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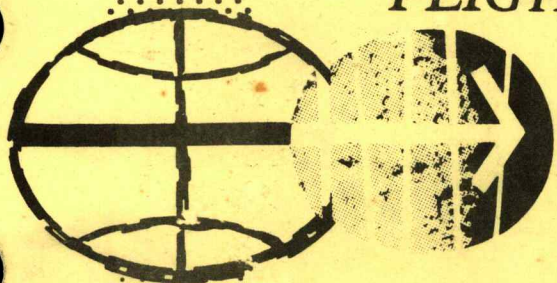
COMMAND/SERVICE MODULE SYSTEMS HANDBOOK

CSM 103

MAY 10, 1968

PREPARED BY

FLIGHT CONTROL DIVISION



MANNED SPACECRAFT CENTER
HOUSTON, TEXAS

1 STANDARDS

2 SEQUENTIAL
EVENTS SYSTEM

3 ELECTRICAL
SYSTEM

4 ENVIRONMENTAL
CONTROL SYS

5 FUEL CELL/
CRYOGENIC
SYSTEM

6 COMMUNI-
CATIONS
SYSTEM

7 INSTRU-
MENTATION

8 GUIDANCE AND
CONTROL
SYSTEM

9 SERVICE
PROPULSION
SYSTEM

10 REACTION
CONTROL
SYSTEM

11 MISCELLANEOUS

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COMMAND/SERVICE MODULE SYSTEMS HANDBOOK

CSM 103

PREFACE

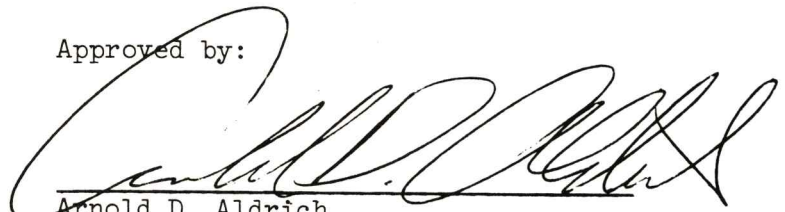
This handbook, prepared by the Flight Control Division, NASA, Manned Spacecraft Center, Houston, Texas with technical support by North American Rockwell Corporation (NR), reflects the Command/Service Module (CSM 103) Spacecraft Systems as of May 10, 1968.

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

Comments concerning the contents of this handbook should be directed to FC36/Mr. Hubert V. Grogan, NR, Flight Operations Support, HU3-5805.

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Approved by:



Arnold D. Aldrich
Chief, CSM Systems Branch



John D. Hodge
Chief, Flight Control Division

CSM 103

MAY 22, 1968

PUBLICATION CONTROL AND EFFECTIVE PAGE SHEET

FIGURE, DRAWING OR PAGE NUMBER	TITLE	REVISION	SIGNOFF DATE
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SECTION 1 STANDARDS

PAGE 1-1 THROUGH PAGE 1-21		BASIC	5/6/68
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SECTION 2 SEQUENTIAL EVENTS SYSTEM

FIGURE 2.1	CONTROL-DISPLAY FIGURE	BASIC	4/30/68
DRAWING 2.1	SEQUENTIAL OVERVIEW	BASIC	4/30/68
DRAWING 2.2	SEQUENTIAL POWER DISTRIBUTION	BASIC	4/30/68
DRAWING 2.3	SEQUENTIAL ABORT INITIATION	BASIC	4/30/68
DRAWING 2.4	SEQUENTIAL LES AND SPS ABORT SUBSYSTEM	BASIC	4/30/68
DRAWING 2.5	SEQUENTIAL EARTH LANDING SUBSYSTEM	BASIC	4/30/68
DRAWING 2.6	SEQUENTIAL UPRIGHTING SYSTEM	BASIC	4/30/68

SECTION 3 ELECTRICAL SYSTEM

FIGURE 3.1	EPS CONTROL-DISPLAY FIGURE	BASIC	4/30/68
DRAWING 3.1	EPS OVERVIEW	BASIC	4/30/68
DRAWING 3.2	ELECTRICAL DC SYSTEM AND DISTRIBUTION	BASIC	4/30/68
DRAWING 3.3	ELECTRICAL AC SYSTEM AND DISTRIBUTION	BASIC	4/30/68
PARAGRAPH 3.4	BUS SUMMARY TABLE		
PAGE 3-6	MAIN BUS A	BASIC	4/30/68
PAGE 3-12	MAIN BUS B	BASIC	4/30/68
PAGE 3-18	BATTERY BUS A	BASIC	4/30/68
PAGE 3-20	BATTERY BUS B	BASIC	4/30/68
PAGE 3-22	BATTERY RELAY BUS	BASIC	4/30/68
PAGE 3-24	FLIGHT BUS	BASIC	4/30/68

** PUBLICATION CONTROL AND EFFECTIVE PAGE SHEET 5/22/68 (CONT'D)

FIGURE, DRAWING OR PAGE NUMBER	TITLE	REVISION	SIGNOFF DATE
PAGE 3-25	FLIGHT AND POSTLANDING BUS	BASIC	4/30/68
PAGE 3-27	BATTERY C	BASIC	4/30/68
PAGE 3-28	BATTERY C PWR, POSTLANDING AND ENTRY CIRCUIT BREAKER (CB22)	BASIC	4/30/68
PAGE 3-29	NON-ESSENTIAL BUS 1	BASIC	4/30/68
PAGE 3-30	NON-ESSENTIAL BUS 2	BASIC	4/30/68
PAGE 3-31	PYRO BUS A	BASIC	4/30/68
PAGE 3-32	PYRO BUS B	BASIC	4/30/68
PAGE 3-33	AC BUS 1	BASIC	4/30/68
PAGE 3-37	AC BUS 2	BASIC	4/30/68
PAGE 3-40	MISCELLANEOUS CIRCUIT BREAKER	BASIC	4/30/68

SECTION 4 ENVIRONMENTAL CONTROL SYSTEM

FIGURE 4.1	ECS CONTROL-DISPLAY FIGURE	BASIC	5/6/68
DRAWING 4.1	ECS OVERVIEW	BASIC	5/6/68
DRAWING 4.2	SUIT AND CABIN PRESSURIZATION	BASIC	5/6/68
DRAWING 4.3	PRIMARY GLYCOL LOOP	BASIC	5/6/68
DRAWING 4.4	SECONDARY GLYCOL LOOP	BASIC	5/6/68
DRAWING 4.5	WATER AND WASTE MANAGEMENT	BASIC	5/6/68

SECTION 5 FUEL CELL/CRYOGENIC SYSTEM

FIGURE 5.1	FUEL CELL/CRYOGENIC CONTROL- DISPLAY FIGURE	BASIC	4/30/68
DRAWING 5.1	FUEL CELL/CRYOGENIC OVERVIEW	BASIC	4/30/68
DRAWING 5.2	CRYOGENIC GAS STORAGE SYSTEM	BASIC	4/30/68
DRAWING 5.3	FUEL CELL	BASIC	4/30/68

SECTION 6 COMMUNICATIONS SYSTEM

FIGURE 6.1	COMMUNICATIONS CONTROL-DISPLAY FIGURE/AUDIO STATION MODES AND CONTROL CHART	BASIC	5/17/68
DRAWING 6.1	COMMUNICATIONS OVERVIEW/RF EQUIPMENT MODES AND CONTROL CHART	BASIC	5/17/68
DRAWING 6.2	UNIFIED S-BAND RF EQUIPMENT	BASIC	5/17/68

FIGURE, DRAWING OR PAGE NUMBER	TITLE	REVISION	SIGNOFF DATE
DRAWING 6.3	VHF AM TRANSCEIVERS AND AUDIO EQUIPMENT	BASIC	5/17/68
DRAWING 6.4	PREMODULATION PROCESSOR	BASIC	5/17/68
DRAWING 6.5	UPDATE LINK	BASIC	5/17/68
DRAWING 6.6	RENDEZVOUS TRANSPONDER AND RECOVERY EQUIPMENT	BASIC	5/17/68
TABLE 6-I	UNIFIED S-BAND TRANSPONDER AND FM TRANSMITTER	BASIC	5/17/68
TABLE 6-II	S-BAND POWER AMPLIFIER	BASIC	5/17/68
TABLE 6-III	S-BAND DOWNLINK MODES AND MODULATION PROCESS	BASIC	5/17/68
TABLE 6-IV	S-BAND UPLINK MODES AND MODULATION PROCESS	BASIC	5/17/68
TABLE 6-V	PREMODULATION PROCESSOR	BASIC	5/17/68
TABLE 6-VI	VHF AM TRANSCEIVER EQUIPMENT	BASIC	5/17/68
TABLE 6-VII	AUDIO CENTER EQUIPMENT	BASIC	5/17/68
TABLE 6-VIII	UPDATE LINK EQUIPMENT	BASIC	5/17/68
TABLE 6-IX	TELEVISION CAMERA, SLOW SCAN	BASIC	5/17/68
TABLE 6-X	RENDEZVOUS RADAR TRANSPONDER AND ANTENNA	BASIC	5/17/68
TABLE 6-XI	VHF RECOVERY BEACON	BASIC	5/17/68
TABLE 6-XII	VHF SURVIVAL BEACON- TRANSCIVER	BASIC	5/17/68
TABLE 6-XIII	ANTENNA SWITCH, S-BAND	BASIC	5/17/68
TABLE 6-XIV	ANTENNA SWITCH, VHF	BASIC	5/17/68
TABLE 6-XV	ANTENNA, S-BAND OMNI	BASIC	5/17/68
TABLE 6-XVI	ANTENNA, VHF SCIMITAR	BASIC	5/17/68
TABLE 6-XVII	ANTENNA, VHF RECOVERY	BASIC	5/17/68
TABLE 6-XVIII	ANTENNA, RENDEZVOUS RADAR TRANSPONDER	BASIC	5/17/68
TABLE 6-XIX	ANTENNA, HIGH-GAIN	BASIC	5/17/68

SECTION 7 INSTRUMENTATION

FIGURE 7.1	INSTRUMENTATION CONTROL- DISPLAY FIGURE	BASIC	4/30/68
DRAWING 7.1	INSTRUMENTATION POWER AND CONTROL	BASIC	4/30/68
DRAWING 7.2	INSTRUMENTATION PCM SIGNAL FLOW	BASIC	4/30/68
DRAWING 7.3	CAUTION AND WARNING SYSTEM	BASIC	4/30/68

FIGURE, DRAWING OR PAGE NUMBER	TITLE	REVISION	SIGNOFF DATE
NOTES 7.4	INSTRUMENTATION SYSTEM NOTES, PP 7-5 THROUGH 7-11	BASIC	4/30/68
TABLE 7-I	PCM TELEMETRY-STRUCTURES	BASIC	4/30/68
TABLE 7-II	PCM TELEMETRY-ELECTRICAL POWER SYSTEM	BASIC	4/30/68
TABLE 7-III	PCM TELEMETRY-LAUNCH ESCAPE SYSTEM	BASIC	4/30/68
TABLE 7-IV	PCM TELEMETRY-EARTH LANDING SEQUENCER CONTROLLER	BASIC	4/30/68
TABLE 7-V	PCM TELEMETRY-ENVIRONMENTAL CONTROL SYSTEM	BASIC	4/30/68
TABLE 7-VI	PCM TELEMETRY-GUIDANCE AND NAVIGATION SYSTEM	BASIC	4/30/68
TABLE 7-VII	PCM TELEMETRY-STABILIZATION AND CONTROL SYSTEM	BASIC	4/30/68
TABLE 7-VIII	PCM TELEMETRY-LIFE SYSTEM	BASIC	4/30/68
TABLE 7-IX	PCM TELEMETRY-FLIGHT TECHNOLOGY	BASIC	4/30/68
TABLE 7-X	PCM TELEMETRY-SCIENTIFIC EQUIPMENT	BASIC	4/30/68
TABLE 7-XI	PCM TELEMETRY-SERVICE PROPULSION SYSTEM	BASIC	4/30/68
TABLE 7-XII	PCM TELEMETRY-REACTION CONTROL SYSTEM	BASIC	4/30/68
TABLE 7-XIII	PCM TELEMETRY-CREW SAFETY SYSTEM	BASIC	4/30/68
TABLE 7-XIV	PCM TELEMETRY-COMMUNICATION AND INSTRUMENTATION	BASIC	4/30/68

SECTION 8 GUIDANCE AND CONTROL SYSTEM

FIGURE 8.1	GUIDANCE AND CONTROL SYSTEM CONTROL-DISPLAY FIGURE	} TO BE PUBLISHED AT A LATER DATE
DRAWING 8.1	GUIDANCE AND CONTROL SYSTEM OVERVIEW	
DRAWING 8.2	GUIDANCE AND NAVIGATION OVERVIEW	
PAGE 8-3	POWER CODE (REF DWG 8.3 ZONE B/6)	
DRAWING 8.3	STABILIZATION/CONTROL SYSTEM	

FIGURE, DRAWING OR PAGE NUMBER	TITLE	REVISION	SIGNOFF DATE
DRAWING 8.4	G&N POWER DISTRIBUTION	} TO BE PUBLISHED AT A LATER DATE	
DRAWING 8.5	INERTIAL SUBSYSTEM		
DRAWING 8.6	OPTICS SUBSYSTEM		
PAGE 8-7	SCS SIGNAL AND POWER CODE	BASIC	5/20/68
DRAWING 8.7	SCS POWER DISTRIBUTION	BASIC	5/20/68
DRAWING 8.8	ATTITUDE REFERENCE SUBSYSTEM	BASIC	5/20/68
DRAWING 8.8A	ATTITUDE REFERENCE LOGIC	BASIC	5/20/68
DRAWING 8.9	CONTROL ELECTRONICS (ECA/ TVC/GYROS)	BASIC	5/20/68
DRAWING 8.9A	CONTROL ELECTRONICS LOGIC	BASIC	5/20/68
DRAWING 8.10	AUTO/MANUAL RCS	BASIC	5/20/68
<u>SECTION 9 SERVICE PROPULSION SYSTEM</u>			
FIGURE 9.1	SPS CONTROL-DISPLAY FIGURE	BASIC	5/20/68
DRAWING 9.1	SERVICE PROPULSION SYSTEM	BASIC	5/20/68
DRAWING 9.2	SPS PROPELLANT GAUGING SYSTEM	BASIC	5/20/68
DRAWING 9.3	SPS PROPELLANT UTILIZATION VALVE CONTROL	BASIC	5/20/68
<u>SECTION 10 REACTION CONTROL SYSTEM</u>			
FIGURE 10.1	RCS CONTROL-DISPLAY FIGURE	BASIC	5/20/68
DRAWING 10.1	SERVICE MODULE REACTION CONTROL SYSTEM	BASIC	5/20/68
DRAWING 10.2	COMMAND MODULE REACTION CONTROL SYSTEM	BASIC	5/20/68
<u>SECTION 11 MISCELLANEOUS</u>			
FIGURE 11.1	CONTROL-DISPLAY FIGURE	N/A**	11/2/67
DRAWING 11.1.1 THROUGH DRAWING 11.1.9	NR INBOARD PROFILE DRAWINGS	N/A**	2/20/68
DRAWING 11.2	LIGHTING	} TO BE PUBLISHED AT A LATER DATE	
DRAWING 11.3	TIMER		
DRAWING 11.4	SYSTEMS TESTMETER		
DRAWING 11.5	DOCKING	BASIC	5/22/68

**NR DRAWINGS, NOT OFFICIAL FCD DRAWINGS.

*

FOREWORD

The basic Command/Service Module Systems Handbook (CSM 103) is being published and distributed by sections.

