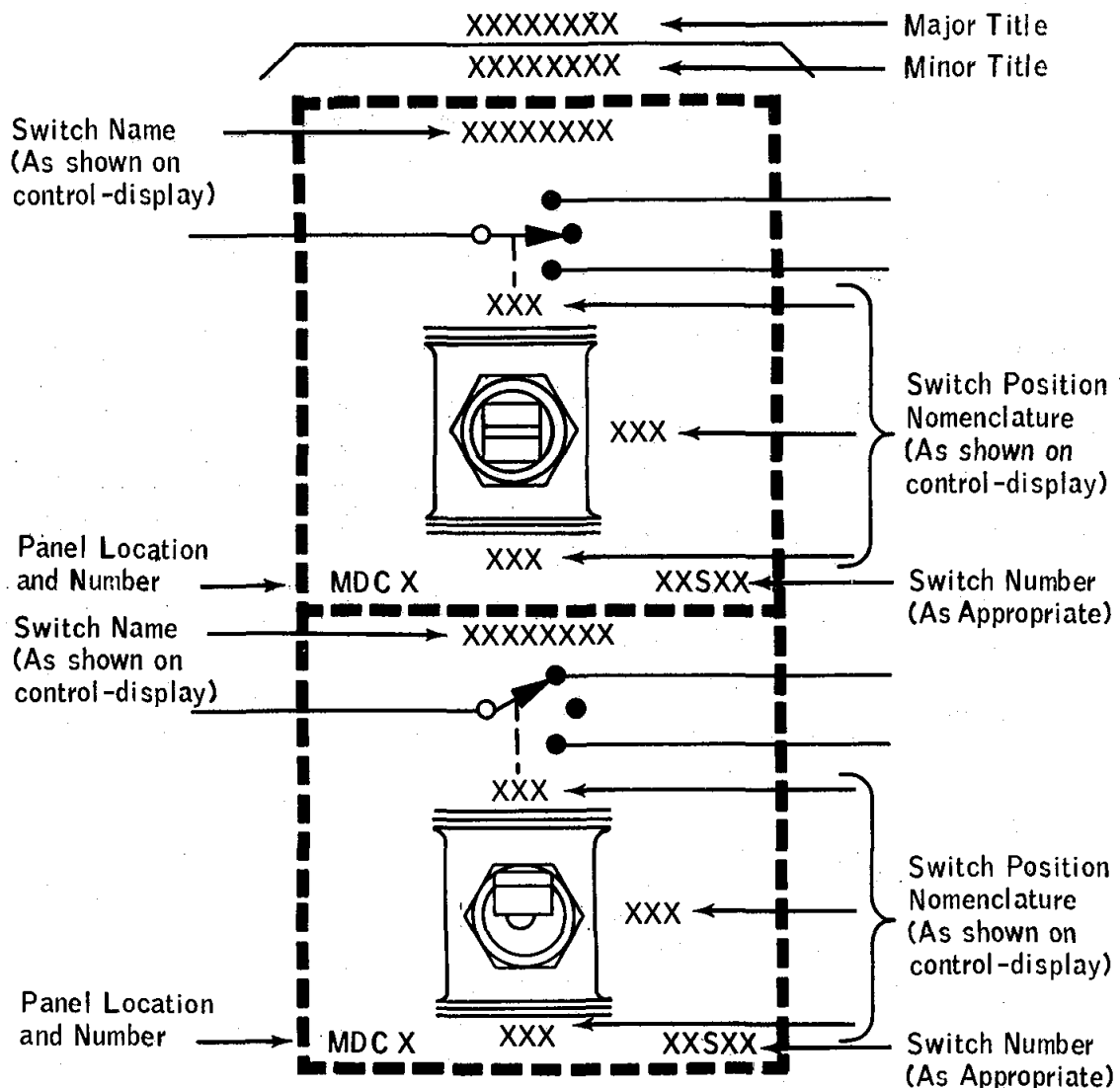
All switches will be shown in the de-energized position (if possible). When a switch has more than one set of contacts, only one set needs to have switch contact nomenclature.

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

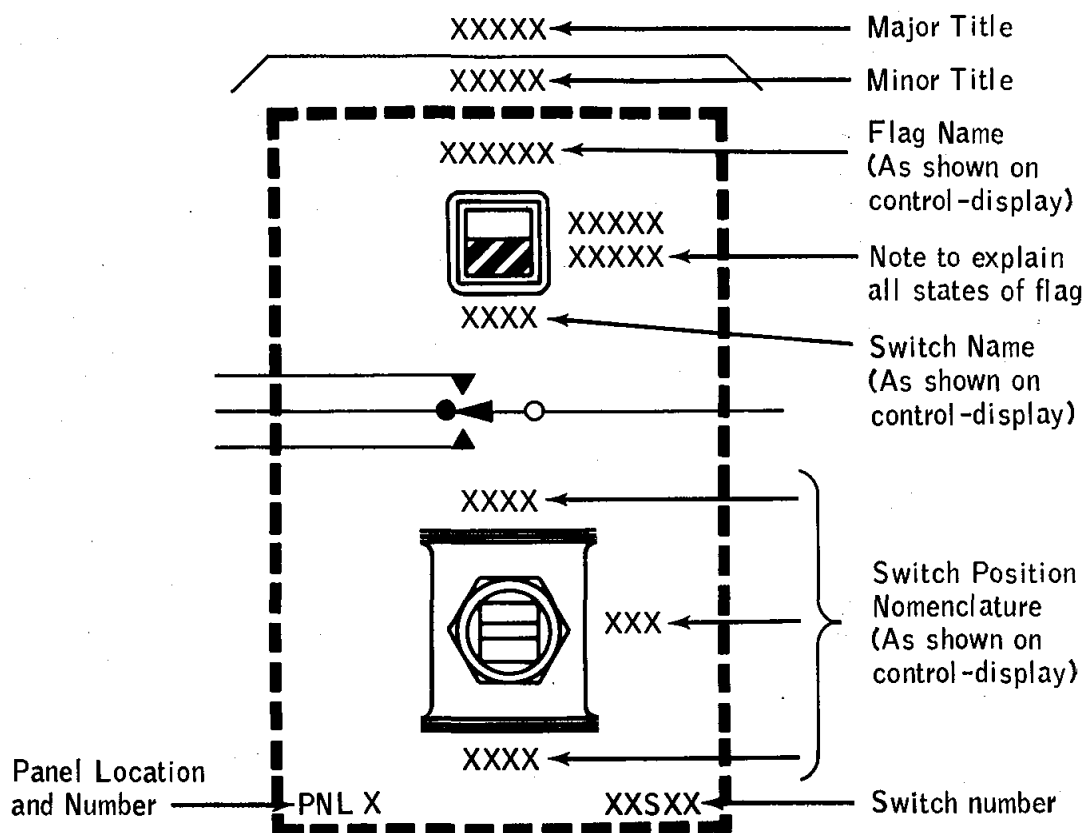
Note: If more than one switch has identical major and minor titles, they may be stacked without repeating these titles.



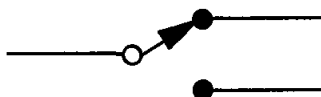
1.5.1.2

Switch controlled flag

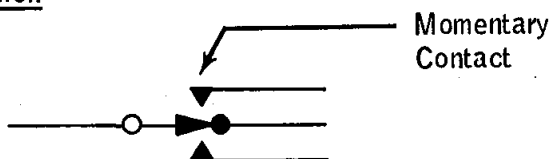
If a flag is directly controlled by a switch, it may be shown in the following manner:



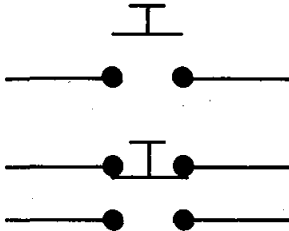
1.5.1.3

Two-position

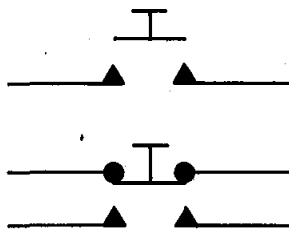
1.5.1.4

Three-position

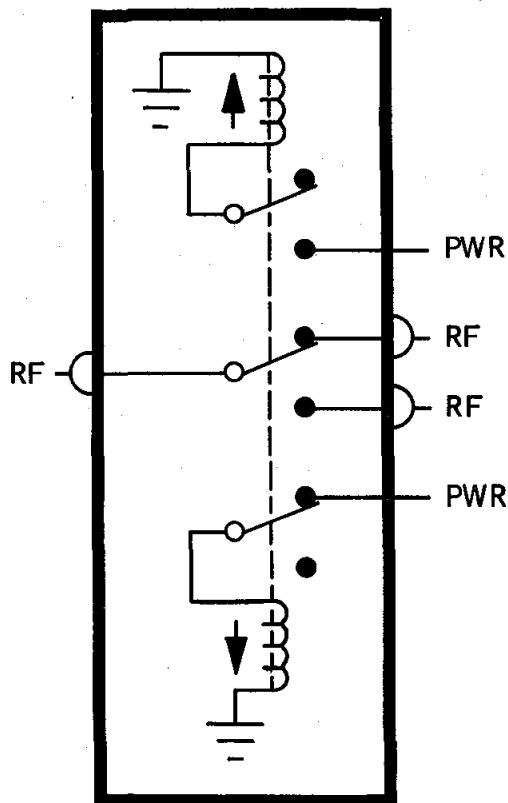
1.5.1.5 Pushbutton
1.5.1.5.1 Latching



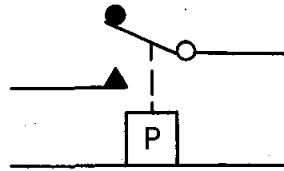
1.5.1.5.2 Momentary



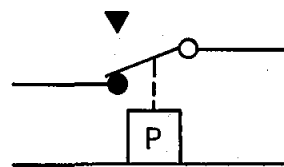
1.5.1.6 Coax



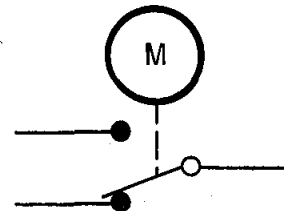
1.5.1.7 Pressure
1.5.1.7.1 Closed decreased pressure



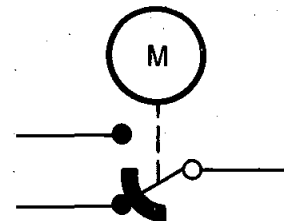
1.5.1.7.2 Closed increased pressure



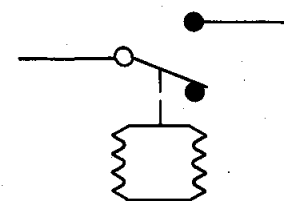
1.5.1.8 Motor
1.5.1.8.1 Break before make



1.5.1.8.2 Make before break



1.5.1.9 Baro



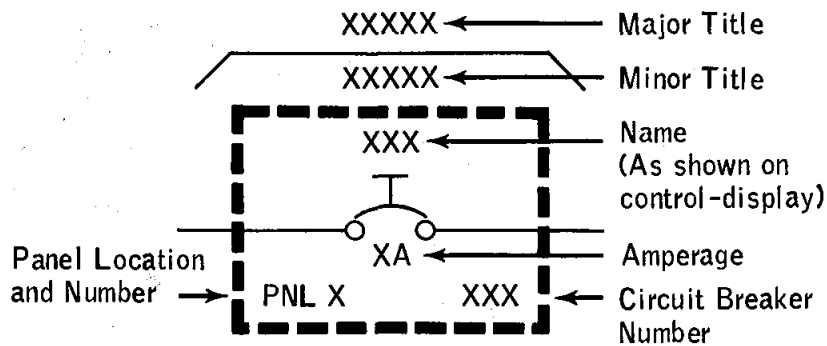
Close XXX psi or altitude
Open XXX psi or altitude

1.5.2

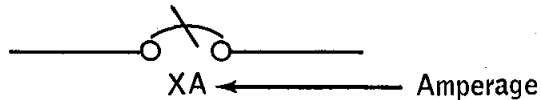
Circuit Breakers

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

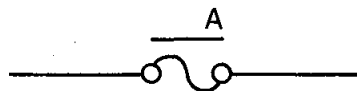
1.5.2.2

Automatic

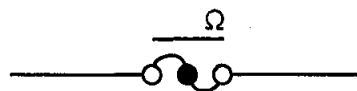
1.5.3

Fuses

1.5.3.1

General

1.5.3.2

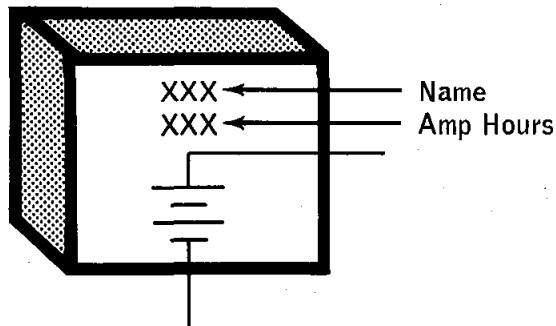
Fusistor

1.5.4

Battery

1/16-inch black tape

Size varies with number of cells and drawing arrangement.

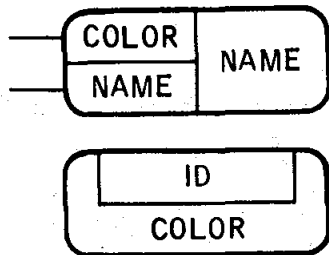


1.5.5

Lights

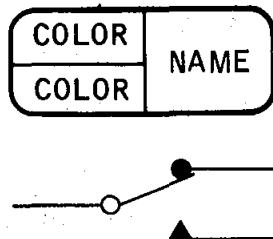
1.5.5.1

Telelights



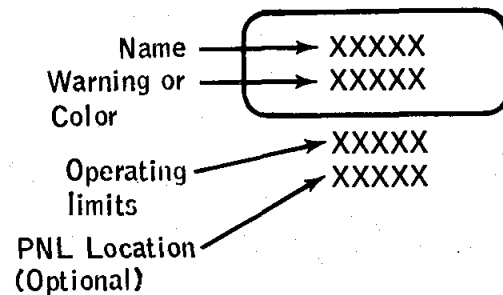
1.5.5.2

Switching



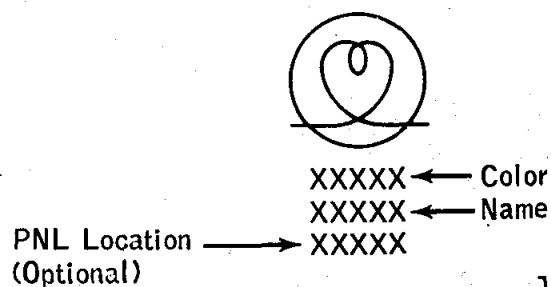
1.5.5.3

Caution and warning



1.5.5.4

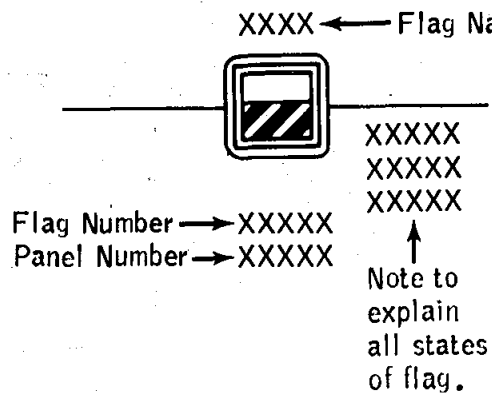
Component



1.5.6

Annunciator Flag

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



1.5.7

Relays

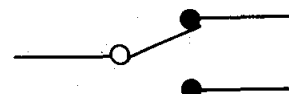
1.5.7.1

Momentary contact



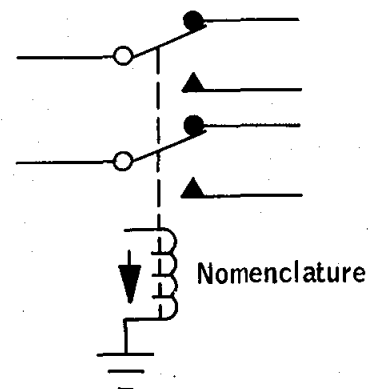
1.5.7.2

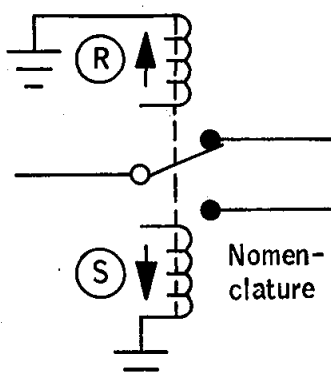
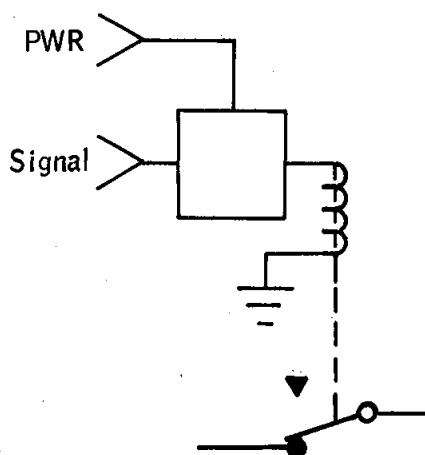
Latching contacts



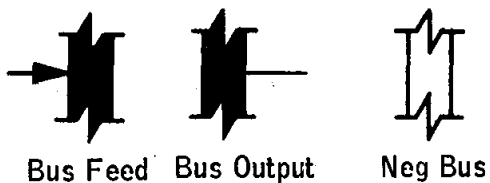
1.5.7.3

Non-Latching relay

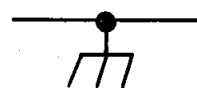
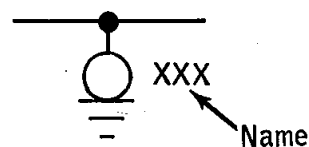
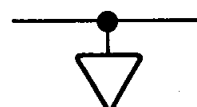


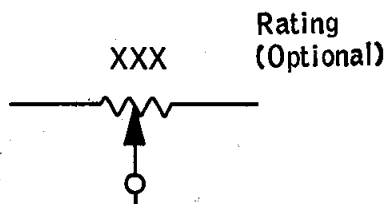
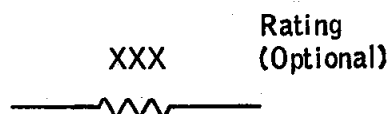
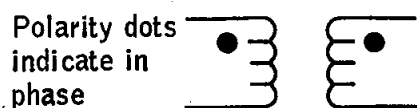
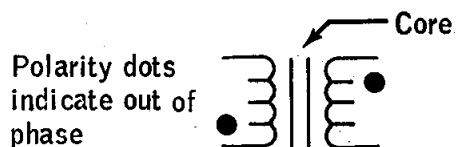
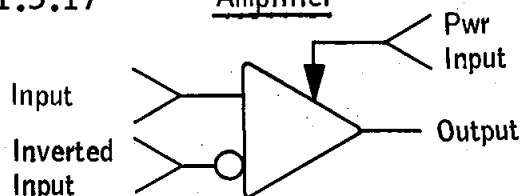
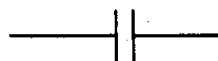
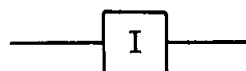
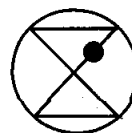
1.5.7.4 Latching relay1.5.8 Relay or Solenoid Driver1.5.9 Buses
1.5.9.1 Symbol

Length can vary depending on the bus function on a given drawing.

1.5.9.2 Designation
See bus designation list.

V
X X X

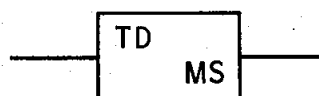
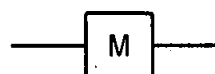
1.5.10 Grounds
1.5.10.1 System1.5.10.2 Frame1.5.10.3 Floating or Controlled1.5.10.4 Signal1.5.11 Diodes
1.5.11.1 General1.5.11.2 Zener1.5.11.3 Tunnel

1.5.11.4 Control rectifier (SCR)1.5.12 Potentiometer1.5.13 Fixed Resistor1.5.14 Heater1.5.15 Thermostat1.5.16 Transformers1.5.17 Amplifier1.5.18 Capacitor1.5.19 Digital Inverter1.5.20 Wire Resolver

X = Sine Winding

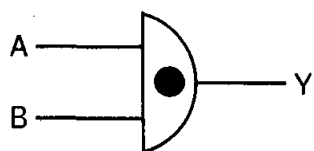
● = Minus Sine

— = Cosine Winding

1.5.21 Time Delay1.5.22 Electrical Filter1.5.23 Modulator

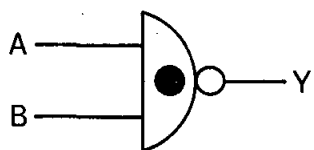
1.5.24 Gates

1.5.24.1 And



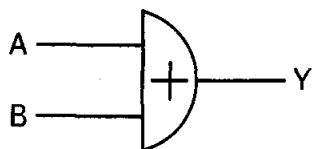
A	B	Y
1	1	1
1	0	0
0	1	0
0	0	0

1.5.24.2 Nand



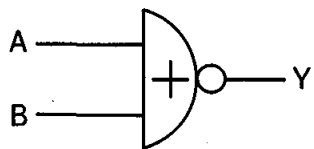
A	B	Y
1	1	0
1	0	1
0	1	1
0	0	1

1.5.24.3 Or



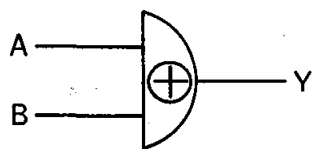
A	B	Y
1	1	1
1	0	1
0	1	1
0	0	0

1.5.24.4 Nor



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

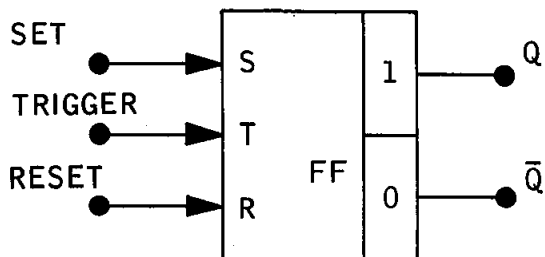
1.5.24.5 Exclusive Or



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

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

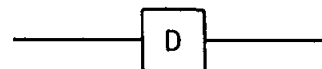
T

Q and $\bar{Q}$ Change States

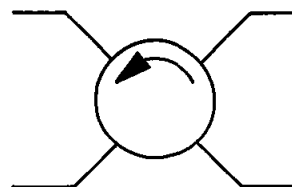
R

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

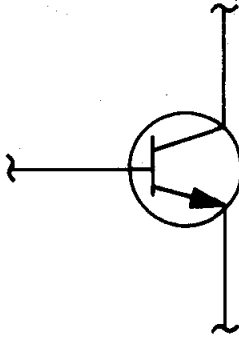
1.5.25 Demodulator



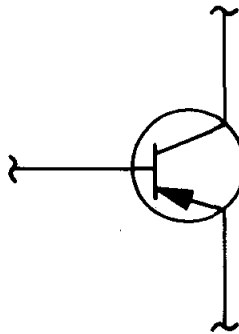
1.5.26 RF Circulator



1.5.27 Transistor
 1.5.27.1 NPN



1.5.27.2 PNP



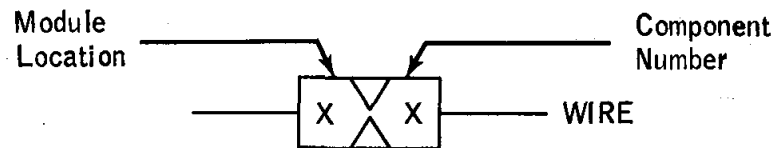
1.5.28 Antenna

Name
 (Type or Function)

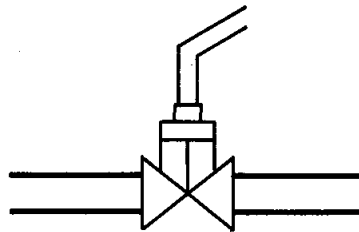


1.6 PYROTECHNIC SYMBOLS

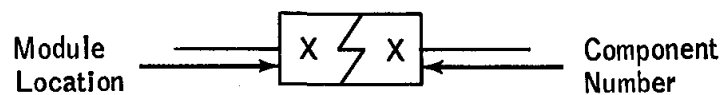
1.6.1 Pyro Guillotine



1.6.2 Pyro Valve with Single Initiator

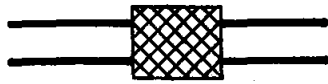


1.6.3 Electrical Circuit Interrupter

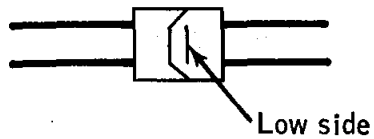


1.7 MECHANICAL SYMBOLS

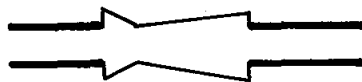
1.7.1 Mechanical Filter



1.7.2 Burst Diaphragm



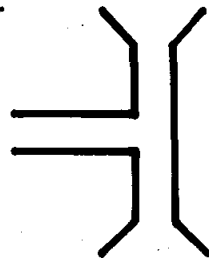
1.7.3 Venturi



1.7.4 Vent



1.7.5 Thrust Neutralized Vent

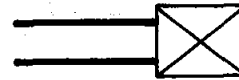


1.7.6 Disconnects

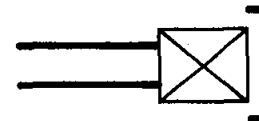
1.7.6.1 Self-sealing



1.7.6.2 Quick



1.7.7 Quick Disconnect Fill and Drain

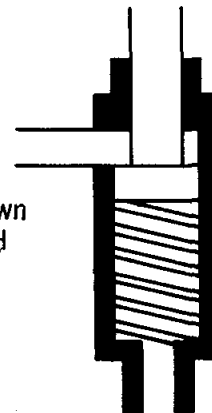


1.7.8 Fill and Drain



1.7.9 Ball Valve Actuator

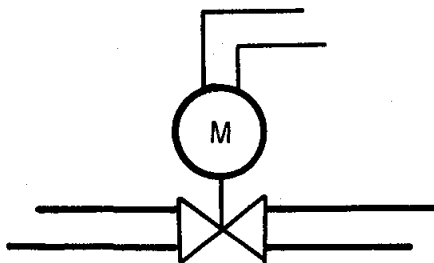
May be shown
in depressed
or partially
depressed
position



1.7.10 Valves



1.7.10.1 Motor Control



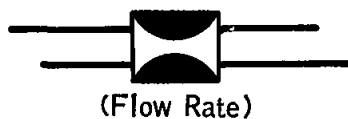
1.7.10.2 Manual Control



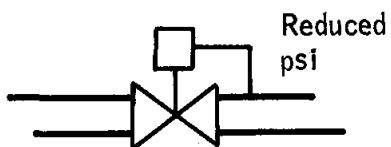
1.7.10.3 Check Valve



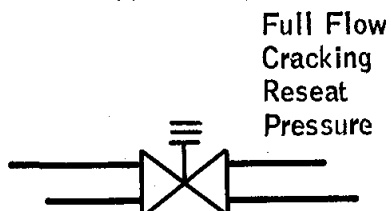
1.7.10.4 Orifice



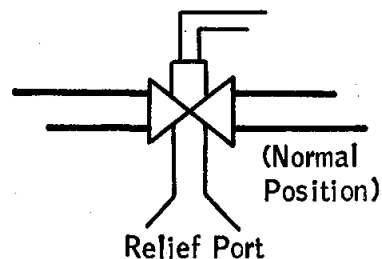
1.7.10.5 Pressure regulator



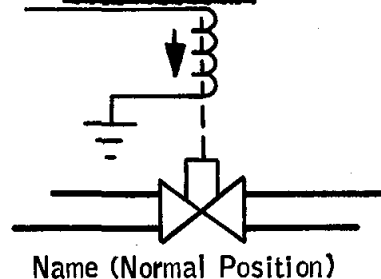
1.7.10.6 Relief Valve



1.7.10.7 Pneumatic controlled valve with line bleed

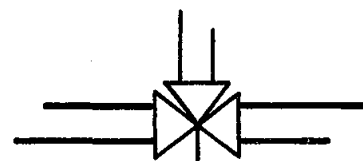


1.7.10.8 Solenoid valve

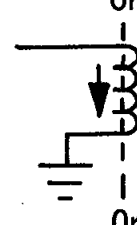


1.7.10.9 Three-way valve

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

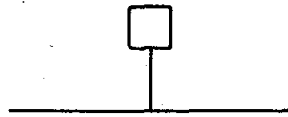


1.8.2 Overview Drawing Instrumentation Legend

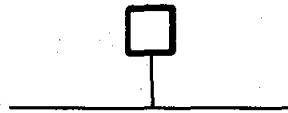
1.8.2.1 Automatic control only



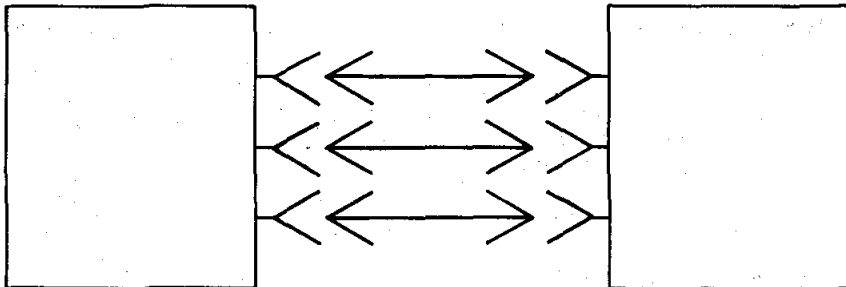
1.8.2.2 PCM only



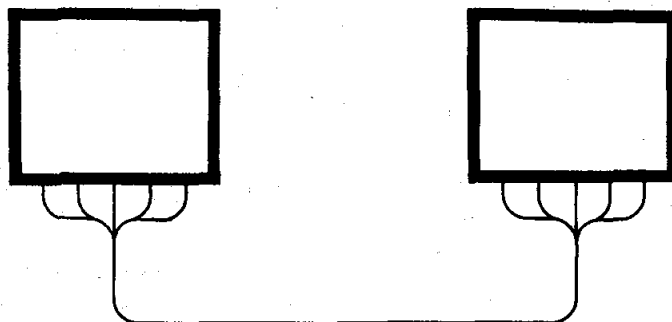
1.8.2.3 PCM and/or onboard display



1.8.3 Two-unit Interface



1.8.4 Two-unit Cable Connection



1.8.5 Buses1.8.5.1 Power buses.-

Prime CSH
generation
dwg No.

V _{MA}	- MAIN BUS A	3.2
V _{MB}	- MAIN BUS B	3.2
V _{BA}	- BATTERY BUS A	3.2
V _{BB}	- BATTERY BUS B	3.2
V _{BR}	- BATTERY RELAY BUS	3.2
V _{FP}	- FLIGHT AND POSTLANDING BUS	3.2
V _E	- EXPERIMENT BUS	3.2
V _{AC1}	- AC BUS 1	3.3
V _{AC2}	- AC BUS 2	3.3
V _F	- FLIGHT BUS	3.2
V _{SMA}	- SERVICE MODULE BUS A	3.2
V _{SMB}	- SERVICE MODULE BUS B	3.2
V _{DMA}	- DOCKING MODULE BUS A	3.2
V _{DMB}	- DOCKING MODULE BUS B	3.2

1.8.5.2

Sequential buses.-

Prime CSH
generation
dwg No.

V _{SQA}	- SEQUENTIAL PYRO BUS A	2.2
V _{RQA}	- RCS CONTROLLER PYRO BUS A	2.2
V _{RLA}	- RCS CONTROLLER LOGIC BUS A	2.2
V _{SLA}	- SEQUENTIAL LOGIC BUS A	2.2
V _{SAA}	- SEQUENTIAL ARM BUS A	2.2
V _{ELA}	- EARTH LANDING BUS A	2.5
V _{SQB}	- SEQUENTIAL PYRO BUS B	2.2
V _{RQB}	- RCS CONTROLLER PYRO BUS B	2.2
V _{RLB}	- RCS CONTROLLER LOGIC BUS B	2.2
V _{SLB}	- SEQUENTIAL LOGIC BUS B	2.2
V _{SAB}	- SEQUENTIAL ARM BUS B	2.2
V _{ELB}	- EARTH LANDING BUS B	2.5
V _{ED 1}	- EMERGENCY DETECTION SYSTEM BUS NO 1	2.3
V _{ED 2}	- EMERGENCY DETECTION SYSTEM BUS NO 2	2.3

Sequential buses (cont'd) .-

Prime CSH
generation
dwg No.

V _{ED 3}	- EMERGENCY DETECTION SYSTEM BUS NO 3	2.3
V _{6D95}	- IU ABORT BUS	2.3

1.8.5.3

Instrumentation buses .-

V ₁	- CM ESS INST BUS PWR FROM RHEB PNL 276-CB1	7.1
V ₂	- CM ESS INST BUS PWR FROM RHEB PNL 276-CB2	7.1
V _{3S}	- SM ESS INST BUS PWR FROM RHEB PNL 276-CB3	7.1
V _{4S}	- SM ESS INST BUS PWR FROM RHEB PNL 276-CB4	7.1
V _{SC}	- SCE PWR REQ'D FOR SIGNAL CONDITIONING (+20, -20, and/or +10Vdc)	7.1 and Page 7-18
V _{SC5}	- SCE CM +5Vdc PWR	7.1
V _{RCS}	- SM RCS INDICATOR BUS POWER FROM SM MAIN BUS	10.2
V _{RCS}	- SM RCS INDICATOR BUS POWER FROM SM MAIN BUS	10.2

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

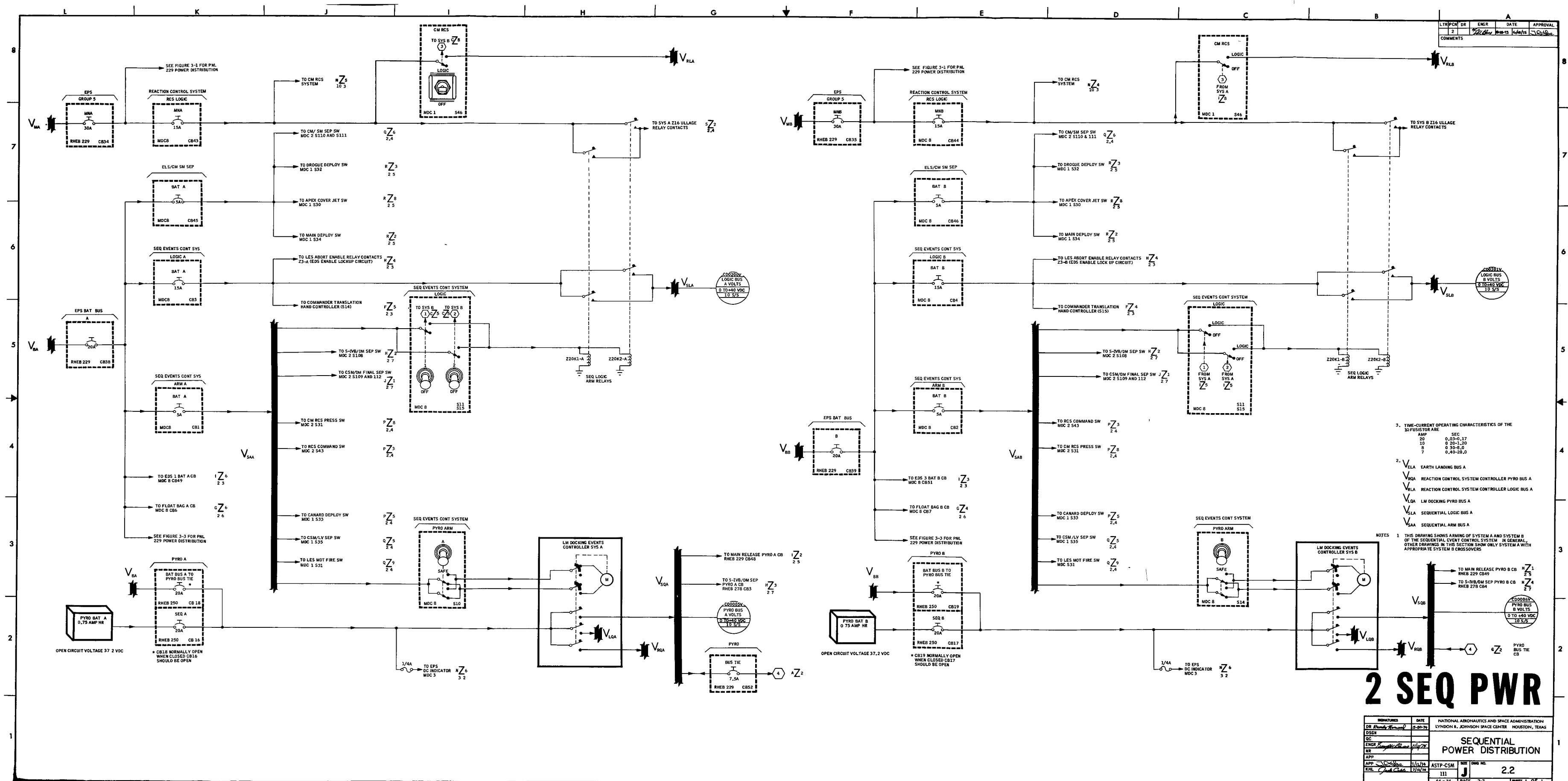
Prime CSH
generation
dwg No.

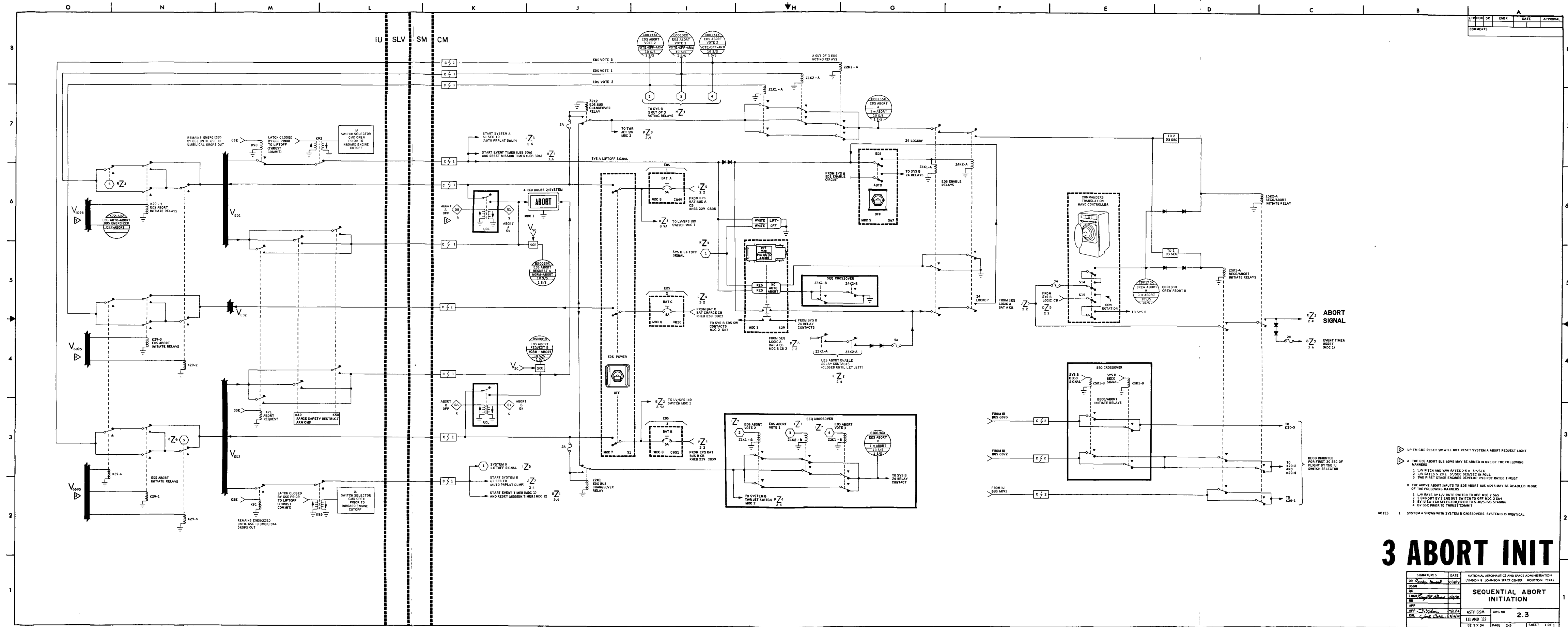
8.2

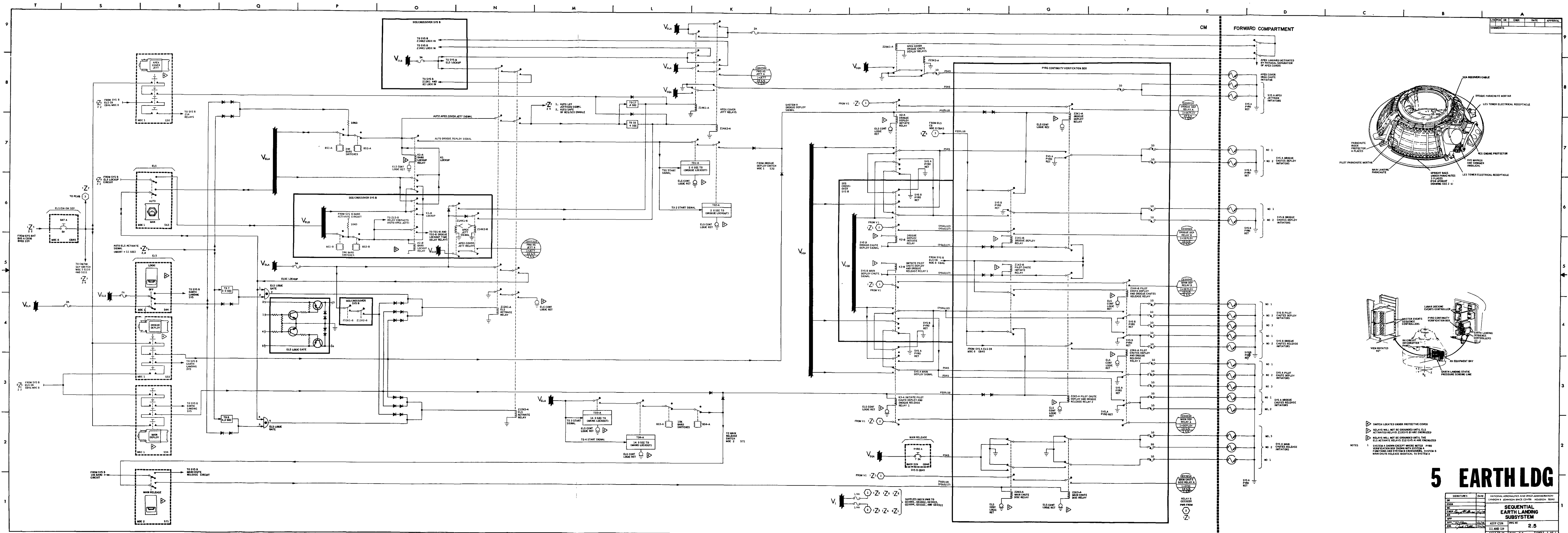
8.2

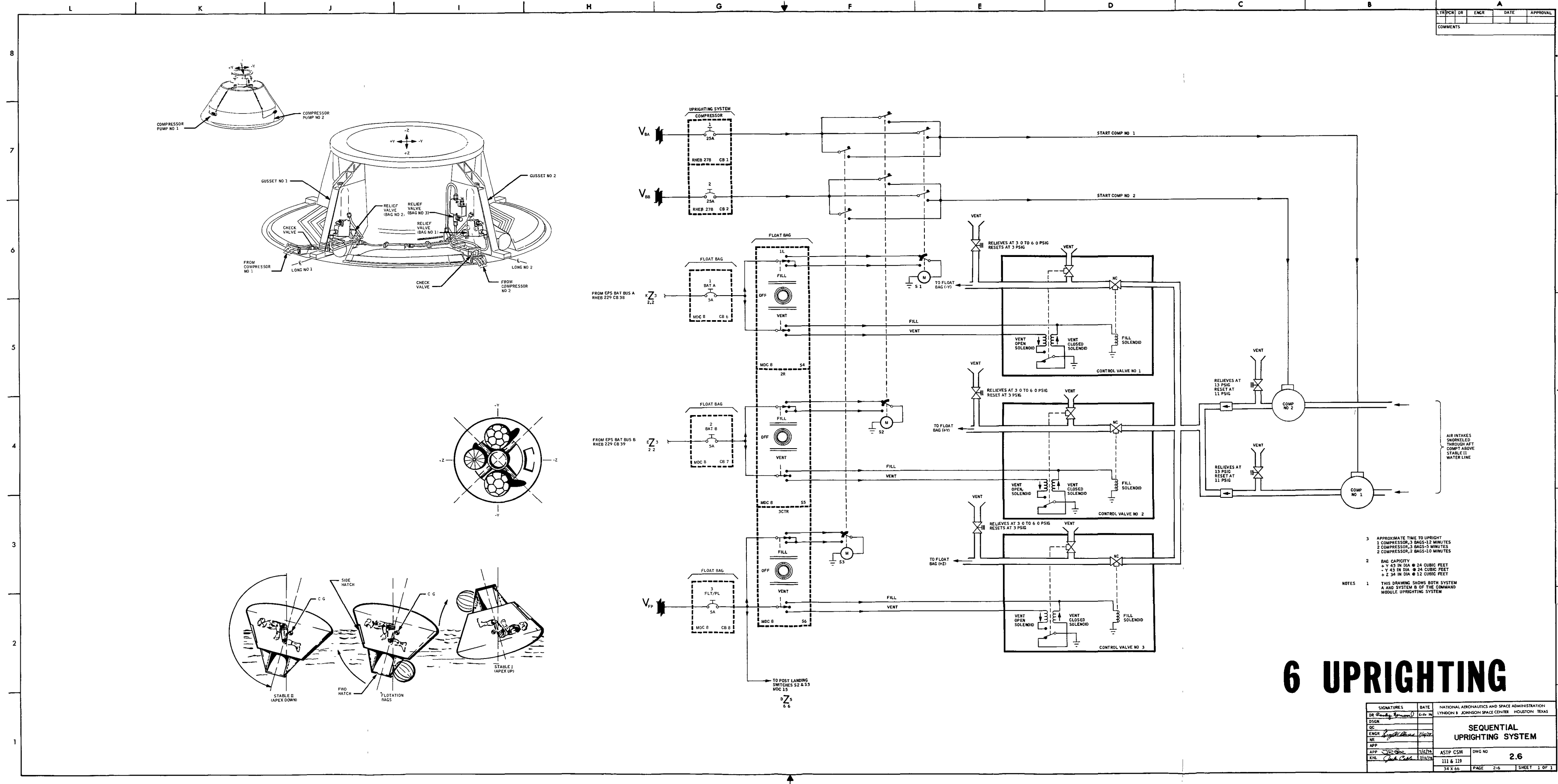
8.2

8.2

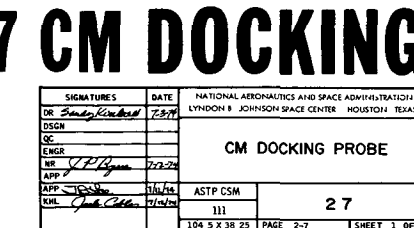


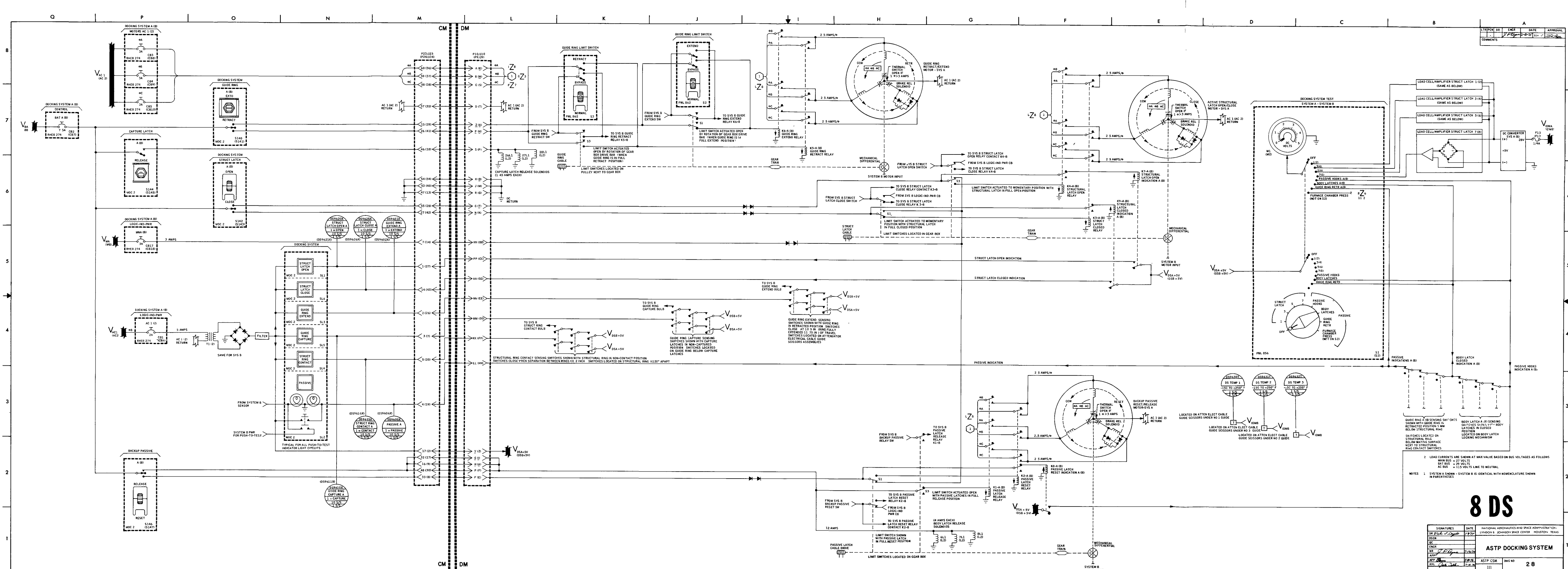




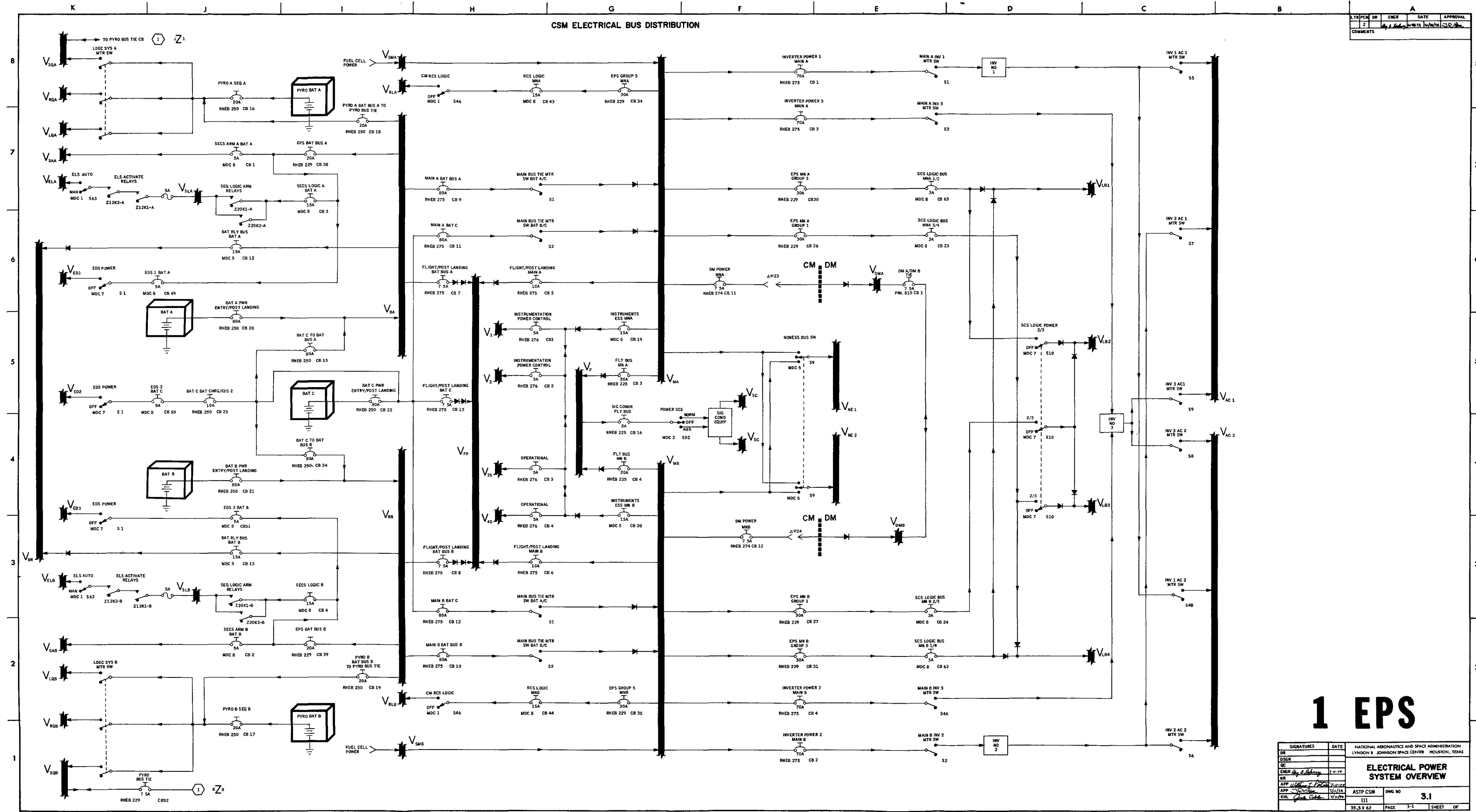


SIGNATURES		DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION	
DR	<i>[Signature]</i>	11/1/66	LYNDON B. JOHNSON SPACE CENTER HOUSTON TEXAS	
DC	<i>[Signature]</i>	11/1/66		
ENGR	<i>[Signature]</i>	11/1/66		
APP	<i>[Signature]</i>	11/1/66		
CHK	<i>[Signature]</i>	11/1/66		
ASTP CSM		DWG NO	2.6	
III & IV		PAGE	2-6	
34 X 56		SHEET	1 OF 1	



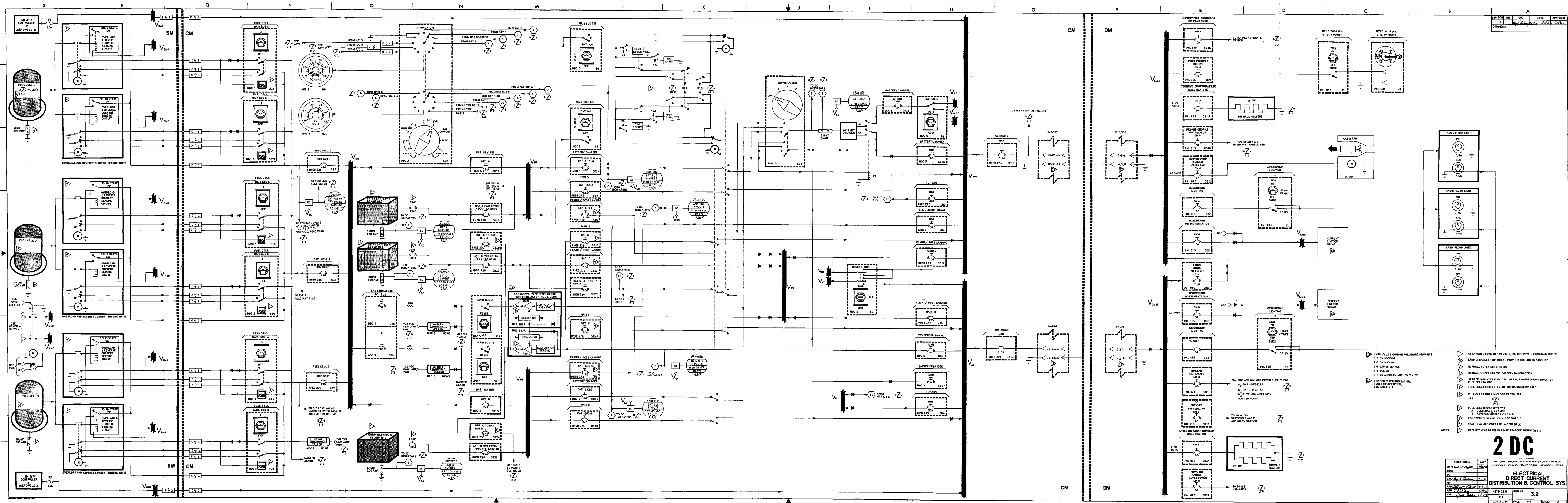


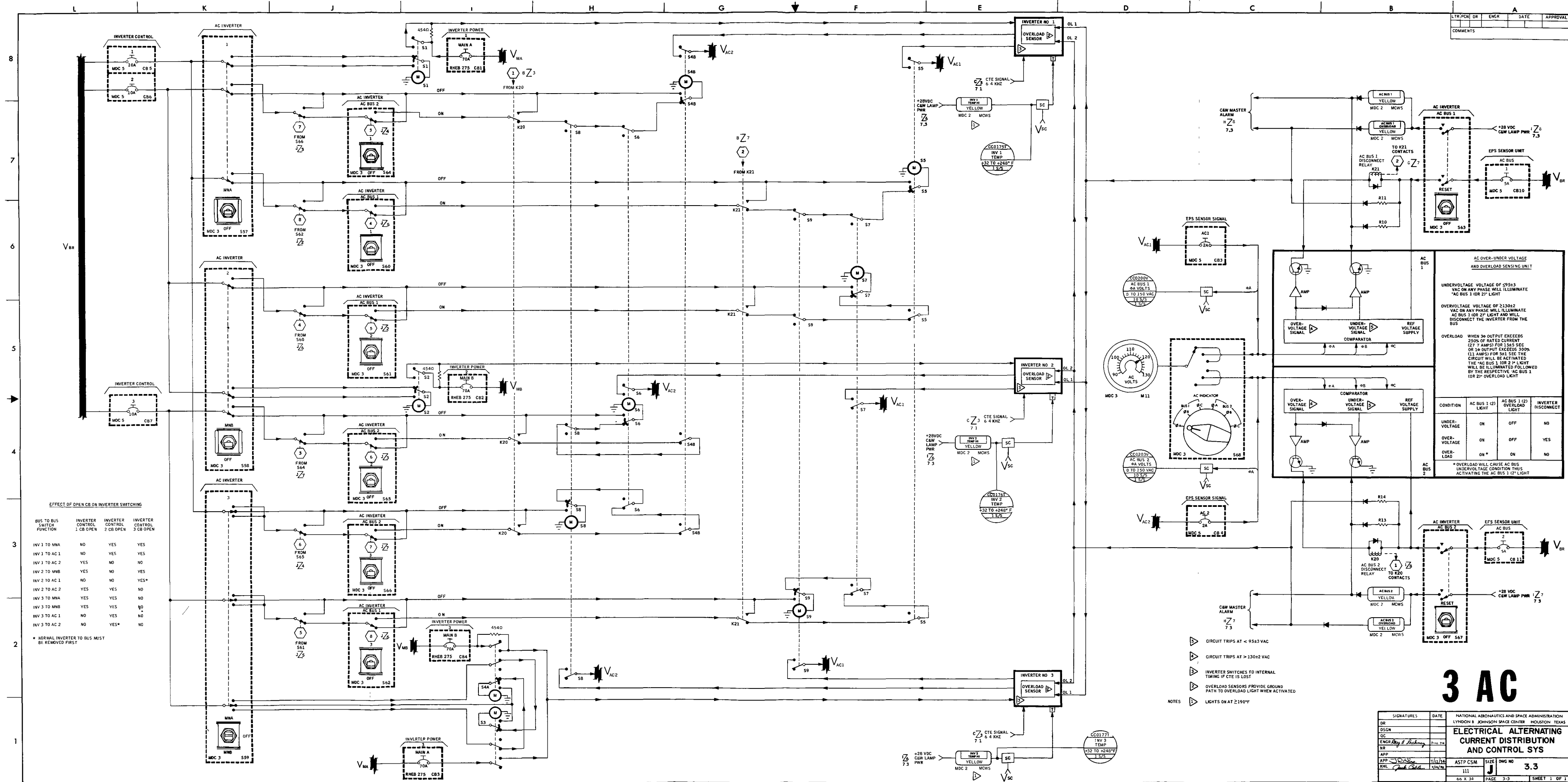
3 ELECTRICAL
SYSTEM



1 EPS

SIGNATURES		DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION	
DR			LYNN B. JOHNSON SPACE CENTER, HOUSTON, TEXAS	
DCR				
QC				
DR	<i>John S. Baker</i>	7-1-77		
APP	<i>William F. Peltz</i>	7-1-77		
CHK	<i>John S. Baker</i>	7-1-77		
			ASTP CSM	DWG NO
			111	3.1
			PAGE 3-1	SHEET 07