The publication control and effective page sheet immediately following this foreword will serve as a table of contents since it lists by sections all figures, drawings, tables and pages of text that will be in the handbook whether they are included in this first issue or not.

The publication control and effective page sheet, which will be continuously updated each time additional sections are issued, will give a chronological history of the document and will show the date for which the information in each section is valid.

MAY 10, 1968

PUBLICATION CONTROL AND EFFECTIVE PAGE SHEET

FIGURE, DRAWING OR PAGE NUMBER	TITLE	REVISION	SIGNOFF DATE
<u>SECTION 1 STANDARDS</u>			
PAGE 1-1 THROUGH PAGE 1-21		BASIC	5/6/68
<u>SECTION 2 SEQUENTIAL EVENTS SYSTEM</u>			
FIGURE 2.1	CONTROL-DISPLAY FIGURE	BASIC	4/30/68
DRAWING 2.1	SEQUENTIAL OVERVIEW	BASIC	4/30/68
DRAWING 2.2	SEQUENTIAL POWER DISTRIBUTION	BASIC	4/30/68
DRAWING 2.3	SEQUENTIAL ABORT INITIATION	BASIC	4/30/68
DRAWING 2.4	SEQUENTIAL LES AND SPS ABORT SUBSYSTEM	BASIC	4/30/68
DRAWING 2.5	SEQUENTIAL EARTH LANDING SUBSYSTEM	BASIC	4/30/68
DRAWING 2.6	SEQUENTIAL UPRIGHTING SYSTEM	BASIC	4/30/68
<u>SECTION 3 ELECTRICAL SYSTEM</u>			
FIGURE 3.1	EPS CONTROL-DISPLAY FIGURE	BASIC	4/30/68
DRAWING 3.1	EPS OVERVIEW	BASIC	4/30/68
DRAWING 3.2	ELECTRICAL DC SYSTEM AND DISTRIBUTION	BASIC	4/30/68
DRAWING 3.3	ELECTRICAL AC SYSTEM AND DISTRIBUTION	BASIC	4/30/68
PARAGRAPH 3.4	BUS SUMMARY TABLE		
PAGE 3-6	MAIN BUS A	BASIC	4/30/68
PAGE 3-12	MAIN BUS B	BASIC	4/30/68
PAGE 3-18	BATTERY BUS A	BASIC	4/30/68
PAGE 3-20	BATTERY BUS B	BASIC	4/30/68
PAGE 3-22	BATTERY RELAY BUS	BASIC	4/30/68
PAGE 3-24	FLIGHT BUS	BASIC	4/30/68

** PUBLICATION CONTROL AND EFFECTIVE PAGE SHEET 5/10/68 (CONT'D)

FIGURE, DRAWING OR PAGE NUMBER	TITLE	REVISION	SIGNOFF DATE
PAGE 3-25	FLIGHT AND POSTLANDING BUS	BASIC	4/30/68
PAGE 3-27	BATTERY C	BASIC	4/30/68
PAGE 3-28	BATTERY C PWR, POSTLANDING AND ENTRY CIRCUIT BREAKER (CB22)	BASIC	4/30/68
PAGE 3-29	NON-ESSENTIAL BUS 1	BASIC	4/30/68
PAGE 3-30	NON-ESSENTIAL BUS 2	BASIC	4/30/68
PAGE 3-31	PYRO BUS A	BASIC	4/30/68
PAGE 3-32	PYRO BUS B	BASIC	4/30/68
PAGE 3-33	AC BUS 1	BASIC	4/30/68
PAGE 3-37	AC BUS 2	BASIC	4/30/68
PAGE 3-40	MISCELLANEOUS CIRCUIT BREAKER	BASIC	4/30/68

SECTION 4 ENVIRONMENTAL CONTROL SYSTEM

FIGURE 4.1	ECS CONTROL-DISPLAY FIGURE	BASIC	5/6/68
DRAWING 4.1	ECS OVERVIEW	BASIC	5/6/68
DRAWING 4.2	SUIT AND CABIN PRESSURIZATION	BASIC	5/6/68
DRAWING 4.3	PRIMARY GLYCOL LOOP	BASIC	5/6/68
DRAWING 4.4	SECONDARY GLYCOL LOOP	BASIC	5/6/68
DRAWING 4.5	WATER AND WASTE MANAGEMENT	BASIC	5/6/68

SECTION 5 FUEL CELL/CRYOGENIC SYSTEM

FIGURE 5.1	FUEL CELL/CRYOGENIC CONTROL- DISPLAY FIGURE	BASIC	4/30/68
DRAWING 5.1	FUEL CELL/CRYOGENIC OVERVIEW	BASIC	4/30/68
DRAWING 5.2	CRYOGENIC GAS STORAGE SYSTEM	BASIC	4/30/68
DRAWING 5.3	FUEL CELL	BASIC	4/30/68

SECTION 6 COMMUNICATIONS SYSTEM

FIGURE 6.1	COMMUNICATIONS CONTROL-DISPLAY FIGURE/AUDIO STATION MODES AND CONTROL CHART	} TO BE PUBLISHED AT A LATER DATE
DRAWING 6.1	COMMUNICATIONS OVERVIEW/RF EQUIPMENT MODES AND CONTROL CHART	
DRAWING 6.2	UNIFIED S-BAND RF EQUIPMENT	

FIGURE, DRAWING OR PAGE NUMBER	TITLE	REVISION	SIGNOFF DATE
DRAWING 6.3	VHF AM TRANSCEIVERS AND AUDIO EQUIPMENT	}	TO BE PUBLISHED AT A LATER DATE
DRAWING 6.4	PREMODULATION PROCESSOR		
DRAWING 6.5	UPDATE LINK		
DRAWING 6.6	RENDEZVOUS TRANSPONDER AND RECOVERY EQUIPMENT		
TABLE 6-I	UNIFIED S-BAND TRANSPONDER AND FM TRANSMITTER		
TABLE 6-II	S-BAND POWER AMPLIFIER		
TABLE 6-III	S-BAND DOWNLINK MODES AND MODULATION PROCESS		
TABLE 6-IV	S-BAND UPLINK MODES AND MODULATION PROCESS		
TABLE 6-V	PREMODULATION PROCESSOR		
TABLE 6-VI	VHF AM TRANSCEIVER EQUIPMENT		
TABLE 6-VII	AUDIO CENTER EQUIPMENT		
TABLE 6-VIII	UPDATA LINK EQUIPMENT		
TABLE 6-IX	TELEVISION CAMERA, SLOW SCAN		
TABLE 6-X	RENDEZVOUS RADAR TRANSPONDER AND ANTENNA		
TABLE 6-XI	VHF RECOVERY BEACON		
TABLE 6-XII	VHF SURVIVAL BEACON- TRANSCIVER		
TABLE 6-XIII	ANTENNA SWITCH, S-BAND		
TABLE 6-XIV	ANTENNA SWITCH, VHF		
TABLE 6-XV	ANTENNA, S-BAND OMNI		
TABLE 6-XVI	ANTENNA, VHF SCIMITAR		
TABLE 6-XVII	ANTENNA, VHF RECOVERY		
TABLE 6-XVIII	ANTENNA, RENDEZVOUS RADAR TRANSPONDER		
<u>SECTION 7 INSTRUMENTATION</u>			
FIGURE 7.1	INSTRUMENTATION CONTROL- DISPLAY FIGURE	BASIC	4/30/68
DRAWING 7.1	INSTRUMENTATION POWER AND CONTROL	BASIC	4/30/68
DRAWING 7.2	INSTRUMENTATION PCM SIGNAL FLOW	BASIC	4/30/68
DRAWING 7.3	CAUTION AND WARNING SYSTEM	BASIC	4/30/68

FIGURE, DRAWING OR PAGE NUMBER	TITLE	REVISION	SIGNOFF DATE
NOTES 7.4	INSTRUMENTATION SYSTEM NOTES, PP 7-5 THROUGH 7-11	BASIC	4/30/68
TABLE 7-I	PCM TELEMETRY-STRUCTURES	BASIC	4/30/68
TABLE 7-II	PCM TELEMETRY-ELECTRICAL POWER SYSTEM	BASIC	4/30/68
TABLE 7-III	PCM TELEMETRY-LAUNCH ESCAPE SYSTEM	BASIC	4/30/68
TABLE 7-IV	PCM TELEMETRY-EARTH LANDING SEQUENCER CONTROLLER	BASIC	4/30/68
TABLE 7-V	PCM TELEMETRY-ENVIRONMENTAL CONTROL SYSTEM	BASIC	4/30/68
TABLE 7-VI	PCM TELEMETRY-GUIDANCE AND NAVIGATION SYSTEM	BASIC	4/30/68
TABLE 7-VII	PCM TELEMETRY-STABILIZATION AND CONTROL SYSTEM	BASIC	4/30/68
TABLE 7-VIII	PCM TELEMETRY-LIFE SYSTEM	BASIC	4/30/68
TABLE 7-IX	PCM TELEMETRY-FLIGHT TECHNOLOGY	BASIC	4/30/68
TABLE 7-X	PCM TELEMETRY-SCIENTIFIC EQUIPMENT	BASIC	4/30/68
TABLE 7-XI	PCM TELEMETRY-SERVICE PROPULSION SYSTEM	BASIC	4/30/68
TABLE 7-XII	PCM TELEMETRY-REACTION CONTROL SYSTEM	BASIC	4/30/68
TABLE 7-XIII	PCM TELEMETRY-CREW SAFETY SYSTEM	BASIC	4/30/68
TABLE 7-XIV	PCM TELEMETRY-COMMUNICATION AND INSTRUMENTATION	BASIC	4/30/68

SECTION 8 GUIDANCE AND CONTROL SYSTEM

FIGURE 8.1	GUIDANCE AND CONTROL SYSTEM CONTROL-DISPLAY FIGURE	} TO BE PUBLISHED AT A LATER DATE
DRAWING 8.1	GUIDANCE AND CONTROL SYSTEM OVERVIEW	
DRAWING 8.2	GUIDANCE AND NAVIGATION OVERVIEW	
PAGE 8-3	POWER CODE (REF DWG 8.3 ZONE B/6)	
DRAWING 8.3	STABILIZATION/CONTROL SYSTEM	

FIGURE, DRAWING OR PAGE NUMBER	TITLE	REVISION	SIGNOFF DATE
DRAWING 8.4	G&N POWER DISTRIBUTION	}	TO BE PUBLISHED AT A LATER DATE
DRAWING 8.5	INERTIAL SUBSYSTEM		
DRAWING 8.6	OPTICS SUBSYSTEM		
DRAWING 8.7	SCS POWER DISTRIBUTION		
DRAWING 8.8	ATTITUDE REFERENCE SUBSYSTEM		
DRAWING 8.8A	ATTITUDE REFERENCE LOGIC		
DRAWING 8.9	CONTROL ELECTRONICS (ECA/ TVC/GYROS)		
DRAWING 8.9A	CONTROL ELECTRONICS LOGIC		
DRAWING 8.10	AUTO/MANUAL RCS		
<u>SECTION 9 SERVICE PROPULSION SYSTEM</u>			
FIGURE 9.1	SPS CONTROL-DISPLAY FIGURE	}	TO BE PUBLISHED AT A LATER DATE
DRAWING 9.1	SERVICE PROPULSION SYSTEM		
DRAWING 9.2	SPS PROPELLANT GAUGING SYSTEM		
DRAWING 9.3	SPS PROPELLANT UTILIZATION VALVE CONTROL		
<u>SECTION 10 REACTION CONTROL SYSTEM</u>			
FIGURE 10.1	RCS CONTROL-DISPLAY FIGURE		
DRAWING 10.1	SERVICE MODULE REACTION CONTROL SYSTEM		TO BE PUBLISHED AT A LATER DATE
DRAWING 10.2	COMMAND MODULE REACTION CONTROL SYSTEM		
<u>SECTION 11 MISCELLANEOUS</u>			
FIGURE 11.1	CONTROL-DISPLAY FIGURE	N/A*	11/2/67
DRAWING 11.1.1 THROUGH DRAWING 11.1.9	NR INBOARD PROFILE DRAWINGS	N/A*	2/20/68
DRAWING 11.2	LIGHTING	}	TO BE PUBLISHED AT A LATER DATE
DRAWING 11.3	TIMER		
DRAWING 11.4	SYSTEMS TESTMETER		

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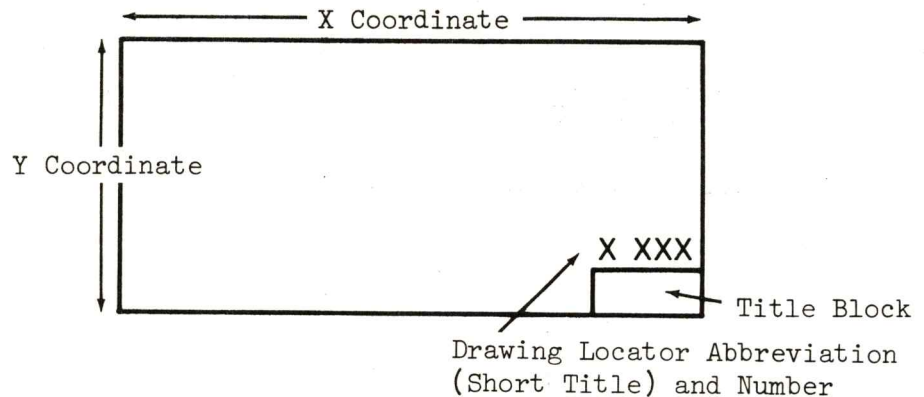
1 STANDARDS

STANDARDS

1.1 GENERAL DRAWING INFORMATION

1.1.1 Cross-indexing1.1.1.1 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.

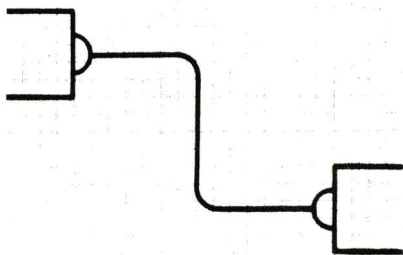
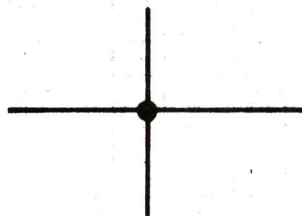
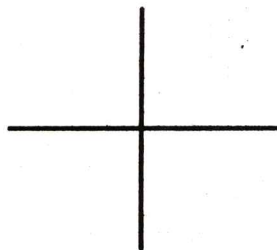


3 - Drawing Locator Number for the given detail subsystem drawing
K - X Coordinate
4 - Y Coordinate

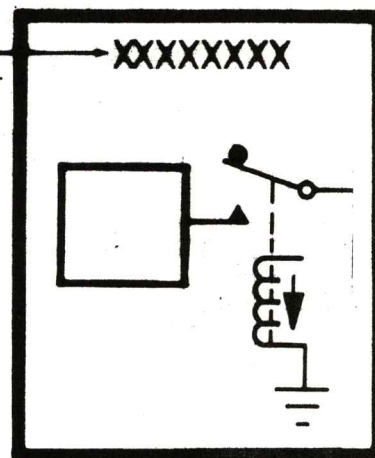
1.2.1 Technical Zone References1.2.1.1 Zone reference

When this number appears it refers to another drawing. When there is no number the zone refers to another area on the same drawing.