EFFECT OF OPEN CB ON INVERTER SWITCHING

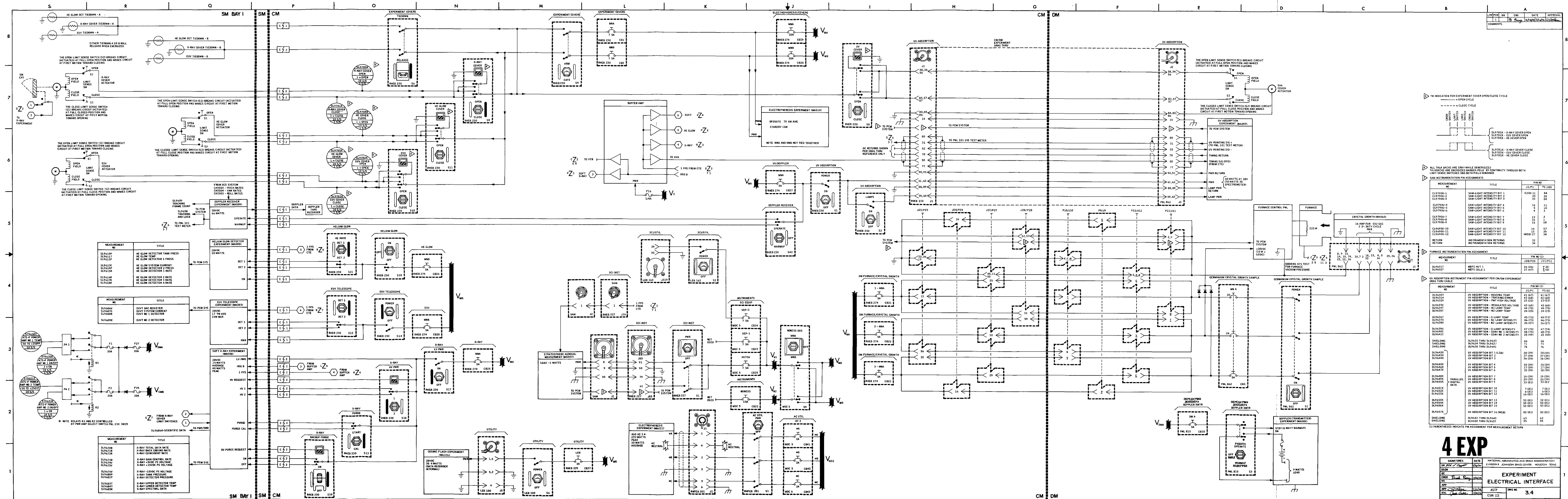
BUS TO BUS SWITCH FUNCTION	INVERTER CONTROL 1 CB OPEN	INVERTER CONTROL 2 CB OPEN	INVERTER CONTROL 3 CB OPEN
INV 1 TO MNA	NO	YES	YES
INV 3 TO AC 1	NO	YES	YES
INV 3 TO AC 2	YES	NO	NO
INV 2 TO MNB	YES	NO	YES
INV 2 TO AC 1	NO	NO	YES*
INV 2 TO AC 2	YES	YES	NO
INV 3 TO MNA	YES	YES	NO
INV 3 TO MNB	YES	YES	NO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

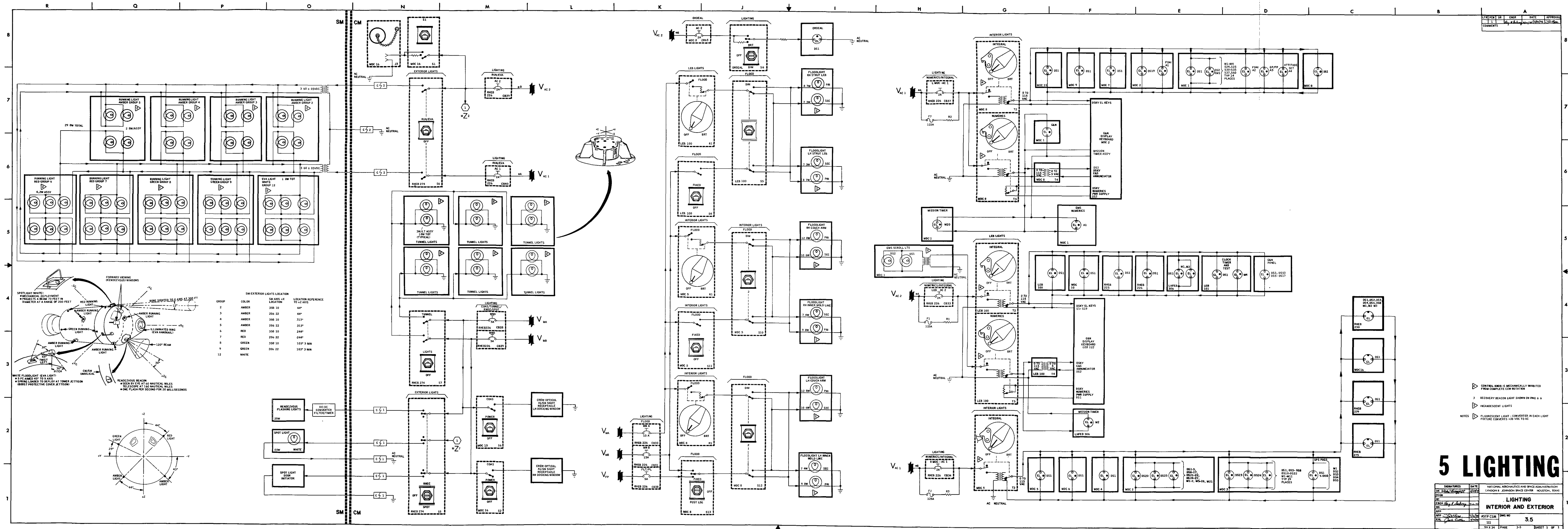
* NORMAL INVERTER TO BUS MUST BE REMOVED FIRST

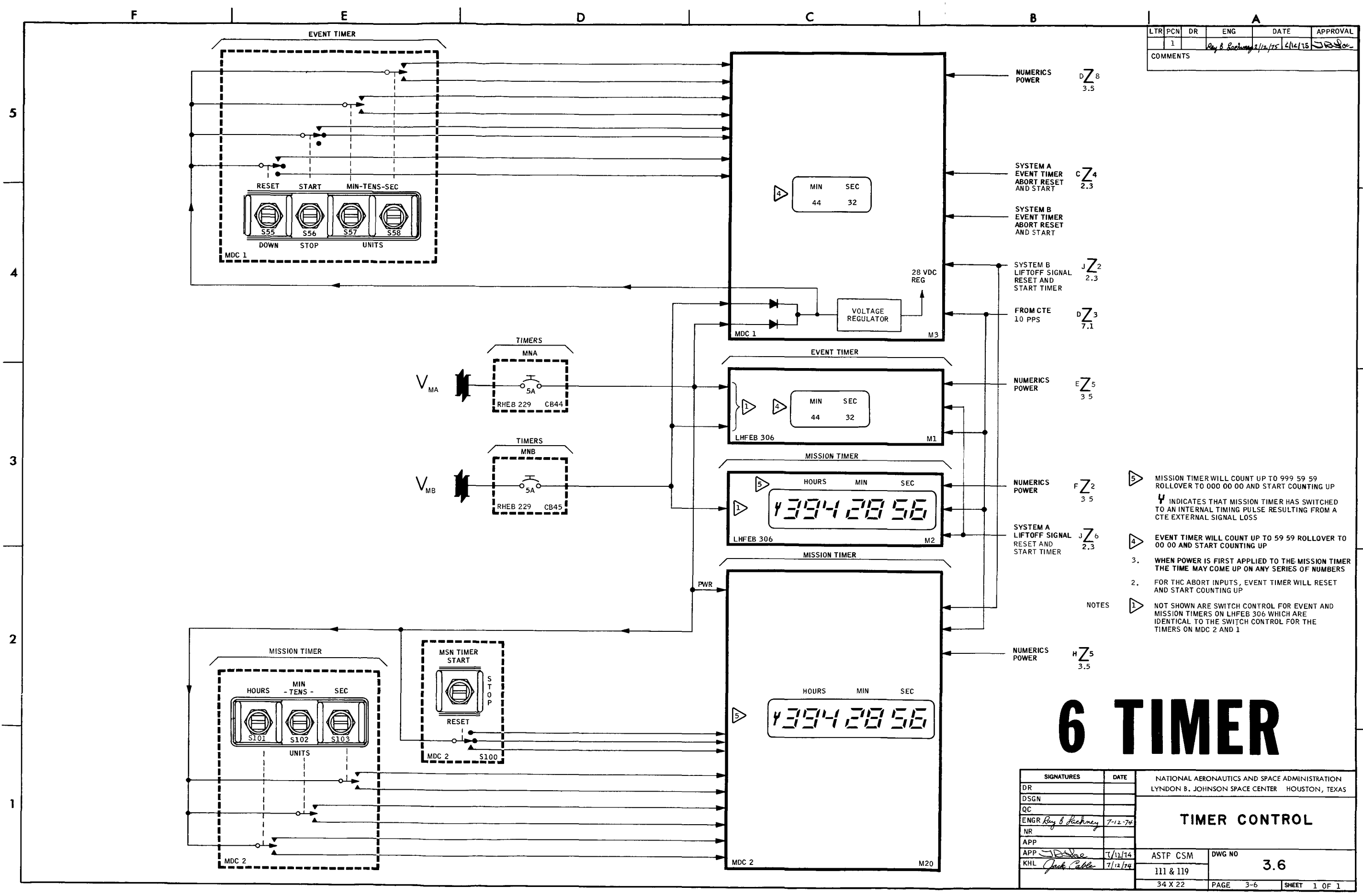
- NOTES
- △ CIRCUIT TRIPS AT < 95% VAC
 - △ CIRCUIT TRIPS AT > 130% VAC
 - △ INVERTER SWITCHES TO INTERNAL TIMING IF CTE IS LOST
 - △ OVERLOAD SENSORS PROVIDE GROUND PATH TO OVERLOAD LIGHT WHEN ACTIVATED
 - △ LIGHTS ON AT 2100°F

3 AC

SIGNATURES		DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS	
DR				
DCN				
ENGR	By <i>[Signature]</i>	7/24/72		
NR				
APP				
REL				
ASTP CSM		SIDE	3.3	
111		PAGE 3-3 SHEET 1 OF 1		



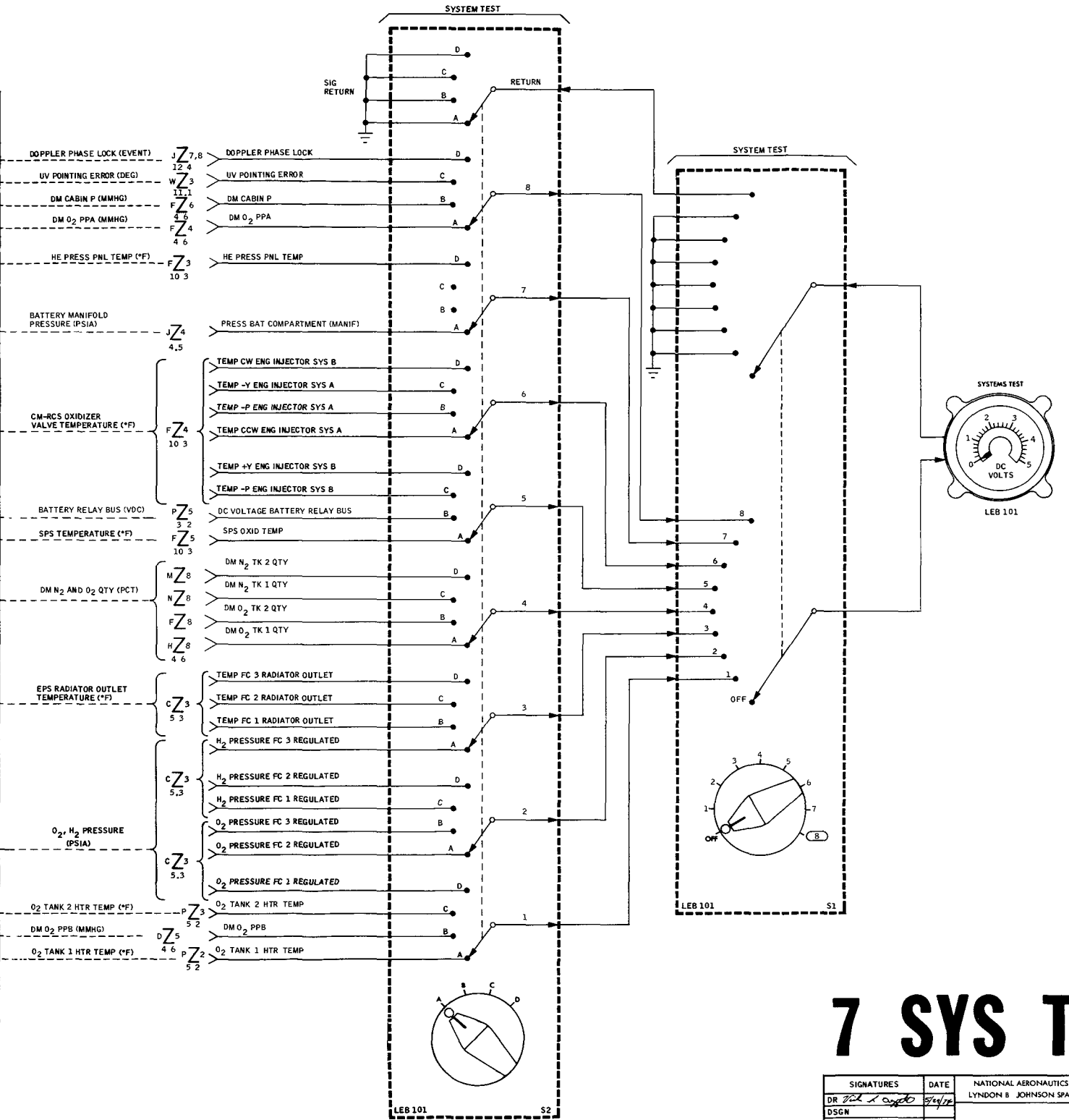


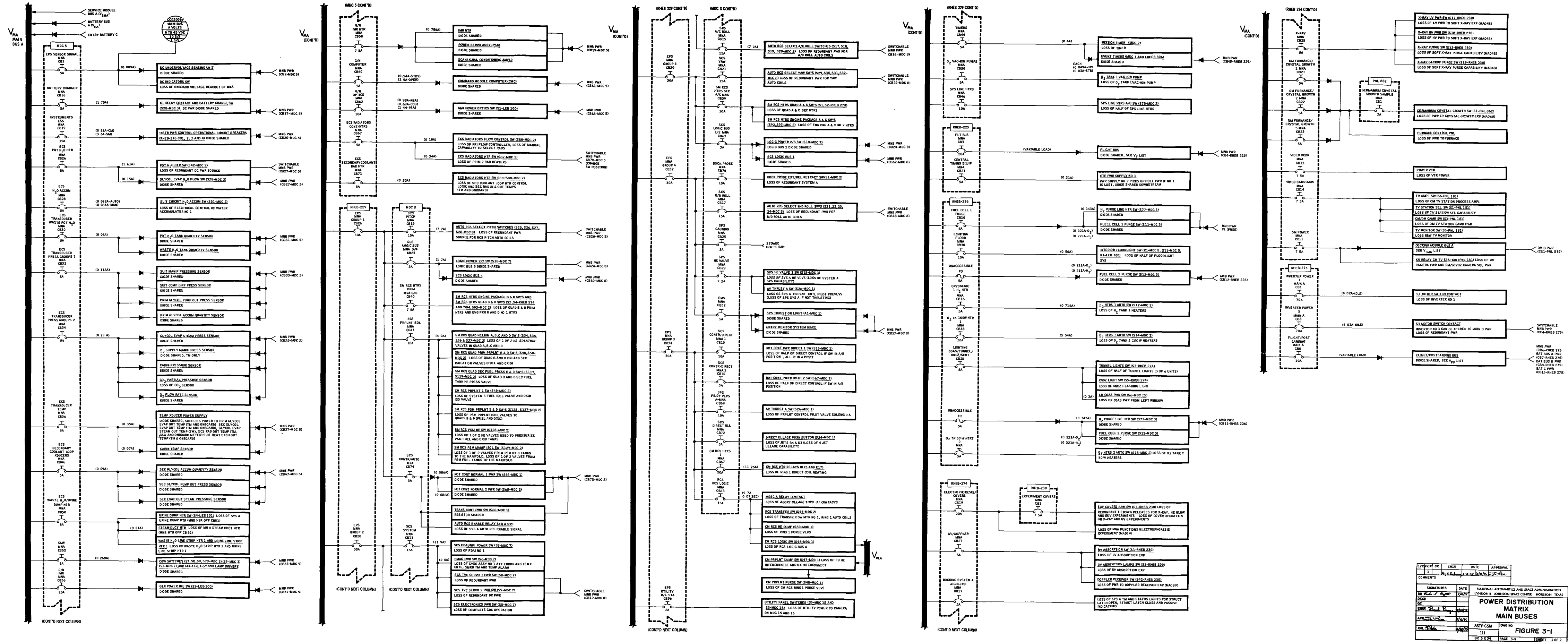


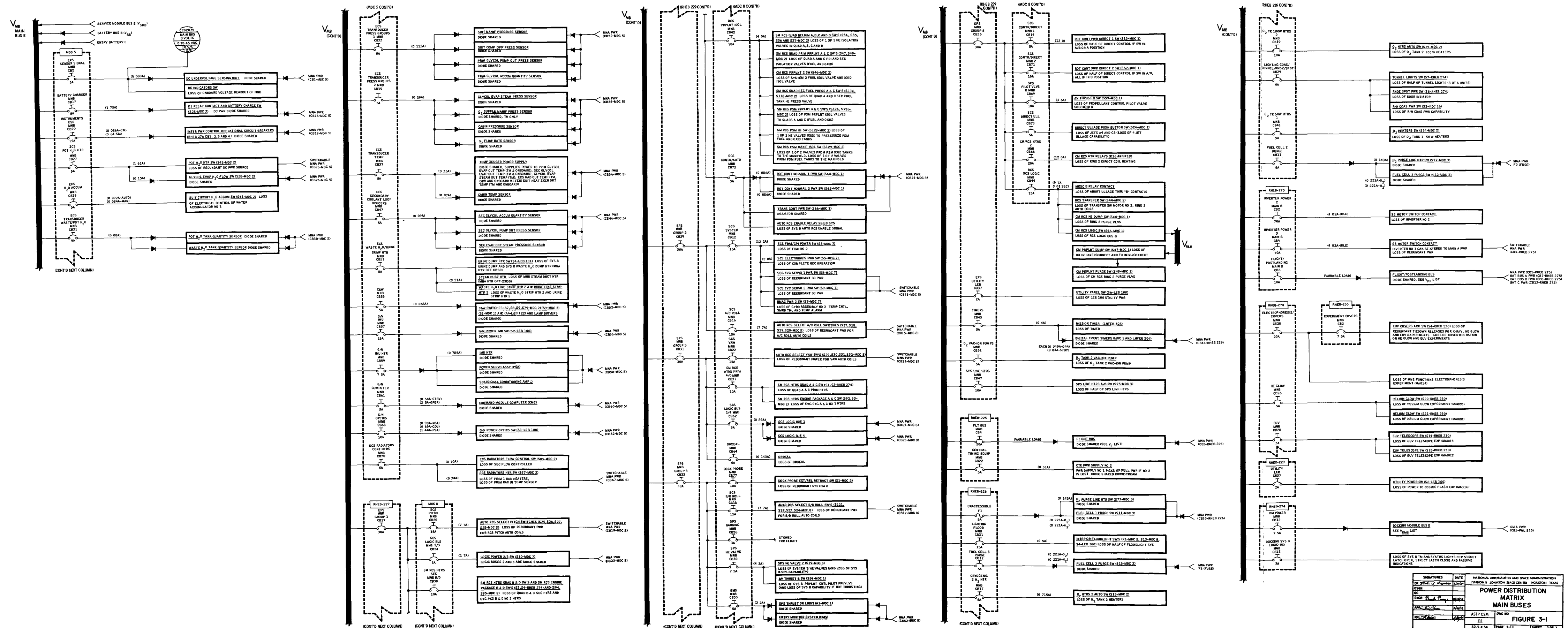
6 TIMER

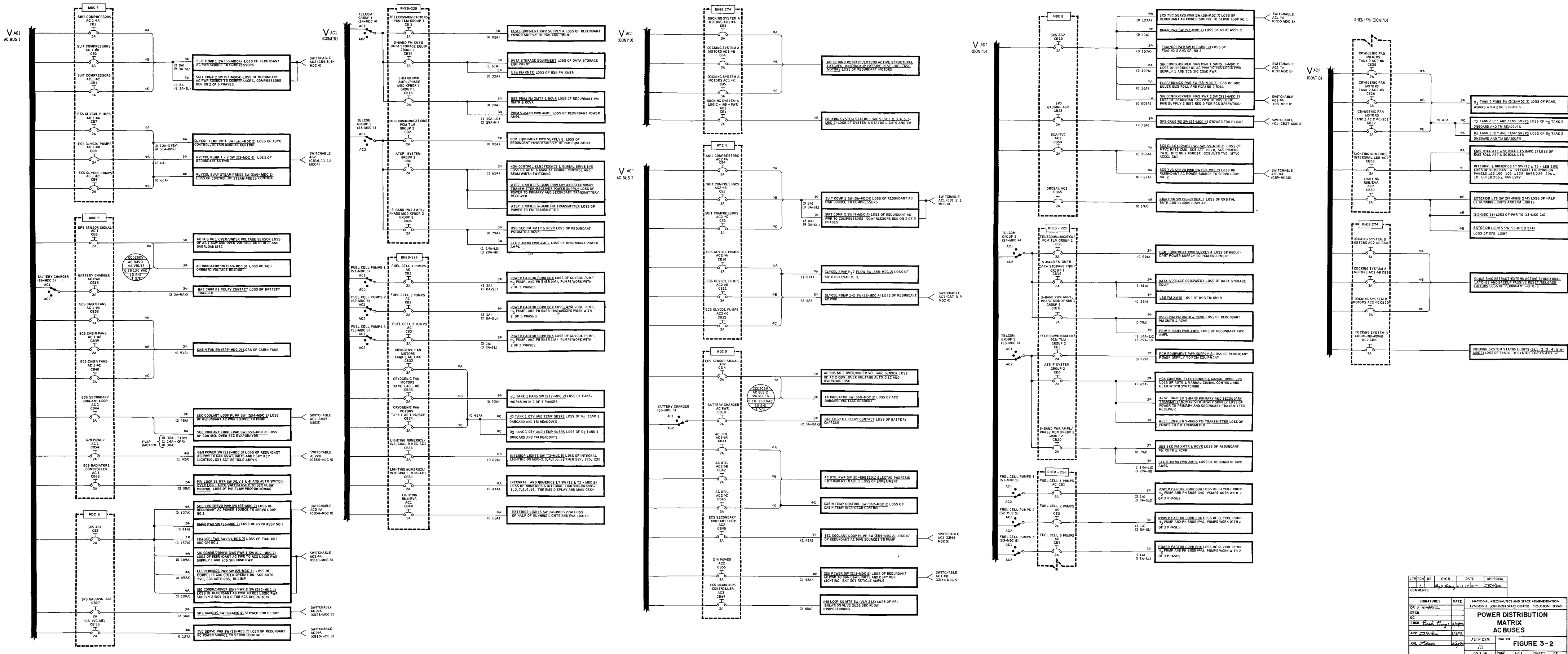
SIGNATURES		DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS	
DR				
DSGN				
QC				
ENGR	Roy & Beckney	7-12-74		
NR				
APP				
KHL	John R. Allen	7/12/74		
			ASTF CSM	DWG NO
			111 & 119	3.6
			PAGE 3-6	SHEET 1 OF 1

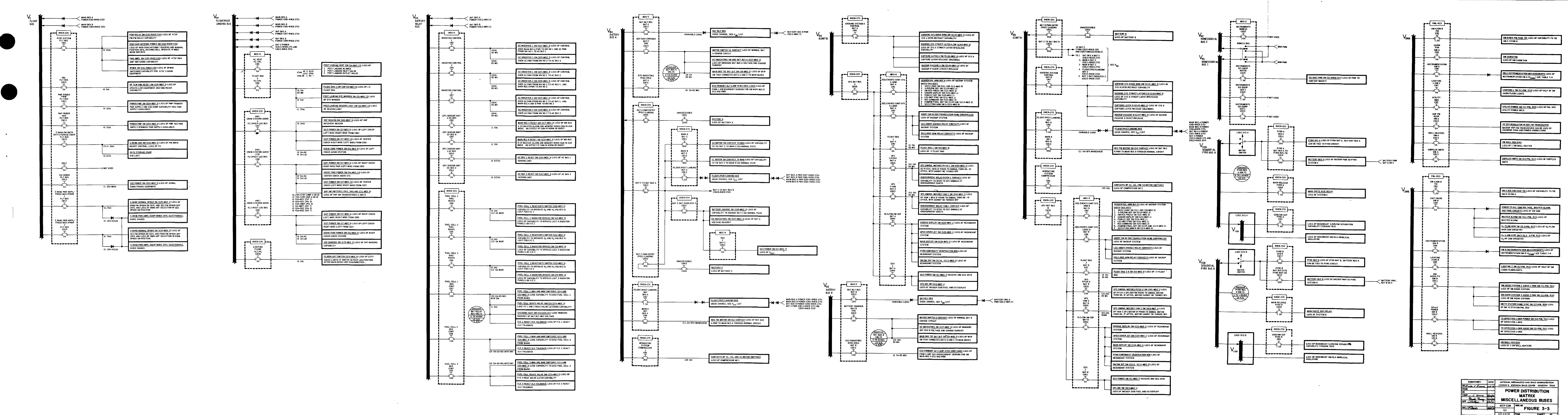
SYSTEM TEST METER DISPLAY (VOLTS)																									
0.0	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.2	3.4	3.6	3.8	4.0	4.2	4.4	4.6	4.8	5.0
<0.5V = UNLOCKED, >3.5V = LOCKED																									
-1.5	-1.38	-1.26	-1.14	-1.02	-.90	-.78	-.66	-.54	-.42	-.30	-.18	-.06	.06	.18	.30	.42	.54	.66	.78	.90	1.02	1.14	1.26	1.38	1.5
0	35.2	70.4	105.6	140.8	176.0	211.2	246.4	281.6	316.8	352.0	387.2	422.4	457.6	492.8	528.0	563.2	598.4	633.6	668.8	704.0	739.2	774.4	809.6	844.8	880.0
0	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380	400	420	440	460	480	500
0	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	144	152	160	168	176	184	192	200
0.0	0.8	1.6	2.4	3.2	4.0	4.8	5.6	6.4	7.2	8.0	8.8	9.6	10.4	11.2	12.0	12.8	13.6	14.4	15.2	16.0	16.8	17.6	18.4	19.2	20.0
-50	-46	-42	-38	-34	-30	-26	-22	-18	-14	-10	-6	-4	0	+4	+10	+14	+18	+22	+26	+30	+34	+38	+42	+46	+50
0	18	36	54	72	90	108	126	144	162	180	198	216	234	252	270	288	306	324	342	360	378	396	414	432	450
0	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	144	152	160	168	176	184	192	200
0	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80	84	88	92	96	100
-50	-36	-22	-8	+6	+20	+34	+48	+62	+76	+90	+104	+118	+132	+146	+160	+174	+188	+202	+216	+230	+244	+258	+272	+286	+300
-300	-264	-228	-192	-156	-120	-84	-48	-12	24	60	96	132	168	204	240	276	312	348	384	420	456	492	528	564	600
0	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380	400	420	440	460	480	500
-300	-264	-228	-192	-156	-120	-84	-48	-12	24	60	96	132	168	204	240	276	312	348	384	420	456	492	528	564	600
0.0	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.2	3.4	3.6	3.8	4.0	4.2	4.4	4.6	4.8	5.0
SYSTEMS TEST METER DISPLAY (VOLTS)																									

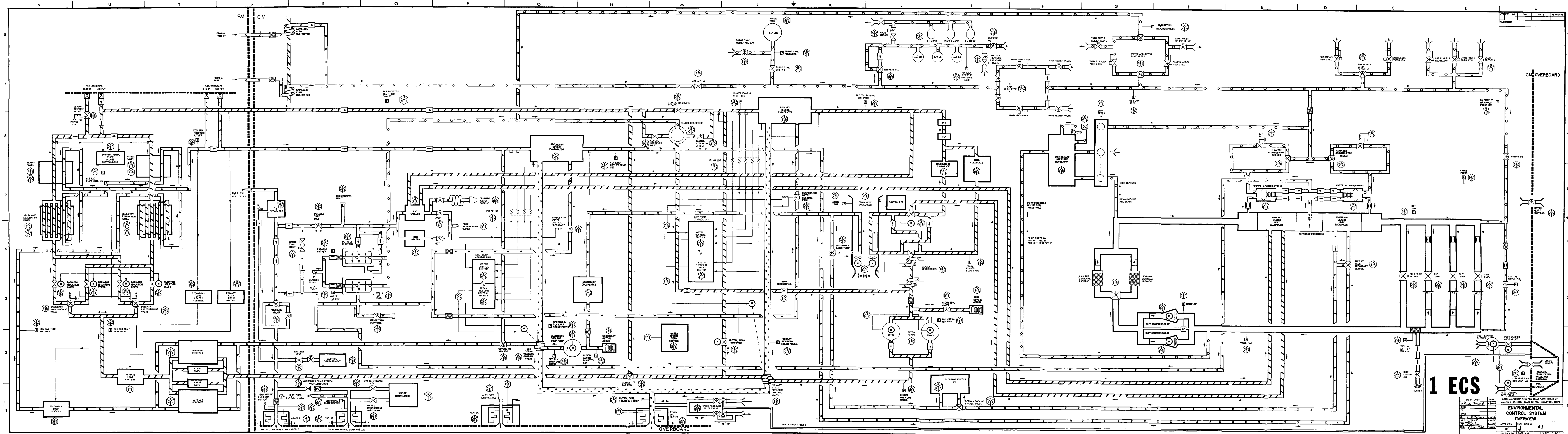


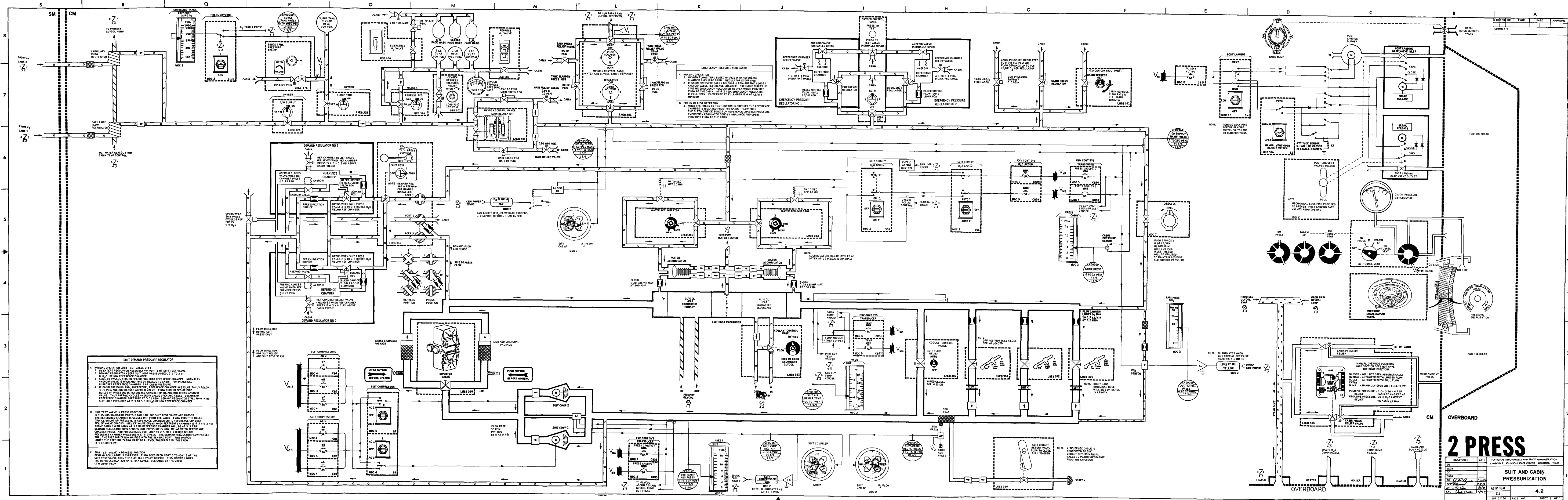


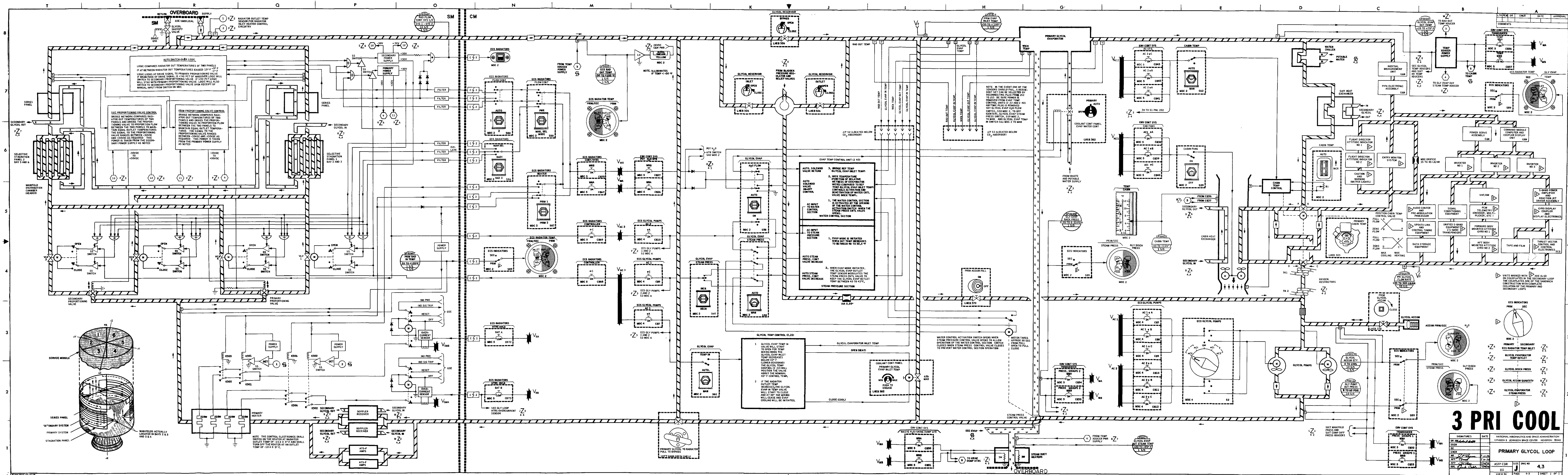


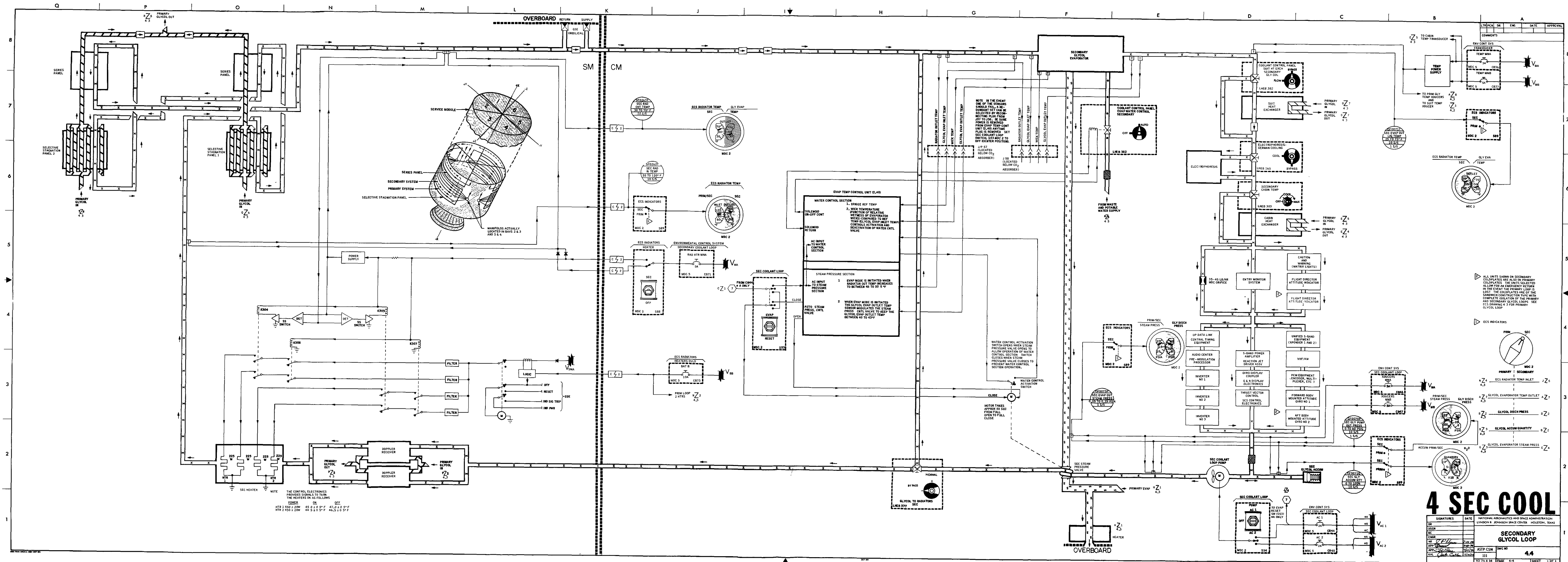


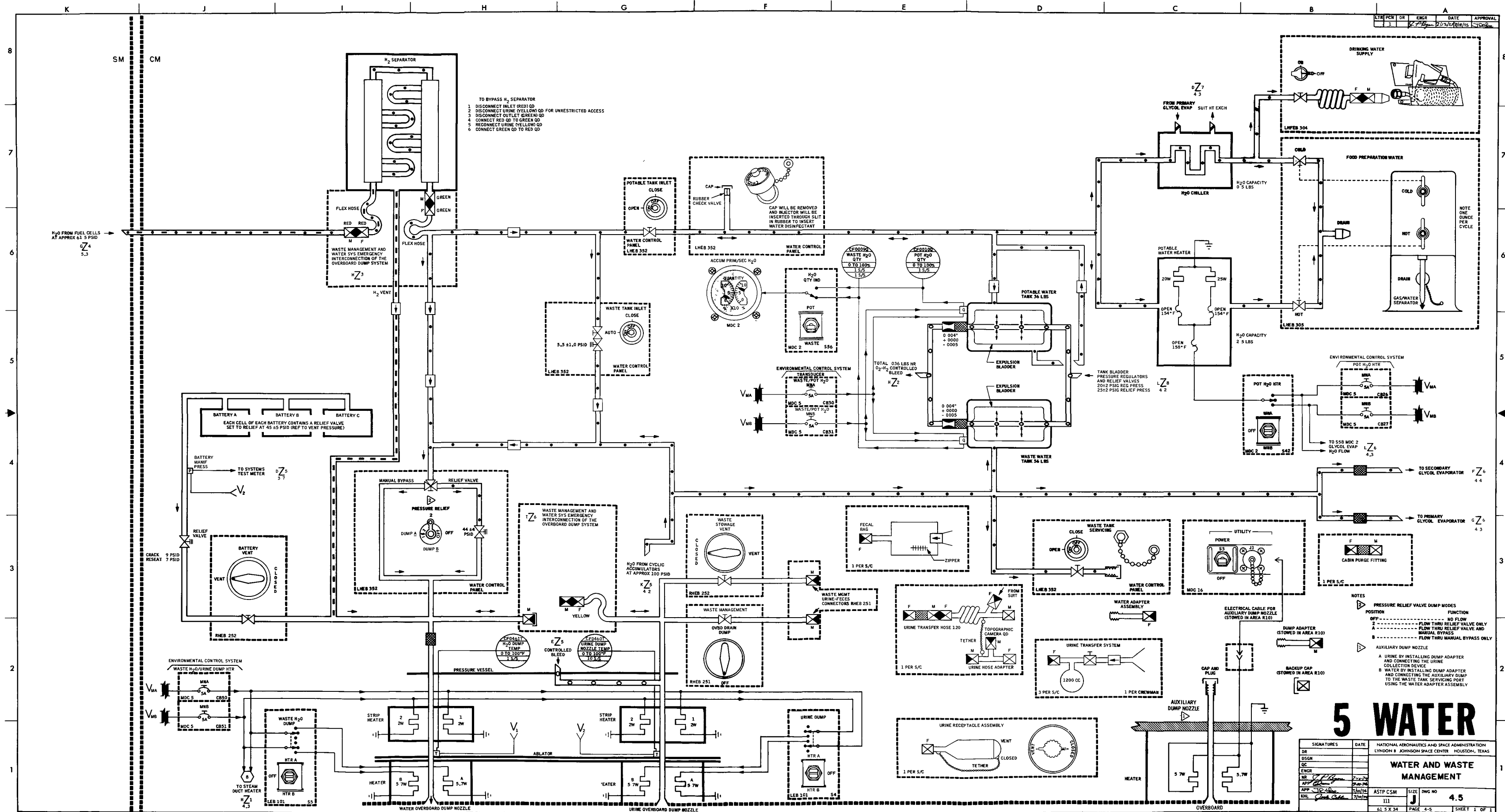




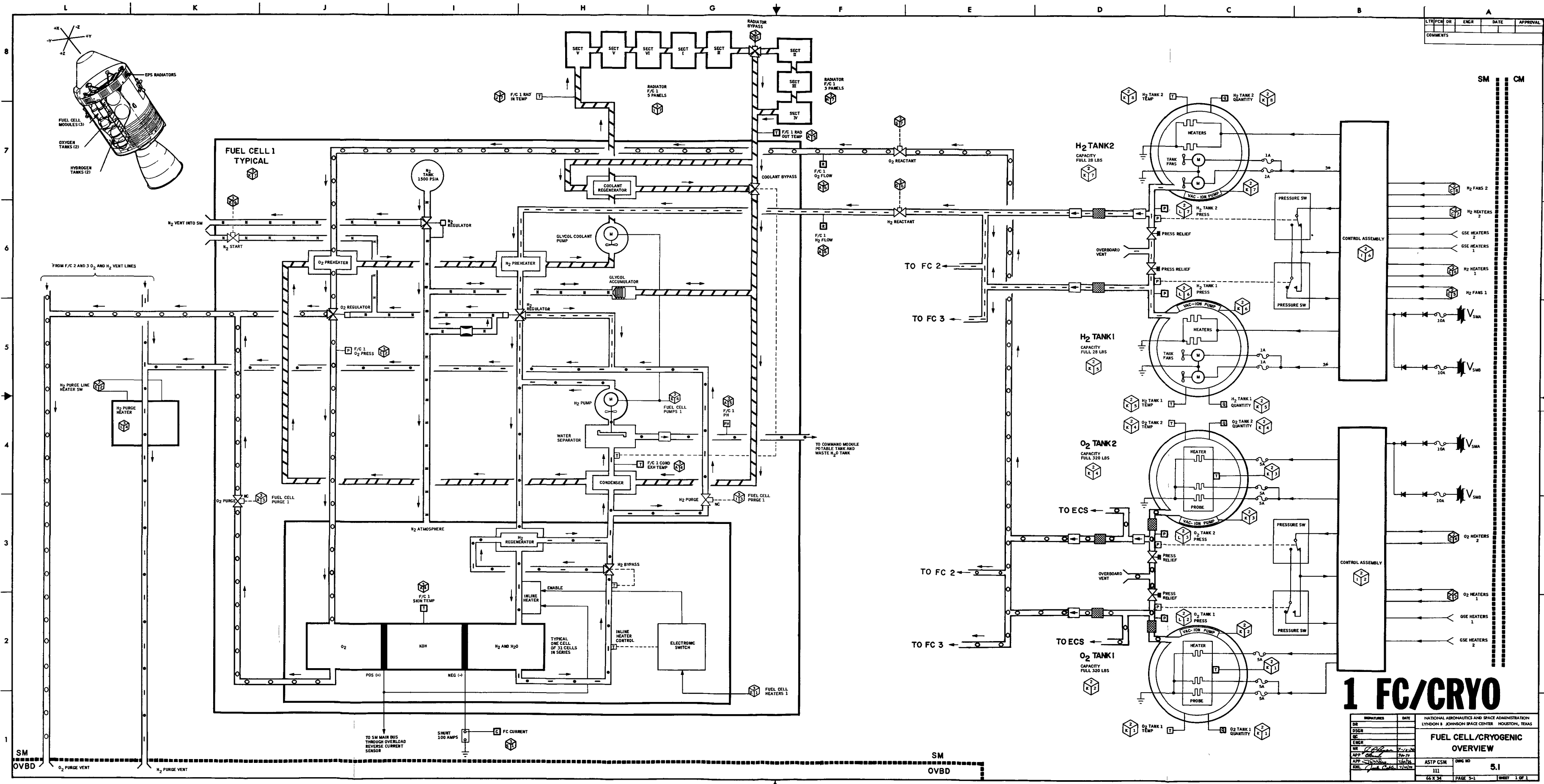








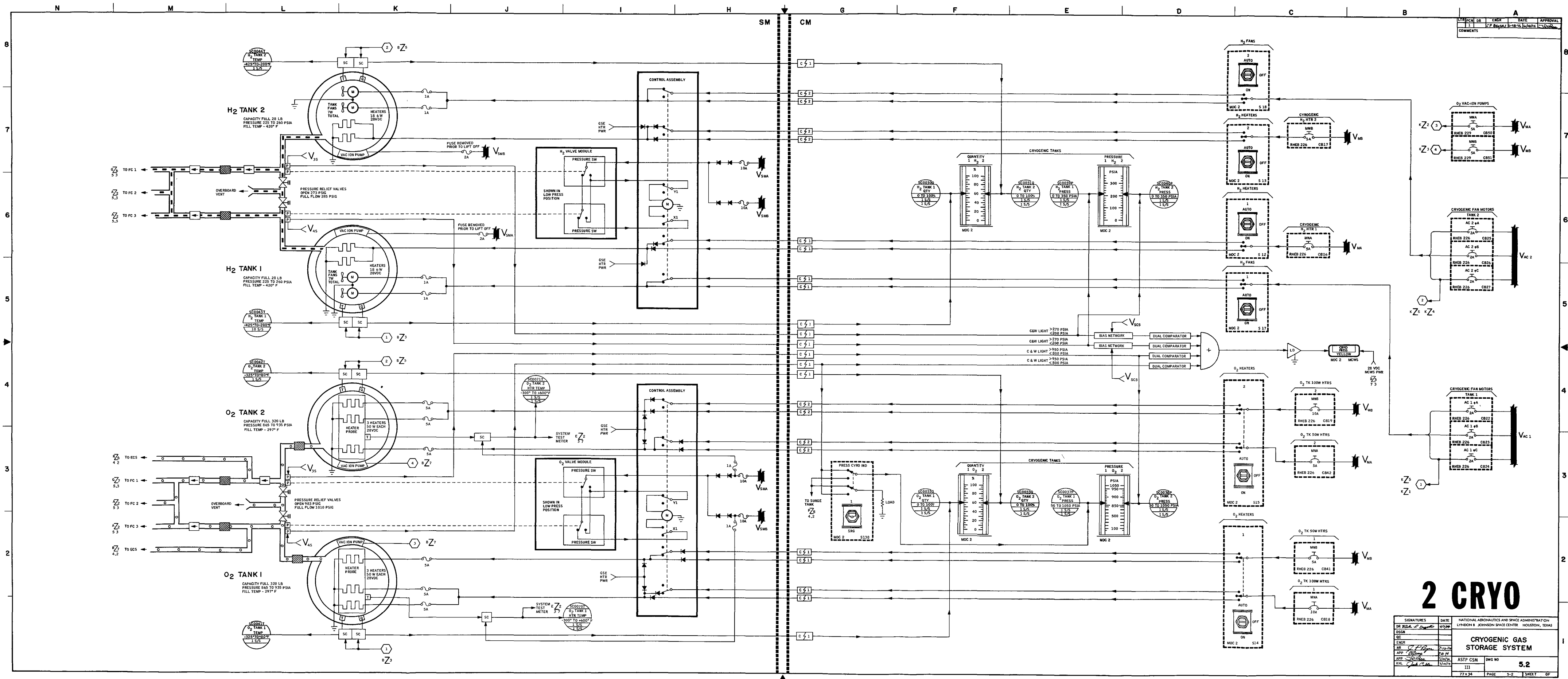
5 FUEL CELL/
CRYOGENIC
SYSTEM



1 FC/CRYO

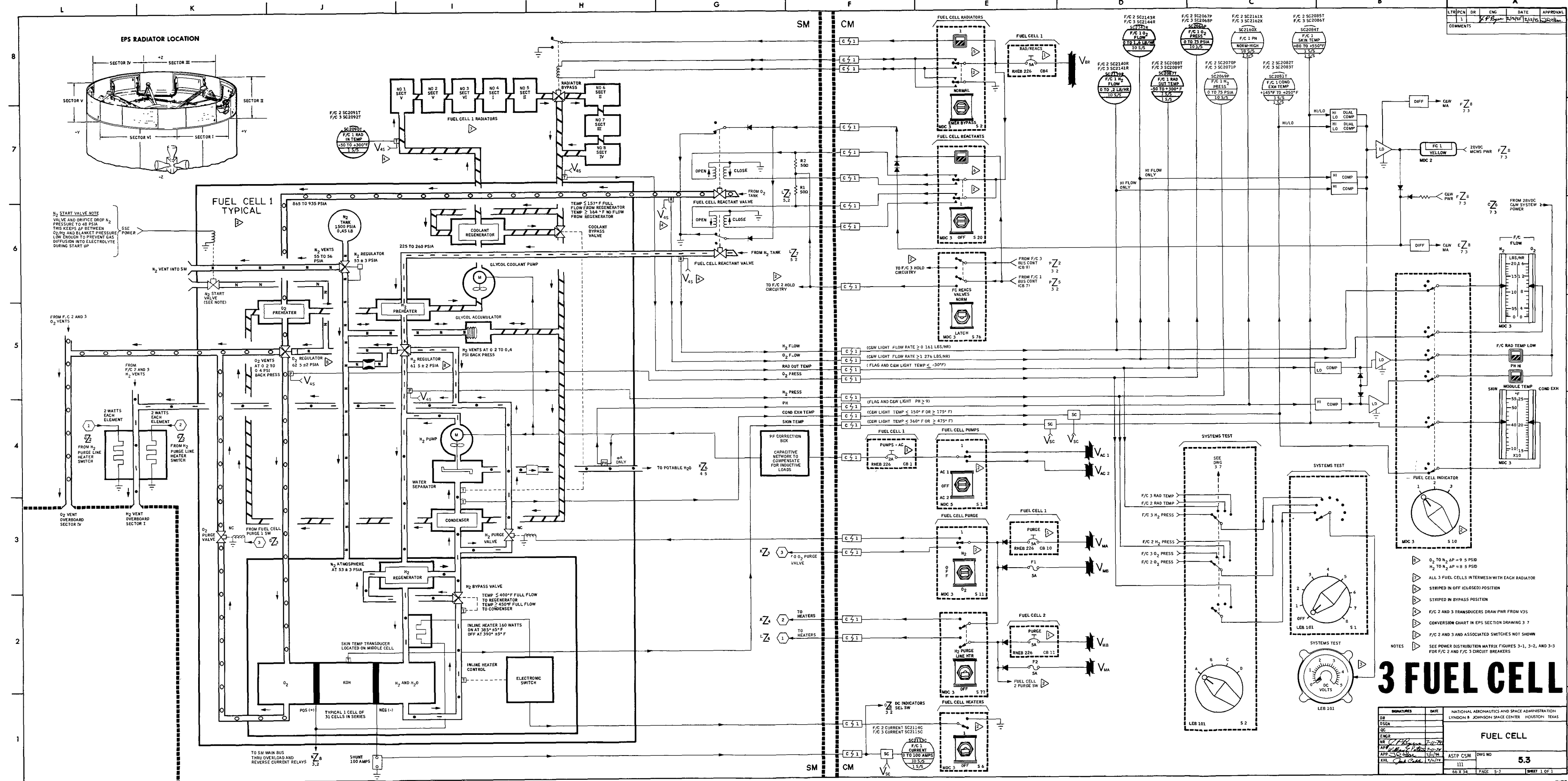
REVISIONS	DATE	DESCRIPTION
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3	3/1/78	REVISED TO ADD FUEL CELL 3
4	4/1/78	REVISED TO ADD FUEL CELL 4
5	5/1/78	REVISED TO ADD FUEL CELL 5
6	6/1/78	REVISED TO ADD FUEL CELL 6
7	7/1/78	REVISED TO ADD FUEL CELL 7
8	8/1/78	REVISED TO ADD FUEL CELL 8
9	9/1/78	REVISED TO ADD FUEL CELL 9
10	10/1/78	REVISED TO ADD FUEL CELL 10
11	11/1/78	REVISED TO ADD FUEL CELL 11
12	12/1/78	REVISED TO ADD FUEL CELL 12
13	1/1/79	REVISED TO ADD FUEL CELL 13
14	2/1/79	REVISED TO ADD FUEL CELL 14
15	3/1/79	REVISED TO ADD FUEL CELL 15
16	4/1/79	REVISED TO ADD FUEL CELL 16
17	5/1/79	REVISED TO ADD FUEL CELL 17
18	6/1/79	REVISED TO ADD FUEL CELL 18
19	7/1/79	REVISED TO ADD FUEL CELL 19
20	8/1/79	REVISED TO ADD FUEL CELL 20
21	9/1/79	REVISED TO ADD FUEL CELL 21
22	10/1/79	REVISED TO ADD FUEL CELL 22
23	11/1/79	REVISED TO ADD FUEL CELL 23
24	12/1/79	REVISED TO ADD FUEL CELL 24
25	1/1/80	REVISED TO ADD FUEL CELL 25
26	2/1/80	REVISED TO ADD FUEL CELL 26
27	3/1/80	REVISED TO ADD FUEL CELL 27
28	4/1/80	REVISED TO ADD FUEL CELL 28
29	5/1/80	REVISED TO ADD FUEL CELL 29
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33	9/1/80	REVISED TO ADD FUEL CELL 33
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37	1/1/81	REVISED TO ADD FUEL CELL 37
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61	1/1/83	REVISED TO ADD FUEL CELL 61
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78	6/1/84	REVISED TO ADD FUEL CELL 78
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82	10/1/84	REVISED TO ADD FUEL CELL 82
83	11/1/84	REVISED TO ADD FUEL CELL 83
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87	3/1/85	REVISED TO ADD FUEL CELL 87
88	4/1/85	REVISED TO ADD FUEL CELL 88
89	5/1/85	REVISED TO ADD FUEL CELL 89
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92	8/1/85	REVISED TO ADD FUEL CELL 92
93	9/1/85	REVISED TO ADD FUEL CELL 93
94	10/1/85	REVISED TO ADD FUEL CELL 94
95	11/1/85	REVISED TO ADD FUEL CELL 95
96	12/1/85	REVISED TO ADD FUEL CELL 96
97	1/1/86	REVISED TO ADD FUEL CELL 97
98	2/1/86	REVISED TO ADD FUEL CELL 98
99	3/1/86	REVISED TO ADD FUEL CELL 99
100	4/1/86	REVISED TO ADD FUEL CELL 100

FUEL CELL/CRYOGENIC OVERVIEW	
ASTP CSM	111
DATE	1/1/78
BY	J. L. Smith
CHKD	J. L. Smith
APP	J. L. Smith
REV	J. L. Smith
66 X 36	PAGE 5-1
1 OF 1	

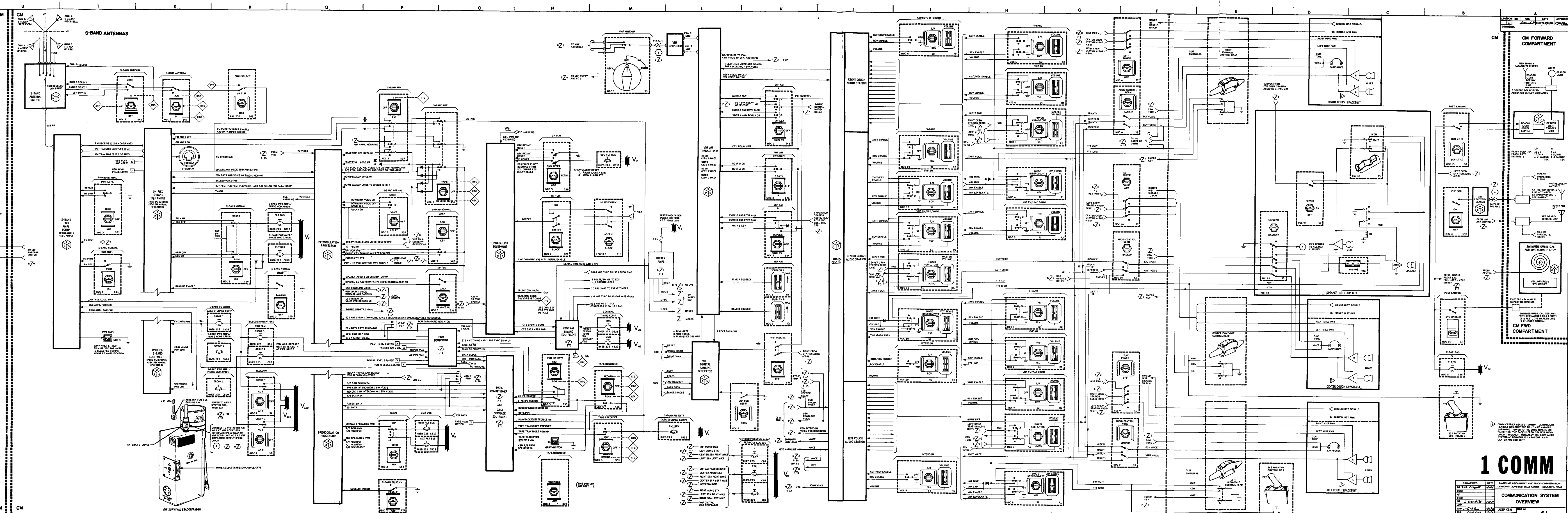
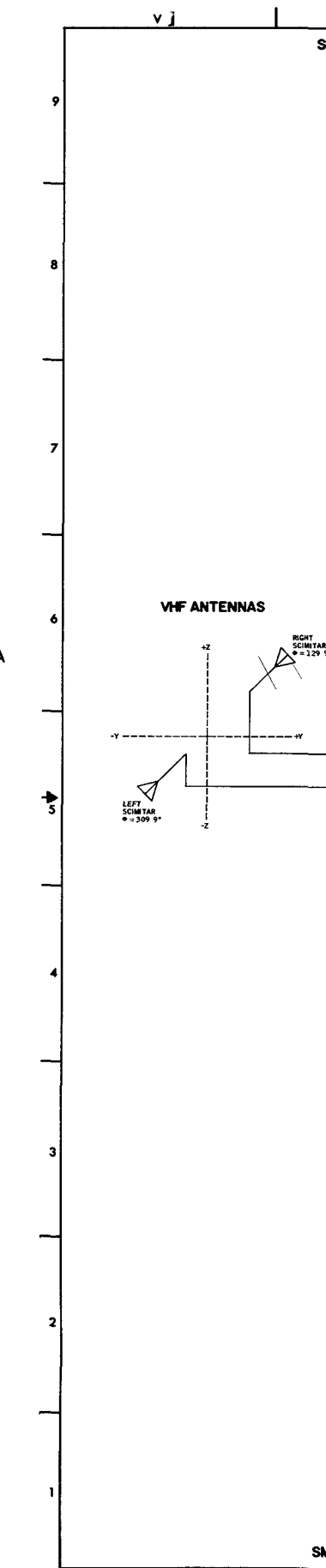


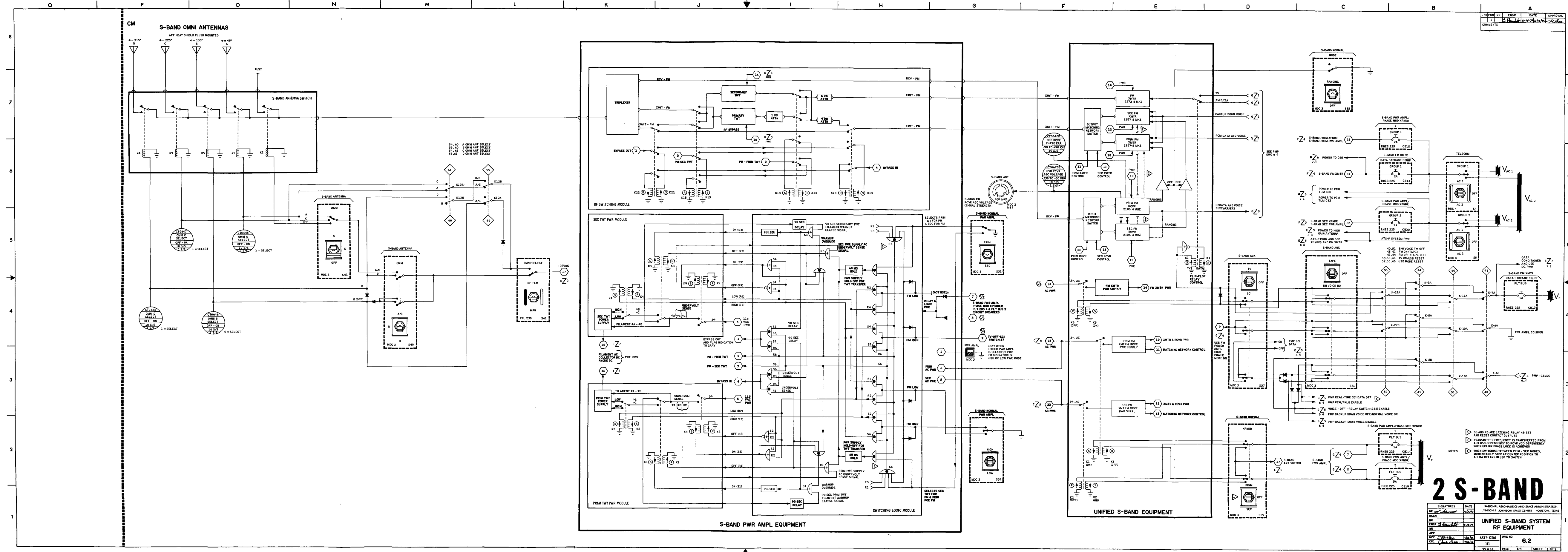
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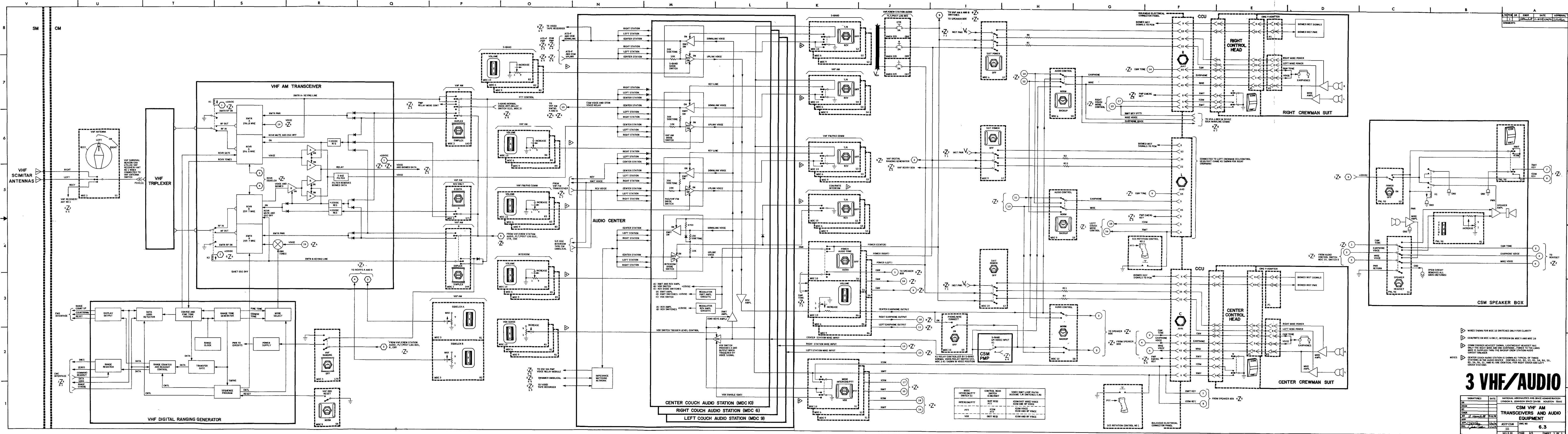
SIGNATURES	DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
DR. J. G. A. [Signature]	7/7/77	LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
DESIGN		
ENGR		
APP	7/22/77	
CHKD	7/22/77	
APP	7/22/77	
CHKD	7/22/77	

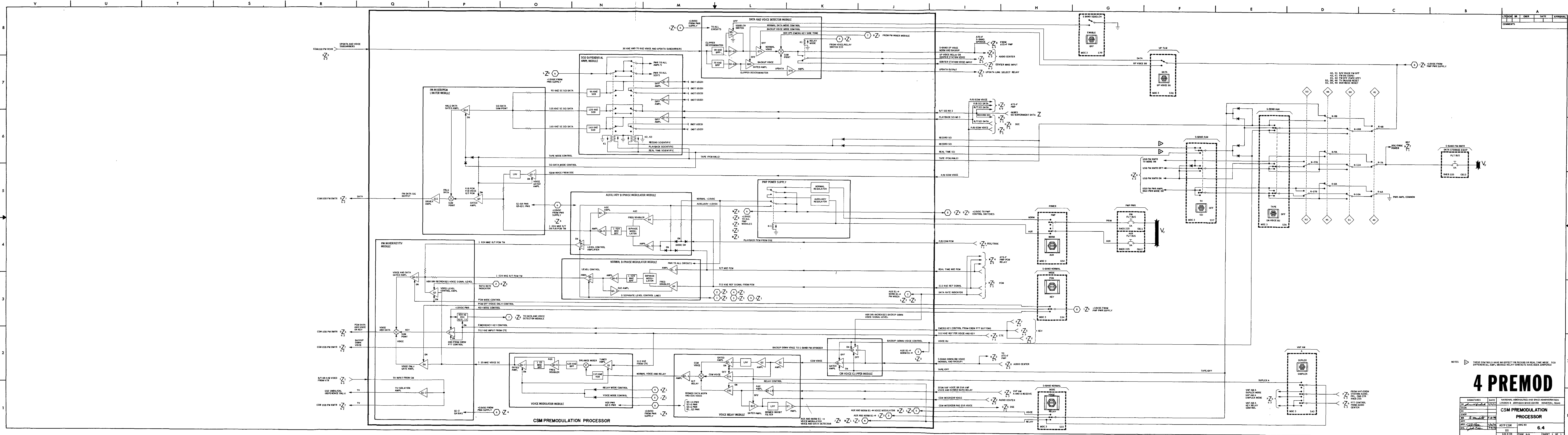


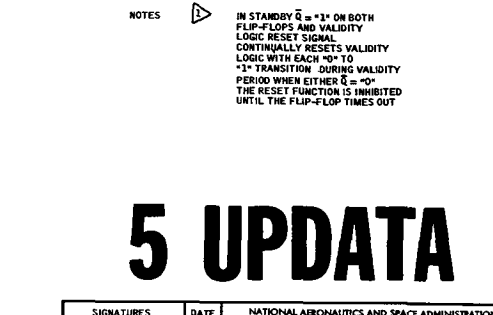
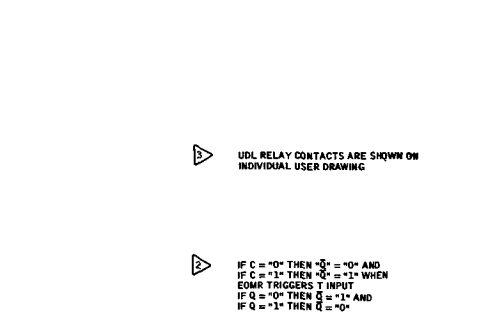
6 COMMUNICATIONS
SYSTEM



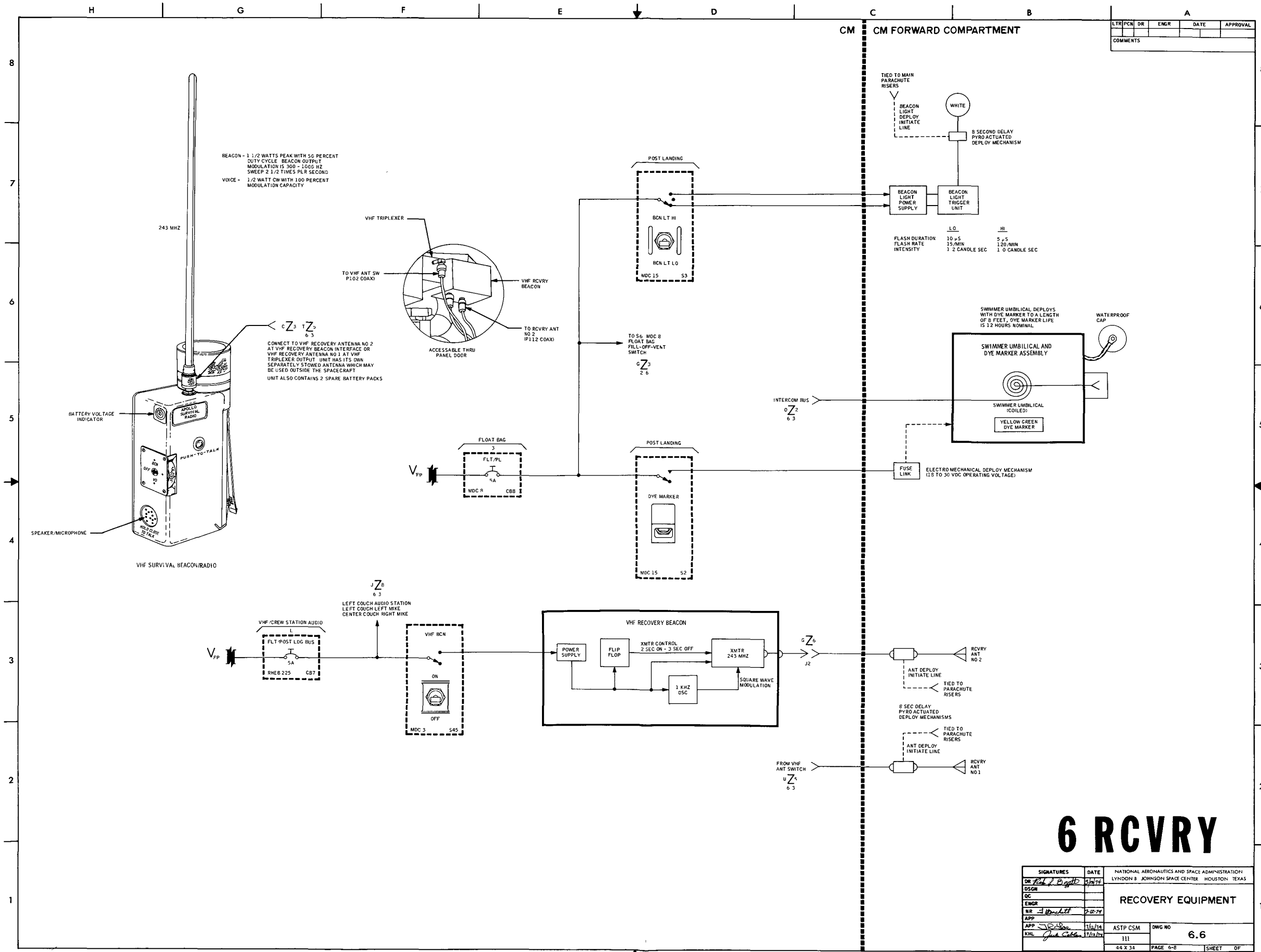






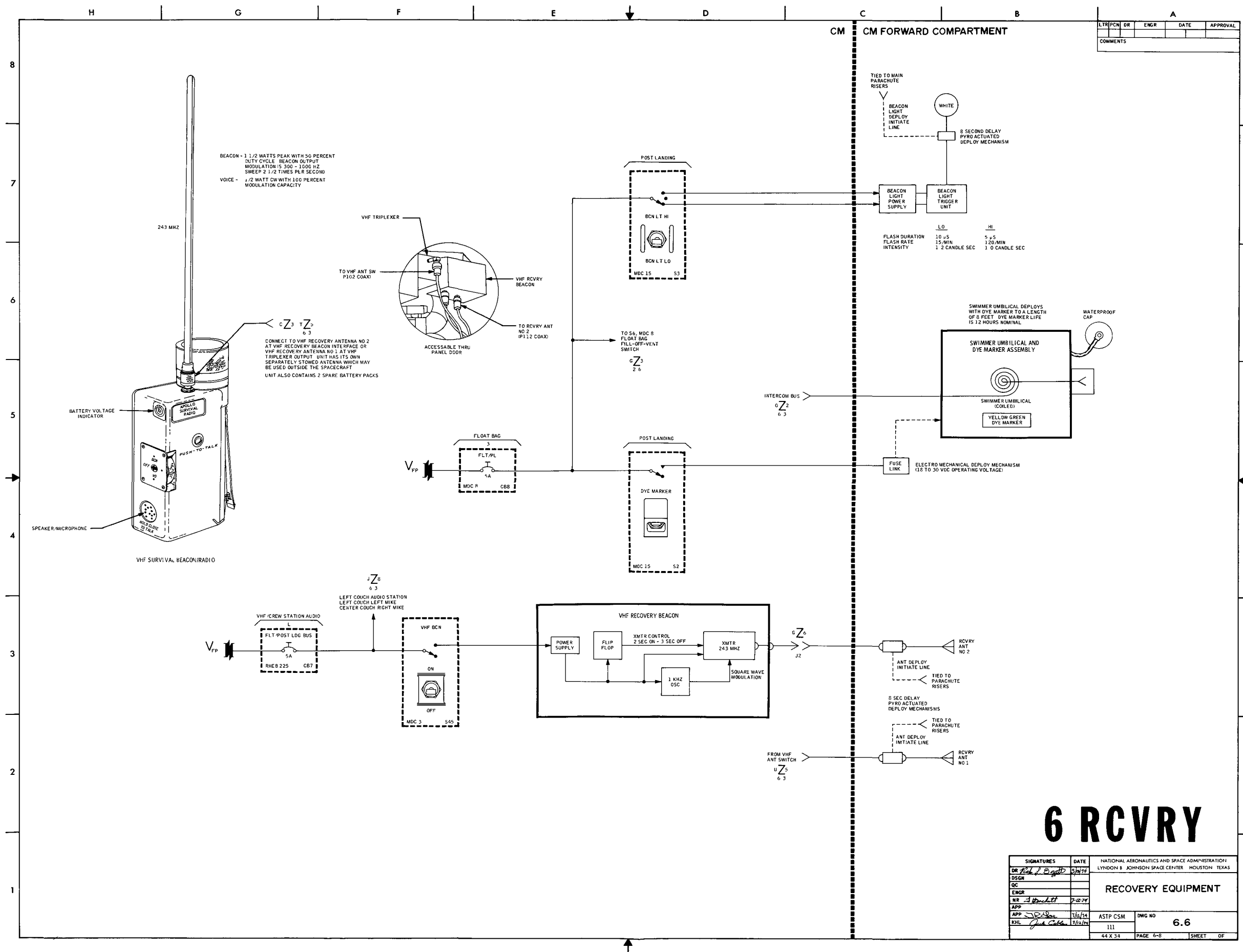
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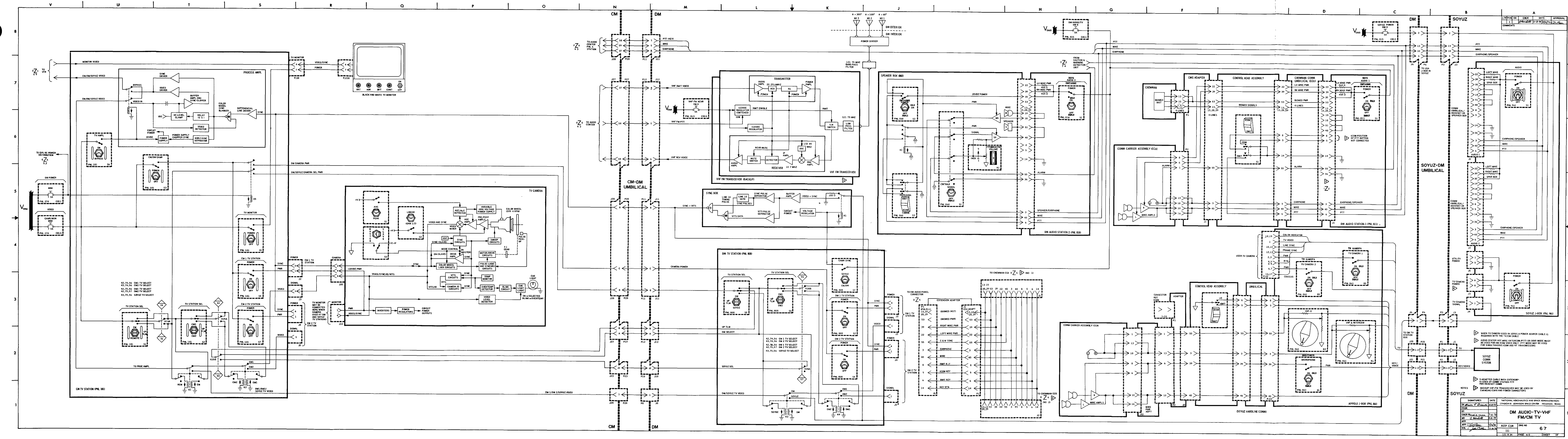
APP <i>SR</i>	7/12/74	ASTP-CSM	DWG NO 6.5
KRL <i>John Collins</i>	7/12/74	111	

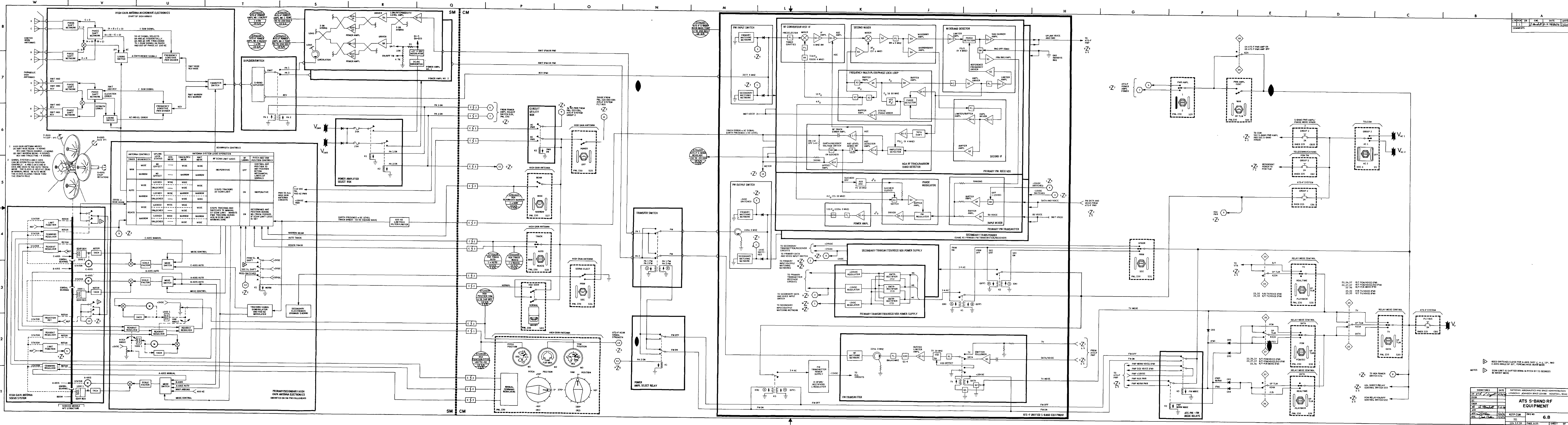


6 RCVRY

SIGNATURES	DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
DR <i>Paul P. Dwyer</i>	5/1/74	LYNDON B JOHNSON SPACE CENTER HOUSTON TEXAS
DSGM		
QC		
ENGR		
NIR <i>A. H. L. H.</i>	7-12-74	
APP	11/1/74	
KHL <i>John C. KHL</i>	11/1/74	
ASTP CSM	OWG NO	
111	6.6	
44 X 34	PAGE 6-8	SHEET OF

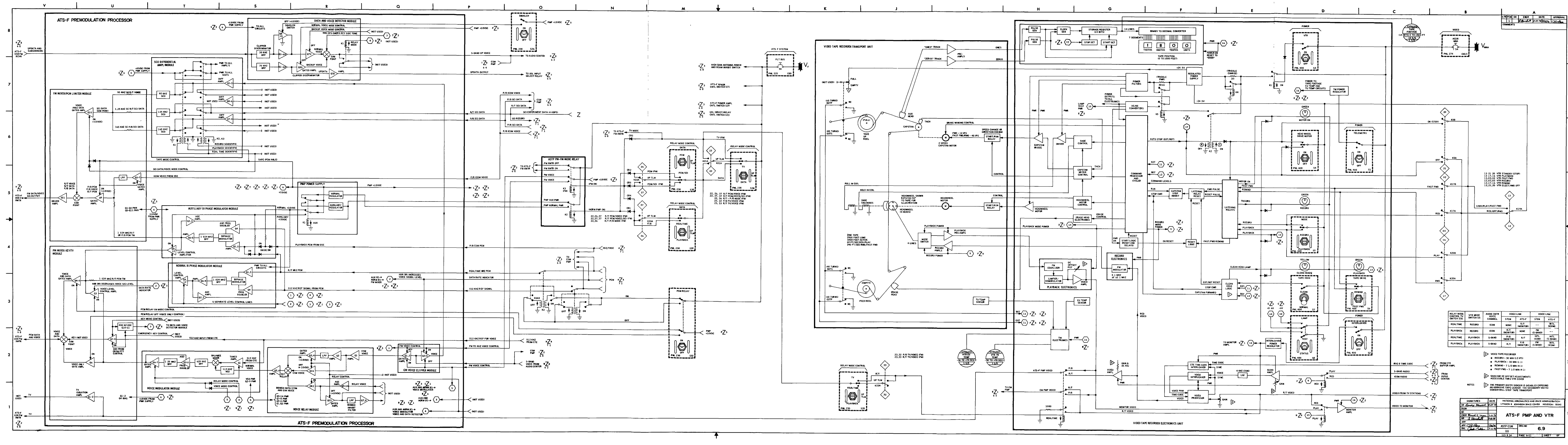






REVISION	DATE	APPROVAL
1	11-1-68	11-1-68

COMMENTS



RELAY MODE	VTR MODE	VIDEO LINK	VOICE LINK
SWITCH 535	STON	ATS-F	ATS-F
REALTIME	ICOM	NONE	NONE
PLAYBACK	RECORD	ICOM	NONE
REALTIME	PLAYBACK	S-BAND	P/R
PLAYBACK	PLAYBACK	S-BAND	P/R

- VIDEO TAPE RECORDER
- RECORD - 30 MIN (12 IPS)
 - PLAYBACK - 30 MIN (12 IPS)
 - REWIND - 7 1/2 MIN (4 1)
 - FAST FWD - 7 1/2 MIN (4 1)
- NOTES
- THE PRIMARY STOP/SERVO IS DISABLED EXPOSING AN AGGRESSIVE TAPE LEADER THE SECONDARY SERVO SERVO WILL STOP TAPE TRANSPORT

TABLE 6-1.- CSM AND ATS-F UNIFIED S-BAND
TRANSPONDER AND FM TRANSMITTER.

ITEM	FUNCTION AND/OR PARAMETERS
1. Weight	32 pounds
2. Cooling	
a. CSM	ECS Primary and/or Secondary Glycol loops
b. ATS-F	Crew suit 0 Hoses 2
3. Electrical Power	
a. Dc Voltage	28 $\pm$ 4 Vdc (for control only)
b. Ac Voltage	115 Vac, 400 Hz, 3 phase
c. Power	
(1) PM Transponder	1.0 watts dc 16.5 watts dc (Prim or Sec)
(2) FM Transmitter	1.5 watts dc 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)	
(1) Apollo	2106.40625 MHz
(2) ATS-F	2077.4 MHz

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

ITEM	FUNCTION AND/OR PARAMETERS
c. Phase Lock Tracking Loop	
(1) In-Lock Range	± 90 kHz for RF INPUT > -114 dBm and STATIC PHASE ERROR < 15 degrees peak.
(2) In-Lock Rate	Linear rate of 35 kHz/sec or less ± 90 kHz for RF INPUT > -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 at -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.
(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	0.1 seconds
(2) Decay	3 seconds (-51 dBm to -127 dBm)

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

ITEM	FUNCTION AND/OR PARAMETERS
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.
(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 Tables 6-IV and 6-V Modes)
7. FM Transmitter	
a. Type	FM, S-band
b. Frequency	
(1) Apollo	2272.5 MHz $\pm$ 445 kHz
(2) ATS-F	2256.0 MHz
c. Frequency Deviation	
(1) Apollo	($\pm$ 3 MHz maximum)
(2) ATS-F	($\pm$ 5 MHz maximum)
d. RF Output	111 to 138 milliwatts (Test Data)
e. Inputs (CSM)	(See Tables 6-IV and 6-V)

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

ITEM	FUNCTION AND/OR PARAMETERS
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-VI and Table 6-VII Modes)
6. PM Transmitter (Prim/Sec)	
a. Type	PM, S-band
b. Frequency	
(1) Apollo	2287.5 MHz (Aux OSC Mode)
(2) ATS-F	2256.0 MHz (Aux OSC Mode)
(3) Locked Mode	240/221 times RCVR frequency when RCVR is phase locked to uplink RF signal. (See Auto OSC Control.)

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

ITEM	FUNCTION AND/OR PARAMETERS
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.
(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 Tables 6-IV and 6-V Modes)
7. FM Transmitter	
a. Type	FM, S-band
b. Frequency	
(1) Apollo	2272.5 MHz $\pm$ 445 kHz
(2) ATS-F	2256.0 MHz
c. Frequency Deviation	
(1) Apollo	($\pm$ 3 MHz maximum)
(2) ATS-F	($\pm$ 5 MHz maximum)
d. RF Output	111 to 138 milliwatts (Test Data)
e. Inputs (CSM)	(See Tables 6-IV and 6-V)

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

ITEM	FUNCTION AND/OR PARAMETERS
(1) TV (dc coupled)	f_o at +1.3 Vdc Input $\Delta f/V = 1 \text{ MHz/V}$ Response dc to 500 kHz
(2) Wideband (ac coupled)	$\Delta f/V = 1 \text{ MHz/V}$ Response 200 Hz to 300 kHz
f. Inputs (ATS-F)	(See Table 6-V)
(1) TV (dc coupled)	f_o at +1.3 Vdc Input $\Delta f/V = 2.5 \text{ MHz/V}$ Response dc to 2.0 MHz
(2) Wideband (ac coupled)	$\Delta f/V = 1 \text{ MHz/V}$ 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.- CSM 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 $\pm$ 4 Vdc control						
	115 Vac, 400 Hz, 3 ϕ						
b. Input Power							
(1) Control Power	5 watts maximum steady state and 350 watts during switching for 0.5 seconds maximum.						
(2) Ac Power	<table> <tr> <td>High Pwr Ampl Mode</td><td>81 watts</td></tr> <tr> <td>Low Pwr Ampl Mode</td><td>32 watts</td></tr> <tr> <td>Off/Bypass</td><td>0 watts</td></tr> </table>	High Pwr Ampl Mode	81 watts	Low Pwr Ampl Mode	32 watts	Off/Bypass	0 watts
High Pwr Ampl Mode	81 watts						
Low Pwr Ampl Mode	32 watts						
Off/Bypass	0 watts						
	Sum ac power values to obtain simultaneous power level operation of Prim and Sec power amplifiers.						
4. Power Amplification Activation Time	No RF amplification until 90 second nominal filament warmup period complete.						
	RF transfer (PM or FM) from one power amplifier to the other - with a 60 millisecond RF amplification dropout - is possible without an additional 90 second delay (filament warm-up) if the desired power amplifier is operating at the time of transfer.						

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

ITEM	FUNCTION AND/OR PARAMETERS
5. RF Output a. PM Output - Prim or Sec Power Amplifier b. FM 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 High Pwr Mode: 11.2 watts min
6. RF Input a. PM b. FM	275 to 400 milliwatts 100 to 145 milliwatts (For rated output)
7. Undervoltage Protection	Undervoltage 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 warmup delay will occur when ac voltage is restored.
8. Special Operating Instructions	Dc power should be applied before ac power and removed after ac power removal to prevent possible damage.

TABLE 6-III.- ATS-F POWER AMPLIFIER

ITEM	FUNCTION AND/OR PARAMETERS
1. Weight	12 pounds
2. Cooling	SM Coolant Loop
3. Electrical Power	
a. Input Voltage	28 ± 4 Vdc
b. Input Power	330 watts
4. Activation Time	None (solid state design)
5. RF Output	40 watts (minimum) into 50 OHMS
6. Output Protection	Open or short at the RF output for minimum of three hours will not damage amplifier.
7. RF Input	
a. PM	200 to 400 milliwatts
b. FM	80 to 145 milliwatts

TABLE 6-IV.- CSM S-BAND DOWNLINK MODES AND MODULATION PROCESS
(DIRECT LINK)

PM DOWNLINK MODE AVAILABLE	MODE NUMBER																	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	0
PM DOWNLINK MODE AVAILABLE	Channels Included	Carrier Voice	Carrier Voice	Carrier Voice	Carrier Voice	Carrier Voice	Carrier Voice	Carrier Voice	Carrier Backup Voice	Carrier Voice	Carrier Backup Voice(C)	Carrier Voice	Carrier Voice	Carrier Voice	Carrier Backup Voice(C)	Carrier Voice	Carrier Backup Voice	No Carrier
		51.2- kbps TI -- --	51.2- kbps TI PRI --	1.6- kbps TI PRI --	1.6- kbps TI -- --	1.6- kbps TI -- --	-- -- -- KEY	-- -- PRI --	1.6- kbps TI -- --	1.6- kbps TI PRI --	-- -- -- --	-- -- PRI --	-- -- -- --	51.2- kbps TI -- --	-- -- -- --	51.2- kbps TI PRI --	51.2- kbps TI -- --	-- -- -- --
PM DOWNLINK MODULATION PROCESS	Modulation Schemes	PRI : PM directly on carrier (2237.5 MHz) Backup Voice: PM directly on carrier (2237.5 MHz)																
	Sub-carrier Characteristics	Normal Voice: FM/PM; 1.25 MHz subcarrier deviated ± 7.5 kHz subcarrier TI : PCM/PSK/PM; 1.024 MHz subcarrier bi-phase modulated ± 90 degrees Key : AM/PM; 512 kHz, 100 percent AM																
PM DOWNLINK MODULATION PROCESS	Peak Carrier Deviation Radians ($\Delta\phi$)	PRI : (A) Normal Voice: 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 TI (D) : 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										
		0	1	2	3	4	5	6	7	8	9
FM DOWNLINK MODES AVAILABLE	Channels Included	No Carrier	51.2-kbps TI and 4-kbps TM Realtime, 4-kbps TM (E)	32:1 Play- back Voice, 1.6-kbps TI	1:1 Playback TV, Inter- leaved Voice and CTE Time	Realtime TV	Realtime 4-kbps TM (E)	Realtime 51.2-kbps TI and 4-kbps TM, 1:1 Playback Voice and 4-kbps TM (E)(B)	Realtime 1.6-kbps TI and 4-kbps TM, 1:1 Playback Voice and 4-kbps TM (F)(B)	Realtime 51.2-kbps TI and 4-kbps TM (E)(n)	Realtime 1.60-kbps TI and 4-kbps TM (E)(B)
	Modulation Schemes	TV : FM Directly on carrier (2272.5 MHz) Playback Voice : FM Directly on carrier (2272.5 MHz) Playback CSM TM (B) : PCM/PSK/FM; 1.024 MHz subcarrier bi-phase modulated ± 90 degrees Scientific Data: FM/FM 95 kHz (not used) PCM/FM 125 kHz R/T SCI (4-kbps BI-o PCM) PCM/FM 165 kHz P/B SCI (4-kbps BI-o PCM)									
FM DOWNLINK MODULATION PROCESS	Sub-carrier Characteristics										
	Peak Carrier Deviation Radians (Δf)	Playback Voice : 100 kHz ± 20 percent (not used) 75 kHz ± 15 percent (95 kHz SC) Playback CSM TM: 600 kHz ± 15 percent Realtime 4-kbps TM: 180 kHz ± 15 percent (125 kHz SC) TV (F) : 2.75 MHz ± 10 percent, f_c at 1.3 Vdc Within 0 to +455 kHz Playback 4-kbps TM: 168 kHz ± 15 percent (165 kHz SC)									

(A) Varies with the received uplink signal level.

(B) Aux PMP mode will provide RT/PCM with same USB-FM characteristics as Playback PCM.

(C) For Mode 10 Backup Voice Mod Index, place TM bit rate switch to HIGH.
Use LOW for Mode 14 Mod Index.(D) 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.

(E) 4-kbps data on 125-kHz (RT) and 165-kHz (P/B) SCI subcarrier.

(F) Deviation sensitivity is 1 MHz/volt. TV video is -0.75 volts (sync tip) to
2.75 volts (peak white).

TABLE 6-V.- ATS-F S-BAND DOWNLINK MODES AND MODULATION PROCESS (RELAY LINK)

PM DOWNLINK MODES	MODE NUMBER	CSM TO ATS-F LINK (REVERSE LINK)			
		R1	R2		
	Channels Included	Carrier Voice 51.2-kbps TM	Carrier Voice 1.6-kbps TM		
PM DOWNLINK MODULATION	Modulation Schemes: Subcarrier Characteristics	Voice: FM/PM; 1.25 MHz subcarrier deviated <u>+7.5 kHz</u> peak TM: PCM/PSK/PM; 1.024 MHz Subcarrier bi-phase modulated <u>+90 degrees</u>			
	Peak Carrier Deviation- Radians ($\Delta\theta$)	Voice: 0.7 Mode R1 1.2 Mode R2 TM: 0.94 Mode R1 (51.2 kbps) 0.7 Mode R2 (1.6 kbps)			

FM DOWNLINK MODES	MODE NUMBER	R3	R4	R5	R6	
		Real-time TV, Voice, and CTE Time	Playback TV, Voice, and CTE Time	Real-time Voice and 4-kbps TM; Playback 51.2-kbps TM, Voice, and 4-kbps TM.	Real-time Voice 51.2/1.6-kbps TM, and 4-kbps TM.	
FM DOWNLINK MODULATION PROCESS	Modulation Schemes: Subcarrier Characteristics	TV Video: TV Voice and CTE Time: Playback Voice: Real-time Voice: Real-time 51.2/1.6-kbps TM: Playback 51.2/1.6 kbps TM: Real-time 4-kbps TM: Playback 4-kbps TM:				
	Peak Carrier Deviation (Δf)	TV, INTL Voice & CTE Time: Real-time Voice: Playback Voice: Real-time 51.2/1.6-kbps TM: Playback 51.2/1.6-kbps TM: Real-time 4-kbps TM: Playback 4-kbps TM:				

(A) Deviation sensitivity is 2.5 MHz/volt. TV video is -0.75 volts (sync tip) to 2.75 volts (peak white).

TABLE 6-VI.- CSH S-BAND UPLINK MODES AND MODULATION PROCESS (DIRECT LINK)

PM UPLINK MODES AVAILABLE	MODE NUMBER	1	2	3	4	5	6	7	8	9	0	
	Channels Included	Carrier PRN --	Carrier -- Voice	Carrier -- --	Carrier PRN Voice	Carrier PRN --	Carrier PRN Voice	Carrier -- Voice	Carrier PRN Backup Voice	Carrier -- --	Carrier -- --	
	--	--	--	Update	--	Update	Update	Update	--	--	--	
PM UPLINK MODULATION PROCESS	Modulation Schemes: Subcarrier Character- istics	PRN : PM directly on carrier										
		Voice : FM/PM; 30-kHz subcarrier deviated <u>±</u> 7.5 kHz (peak)										
		Update : PSK/FM/PM; 70-kHz subcarrier deviated <u>±</u> 5.0 kHz (peak)										
		Backup Voice : FM/PM; 70-kHz subcarrier deviated <u>±</u> 5.0 kHz (peak)										
	Carrier Phase Deviation (Radians- Peak*	MODE NUMBER	1	2	3	4	5	6	7	8	9	0
		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 $\pm 10\%$ tolerance

TABLE 6-VII.- ATS-F UPLINK MODES AND MODULATION PROCESS (REVERSE LINK)

PM UPLINK MODE	MODE NUMBER	F1	F2	F3	
	Channels Included	Carrier Voice -----	Carrier Voice Update	Carrier ----- Update	
PM UPLINK MODULATION PROCESS	Modulation Schemes Subcarrier Character- istics	Voice : FM/PM; 30-kHz subcarrier deviated ± 7.5 kHz (peak) Update : PSK/FM/PM; 70-kHz subcarrier deviated ± 5.0 kHz (peak)			
		MODE NUMBER	F1	F2	F3
	Carrier Phase Deviation (Radians- Peak)*	Voice	$1.1 \pm 10\%$	$1.1 \pm 10\%$	-----
		Update	-----	$1.1 \pm 10\%$	$1.1 \pm 10\%$

TABLE 6-VIII.- CSM AND ATS-F PREMODULATION PROCESSORS

ITEM	FUNCTION AND/OR PARAMETERS
1. Weight	14.5 pounds
2. Cooling	
a. CSM	ECS Primary and/or Secondary Glycol Loops
b. ATS-F	Suit 0 Hose 2
3. Electrical Power	
a. Input Voltage	28 ± 4 Vdc
b. Input Power	8.5 watts
4. CM Down Voice Channel (Normal)	
a. Subcarrier	1.25 MHz ($\pm$ 500 Hz) derived from CTE 512 kHz
b. Response	300 to 3000 Hz flat within 6 dB.
5. CSM Down Voice Channel (Backup) or ATS-F 95 kHz SC Voice Channel	
a. Response	300 to 2300 Hz flat within 6 dB.
6. LM/EVA Voice and LM Biomed Relay Channel (not used)	
a. Subcarrier	1.25 MHz derived from CTE 512 kHz.
b. Subcarrier Deviation	LM Voice - 8 kHz EVA Voice and Biomed - 9 kHz
c. Response	300 to 13,300 Hz flat within 2 dB.
d. LM Input (not used)	Voice

TABLE 6-VIII.- CSM AND ATS-F PREMODULATION PROCESSORS - Continued

ITEM	FUNCTION AND/OR PARAMETERS
e. EVA Input (not used)	Voice and/or 7 Biomed Subcarriers 4.0 kHz $\pm$ 5% f 5.4 kHz $\pm$ 5% f 6.8 kHz $\pm$ 5% f 8.2 kHz $\pm$ 5% f 9.6 kHz $\pm$ 4% f 11.0 kHz $\pm$ 3% f 12.4 kHz $\pm$ 3% f
7. Tape Recorder Output - VHF & CSM Voice	VHF and CSM intercom voice are mixed and output to DSE for recording.
a. Response	300 to 2300 Hz flat within 2 dB.
8. LM PCM Output Channel (not used)	LM PCM (1.6 kbs) is limited and output to DSE for recording.
a. Response	600 to 2800 Hz flat within 1 dB.
9. CM PCM DATA Channel (Realtime and Playback)	
a. Input	51.2 kbs or 1.6 kbs NRZ PCM data.
b. Subcarrier	1.024 MHz derived from PCM 512 kHz ref signal.
c. Modulation	Bi-phase

TABLE 6-VIII.- CSM AND ATS-F PREMODULATION PROCESSORS - Continued

ITEM	FUNCTION AND/OR PARAMETERS
10. Scientific Data Channel (Realtime)	
a. Response	Flat within 2 dB
	<u>Channel</u>
	1 0 to 2850 Hz (95 kHz SC)
	2 0 to 3750 Hz (125 kHz SC)
	3 0 to 4950 Hz (165 kHz SC)
b. Frequency and Deviation	See Tables 6-IV & 6-V
11. Scientific Data Channel (Playback)	
a. Response	Flat within 2 dB.
	<u>Ch. 32:1 Playback 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 (not used)	
a. Response	15 to 90 kHz flat within 1 dB.
13. Uplink Subcarrier Detectors	
a. Up Voice	30 kHz (normal) 70 kHz (backup) not used on ATS-F
b. Udata	70 kHz
c. Response	300 to 4,000 kHz flat within 3 dB.

TABLE 6-VIII.- CSM AND ATS-F PREMODULATION PROCESSORS - Continued

ITEM	FUNCTION AND/OR PARAMETERS
14. Emergency Key Control (not used on ATS-F PMP)	512 kHz signal derived from CTE 512 kHz timing signal baseband modulates S-band PM carrier when key is depressed. A 400 Hz side- tone 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 Direct wire through put. To GSE hardline 10 to 500,000 Hz flat within 3 dB.
17. Uplink Voice Squelch (30 kHz Discriminator Output) a. Operation	Transistor switch actuated by voice subcarrier threshold detec- tor. Switch grounds input to voice output amplifier.

TABLE 6-VIII.- CSM AND ATS-F PREMODULATION PROCESSORS - Concluded

ITEM	FUNCTION AND/OR PARAMETERS		
b. Threshold	CSM MODE	ATS-F MODE	Received Carrier Pwr
	2	--	-119 dBm
	4	--	-111 dBm
	6	--	-108 dBm
	7	F1&F2	-109 dBm
c. Squelch Level	Greater than 35 dB squelch of audio output when threshold is reached.		

TABLE 6-IX.- VHF AM TRANSCEIVER EQUIPMENT

ITEM	FUNCTION AND/OR PARAMETERS																						
1. Weight	13 pounds maximum																						
2. Cooling	ECS Primary and/or Secondary Glycol Loop																						
3. Electrical Power																							
a. Input Voltage	28 ± 4 Vdc																						
b. Input Power	<table> <tr> <td>Duplex A (Key OFF)</td><td>4.2 watts</td></tr> <tr> <td>Duplex A (Key ON)</td><td>28.8 watts</td></tr> <tr> <td>Simplex A (Key OFF)</td><td>4.1 watts</td></tr> <tr> <td>Simplex A (Key ON)</td><td>28.8 watts</td></tr> <tr> <td>Duplex B (Key OFF)</td><td>3.8 watts</td></tr> <tr> <td>Duplex B (Key ON)</td><td>27.6 watts</td></tr> <tr> <td>Simplex B (Key OFF)</td><td>4.0 watts</td></tr> <tr> <td>Simplex B (Key ON)</td><td>27.6 watts</td></tr> <tr> <td>RCV A Only</td><td>1.2 watts</td></tr> <tr> <td>RCV B Only</td><td>1.2 watts</td></tr> <tr> <td>PTT (Key ON)</td><td>1.3 watts</td></tr> </table>	Duplex A (Key OFF)	4.2 watts	Duplex A (Key ON)	28.8 watts	Simplex A (Key OFF)	4.1 watts	Simplex A (Key ON)	28.8 watts	Duplex B (Key OFF)	3.8 watts	Duplex B (Key ON)	27.6 watts	Simplex B (Key OFF)	4.0 watts	Simplex B (Key ON)	27.6 watts	RCV A Only	1.2 watts	RCV B Only	1.2 watts	PTT (Key ON)	1.3 watts
Duplex A (Key OFF)	4.2 watts																						
Duplex A (Key ON)	28.8 watts																						
Simplex A (Key OFF)	4.1 watts																						
Simplex A (Key ON)	28.8 watts																						
Duplex B (Key OFF)	3.8 watts																						
Duplex B (Key ON)	27.6 watts																						
Simplex B (Key OFF)	4.0 watts																						
Simplex B (Key ON)	27.6 watts																						
RCV A Only	1.2 watts																						
RCV B Only	1.2 watts																						
PTT (Key ON)	1.3 watts																						
4. Transmitter (A or B)																							
a. Activation Time	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 $\pm$ 8.90 kHz XMTR B 259.7 MHz $\pm$ 7.79 kHz																						

TABLE 6-IX.- VHF AM TRANSCEIVER EQUIPMENT - Continued

ITEM	FUNCTION AND/OR PARAMETERS
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.
5. Receiver (A or B)	
a. Activation Time	500 milliseconds maximum to reach full receive operation from turn-on. 100 milliseconds maximum to reach full receive operation from PTT release (Key OFF)
b. RCVR RF Input	2 to 625,000 microvolts
c. A&B Output Response	
(1) Output to Audio	300 to 3000 Hz, + 2 dB - 3 dB maximum variation, down 12 dB minimum at 5000 Hz.
(2) Output to PMP (Voice and Biomed Data)	300 to 13,000 (2 dB).
d. RCVR B LM PCM Output (not used)	300 to 13,000 Hz (2 dB).
e. RCVR Squelch	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)

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

ITEM	FUNCTION AND/OR PARAMETERS
6. VHF Digital Ranging Generator Interface a. RCVR A Gate Input b. RCVR A Tone Output c. XMTR B Tone Input d. XMTR B Quieting (SC Inhibit)	5.266 kHz early-late gate signal to gate fine tone error signal through RCVR IF AMPLS. RCVR A detected IF amplifier output to digital ranging generator. Coarse and module 2 sum of coarse and medium tone input during acquisition and fine tone input during range tracking. Inhibit to XMTR 30 kHz quieting OSC during fine tone transmissions.

TABLE 6-X.- VHF FM TRANSCEIVER

ITEM	FUNCTION AND/OR PARAMETERS
1. Weight	6 pounds
2. Cooling	Not required
3. Electrical	
a. Input Voltage	28 ± 4 Vdc
b. Input Power	RCV 3 watts XMIT 13.5 watts
4. Transmitter	
a. Activation Time	Instantaneous
b. Frequency	$121.75 \text{ MHz} \pm 6 \text{ kHz}$
c. Modulation	Peak deviation $10 \text{ kHz} \pm 2 \text{ kHz}$
d. RF Output	7.5 watts nominal
5. Receiver	
a. Activation Time	Instantaneous
b. Noise Figure	8 dB S/N
c. Squelch Level	Not less than -105 dBm (-110 nominal)
d. Audio Output	0.8 VRMS ± 3 dB
6. Input Filter	
a. Loss	$< 0.8 \text{ dB}$ at $121.75 \pm 0.5 \text{ MHz}$
b. Attenuation	35 dB at 142 MHz

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TABLE 6-XI.- 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 $\pm$ Vdc
b. Input Power	14.2 watts (3 Stations ON)
4. Stations	Left Couch Station (Panel 9) Right Couch Station (Panel 6) Center Couch Station (Panel 10)
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 $\pm$ dB (referred to input)
d. Output	0 dBm $\pm$ 3 dB at threshold
e. Isolation	30 dB or greater between modulation output channels

TABLE 6-XI.- AUDIO CENTER EQUIPMENT - Continued

ITEM	FUNCTION AND/OR PARAMETERS
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 $\pm$ 3 dBm
c. Response	300 to 3000 Hz flat within 2 dB
d. Isolation	40 dB or greater between input channels
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 $\pm$ 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-XI.- AUDIO CENTER EQUIPMENT - Concluded

ITEM	FUNCTION AND/OR PARAMETERS
10. Individual Volume Controls	Minimum volume is 35 dB down.
11. Transmit/Receive Controls	40 dB isolation when function is not selected.

TABLE 6-XII.- 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).

TABLE 6-XII.- UPDATA LINK EQUIPMENT - Continued

ITEM	FUNCTION AND/OR PARAMETERS
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.
(2) System Address	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	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.

TABLE 6-XII.- UPDATA LINK EQUIPMENT - Continued

ITEM	FUNCTION AND/OR PARAMETERS																																		
	Vehicle address recognition disables access bit decoding and enables the decoding of the remaining message.																																		
	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.																																		
8. Verification Signal	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: <table><tr><th>PCM_BIT</th><th>B1</th><th>B2</th><th>B3</th><th>B4</th></tr><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></table> *Verification signal is presented to the PCM as follows: <table><tr><td>PCM HBR</td><td>55 milliseconds</td></tr><tr><td>PCM LBR</td><td>250 milliseconds</td></tr></table>	PCM_BIT	B1	B2	B3	B4	UDL OFF	0	0	0	0	*TEST A	0	1	1	0	*TEST B	1	0	0	1	*SYS VAL	0	1	0	1	UDL STANDBY (ON)	1	0	1	0	PCM HBR	55 milliseconds	PCM LBR	250 milliseconds
PCM_BIT	B1	B2	B3	B4																															
UDL OFF	0	0	0	0																															
*TEST A	0	1	1	0																															
*TEST B	1	0	0	1																															
*SYS VAL	0	1	0	1																															
UDL STANDBY (ON)	1	0	1	0																															
PCM HBR	55 milliseconds																																		
PCM LBR	250 milliseconds																																		

TABLE 6-XII.- UPDATA LINK EQUIPMENT - CONCLUDED

ITEM	FUNCTION AND/OR PARAMETERS
9. Internal Relays	
a. Type	32 double-pole, double-throw relays, magnetic latching
b. Rating	2 ampere, minimum, contact rating
c. Actuation Time	Opening or closure less than 5 milliseconds.
d. Dc Current	18.7 milliamperes per relay
e. Latch-in Current	7.1 milliamperes per relay

TABLE 6-XIII.- 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 ± 0.0126 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-XIV.- 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 warmup period
5. Receiver	
a. Type	Portable, VHF AM Beacon - xcvr with integral microphone, speaker, PTT pushbutton battery, antenna, and test meter
b. Frequency	234 MHz
Sensitivity ($\frac{S + N}{N} = 10 \text{ dB}$)	-97 dBm minimum
6. Transmitter	
a. Frequency	234 MHz
b. RF Output	
(1) Beacon	1.25 watts (peak)
(2) Voice	0.5 watts minimum (unmodulated)

TABLE 6-XIV.- VHF SURVIVAL BEACON-TRANSCIVER - Concluded

ITEM	FUNCTION AND/OR PARAMETERS
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-XV.- CSM 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-XVI.- ANTENNA SWITCH, VHF

ITEM	FUNCTION AND/OR PARAMETERS
1. Weight	0.75 pounds maximum
2. Cooling	Not required
3. Electrical	
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-XVII.- ANTENNA, CSM 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 $\theta > 45$ degrees and $\theta \geq 145$ degrees (See Item 5 below)								
4. Polarization	Right-hand circular								
5. Coverage	The following coverage is applicable with sequential selection of the four antennas: <table> <tr> <th>*GAIN</th><th>SOLID ANGLE</th></tr> <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> </table> GAIN WILL BE LESS THAN -24 dB for cones, with solid angles of 20 degrees at the spacecraft nose and SPS nozzle.	*GAIN	SOLID ANGLE	≥ -3 dB	between $\theta = 45^\circ$ and 145°	≥ -20 dB	between $\theta = 15^\circ$ and 165°	≥ -24 dB	between $\theta = 10^\circ$ and 170°
*GAIN	SOLID ANGLE								
≥ -3 dB	between $\theta = 45^\circ$ and 145°								
≥ -20 dB	between $\theta = 15^\circ$ and 165°								
≥ -24 dB	between $\theta = 10^\circ$ and 170°								
6. Power Rating	15 watts of CW RF								

*Applicable for $\theta = 0^\circ$ to 360°

TABLE 6-XVIII.- 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-XIX.- ANTENNA, VHF RECOVERY

ITEM	FUNCTION AND/OR PARAMETERS
1. Type	10-inch erectible tape with groundplane 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-XX.- ANTENNA, ATS-F HIGH-GAIN

ITEM	FUNCTION AND/OR PARAMETERS																		
1. Type	Multi-mode, variable gain, beam-width, steerable antenna, consisting of four parabolas, a central horn, three-axis gimbal system and control logic.																		
2. Frequency	Transmit: 2256 $\pm$ 2.5 MHz Receive: 2077.4 $\pm$ 2 MHz																		
3. Gain (RF Axis) and Beamwidth (3 dB) for Antenna and Electronics Box	<table><tr><td><u>XMIT_MODE</u></td><td><u>GAIN</u></td><td><u>BEAMWIDTH</u></td></tr><tr><td>Wide</td><td>8.0 dB</td><td>40.0^o</td></tr><tr><td>Narrow</td><td>25.7 dB</td><td>3.9^o</td></tr><tr><td><u>RCV_MODE</u></td><td><u>GAIN</u></td><td><u>BEAMWIDTH</u></td></tr><tr><td>Wide</td><td>3.1 dB</td><td>40.0^o</td></tr><tr><td>Narrow</td><td>23.0 dB</td><td>4.5^o</td></tr></table>	<u>XMIT_MODE</u>	<u>GAIN</u>	<u>BEAMWIDTH</u>	Wide	8.0 dB	40.0 ^o	Narrow	25.7 dB	3.9 ^o	<u>RCV_MODE</u>	<u>GAIN</u>	<u>BEAMWIDTH</u>	Wide	3.1 dB	40.0 ^o	Narrow	23.0 dB	4.5 ^o
<u>XMIT_MODE</u>	<u>GAIN</u>	<u>BEAMWIDTH</u>																	
Wide	8.0 dB	40.0 ^o																	
Narrow	25.7 dB	3.9 ^o																	
<u>RCV_MODE</u>	<u>GAIN</u>	<u>BEAMWIDTH</u>																	
Wide	3.1 dB	40.0 ^o																	
Narrow	23.0 dB	4.5 ^o																	
4. Polarization	Right-hand circular																		
5. Coverage	Spherical except for pointing angles where the STDN 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	40 watts continuous																		
7. Electrical																			
a. Dc Voltage	28 (+2, -4) Vdc																		
b. Ac Voltage	115/200 Vac, 400 Hz, 3-phase																		

TABLE 6-XX.- ANTENNA, ATS-F HIGH-GAIN - Continued

ITEM	FUNCTION AND/OR PARAMETERS
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.
11. RF Scan Limit	Electronic limit set to correspond to CSM RF shadow profile.
12. Gimbal Limits	
A-axis	⁰ 360° Rotation
B-axis	⁰ ±23.5°
C-axis	⁰ ⁰ +125°, -4°
	A-, B-, and C-axis are each at 0 degrees when B-axis is parallel to CSM X-axis and C-axis forms a right angle with A-axis.
	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.

TABLE 6-XX.- ANTENNA, ATS-F HIGH-GAIN - Concluded

ITEM	FUNCTION AND/OR PARAMETERS
13. Scan Warning Limit	Warning limit is set 15 ± 3 deg outside RF Scan Limit
14. Deployment	Deployment is initiated by SLA panel deployment. The HGA boom is pivoted in the deployment mechanism by spring-loaded push push arms. Deployment period is nominally 10 seconds.
15. Inhibit Scan Limit Mode	The Inhibit Scan Limit Mode selected by PNL 230 control switch will drop the scan limit and scan warning limit functions 15 degrees away from the normal limit functions in the direction of negative pitch.
16. Track Error Input Filter	
a. Response	Flat dc to 600 Hz within ±1 dB
b. Rolloff	Down 3 dB at 700 Hz with rolloff at 36 dB per octave.

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TABLE 6-XXI.- ATS-F DIPLEXER/SWITCH

ITEM	FUNCTION AND/OR PARAMETERS
1. Weight	3 pounds
2. Electrical	
a. Voltage	28 $\pm$ 4 Vdc for switching
b. Power	2 watts
3. Frequencies/Bandwidth	Center Frequency/1 dB Bandwidth
a. XMIT (Channel 1&2)	2256.0 MHz/12 MHz
b. RCV	2077.4 MHz/3 MHz
4. Isolation	80 dB between transmit and receive ports.
5. Insertion Loss	Not more than 1.0 dB Transmit and 2.0 dB receive.
6. RF Power Limit	50 watts CW minimum each transmit port.
7. Impedance/VSWR	VSWR not more than 1.3:1 at any port with other ports terminated in 50 ohm load.

TABLE 6-XXII - RF TRANSFER SWITCH

ITEM	FUNCTION AND/OR PARAMETERS
1. Weight	1/4 pound
2. Electrical	
a. Voltage	28 $\pm$ 4 Vdc
b. Power	3 watts
3. Frequency Range	2250 to 2262 MHz
4. VSWR	1.30:1 maximum with connectors terminated in matched loads.
5. Insertion Loss	0.25 dB maximum
6. Power Rating	1 watt average
7. Switching Contacts	Break before make
8. Switching Time	Not greater than 25 milliseconds.

TABLE 6-XXIII.- 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 $\pm$ 4 Vdc
b. Input Power	10 watts maximum
4. Ranging Accuracy	$\pm$ 450 feet maximum error at 500 feet for ranging system: $\pm$ 180 ft random $\pm$ 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 initial 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:

TABLE 6-XXIII.- VHF DIGITAL RANGING GENERATOR - Continued

ITEM	FUNCTION AND/OR PARAMETERS
7. CMC Interface a. Range Data Signal b. Command Readout Input c. Range Strobe Input d. Data Good Signal	a. Data Good test fails b. Reacquisition sequence is initiated. c. Range rate is greater than 1,800 feet/second. 15-bit serial word with the '1' and '0' bits provided as pulse outputs on separate lines, most significant bit first. 3.2 kilobit/second pulse train from CMC to clock out the range data signal. 3.2 kilobit/second pulse train from CMC to provide internal timing for loading range data into range data register. A Data Good test is initiated by the range strobe input just prior to loading the range data register and prior to permitting the output register to be clocked out to the CMC. Absence of the Data Good signal for two successive tests will result in a CMC alarm.
8. Data Good Signal	Data Good test is performed only during the following periods:

TABLE 6-XXIII.- VHF DIGITAL RANGING GENERATOR - Concluded

ITEM	FUNCTION AND/OR PARAMETERS
	a. Range reacquisition sequence (initiated by VHF ranging reset switch) b. CMC range strobe sequence Data Good test will fail under the following conditions: a. Fine tracker loses lock during fine tone tracking. b. Range rate of greater than 1800 feet/second c. Coarse tone tracker is locked to an ambiguous null. This condition is corrected by the internal logic which forces the tracker to reacquire during acquisition.

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

ITEM	FUNCTION AND/OR PARAMETERS
1. Weight	42.5 pounds
2. Cooling	ECS Primary Glycol Loop
3. Electrical	
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 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' = $6 \pm .8$ Vdc

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

ITEM	FUNCTION AND/OR PARAMETERS
c. Type	$\begin{aligned} \text{'0'} &= +.8 \\ &\quad \text{Vdc} \\ &= -.0 \end{aligned}$ NRZ-L
d. Frequency Stability	$5 \text{ parts in } 10^4$
6. CSM PCM Output	
a. Bit Rate	51.2 kbps
b. Level	$\begin{aligned} \text{'1'} &= 6 \pm .6 \text{ Vdc} \\ \text{'0'} &= +.5 \\ &\quad \text{Vdc} \\ &= -.0 \end{aligned}$ NRZ-L
c. Type	NRZ-L
d. Bit Error Rate	
(1) HBR Dump	$1 \text{ in } 10^5 \text{ (max)}$
(2) LBR Dump	$3 \text{ in } 10^5 \text{ (max)}$
7. CSM PCM Data Rate Timing	
a. Wave Form	Square
b. Frequency	1.6 or 51.2 kHz
c. Level	$\begin{aligned} \text{'1'} &= 6 \pm .8 \text{ V} \\ \text{'0'} &= 0 \\ &\quad \text{V} \\ &= -.0 \end{aligned}$

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

ITEM	FUNCTION AND/OR PARAMETERS
8. SIM PCM Input (not used) a. Bit Rate b. Level c. Type	64 kbps "1" = 5 ± 1 Vdc "0" = $0 \pm .6$ Vdc NRZ-L
9. SIM PCM Output (not used) a. Bit Rate b. Level c. Type d. Error Rate	64 kbps "1" = $6 \pm .6$ Vdc "0" = $0 \pm .5$ Vdc NRZ-L 5 3 in 10 (max)
10. SIM PCM Data Rate Timing (not used) a. Wave Form b. Frequency c. Level	Positive "Rectangular" Pulse 64 $\pm 1\%$ kHz "1" = 5 ± 1 V "0" = $0 \pm .6$ V
11. LM PCM Data (not used) a. Bit Rate b. Type	1.6 kbps Serial, Manchester Code

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

ITEM	FUNCTION AND/OR PARAMETERS
12. Analog Inputs	
a. Level	0 to 5 Vdc
b. Frequency	
(1) 1.875 ips	12.5 to 2500 Hz
(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

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

ITEM	FUNCTION AND/OR PARAMETERS
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 (not used)	64 kbps, NRZ-L
(4) 1-LM PCM (not used)	1.6 kbps, Manchester split-phase
(5) 1-Voice	CSM/VHF
(6) 1-Timing	500 Hz in LBR No Timing in HBR

TABLE 6-XXV.- 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 ----- 7.5 ips	Bit Rate Select Switch	Voice 1.6 kbps ----- Voice 51.2 kbps	60 ips (32:1) ----- 7.5 ips (1:1)	Auto Speed Select (2)	Voice 51.2 kbps ----- Voice 51.2 kbps
SDS (1) (3)	7.5 ips	Bit Rate Select Switch	64-kbps Analog	7.5 ips	Auto Speed Select (2)	64-kbps Analog
LM (3)	1.875 ips ----- 7.5 ips	Bit Rate Select Switch	1.6 kbps	60 ips	Tape Recorder LM PCM Switch (s49)	51.2 kbps ----- 12.8 kbps
4-kbps SCI Data (1)	7.5 ips	Bit Rate Select Switch	4-kbps SCI Data	7.5 ips (1:1)	Auto Speed Select (2)	4-kbps SCI Data

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.

(3) Not Used.

TABLE 6-XXVI.- 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 $\pm$ 768 bits per second
b. NRZ-L	Synchronous with bi-phase input within ± 5 microseconds.
c. Stability	Jitter is typically a frequency modulation of the input signal at a 10 Hz to 1250 Hz rate with maximum deviation of $\pm 1\%$ (10 Hz to 50 Hz) and $\pm 2\%$ (50 Hz to 1250 Hz).
5. 64 kbps PCM Inputs (not used)	
a. Bi-phase Space	64,000 $\pm$ 960 bits per second
b. NRZ-L	Synchronous with bi-phase input within ± 5 microseconds.
c. Stability	Jitter is typically a frequency modulation of the input signal at a 10 Hz to 1250 Hz rate with max- imum deviation of $\pm 1\%$ (10 Hz to 50 Hz) and $\pm 2\%$ (50 Hz to 1250 Hz).