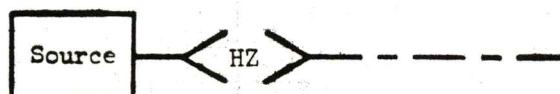
1.2 LINE LEGEND

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 Enclosures

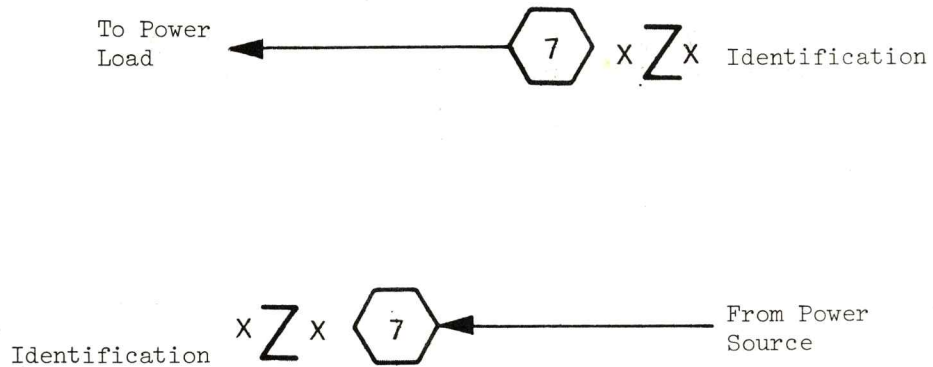
Title
(Directory
Type)

1.2.4.1 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

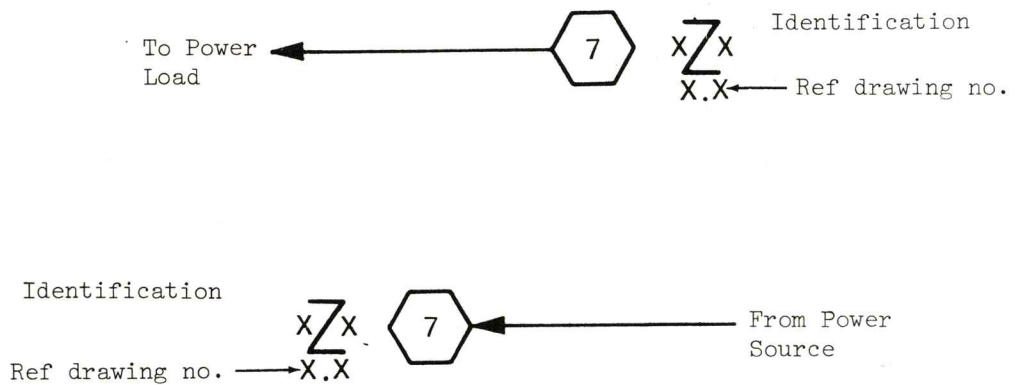
CM ■ ■ SM

1.2.5 Mechanical Linkage1.2.6 Timing Pulses

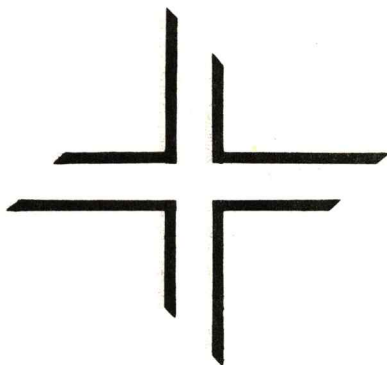
1.2.1.2 Power intra-drawing
(Section to section within the same drawing)



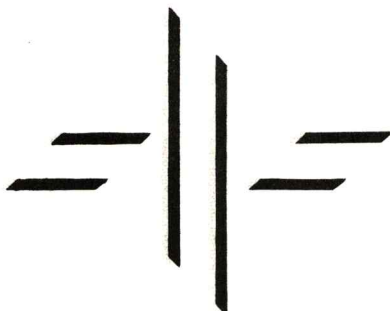
1.2.1.3 Power inter-drawings
(Drawing to drawing)



1.3 PIPE LEGEND
 1.3.1 General
 1.3.1.1 Plumbing connected

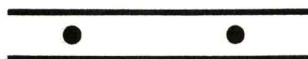


1.3.1.2 Plumbing crossover



1.3.2 Line Designation

1.3.2.1 Water



1.3.2.2 Oxygen



1.3.2.3 Nitrogen



1.3.2.4 Helium



1.3.2.5 Primary Coolant



1.3.2.6 Secondary Coolant



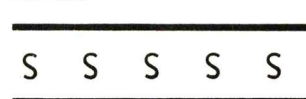
1.3.2.7 Fuel



1.3.2.8 Hydrogen



1.3.2.9 Steam



1.3.2.10 Suit Loop



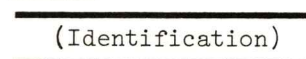
1.3.2.11 Sense Lines



1.3.2.12 Oxidizer

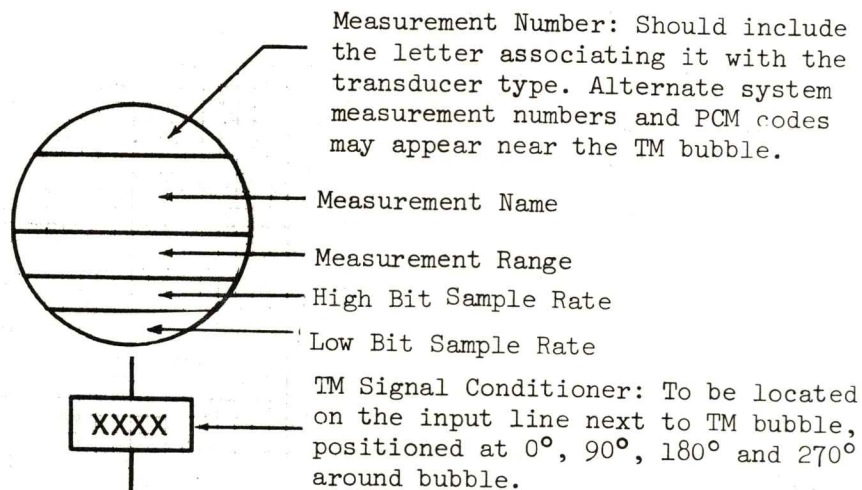


1.3.2.13 Others



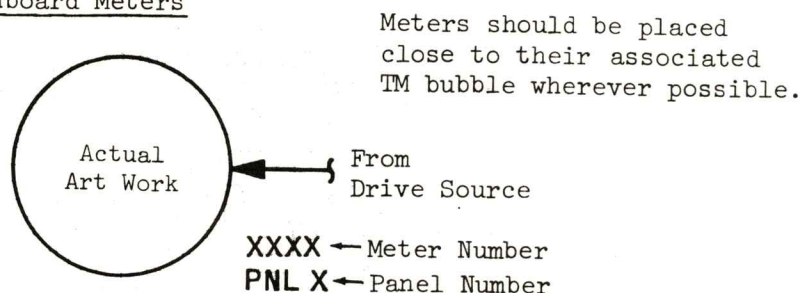
1.4
1.4.1

TELEMETRY SYMBOLS
Measurements Telemetered



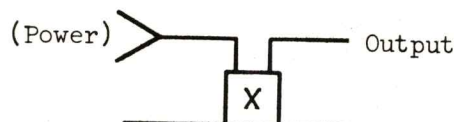
1.4.2

Onboard Meters



1.4.3
1.4.3.1

Sensors
Single source

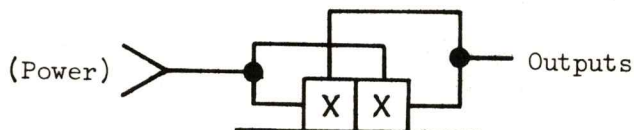


Example: Letter indicates the type:

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

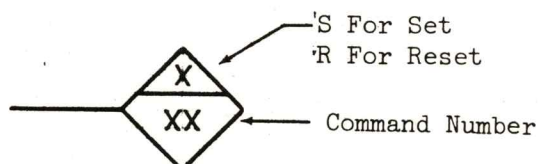
1.4.3.2

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

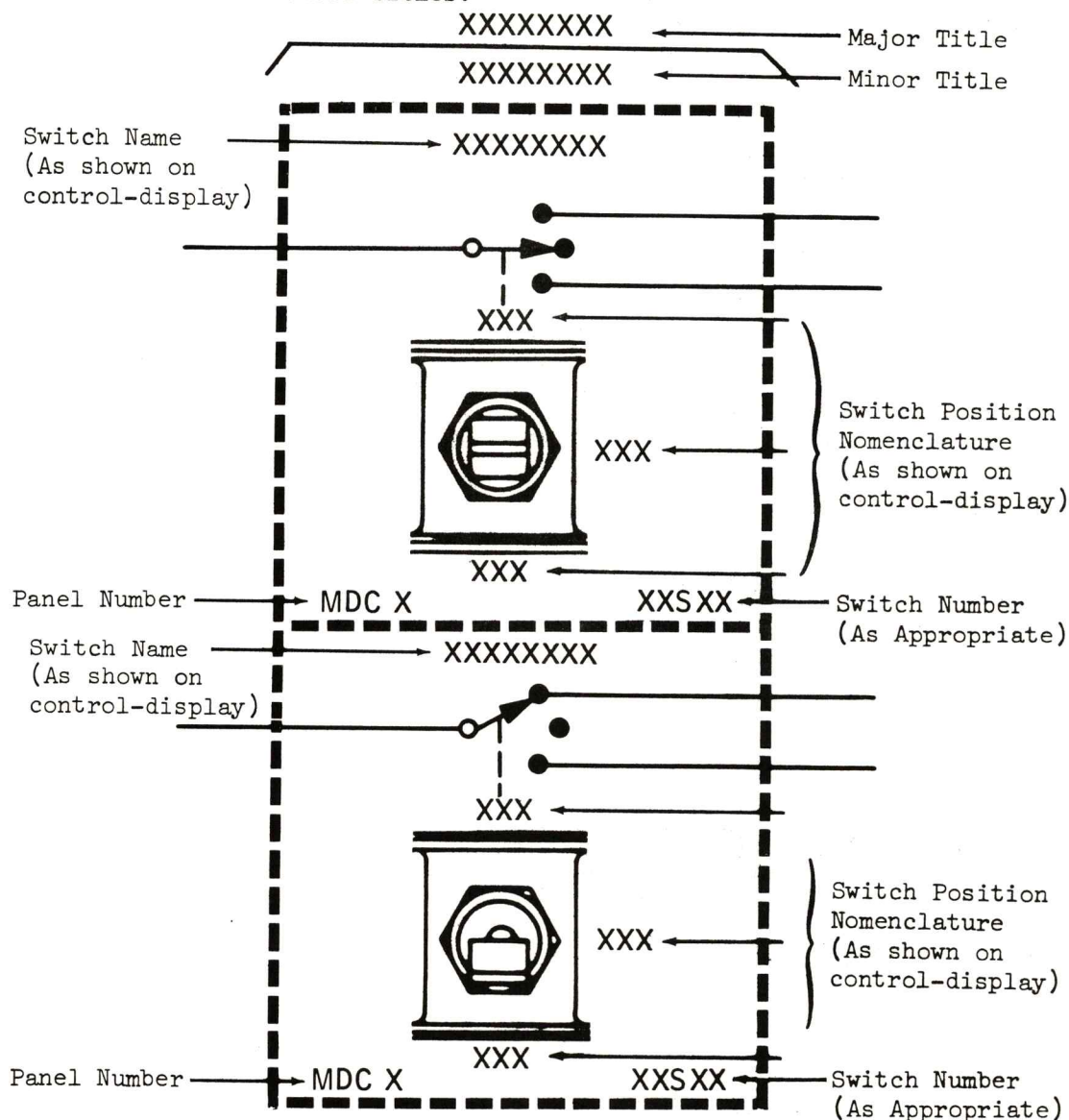
All switches will be shown in the deenergized position (if possible). When a switch has more than one set of contacts, only one set needs to have switch contact nomenclature.

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

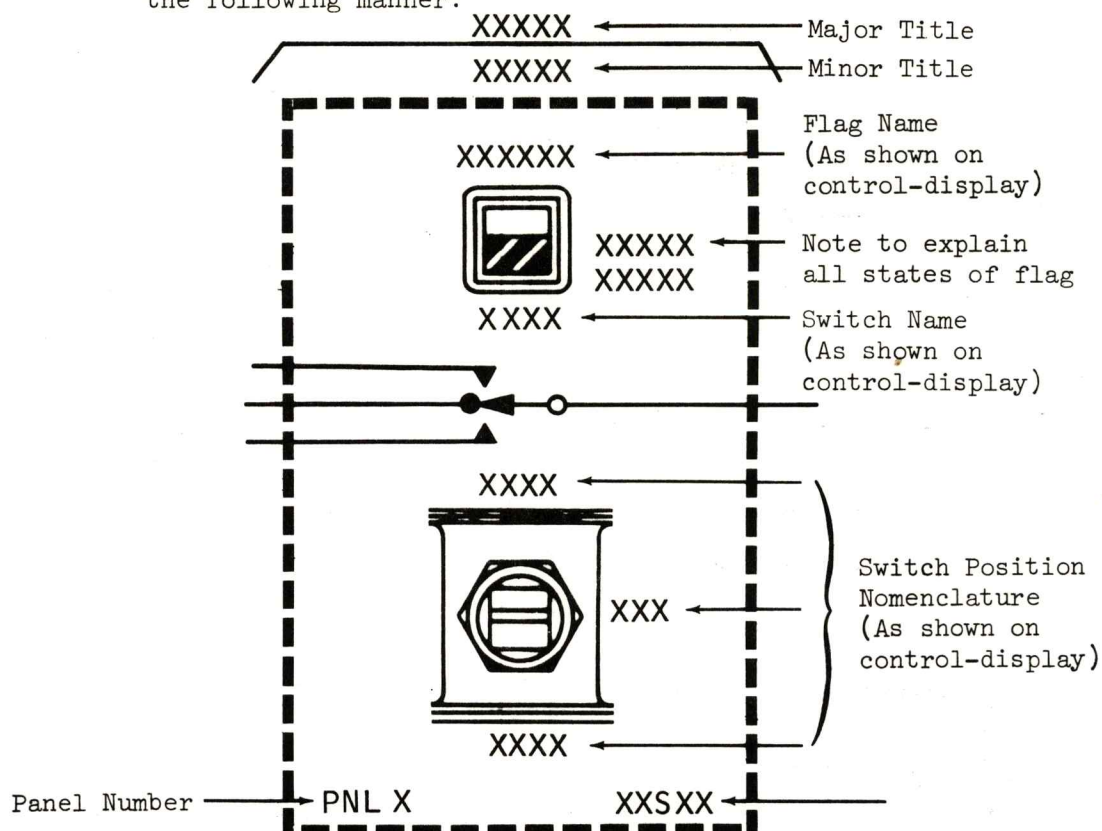
NOTE: If more than one switch has identical major and minor titles, they may be stacked without repeating these titles.