TABLE 6-XXVI.- DATA CONDITIONER (TRDC) - Continued

ITEM	FUNCTION AND/OR PARAMETERS
6. 51.2 kbps PCM Output	Two buffered, time-stabilized NRZ-L signals
a. Bit Rate	51,200 $\pm$ 768 bits per second
b. Stability (maximum frequency modulation of output signal)	0 to 10 Hz (same as input) 10 Hz to 50 Hz ($\pm 1\%$ to $\pm 0.01\%$) 50 Hz and higher ($\pm 0.02\%$)
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.
7. 64 kbps PCM Output (not used)	Time stabilized NRZ-L signal
a. Bit Rate	64,000 $\pm$ 960 bits per second
b. Stability (maximum frequency modulation of output signal)	0 to 10 Hz (same as input) 10 Hz to 50 Hz ($\pm 1\%$ to $\pm 0.01\%$) 50 Hz and Higher ($\pm 0.02\%$)
c. Bit Error Rate	Bit Error Rate 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-XXVI.- DATA CONDITIONER (TRDC) - Concluded

P-1

ITEM	FUNCTION AND/OR PARAMETERS
8. Fail Safe	In the event of loss of stable clock lock, input clock lock, or power supply output, the quad redundant fail safe switches will throughput the unconditioned NRZ-L data.
9. Lockup Time	Nominal lockup time before data conditioning occurs is 1 second.

TABLE 6-XXVII.- COLOR TELEVISION CAMERA

ITEM	FUNCTION AND/OR PARAMETERS
1. Weight	Camera 16.0 pounds Lens (SKYLAB) 1.3 pounds Lens (zoom) 4.5 pounds
2. Cooling	Not required
3. Electrical Power	
a. Input Voltage	28 Vdc
b. Input Power	31 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	4.0 MHz with aperture correction ±3 db response in 200 TV lines) limited to 2.0 MHz by CSM FM transmitter.
8. Illumination Levels	1 to 10,000 foot-candles at S/N of 35 dBm. (20 watt flourescent lamp ≈ 4870 foot-candles.)
9. Aspect Ratio	4:3

TABLE 6-XXVII.- COLOR TELEVISION CAMERA - Continued

ITEM	FUNCTION AND/OR PARAMETERS
10. Optics	Field_of_View Near_Object_Dist.
a. Zoom Lens (6:1)	7 deg Focused 24 in. to ∞ 43 deg Focused 20 in. to ∞
b. f-stops	4.4 to 44 continuously variable
c. Focal Length	25 to 150 mm
d. Wide Angle (3:1) Zoom Lens	Field_of_View
	50 degrees 108 degrees
e. f-stops	3.5 to 35 continuously variable
f. Focal Length	9 mm to 27 mm
11. Video Output	-0.75 to 2.75 peak-to-peak, sync tip-to-peak white into 100 ohm load
12. Connectors	One video, one power
13. Motor	1798.2 rpm synchronous motor, 3:1 reduction gear drives color wheel
14. Color Wheel	Six segment 59 9.4 rpm wheel pro- vides the color field rate 59.95 Hz
15. ALC/Age Range	1000:1
16. Gray Shades	7 shades (ETA Logarithmic)
17. Temperature Sensor Range	-55 to 55 $^{\circ}$ C (-67 to 140 $^{\circ}$ F)

TABLE 6-XXVII.- COLOR TELEVISION CAMERA - Continued

ITEM	FUNCTION AND/OR PARAMETERS
18. Color Lock	In slave mode, the maximum time for color lock after receiving a color sync signal from a master camera is 27.5 seconds.
19. Vertical Interval Test Signal (VITS)	VITS provides: a. Amplitude reference signal (Line 18) b. Red field identifier signal (Line 18) c. Test signal (Line 19, Fields 1 and 2) (1) System gain (2) Linearity (3) Frequency response (4) Transient response d. Camera temperature signal (Line 18) e. Camera ID (Line 16)
20. Automatic Light Control	a. Average Camera responds to a 50 percent bright area within the field of view for outside scenes. b. Peak Camera responds to a 0.5 percent bright area within the field of view for inside scenes.

TABLE 6-XXVII.- COLOR TELEVISION CAMERA - Concluded

ITEM	FUNCTION AND/OR PARAMETERS
21. Linear/GAM 1/2 Control	
a. Linear	For interior cabin scenes (low contrast scenes).
b. GAM 1/2	For external scenes (high contrast scenes).
22. Master/Slave Control	
a. Master	Camera uses internal sync signals and provides sync (horizontal, vertical, and color lock) output for slaving other system cameras.
b. Slave	Camera operates as sync slave to master sync camera.

TABLE 6.-XXVIII.- TV MONITOR

ITEM	FUNCTION AND/OR PARAMETERS
1. Weight	2 pounds
2. Electrical	
a. Dc Voltage	28 $\pm$ 4 Vdc
b. Power	3 watts
3. Controls	
a. Vertical Hold	
b. Horizontal Hold	
c. Brightness	50:1 range
d. Contrast	50 percent above cutoff to saturation
e. Power	OFF-ON
4. Use	The monitor provides crew viewing of actual camera picture transmitted so that f-stop, light level, zoom position and focus can be properly accomplished.

TABLE 6-XXIX.- VIDEO TAPE RECORDER

ITEM	FUNCTION AND/OR PARAMETERS
1. Weight	
a. Transport Unit	44 pounds
b. Electronics Unit	50 pounds
c. Cables	2 pounds
2. Cooling	Crew 0 suit hose 2
3. Electrical	
a. DC Voltage	27 + 3, -4 Vdc
b. Power	
VTR Power ON	20 watts
TM Power ON	5 watts (additional load)
Interleaver Power ON	15 watts (additional load)
HW Motor ON	68 watts (mode total)
Record	125 watts (mode total)
Playback	124 watts (mode total)
Rewind	86 watts (mode total)
Fast Forward	86 watts (mode total)
4. Video Recording Technique	Frequency Modulation
5. Tape	
a. Width	2 inches
b. Length	2000 feet (1800 feet minimum usable length)
c. Speed	12 ips (Record or Playback) 48 ips (Rewind or Fast Forward)

TABLE 6-XXIX.- VIDEO TAPE RECORDER - Concluded

ITEM	FUNCTION AND/OR PARAMETERS
6. Scan Mode	Transverse Scan using 4 heads
7. Scan Speed	1964 inches/second
8. Head Wheel Speed	18,750 revolutions/minute
9. Temperature Sensors	
a. Electronic Unit	-30 to +70 deg C
b. Transport Unit	-30 to +70 deg C

TABLE 6-XXX.- VIDEO SYNC BOX

ITEM	FUNCTION AND/OR PARAMETERS
1. Weight	1.25 pounds
2. Cooling	Not required
3. Electrical	
a. Dc voltage	28 $\pm$ 4 Vdc
b. Power	5 watts
4. Horizontal Sync Amplitude	2.4 volts
5. Horizontal Sync Width	5.0 microseconds
6. Horizontal Sync Delay	50 nanoseconds
7. Color Pulse Amplitude	2.4 volts
8. Color Pulse Width	5.0 microseconds
9. Color Timing	16 microseconds
10. Use	Receives composite video from Soyuz to camera and strips out the sync signal for TV sync of CM and DM TV cameras.

TABLE 6-XXXI.- VIDEO PROCESSING AMPLIFIER

ITEM	FUNCTION AND/OR PARAMETERS
1. Weight	1.25 pounds
2. Cooling	Not required
3. Electrical	
a. Dc Voltage	28 ± 4 Vdc
b. Power	3.2 watts
4. Video Gain	0.96 volts/volt
5. Video Delay	60 nanoseconds
6. White Clipping Level	2.70 volts
7. Sync Amplitude	-0.76 volts
8. Sync Delay	90 nanoseconds, 50 nanoseconds rise time
9. Use	Ensures continuous transmission of sync signal when video is switched from camera to camera. Sync is derived from a single camera and mixed with video in processing amplifier.

SECTION 7
INSTRUMENTATION

7.1 GENERAL

This section contains instrumentation data for CSM 111. The notes, definitions, and tables are arranged to precede the drawings to which they are related.

TABLE 7-1 SIGNAL CONDITIONING EQUIPMENT (SCE) PARAMETER LISTING

MEAS ID	MEAS DESCRIPTION	MODULE TYPE	MODULE PLUG-CKT*	OUTPUT PCM	SIGNAL DISPLAY	DIST C&W
SC0039P	H2 TK 1 PRESS (5V BIAS)	--	--	--	--	C&W
SC0040P	H2 TK 2 PRESS (5V BIAS)	--	--	--	--	C&W
SR0007P	PSM FU TK PRESS (5V BIAS)	--	--	--	--	C&W
CC0175T	INVERTER 1 TEMP	DBA	35-1 (2)	PCM	--	C&W
CC0176T	INVERTER 2 TEMP	DBA	35-2 (2)	PCM	--	C&W
CC0177T	INVERTER 3 TEMP	DBA	36-1	PCM	--	C&W
CC0200V	AC BUS 1 PH A VOLTS	AC	24-1 (2)	PCM	--	--
CC0203V	AC BUS 2 PH A VOLTS	AC	24-2 (2)	PCM	--	--
CC0206V	MAIN BUS A VOLTS	AA	13-1 (5)	PCM	--	--
CC0207V	MAIN BUS B VOLTS	AA	13-2 (5)	PCM	--	--
CC0210V	BAT BUS A VOLTS	AA	13-3 (5)	PCM	--	--
CC0211V	BAT BUS B VOLTS	AA	13-4 (5)	PCM	--	--
CC0212V	BAT RELAY BUS VOLTS	AA	13-7 (5)	PCM	SEL MTR	--
CC0215C	BAT CHGR CUR	DA	30-1 (2)	PCM	--	--
CC0222C	BAT A CUR	DA	30-2 (2)	PCM	--	--
CC0223C	BAT B CUR	DA	31-1 (2)	PCM	--	--
CC0224C	BAT C CUR	DA	31-2 (2)	PCM	--	--
SC2031T	FC 1 COND EXH TEMP	DBA	46-1 (2)	PCM	SEL MTR	C&W
SC2032T	FC 2 COND EXH TEMP	DBA	46-2 (2)	PCM	SEL MTR	C&W
SC2033T	FC 3 COND EXH TEMP	DBA	47-1	PCM	SEL MTR	C&W
SC2034T	FC 1 SKIN TEMP	DBA	41-1 (2)	PCM	SEL MTR	C&W
SC2035T	FC 2 SKIN TEMP	DBA	41-2 (2)	PCM	SEL MTR	C&W
SC2036T	FC 3 SKIN TEMP	DBA	42-1	PCM	SEL MTR	C&W
SC2113C	FC 1 CUR	DA	32-1 (2)	PCM	--	--
SC2114C	FC 2 CUR	DA	32-2 (2)	PCM	--	--
SC2115C	FC 3 CUR	DA	33-1	PCM	--	--
SF0266X	RAD FLOW CONT SYS 1 OR 2	AA	21-4 (4)	PCM	--	--
CH3635X	BMAG MODE SW-ROLL ATT 1 RT 2	AA	19-1 (6)	PCM	--	--
CH3636X	BMAG MODE SW-ROLL RATE 2	AA	19-2 (6)	PCM	--	--
CH3638X	BMAG MODE SW-PITCH ATT 1 RT 2	AA	19-3 (6)	PCM	--	--
CH3639X	BMAG MODE SW-PITCH RATE 2	AA	19-4 (6)	PCM	--	--
CH3641X	BMAG MODE SW-YAW ATT 1 RT 2	AA	19-5 (6)	PCM	--	--
CH3642X	BMAG MODE SW-YAW RATE 2	AA	19-6 (6)	PCM	--	--
SF0062T	SPS INJECTOR FLANGE TEMP 2	DBA	43-2	PCM	--	--
BS0050P	SIVB OX TK PRESS A	DA	39-1 (2)	--	SEL MTR	--
BS0051P	SIVB OX TK PRESS B	DA	40-1 (2)	--	SEL MTR	--
BS0052P	SIVB FUEL PRESS A	DA	39-1 (2)	--	SEL MTR	--
BS0053P	SIVB FUEL PRESS B	DA	40-2 (2)	--	SEL MTR	--
BS0080X	EDS ABORT REQUEST A	AA	21-1 (4)	PCM	--	--
BS0081X	EDS ABORT REQUEST B	AA	21-5 (4)	PCM	--	--
CS0150X	MASTER CAUTION WARNING	AA	21-2 (4)	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	--	--

* The number of parameters per module is shown in parenthesis.

TABLE 7-2 INSTRUMENTATION - CM POWER DISTRIBUTION

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

A. V1 - CURRENT LIMITER BOX C18A6 (FUSES 1 THRU 9).

MEAS ID	MEAS DESCRIPTION	FUSE NO.*	PCM	DISPLAY	C&W
CF0461T	H2O 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 MANF 1 PRESS	9	PCM	--	C&W
CR0038P	CM He MANF 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 (FUSES 1 THRU 21).

MEAS ID	MEAS DESCRIPTION	FUSE NO.*	PCM	DISPLAY	C&W
CC0183P	BATT MANF 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	MTR	--
CF0006P	SURGE TANK PRESS	3	PCM	SEL MTR	--
CF0120P	H2O TANK-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	9	PCM	--	--
CK0027A	CM Y-AXIS ACCEL	5	PCM	--	--
CK0028A	CM Z-AXIS ACCEL	6	PCM	--	--
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	--	--
	BUFFER AMPLIFIER (C28A33) (TIMING SIGNALS TO VTR, MA048, MA059, MA083 AND MA088)	16			

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

TABLE 7-2 INSTRUMENTATION - CM POWER DISTRIBUTION (CONCLUDED)

D. V2 - CURRENT LIMITER BOX C28A6 (FUSES 10 THRU 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 1A TEMP	13 (4)	PCM	--	--
CA1821T	SIDE HS SURF LOC 4A TEMP	13 (4)	PCM	--	--
CA1822T	SIDE HS SURF LOC 7A TEMP	13 (4)	PCM	--	--
CA1823T	SIDE HS SURF LOC 10A TEMP	13 (4)	PCM	--	--
CF0460T	URINE DUMP NOZZLE TEMP	11	PCM	--	--
CR0002P	CM He TK 2 PRESS	20	PCM	SPL MTR	--
CR0004T	CM He TK 2 TEMP	19	PCM	SPL MTR	--
CR0036P	CM He MANF 2 PRESS	22	PCM	--	C&W
CR0037P	CM He MANF 1 PRESS	23	--	SPL MTR	C&W
CR2116T	SYS 2 ENG 25 INJECT TEMP	21	--	SPL MTR	--
CR2119T	SYS 2 ENG 21 INJECT TEMP	16	--	SPL MTR	--

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

TABLE 7-3 INSTRUMENTATION - SM POWER DISTRIBUTION

1. PANEL 276 CB 3 (V3S) INSTRUMENTATION POWER DISTRIBUTION.

A. V3S - CURRENT LIMITER BOX S28A9.

MEAS ID	MEAS DESCRIPTION	FUSE NO.*	PCM	DISPLAY	C&W
SC0038P	O2 TK 2 PRESS	20	PCM	MTR	C&W
SC0040P	H2 TK 2 PRESS	21	PCM	MTR	C&W
SC2061P	FC 2 N2 PRESS (GSE ONLY)	1	--	--	--
SC2062P	FC 3 N2 PRESS (GSE ONLY)	8	--	--	--
SC2067P	FC 2 O2 PRESS	2	PCM	SEL MTR	--
SC2068P	FC 3 O2 PRESS	3	PCM	SEL MTR	--
SC2070P	FC 2 H2 PRESS	3	PCM	SEL MTR	--
SC2071P	FC 3 H2 PRESS	2	PCM	SEL MTR	--
SC2088T	FC 2 RAD OUT TEMP	11	PCM	SEL MTR	C&W
SC2089T	FC 3 RAD OUT TEMP	17	PCM	SEL MTR	C&W
SC2140R	FC 2 H2 FLOW	15	PCM	SEL MTR	C&W
SC2141R	FC 3 H2 FLOW	17	PCM	SEL MTR	C&W
SC2143R	FC 2 O2 FLOW	16	PCM	SEL MTR	C&W
SC2144R	FC 3 O2 FLOW	18	PCM	SEL MTR	C&W
SP0001P	He TK PRESS	4	PCM	--	--
SP0003P	OX TK PRESS	5	PCM	MTR	C&W
SP0022H	FU/OX VLV 1 POS	27 (4)	PCM	--	--
SP0024H	FU/OX VLV 3 POS	27 (4)	PCM	--	--
SP0027H	FU/OX VLV 2 POS	27 (4)	--	MTR	--
SP0029H	FU/OX VLV 4 POS	27 (4)	--	MTR	--
SP0048T	SPS FU FEED LINE TEMP	23	PCM	MTR	--
SP0054T	OX LINE 1 TEMP	24	PCM	--	--
SP0055T	OX SUMP TK SURF TEMP	19	PCM	--	--
SP0056T	FU SUMP TK SURF TEMP	13	PCM	--	--
SP0600P	SPS VLV ACT PRESS N2A	14	PCM	SEL MTR	--
SP0661P	ENG CHAMBER PRESS	10	PCM	MTR	--
SP0930P	FU SM/ENG INTERFACE PRESS	6	PCM	--	--
SM RCS QUAD A CURRENT LIMITER S28A10		28 (9)			
SM RCS QUAD C CURRENT LIMITER S28A10		29 (9)			

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B. V3S - CURRENT LIMITER BOX S28A13.

MEAS ID	MEAS DESCRIPTION	FUSE NO.*	PCM	DISPLAY	C&W
SC2091T	FC 2 RAD IN TEMP	1	PCM	--	--
SC2092T	FC 3 RAD IN TEMP	2	PCM	--	--
ST9630T	ATS-F PWR AMPL NO. 1 TEMP	17 (2)	PCM	--	--
ST9631T	ATS-F PWR AMPL NO. 2 TEMP	6 (2)	PCM	--	--
ST9632X	ATS-F PWR AMPL NO.1 ON	17 (2)	PCM	--	--
ST9633X	ATS-F PWR AMPL NO. 2 ON	6 (2)	PCM	--	--
SM RCS PSM 1 CURRENT LIMITER S28A11		29 (7)			

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

TABLE 7-3 INSTRUMENTATION - SM POWER DISTRIBUTION (CONTINUED)

C. V3S - SM RCS QUAD A CURRENT LIMITER BOX S28A10 (POWERED VIA S28A9).

MEAS ID	MEAS DESCRIPTION	FUSE NO.*	PCM	DISPLAY	C&W
SR5001P	SM He TK A PRESS	1	PCM	SEL MTR	--
SR5013T	SM He TK A TEMP	10	PCM	SEL MTR	--
SR5025Q	SM RCS A PROP QTY	7	PCM	SEL MTR	--
SR5065T	SM ENG PKG A TEMP	11	PCM	SEL MTR	C&W
SR5073T	SM PRI FU TK A OUT SURF TEMP	15	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
SR9216T	PSM QD A FEED LINE BRKT TEMP	5	PCM	--	--

D. V3S - SM RCS QUAD C CURRENT LIMITER BOX S28A10 (POWERED VIA S28A9).

MEAS ID	MEAS DESCRIPTION	FUSE NO.*	PCM	DISPLAY	C&W
SR5003P	SM He TK C PRESS	1	PCM	SEL MTR	--
SR5015T	SM He TK C TEMP	10	PCM	SEL MTR	--
SR5027Q	SM RCS C PROP QTY	7	PCM	SEL MTR	--
SR5067T	SM ENG PKG C TEMP	11	PCM	SEL MTR	C&W
SR5075T	SM PRI FU TK C OUT SURF TEMP	15	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
SR9416T	PSM QD C FEED LINE BRKT TEMP	5	PCM	--	--

E. V3S - SM RCS PSM 1 CURRENT LIMITER BOX S28A11 (POWERED VIA S28A13).

MEAS ID	MEAS DESCRIPTION	FUSE NO.*	PCM	DISPLAY	C&W
SR9801Q	PSM 1 PROP QTY	10	PCM	SEL MTR	--
SR9802T	PSM 1 He TK TEMP	11	PCM	SEL MTR	--
SR9804P	PSM 1 He TK PRESS	1	PCM	SEL MTR	--
SR9806P	PSM 1 OX TK PRESS	2	PCM	--	--
SR9807P	PSM 1 FU TK PRESS	3	PCM	SEL MTR	C&W
SR9808T	PSM 1 OX TK TEMP	12	PCM	--	--
SR9809T	PSM 1 FU TK TEMP	13	PCM	--	--

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

TABLE 7-3 INSTRUMENTATION - SM POWER DISTRIBUTION (CONTINUED)

2. PANEL 276 CB 4 (V4S) INSTRUMENTATION POWER DISTRIBUTION.

A. V4S - CURRENT LIMITER BOX S28A7.

MEAS ID	MEAS DESCRIPTION	FUSE NO.*	PCM	DISPLAY	C&W
SC2090T	FC 1 RAD IN TEMP	13	PCM	--	--
SP0006P	FU TK PRESS	14	PCM	MTR	C&W
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)	--	MTR	--
SP0028H	FU/OX VLV 3 POS	22 (4)	--	MTR	--
SP0035P	He TK PRESS	8	--	SEL MTR	-- P-2
SP0049T	ENG OX FEED LINE TEMP	18	PCM	SEL MTR	--
SP0601P	ENG VLV ACT PRESS N2B	14	PCM	SEL MTR	-- P-2
SP0931P	OX SM/ENG INTERFACE PRESS	3	PCM	--	--
SP9014T	OX SUMP TK OUTBOARD TEMP	20	PCM	--	-- P-2
SP9017T	SPS He PRESS PANEL TEMP	11	PCM	SEL MTR	--
SP9027T	SPS He TK UPPER SURF TEMP	5	PCM	--	--
SM RCS QUAD B CURRENT LIMITER S28A10		28 (9)			
SM RCS QUAD D CURRENT LIMITER S28A10		29 (9)			

B. V4S - CURRENT LIMITER BOX S28A12.

MEAS ID	MEAS DESCRIPTION	FUSE NO.*	PCM	DISPLAY	C&W
SC0037P	O2 TK 1 PRESS	20	PCM	SEL MTR	C&W
SC0039P	H2 TK 1 PRESS	5	PCM	MTR	C&W
SC2060P	FC 1 N2 PRESS (GSE ONLY)	8	--	--	--
SC2066P	FC 1 O2 PRESS	9	PCM	SEL MTR	--
SC2069P	FC 1 H2 PRESS	7	PCM	SEL MTR	--
SC2087T	FC 1 RAD OUT TEMP	12	PCM	SEL MTR	C&W
SC2139R	FC 1 H2 FLOW	17	PCM	SEL MTR	C&W
SC2142R	FC 1 O2 FLOW	18	PCM	SEL MTR	C&W
SP0045T	SPS VLV BODY TEMP	13	PCM	--	--
SP0057T	FU LINE 1 TEMP	15	PCM	--	--

C. V4S - SM RCS QUAD B CURRENT LIMITER BOX S28A10 (POWERED VIA S28A7).

MEAS ID	MEAS DESCRIPTION	FUSE NO.*	PCM	DISPLAY	C&W
SR5002P	SM He TK B PRESS	1	PCM	SEL MTR	--
SR5014T	SM He TK B TEMP	10	PCM	SEL MTR	--
SR5026Q	SM RCS B PROP QTY	7	PCM	SEL MTR	--
SR5066T	SM ENG PKG B TEMP	11	PCM	SEL MTR	C&W
SR5074T	SM PRI FU TK B OUT SURF TEMP	15	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
SR9316T	PSM QD B FEED LINE BRKT TEMP	5	PCM	--	--

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

TABLE 7-3 INSTRUMENTATION - SM POWER DISTRIBUTION (CONTINUED)

D. V4S - SM QUAD D CURRENT LIMITER BOX S28A10 (POWERED VIA S28A7).

<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	1	PCM	SEL MTR	--
SR5016T	SM He TK D TEMP	10	PCM	SEL MTR	--
SR5028Q	SM RCS D PROP QTY	7	PCM	SEL MTR	--
SR5068T	SM ENG PKG D TEMP	11	PCM	SEL MTR	C&W
SR5076T	SM PRI FU TK D OUT SURF TEMP	15	PCM	--	--
SR5821P	SM OX MANF D PRESS	17	PCM	--	--
SR5823P	SM FU MANF D PRESS	14	PCM	SEL MTR	C&W
SR5830P	SM He MANF D PRESS	12	PCM	--	--
SR9516T	PSM QD D FEED LINE BRKT TEMP	5	PCM	--	--

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

TABLE 7-4 INSTRUMENTATION - DM POWER DISTRIBUTION

1. PANEL 815, CB INSTRUMENTATION DM A (VIDMA) POWER DISTRIBUTION.

A. VIDMA - CURRENT LIMITER BOX D28A1.

MEAS ID	MEAS DESCRIPTION	FUSE NO.*	CM DISPLAY	PCM	DM DISPLAY	DM C&W
DF9601T	DM CABIN TEMP	1	--	--	MTR	--
DF9602T	DM CABIN INNER WALL TEMP 1	9	--	PCM	--	--
DF9603T	DM CABIN INNER WALL TEMP 2	5	--	PCM	--	--
DF9605P	DM CABIN PRESS	7	SEL MTR	PCM	MTR	--
DF9615P	DM SYS A O2 PP	4	SEL MTR	PCM	MTR	C&W
DF9620P	DM CO2 PP	25	--	--	MTR	--
DF9632Q	DM SYS A O2 TK 1 QTY	15	SEL MTR	PCM	--	--
DF9637Q	DM SYS A O2 TK 2 QTY	17	SEL MTR	PCM	--	--
DF9640X	DM O2 FLOW HIGH	19	--	--	--	C&W
DF9652Q	DM SYS A N2 TK 1 QTY	12	SEL MTR	PCM	--	--
DF9657Q	DM SYS A N2 TK 2 QTY	11	SEL MTR	PCM	--	--
DL9689P	MA010 FURNACE VENT PRESS	18	--	--	SEL MTR	--
DS9635S	DS SYS A STRUCT LTCH 1 STRAIN	13(4)	--	--	SEL MTR	--
DS9637S	DS SYS A STRUCT LTCH 3 STRAIN	13(4)	--	--	SEL MTR	--
DS9639S	DS SYS A STRUCT LTCH 5 STRAIN	13(4)	--	--	SEL MTR	--
DS9641S	DS SYS A STRUCT LTCH 7 STRAIN	13(4)	--	--	SEL MTR	--

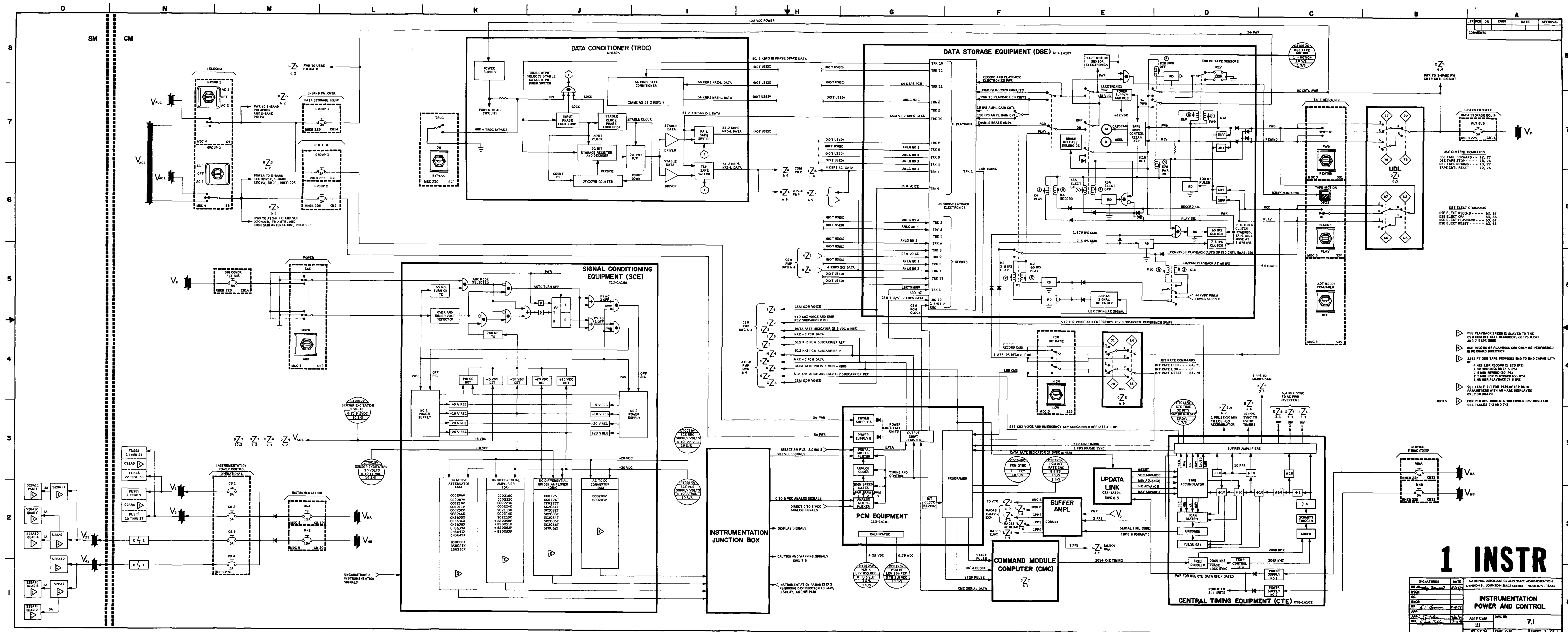
P-2

2. PANEL 815, CB INSTRUMENTATION DM B (VIDMB) POWER DISTRIBUTION.

A. VIDMB - CURRENT LIMITER BOX D28A2.

MEAS ID	MEAS DESCRIPTION	FUSE NO.*	CM DISPLAY	PCM	DM DISPLAY	DM C&W
DF9616P	DM SYS B O2 PP	13	SEL MTR	PCM	MTR	C&W
DF9631Q	DM SYS B O2 TK 1 QTY	23	--	--	MTR	--
DF9636Q	DM SYS B O2 TK 2 QTY	25	--	--	MTR	--
DF9651Q	DM SYS B N2 TK 1 QTY	19	--	--	MTR	--
DF9656Q	DM SYS B N2 TK 2 QTY	21	--	--	MTR	--
DS9630T	DS TEMP 1	10	--	PCM	--	--
DS9631T	DS TEMP 2	11	--	PCM	--	--
DS9632T	DS TEMP 3	12	--	PCM	--	--
DS9636S	DS SYS B STRUCT LTCH 2 STRAIN	17(4)	--	--	SEL MTR	--
DS9638S	DS SYS B STRUCT LTCH 4 STRAIN	17(4)	--	--	SEL MTR	--
DS9640S	DS SYS B STRUCT LTCH 6 STRAIN	17(4)	--	--	SEL MTR	--
DS9642S	DS SYS B STRUCT LTCH 8 STRAIN	17(4)	--	--	SEL MTR	--

* Fuses 1 through 27 are 0.25 amp. Fuses 28, 29 and 30 are 3.0 amps. Numbers in parenthesis indicate the number of parameters on the 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 (1.6 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 shift register are block redundant circuits, which are initialized to the primary block when power is first applied. Error detection circuits will cause automatic switchover 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 the actual format change.

7.2.4.1 High bit rate format.

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 format.

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 7-5.

7.2.6 Operating Characteristics.

PCM equipment operating characteristics are listed in table 7-6.

TABLE 7-5 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 CHANNEL	1 @ 200 S/S	--
7.	8-BIT PARALLEL DIGITAL CHANNELS	1 @ 50 S/S	1 @ 10 S/S
		31 @ 10 S/S	29 @ 1 S/S
8.	40-BIT SERIAL DIGITAL CHANNEL	1 @ 50 S/S	1 @ 10 S/S
9.	8-BIT SYNC WORDS	3 @ 50 S/S	3 @ 1 S/S
	WORD 1 - 00000101		
	WORD 2 - 01111001		
	WORD 3 - 10110111		
10.	8-BIT FRAME COUNT WORD	1 @ 50 S/S	1 @ 1 S/S
	(TWO "ONE" BITS PLUS 6 BITS FRAME COUNT)		
11.	8-BIT FORMAT ID WORD	1 @ 1 S/S	1 @ 1 S/S
	HBR - 01100110		
	LBR - 10011001		
12.	8-BIT OUTPUT SHIFT REGISTER TEST WORDS	2 @ 10 S/S	2 @ 1 S/S
13.	UNAVAILABLE 8-BIT WORDS	29 @ 1 S/S	--

TABLE 7-6 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 DEG 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 $\pm$ 0.5 VOLTS
	INTERPULSE VOLTAGE	0 TO 0.2 VOLTS
7.	GSE POWER INPUT (FOR PCM RZ OUTPUT)	
	VOLTAGE	11 $\pm$ 0.3 VOLTS
	CURRENT	400 MA MAX
8.	DATA INPUTS	
8.1	ANALOG	
	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 GROUND
8.2	ANALOG ENCODING (9-BITS)	
	ZERO OR LESS VOLTS	00000001
	5.00 OR GREATER VOLTS	11111110
	NO EXTERNAL CONNECTION	RANDOM OUTPUT
	ACCURACY	± 2 COUNTS
	OUTPUT SEQUENCE	MSB FIRST
8.3	PARALLEL DIGITAL	
	MAX VOLTAGE RANGE	-2 TO +32 VOLTS
	LOGIC ONE	4.0 TO 10.0 VOLTS
	LOGIC ZERO	0 $\pm$ 0.5 VDC
	SOURCE IMPEDANCE	5K OHMS MAX
	NO CONNECTION	LOGIC ONE
	UNUSED INPUTS	NORMALLY OPEN

TABLE 7-6 PCM EQUIPMENT OPERATING CHARACTERISTICS - CONCLUDED

<u>ITEM NO.</u>	<u>ITEM DESCRIPTION</u>	<u>FUNCTION OR VALUE</u>
8.4	SERIAL DIGITAL INTERFACE	
	MAX VOLTAGE RANGE	-6 TO +13 VOLTS
	LOGIC ONE	4.5 TO 10 VOLTS
	LOGIC ZERO	-6 TO +0.5 VOLTS
	START PULSE (1 BIT TIME PRIOR TO FIRST CLOCK PULSE)	4.5 $\pm$ 1 VOLT
	40 CLOCK PULSES (AT OUTPUT BIT RATE)	4.5 $\pm$ 1 VOLT
	STOP PULSE (1 BIT TIME AFTER LAST CLOCK PULSE)	4.5 $\pm$ 1 VOLT
8.5	CALIBRATION SIGNALS	
	15% VOLTAGE	0.75 $\pm$ 0.01 VOLT
	85% VOLTAGE	4.25 $\pm$ 0.01 VOLT
9.	ISOLATED PCM OUTPUTS	
9.1	NRZ-C OUTPUTS (TO PMP AND DSE)	
	LOGIC ONE	6 $\pm$ 0.6 VOLTS
	LOGIC ZERO	0 TO 0.8 VOLTS
9.2	RZ OUTPUT (TO GSE)	
	LOGIC ONE	4.0 TO 6.5 VOLTS
	LOGIC ZERO	-0.25 TO 0.0 VOLTS
9.3	DATA RATE TIMING (TO DSE)	
	FREQUENCY (SQUARE WAVE)	1.6 OR 51.2 KRPS
	P-P VOLTAGE	4.0 TO 6.5 VOLTS
	PHASING TO RZ OUTPUT	$\pm$ 0.6 MICRO SEC
9.4	SUBCARRIER REFERENCE (TO PMP)	
	FREQUENCY (SQUARE WAVE)	512 KHz
	P-P VOLTAGE	4.0 TO 6.5 VOLTS
	PHASING TO RZ OUTPUT	$\pm$ 1 MICRO SEC
9.5	DATA RATE INDICATOR (TO PMP AND UDL)	
	HBR	5.5 $\pm$ 1.0 VOLT
	LER	0 $\pm$ 0.8 VOLT
	TRANSITION TIME PRIOR TO NRZ OUTPUT CHANGE	2 TO 6 MICRO SEC

7.3 COLUMN DEFINITIONS FOR PCM EQUIPMENT PARAMETER LOADING TABLES 7-7 THROUGH 7-20

7.3.1 Column 1 - "MEAS ID/FTNOTE".

The measurement ID consists of seven characters: two letters followed by a four digit number and one letter. Additional parameter information may be referenced by using a slash (/) followed by a table footnote number.

A. Module Code.

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

- A - adapter
- B - hooster
- C - command module
- D - docking module
- L - launch escape tower
- S - service module.

B. Functional Subsystem Code.

The second character, a letter, denotes the subsystem wherein the measurement originates according to the following 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 - communication 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, a letter, 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 (0 to 5 VDC).
- 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:

2	2	A	1
			Channel code number*.
			A - analog, high level (0 to 5 VDC).
			D - 8-bits digital parallel.
			DS - digital, serial.
			E - event.
			Number of zeros following first digit in HBR sample rate.
			First digit in HBR sample rate.

* 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.

7.3.5 Column 5 - "HBR FR-WD".

This column, consisting of a two digit number, a hyphen, and a three digit number, 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 low hit rate parameter 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 conditioned within a particular system using that systems' power and will be indicated by "SYS".
- 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, CB 1.

V2 - CM ESS INST BUS PWR FROM RHEB PNL 276, CB 2.

V3S - SM ESS INST BUS PWR FROM RHEB PNL 276, CB 3.

V4S - SM ESS INST BUS PWR FROM RHEB PNL 276, CB 4.

VSC - SCE PWR REQUIRED FOR SIGNAL CONDITIONING (+20, -20, and/or +10 VDC).

VIDMA - DM INST BUS PWR FROM DM PNL 815, CB INSTRUMENTATION DM A.

VIDMB - DM INST BUS PWR FROM DM PNL 815, CB INSTRUMENTATION DM B.

7.3.9 Column 9 - "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. Parameters displayed in the docking module will be listed in the DM column. Parameters displayed in the command module will be listed in the CM column.

(An acronym followed by an * means the parameter is displayed on the appropriate vehicle 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.

7.3.10 Column 10 - "SIG DIST".

The following acronyms indicate common circuit characteristics of the PCM parameters being displayed to the crew. Unless otherwise stated, the SIG DIST characteristic will apply to both DM and CM display columns.

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

7.3.11 Column 11 - "CSH DWG".

This column will reference the CSM Systems Handbook drawing for system information.

CSM
SC 111
PCN 1

TABLE 7-7 CSM PCM TELEMETRY (51.2 KBPS) - STRUCTURES.

<u>MEAS ID</u> <u>/FTNOTE</u>	<u>MEAS DESCRIPTION</u>	<u>TM</u>	<u>CHAN</u> <u>CODE</u>	<u>HBR</u> <u>FR-WD</u>	<u>LBR</u> <u>WD</u>	<u>LO</u>	<u>DATA RANGE</u> <u>HI</u>	<u>UNITS</u>	<u>INST</u> <u>BUS</u>	<u>O/B</u> <u>DM</u>	<u>DISPL</u> <u>CM</u>	<u>SIG</u> <u>DIST</u>	<u>CSH</u> <u>DWG</u>
CA1820T	SIDE HS SURF LOC 1A TEMP	H1	10A65	22-084	--	-260	+830	DEG F	V2	--	--	--	
CA1821T	SIDE HS SURF LOC 4A TEMP	H1	10A70	24-052	--	-260	+830	DEG F	V2	--	--	--	
CA1822T	SIDE HS SURF LOC 7A TEMP	H1	10A74	25-084	--	-260	+830	DEG F	V2	--	--	--	
CA1823T	SIDE HS SURF LOC 10A TEMP	H1	10A79	27-052	--	-260	+830	DEG F	V2	--	--	--	

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TABLE 7-8 CSM PCM TELEMETRY (51.2 KBPS) - ELECTRICAL POWER.

MEAS ID /FTNOTE	MEAS DESCRIPTION	TM	CHAN CODE	HBR FR-WD	LBR WD	LO	DATA RANGE HI	UNITS	INST BUS	O/B DM	DISPL CM	SIG DIST	CSH DWG
SC0030Q	H2 TK 1 QTY	H2	10A141	47-116	056	0	100	PCT	SYS	--	M	CS	5.2
SC0031Q	H2 TK 2 QTY	H2	10A144	48-116	096	0	100	PCT	SYS	--	M	CS	5.2
SC0032Q	O2 TK 1 QTY	H2	10A147	49-116	136	0	100	PCT	SYS	--	M	CS	5.2
SC0033Q	O2 TK 2 QTY	H2	10A42	14-116	139	0	100	PCT	SYS	--	M	CS	5.2
SC0037P	O2 TK 1 PRESS	H2	10A150	50-116	176	50	1050	PSIA	V4S	--	SM*	CS	5.2
SC0038P	O2 TK 2 PRESS	H2	10A66	22-116	077	50	1050	PSIA	V3S	--	M*	CS	5.2
SC0039P	H2 TK 1 PRESS	H2	10A36	12-116	059	0	350	PSIA	V4S	--	M*	CS	5.2
SC0040P	H2 TK 2 PRESS	H2	10A39	13-116	099	0	350	PSIA	V3S	--	M*	CS	5.2
SC0041T	O2 TK 1 TEMP	H1	10A38	13-084	--	-325	+80	DEG F	SYS	--	--	--	5.2
SC0042T	O2 TK 2 TEMP	H1	10A50	17-084	--	-325	+80	DEG F	SYS	--	--	--	5.2
SC0043T	H2 TK 1 TEMP	H1	11A26	01-091	--	-425	-200	DEG F	SYS	--	--	--	5.2
SC0044T	H2 TK 2 TEMP	H1	10A62	21-084	--	-425	-200	DEG F	SYS	--	--	--	5.2
SC0070T	O2 TK 1 HTR TEMP	H2	10A108	36-116	040	-300	+600	DEG F	SYS	--	SM	CS	5.2
SC0071T	O2 TK 2 HTR TEMP	H2	10A111	37-116	080	-300	+600	DEG F	SYS	--	SM	CS	5.2
CC0175T	INVERTER 1 TEMP	H1	10A86	29-084	--	32	248	DEG F	VSC	--	L*	CS	3.3
CC0176T	INVERTER 2 TEMP	H1	10A88	30-052	--	32	248	DEG F	VSC	--	L*	CS	3.3
CC0177T	INVERTER 3 TEMP	H1	10A89	30-084	--	32	248	DEG F	VSC	--	L*	CS	3.3
CC0200V	AC BUS 1 PH A VOLTS	H2	11A147	05-011	063	0	150	VAC	VSC	--	SM*	TSC	3.3
CC0203V	AC BUS 2 PH A VOLTS	H2	11A56	02-074	146	0	150	VAC	VSC	--	SM*	TSC	3.3
CC0206V	MAIN BUS A VOLTS	H2	11A57	02-075	147	0	45	VDC	VSC	--	SM*	TSC	3.2
CC0207V	MAIN BUS B VOLTS	H2	11A58	02-076	148	0	45	VDC	VSC	--	SM*	TSC	3.2
CC0210V	BAT BUS A VOLTS	H2	11A91	03-073	165	0	45	VDC	VSC	--	SM	TSC	3.2
CC0211V	BAT BUS B VOLTS	H2	11A93	03-075	167	0	45	VDC	VSC	--	SM	TSC	3.2
CC0215C	BAT CHGR CURRENT	H2	11A73	03-009	025	0	5	AMPS	VSC	--	SM	TSC	3.2
CC0222C	BAT A CURRENT	H2	11A74	03-010	026	0	100	AMPS	VSC	--	SM	TSC	3.2
CC0223C	BAT B CURRENT	H2	11A109	04-009	045	0	100	AMPS	VSC	--	SM	TSC	3.2
CC0224C	BAT C CURRENT	H2	11A110	04-010	046	0	100	AMPS	VSC	--	SM	TSC	3.2
CC0232V	BAT RELAY BUS VOLTS	H2	11A75	03-011	027	0	45	VOLTS	VSC	--	SM	CS	3.2
SC2066P	FC 1 O2 PRESS	H1	11A67	02-108	--	0	75	PSIA	V4S	--	SM	CS	5.3
SC2067P	FC 2 O2 PRESS	H1	11A68	02-113	--	0	75	PSIA	V3S	--	SM	CS	5.3
SC2068P	FC 3 O2 PRESS	H1	11A69	02-121	--	0	75	PSIA	V3S	--	SM	CS	5.3
SC2069P	FC 1 H2 PRESS	H1	11A70	02-122	--	0	75	PSIA	V4S	--	SM	CS	5.3
SC2070P	FC 2 H2 PRESS	H1	11A71	02-123	--	0	75	PSIA	V3S	--	SM	CS	5.3
SC2071P	FC 3 H2 PRESS	H1	11A72	02-124	--	0	75	PSIA	V3S	--	SM	CS	5.3

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TABLE 7-8 CSM PCM TELEMETRY (51.2 KBPS) - ELECTRICAL POWER (CONCLUDED)

MEAS ID /FTNOTE	MEAS DESCRIPTION	TM	CHAN CODE	HBR FR-WD	LBR WD	LO	DATA RANGE HI	UNITS	INST BUS	O/B DM	DISPL CM	SIG DIST	CSH DWG
SC2081T	FC 1 COND EXH TEMP	H2	10A51	17-116	060	145	250	DEG F	VSC	--	SM*	CS	5.3
SC2082T	FC 2 COND EXH TEMP	H2	10123	41-116	015	145	250	DEG F	VSC	--	SM*	CS	5.3
SC2083T	FC 3 COND EXH TEMP	H2	10A69	23-116	117	145	250	DEG F	VSC	--	SM*	CS	5.3
SC2084T	FC 1 SKIN TEMP	H2	10A72	24-116	157	80	550	DEG F	VSC	--	SM*	CS	5.3
SC2085T	FC 2 SKIN TEMP	H2	10A75	25-116	197	80	550	DEG F	VSC	--	SM*	CS	5.3
SC2086T	FC 3 SKIN TEMP	H2	10A78	26-116	038	80	550	DEG F	VSC	--	SM*	CS	5.3
SC2087T	FC 1 RAD OUT TEMP	H2	10A126	42-116	055	-50	+300	DEG F	V4S	--	SMB*	CS	5.3
SC2088T	FC 2 RAD OUT TEMP	H2	10A129	43-116	095	-50	+300	DEG F	V3S	--	SMB*	CS	5.3
SC2089T	FC 3 RAD OUT TEMP	H2	10A132	44-116	135	-50	+300	DEG F	V3S	--	SMB*	CS	5.3
SC2090T	FC 1 RAD IN TEMP	H1	10A130	44-052	--	-50	+300	DEG F	V4S	--	--	--	5.3
SC2091T	FC 2 RAD IN TEMP	H1	10A131	44-084	--	-50	+300	DEG F	V3S	--	--	--	5.3
SC2092T	FC 3 RAD IN TEMP	H1	10A67	23-052	--	-50	+300	DEG F	V3S	--	--	--	5.3
SC2113C	FC 1 CUR	H2	11A76	03-012	028	0	100	AMPS	VSC	--	SM	TSC	3.2
SC2114C	FC 2 CUR	H2	11A84	03-043	103	0	100	AMPS	VSC	--	SM	TSC	3.2
SC2115C	FC 3 CUR	H2	11A85	03-044	104	0	100	AMPS	VSC	--	SM	TSC	3.2
SC2139R	FC 1 H2 FLOW	H1	11A77	03-017	--	0	0.2	LB/HR	V4S	--	SM*	CS	5.3
SC2140R	FC 2 H2 FLOW	H1	11A78	03-025	--	0	0.2	LB/HR	V3S	--	SM*	CS	5.3
SC2141R	FC 3 H2 FLOW	H1	11A79	03-026	--	0	0.2	LB/HR	V3S	--	SM*	CS	5.3
SC2142R	FC 1 O2 FLOW	H1	11A80	03-027	--	0	1.6	LB/HR	V4S	--	SM*	CS	5.3
SC2143R	FC 2 O2 FLOW	H1	11A81	03-028	--	0	1.6	LB/HR	V3S	--	SM*	CS	5.3
SC2144R	FC 3 O2 FLOW	H1	11A82	03-041	--	0	1.6	LB/HR	V3S	--	SM*	CS	5.3
SC2160X	FC 1 ph	E2	11E28-1	05-066	102	NORM	HIGH	EVENT	SYS	--	STB*	CS	5.3
SC2161X	FC 2 ph	E2	11E28-2	05-066	102	NORM	HIGH	EVENT	SYS	--	STB*	CS	5.3
SC2162X	FC 3 ph	E2	11E28-3	05-066	102	NORM	HIGH	EVENT	SYS	--	STB*	CS	5.3

TABLE 7-9 CSM PCM TELEMETRY (51.2 KBPS) - MASTER EVENTS SEQUENCE CONTROLLER

MEAS ID /FTNOTE	MEAS DESCRIPTION	TM	CHAN CODE	HBR FR-WD	LBR WD	LO	DATA RANGE HI	UNITS	INST BUS	O/B DM	DISPL CM	SIG DIST	CSH DWG
CD0005V	PYRO BUS A VOLTS	H1	11A9	01-028	--	0	40	VDC	SYS	--	--	--	2.2
CD0006V	PYRO BUS B VOLTS	H1	11A5	01-017	--	0	40	VDC	SYS	--	--	--	2.2
CD0023X	CM-SM SEP RELAY A	E2	11E22-1	04-067	195		SEP	EVENT	SYS	--	--	--	2.4
CD0024X	CM-SM SEP RELAY B	E2	11E23-1	04-068	196		SEP	EVENT	SYS	--	--	--	2.4
CD0123X	SLA SEP RELAY A	E2	11E22-5	04-067	195		SEP	EVENT	SYS	--	--	--	2.4
CD0124X	SLA SEP RELAY B	E2	11E23-7	04-068	196		SEP	EVENT	SYS	--	--	--	2.4
CD0130X	CREW ABORT A	E2	11E13-3	03-065	115		ABORT	EVENT	SYS	--	--	--	2.3
CD0131X	CREW ABORT B	E2	11E13-6	03-065	115		ABORT	EVENT	SYS	--	--	--	2.3
CD0132X	EDS ABORT VOTE 1	E2	11E14-1	03-066	116	VOTE/OFF ARM		EVENT	SYS	--	--	--	2.3
CD0133X	EDS ABORT VOTE 2	E2	11E14-2	03-066	116	VOTE/OFF ARM		EVENT	SYS	--	--	--	2.3
CD0134X	EDS ABORT VOTE 3	E2	11E14-4	03-066	116	VOTE/OFF ARM		EVENT	SYS	--	--	--	2.3
CD0135X	EDS ABORT A	E2	11E13-7	03-065	115		ABORT	EVENT	SYS	--	--	--	2.3
CD0136X	EDS ABORT B	E2	11E13-4	03-065	115		ABORT	EVENT	SYS	--	--	--	2.3
CD0170X	AUTO RCS ACTIVATE SIG A	E2	11E22-3	04-067	195		ACT	EVENT	SYS	--	--	--	2.4
CD0171X	AUTO RCS ACTIVATE SIG B	E2	11E23-3	04-068	196		ACT	EVENT	SYS	--	--	--	2.4
CD0173X	CM RCS PRESS SIG A	E2	11E22-7	04-067	195		PRESS	EVENT	SYS	--	--	--	2.4
CD0174X	CM RCS PRESS SIG B	E2	11E23-5	04-068	196		PRESS	EVENT	SYS	--	--	--	2.4
CD0200V	LOGIC BUS A VOLTS	H1	11A8	01-027	--	0	40	VDC	SYS	--	--	--	2.2
CD0201V	LOGIC BUS B VOLTS	H1	11A6	01-025	--	0	40	VDC	SYS	--	--	--	2.2
CD0230X	FWD HS JET A	E2	11E24-1	04-097	043		JETT	EVENT	SYS	--	--	--	2.5
CD0231X	FWD HS JET B	E2	11E26-5	04-099	081		JETT	EVENT	SYS	--	--	--	2.5
CD1154X	DOCK RING SEP RELAY A	E2	11E15-6	03-067	141		SEP	EVENT	SYS	--	--	--	2.7
CD1155X	DOCK RING SEP RELAY B	E2	11E15-7	03-067	141		SEP	EVENT	SYS	--	--	--	2.7

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TABLE 7-10 CSM PCM TELEMETRY (51.2 KBPS) - EARTH LANDING SEQUENCE CONTROLLER

MEAS ID /FTNOTE	MEAS DESCRIPTION	TM	CHAN CODE	HDR PR-UD	LDR UD	LO	DATA RANGE HI	UNITS	INST BUS	O/B DM	DISPL CM	SIG DIST	CSH DUG
CE0001X	DROGUE DEP RELAY A	E2	11E29-1	05-067	155		DEPLOY	EVENT	V2	--	--	--	2.5
CE0002X	DROGUE DEP RELAY B	E2	11E30-6	05-068	163		DEPLOY	EVENT	V2	--	--	--	2.5
CE0003X	MAIN DEPLOY RFLAY A	E2	11E29-8	05-067	155		DEPLOY	EVENT	V2	--	--	--	2.5
CE0004X	MAIN DEPLOY RELAY B	E2	11E30-3	05-068	163		DEPLOY	EVENT	V2	--	--	--	2.5
CE0321X	MAIN CHUTE DISC RELAY A	E2	11E29-5	05-067	155		DISC	EVENT	V2	--	--	--	2.5
CE0322X	MAIN CHUTE DISC RELAY B	E2	11E30-8	05-068	163		DISC	EVENT	V2	--	--	--	2.5

TABLE 7-11 CSM PCM TELEMETRY (51.2 KIPS) - ENVIRONMENTAL CONTROL.

MEAS ID /FTNOTE	MEAS DESCRIPTION	TM	CHAN CODE	HBR FR-WD	LBR WD	LO	DATA RANGE HI	UNITS	INST BUS	C/B DM	DISPL CM	SIG DIST	CSH DNG
CF0001P	CABIN PRESS	H2	10A6	02-116	057	0	17	PSIA	SYS	--	M	CS	4.2
CF0002T	CABIN TEMP	H1	10A128	43-084	--	40	125	DEG F	SYS	--	M	CS	4.3
CF0003P	SUIT-CABIN DELTA PRESS	H1	11A37	02-009	--	-5	+5	IN H2O	V2	--	M	CS	4.2
CF0005P	CO2 PARTIAL PRESS	H1	11A15	01-057	--	0	30	MM HG	SYS	--	M*	SS	4.2
CF0006P	SURGE TANK PRESS	H2	11A4	01-012	008	50	1050	PSIA	V2	--	SM	CS	4.2
CF0008T	SUIT AIR HX OUT TEMP	H1	11A17	01-059	--	20	95	DEG F	SYS	--	M	CS	4.2
CF0009Q	WASTE H2O QTY	H2	10A9	03-116	097	0	100	PCT	SYS	--	SM	CS	4.5
CF0010Q	POTABLE H2O QTY	H1	10A103	35-052	--	0	100	PCT	SYS	--	SM	CS	4.5
CF0012P	SUIT MANF ABS PRESS	H2	11A1	01-009	005	0	17	PSIA	SYS	--	M	CS	4.2
CF0015P	SUIT COMP DELTA P	H2	11A2	01-010	006	0	1	PSID	SYS	--	M*	CS	4.2
CF0016P	GLY PUMP OUT PRESS	H2	11A3	01-011	007	0	60	PSIG	SYS	--	SM	CS	4.3
CF0017T	GLY EVAP OUT STEAM TEMP	H1	10A133	45-052	--	20	95	DEG F	SYS	--	--	--	4.3
CF0018T	GLY EVAP OUT TEMP	H2	10A12	04-116	137	25	75	DEG F	SYS	--	SM	CS	4.3
CF0019Q	GLY ACCUM QTY	H1	11A7	01-026	--	0	100	PCT	SYS	--	SM	CS	4.3
CF0020T	ECS RAD OUT TEMP	H2	10A15	05-116	177	-50	+100	DEG F	SYS	--	M*	CS	4.3
CF0034P	GLY EVAP BACK PRESS	H1	10A4	02-052	--	0.05	0.25	PSIA	SYS	--	SM	CS	4.3
CF0035R	ECS O2 FLOW O2 SUPPLY MANF	H2	10A114	38-116	120	0.2	1.0	LB/HR	SYS	--	M*	CS	4.2
CF0036P	O2 SUPPLY MANF PRESS	H2	11A55	02-073	145	0	150	PSIG	SYS	--	--	--	4.2
CF0070P	SEC GLY PUMP OUT PRESS	H2	11A157	05-044	128	0	60	PSIG	SYS	--	SM	CS	4.4
CF0071T	SEC EVAP OUT LIQ TEMP	H2	11A118	04-041	105	25	75	DEG F	SYS	--	SM	CS	4.4
CF0072Q	SEC GLY ACCUM QUANTITY	H1	11A44	02-027	--	0	100	PCT	SYS	--	SM	CS	4.4
CF0073P	SEC EVAP OUT STEAM PRESS	H1	10A8	03-084	--	0.05	0.25	PSIA	SYS	--	SM	CS	4.4
CF0120P	H2O TANK - GLY RES PRESS	H1	10A101	34-084	--	0	50	PSIA	V2	--	--	--	4.2
CF0157R	PRI GLYCOL FLOW RATE	H1	11A87	03-057	--	100	300	LB/HR	V2	--	--	--	4.3
CF0181T	PRI EVAP INLET TEMP	H1	10A100	34-052	--	35	100	DEG F	V2	--	--	--	4.3
SF0260T	PRI RAD IN TEMP	H2	10A48	16-116	020	55	120	DEG F	SYS	--	SM	CS	4.3
SF0262T	SEC RAD IN TEMP	H1	11A19	01-073	--	55	120	DEG F	SYS	--	SM	CS	4.4
SF0263T	SEC RAD OUT TEMP	H1	10A5	02-084	--	30	70	DEG F	SYS	--	M	CS	4.4
SF0266X	RAD FLOW CONT SYS 1 OR 2	E2	11E4-8	01-098	041	OFF/1	SYS 2	EVENT	VSC	--	TB	TSC	4.3
CF0460T	URINE DUMP NOZZLE TEMP	H1	11A14	01-049	--	0	100	DEG F	V2	--	--	--	4.5
CF0461T	H2O DUMP TEMP	H1	10A82	28-052	--	0	100	DEG F	V1	--	--	--	4.5
DF9602T	DM CABIN INNER WALL TEMP 1	H2	10A105	35-116	199	0	150	DEG F	VIDMA	--	--	--	4.6
DF9603T	DM CABIN INNER WALL TEMP 2	H2	10A54	18-116	100	0	150	DEG F	VIDMA	--	--	--	4.6
DF9605P	DM CABIN PRESS	H2	11A154	05-041	125	0	880	MM HG	VIDMA	M	SM	CS	4.6
DF9615P	DM SYS A O2 PARTIAL PRESS	H2	10A3	01-116	017	0	500	MM HG	VIDMA	M*	SM	CS	4.6
DF9616P	DM SYS B O2 PARTIAL PRESS	H2	10A60	20-116	180	0	500	MM HG	VIDMB	M*	SM	CS	4.6
DF9632Q	DM SYS A O2 TK 1 QTY	H2	10A45	15-116	179	0	100	PCT	VIDMA	--	SM	CS	4.6
DF9637Q	DM SYS A O2 TK 2 QTY	H2	11A119	04-042	106	0	100	PCT	VIDMA	--	SM	CS	4.6
DF9652Q	DM SYS A N2 TK 1 QTY	H2	10A87	29-116	158	0	100	PCT	VIDMA	--	SM	CS	4.6
DF9657Q	DM SYS A N2 TK 2 QTY	H2	11A148	05-012	064	0	100	PCT	VIDMA	--	SM	CS	4.6

TABLE 7-12 CSM PCM TELEMETRY (51.2 KBPS) - GUIDANCE AND NAVIGATION

MEAS ID /FTNOTE	MEAS DESCRIPTION	TM	CHAN CODE	HBR FR-WD	LBR WD	LO	DATA RANGE HI	UNITS	INST BUS	O/B DM	DISPL CM	SIG DIST	CSH DWG
CG0001V	CPTR DIG DATA-40 BITS	S2	51DS1	01-032	009	--	--	--	SYS	--	--	--	8.1
CG1040V	PIPA +120 VDC	H1	10A83	28-084	--	85	135	VDC	SYS	--	--	--	8.4
CG1110V	TM BIAS 2.5 VDC	H1	10A95	32-084	--	0	5	VDC	SYS	--	--	--	8.4
CG1201V	IMU 28 VAC 800 HZ	H1	10A91	31-052	--	0	31.1	VRMS	SYS	--	--	--	8.4
CG1331V	3.2 KHZ 28V SUPPLY	H1	10A85	29-052	--	0	31.1	VRMS	SYS	--	--	--	8.4
CG1513X	IMU HTR +28 VDC	E2	11E15-2	03-067	141	OFF	STDBY	EVENT	SYS	--	--	--	8.4
CG1523X	CMC OPERATE +28 VDC	E2	11E15-3	03-067	141	OFF	OPER	EVENT	SYS	--	--	--	8.4
CG1533X	OPTX OPERATE 28 VAC	E2	11E15-4	03-067	141	OFF	OPER	EVENT	SYS	--	--	--	8.4
CG2112V	IG 1X RSVR OUT SIN	H1	11A54	02-060	--	-50/230	+50/130	DEG	SYS	--	--	--	8.5
CG2113V	IG 1X RSVR OUT COS	H1	11A59	02-081	--	130/230	50/310	DEG	SYS	--	--	--	8.5
CG2117V	IGA SERVO ERR IN PHASE	H1	12A2	01-014	--	-3	+3	VRMS	SYS	--	--	--	8.5
CG2142V	MG 1X RSVR OUT SIN	H1	11A60	02-089	--	-50/230	+50/130	DEG	SYS	--	--	--	8.5
CG2143V	MG 1X RSVR OUT COS	H1	11A61	02-090	--	130/230	50/310	DEG	SYS	--	--	--	8.5
CG2147V	MGA SERVO ERR IN PHASE	H1	12A1	01-013	--	-3	+3	VRMS	SYS	--	--	--	8.5
CG2172V	OG 1X RSVR OUT SIN	H1	11A62	02-091	--	-50/230	+50/130	DEG	SYS	--	--	--	8.5
CG2173V	OG 1X RSVR OUT COS	H1	11A63	02-092	--	130/230	50/310	DEG	SYS	--	--	--	8.5
CG2177V	OGA SERVO ERR IN PHASE	H1	12A3	01-015	--	-3	+3	VRMS	SYS	--	--	--	8.5
CG2300T	PIPA TEMP	H2	10A96	32-116	079	120	140	DEG F	SYS	--	--	--	8.5
CG3721V	SHAFT CDU DAC OUT	H1	11A52	02-058	--	-10	+10	VRMS	SYS	--	--	--	8.9
CG3722V	TRUNNION CDU OUT	H1	11A53	02-059	--	-10	+10	VRMS	SYS	--	--	--	8.9
CG5040X	CMC WARNING	E2	11E19-1	03-099	162	WARN		EVENT	SYS	--	L*	SS	8.6

TABLE 7-13 CSM PCM TELEMETRY (51.2 KBPS) - STABILIZATION AND CONTROL SYSTEM

MEAS ID /FTNOTE	MEAS DESCRIPTION	TM	CHAN CODE	HBR FR-WD	LBR WD	DATA RANGE LO HI	UNITS	INST BUS	O/B DM	DISPL CM	SIG DIST	CSH DWG
CH3500H	PITCH ATT ERR	H1	51A5	01-062	--	-5/15 +5/15	DEG	SYS	--	M	TSC	8.8
CH3501H	YAW ATT ERR	H1	51A6	01-063	--	-5/15 +5/15	DEG	SYS	--	M	TSC	8.8
CH3502H	ROLL ATT ERR	H1	12A4	01-016	--	-5/12.5 +5/12.5 -20/50 +20/50	DEG	SYS	--	M	TSC	8.8
CH3503R	SCS PITCH BODY RATE	H1	12A5	01-021	--	-1/5/10 +1/5/10	DEG/S	SYS	--	M	TSC	8.8
CH3504R	SCS YAW BODY RATE	H1	12A6	01-022	--	-1/5/10 +1/5/10	DEG/S	SYS	--	M	TSC	8.8
CH3505R	SCS ROLL BODY RATE	H1	12A7	01-023	--	-1/5/50 +1/5/50	DEG/S	SYS	--	M	TSC	8.8
CH3517H	PITCH GMBL POS 1 OR 2	H1	12A8	01-024	--	-5 +5	DEG	SYS	--	M	TSC	8.9
CH3518H	YAW GMBL POS 1 OR 2	H1	12A10	01-046	--	-5 +5	DEG	SYS	--	M	TSC	8.9
CH3546X	+PITCH/+X ENG	E1	22E1-1	01-018	--	FIRE/OFF ARM	EVENT	SYS	--	--	--	8.10
CH3547X	-PITCH/+X ENG	E1	22E2-2	01-018	--	FIRE/OFF ARM	EVENT	SYS	--	--	--	8.10
CH3548X	+PITCH/-X ENG	E1	22E3-3	01-018	--	FIRE/OFF ARM	EVENT	SYS	--	--	--	8.10
CH3549X	-PITCH/-X ENG	E1	22E4-4	01-018	--	FIRE/OFF ARM	EVENT	SYS	--	--	--	8.10
CH3550X	+YAW/+X ENG	E1	22E5-5	01-018	--	FIRE/OFF ARM	EVENT	SYS	--	--	--	8.10
CH3551X	-YAW/+X ENG	E1	22E6-6	01-018	--	FIRE/OFF ARM	EVENT	SYS	--	--	--	8.10
CH3552X	+YAW/-X ENG	E1	22E7-7	01-018	--	FIRE/OFF ARM	EVENT	SYS	--	--	--	8.10
CH3553X	-YAW/-X ENG	E1	22E8-8	01-018	--	FIRE/OFF ARM	EVENT	SYS	--	--	--	8.10
CH3554X	+ROLL/+Z ENG	E1	22E9-1	01-019	--	FIRE/OFF ARM	EVENT	SYS	--	--	--	8.10
CH3555X	-ROLL/+Z ENG	E1	22E13-5	01-019	--	FIRE/OFF ARM	EVENT	SYS	--	--	--	8.10
CH3556X	+ROLL/-Z ENG	E1	22E14-6	01-019	--	FIRE/OFF ARM	EVENT	SYS	--	--	--	8.10
CH3557X	-ROLL/-Z ENG	E1	22E10-2	01-019	--	FIRE/OFF ARM	EVENT	SYS	--	--	--	8.10
CH3558X	+ROLL/+Y ENG	E1	22E15-7	01-019	--	FIRE/OFF ARM	EVENT	SYS	--	--	--	8.10
CH3559X	-ROLL/+Y ENG	E1	22E11-3	01-019	--	FIRE/OFF ARM	EVENT	SYS	--	--	--	8.10
CH3560X	+ROLL/-Y ENG	E1	22E12-4	01-019	--	FIRE/OFF ARM	EVENT	SYS	--	--	--	8.10
CH3561X	-ROLL/-Y ENG	E1	22E16-8	01-019	--	FIRE/OFF ARM	EVENT	SYS	--	--	--	8.10
CH3574X	TRANS CNTL +X CMD	E2	11E22-4	04-067	195	OFF ON	EVENT	SYS	--	--	--	8.10
CH3575X	TRANS CNTL -X CMD	E2	11E22-6	04-067	195	OFF ON	EVENT	SYS	--	--	--	8.10
CH3576X	TRANS CNTL +Y CMD	E2	11E22-8	04-067	195	OFF ON	EVENT	SYS	--	--	--	8.10
CH3577X	TRANS CNTL -Y CMD	E2	11E23-6	04-068	196	OFF ON	EVENT	SYS	--	--	--	8.10
CH3578X	TRANS CNTL +Z CMD	E2	11E23-8	04-068	196	OFF ON	EVENT	SYS	--	--	--	8.10
CH3579X	TRANS CNTL -Z CMD	E2	11E24-2	04-097	043	OFF ON	EVENT	SYS	--	--	--	8.10
CH3582V	SCS TVC PITCH AUTO CMD	H1	12A15	01-055	--	+10 -10	VDC	SYS	--	--	--	8.9
CH3583V	SCS TVC YAW AUTO CMD	H1	12A13	01-053	--	+10 -10	VDC	SYS	--	--	--	8.9
CH3585H	MTVC PITCH CMD	H1	51A11	01-096	--	-11.5 +11.5	DEG	SYS	--	--	--	8.9
CH3586H	MTVC YAW CMD	H1	51A12	01-125	--	-11.5 +11.5	DEG	SYS	--	--	--	8.9
CH3587H	ROT ROLL CMD	H1	51A13	01-126	--	-11.5 +11.5	DEG	SYS	--	--	--	8.9

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TABLE 7-13 CSM PCM TELEMETRY (51.2 KBPS) - STABILIZATION AND CONTROL SYSTEM (CONCLUDED).

MEAS ID /FTNOTE	MEAS DESCRIPTION	TM	CHAN CODE	HER FR-WD	LER WD	LO	DATA RANGE HI	UNITS	INST BUS	O/B DM	DISPL CM	SIG DIST	CSH DWG
CH3588X	ATT DEADBAND MIN	E2	11E8-2	02-067	075	MAX	MIN	EVENT	SYS	--	--	--	8.9A
CH3590X	HI RATE LIMIT	E2	11E8-4	02-067	075	LOW	HIGH	EVENT	SYS	--	--	--	8.9A
CH3592X	FDAL ERR 5, RATE 5	E2	11E8-5	02-067	075	OFF	ON	EVENT	SYS	--	--	--	8.8A
CH3593X	FDAL SCALE ERR 50/15	E2	11E8-6	02-067	075	OFF	ON	EVENT	SYS	--	--	--	8.8A
CH3600X	ATVC GAIN	E2	11E9-3	02-068	076	HIGH	LOW	EVENT	SYS	--	--	--	8.9A
CH3601X	DIRECT RCS NO. 1	E2	11E24-3	04-097	043	OFF	ENABLE	EVENT	SYS	--	--	--	8.7
CH3602X	DIRECT RCS NO. 2	E2	11E24-4	04-097	043	OFF	ENABLE	EVENT	SYS	--	--	--	8.7
CH3604X	SPS SOL DRIVER 1	E2	11E4-4	01-098	041	FIRE/OFF	ARM	EVENT	SYS	--	--	--	8.9
CH3605X	SPS SOL DRIVER 2	E2	11E9-4	02-068	076	FIRE/OFF	ARM	EVENT	SYS	--	--	--	8.9
CH3606X	LIMIT CYCLE SWITCH	E2	11E25-1	04-098	044	ON	OFF	EVENT	SYS	--	--	--	8.9A
CH3607X	S/C CNTL SCS	E2	11E9-5	02-068	076	CMC	SCS	EVENT	SYS	--	--	--	8.9
CH3609X	MANUAL ROLL ACCEL CMD	E2	11E25-7	04-098	044	OFF	ON	EVENT	SYS	--	--	--	8.9A
CH3610X	MANUAL ROLL MIN IMP CMD	E2	11E25-8	04-098	044	OFF	ON	EVENT	SYS	--	--	--	8.9A
CH3612X	MANUAL PITCH ACCEL CMD	E2	11E25-3	04-098	044	OFF	ON	EVENT	SYS	--	--	--	8.9A
CH3613X	MANUAL PITCH MIN IMP CMD	E2	11E25-4	04-098	044	OFF	ON	EVENT	SYS	--	--	--	8.9A
CH3615X	MANUAL YAW ACCEL CMD	E2	11E25-5	04-098	044	OFF	ON	EVENT	SYS	--	--	--	8.9A
CH3616X	MANUAL YAW MIN IMP CMD	E2	11E25-6	04-098	044	OFF	ON	EVENT	SYS	--	--	--	8.9A
CH3623X	GYRO 1 COMB SMRD	E2	11E8-7	02-067	075	LOW	NORM	EVENT	SYS	--	--	--	8.9
CH3624X	GYRO 2 COMB SMRD	E2	11E8-7	02-067	075	LOW	NORM	EVENT	SYS	--	--	--	8.9
CH3635X	BMAG MODE SW-ROLL ATT 1 RT 2	E1	11E33-1	05-099	--	OFF	ON	EVENT	VSC	--	--	--	8.9A
CH3636X	BMAG MODE SW-ROLL RATE 2	E1	11E33-2	05-099	--	OFF	ON	EVENT	VSC	--	--	--	8.9A
CH3638X	BMAG MODE SW-PITCH ATT 1 RT 2	E1	11E33-3	05-099	--	OFF	ON	EVENT	VSC	--	--	--	8.9A
CH3639X	BMAG MODE SW-PITCH RATE 2	E1	11E33-4	05-099	--	OFF	ON	EVENT	VSC	--	--	--	8.9A
CH3641X	BMAG MODE SW-YAW ATT 1 RT 2	E1	11E33-5	05-099	--	OFF	ON	EVENT	VSC	--	--	--	8.9A
CH3642X	BMAG MODE SW-YAW RATE 2	E1	11E33-6	05-099	--	OFF	ON	EVENT	VSC	--	--	--	8.9A
CH3666C	PITCH DIFF CLUTCH CURRENT	H1	22A4	01-003	--	-0.807	+0.807	AMP	SYS	--	--	--	8.9
CH3667C	YAW DIFF CLUTCH CURRENT	H1	12A16	01-056	--	-0.807	+0.807	AMP	SYS	--	--	--	8.9

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TABLE 7-14 CSM PCM TELEMETRY (51.2 KBPS) - CREW EQUIPMENT

<u>MEAS ID</u> <u>/FTNOTE</u>	<u>MEAS DESCRIPTION</u>	<u>TM</u>	<u>CHAN</u> <u>CODE</u>	<u>HR</u> <u>FR-WD</u>	<u>LDR</u> <u>WD</u>	<u>LO</u>	<u>DATA RANGE</u> <u>HI</u>	<u>UNITS</u>	<u>INST</u> <u>BUS</u>	<u>O/B</u> <u>DM</u>	<u>DISPL</u> <u>CM</u>	<u>SIG</u> <u>DIST</u>	<u>CSH</u> <u>DWG</u>
CJ0060J	ASTRO 1 EKG AXIS 1	H1	22A3	01-007	--	0.1	5	MY	V2	--	--	--	
CJ0061J	ASTRO 2 EKG AXIS 1	H1	22A1	01-005	--	0.1	5	TV	V2	--	--	--	
CJ0062J	ASTRO 3 EKG AXIS 1	H1	22A2	01-006	--	0.1	5	MV	V2	--	--	--	
CJ0200R	ASTRO 1 RESPIR	H1	51A7	01-064	--	-5	+5	OHMS	V2	--	--	--	
CJ0201R	ASTRO 2 RESPIR	H1	51A8	01-093	--	-5	+5	OHMS	V2	--	--	--	
CJ0202R	ASTRO 3 RESPIR	H1	51A9	01-094	--	-5	+5	OHMS	V2	--	--	--	

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TABLE 7-15 CSM PCM TELEMETRY (51.2 KBPS) - FLIGHT TECHNOLOGY.

<u>MEAS ID</u> <u>/FTNOTE</u>	<u>MEAS DESCRIPTION</u>	<u>TM</u>	<u>CHAN</u> <u>CODE</u>	<u>HBR</u> <u>FR-WD</u>	<u>LER</u> <u>WD</u>	<u>LO</u>	<u>DATA RANGE</u> <u>HI</u>	<u>UNITS</u>	<u>INST</u> <u>BUS</u>	<u>O/B</u> <u>DM</u>	<u>DISPL</u> <u>CM</u>	<u>SIG</u> <u>DIST</u>	<u>CSH</u> <u>DWG</u>
CK0026A	CM X AXIS ACCEL	H1	12A9	01-045	--	-2	+10	G	V2	--	--	--	
CK0027A	CM Y AXIS ACCEL	H1	12A11	01-047	--	-2	+2	G	V2	--	--	--	
CK0028A	CM -Z AXIS ACCEL	H1	12A12	01-048	--	-2	+2	G	V2	--	--	--	
CK1040X/1	16MM DAC SHUTTER OPEN	H1	51A3 AND 51A10	01-031	--		OPEN	EVENT	SYS	--	--	--	
CK1043X/1	70MM CAMERA SHUTTER OPEN	H1	51A3 AND 51A10	01-031	--		OPEN	EVENT	SYS	--	--	--	

1. Two 50 s/s channels are supercommutated to provide 100 s/s of the time shared parameters CK1040X and CK1043X.

TABLE 7-16 CSM PCM TELEMETRY (51.2 KBPS) - SCIENTIFIC EQUIPMENT.

MEAS ID /FTNOTE	MEAS DESCRIPTION	TM	CHAN CODE	HBR FR-WD	LBR WD	DATA RANGE LO HI	UNITS	INST BUS	O/B DM	DISPL CM	SIG DIST	CSH DWG
SL1003U	SCI EXP 3	H1	10A104	35-084	--	PROVISIONED FOR						
SL1004U	SCI EXP 4	H1	10A106	36-052	--	PROVISIONED FOR						
SL1005U	SCI EXP 5	H1	10A107	36-084	--	PROVISIONED FOR						
SL1006U	SCI EXP 6	H1	10A109	37-052	--	PROVISIONED FOR						
SL1007U	SCI EXP 7	H1	10A110	37-084	--	PROVISIONED FOR						
SL1008U	SCI EXP 8	H1	10A112	38-052	--	PROVISIONED FOR						
SL1009U	SCI EXP 9	H1	10A113	38-084	--	PROVISIONED FOR						
SL1010U	SCI EXP 10	H1	10A115	39-052	--	PROVISIONED FOR						
SL1011U	SCI EXP 11	H1	10A116	39-084	--	PROVISIONED FOR						
SL1012U	SCI EXP 12	H1	10A118	40-052	--	PROVISIONED FOR						
SL1013U	SCI EXP 13	H1	10A119	40-084	--	PROVISIONED FOR						
SL1014U	SCI EXP 14	H1	10A121	41-052	--	PROVISIONED FOR						
SL1015U	SCI EXP 15	H1	10A122	41-084	--	PROVISIONED FOR						
SL1016U	SCI EXP 16	D2	11D16	03-068	142	PROVISIONED FOR						
SL1017U	SCI EXP 17	D2	11D3	01-097	035	PROVISIONED FOR						
SL1018U	SCI EXP 18	D2	11D5	01-099	042	PROVISIONED FOR						
SL1021U	SCI EXP 21	D2	11D10	02-097	082	PROVISIONED FOR						
SL1022U	SCI EXP 22	D2	11D11	02-098	083	PROVISIONED FOR						
SL1023U	SCI EXP 23	D2	11D12	02-099	084	PROVISIONED FOR						
DL9601T/1	MEFS HOT 1	H1	11A174	05-107	--	0 1200	DEG C	SYS	--	--	--	
DL9602T/1	MEFS COLD 1	H1	11A175	05-108	--	0 200	DEG C	SYS	--	--	--	P-1
SL9606V	EUVT DAC REGISTER	H1	11A99	03-092	--	0 5	VDC	SYS	--	--	--	
SL9607C	EUVT SYSTEM CURRENT	H1	11A100	03-105	--	0 1	AMP	SYS	--	--	--	
SL9608K	EUVT NO. 1 DETECTOR	H1	11A97	03-090	--	1 100K	C/SEC	SYS	--	--	--	
SL9609K	EUVT NO. 2 DETECTOR	H1	11A98	03-091	--	1 100K	C/SEC	SYS	--	--	--	
SL9610P	He GLOW DETECTOR TANK PRESS	H1	11A101	03-106	--	0 1200	PSIG	SYS	--	--	--	
SL9611T	He GLOW TEMP	H1	11A102	03-107	--	0 150	DEG F	SYS	--	--	--	
SL9612P	He GLOW FILTER CELL 1 PRESS	H1	11A103	03-108	--	.1 10	TORR	SYS	--	--	--	
SL9613C	He GLOW SYSTEM CURRENT	H1	11A104	03-113	--	0 .18	AMP	SYS	--	--	--	
SL9614P	He GLOW FILTER CELL 2 PRESS	H1	11A113	04-017	--	.1 10	TORR	SYS	--	--	--	P-1
SL9615K	He GLOW DETECTOR 1 RATE	H1	11A105	03-121	--	1 100K	C/SEC	SYS	--	--	--	
SL9616K	He GLOW DETECTOR 2 RATE	H1	11A106	03-122	--	1 100K	C/SEC	SYS	--	--	--	
SL9617K	He GLOW DETECTOR 3 RATE	H1	11A107	03-123	--	1 100K	C/SEC	SYS	--	--	--	
SL9618K	He GLOW DETECTOR 4 RATE	H1	11A108	03-124	--	1 100K	C/SEC	SYS	--	--	--	

1. DL9687T and DL9688T can be inflight selected to replace DL9601T and DL9602T respectively.

TABLE 7-16 CSM PCM TELEMETRY (51.2 KBPS) - SCIENTIFIC EQUIPMENT (CONTINUED).

MEAS ID /FTNOTE	MEAS DESCRIPTION	TM	CHAN CODE	HBR FR-WD	LBR WD	LO	DATA RANGE HI	UNITS	INST BUS	O/B DM	DISPL CM	SIG DIST	CSH DWG
DL9630T	UVA HOUSING TEMP	H1	11A36	01-124	--	-40	+180	DEG F	SYS	--	--	--	
DL9631H	UVA POINTING ERROR	H1	11A41	02-017	--	-1.5	+1.5	DEG	SYS	SM	--	SS	
DL9632V	UVA PMT HIGH VOLTAGE	H1	11A42	02-025	--	0	4000	VDC	SYS	--	--	--	
DL9633V	UVA REGULATED VOLTAGE	H1	11A83	03-042	--	0	10	VDC	SYS	--	--	--	
DL9634T	UVA NITROGEN LAMP TEMP	H1	11A86	03-049	--				SYS	--	--	--	
DL9635T	UVA STAR TRKR BRIGHTNESS	H1	11A88	03-058	--	-4	+3	MAGN	SYS	--	--	--	
DL9636T	UVA OXYGEN LAMP TEMP	H1	11A89	03-059	--	0	300	DEG C	SYS	--	--	--	
DL9637U	UVA NITROGEN LAMP INTENSITY	H1	11A90	03-060	--	0	150	PCT	SYS	--	--	--	
DL9638U	UVA VISIBLE LAMP INTENSITY	H1	11A95	03-081	--	0	150	PCT	SYS	--	--	--	
DL9639U	UVA OXYGEN LAMP INTENSITY	H1	11A96	03-089	--	0	150	PCT	SYS	--	--	--	
DL9640C	UVA CONV 1 CURRENT	H1	11A177	05-121	--	0	4	AMPS	SYS	--	--	--	
DL9641C	UVA CONV 2 CURRENT	H1	11A178	05-122	--	0	2	AMPS	SYS	--	--	--	
DL9642X	UVA BIT 1 (LSB)	E2	11E20-1	04-065	181	OFF	ON	EVENT	SYS	--	--	--	
DL9643X	UVA BIT 2	E2	11E20-2	04-065	181	OFF	ON	EVENT	SYS	--	--	--	
DL9644X	UVA BIT 3	E2	11E20-3	04-065	181	OFF	ON	EVENT	SYS	--	--	--	
DL9645X	UVA BIT 4	E2	11E20-4	04-065	181	OFF	ON	EVENT	SYS	--	--	--	
DL9646X	UVA BIT 5	E2	11E20-5	04-065	181	OFF	ON	EVENT	SYS	--	--	--	
DL9647X	UVA BIT 6	E2	11E20-6	04-065	181	OFF	ON	EVENT	SYS	--	--	--	
DL9648X	UVA BIT 7	E2	11E20-7	04-065	181	OFF	ON	EVENT	SYS	--	--	--	
DL9649X	UVA BIT 8	E2	11E20-8	04-065	181	OFF	ON	EVENT	SYS	--	--	--	
DL9650X	UVA BIT 9	E2	11E21-1	04-066	182	OFF	ON	EVENT	SYS	--	--	--	
DL9651X	UVA BIT 10	E2	11E21-2	04-066	182	OFF	ON	EVENT	SYS	--	--	--	
DL9652X	UVA BIT 11	E2	11E21-3	04-066	182	OFF	ON	EVENT	SYS	--	--	--	
DL9653X	UVA BIT 12	E2	11E21-4	04-066	182	OFF	ON	EVENT	SYS	--	--	--	
DL9654X	UVA BIT 13	E2	11E21-5	04-066	182	OFF	ON	EVENT	SYS	--	--	--	
DL9655X	UVA BIT 14	E2	11E21-6	04-066	182	OFF	ON	EVENT	SYS	--	--	--	
DL9656X	UVA BIT 15	E2	11E21-7	04-066	182	OFF	ON	EVENT	SYS	--	--	--	
DL9657X	UVA BIT 16 (MSB)	E2	11E21-8	04-066	182	OFF	ON	EVENT	SYS	--	--	--	
SL9658X	DPLR TRKING RCVR LOCK	E2	11E13-1	03-065	115	OFF	ON	EVENT	SYS	--	SM	CS	
SL9659X	DPLR TRKING FRAME COUNT	E2	11E13-8	03-065	115	OFF	ON	EVENT	SYS	--	--	--	
SL9670R	X-RAY DATA RATE	H1	11A125	04-059	--	0	5K	CTS/S	SYS	--	--	--	
SL9671R	X-RAY BACKGROUND RATE	H1	11A126	04-060	--	0	10K	CTS/S	SYS	--	--	--	
SL9672R	X-RAY COINCIDENT RATE	H1	11A127	04-073	--	0	10K	CTS/S	SYS	--	--	--	
SL9673R	X-RAY HI VOLT MONITOR	H1	11A128	04-074	--	0	4000	VDC	SYS	--	--	--	
SL9674V	X-RAY P.S. +5 VDC	H1	11A131	04-081	--	0	10	VDC	SYS	--	--	--	
SL9675V	X-RAY P.S. +15 VDC	H1	11A132	04-089	--	0	30	VDC	SYS	--	--	--	
SL9676V	X-RAY GAS EMERGENCY MONITOR	H1	11A134	04-091	--	0	5	VDC	SYS	--	--	--	
SL9680P	X-RAY TANK PRESS	H1	11A135	04-092	--	0	5000	PSIA	SYS	--	--	--	

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TABLE 7-16 CSM PCM TELEMETRY (51.2 KBPS) - SCIENTIFIC EQUIPMENT (CONCLUDED).

MEAS ID /FTRNOTE	MEAS DESCRIPTION	TM	CHAN CODE	HFR FR-WD	LBR WD	LO	DATA RANGE HI	UNITS	INST BUS	O/B DM	DISPL CM	SIG DIST	CSH DWC
SL9681P	X-RAY DETECTOR PRESS	H1	11A137	04-106	--	0	25	PSIA	SYS	--	--	--	
SL9683T	X-RAY BOTTOM BASE TEMP	H1	11A139	04-108	--	-40	+70	DEG C	SYS	--	--	--	
SL9684T	X-RAY TOP RTNR BTM BASE DIFF T	H1	11A140	04-113	--	-20	+20	DEG C	SYS	--	--	--	
SL9685K	X-RAY SPECTRAL DATA	H1	51A15	01-128	--	INTERNALLY PROGRAMMED			SYS	--	--	--	
DL9687T/1	MEFS HOT 2	H1	11A174	05-107	--	0	1200	DEG C	SYS	--	--	--	
DL9688T/1	MEFS COLD 2	H1	11A175	05-108	--	0	200	DEG C	SYS	--	--	--	
SL9780X	X-RAY DOOR POS. 1	E2	11E24-7	04-097	043	OFF	ON	EVENT	SYS	--	--	--	
SL9781X	X-RAY DOOR POS. 2	E2	11E24-8	04-097	043	OFF	ON	EVENT	SYS	--	--	--	
SL9782X	EUVT DOOR POS. 1	E2	11E30-4	05-068	163	OFF	ON	EVENT	SYS	--	--	--	
SL9783X	EUVT DOOR POS. 2	E2	11E30-5	05-068	163	OFF	ON	EVENT	SYS	--	--	--	
SL9784X	He GLOW DOOR POS. 1	E2	11E26-4	04-099	081	OFF	ON	EVENT	SYS	--	--	--	
SL9785X	He GLOW DOOR POS. 2	E2	11E26-6	04-099	081	OFF	ON	EVENT	SYS	--	--	--	
CL9790U	SAM-LIGHT INTENSITY - 12 BITS	D2	11E6-5 THRU 11E7-8	02-065 02-066	061 062	0	1200	DEG C	SYS	--	--	--	

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1. DL9687T and DL9688T can be inflight selected to replace DL9601T and DL9602T respectively.

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TABLE 7-17 CSM PCM TELEMETRY (51.2 KEPS) - SERVICE PROPUSSION.

MEAS ID /FTNOTE	MEAS DESCRIPTION	TH	CHAM CODE	HPR FR-WD	LRR WD	LO	DATA RANGE HI	UNITS	INST BUS	O/B DM	DISPL CM	SIG DIST	CSH DWG
SP0001P	He TK PRESS	H2	11A10	01-041	065	0	5K	PSIA	V3S	--	M	SS	9.1
SP0003P	OX TK PRESS	H2	11A11	01-042	066	0	250	PSIA	V3S	--	M*	CS	9.1
SP0006P	FU TK PRESS	H2	11A12	01-043	067	0	250	PSIA	V4S	--	M*	CS	9.1
SP0022H	FU/OX VLV 1 POS	H1	11A31	01-108	--	0	90	DFG	V3S	--	M	SS	9.1
SP0023H	FU/OX VLV 2 POS	H1	11A32	01-113	--	0	90	DFG	V4S	--	M	SS	9.1
SP0024H	FU/OX VLV 3 POS	H1	11A33	01-121	--	0	90	DEG	V3S	--	M	SS	9.1
SP0025H	FU/OX VLV 4 POS	H1	11A34	01-122	--	0	90	DEG	V4S	--	M	SS	9.1
SP0045T	ENG VLV BODY TEMP	H1	10A37	13-052	--	0	200	DEG F	V4S	--	--	--	9.1
SP0048T	ENG FU FEED LINE TEMP	H2	10A117	39-116	160	0	200	DEG F	V3S	--	M	--	9.1
SP0049T	ENG OX FEED LINE TEMP	H2	10A120	40-116	200	0	200	DEG F	V4S	--	SM	CS	9.1
SP0054T	OX LINE 1 TEMP	H1	10A44	15-084	--	0	200	DEG F	V3S	--	--	--	9.1
SP0055T	OX SUMP TK SURF TEMP	H1	10A61	21-052	--	0	150	DEG F	V3S	--	--	--	9.1
SP0056T	FU SUMP TK SURF TEMP	H1	10A68	23-084	--	0	150	DEG F	V3S	--	--	--	9.1
SP0057T	FU LINE 1 TEMP	H1	10A59	20-084	--	0	200	DEG F	V4S	--	--	--	9.1
SP0062T	ENG INJECTOR FLANGE TEMP 2	H1	10A49	17-052	--	0	600	DEG F	VSC	--	--	--	9.1
SP0600P	ENG VLV ACT PRESS N2A	H1	10A10	04-052	--	0	5K	PSIA	V3S	--	M	CS	9.1
SP0601P	ENG VLV ACT PRESS N2B	H1	10A11	04-084	--	0	5K	PSIA	V4S	--	M	CS	9.1
SP0661P	ENG CHAMBER PRESS	H1	12A14	01-054	--	0	150	PSIA	V3S	--	M	CS	9.1
SP0930P	FU SM/ENG INTERFACE PRESS	H1	11A152	05-027	--	0	300	PSIA	V3S	--	--	--	9.1
SP0931P	OX SM/ENG INTERFACE PRESS	H1	11A161	05-059	--	0	300	PSIA	V4S	--	--	--	9.1
SP9007Q/1	OX SUMP TANK QTY - AUX	H1	10A26	09-084	--	0	100	PCT	SYS	--	--	--	
SP9008Q/1	OX SUMP TANK QTY - PRI	H1	10A28	10-052	--	0	60	PCT	SYS	--	--	--	
SP9009Q/1	FU SUMP TANK QTY - AUX	H1	10A29	10-084	--	0	100	PCT	SYS	--	--	--	
SP9010Q/1	FU SUMP TANK QTY - PRI	H1	10A31	11-052	--	0	60	PCT	SYS	--	--	--	
SP9014T	OX SUMP TK OUTBOARD TEMP	H1	10A137	46-084	--	0	150	DEG F	V4S	--	--	--	9.1
SP9017T	SPS He PRESS PANEL TEMP	H2	10A93	31-116	039	0	200	DEG F	V4S	--	SM	CS	9.1
SP9027T	SPS He TK UPPER SURF TEMP	H1	10A92	31-084	--	-100	+200	DEG F	V4S	--	--	--	9.1

1. Used for ground propellant loading. Not available during flight.

TABLE 7-18 CSM PCM TELEMETRY (51.2 KBPS) - REACTION CONTROL.

MEAS ID /FTNOTE	MEAS DESCRIPTION	TM	CHAN CODE	HBR FR-WD	LBR WD	LO	DATA RANGE HI	UNITS	INST BUS	O/B DM	DISPL CM	SIG DIST	CSH DMG
CR0001P	CM He TK 1 PRESS	H2	11A155	05-042	126	0	5K	PSIA	V1	--	SM	CS	10.3
CR0002P	CM He TK 2 PRESS	H2	11A156	05-043	127	0	5K	PSIA	V2	--	SM	CS	10.3
CR0003T	CM He TK 1 TEMP	H2	10A18	06-116	018	0	300	DEG F	V1	--	SM	CS	10.3
CR0004T	CM He TK 2 TEMP	H2	10A21	07-116	058	0	300	DEG F	V2	--	SM	CS	10.3
CR0035P	CM He MANF 1 PRESS	H2	11A21	01-075	143	0	400	PSIA	V1	--	SM*	SS	10.3
CR0036P	CM He MANF 2 PRESS	H2	11A22	01-076	144	0	400	PSIA	V2	--	SM*	SS	10.3
SR5001P	SM He TK A PRESS	H2	11A163	05-073	185	0	5K	PSIA	V3S	--	SM	CS	10.1
SR5002P	SM He TK B PRESS	H2	11A164	05-074	186	0	5K	PSIA	V4S	--	SM	CS	10.1
SR5003P	SM He TK C PRESS	H2	11A165	05-075	187	0	5K	PSIA	V3S	--	SM	CS	10.1
SR5004P	SM He TK D PRESS	H2	11A166	05-076	188	0	5K	PSIA	V4S	--	SM	CS	10.1
SR5013T	SM He TK A TEMP	H2	10A24	08-116	098	0	150	DEG F	V3S	--	SM	CS	10.1
SR5014T	SM He TK B TEMP	H2	10A27	09-116	138	0	150	DEG F	V4S	--	SM	CS	10.1
SR5015T	SM He TK C TEMP	H2	10A30	10-116	178	0	150	DEG F	V3S	--	SM	CS	10.1
SR5016T	SM He TK D TEMP	H2	10A33	11-116	019	0	150	DEG F	V4S	--	SM	CS	10.1
SR5025Q	SM RCS A PROP QTY	H1	10A73	25-052	--	0	100	PCT	V3S	--	SM	CS	10.1
SR5026Q	SM RCS B PROP QTY	H1	10A76	26-052	--	0	100	PCT	V4S	--	SM	CS	10.1
SR5027Q	SM RCS C PROP QTY	H1	10A71	24-084	--	0	100	PCT	V3S	--	SM	CS	10.1
SR5028Q	SM RCS D PROP QTY	H1	10A77	26-084	--	0	100	PCT	V4S	--	SM	CS	10.1
SR5065T	SM ENG PKG A TEMP	H1	10A136	46-052	--	0	300	DEG F	V3S	--	SM*	CS	10.1
SR5066T	SM ENG PKG B TEMP	H1	10A17	06-084	--	0	300	DEG F	V4S	--	SM*	CS	10.1
SR5067T	SM ENG PKG C TEMP	H1	10A19	07-052	--	0	300	DEG F	V3S	--	SM*	CS	10.1
SR5068T	SM ENG PKG D TEMP	H1	10A20	07-084	--	0	300	DEG F	V4S	--	SM*	CS	10.1
SR5073T	SM PRI FU TK A OUT SURF TEMP	H1	10A1	01-052	--	0	150	DEG F	V3S	--	--	--	10.1
SR5074T	SM PRI FU TK B OUT SURF TEMP	H1	10A2	01-084	--	0	150	DEG F	V4S	--	--	--	10.1
SR5075T	SM PRI FU TK C OUT SURF TEMP	H1	10A16	06-052	--	0	150	DEG F	V3S	--	--	--	10.1
SR5076T	SM PRI FU TK D OUT SURF TEMP	H1	10A32	11-084	--	0	150	DEG F	V4S	--	--	--	10.1
SR5729P	SM He MANF A PRESS	H1	11A23	01-081	--	0	400	PSIA	V3S	--	--	--	10.1
SR5733P	SM OX MANF A PRESS	H2	11A39	02-011	023	0	300	PSIA	V3S	--	--	--	10.1
SR5737P	SM FU MANF A PRESS	H2	11A92	03-074	166	0	400	PSIA	V3S	--	SM*	CS	10.1
SR5776P	SM He MANF B PRESS	H1	11A24	01-089	--	0	400	PSIA	V4S	--	--	--	10.1
SR5780P	SM OX MANF B PRESS	H2	11A40	02-012	024	0	300	PSIA	V4S	--	--	--	10.1
SR5784P	SM FU MANF B PRESS	H2	11A94	03-076	168	0	400	PSIA	V4S	--	SM*	CS	10.1
SR5817P	SM He MANF C PRESS	H1	11A27	01-092	--	0	400	PSIA	V3S	--	--	--	10.1
SR5820P	SM OX MANF C PRESS	H2	11A46	02-041	085	0	300	PSIA	V3S	--	--	--	10.1
SR5821P	SM OX MANF D PRESS	H2	11A130	04-076	184	0	300	PSIA	V4S	--	--	--	10.1

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TABLE 7-18 CSM PCM TELEMETRY (51.2 KEPS) - REACTION CONTROL (CONCLUDED)

MEAS ID /FTICOTE	MEAS DESCRIPTION	TM	CHAN CODE	HFR FR-WD	LPP WD	LO	DATA RANGE RT	UNITS	INST BUS	O/B DISPL DM CM	SIG DIST	CSH DUG
SR5822P	SM FU MANIF C PRESS	H2	11A111	04-011	047	0	400	PSIA	V3S	-- SM*	CS	10.1
SR5823P	SM FU MANIF D PRESS	H2	11A112	04-012	048	0	400	PSIA	V4S	-- SM*	CS	10.1
SR5830P	SM He MANIF D PRESS	H1	11A28	01-105	--	0	400	PSIA	V4S	-- --	--	10.1
SR9216T	PSM QD A FEED LINE BRKT TEMP	H2	10A94	28-116	118	0	150	DEG F	V3S	-- --	--	10.1
SR9316T	PSM QD B FEED LINE BRKT TEMP	H2	10A99	33-116	119	0	150	DEG F	V4S	-- --	--	10.1
SR9416T	PSM QD C FEED LINE BRKT TEMP	H2	10A102	34-116	159	0	150	DEG F	V3S	-- --	--	10.1
SR9516T	PSM QD D FEED LINE BRKT TEMP	H2	10A135	45-116	175	0	150	DEG F	V4S	-- --	--	10.1
SR9801Q	PSM 1 PROP QTY	H1	10A23	08-084	--	0	100	PCT	V3S	-- SM	CS	10.2
SR9802T	PSM 1 He TK TEMP	H1	10A25	09-052	--	-50	+150	DEG F	V3S	-- SM	CS	10.2
SR9804P	PSM 1 He TK PRESS	H2	11A47	02-042	036	0	5K	PSIA	V3S	-- SM	CS	10.2
SR9806P	PSM 1 OX TK PRESS	H2	11A49	02-044	088	0	400	PSIA	V3S	-- --	--	10.2
SR9807P	PSM 1 FU TK PRESS	H2	11A120	04-043	107	0	400	PSIA	V3S	-- SM*	CS	10.2
SR9808T	PSM 1 OX TK TEMP	H1	10A34	12-052	--	0	150	DEG F	V3S	-- --	--	10.2
SR9809T	PSM 1 FU TK TEMP	H1	10A35	12-084	--	0	150	DEG F	V3S	-- --	--	10.2

TABLE 7-19 CSM PCM TELEMETRY (51.2 KBPS) - CREW SAFETY.

MPAS ID /FTNOTE	MEAS DESCRIPTION	TM	CHAN CODE	HER FR-WD	LER WD	LO	DATA RANGE HI	UNITS	INST BUS	O/B DM	DISPL CM	SIG DIST	CSH DWG
BS0080X	EDS ABORT REQUEST A	E2	11E4-5	01-098	041		ABORT	EVENT	VSC	--	L	TSC	2.3
BS0081X	EDS ABORT REQUEST B	E2	11E4-3	01-098	041		ABORT	EVENT	VSC	--	L	TSC	2.3
CS0150X	CM MASTER CAUTION WARNING	E2	11E4-6	01-098	041	WARN/OFF	NORM	EVENT	VSC	--	L*	TSC	7.3
CS0220T	DOCKING PROBE TEMP	H1	10A22	08-052	--	-100	+300	DEG F	V1	--	--	--	2.7
DS9601X	DS GUIDE RING EXTD A	E2	11E28-4	05-066	102		EXTD	EVENT	SYS	--	L	CS	2.8
DS9602X	DS GUIDE RING EXTD B	E2	11E28-5	05-066	102		EXTD	EVENT	SYS	--	L	CS	2.8
DS9605X	DS BODY/RING PASSIVE A	E2	11E28-6	05-066	102		CL/RETR	EVENT	SYS	--	L	CS	2.8
DS9606X	DS BODY/RING PASSIVE B	E2	11E28-7	05-066	102		CL/RETR	EVENT	SYS	--	L	CS	2.8
DS9610X	DS GUIDE RING CAPT LTCH A	E2	11E28-8	05-066	102		LATCH	EVENT	SYS	--	L	CS	2.8
DS9611X	DS GUIDE RING CAPT LTCH B	E2	11E29-2	05-067	155		LATCH	EVENT	SYS	--	L	CS	2.8
DS9615X	DS STRUCT RING CONTACT A	E2	11E29-3	05-067	155		CONT	EVENT	SYS	--	L	CS	2.8
DS9616X	DS STRUCT RING CONTACT B	E2	11E29-4	05-067	155		CONT	EVENT	SYS	--	L	CS	2.8
DS9620X	DS STRUCT LATCHES OPEN A	E2	11E29-6	05-067	155		OPEN	EVENT	SYS	--	L	CS	2.8
DS9621X	DS STRUCT LATCHES OPEN B	E2	11E29-7	05-067	155		OPEN	EVENT	SYS	--	L	CS	2.8
DS9625X	DS STRUCT LATCHES CLOSED A	E2	11E30-1	05-068	163		CLOSED	EVENT	SYS	--	L	CS	2.8
DS9626X	DS STRUCT LATCHES CLOSED B	E2	11E30-2	05-068	163		CLOSED	EVENT	SYS	--	L	CS	2.8
DS9630T	DS TEMP 1	H2	10A57	19-116	140	-150	+250	DEG F	VIDMB	--	--	--	2.8
DS9631T	DS TEMP 2	H2	10A63	21-116	037	-150	+250	DEG F	VIDMB	--	--	--	2.8
DS9632T	DS TEMP 3	H2	10A138	46-116	016	-150	+250	DEG F	VIDMB	--	--	--	2.8

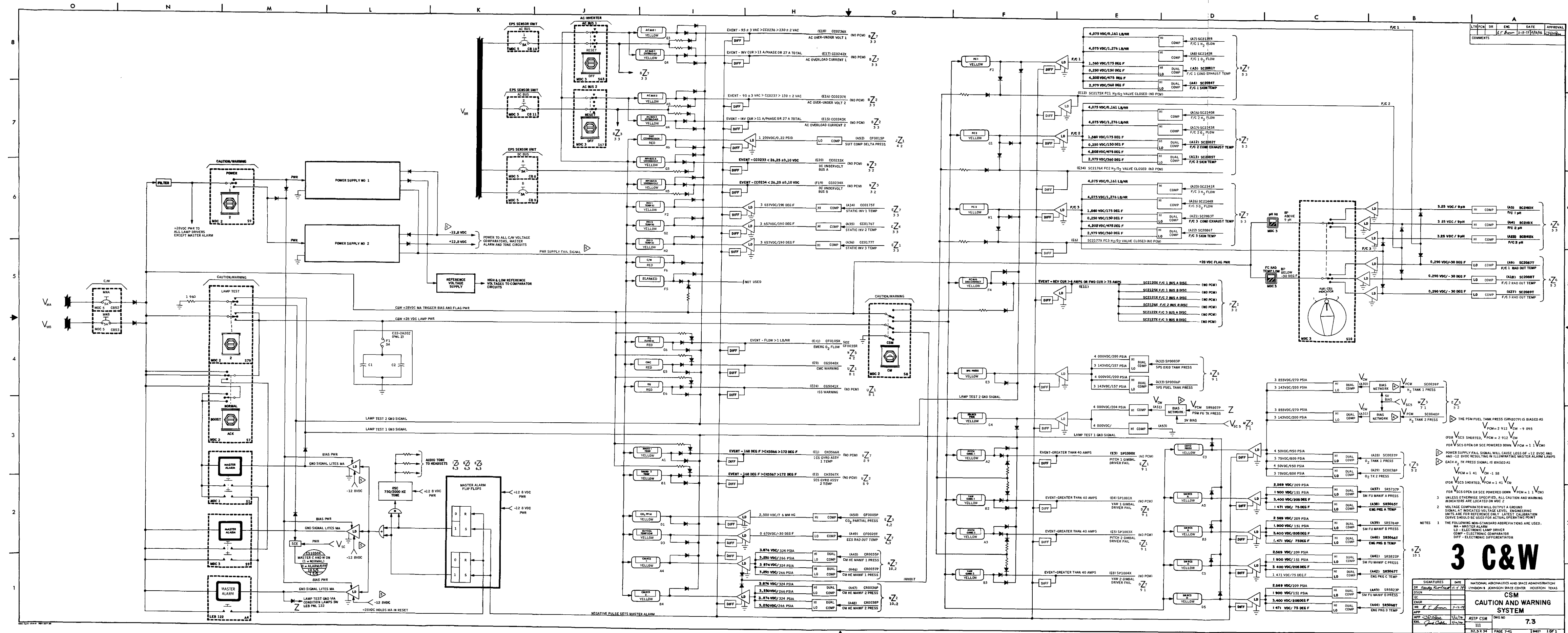
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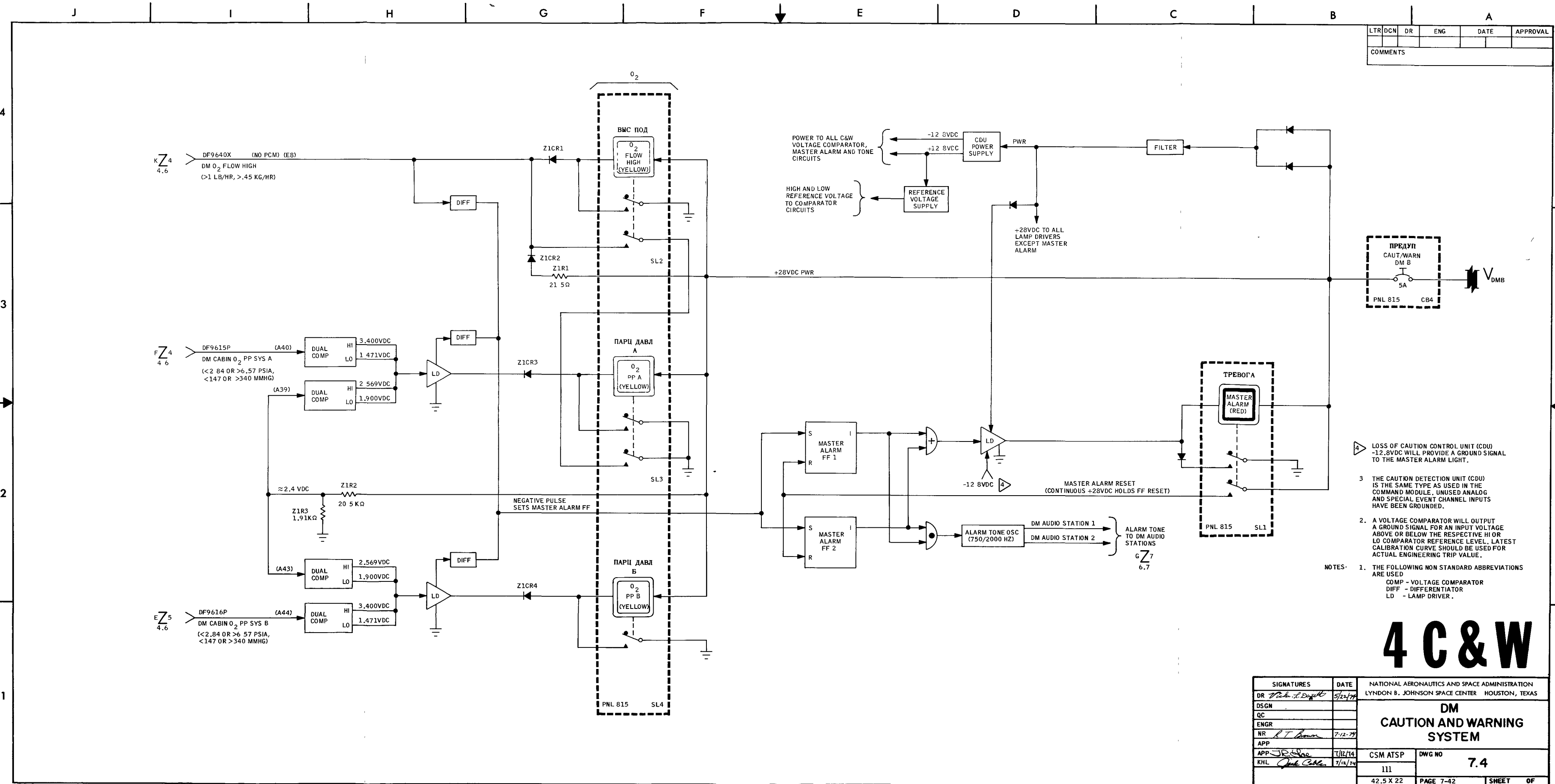
TABLE 7-20 CSM PCM TELEMETRY (51.2 KEPS) - COMMUNICATION AND INSTRUMENTATION.

MEAS ID /FTNOTE	MEAS DESCRIPTION	TM	CHAN CODE	HR FR-WD	LBR WD	LO	DATA RANGE HI	UNITS	INST BUS	O/B DM	DISPL CM	SIG DIST	CSH DWC
CT0012X	DSE TAPE MOTION	E2	11E14-5	03-066	116	OFF	MOTION	EVENT	SYS	--	TB	SS	7.1
CT0015V	SCE POS SUPPLY VOLTS	H1	11A29	01-106	--	0	22	VDC	SYS	--	--	--	7.1
CT0016V	SCE NEG SUPPLY VOLTS	H1	11A30	01-107	--	0	-22	VDC	SYS	--	--	--	7.1
CT0017V	SENSOR EXCITATION 5 VOLTS	H1	11A179	05-123	--	0	5.5	VDC	SYS	--	--	--	7.1
CT0018V	SENSOR EXCITATION 10 VOLTS	H1	11A45	02-028	--	0	11	VDC	SYS	--	--	--	7.1
CT0120X	PCM BIT RATE CHANGE - 8 BITS	D2	10D1	01-020	021	231	146	OCTAL	SYS	--	--	--	7.1
CT0125V	PCM HI LEVEL 85 PCT REF	H2	10A81	27-116	078	0	5	VDC	SYS	--	--	--	7.1
CT0126V	PCM HI LEVEL 15 PCT REF	H1	11A35	01-123	--	0	1	VDC	SYS	--	--	--	7.1
CT0145F	CTE TIME - 32 BITS	D2	11D2	01-065	121	--	--	--	SYS	--	--	--	7.1
ST0152H	HGA PITCH POSITION	H2	11A13	01-044	068	+90	-90	DEG	SYS	--	M	CS	6.8
ST0153H	HGA YAW POSITION	H2	11A129	04-075	183	0	360	DEG	SYS	--	M	CS	6.8
ST0161X	HGA BEAMWIDTH SW - NAR	E2	11E26-1	04-099	081	--	NARROW	EVENT	SYS	--	--	--	6.8
ST0163X	HGA TRACK SW - AUTO	E2	11E26-2	04-099	081	--	AUTO	EVENT	SYS	--	--	--	6.8
ST0164X	HGA TRACK SW - REACQ	E2	11E26-3	04-099	081	--	REACQ	EVENT	SYS	--	--	--	6.8
CT0262V	UDL VALIDITY - 4 BITS	D2	51D2	01-100	014	--	--	--	SYS	--	--	--	6.5
CT0340X	PCM SYNC	E1	11E32-8	05-098	--	INT	EXT	EVENT	SYS	--	--	--	7.1
CT0620E	USB RCVR AGC VOLTAGE	H2	11A121	04-044	108	-130	-50	DBM	SYS	--	M	CS	6.2
CT0640F	USB RCVR PHASE ERR	H1	11A50	02-049	--	-90	+90	KHZ	SYS	--	--	--	6.2
CT0645X	USB OMNI ANT A SELECTED	E2	11E9-1	02-068	076	OFF	ON	EVENT	SYS	--	--	--	6.2
CT0646X	USB OMNI ANT B SELECTED	E2	11E9-2	02-068	076	ON	OFF	EVENT	SYS	--	--	--	6.2
CT0647X	USB OMNI ANT C SELECTED	E2	11E9-7	02-068	076	OFF	ON	EVENT	SYS	--	--	--	6.2
CT0648X	USB OMNI ANT D SELECTED	E2	11E9-8	02-068	076	OFF	ON	EVENT	SYS	--	--	--	6.2
CT9625U	VTR TAPE FOOTAGE - 14 BITS	D2	11E17-3 THRU 11E18-8	03-097 03-098	156 161	1	1800	FOET	SYS	--	M	TSC	6.9
CT9626T	VTR TRANSPORT UNIT TEMP	H1	10A14	05-084	--	-22	+158	DEG F	SYS	--	--	--	6.9
CT9627T	VTR ELECTRONICS UNIT TEMP	H1	10A13	05-052	--	-22	+158	DEG F	SYS	--	--	--	6.9
ST9630T	ATS-F PWR AMPL NO. 1 TEMP	H1	11A133	04-090	--	-50	+250	DEG F	V3S	--	--	--	6.8
ST9631T	ATS-F PWR AMPL NO. 2 TEMP	H1	11A150	05-025	--	-50	+250	DEG F	V3S	--	--	--	6.8
ST9632X	ATS-F PWR AMPL NO. 1 ON	E2	11E26-7	04-099	081	OFF	ON	EVENT	V3S	--	--	--	6.8
ST9633X	ATS-F PWR AMPL NO. 2 ON	E2	11E26-8	04-099	081	OFF	ON	EVENT	V3S	--	--	--	6.8
CT9634V	ATS-F S-BAND RCVR AGC	H2	11A48	02-043	087	-130	-50	DBM	SYS	--	M	CS	6.8
CT9635T	ATS-F S-BAND RCVR BASE TEMP	H1	11A25	01-090	--	32	248	DEG F	SYS	--	--	--	6.8

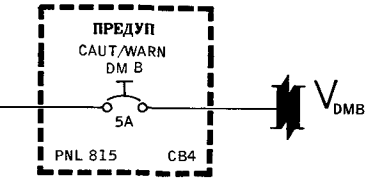
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LTR/DCN	DR	ENG	DATE	APPROVAL
COMMENTS				



- 4 LOSS OF CAUTION CONTROL UNIT (CDU) -12.8VDC WILL PROVIDE A GROUND SIGNAL TO THE MASTER ALARM LIGHT.
- 3 THE CAUTION DETECTION UNIT (CDU) IS THE SAME TYPE AS USED IN THE COMMAND MODULE. UNUSED ANALOG AND SPECIAL EVENT CHANNEL INPUTS HAVE BEEN GROUNDING.
- 2 A VOLTAGE COMPARATOR WILL OUTPUT A GROUND SIGNAL FOR AN INPUT VOLTAGE ABOVE OR BELOW THE RESPECTIVE HI OR LO COMPARATOR REFERENCE LEVEL. LATEST CALIBRATION CURVE SHOULD BE USED FOR ACTUAL ENGINEERING TRIP VALUE.

- NOTES:
1. THE FOLLOWING NON STANDARD ABBREVIATIONS ARE USED
COMP - VOLTAGE COMPARATOR
DIFF - DIFFERENTIATOR
LD - LAMP DRIVER.

4 C & W

SIGNATURES		DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION	
DR	<i>John L. Dwyer</i>	5/24/77	LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS	
DCN				
ENGR				
NR	<i>R. T. Brown</i>	7-12-77		
APP				
KHL	<i>John L. Dwyer</i>	7/12/77		
			CSM ATSP	DWG NO
			111	7.4
			42.5 X 22	PAGE 7-42 SHEET OF

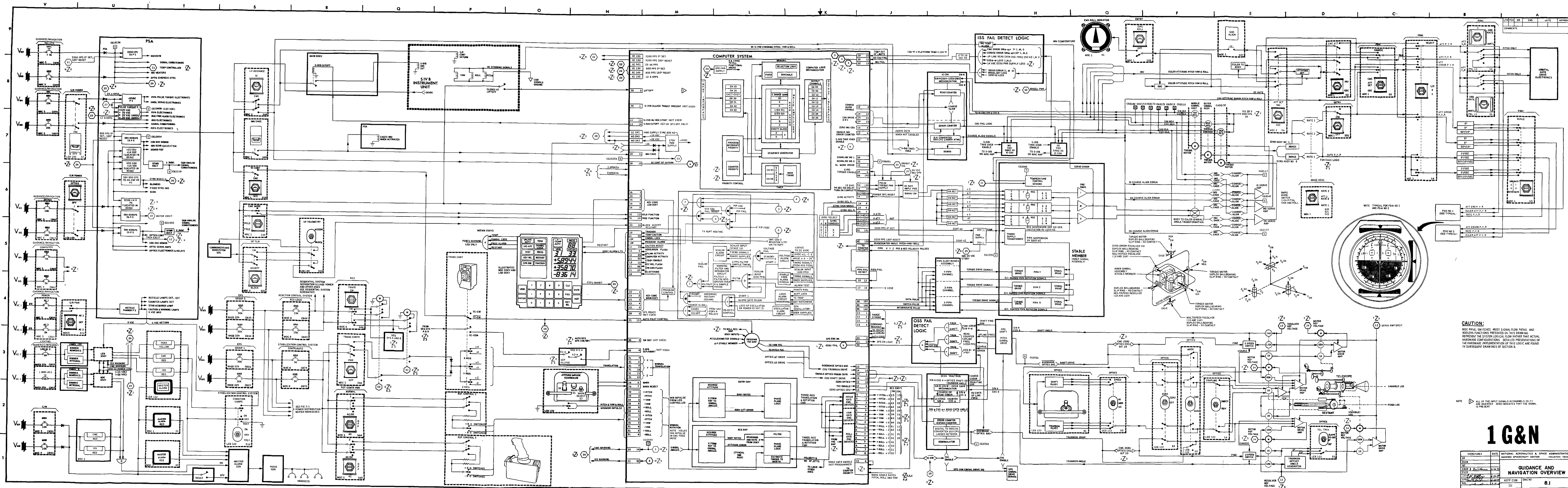
8 GUIDANCE
AND CONTROL
SYSTEM

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

RCS ENG SM CM		COMMANDS	QUAD	CHANNEL	CHANNEL SWITCH POSITION	
					A	B
C3	13	+X +θ	C	PITCH	CB19	CB20
C4	24	-X -θ	C	PITCH		
A3	23	-X +θ	A	PITCH		
A4	14	+X -θ	A	PITCH		
D3	25	+X +ψ	D	YAW	CB21	CB22
D4	16	-X -ψ	D	YAW		
B3	15	-X -ψ	B	YAW		
B4	26	+X +ψ	B	YAW		
B1	11	+Z +φ	B	ROLL	CB17	CB18
B2	12	-Z -φ	B	ROLL		
D1	21	-Z -φ	D	ROLL		
D2	22	+Z +φ	D	ROLL		
A1		+Y +φ	A	ROLL	CB15	CB16
A2		-Y -φ	A	ROLL		
C1		-Y -φ	C	ROLL		
C2		+Y +φ	C	ROLL		

ERROR & RATE DEADBAND CONTROL S11 & S12 SC5 MODES				
ATT DBND	RATE SW	ATTITUDE DEADBAND	RATE DEADBAND	ROT CONT PROPORTIONAL
S11 MAX	S12	LOW	$\pm 5^{\circ}$	$\pm 0.2^{\circ}/S, P, Y, R$
		HIGH	$\pm 6.0^{\circ}$	$\pm 20.0^{\circ}/S$ ROLL $\pm 7.0^{\circ}/S, P, Y$
S11 MAX	S12	LOW	$\pm 5^{\circ}$	$\pm 0.2^{\circ}/S, P, Y, R$
		HIGH	$\pm 4^{\circ}$	$\pm 20.0^{\circ}/S$ ROLL $\pm 7.0^{\circ}/S, P, Y$

	FDAI SELECT S4	FDAI SOURCE S5	ATTITUDE SET S6	TOTAL ATTITUDE		ATTITUDE ERROR		ANGULAR VELOCITY	
				FDAI 1	FDAI 2	FDAI 1	FDAI 2	FDAI 1	FDAI 2
	1/2	N/A	N/A	IMU	GDC	ISS ECDU	BMAG 1	BMAG 2	BMAG 2
2		CMC	N/A	N/A	IMU	N/A	ISS ECDU	N/A	BMAG 2
		ATT SET AS	IMU	N/A	IMU	N/A	IMU/(AS) EULER ERROR	N/A	BMAG 2
			GDC	N/A	GDC	N/A	GDC/(AS) BODY ERROR	N/A	BMAG 2
			GDC	N/A	GDC	N/A	BMAG 1	N/A	BMAG 2
1	GDC	N/A	N/A	GDC	N/A	BMAG 1	N/A	BMAG 2	N/A



CAUTION:
MDC PANEL SWITCHES MOST SIGNAL FLOW PATHS AND
BOOLEAN FUNCTIONS PRESENTED ON THIS DRAWING
REPRESENT THE SYSTEM LOGICAL FLOW RATHER THAN ACTUAL
HARDWARE CONFIGURATIONS. DETAILED PRESENTATIONS OF
THE HARDWARE IMPLEMENTATION OF THIS LOGIC ARE FOUND
IN SUBSEQUENT DRAWINGS OF SECTION 8.