1.5.1.2

Switch controlled flag

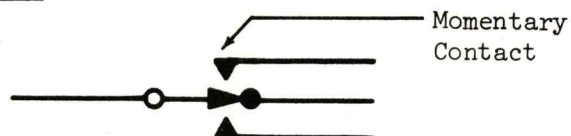
If a flag is directly controlled by a switch, it may be shown in the following manner:

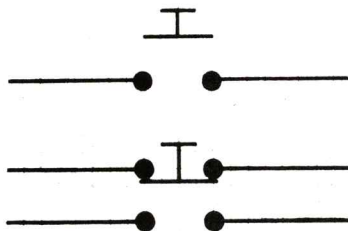
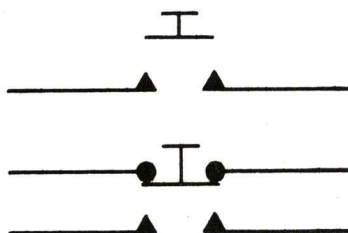
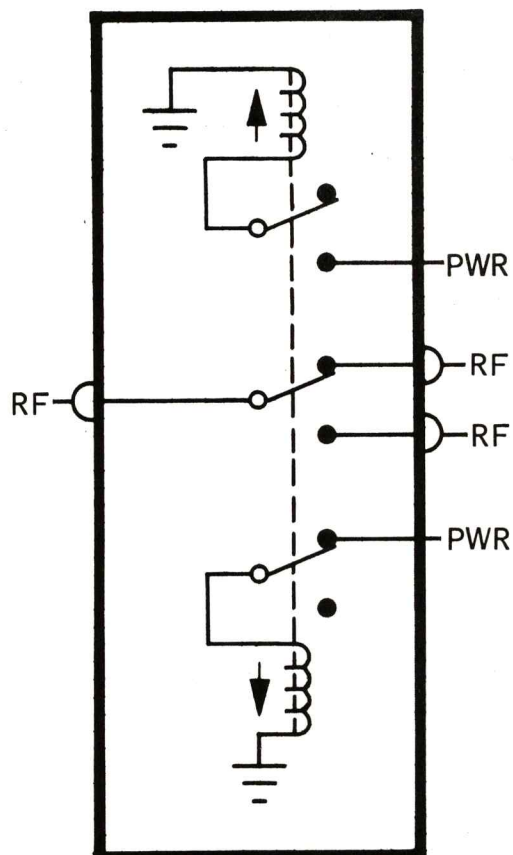
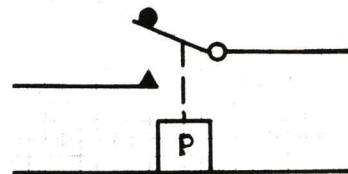
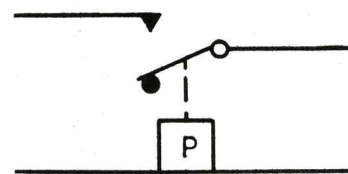
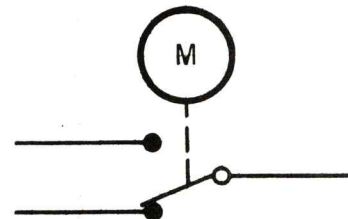
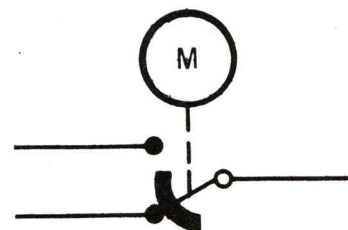
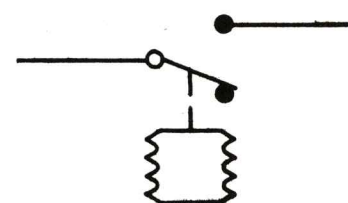


1.5.1.3

Two-position

1.5.1.4

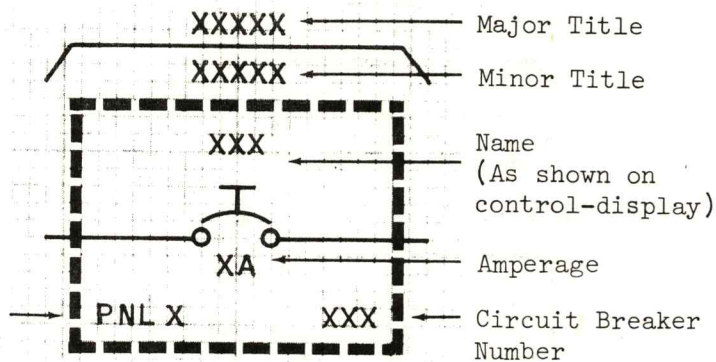
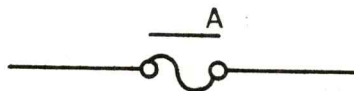
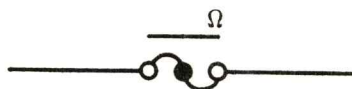
Three-position

1.5.1.5 Pushbutton1.5.1.5.1 Latching1.5.1.5.2 Momentary1.5.1.6 Coax1.5.1.7 Pressure1.5.1.7.1 Closed decreased pressure1.5.1.7.2 Closed increased pressure1.5.1.8 Motor1.5.1.8.1 Break before make1.5.1.8.2 Made before break1.5.1.9 Baro

Close XXX psi or altitude
Open XXX psi or altitude

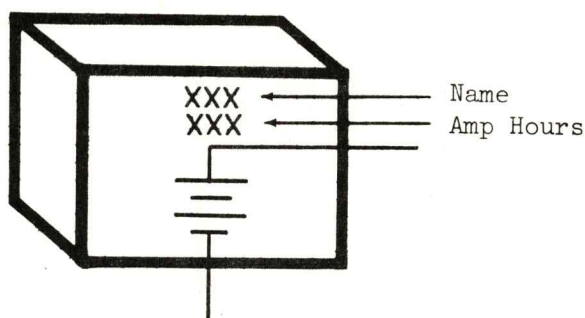
1.5.2 Circuit Breakers

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 Pushbutton1.5.2.2 Automatic1.5.3 Fuses
1.5.3.1 General1.5.3.2 Fusistor1.5.4 Battery

1/16-inch black tape

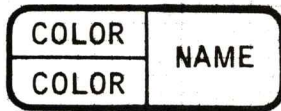
Size varies with number of cells and drawing arrangement.



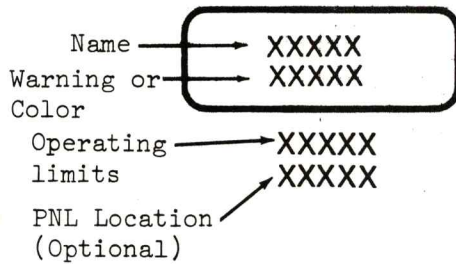
1.5.5 Lights
1.5.5.1 Telelights



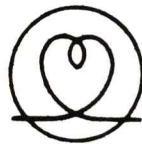
1.5.5.2 Switching



1.5.5.3 Caution and warning



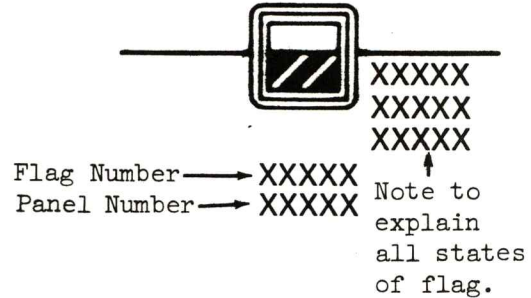
1.5.5.4 Component



PNL Location (Optional) → XXXXX
Color → XXXXX
Name → XXXXX

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

XXXX ← Flag Name



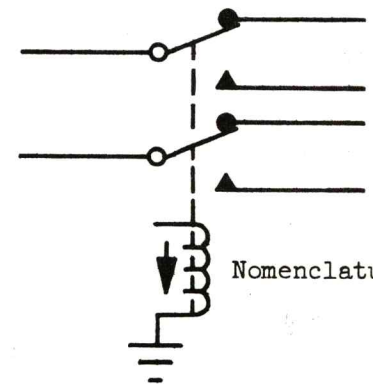
1.5.7 Relays
1.5.7.1 Momentary contact

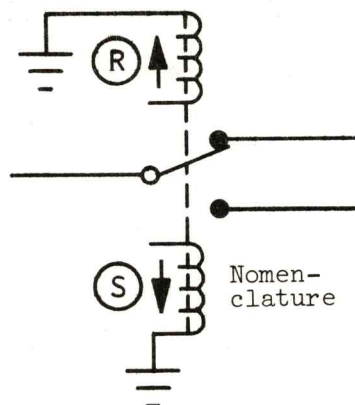
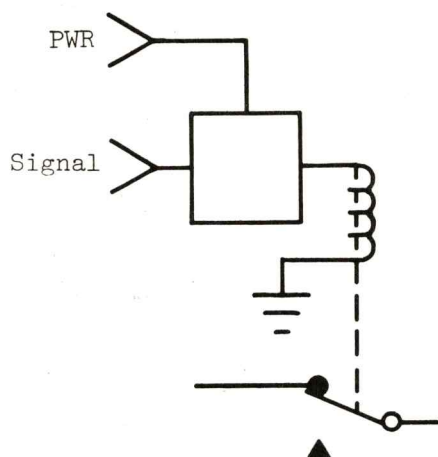


1.5.7.2 Latching contacts



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.



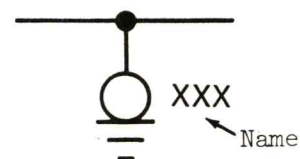
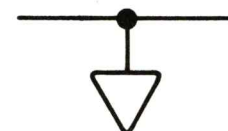
Bus Feed

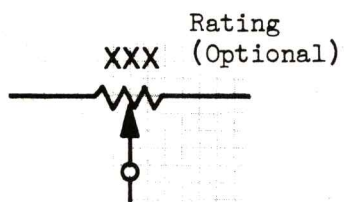
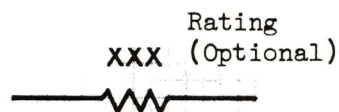
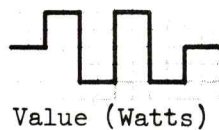


Bus Output

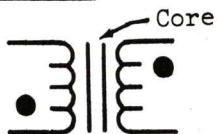


Neg Bus

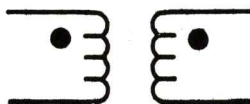
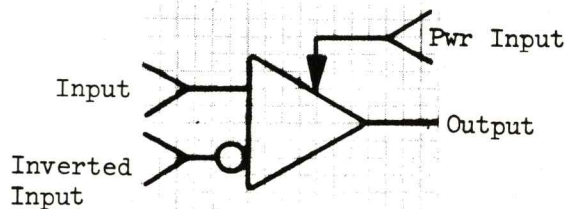
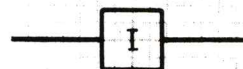
1.5.9.2 Designation
See bus designation list.
$$V_{XXX}$$
1.5.10 Grounds1.5.10.1 System1.5.10 Frame1.5.10.3 Floating or Controlled1.5.10.4 Signal1.5.11 Diodes
1.5.11.1 General1.5.11.2 Zener1.5.11.3 Tunnel

1.5.11.4 Control rectifier
(SCR)1.5.12 Potentiometer1.5.13 Fixed Resistor1.5.14 Heater1.5.15 Thermostat1.5.16 Transformers

Polarity dots
indicate out
phase



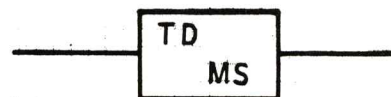
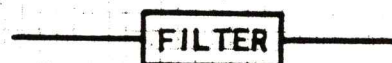
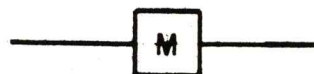
Polarity dots
indicate in
phase

1.5.17 Amplifier1.5.18 Capacitor1.5.19 Digital Inverter1.5.20 Wire Resolver

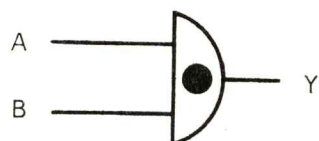
X = Sine Winding

● = Minus Sine

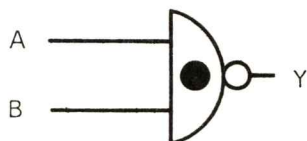
— = Cosine Winding

1.5.21 Time Delay1.5.22 Electrical Filter1.5.23 Modulator

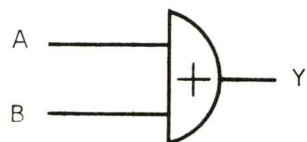
1.5.24 Gates
1.5.24.1 And



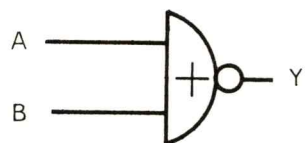
1.5.24.2 Nand



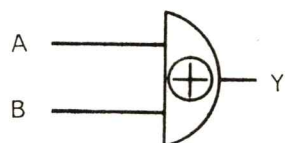
1.5.24.3 Or



1.5.24.4 Nor



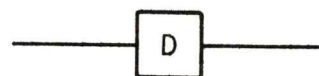
1.5.24.5 Exclusive Or



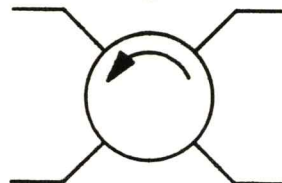
A	B	Y
1	1	1
1	0	0
0	1	0
0	0	0
1	1	0
1	0	1
0	1	1
0	0	1
1	1	1
1	0	1
0	1	1
0	0	0
1	0	0
0	1	0
1	1	0
0	0	1
1	1	0
1	0	1
0	1	1
0	0	0