NOTE ALL OF THE INPUT SIGNALS IN CHANNELS 30-39 ARE INVERTED ZERO INDICATES THAT THE SIGNAL

1 G&N

SIGNATURES		DATE	NATIONAL AERONAUTICS & SPACE ADMINISTRATION MANNED SPACECRAFT CENTER HOUSTON, TEXAS		
DR			GUIDANCE AND NAVIGATION OVERVIEW		
DSGN					
QC					
ENGR	<i>B. Williams</i>	6-20-77			
APP	<i>B. Williams</i>	6-20-77			
APPL	<i>B. Williams</i>	6-20-77			
RHL	<i>John Williams</i>	6-20-77	ASTP CSM	DWG NO	8.1
			111		

LTR	PCN	DR	ENGR	DATE	APPROVAL
	1		<i>L. Green</i>	2/18/75 2/18/75	<i>[Signature]</i>
COMMENTS					

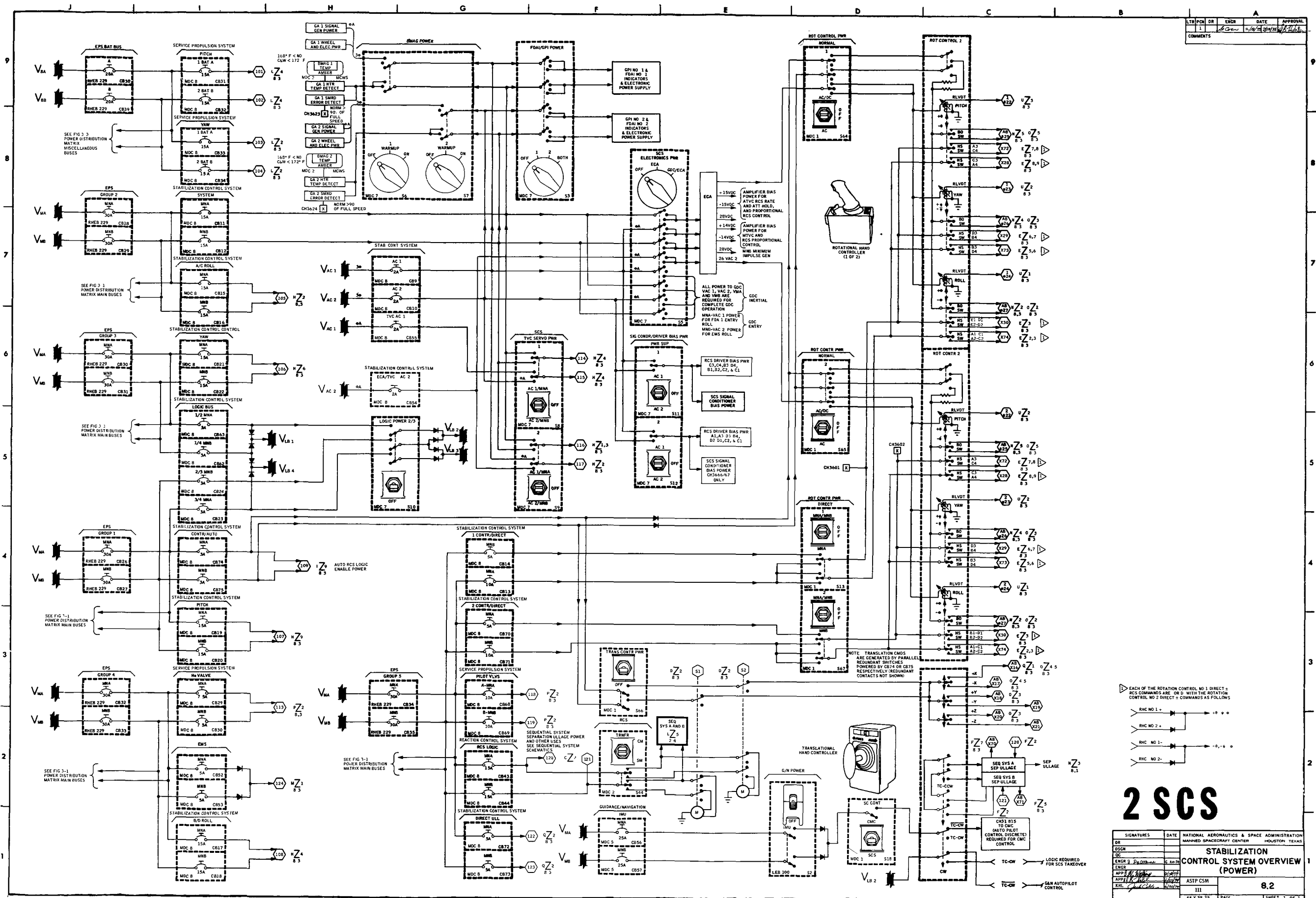
CODE	TYPE OF POWER
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40  GA2 ac RATE
41  dc RATE
42  ENGINE ON WITH 1 SECOND DELAYED OFF
43  ENGINE ON/OFF 1 SECOND DELAY
44  MODE SELECTED SCS
45  PITCH GYRO UNCAGE
46  YAW GYRO UNCAGE
47  ROLL GYRO UNCAGE
48  SIG COND POWER  $\pm 15.0$ , -2.5 AND -10 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
62  115 V 400 Hz
63  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)
75  SIG COND POWER  $\pm 15$ , -2.5 AND -10 Vdc

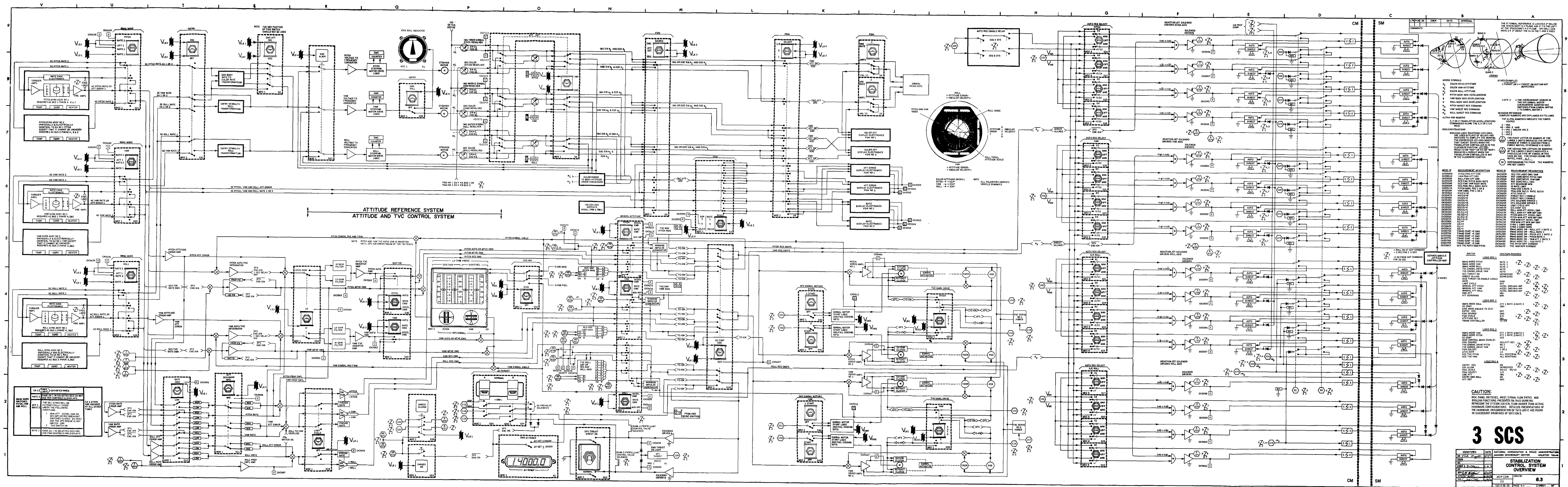
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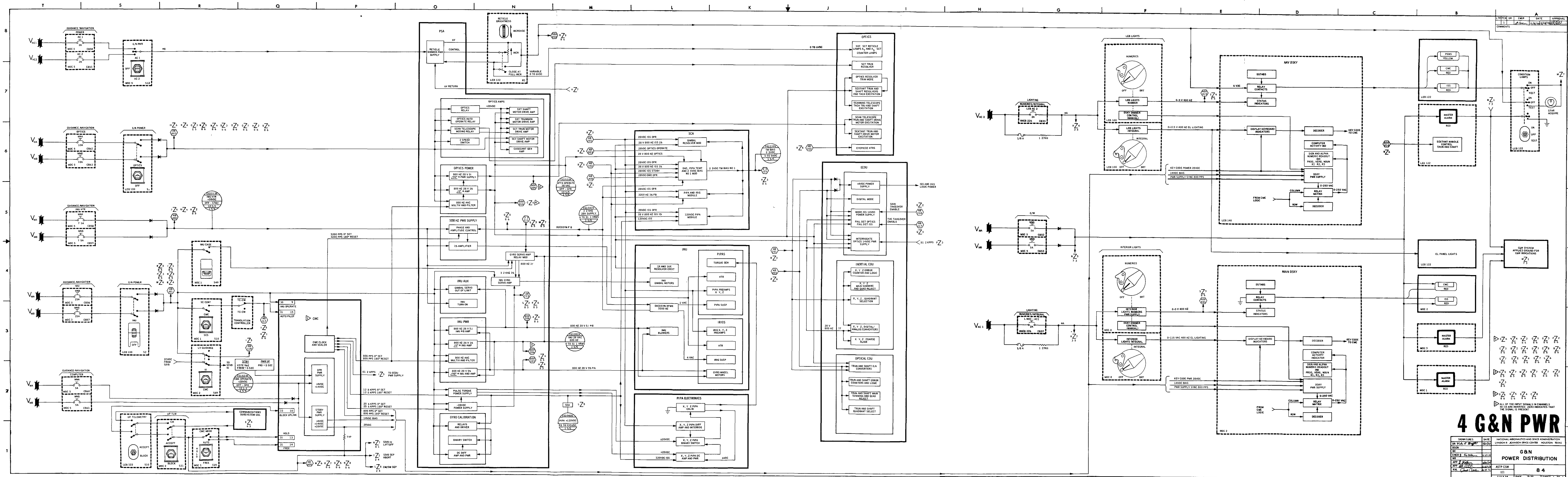
APRON DWG 8 2



2 SCS

SIGNATURES		DATE	NATIONAL AERONAUTICS & SPACE ADMINISTRATION MANNED SPACECRAFT CENTER HOUSTON, TEXAS
DR			STABILIZATION CONTROL SYSTEM OVERVIEW (POWER)
DSGN			
CR			
ENGR 2 <i>DeGroot</i>		<i>2-20-74</i>	
ENGR			
APP <i>W. J. Smith</i>		<i>2/20/74</i>	
APP <i>W. J. Smith</i>		<i>2/20/74</i>	ASTP CSM
RHL <i>W. J. Smith</i>		<i>2/20/74</i>	III
			8.2





SIGNATURES		DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION	
DR	W. J. R. R. R.	10/1/71	LYNDON B. JOHNSON SPACE CENTER	HOUSTON, TEXAS
ENGR	B. J. R. R.	10/1/71	G&N POWER DISTRIBUTION	
APP	R. J. R. R.	10/1/71		
ENGR	B. J. R. R.	10/1/71	ASTP CSM	84
ENGR	B. J. R. R.	10/1/71	111	110 & 14
ENGR	B. J. R. R.	10/1/71	PAGE	8-20
ENGR	B. J. R. R.	10/1/71	SHEET	1 OF 1

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

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

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

TABLE 8-II.- CSM ALARM CODES

<u>ALARM CODE (OCTAL)</u>	<u>ACTION</u>	<u>TITLE-DESCRIPTION</u>
00107	RECYCLE PROGRAM AND SELECT A NEW CELESTIAL BODY TO BE ACQUIRED.	<u>STAR TRACKER GIMBAL ANGLES OUT OF LIMITS</u> - IF THE SELECTED CELESTIAL BODY TO BE ACQUIRED BY THE STAR TRACKER RESULTS IN STAR TRACKER GIMBAL ANGLES BEYOND THE LIMITS OF -87° < OUTER < +87° -40° < INNER < +40°, PROGRAM ALARM WILL BE DISPLAYED.
00110	NONE	<u>NO MARK SINCE LAST MK REJ</u> - THE PROCESS OF MARKING SETS BIT 10 OF MARKSTAT TO ENABLE A MARK REJECT. IF MARKING IS BEING ACCEPTED BY PROGRAM WHEN MARK REJECT IS ACTI- VATED, 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 KEY- RUPT 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 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 RE- SET 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 POSI- TIONING OF THE OPTICS OR USE OF THE OCDU DAC'S FOR GIMBAL POSITIONING DURING THE 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	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 THEN 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	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	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>
00500	PERFORM DOCKED DAP DATA LOAD (R04) ROUTINE TO UNINHIBIT JET REQUIRED TO RESTORE VEHICLE ATTITUDE CONTROL.	<u>NOT ENOUGH JETS IN DOCKED DAP FOR P/Y MANEUVER</u> - THE DOCKED DAP WILL MAINTAIN P/Y ROTATION CONTROL WITH THE JETS AVAILABLE (FORCE OR COUPLE). IF ONE TORQUE COUPLE JET AND BOTH FORCE CONTROL JETS ARE INHIBITED FOR A P/Y COMMAND (REGARDLESS OF WHETHER ROTATION CONTROL PREFERENCE IS TORQUE COUPLE OR FORCE CONTROL), PROGRAM ALARM WILL BE DISPLAYED.
00501	PERFORM DOCKED DAP DATA LOAD (R04) ROUTINE TO UNINHIBIT ROLL JET REQUIRED TO RESTORE VEHICLE ATTITUDE CONTROL.	<u>NOT ENOUGH JETS IN DOCKED DAP FOR ROLL MANEUVER</u> - DOCKED DAP ROLL CONTROL IS ACCOMPLISHED BY UNBALANCING COMMANDED P/Y FORCE JET FIRINGS FOR ROLL COMPENSATION AND BY ROLL TORQUE COUPLES WHEN ROLL COMPENSATION CANNOT BE ACCOMPLISHED. IF ROLL JET INHIBITIONS PRECLUDE ROLL TORQUE COUPLES (REGARDLESS OF ROLL CONTROL PREFERENCE - A/C OR B/D) AND IF ROLL COMPENSATION CANNOT BE ACCOMPLISHED, PROGRAM ALARM WILL BE DISPLAYED.
00600	RECYCLE TO START OF PROGRAM AND ADJUST INPUT PARAMETERS.	<u>FAILURE IN PHASE MATCH ITERATION</u> - IF THE PHASE MATCHING OF THE VEHICLE STATE VECTORS DOES NOT CONVERGE TO A PRESET VALUE (POSSIBLY DUE TO STATE VECTOR ERRORS), PROGRAM ALARM WILL BE DISPLAYED WITH ERROR CODE 600.
00601	RECYCLE AND ADJUST INPUT PARAMETERS FOR NEW SOLUTION.	<u>FAILURE IN HEIGHT MANEUVER ITERATION</u> - IF THE FIRST (NC2) OR SECOND (NCC) HEIGHT MANEUVER SOLUTIONS FAIL TO CONVERGE FOR THE ALTITUDE CONSTRAINTS SPECIFIED AT NCC OR TPI TIMES RESPECTIVELY, PROGRAM ALARM WILL BE DISPLAYED WITH ERROR CODE 601.
00602	RECYCLE AND ADJUST INPUT PARAMETERS FOR NEW SOLUTION.	<u>FAILURE IN OUTER LOOP ITERATION</u> - A PHASING CONSTRAINT AT TPI REQUIRES THE CSM STATE VECTOR SOLUTION TO BE COLINEAR WITH THE DESIRED STATE VECTOR AT TPI BASED ON THE DESIRED Δ HEIGHT AND ELEVATION ANGLE AT TPI. IF NO NCC SOLUTION IS ARRIVED AT WHICH SATISFIES THE CONSTRAINT LIMITS, PROGRAM ALARM WILL BE DISPLAYED WITH ERROR CODE 602.

TABLE 8-II.- CSM ALARM CODES - CONTINUED

<u>ALARM CODE (OCTAL)</u>	<u>ACTION</u>	<u>TITLE-DESCRIPTION</u>
00603	RECYCLE AND ADJUST INPUT PARAMETERS FOR NEW SOLUTION.	<u>FAILURE TO QRDTP1 ITERATION</u> - IF THE DIFFERENCE BETWEEN THE PREDICTED CENTRAL ANGLE OF THE CSM AND OWS AT TPI AND THE DESIRED CENTRAL ANGLE (BASED ON THE Δ HEIGHT AND ELEVATION ANGLE AT TPI) DOES NOT CONVERGE WITHIN SPECIFIED LIMITS, PROGRAM ALARM WILL BE DISPLAYED WITH ERROR CODE 603.
00611	PROCEED WITH DISPLAYS OR RECYCLE PROGRAM WITH NEW INPUT PARAMETERS.	<u>NO TIG FOR ELEVATION ANGLE</u> - IF NO TIG (TPI) SOLUTION EXISTS FOR THE SPECIFIED ELEVATION ANGLE, PROGRAM ALARM WILL BE DISPLAYED WITH ERROR CODE 611.
00777	REF MALF. PROCEDURE G&N 6.	<u>PIPA FAIL CAUSED THE ISS WARNING</u> - WHEN AN ISS FAIL INPUT (IMU, CDU, PIPA) IS DETECTED BY T4RUPT, THE INPUT WHICH CAUSES THE ALARM IS COMMUNICATED TO THE "VARALARM" ROUTINE WHICH PROVIDES FOR AN ERROR CODED DISPLAY OF THE FAIL INPUT. THOSE FAIL BITS OF IMODES 30 (BITS 13, 12, AND 10) WHICH ARE NOT INHIBITED (BITS 4, 3, AND 1) WILL CAUSE ISS WARNING AND THE SUM OF THESE FAIL BITS MINUS 1 WILL YIELD THE ERROR CODE (BIT 10 - 1 = 01000 ₈ - 1 = 0777 ₈), AND A PROGRAM ALARM IS DISPLAYED.
01102	REF MALF. PROCEDURES G&N SSR-1.	<u>CMC SELF TEST ERROR</u> - IF AN ERROR IS DETECTED DURING THE CMC SELF TEST, RE- GARDLESS OF OPTION, A PROGRAM ALARM WILL BE DISPLAYED.
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.

TABLE 8-II.- CSM ALARM CODES - CONTINUED

<u>ALARM CODE (OCTAL)</u>	<u>ACTION</u>	<u>TITLE-DESCRIPTION</u>
01106	REF MALF. PROCEDURES.	<u>UPLINK TOO FAST</u> - TRANSMISSION OF EACH SERIAL UPLINK BIT IS ENABLED AT A 6400 PPS RATE. IF TWO UPLINK BITS (EITHER 1'S OR 0'S) ARE RECEIVED WITHIN A 156 MSEC PERIOD, THE UPLINK TOO-FAST BIT (CH 33 BIT 11) IS RESET AND WHEN DETECTED BY THE T4RUPT ROUTINE, A PROGRAM ALARM IS DISPLAYED.
01107	REF MALF. PROCEDURES. IMU REALIGN MAY BE NECESSARY.	<u>PHASE TABLE FAILURE - ASSUMING ERASABLE MEMORY IS DESTROYED</u> - AT VARIOUS POINTS IN A PROGRAM, THE PHASE TABLE IS SET UP TO ESTABLISH A RESTART POINT IN THE PROGRAM SHOULD A RESTART OCCUR. ESSENTIALLY, TWO TABLES ARE SET UP, ONE BEING THE INVERSE OF THE OTHER. THESE TABLES ARE CHECKED FOR AGREEMENT DURING A RESTART. IF PHASE TABLE DISAGREEMENT OCCURS, IT IS ASSUMED THAT ERASABLE MEMORY HAS BEEN ALTERED AND A FRESH START IS PERFORMED. E MEMORY MUST THEN BE REESTABLISHED. DETECTION OF THE ABOVE RESULTS IN A PROGRAM ALARM DISPLAY.
01301	RECYCLE PROGRAM WHICH 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.
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.

TABLE 8-II.- CSM ALARM CODES - CONTINUED

<u>ALARM CODE (OCTAL)</u>	<u>ACTION</u>	<u>TITLE-DESCRIPTION</u>
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 OVER- FLOW 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.
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 DE- TECTED BY T4RUPT ROUTINE WITH NO FAIL INHIBIT PRESENT, ISS WARNING IS DIS- PLAYED AND THE ROUTINE VARALARM WILL GENERATE AN ERROR CODE OF THE FAIL BIT VALUE MINUS 1 (0400 - 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.

TABLE 8-II.- CSM ALARM CODES - CONTINUED

<u>ALARM CODE (OCTAL)</u>	<u>ACTION</u>	<u>TITLE-DESCRIPTION</u>
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.
14777	REFER TO MALF. PROCEDURE G&N 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.
24030	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 GOTOPOOH.

TABLE 8-II.- CSM ALARM CODES - CONTINUED

<u>ALARM CODE (OCTAL)</u>	<u>ACTION</u>	<u>TITLE-DESCRIPTION</u>
20607	RECYCLE PROGRAM WITH ADJUSTED INPUT PARAMETERS.	<u>NO SOLUTION FROM TIME THETA OR TIME RADIUS ROUTINE</u> - THESE ROUTINES PRO- VIDE TRANSFER TIME SOLUTIONS FOR TWO BODIES WITH INPUTS OF POSITION AND VELOCITY VECTORS AND THE TRANSFER ANGLE TO THE TERMINAL POSITION OR THE RADIUS MAGNITUDE. IF THE CONIC TRAJECTORY IS PARABOLIC OR HYPER- BOLIC 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.
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 T3RUPT ROUTINE TO EXECUTE. A TIME DELAY OF ZERO OR NEGATIVE FOR AN INSERTED TASK IS ILLEGAL AND WILL RESULT IN ABORTING THE TASK.
21206	RESELECT PROGRAM UNLESS AVG G IS RUNNING.	<u>SECOND JOB ATTEMPTS TO GO TO SLEEP VIA KEYBOARD AND DISPLAY 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 GOTOPPOH.

TABLE 8-II.- CSM ALARM CODES - CONTINUED

<u>ALARM CODE (OCTAL)</u>	<u>ACTION</u>	<u>TITLE-DESCRIPTION</u>
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 PROCEED TO GOTOPOOH.
21302	RESELECT PROGRAM UNLESS AVG G IS RUNNING.	<u>SQRT 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 SOFTWARE RESTART IS EXECUTED, AND PROCESSING PROCEEDS TO GOTOPOOH.
21501	RESELECT PROGRAM UNLESS AVG G IS RUNNING.	<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 PRO- CEED TO GOTOPOOH. AN ERROR FOR AN EXTERNAL USER OF THE DSKY WILL RESULT IN AN OPERATE ERROR LIGHT.
21502	RESELECT PROGRAM UNLESS AVG G IS RUNNING.	<u>ILLEGAL FLASHING DISPLAY</u> - IF A REQUEST FOR A FLASHING DISPLAY IS MADE WITH ONE ALREADY ACTIVATED IN THE DISPLAY SYSTEM, A PROGRAM ALARM WILL BE DISPLAYED AND PROCESSING WILL PROCEED TO GOTOPOOH.
21521	DO NOT REQUEST P01, P07 AFTER LIFTOFF.	<u>P01, P07 ILLEGALLY SELECTED</u> - AT LIFTOFF WHEN P11 IS STARTED, THE NODOP01 FLAG (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.

TABLE 8-II.- CSM ALARM CODES - CONTINUED

<u>ALARM CODE (OCTAL)</u>	<u>ACTION</u>	<u>TITLE-DESCRIPTION</u>
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	RESELECT EXTENDED VERB OR CONTINUE.	<u>EXECUTIVE OVERFLOW - NO VAC AREAS</u> - THE PROCESS OF JOB SCHEDULING BY THE EXECUTIVE ROUTINE RESERVES VAC AREAS OR INTERPRETER WORK AREAS FOR THE JOBS ON THE EXECUTIVE CORE SET LIST. IF A JOB IS REQUESTED AND NO VAC AREAS EXIST, A BAILOUT ABORT IS GENERATED WHICH PERFORMS A SOFTWARE RESTART AND DISPLAYS PROGRAM ALARM.
31202	RESELECT EXTENDED VERB OR CONTINUE.	<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	RESELECT EXTENDED VERB OR CONTINUE.	<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 COM- PLETED	<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.

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ASTP CSM 111

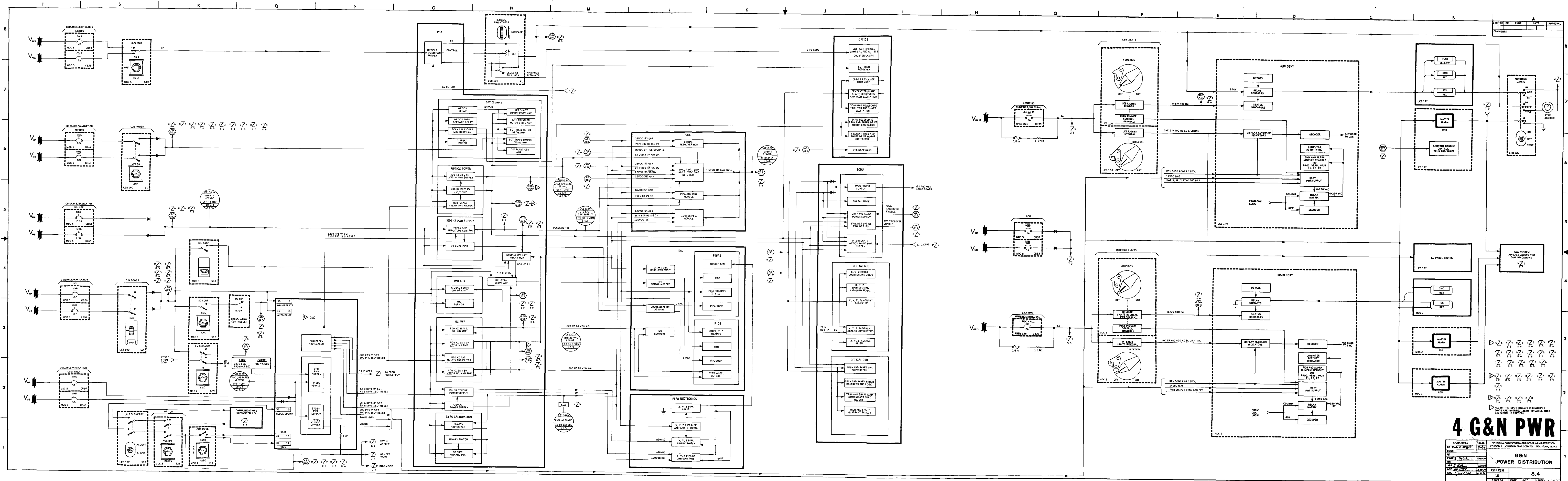
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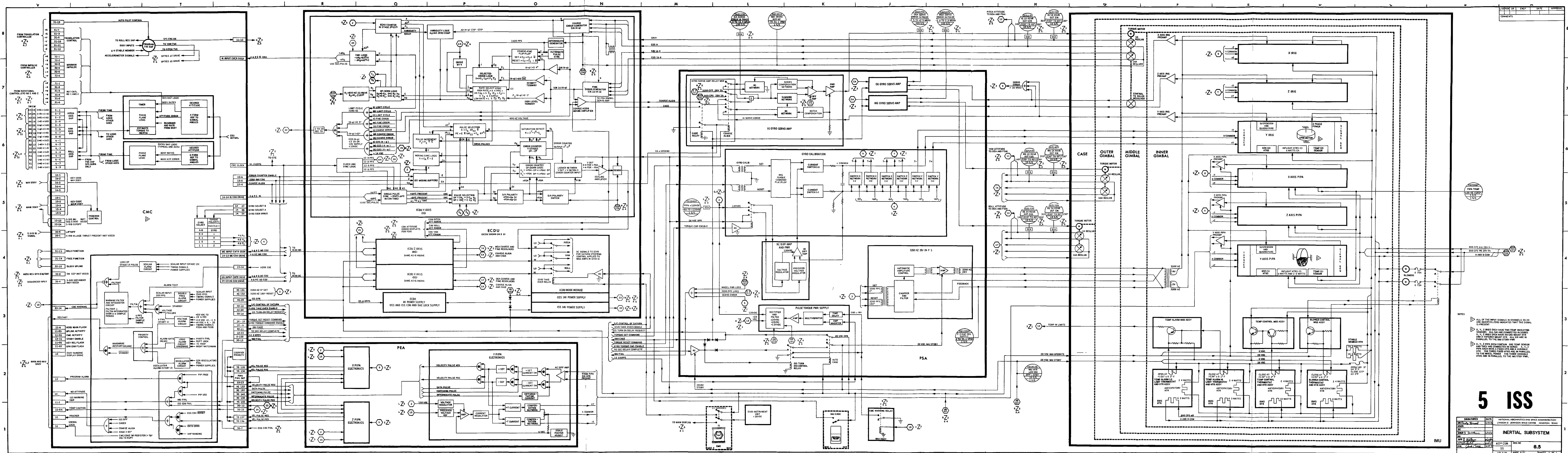
<u>ALARM CODE (OCTAL)</u>	<u>ACTION</u>	<u>TITLE-DESCRIPTION</u>
32000	CONTINUE	<u>DAP TASK STILL IN PROGRESS WHEN NEXT TASK ATTEMPTED - IF THE DOCKED DAP JET SELECT COMPUTATIONS ARE NOT COMPLETED WHEN A SUBSEQUENT JET SELECT TASK IS ATTEMPTED, A BAILOUT ABORT IS GENERATED WHICH PERFORMS A SOFTWARE RESTART AND DISPLAYS PROGRAM ALARM.</u>

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.

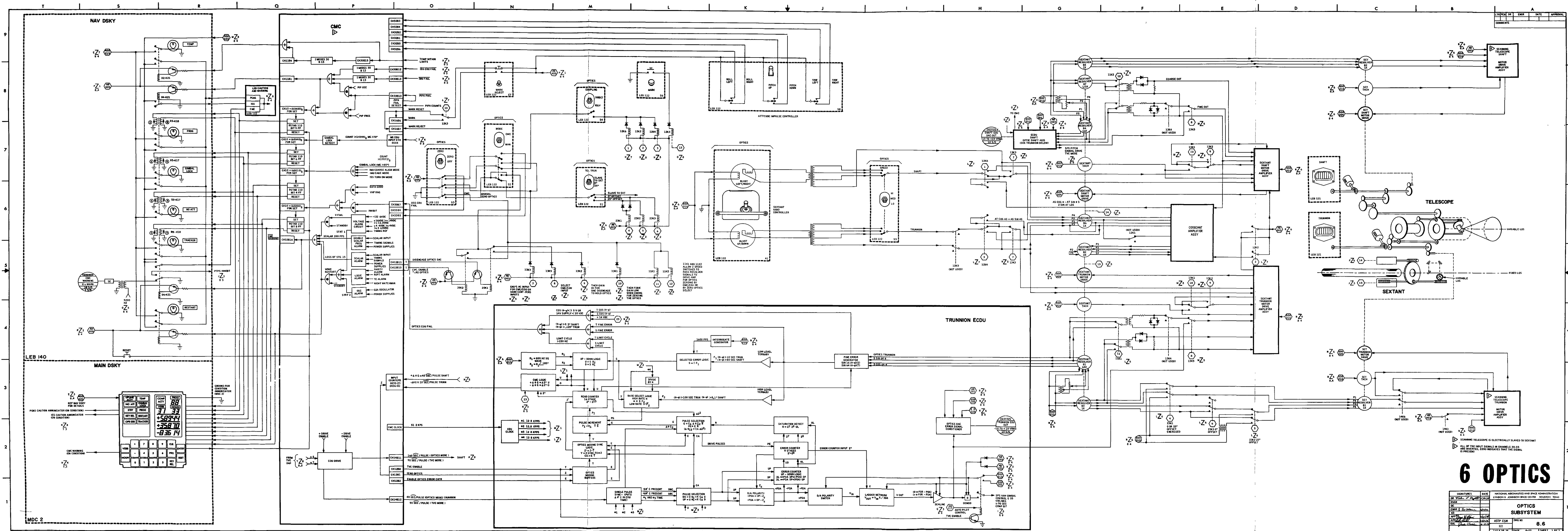




- NOTES
- ALL OF THE INPUT SIGNALS IN CHANNELS 30-33 ARE WIRE-OR'D. ZERO INDICATES THAT THE SIGNAL IS PRESENT.
 - X, Y, Z RINGS EACH HAVE TWO TEMP INDICATING SENSORS. ALL SENSORS ARE CONNECTED IN SERIES AND A THERMAL MOUNT WITH ALL SIX ARE IN PARALLEL TO THE IMU STBY PWR.
 - X, Y, Z PIPAS EACH CONTAIN ONE TEMP SENSOR AND THEY ARE CONNECTED IN SERIES. X, Y, Z PIPAS FROM WHEELS, TOWED HTS ARE IN PARALLEL TO THE WHEELS POWER. THE THREE VARIABLE HTS ARE IN PARALLEL TO THE IMU STBY PWR.

5 ISS

SIGNATURES	DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
DESIGNER	6-63	LYNDON B. JOHNSON SPACE CENTER HOUSTON TEXAS
DR		
ENGINEER	6-63	
TESTER		
APPROVED		
FILE		
111	ASTP GSN	DWG NO
1212.36	PAGE 2-31	SHEET 1 OF 1



DATE	ENGR	DATE	APPROVAL
1/1/74	W. J. [Signature]	1/1/74	[Signature]
1/1/74	W. J. [Signature]	1/1/74	[Signature]

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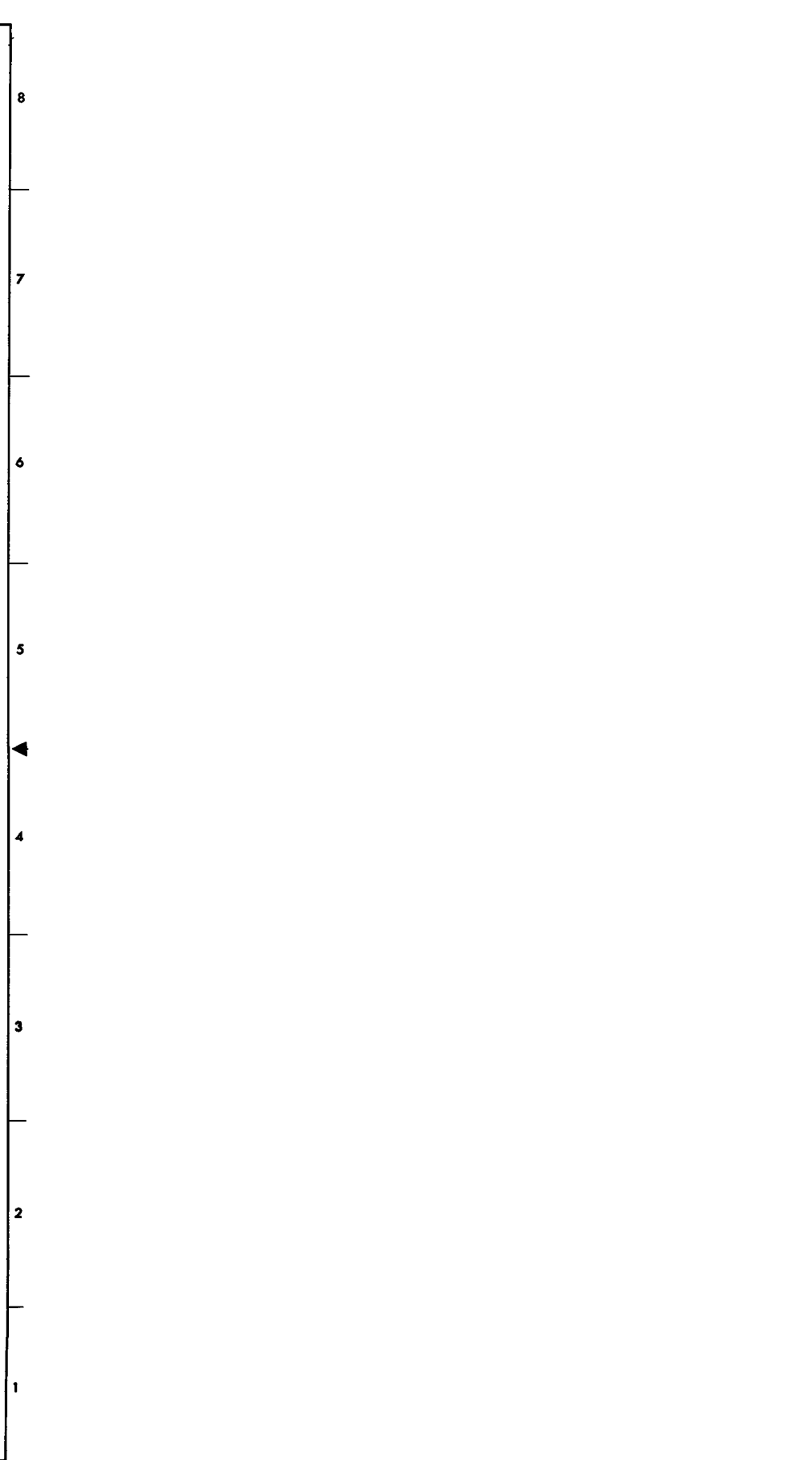
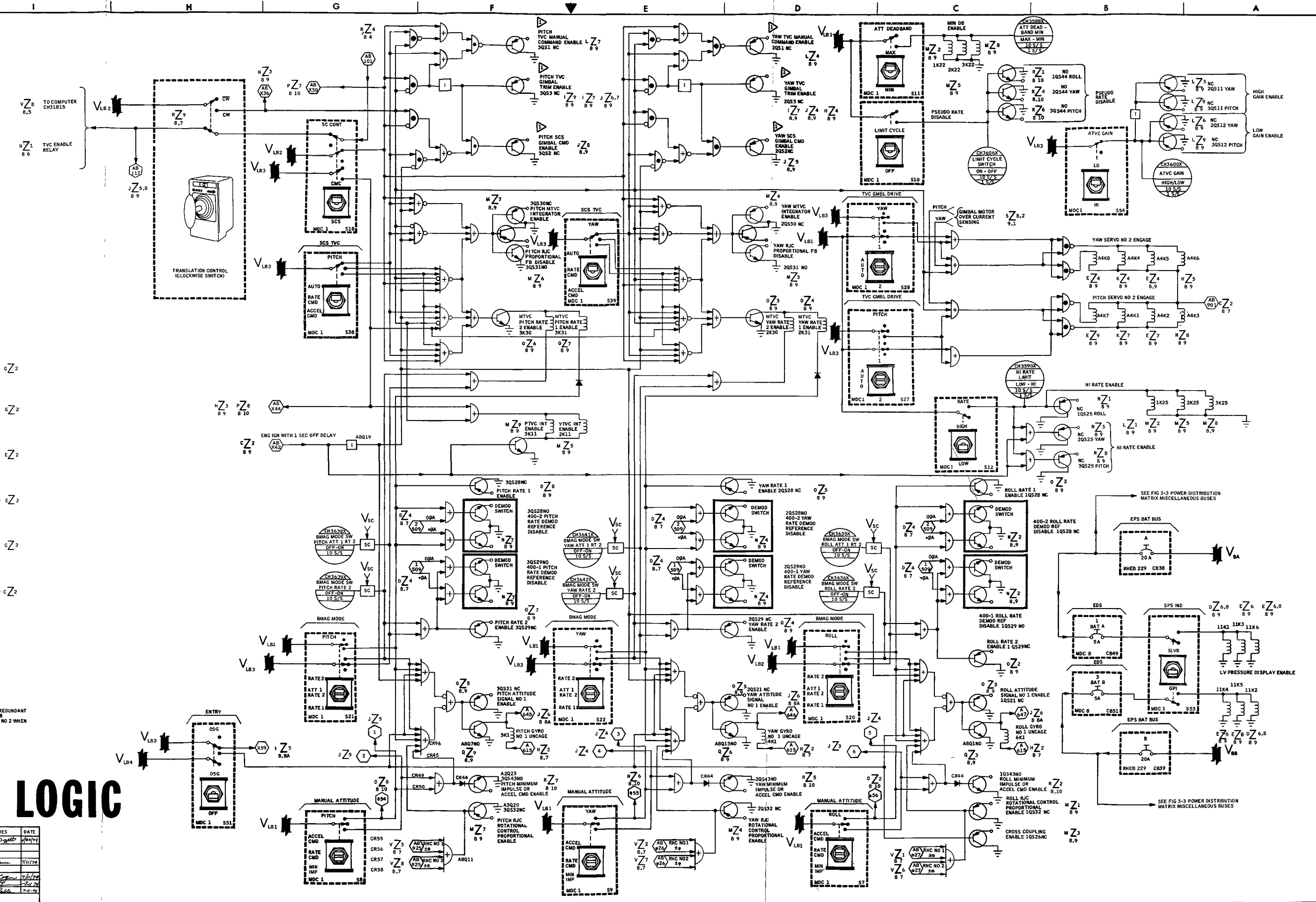
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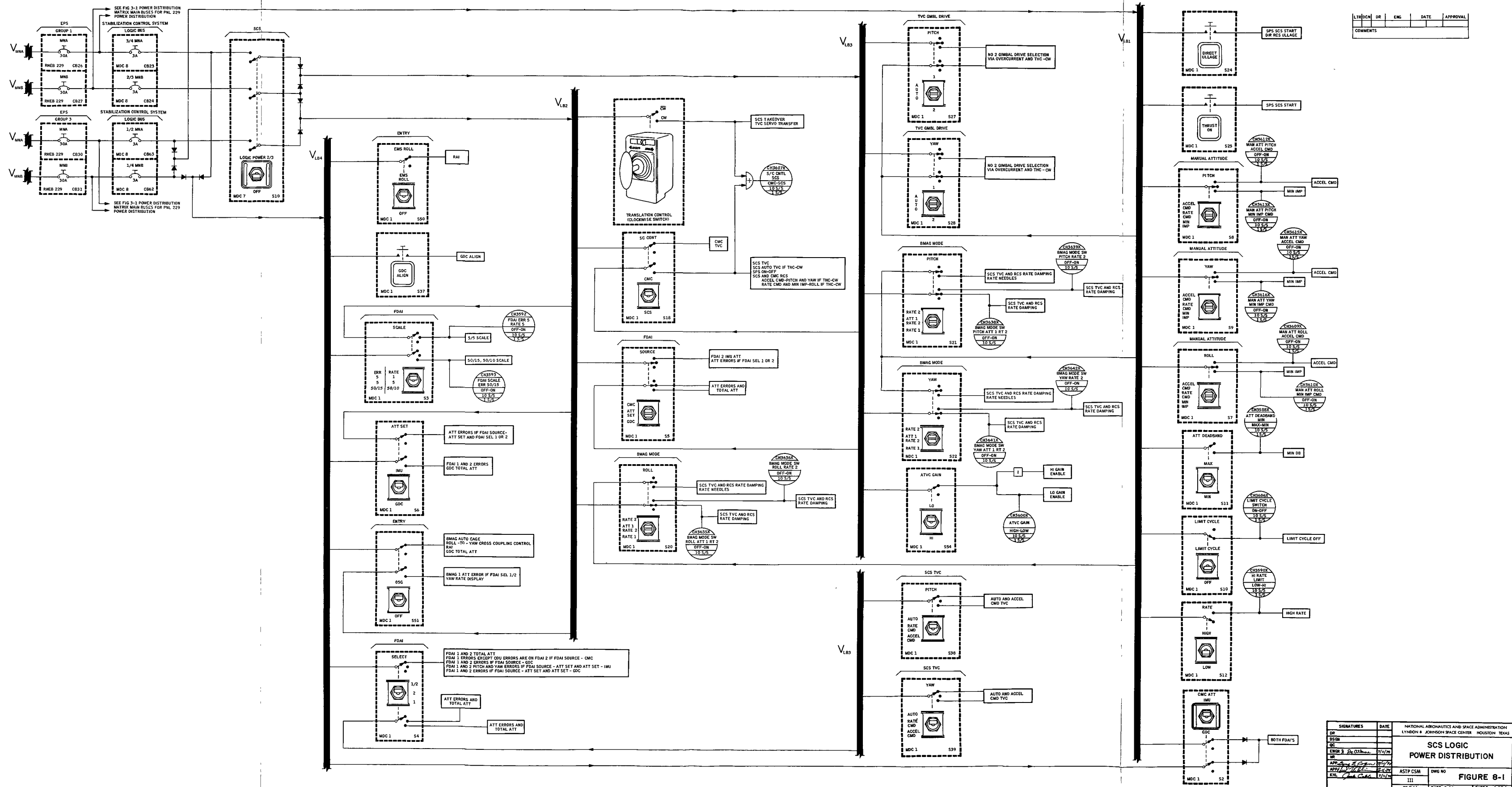
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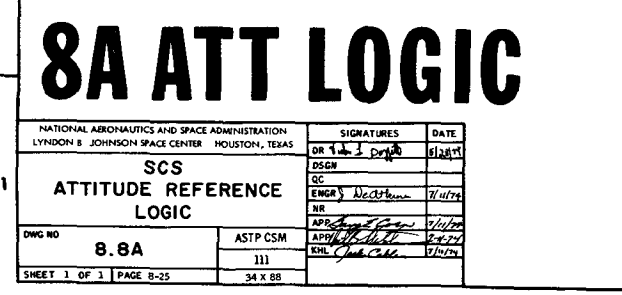
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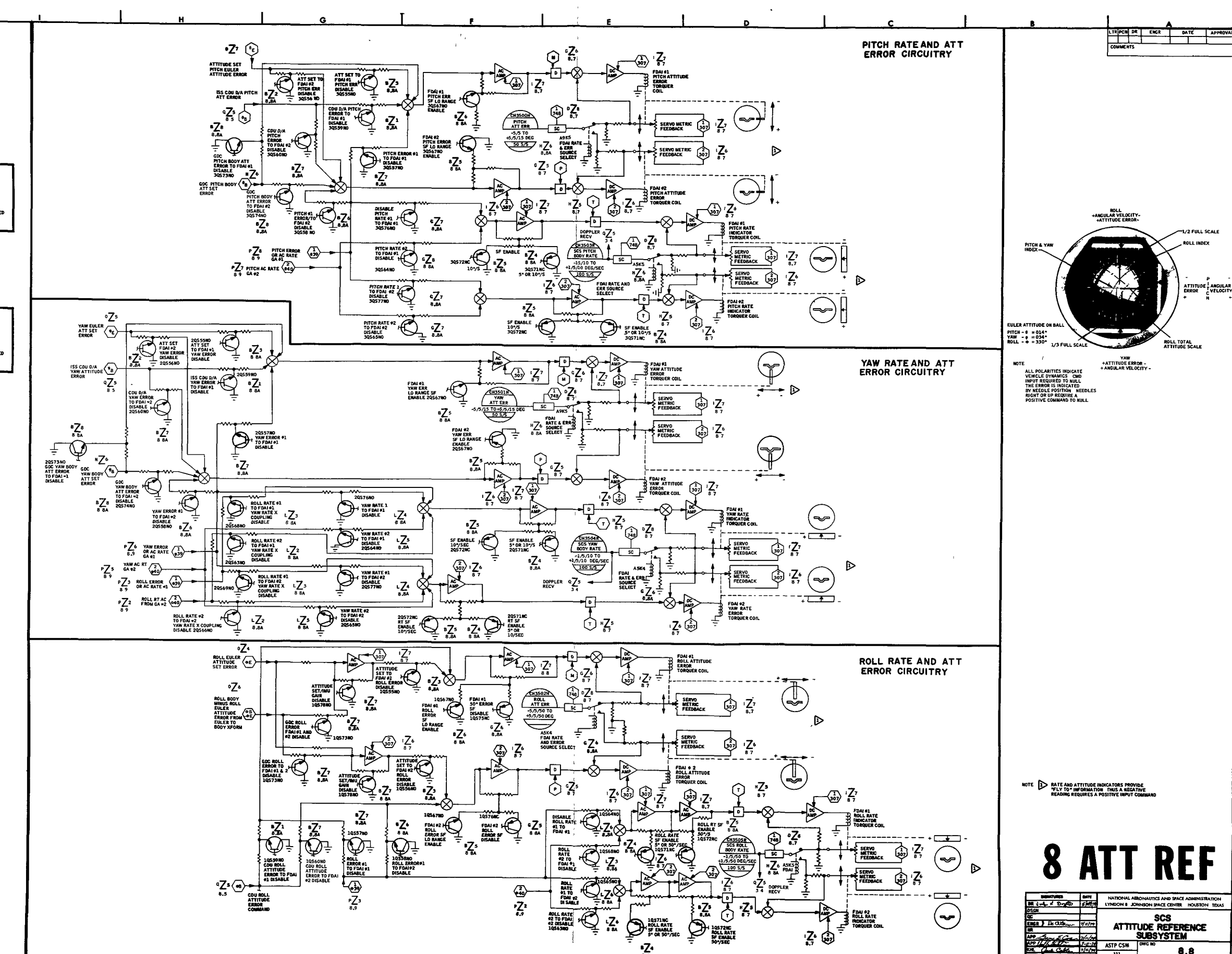
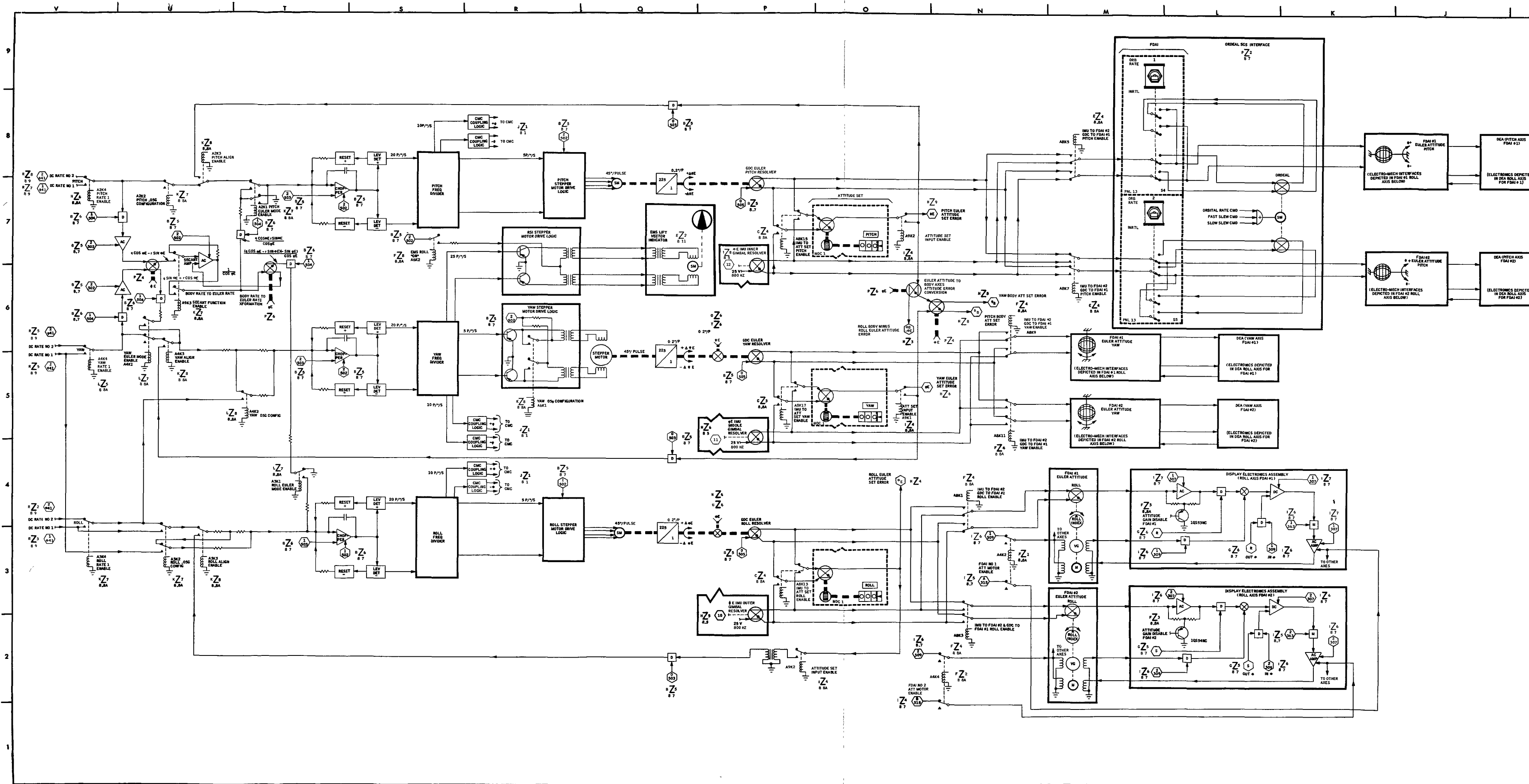


9A CNTL LOGIC

NATIONAL AERONAUTICS & SPACE ADMINISTRATION HOUSTON TEXAS		SIGNATURES		DATE
SCS TVC/RCS ELECTRONICS LOGIC		DR. [Signature]		1/1/74
DWG NO 8.9A		ENGR [Signature]		1/1/74
ASTP CSM		APR [Signature]		1/1/74
111		KHL [Signature]		1/1/74
SHEET 1 OF 1 PAGE 8-27		55 X 34		





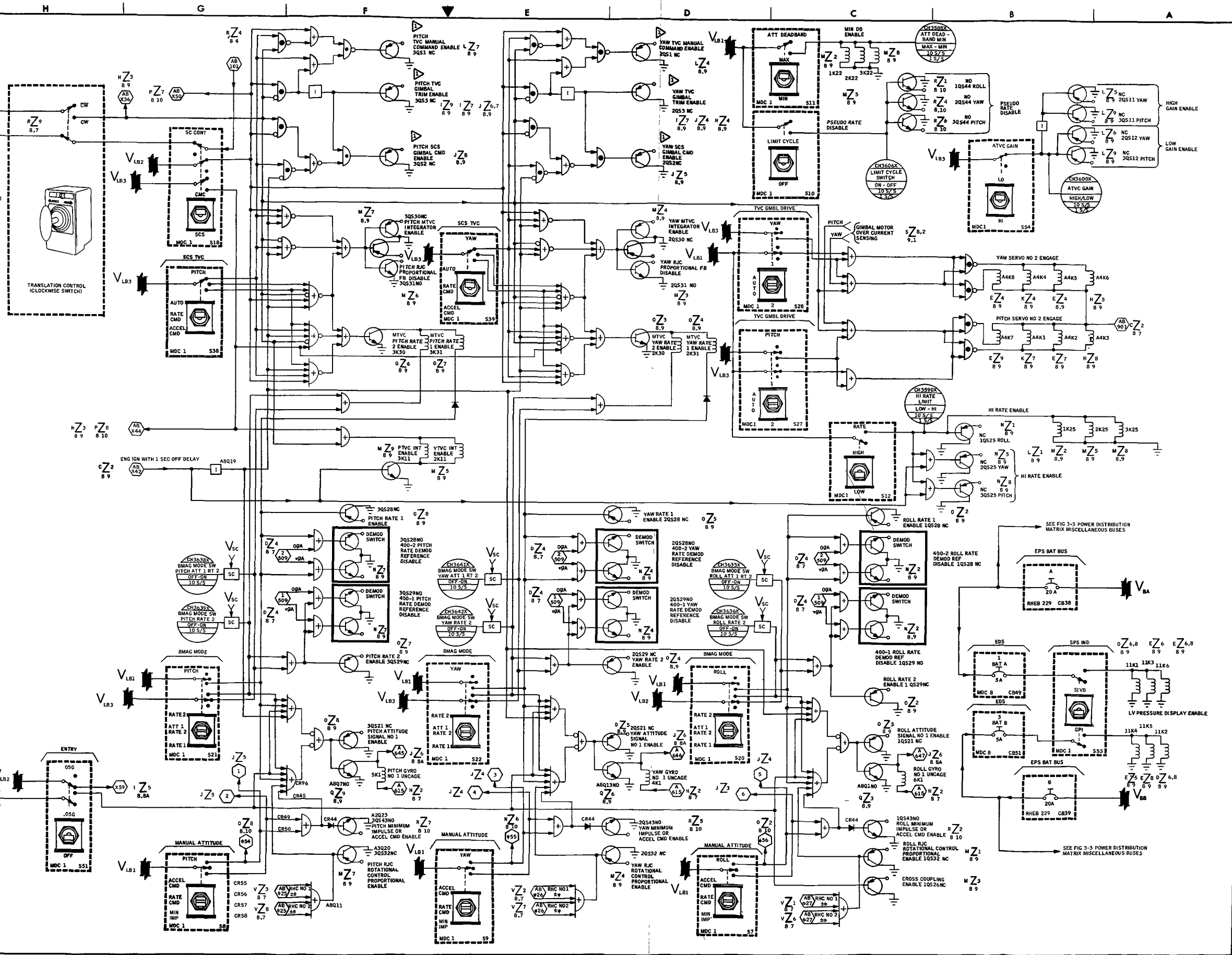


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COMMENTS					

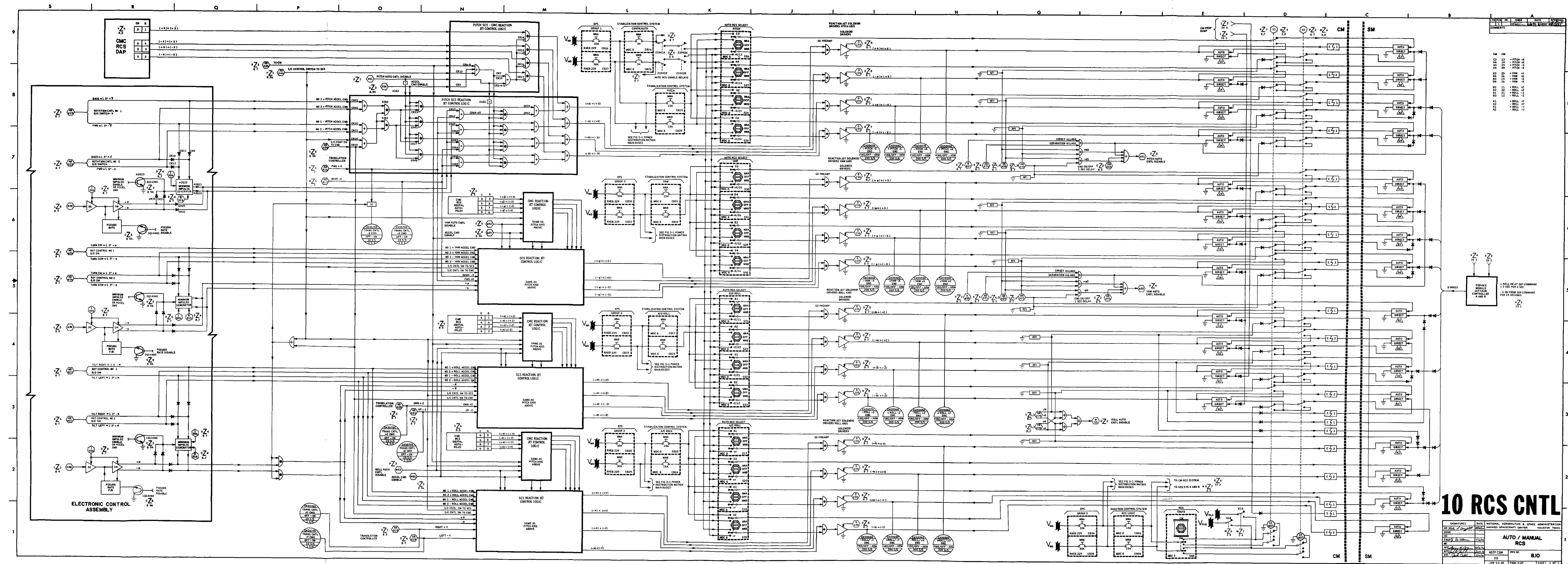
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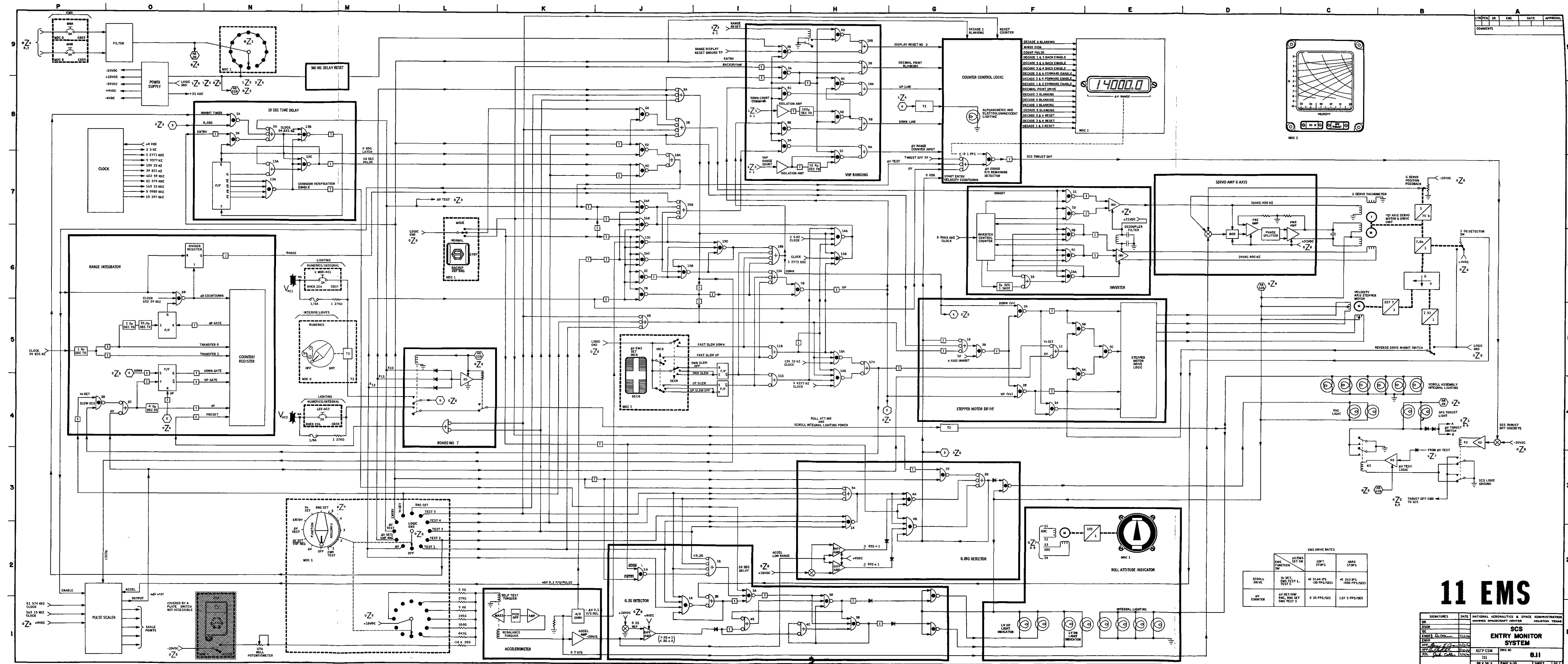
9A CNTL LOGIC

NATIONAL AERONAUTICS & SPACE ADMINISTRATION MANNED SPACECRAFT CENTER		SIGNATURES	DATE
SCS TVC/RCS ELECTRONICS LOGIC		DR <i>David L. Dwyer</i>	10/10/70
DWG NO 89A		QC	
ASTP CSM		ENGR <i>B. J. Dwyer</i>	11/11/70
111		APR <i>James E. Gorman</i>	11/11/70
55 X 34		CHK <i>John C. Gorman</i>	12/11/70
SHEET 1 OF 1 PAGE 8-27			

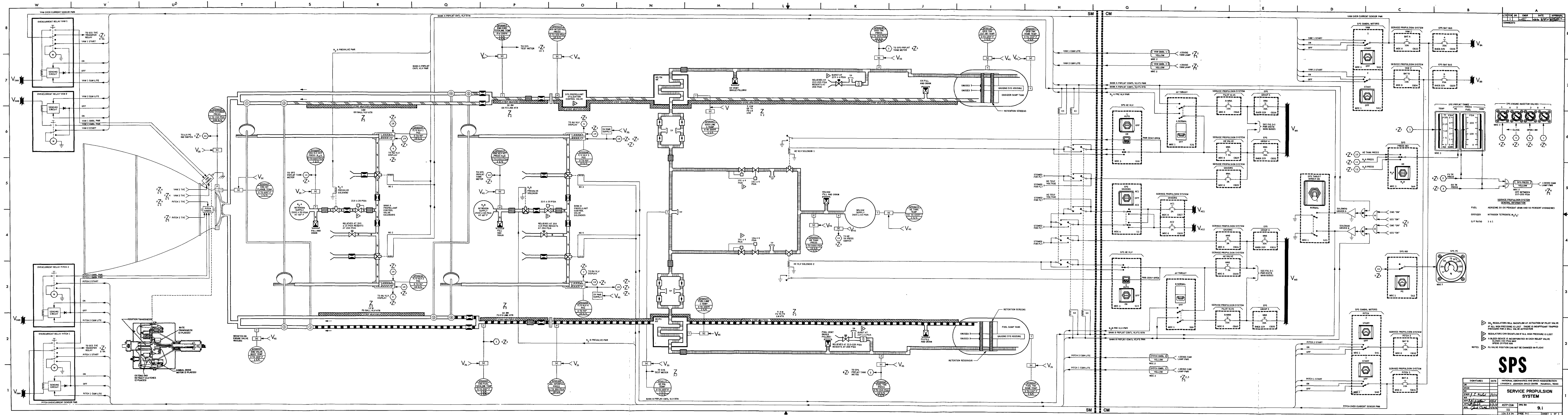


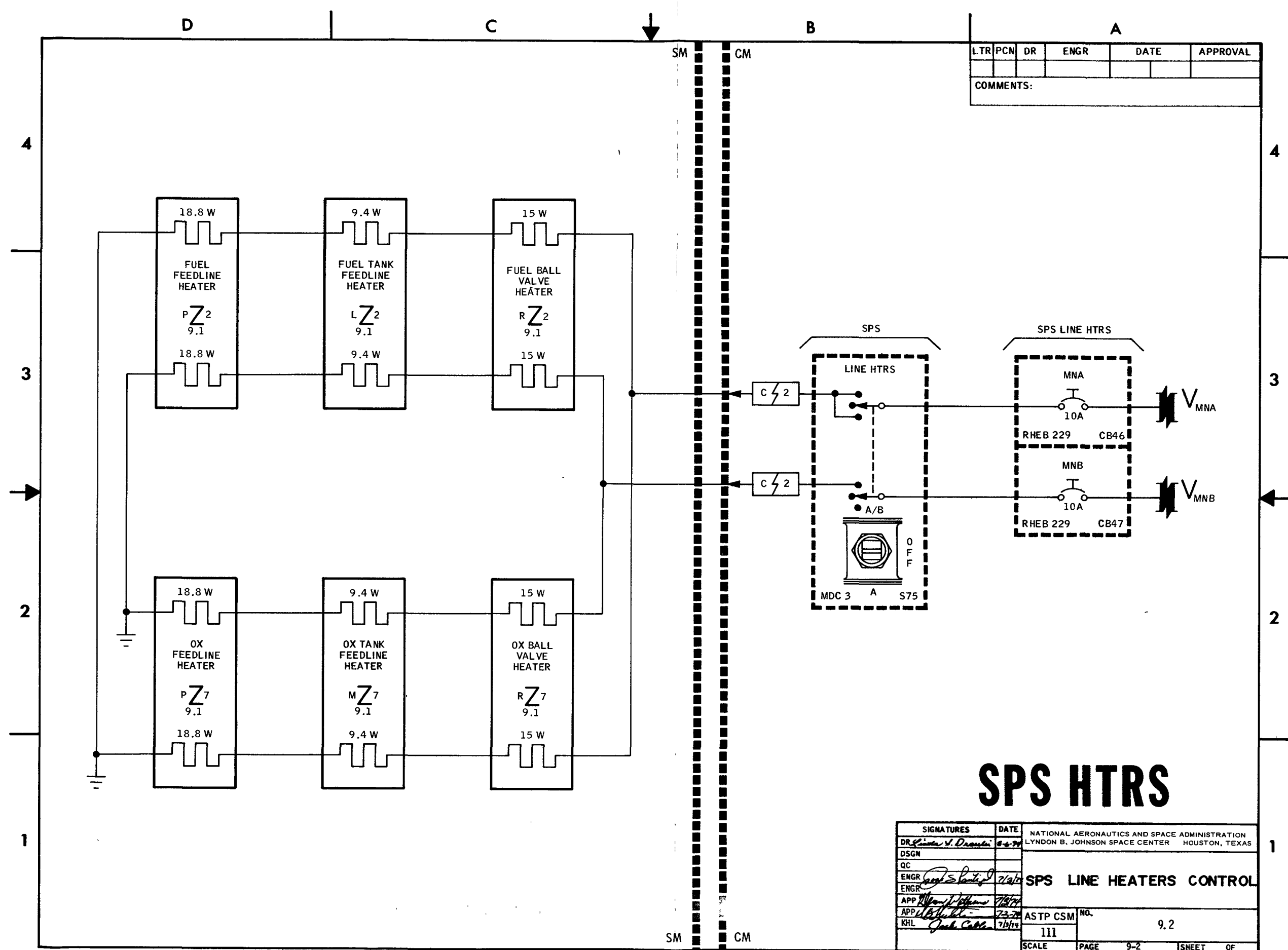
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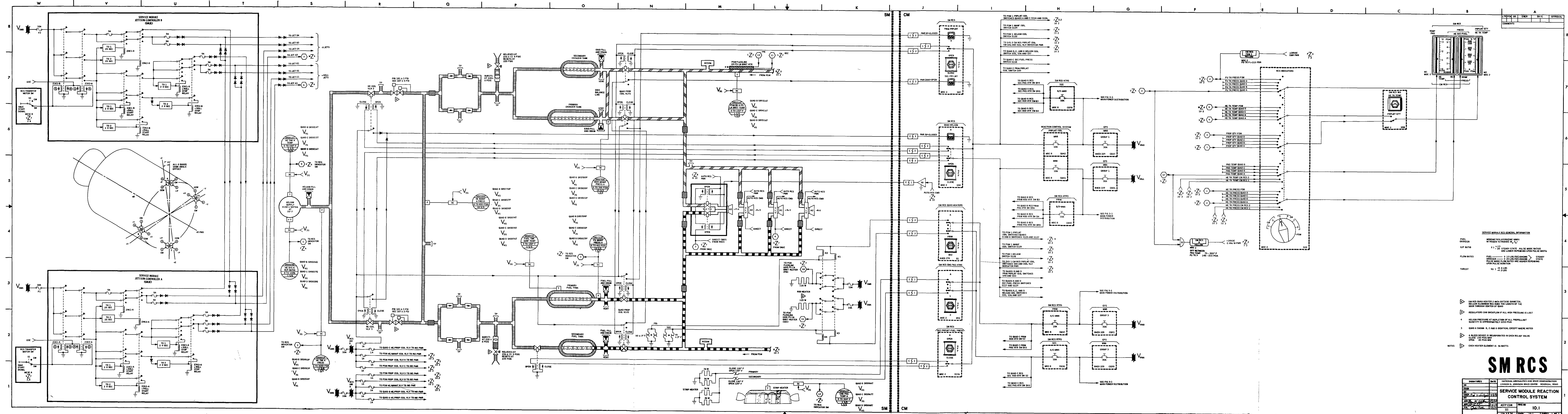


9 SERVICE
PROPULSION
SYSTEM





10 REACTION
CONTROL
SYSTEM



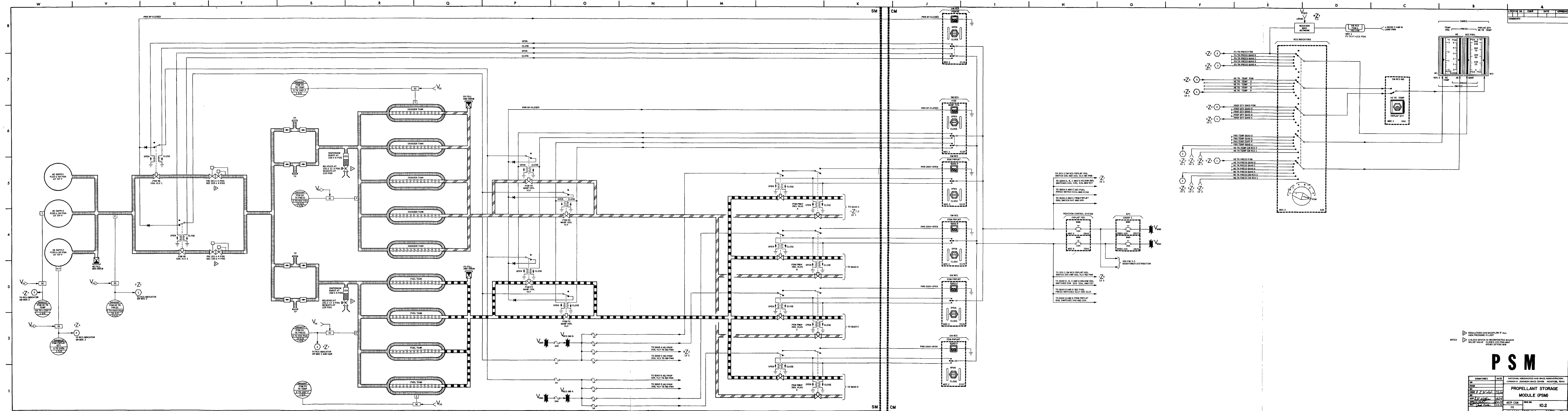
SM RCS

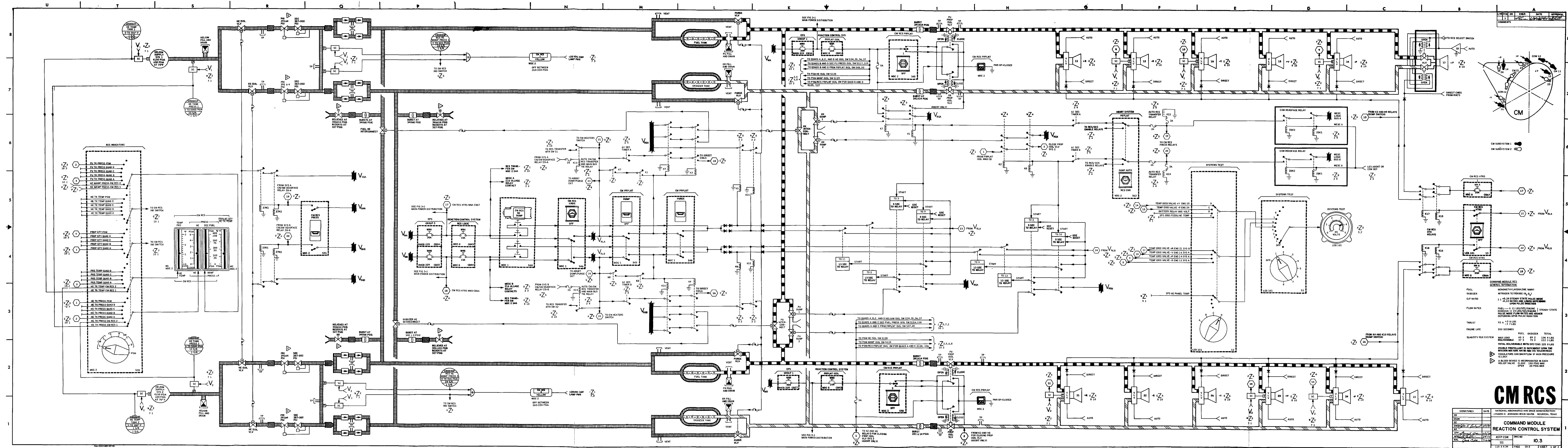
DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
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9/4/79
SERVICE MODULE REAC
CONTROL SYSTEM

ASTP CSM	DWG NO
111	10.1

126.9 X 34	PAGE	10-1	SHEET
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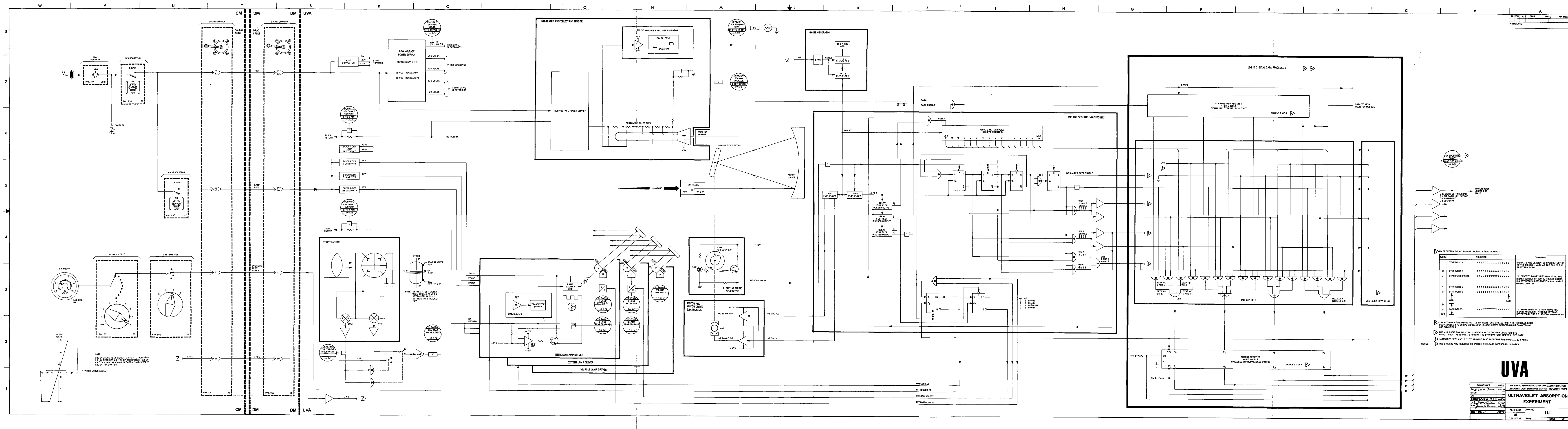




CM RCS

COMMAND MODULE
REACTION CONTROL SYSTEM

ASTP CSM	DWG NO
111	10.3
115.5 X 34	PAGE 10.3



DATE	ENGR	DATE	APPROVAL

COMMENTS

WORD	FUNCTION	COMMENTS
1	SYNC WORD 1	11111111111101010
2	SYNC WORD 2	0000000000010101
3	SCAN PERIOD WORD	00XXXXXXX XXXXXX
4	SYNC WORD 2	0000000000010101
5	SYNC WORD 1	11111111111101010
6	DATA WORDS	YYYYYYYYYYYYYYYY
7	DATA WORDS	YYYYYYYYYYYYYYYY
8	DATA WORDS	YYYYYYYYYYYYYYYY
9	DATA WORDS	YYYYYYYYYYYYYYYY
10	DATA WORDS	YYYYYYYYYYYYYYYY
11	DATA WORDS	YYYYYYYYYYYYYYYY
12	DATA WORDS	YYYYYYYYYYYYYYYY

NOTES

THE ACCUMULATOR AND OUTPUT 16-BIT REGISTERS UTILIZE FOUR 4-BIT MODULES EACH. ONLY MODULE 1 IS SHOWN. MODULES 2, 3, AND 4 HAVE CORRESPONDING CONNECTIONS AND FUNCTIONS.

THE MUX LOGIC FOR BITS 12-15 IS IDENTICAL TO THE MUX LOGIC FOR BITS 16-19. ONLY THE WIRING TO PROVIDE SYNC PATTERN DIFFERS. SEE NOTE.

HARDWIRED "1" AND "0" TO PROVIDE SYNC PATTERN DIFFERS FOR WORDS 1, 2, 4, AND 5.

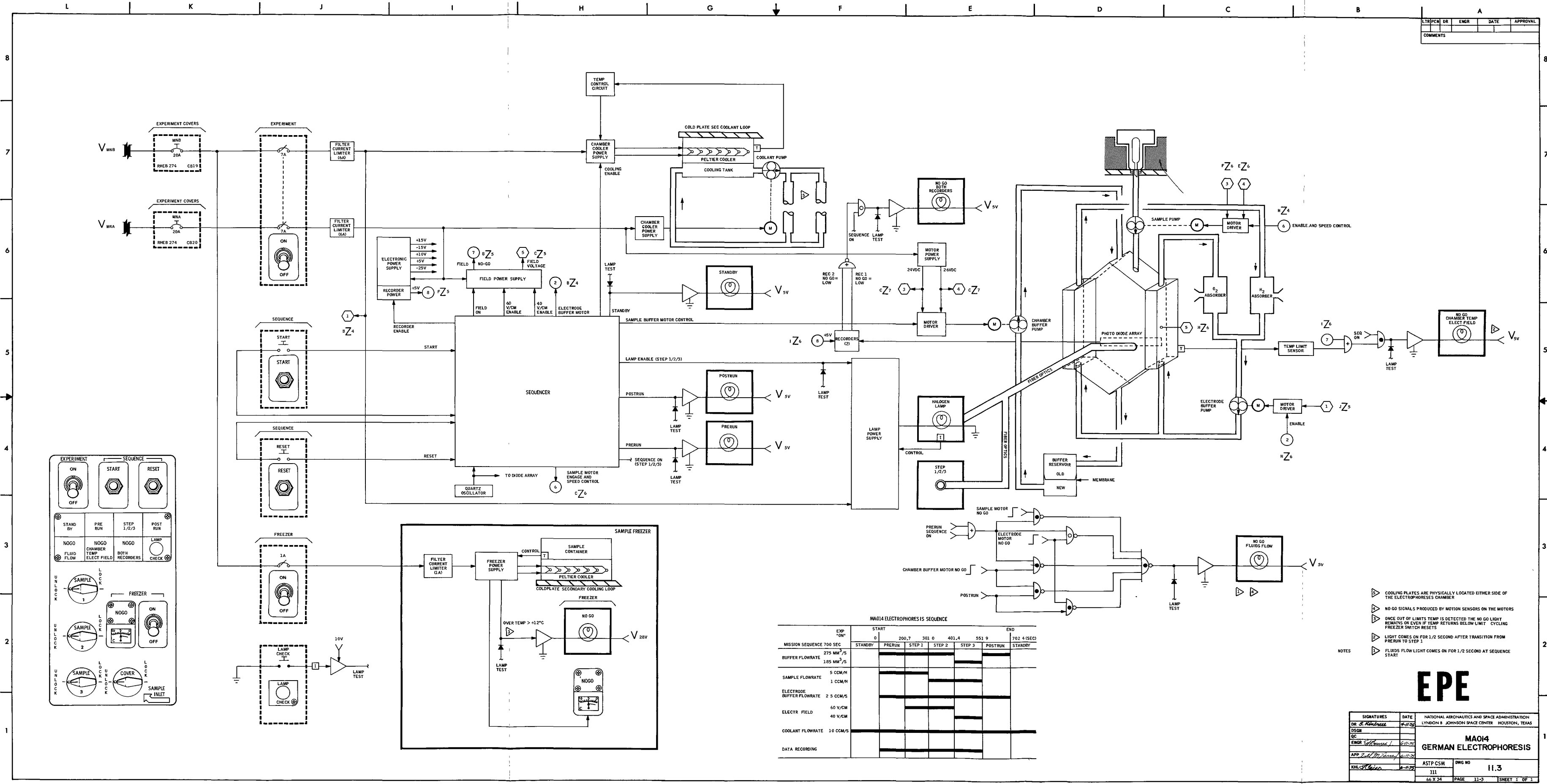
TWO DRIVERS ARE REQUIRED TO HANDLE THE LOADS IMPOSED BY 16 GATES.

SIGNATURES		DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
BY: <i>[Signature]</i>		DATE: <i>[Date]</i>	LYNNHURST JOHNSON SPACE CENTER, HOUSTON, TEXAS
TITLE		DATE	11/11/70
PROJECT		DATE	11/11/70
DRAWN		DATE	11/11/70
CHECKED		DATE	11/11/70
APPROVED		DATE	11/11/70
PROJECT NO.		DATE	11/11/70
SHEET		DATE	11/11/70
PAGE		DATE	11/11/70

UVA

ULTRAVIOLET ABSORPTION

EXPERIMENT

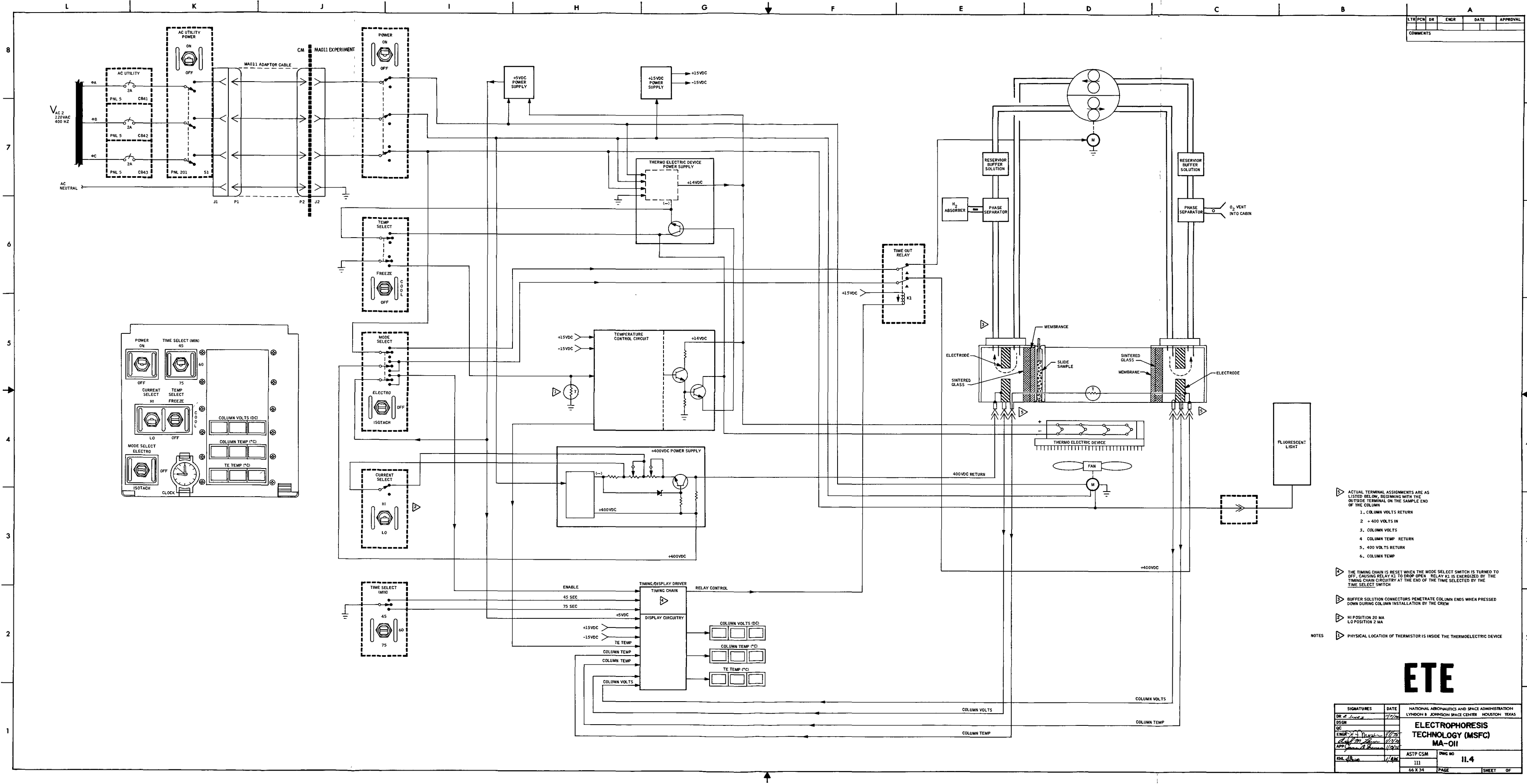


DATE	APPROVAL

- NOTES
- COOLING PLATES ARE PHYSICALLY LOCATED EITHER SIDE OF THE ELECTROPHORESIS CHAMBER
 - NO GO SIGNALS PRODUCED BY MOTION SENSORS ON THE MOTORS
 - ONCE OUT OF LIMITS TEMP IS DETECTED THE NO GO LIGHT REMAINS ON EVEN IF TEMP RETURNS BELOW LIMIT. CYCLING FREEZER SWITCH RESETS
 - LIGHT COMES ON FOR 1/2 SECOND AFTER TRANSITION FROM PRE RUN TO STEP 1
 - FLUIDS FLOW LIGHT COMES ON FOR 1/2 SECOND AT SEQUENCE START

EPE

SIGNATURES	DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
DR. J. R. Anderson	4/1/78	MA014 GERMAN ELECTROPHORESIS
DC		ASTP CSM
		DWG NO
		111
		PAGE 11-2
		SHEET 1 OF 1



- ACTUAL TERMINAL ASSIGNMENTS ARE AS LISTED BELOW, BEGINNING WITH THE OUTSIDE TERMINAL ON THE SAMPLE END OF THE COLUMN
1. COLUMN VOLTS RETURN
 2. + 400 VOLTS IN
 3. COLUMN VOLTS
 4. COLUMN TEMP RETURN
 5. 400 VOLTS RETURN
 6. COLUMN TEMP

THE TIMING CHAIN IS RESET WHEN THE MODE SELECT SWITCH IS TURNED TO OFF, CAUSING RELAY K1 TO DROP OPEN. RELAY K1 IS ENERGIZED BY THE TIMING CHAIN CIRCUITRY AT THE END OF THE TIME SELECTED BY THE TIME SELECT SWITCH

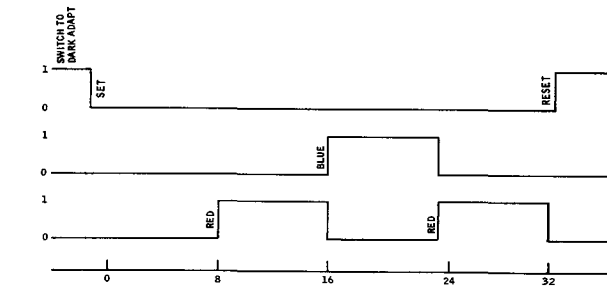
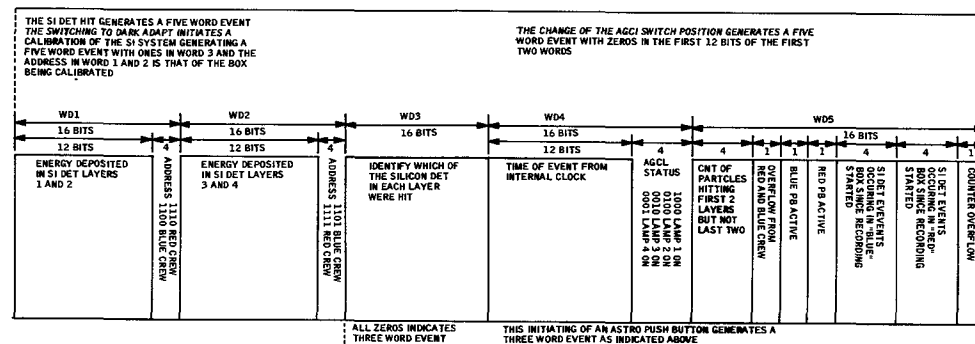
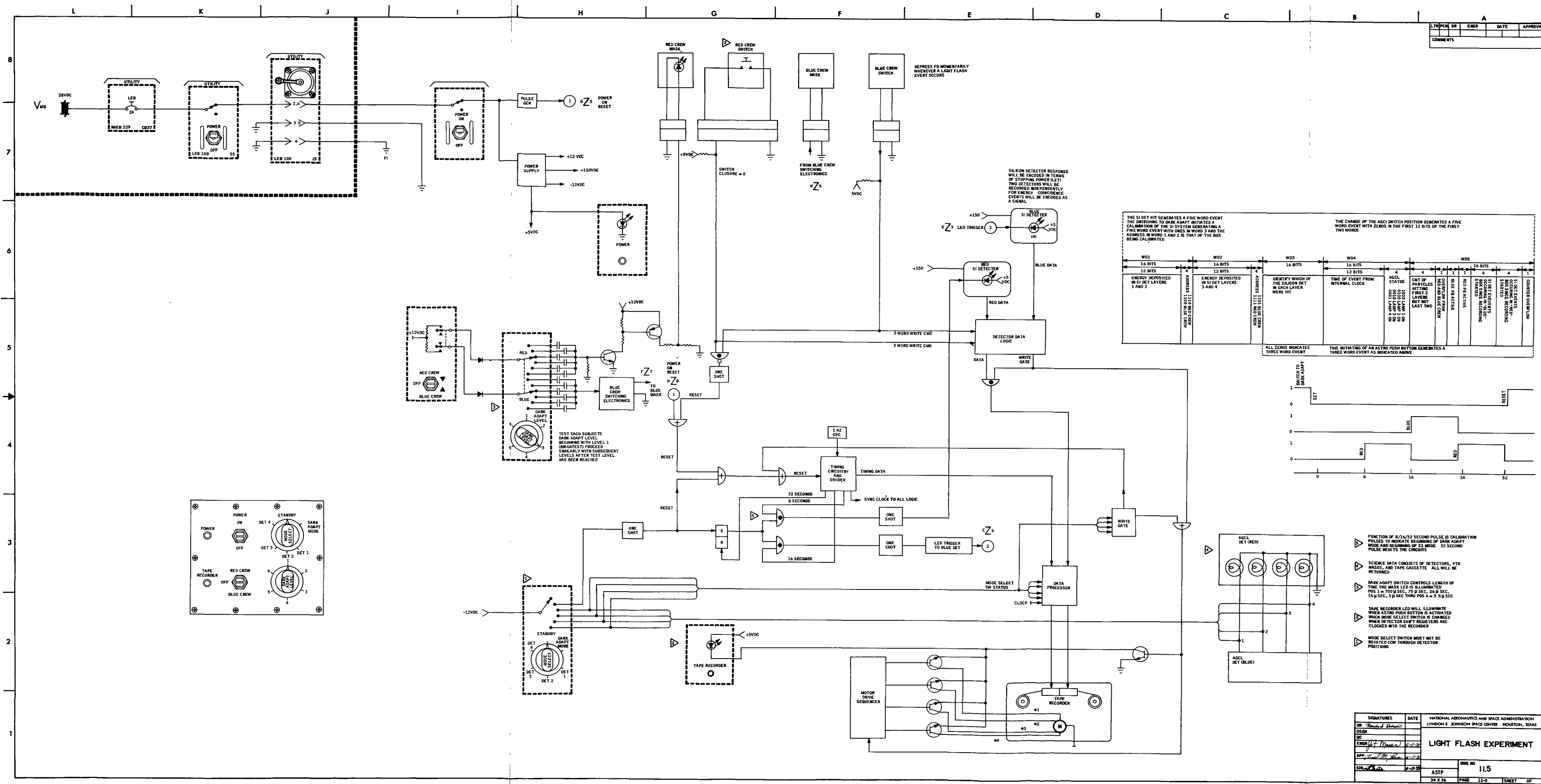
BUFFER SOLUTION CONNECTORS PENETRATE COLUMN ENDS WHEN PRESSED DOWN DURING COLUMN INSTALLATION BY THE CREW

HI POSITION 20 MA
LO POSITION 2 MA

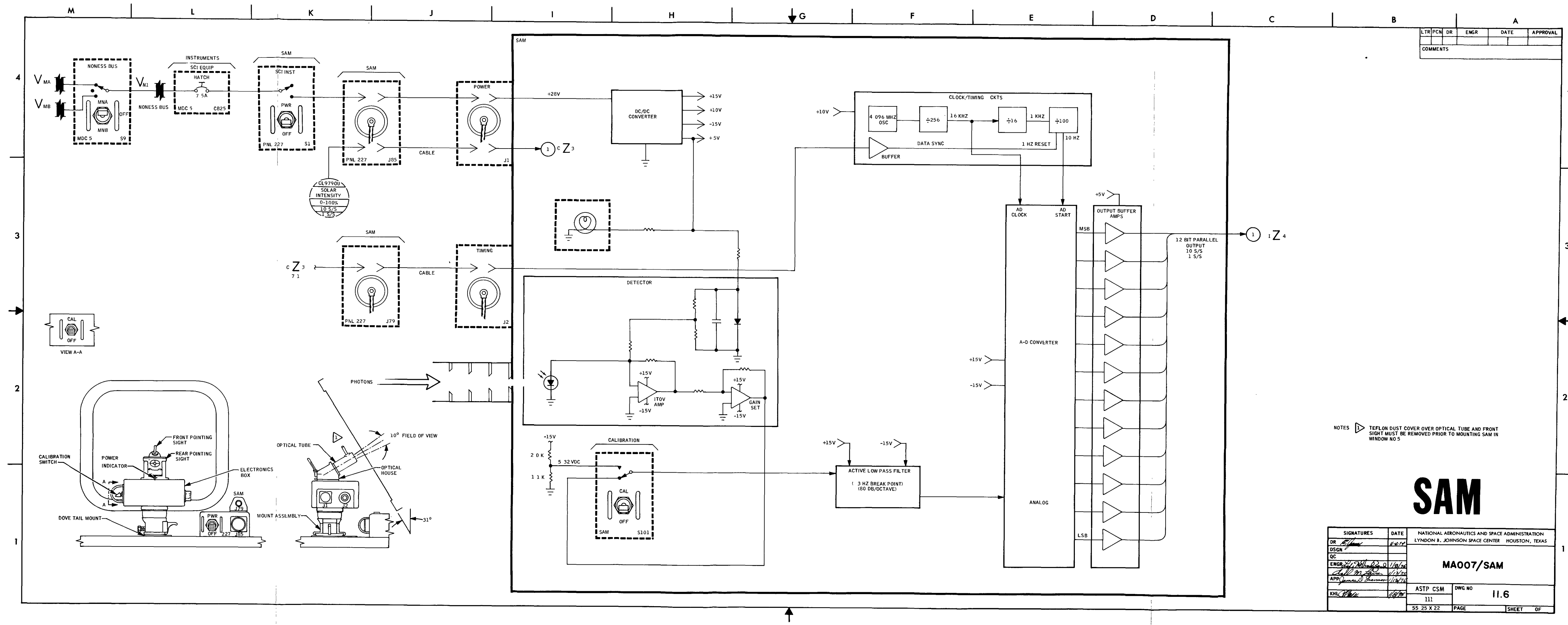
PHYSICAL LOCATION OF THERMISTOR IS INSIDE THE THERMOELECTRIC DEVICE

ETE

SIGNATURES		DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION	
DR	W. J. ...	7/7/72	LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS	
DESIGN	...	...	ELECTROPHORESIS	
QC	...	...	TECHNOLOGY (MSFC)	
TEST	...	...	MA-OH	
APP	...	...	ASTP CSM	
REL	...	...	PAGE 11.4	
66 X 35		PAGE	SHEET 01	



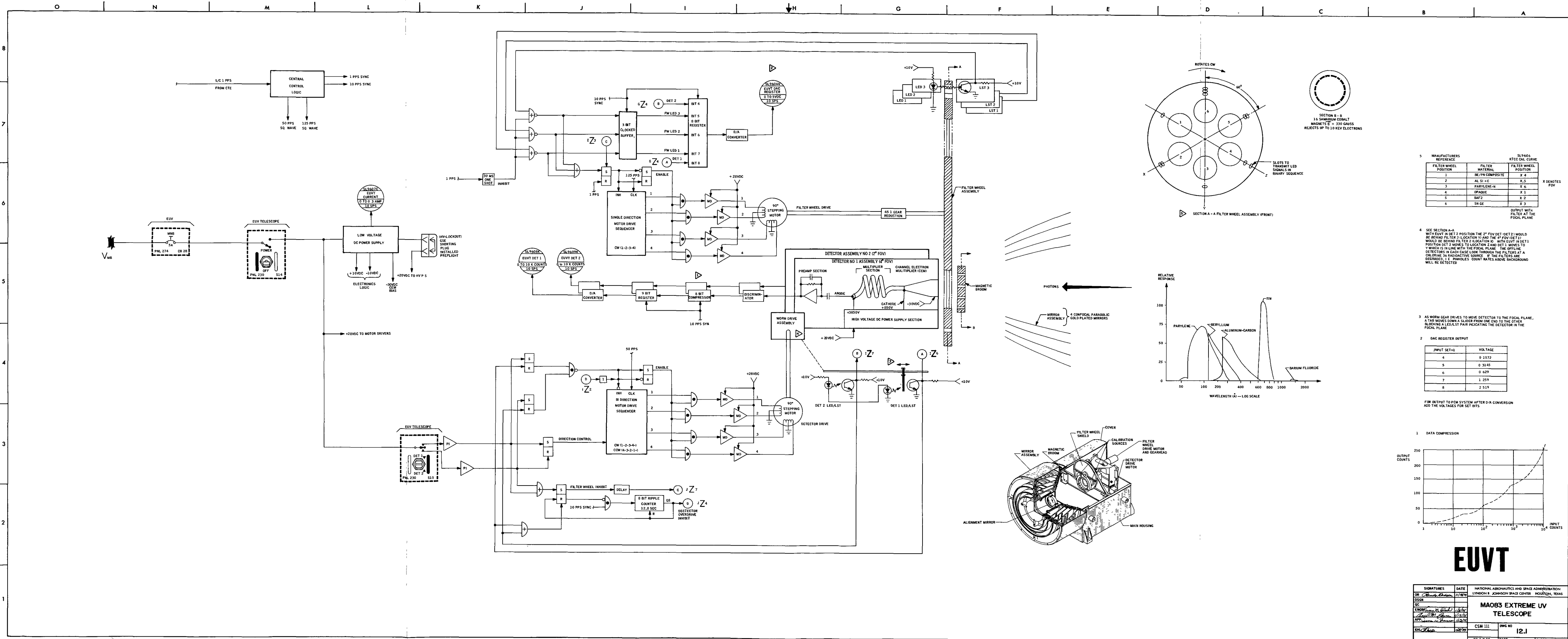
- FUNCTION OF 8/16/32 SECOND PULSE IS CALIBRATION PULSES TO INDICATE BEGINNING OF DARK ADAPT MODE AND BEGINNING OF SI MODE 32 SECOND PULSE RESETS THE CIRCUITS
- SCIENCE DATA CONSISTS OF DETECTORS, PTR MASKS, AND TAPE CASSETTE ALL WILL BE RETURNED
- DARK ADAPT SWITCH CONTROLS LENGTH OF TIME THE MASK LED IS ILLUMINATED POS 1 = 700 μSEC, 75 μSEC, 25 μSEC, 10 μSEC, 9 μSEC THRU POS 6 = 3 μSEC
- TAPE RECORDER LED WILL ILLUMINATE WHEN ASTRO PUSH BUTTON IS ACTIVATED WHEN MODE SELECT SWITCH IS CHANGED WHEN DETECTOR SHUT REGISTERS ARE CLOKED INTO THE RECORDER
- MODE SELECT SWITCH MUST NOT BE ROTATED COW THROUGH DETECTOR POSITIONING



NOTES
▷ TEFLON DUST COVER OVER OPTICAL TUBE AND FRONT SIGHT MUST BE REMOVED PRIOR TO MOUNTING SAM IN WINDOW NO 5

SAM

SIGNATURES		DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION	
DR	<i>[Signature]</i>	11/1/74	LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS	
DSGN	<i>[Signature]</i>			
QC	<i>[Signature]</i>			
ENGR	<i>[Signature]</i>	11/1/74		
APP	<i>[Signature]</i>	11/1/74		
KHL	<i>[Signature]</i>	11/1/74		
			ASTP CSM	DWG NO
			111	11.6
			55 25 X 22	PAGE SHEET OF



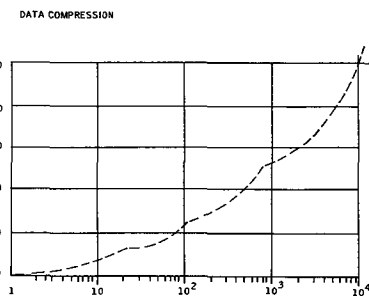
MANUFACTURER'S REFERENCE	SL9466 RTCC CAL CURVE
1	AL Si + C
2	PARYLENE-N
3	OPAQUE
4	BAF2
5	SiGe
6	

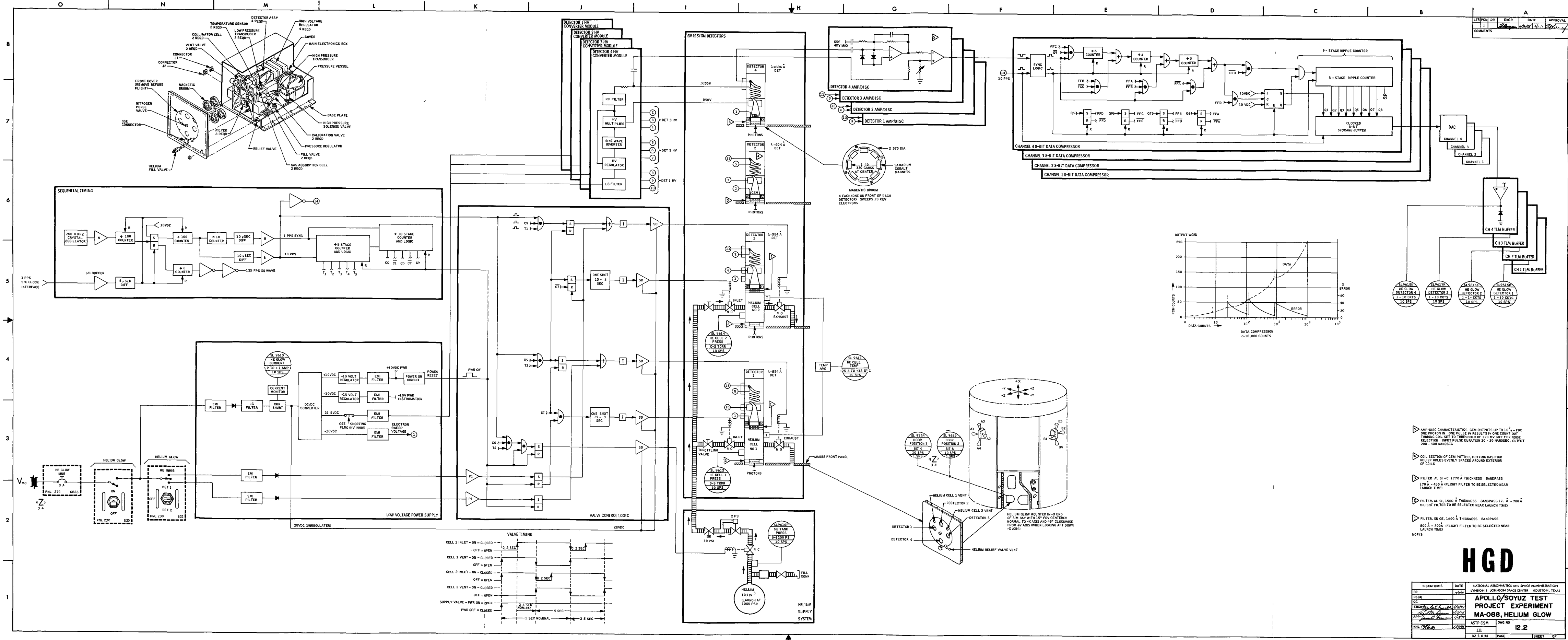
SEE SECTION A-A
WITH EUVT IN DET 2 POSITION THE 2° FOV DET (DET 2) WOULD BE BEHIND FILTER 2 (LOCATION 1) AND THE 4° FOV (DET 1) WOULD BE BEHIND FILTER 2 (LOCATION 2) WITH EUVT IN DET 3 POSITION DET 2 MOVES TO LOCATION 2 AND DET 1 MOVES TO Y WHICH IS IN LINE WITH THE FOCAL PLANE. THE OFFLINE ON DET 3 IN EACH CASE LOOK THROUGH THE FILTERS AT A DEGRADED, I.E. PHOTONIC, COUNT RATES ABOVE BACKGROUND WILL BE DETECTED

AS WORM GEAR DRIVES TO MOVE DETECTOR TO THE FOCAL PLANE, A TAB MOVES DOWN A SLIDER FROM ONE END TO THE OTHER BLOCKING A LED/ALST PAIR INDICATING THE DETECTOR IN THE FOCAL PLANE

INPUT DET-1	VOLTAGE
4	0.1572
5	0.3145
6	0.629
7	1.259
8	2.519

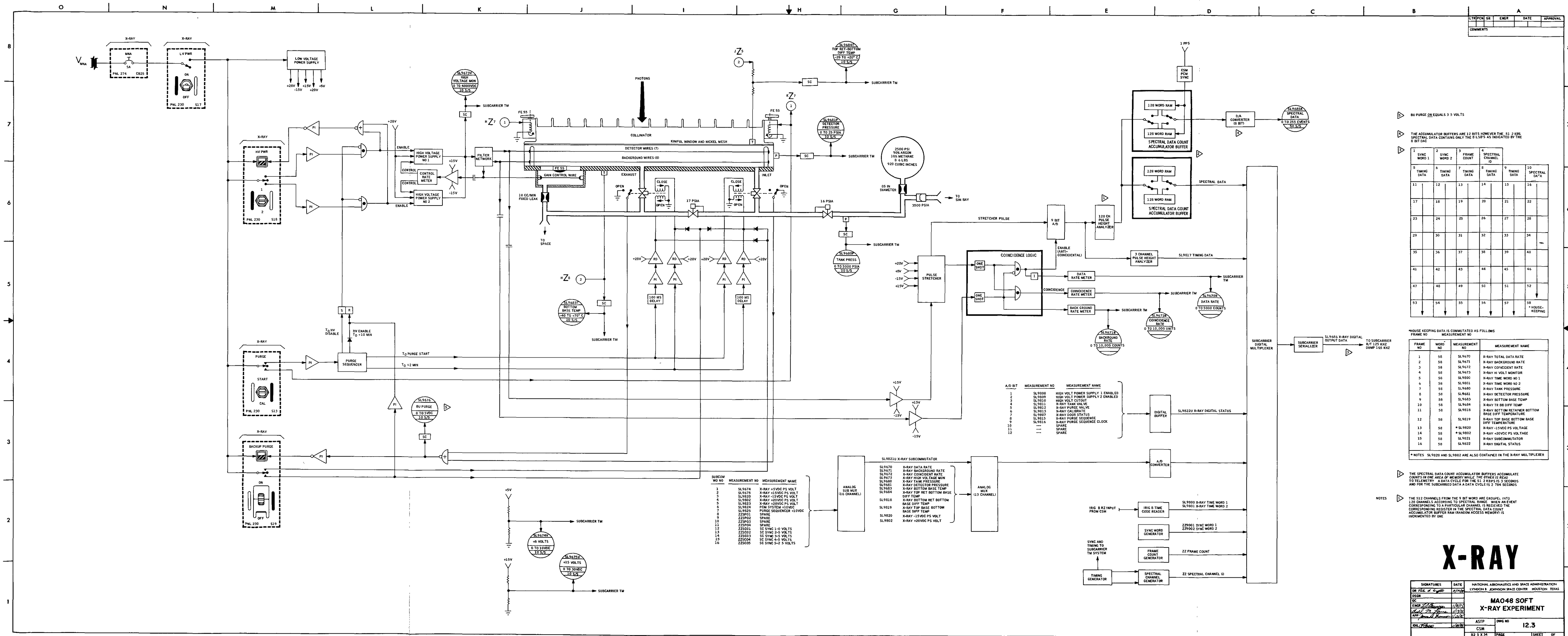
FOR OUTPUT TO PCM SYSTEM AFTER D/A CONVERSION ADD THE VOLTAGES FOR SET BITS

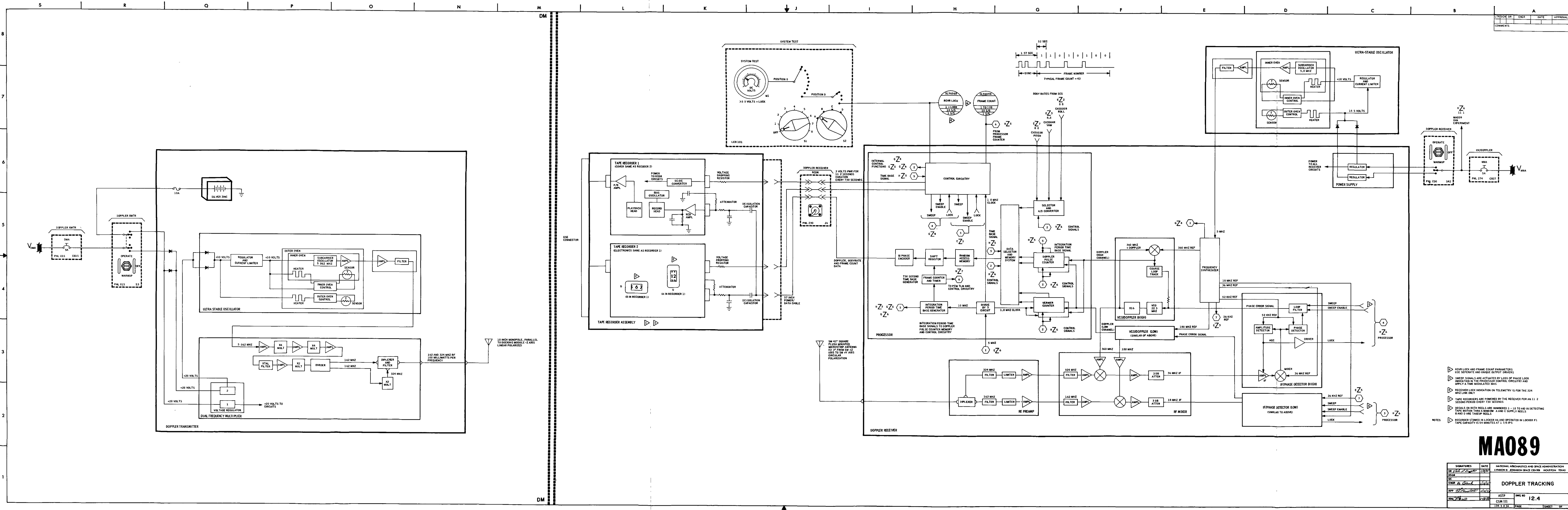


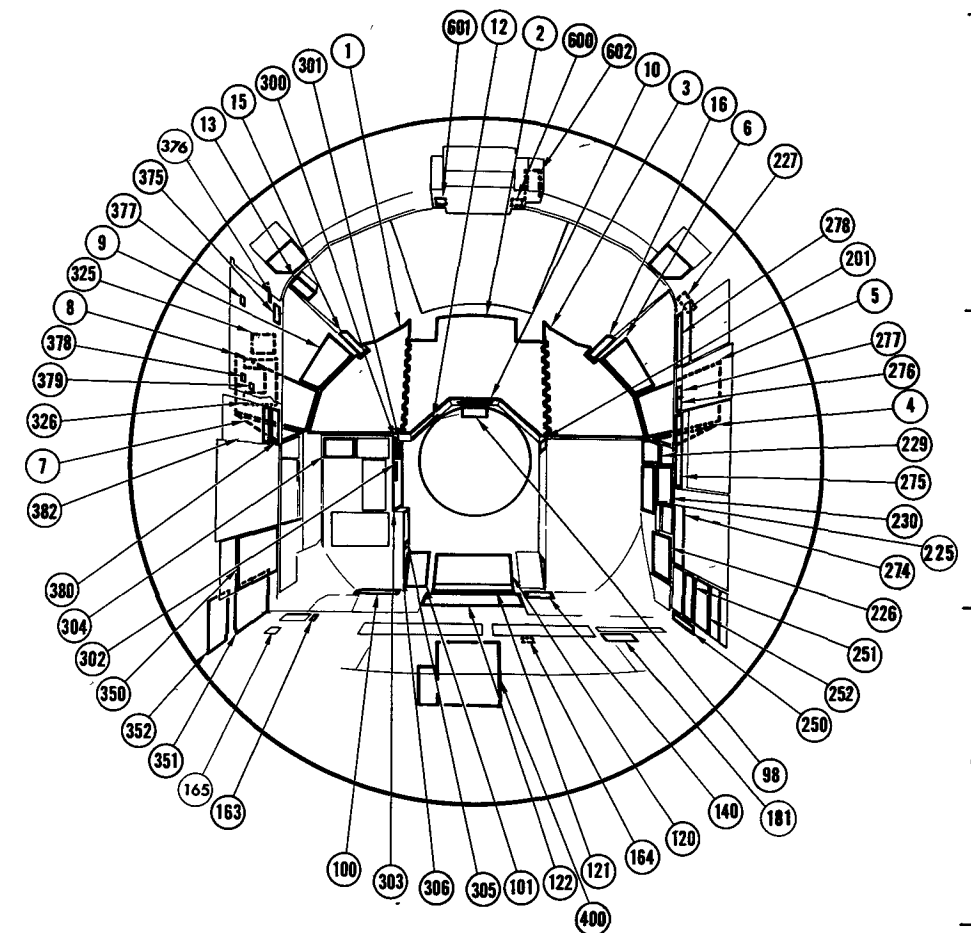
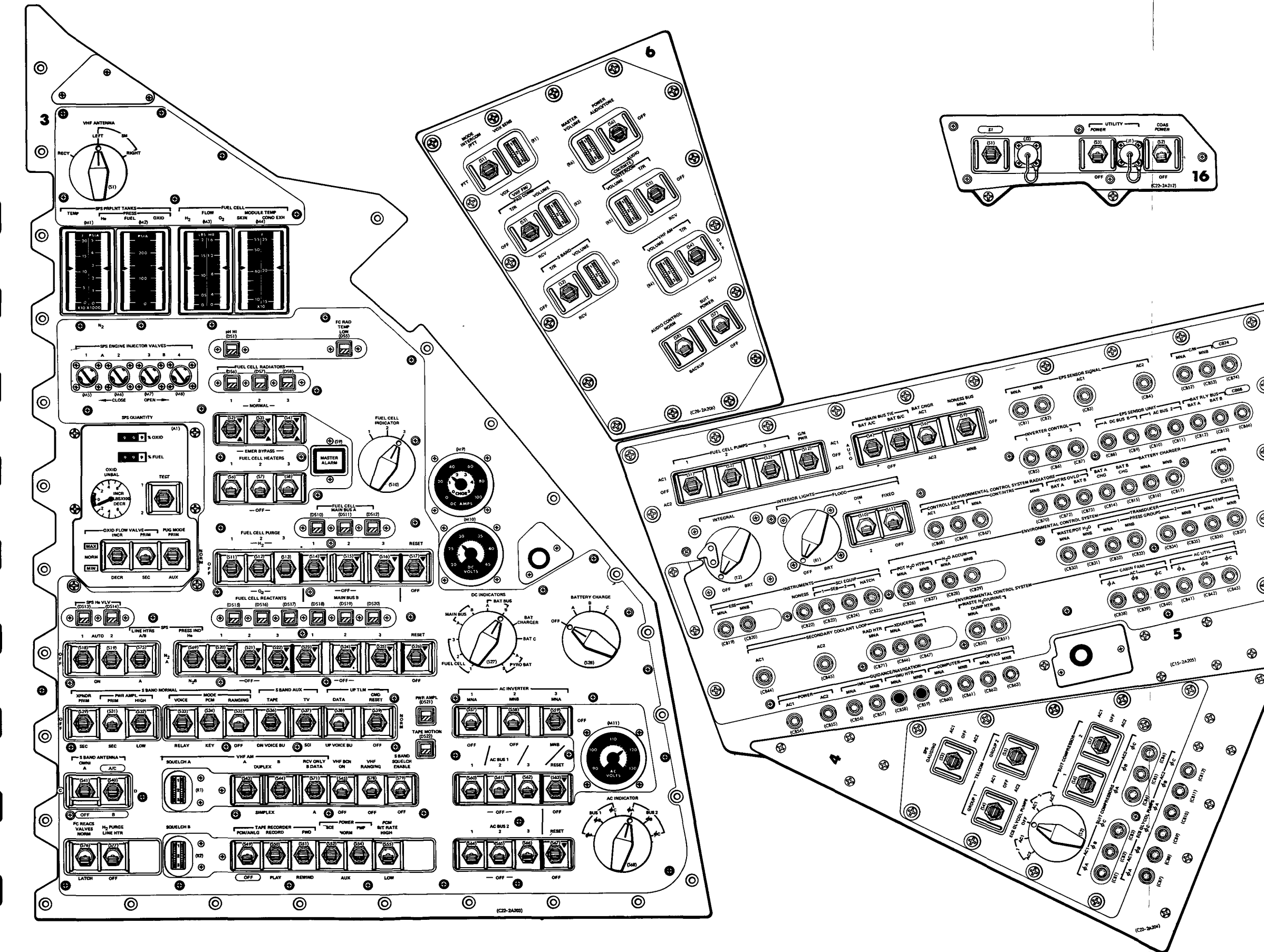
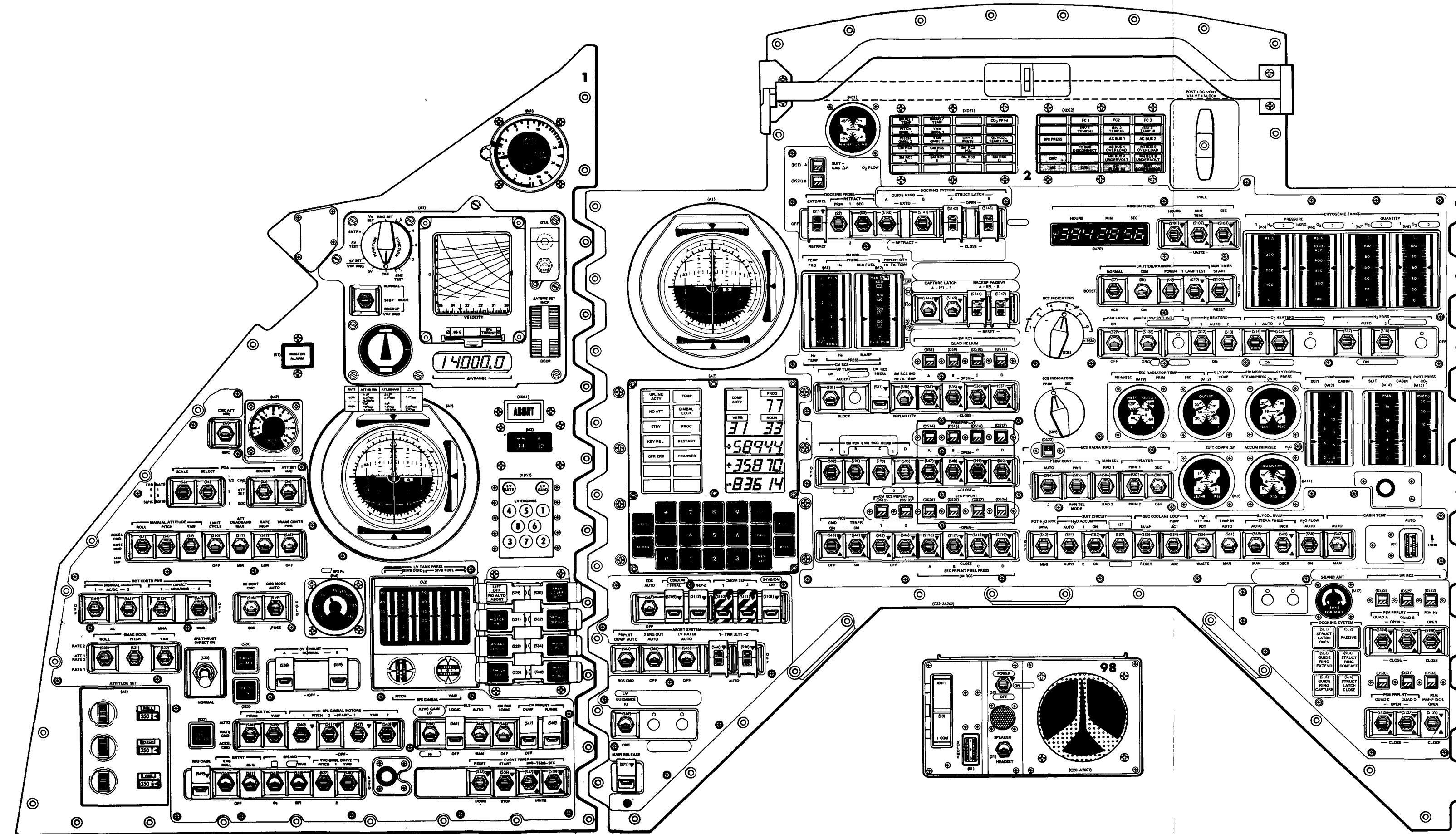