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

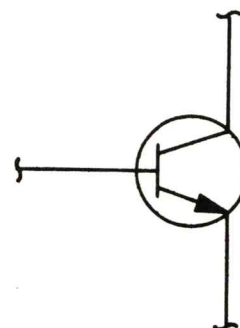
1.5.25 Demodulator



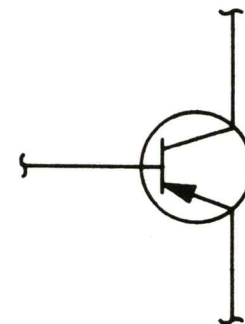
1.5.26 RF Circulator



1.5.27 Transistor
1.5.27.1 NPN



1.5.27.2 PNP

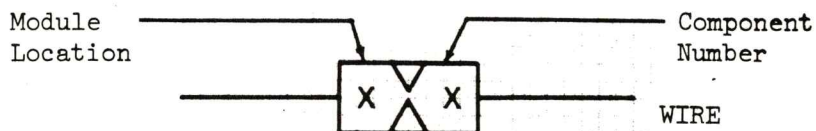


1.5.28 Antenna

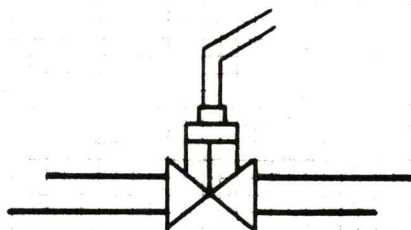
Name
(Type or Function)



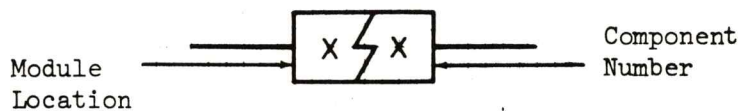
1.6
1.6.1 PYROTECHNIC SYMBOLS
Pyro Guillotine



1.6.2 Pyro Valve with Single Initiator



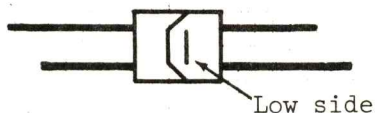
1.6.3 Electrical Circuit Interrupter



1.7
1.7.1 MECHANICAL SYMBOLS
Mechanical Filter



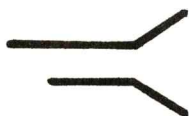
1.7.2 Burst Diaphragm



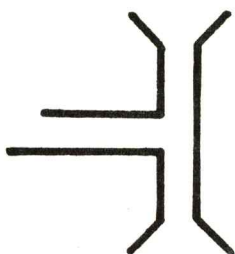
1.7.3 Venturi



1.7.4 Vent



1.7.5 Thrust Neutralized
Vent



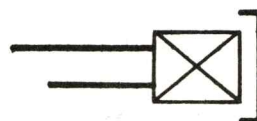
1.7.6 Disconnects
1.7.6.1 Self-sealing



1.7.6.2 Quick



1.7.7 Quick Disconnect Fill
and Drain

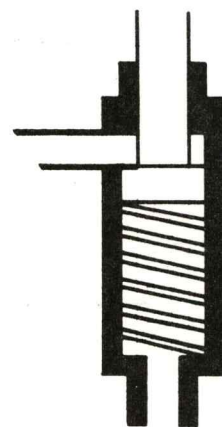


1.7.8 Fill and Drain



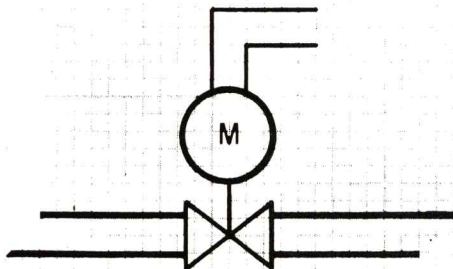
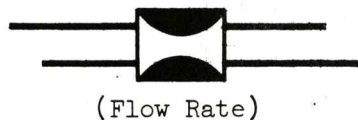
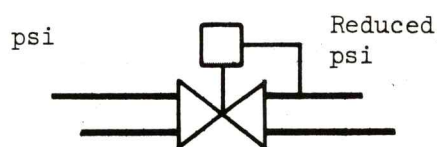
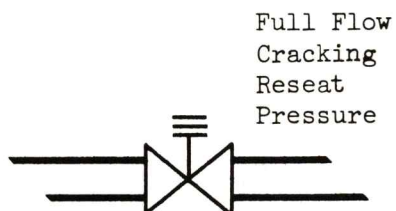
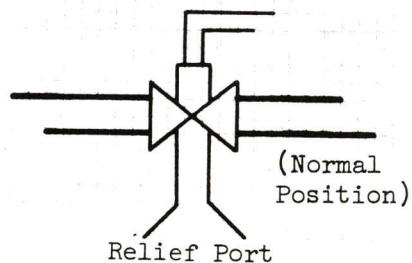
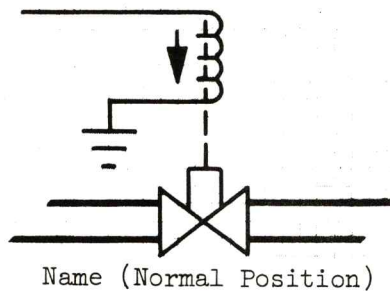
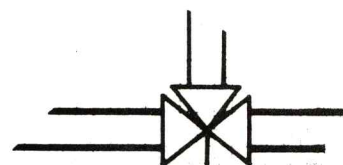
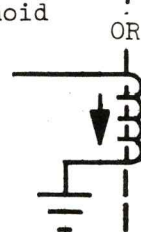
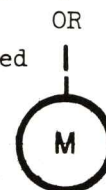
1.7.9 Ball Valve Actuator

May be shown
in depressed
or partially
depressed
position



1.7.10 Valves



1.7.10.1 Motor control1.7.10.2 Manual control1.7.10.3 Check valve1.7.10.4 Orifice1.7.10.5 Pressure regulator1.7.10.6 Relief valve1.7.10.7 Pneumatic controlled valve with line bleed1.7.10.8 Solenoid valve1.7.10.9 Three-way valve1.7.10.9.1 Manual1.7.10.9.2 Solenoid1.7.10.9.3 Motor controlled1.7.10.10 Ball valve

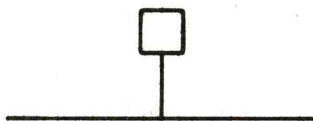
1.8 MISCELLANEOUS SYMBOLS
 1.8.1 Drawing Note Reference



1.8.2 Overview Drawing Instrumentation Legend
 1.8.2.1 Automatic control only



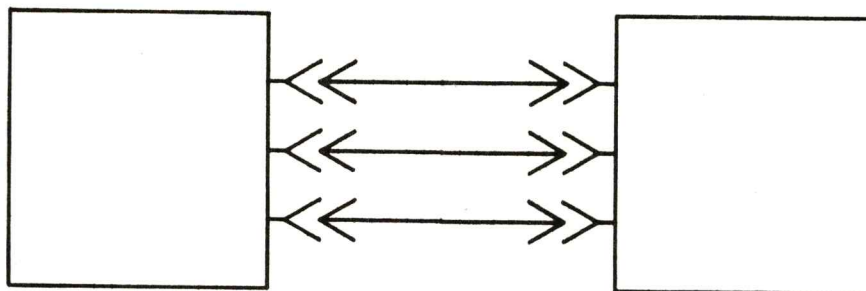
1.8.2.2 PCM only



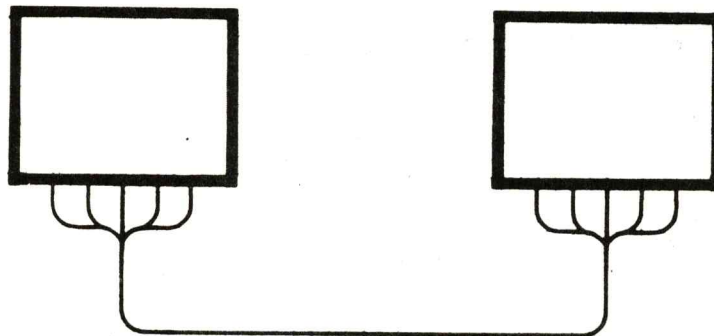
1.8.2.3 PCM and/or onboard display



1.8.3 Two-unit Interface



1.8.4 Two-unit Cable Connection



1.8.5 BUSSES1.8.5.1 POWER BUSSES

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

1.8.5.2

SEQUENTIAL BUSSES

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

SEQUENTIAL BUSSES (cont'd)

- V ED1 - EMERGENCY DETECTION SYSTEM BUS NO. 1
- V ED2 - EMERGENCY DETECTION SYSTEM BUS NO. 2
- V ED3 - EMERGENCY DETECTION SYSTEM BUS NO. 3
- V 6D95 - IU ABORT BUS

1.8.5.3

INSTRUMENTATION BUSSES

- V 1 - CM ESS INST BUS PWR FROM RHEB PNL 276-CB1
- V 2 - CM ESS INST BUS PWR FROM RHEB PNL 276-CB2
- V 3S - SM ESS INST BUS PWR FROM RHEB PNL 276-CB3
- V 4S - SM ESS INST BUS PWR FROM RHEB PNL 276-CB4
- V 5 - CM NON ESS INST BUS PWR FROM RHEB PNL 277-CB5
- V 6 - CM NON ESS INST BUS PWR FROM RHEB PNL 277-CB6
- V 7 - CM NON ESS INST BUS PWR FROM RHEB PNL 277-CB7
- V 8 - CM NON ESS INST BUS PWR FROM RHEB PNL 277-CB8
- V 8S - SM NON ESS INST BUS PWR FROM RHEB PNL 277-CB8

INSTRUMENTATION BUSES (Cont'd)

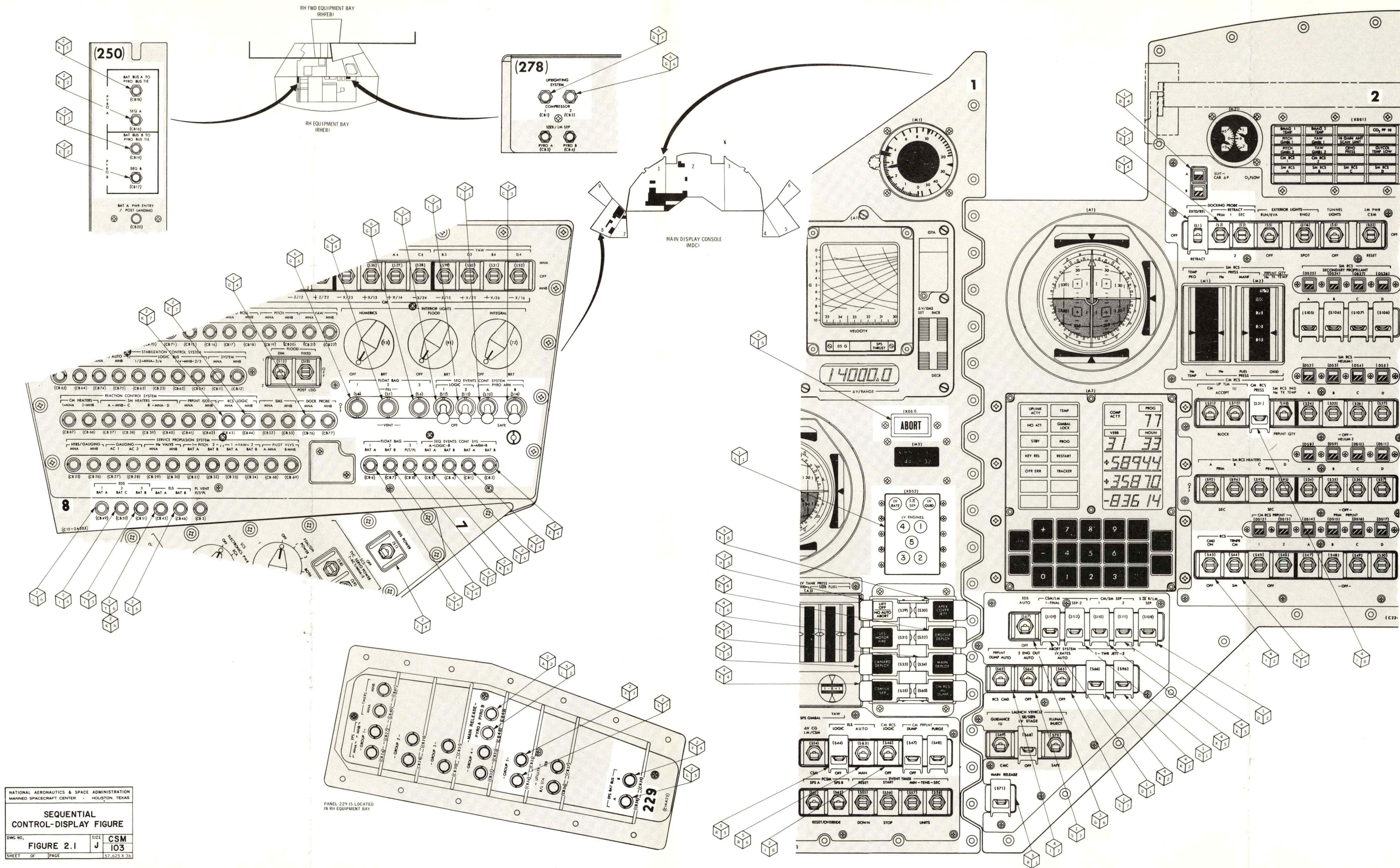
- V₉ - CM NON ESS INST BUS PWR FROM RHEB PNL 277-CB9
- V₁₀ - CM NON ESS INST BUS PWR FROM RHEB PNL 277-CB10
- V_{SC} - SCE PWR REQ'D FOR SIGNAL CONDITIONING
(+20, -20, and/or +10Vdc)
- V_{SC5} - SCE CM +5Vdc PWR

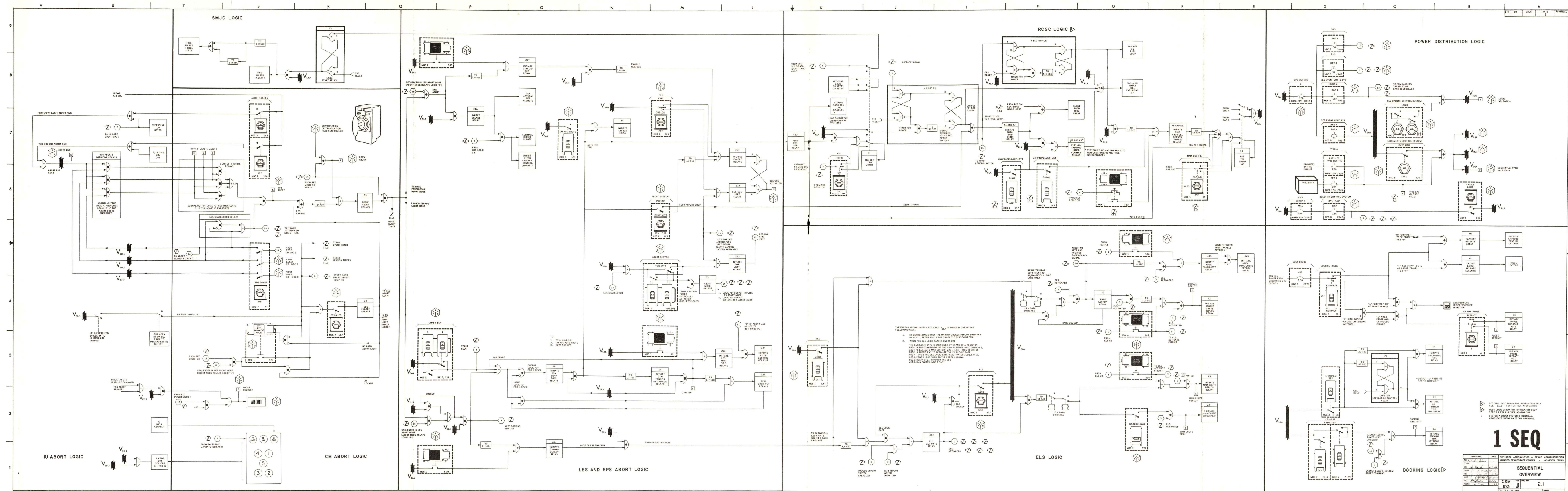
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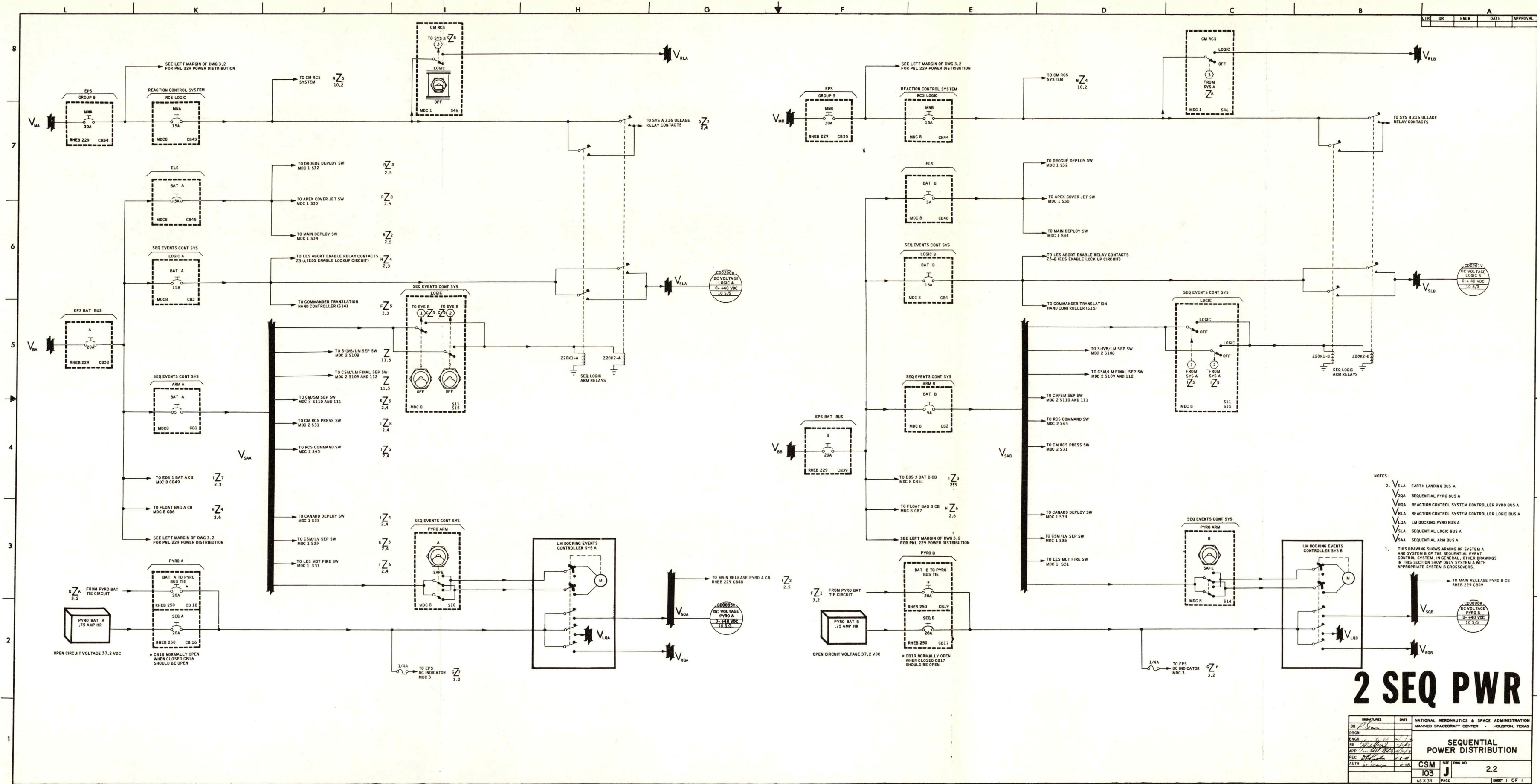
SCS LOGIC BUSES

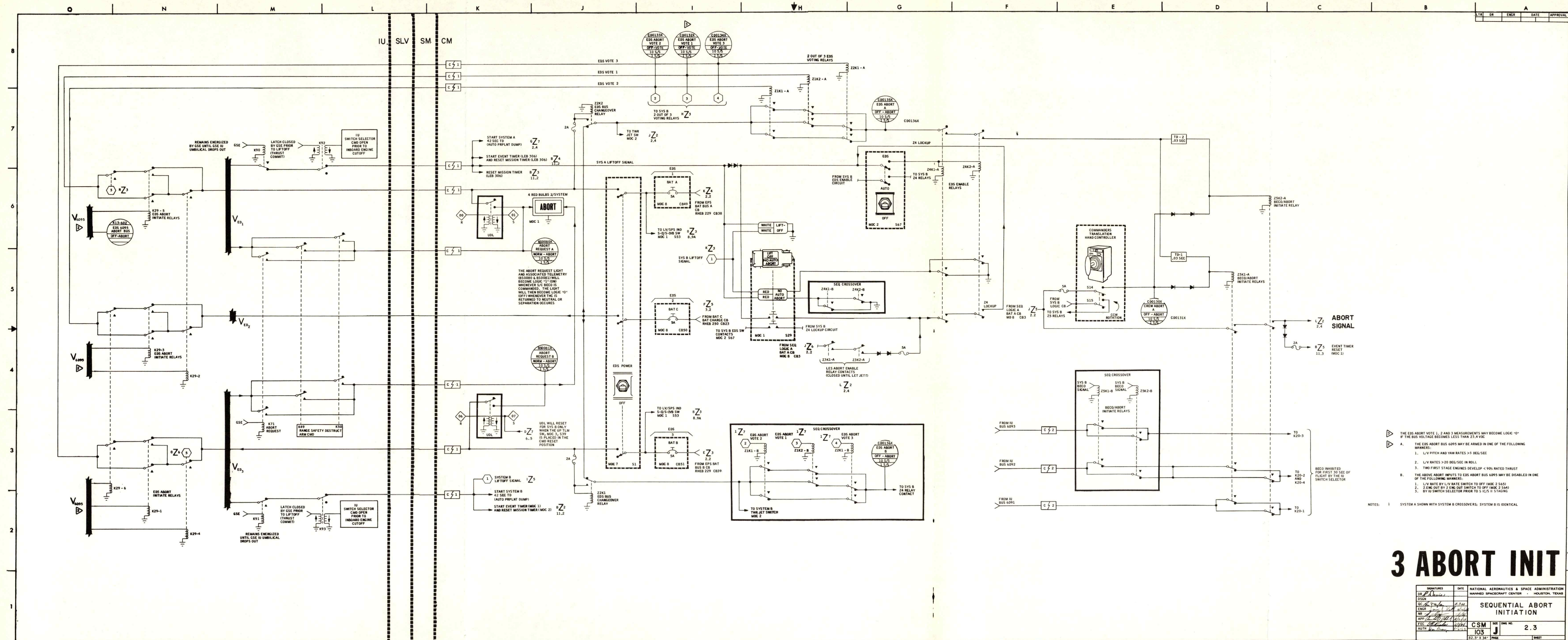
- V_{LB1} - LOGIC BUS 1
- V_{LB2} - LOGIC BUS 2
- V_{LB3} - LOGIC BUS 3
- V_{LB4} - LOGIC BUS 4