HGD

SIGNATURES		DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION	
DR	11/11/68	11/11/68	LYNDON B. JOHNSON SPACE CENTER	HOUSTON, TEXAS
DC	11/11/68	11/11/68	APOLLO/SOYUZ TEST PROJECT EXPERIMENT	
MA-088	11/11/68	11/11/68	MA-088, HELIUM GLOW	
ASTP CSM	11/11/68	11/11/68	ASTP CSM	
DWG NO	111	111	12.2	
PAGE	111	111	PAGE	
SHEET	111	111	SHEET	







5. ALL NUMBERS AND LETTERS ENCLOSED WITH PARENTHESES DO NOT APPEAR ON PANELS.

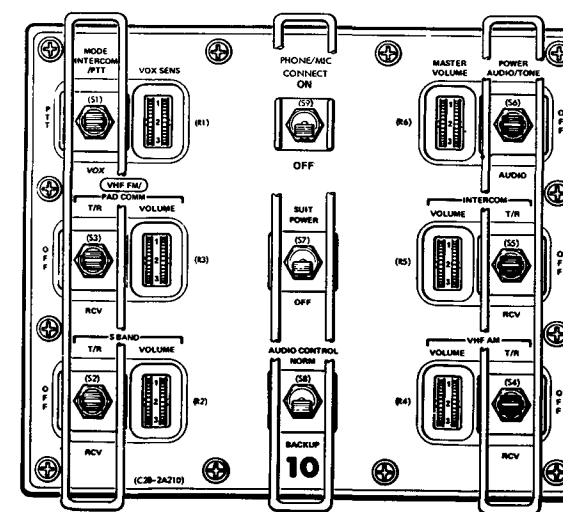
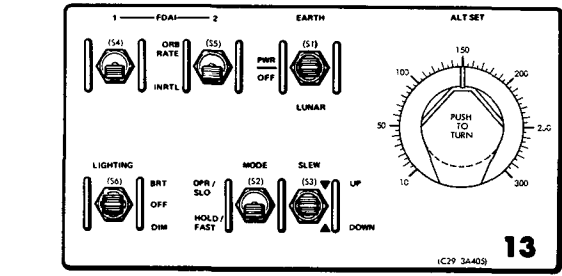
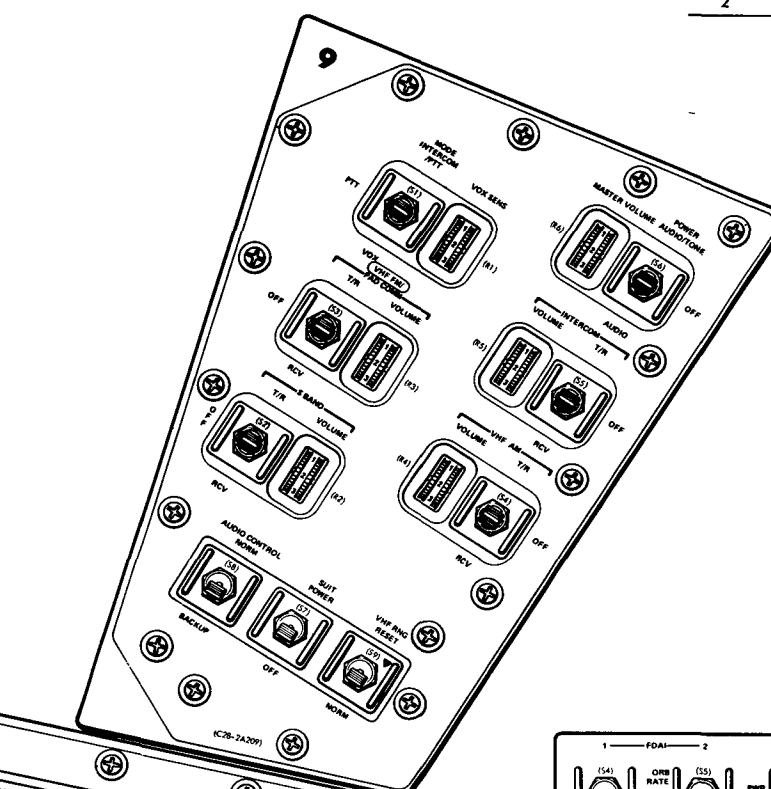
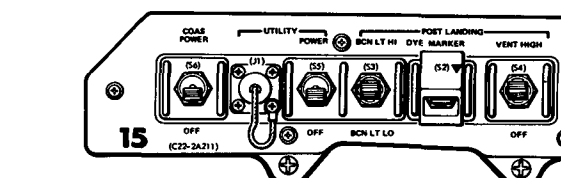
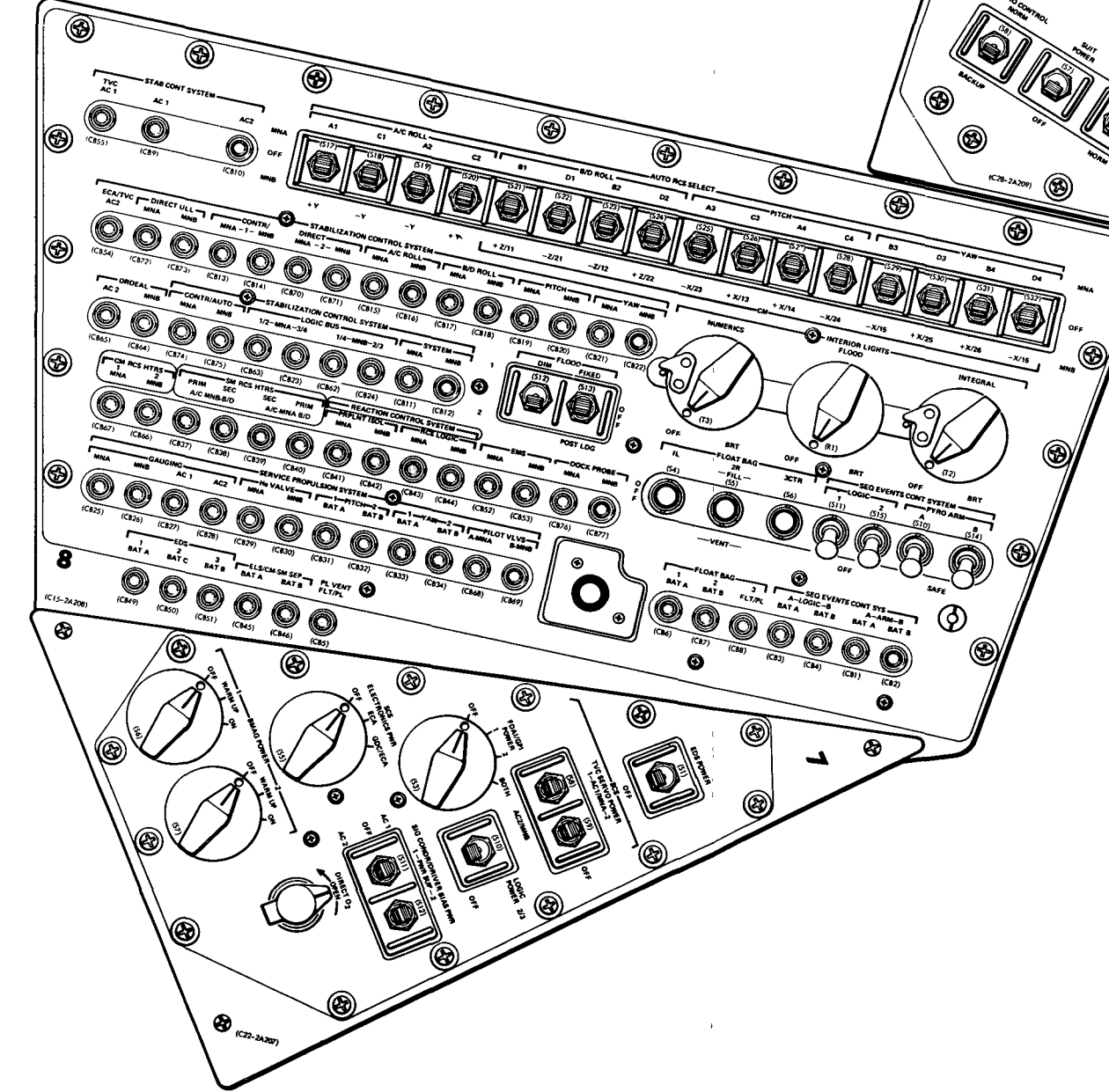
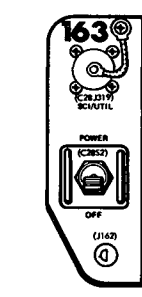
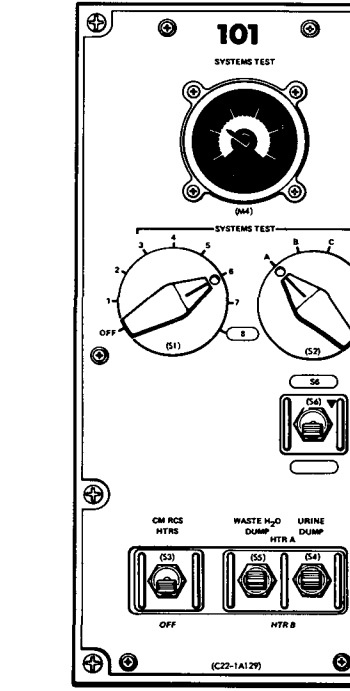
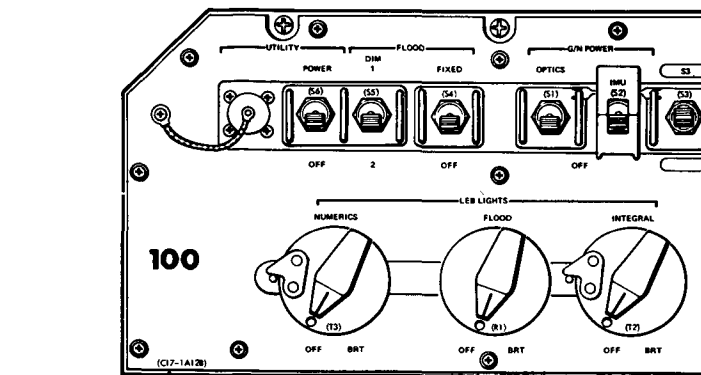
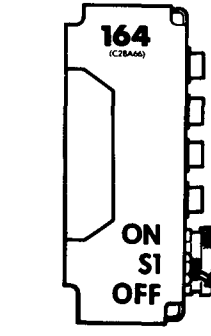
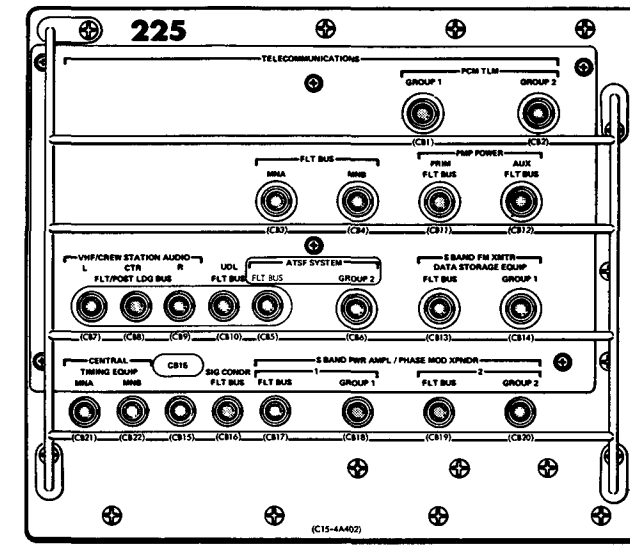
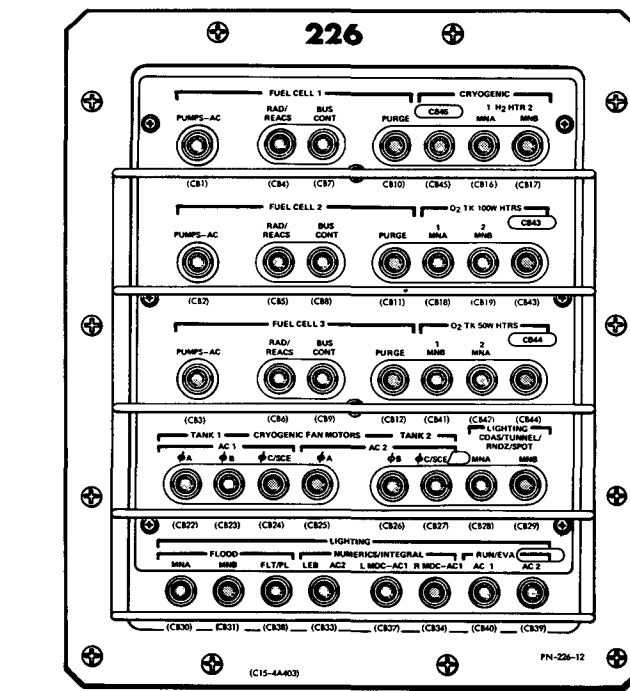
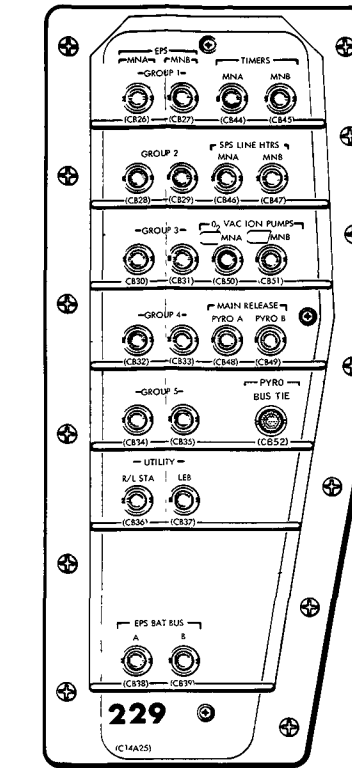
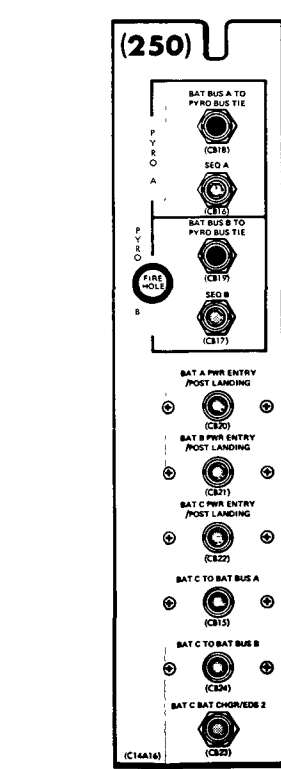
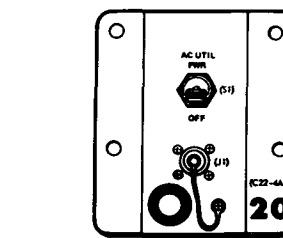
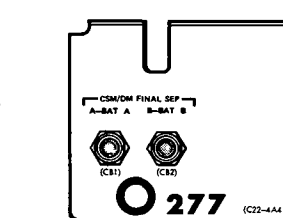
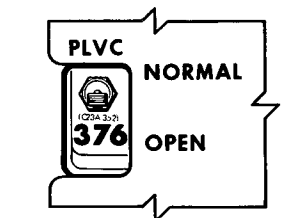
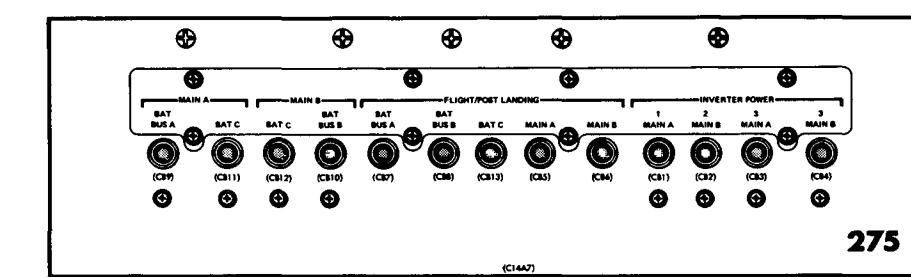
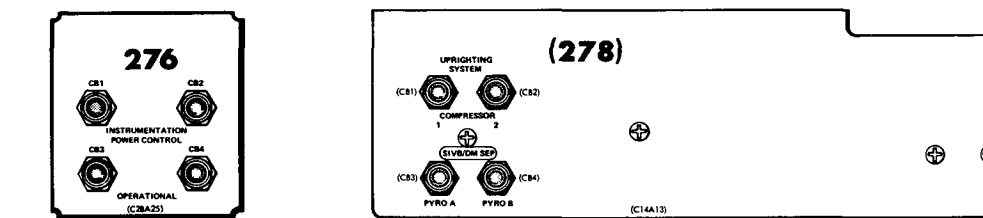
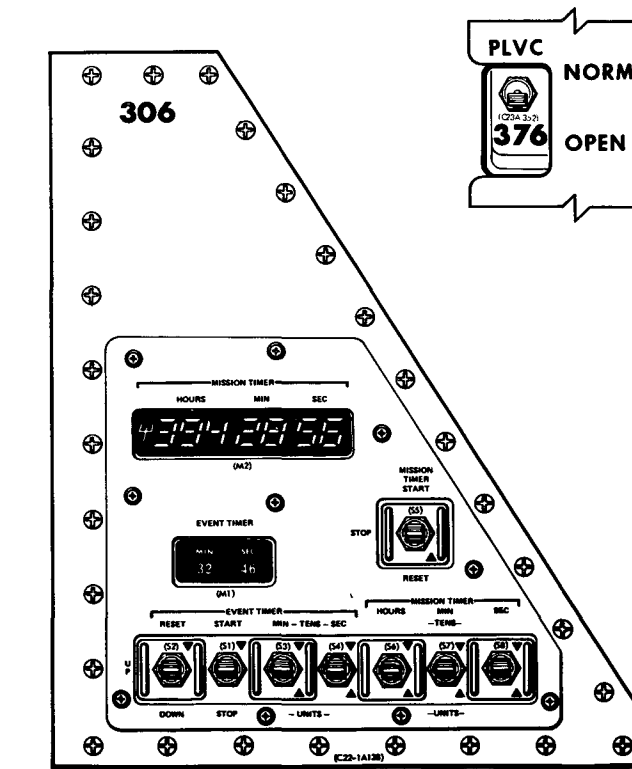
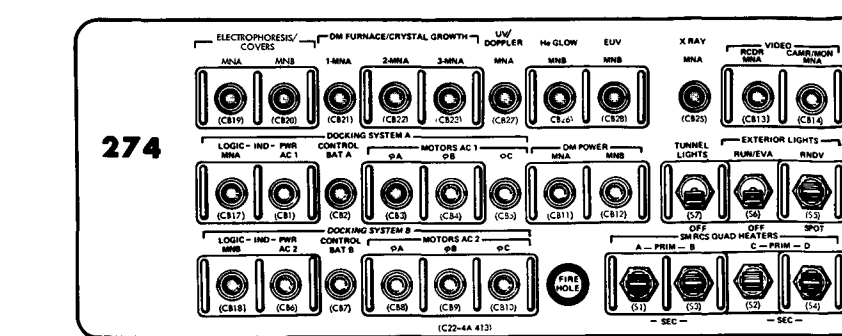
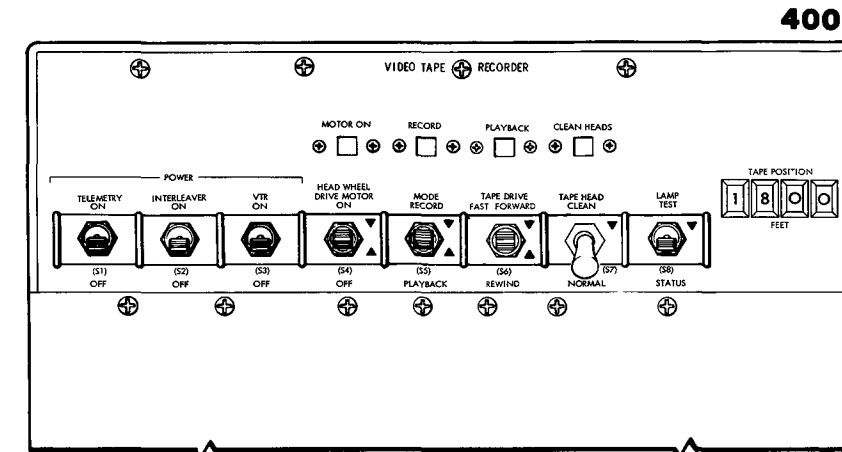
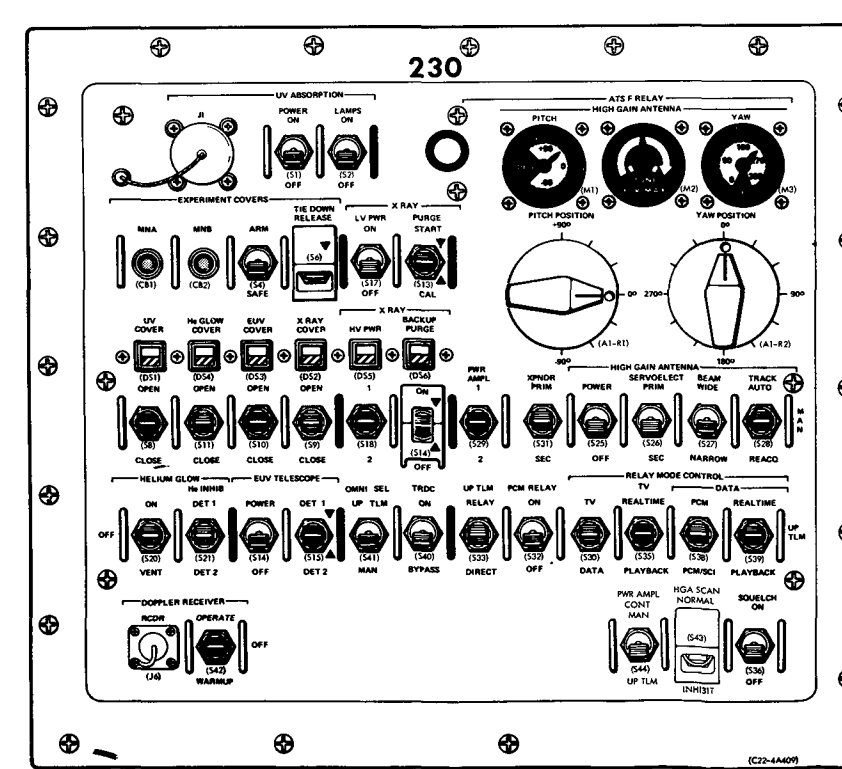
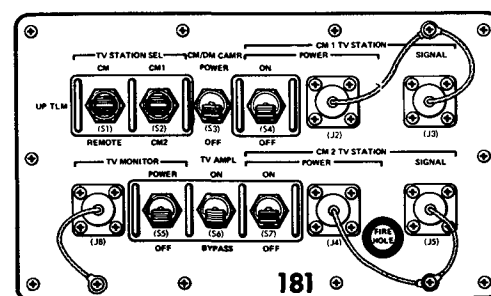
4. ▼ SYMBOL DENOTES MOMENTARY SWITCH POSITION AND DOES NOT APPEAR ON PANELS.

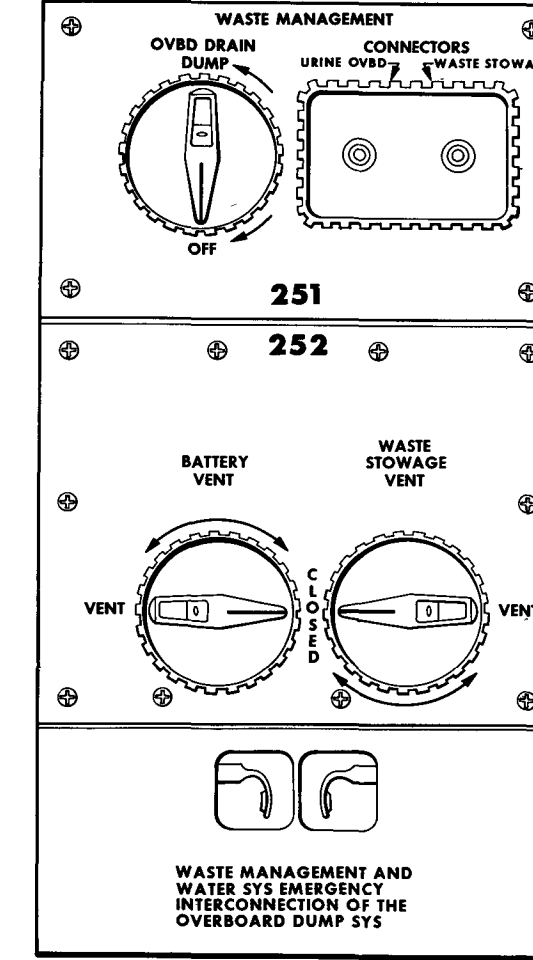
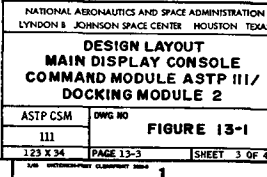
3. SWITCH POSITIONS ARE SHOWN FOR CONVENIENCE ONLY AND DO NOT NECESSARILY REFLECT OPERATING MODES AND/OR MISSION PHASES. TWO POSITION SWITCHES ARE SHOWN IN THE DOWN POSITION. THREE POSITION SWITCHES ARE SHOWN IN CENTER POSITION.

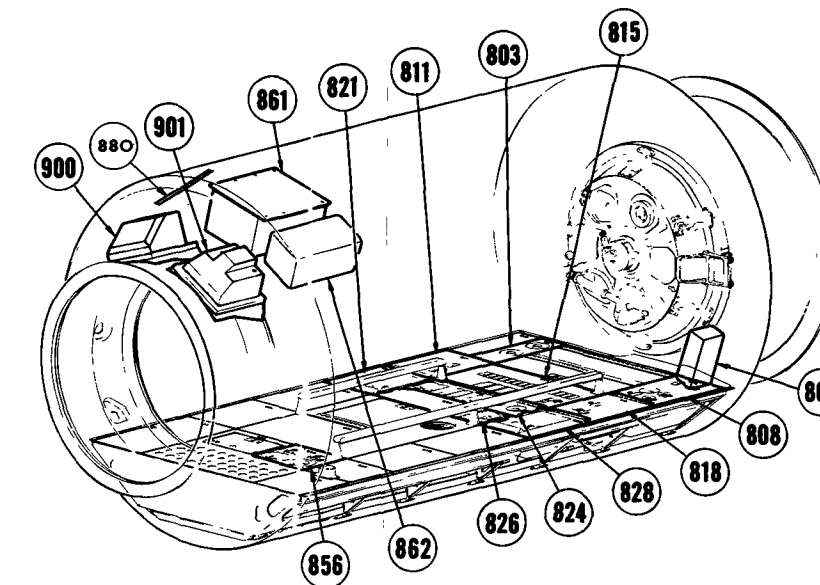
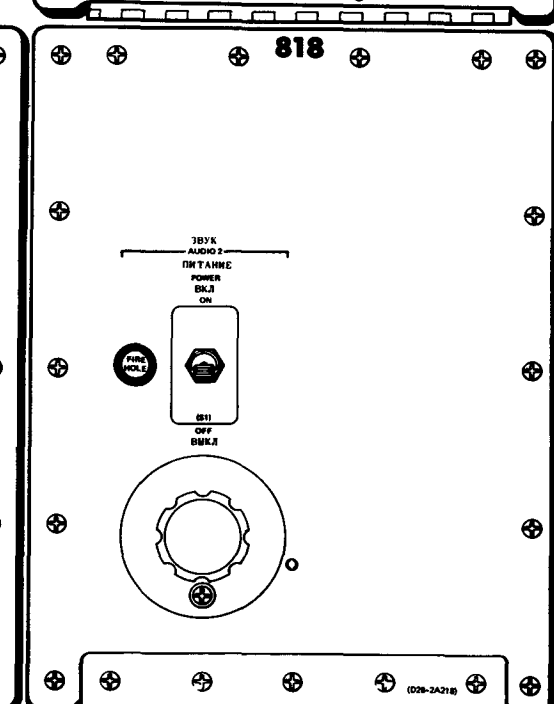
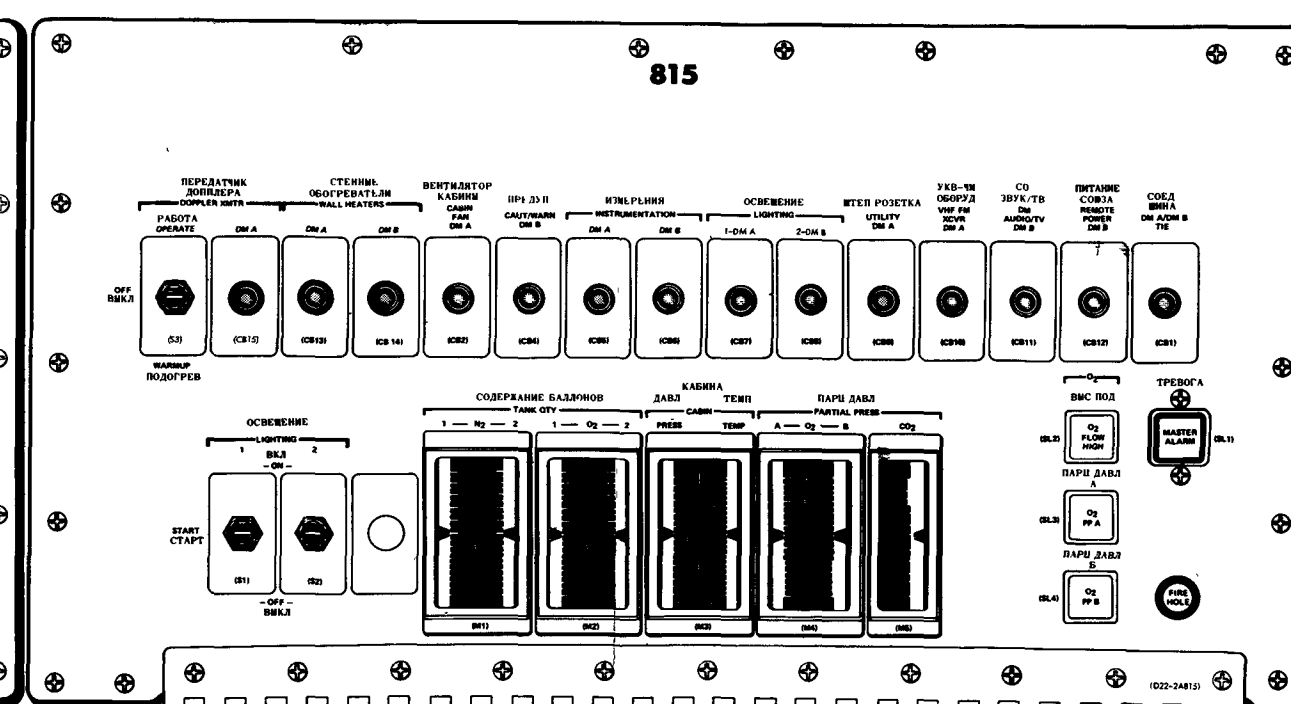
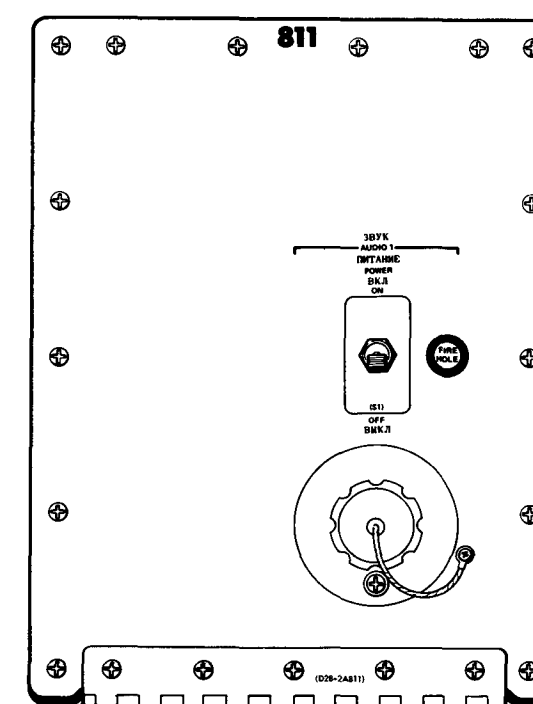
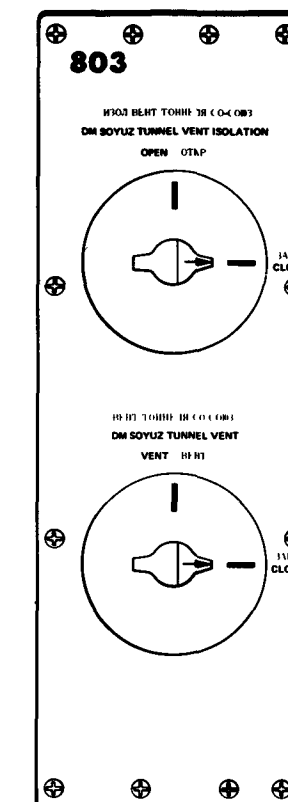
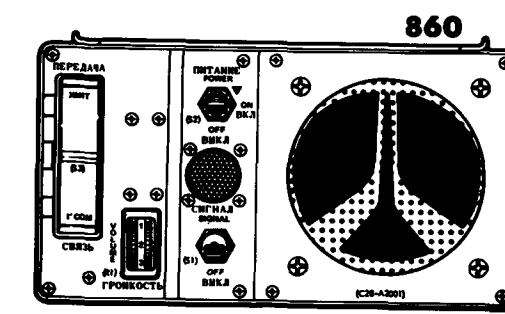
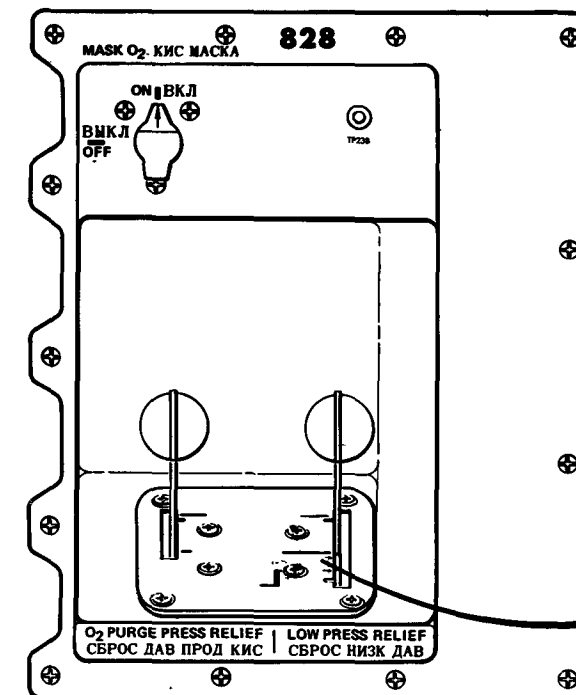
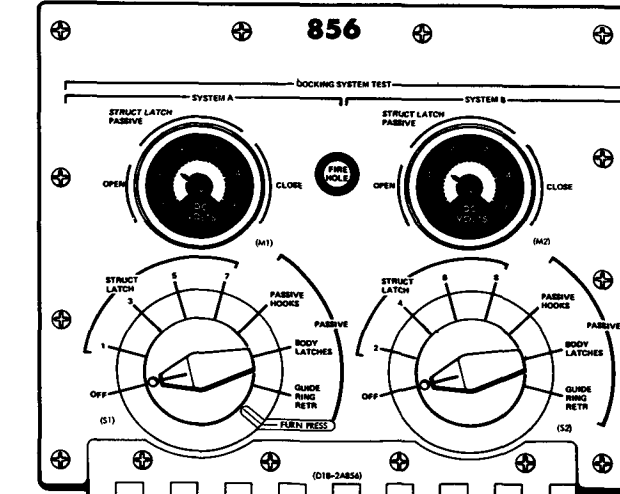
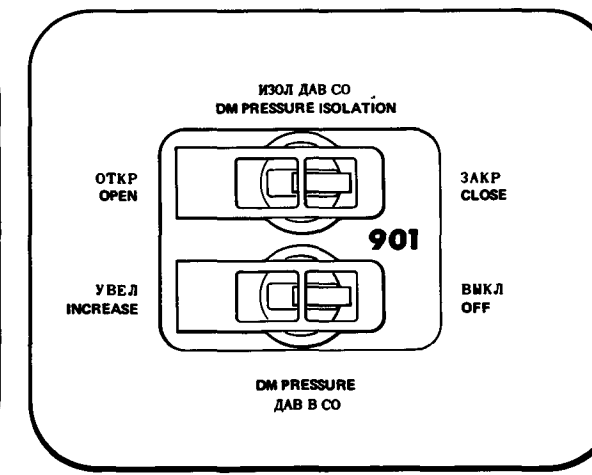
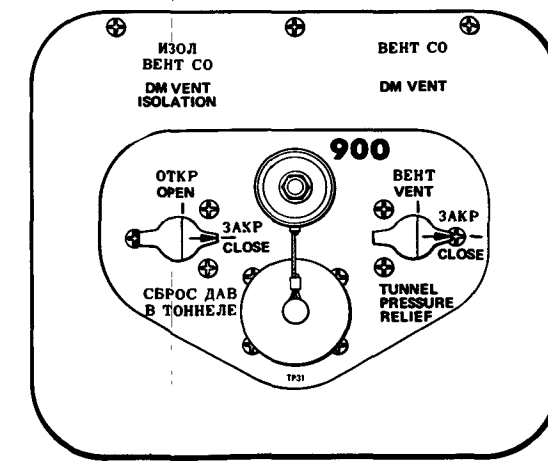
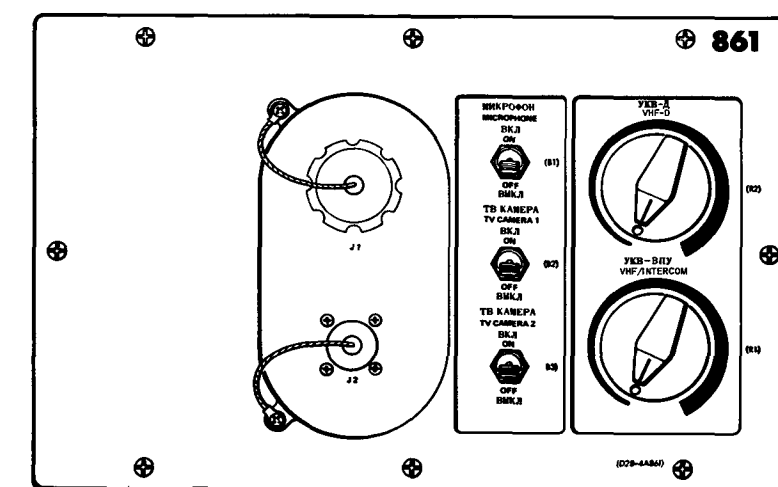
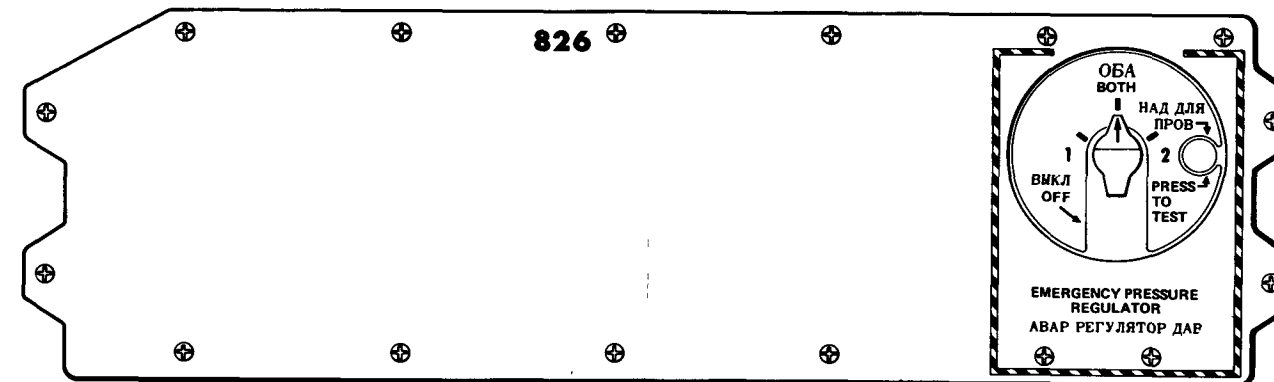
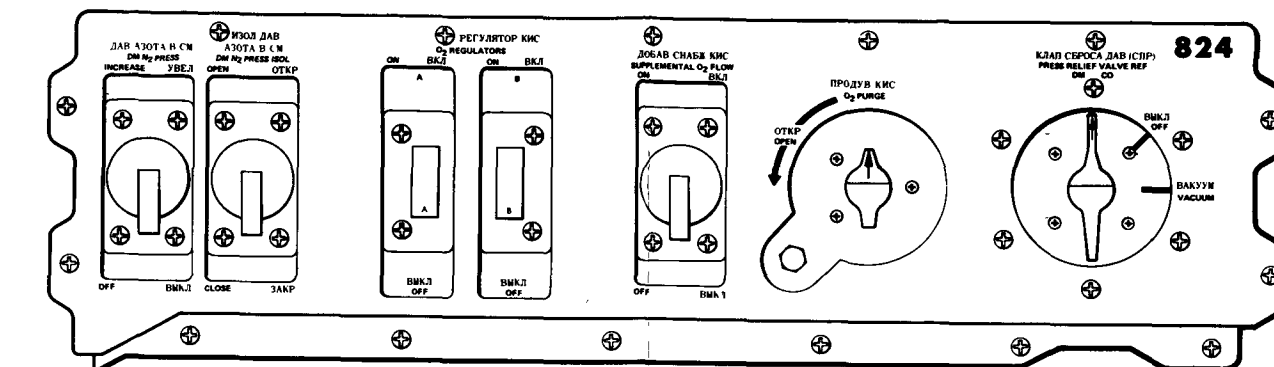
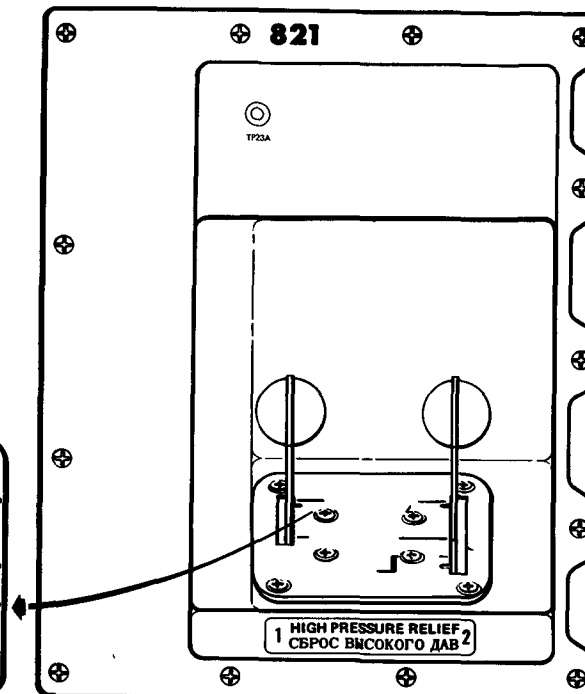
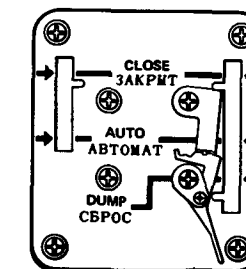
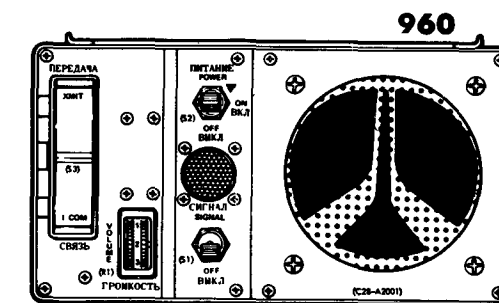
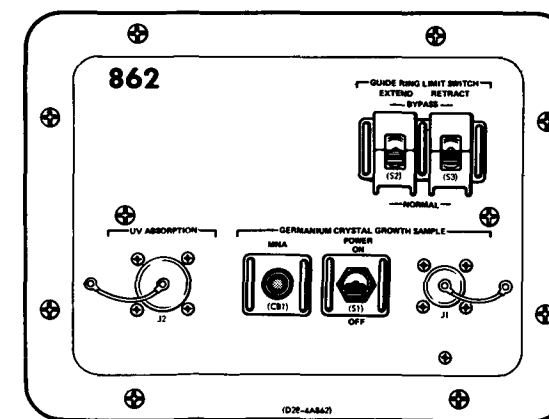
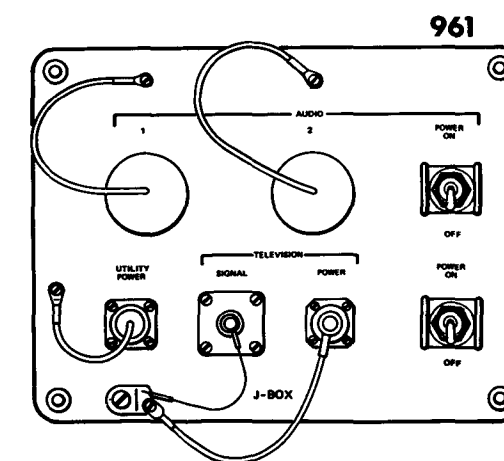
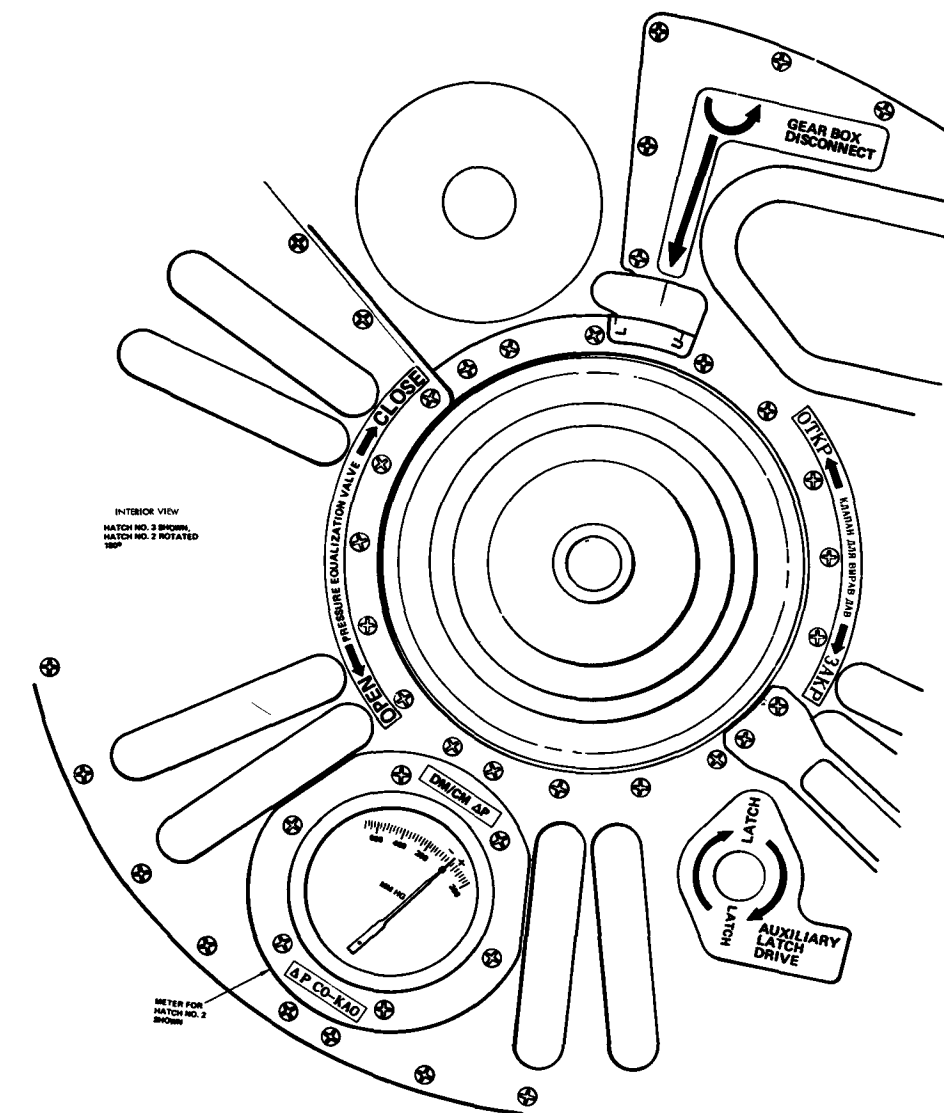
2. THIS IS AN ARRANGEMENT AND NOMENCLATURE CONTROL DWG FOR DESIGN REQUIREMENTS AND FOR USE BY OTHER DWGS AS A GUIDE. ONLY RELEASED DESIGN DRAWINGS AND DOCUMENTS SHALL BE USED FOR MFG, MOCK-UP, SIMULATOR, EVALUATOR, TRAINER OR CONTRIFACE PANELS WHICH ARE INTENDED TO REFLECT CURRENT DESIGN.

1. THIS DWG REFLECTS A CONFIGURATION AS DEFINED BY APPLICABLE SCOTS, ASSEMBLY DWGS AND MARKING DWGS AS OF THE DATE OF RELEASE WITH RESPECT TO THE AFFECTED VEHICLES.

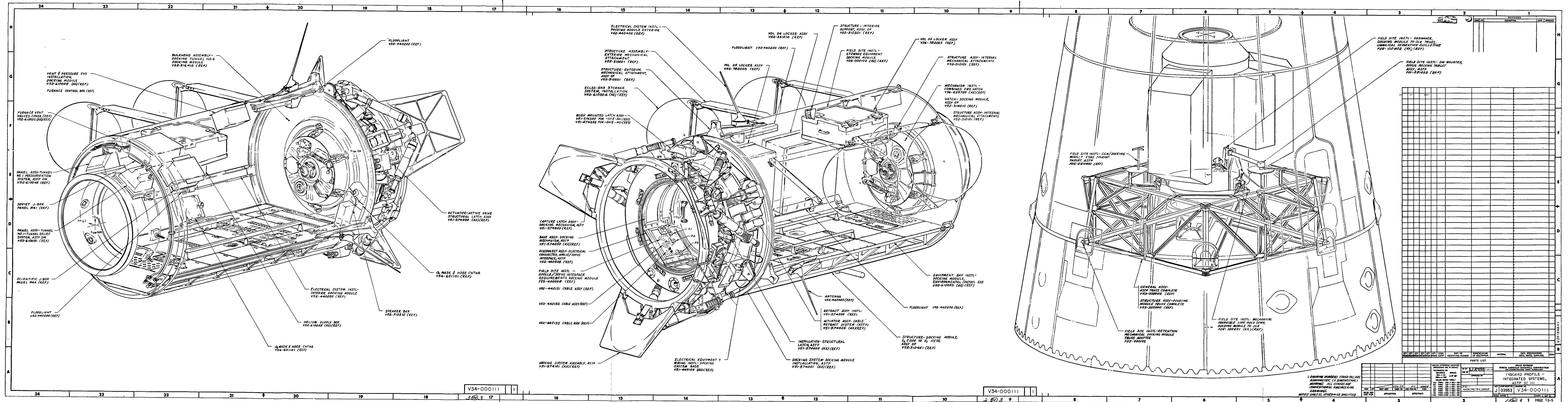
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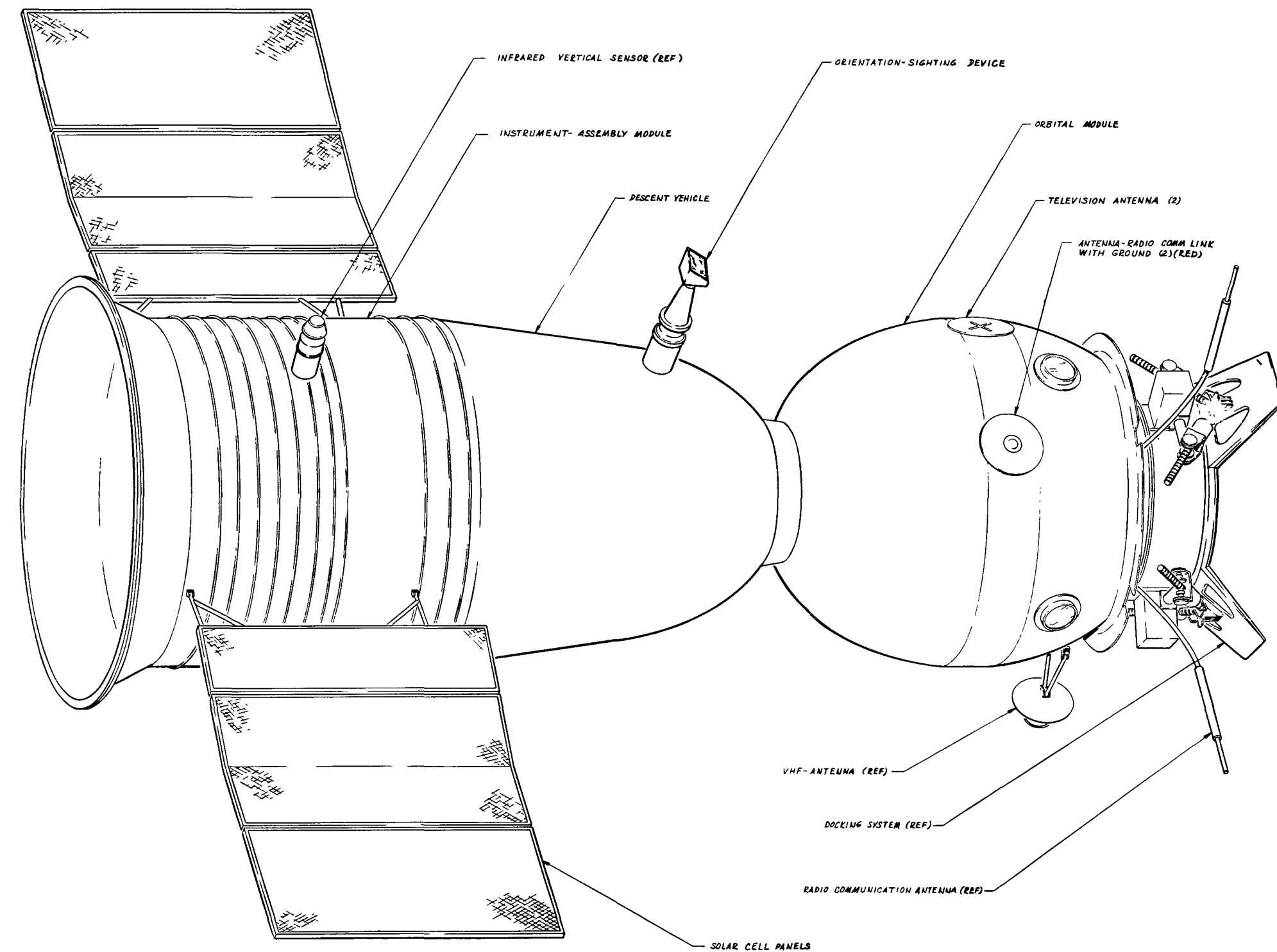






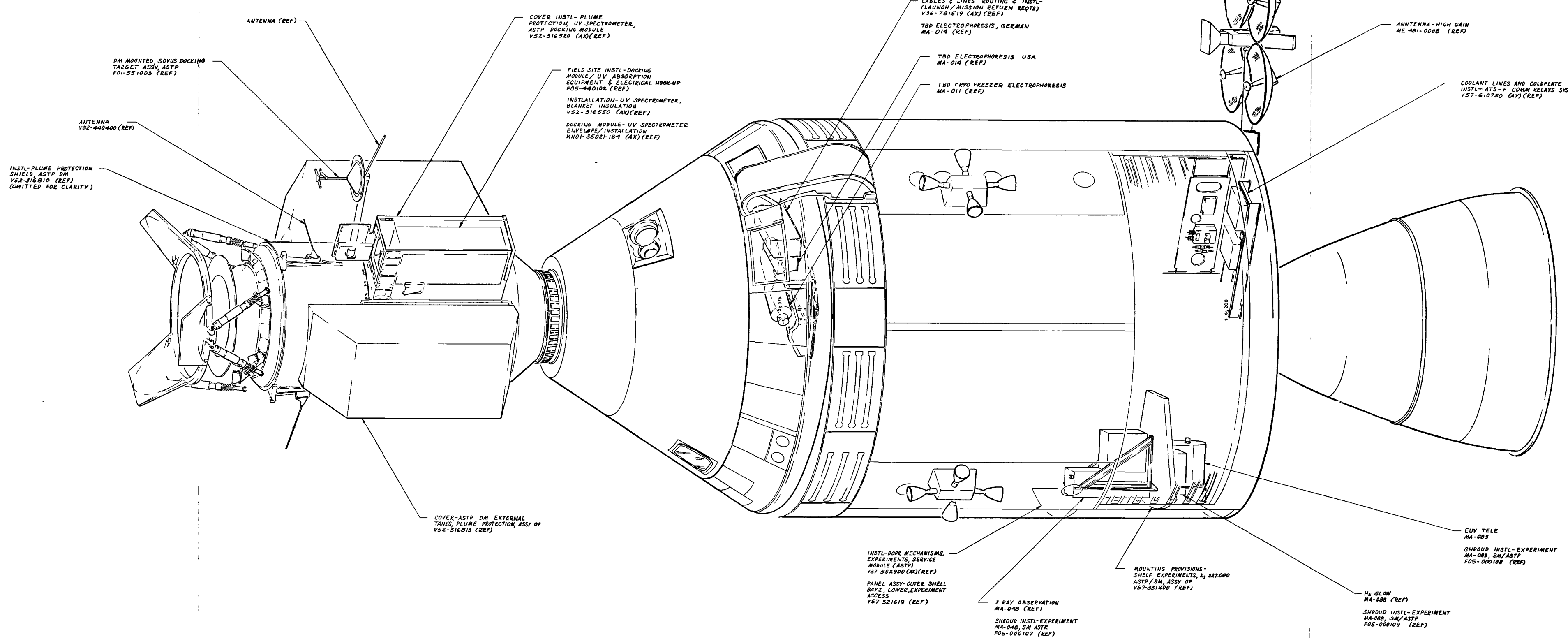
SIGNATURES	DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
DESIGNER		LYNNH & JOHNSON SPACE CENTER, HOUSTON, TEXAS
ENGINEER		
TESTER		
APP		
CHECK		
111		FIGURE 13-1
321 X 34	PAGE 13-4	13-4





V34-000111 2

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ASTP

CSH

**COMMAND/
SERVICE
MODULE
AND DOCKING
MODULE
SYSTEMS
HANDBOOK**

CSM 111

AUGUST 1, 1974



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