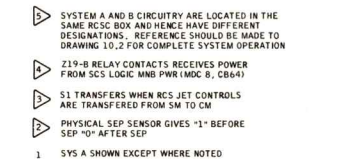
2 SEQUENTIAL
EVENTS SYSTEM

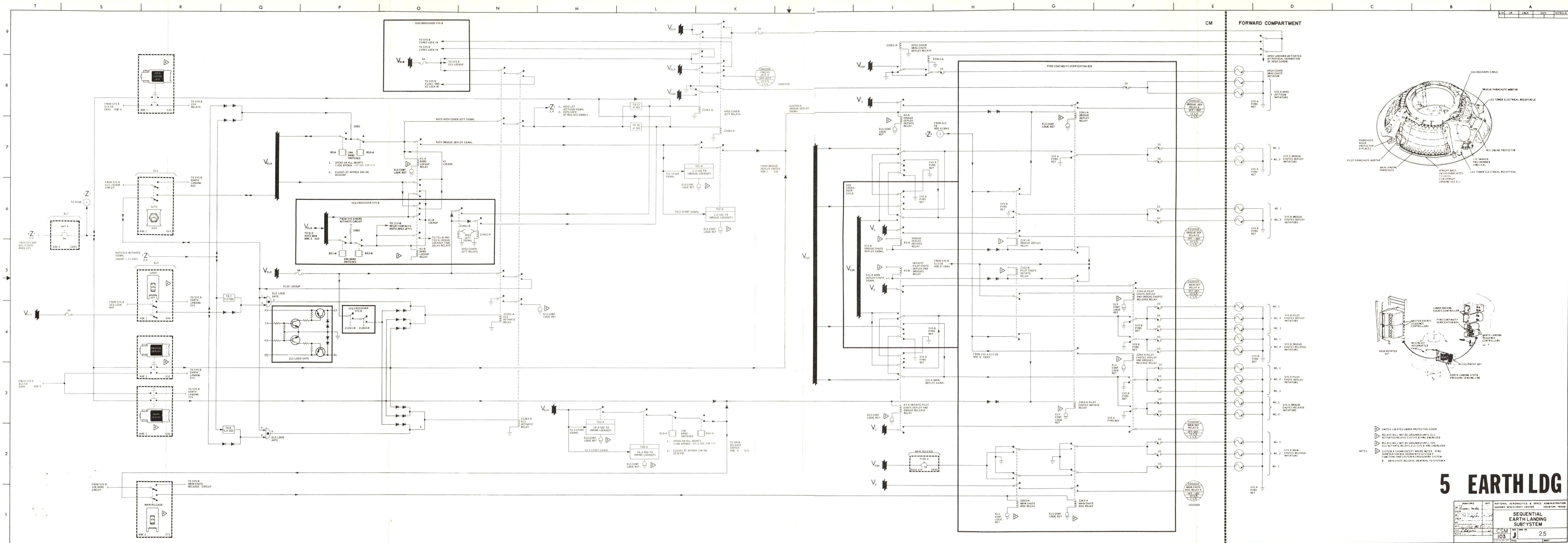


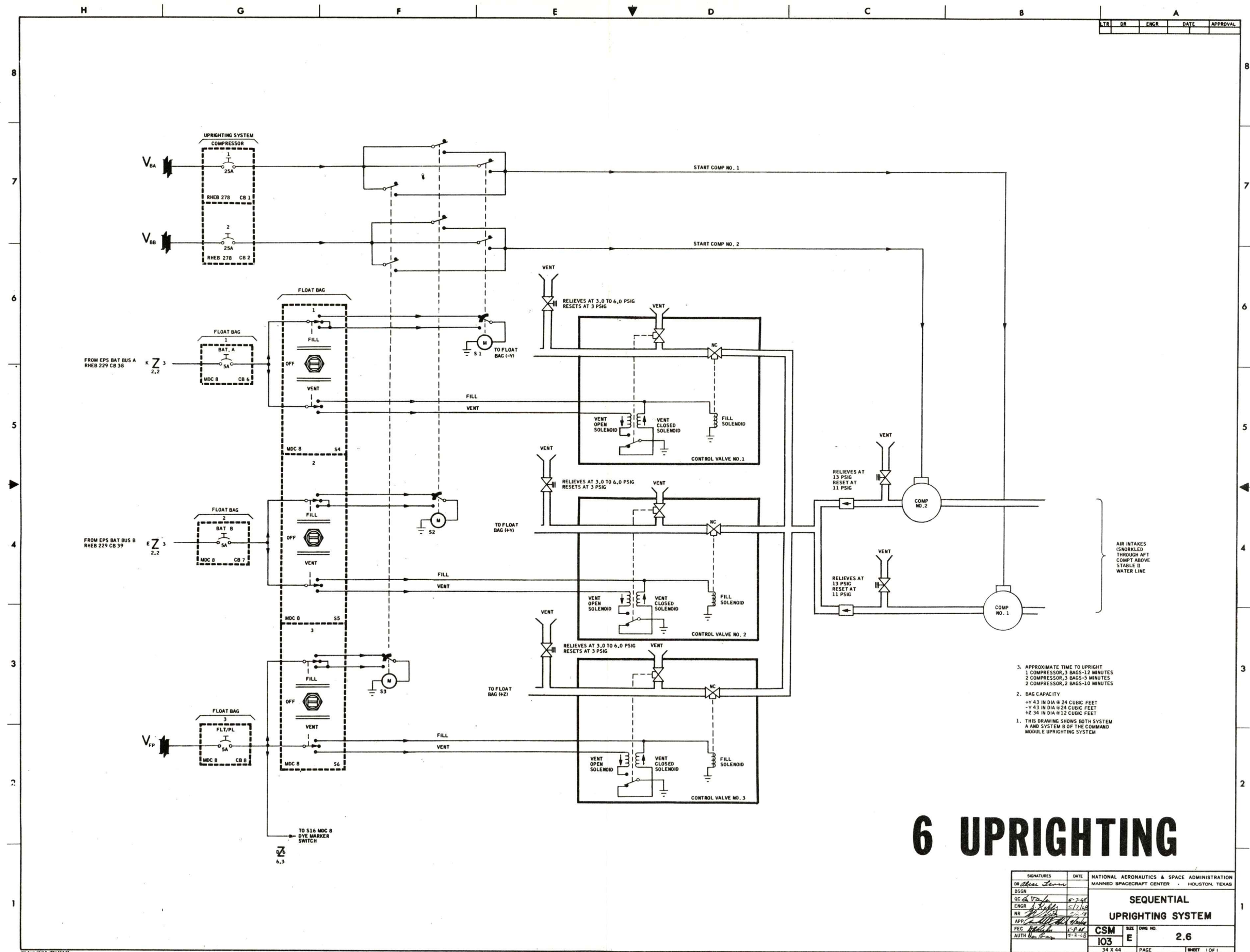


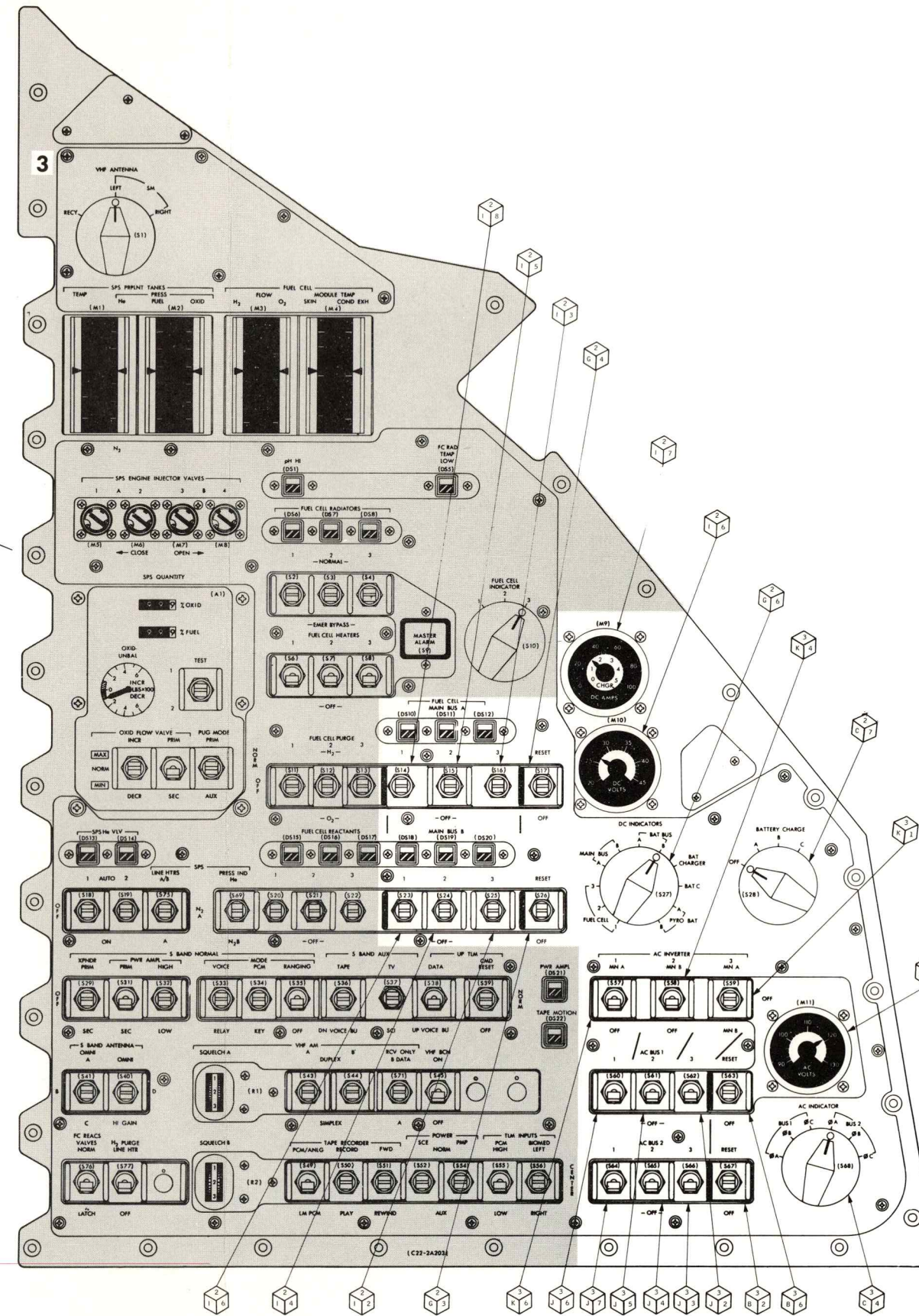
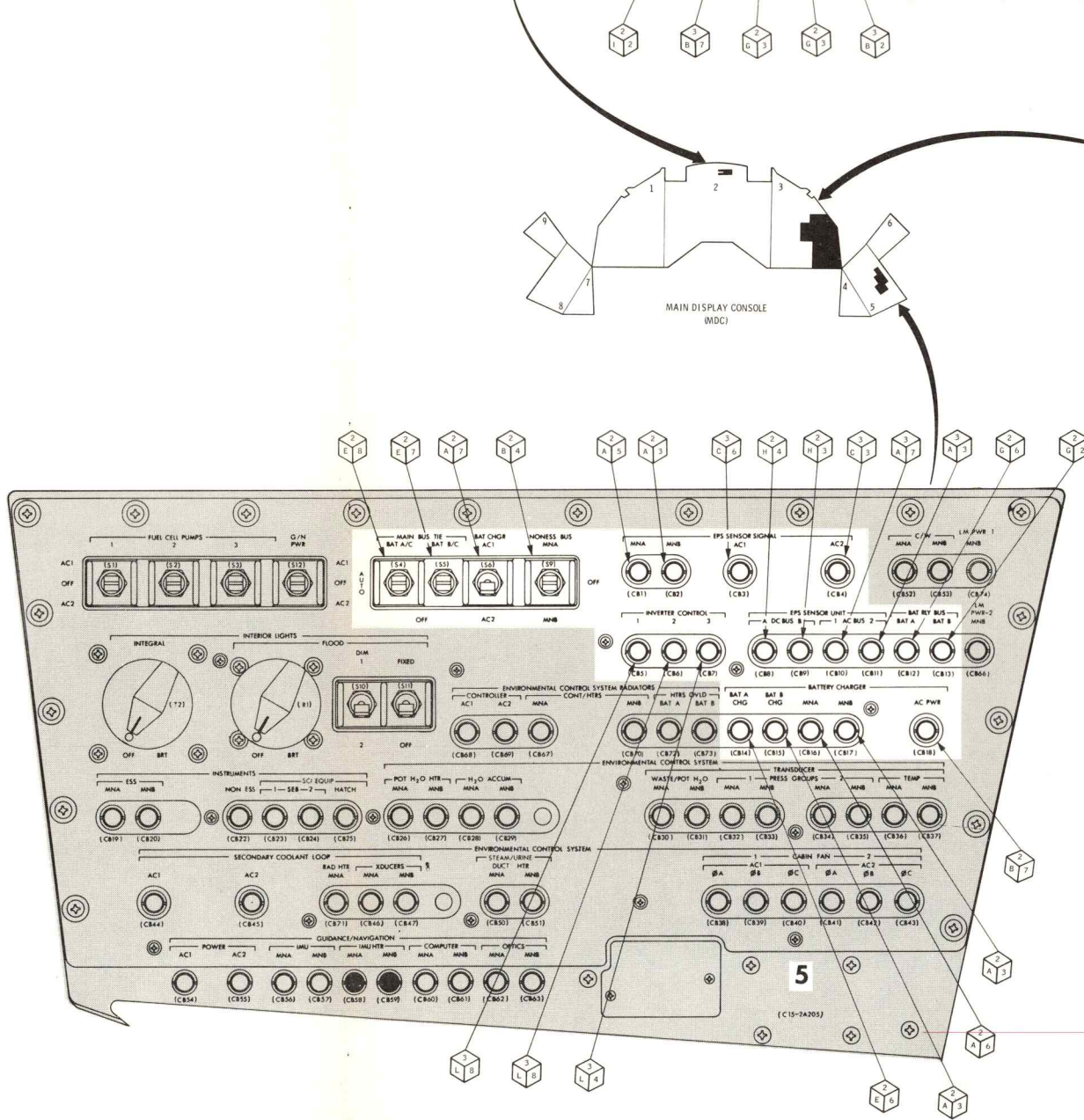
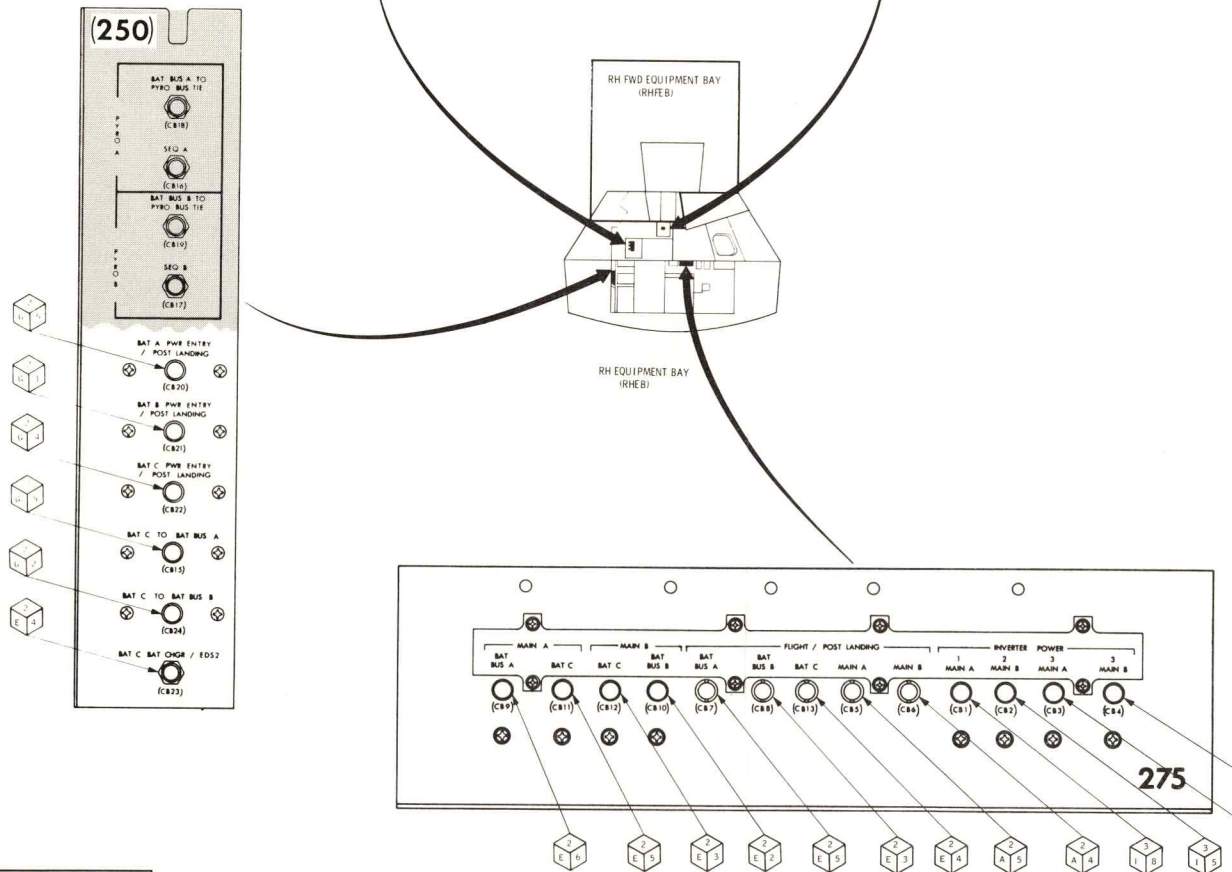
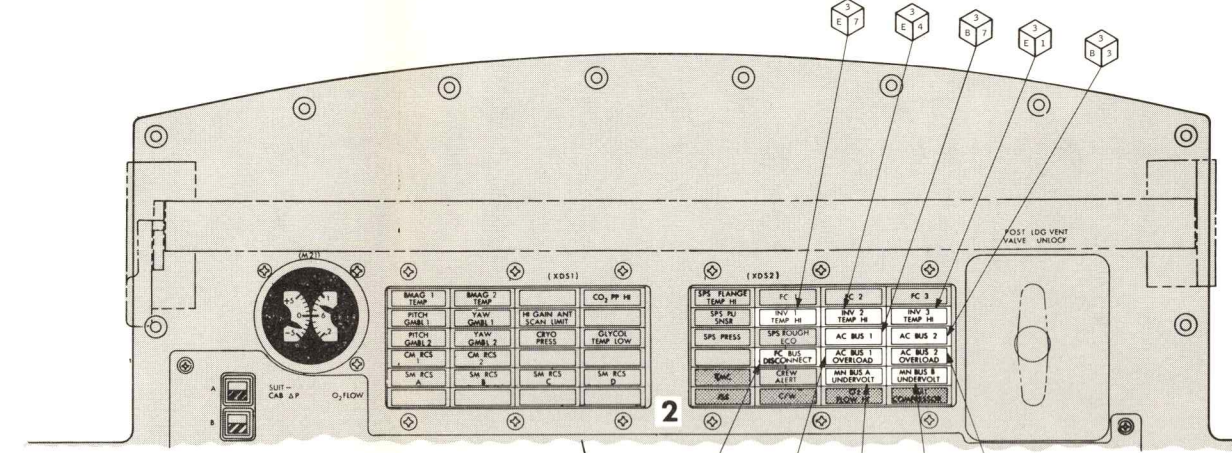
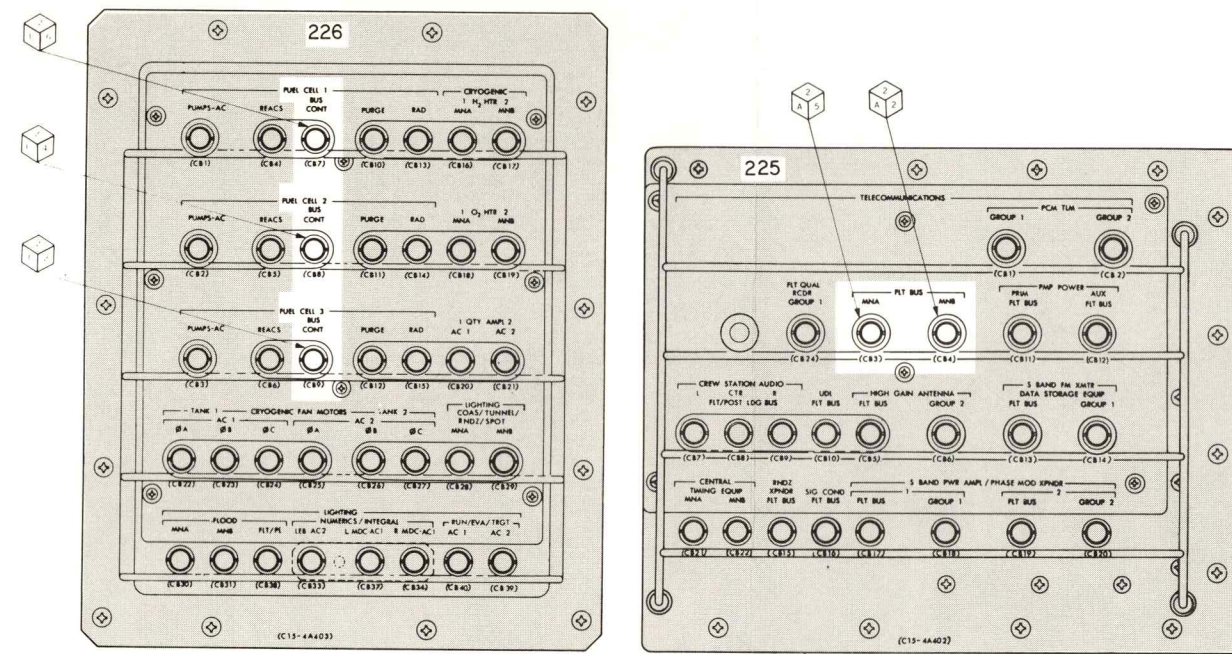


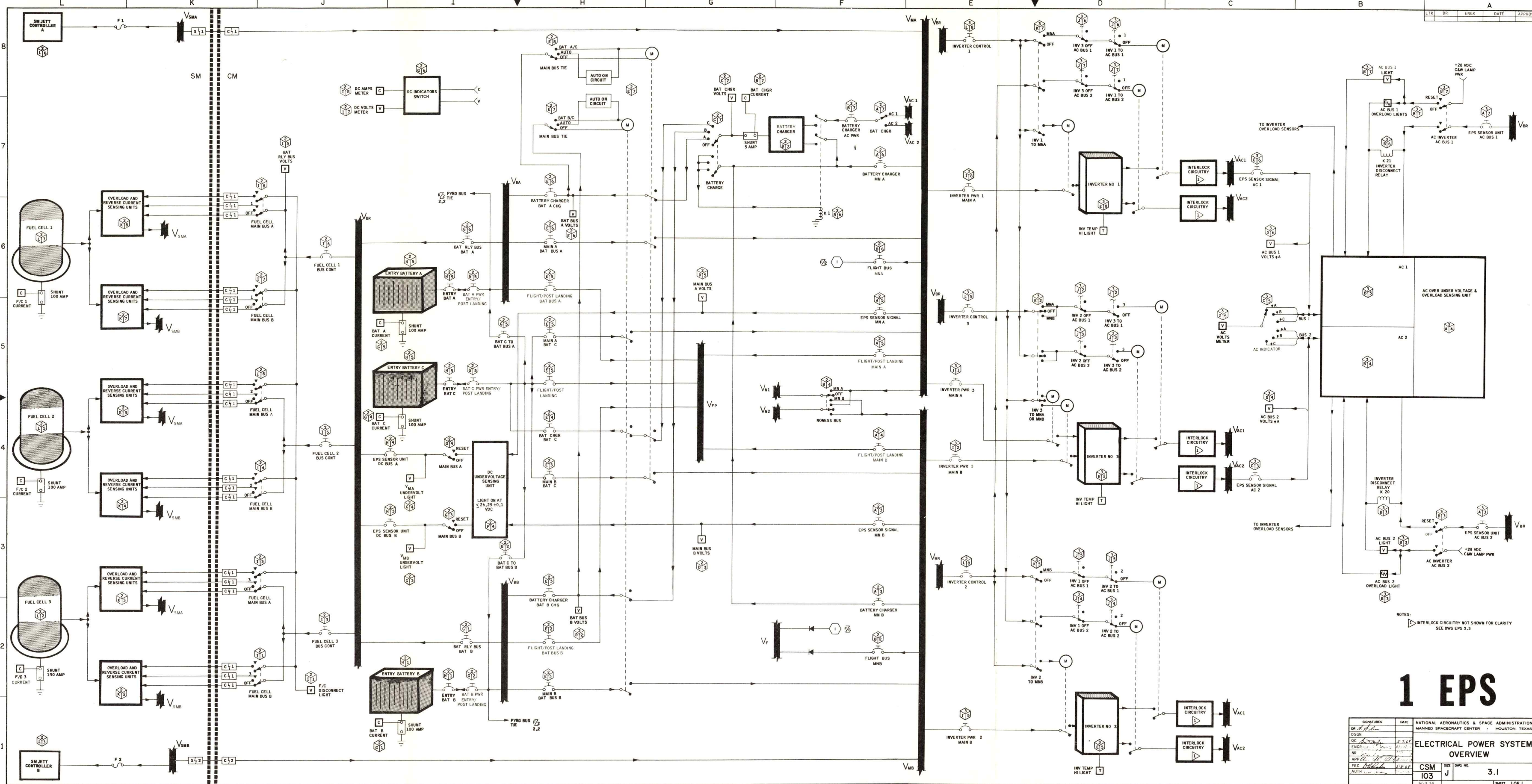






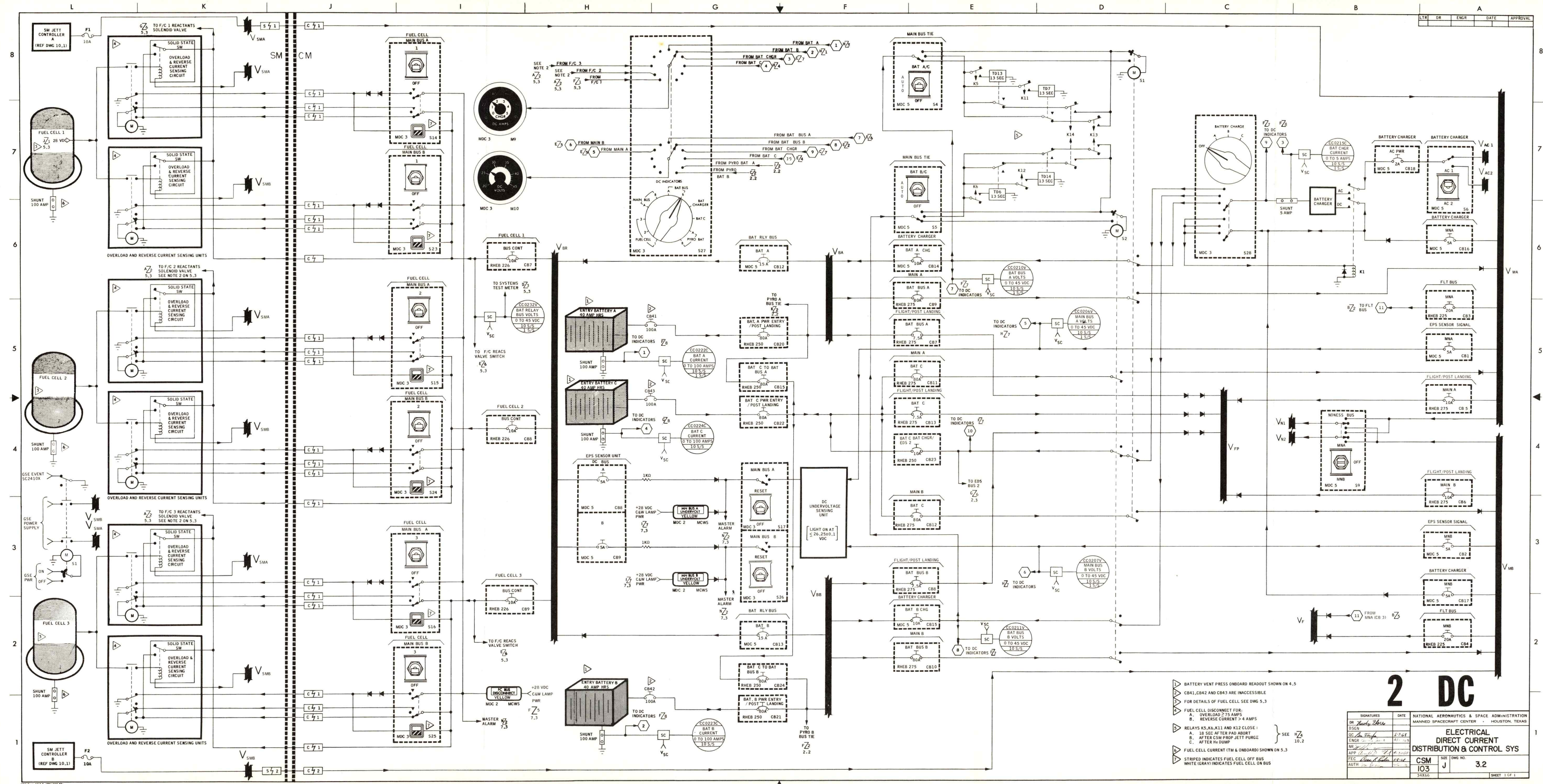




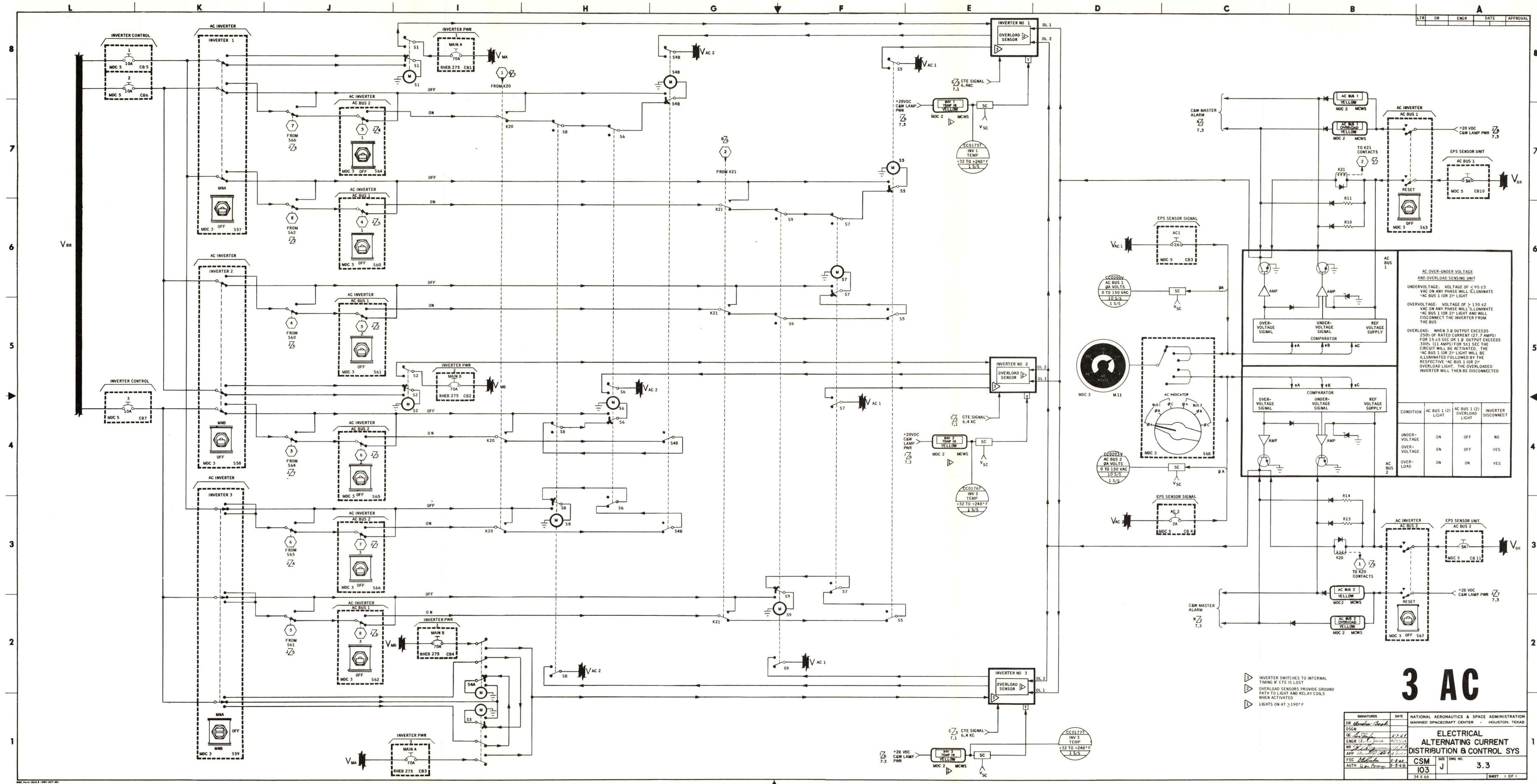


SIGNATURES	DATE	NATIONAL AERONAUTICS & SPACE ADMINISTRATION MANNED SPACECRAFT CENTER • HOUSTON, TEXAS		
OSG		ELECTRICAL POWER SYSTEM OVERVIEW		
DC	5-2-68			
ENGINEER	4-11-68			
NR				
APPROV	11-17-68			
REC	5-2-68	CSM	SIZE	OWG NO.
AUTH		103	J	3.1
		PROG	SHEET 1 OF 1	

NOTE: THESE CIRCUIT BREAKERS WERE INSTALLED TO PROTECT LONG WIRE LEADS



ELECTRICAL
DIRECT CURRENT
DISTRIBUTION & CONTROL SYS



3.4

BUS SUMMARY TABLE

The following table is a listing of spacecraft buses subdivided into the circuit breakers each bus feeds. In turn each circuit breaker is subdivided to list all the components it feeds. A miscellaneous list includes circuit breakers fed by other circuit breakers and circuit breakers installed to protect long wire leads.

- A. Main Bus A
- B. Main Bus B
- C. Battery Bus A
- D. Battery Bus B
- E. Battery Relay Bus
- F. Flight Bus
- G. Flight and Postlanding Bus
- H. Battery C
- I. CB22 (Battery C Pwr, Postlanding and Entry)
- J. Non-essential Bus 1
- K. Non-essential Bus 2
- L. Pyro Bus A
- M. Pyro Bus B
- N. AC Bus 1
- O. AC Bus 2
- P. Miscellaneous Circuit Breakers

CB NO./NOMENCLATURE	PANEL NO.	COMPONENT	POWER WATTS DC @28 VDC	CB RATING	REMARKS
<u>EPS</u>					
CB1/EPS SENSOR SIGNAL MN A	MDC-5	DC UNDERVOLTAGE SENSOR	0.25	5 AMP	
CB1/INVERTER POWER 1 MAIN A	RHEB-275	INVERTER 1	VARIABLE	70 AMP	MOTOR SW ISOLATED, IDLES AT 112.0 WATTS DC
CB3/INVERTER POWER 3 MAIN A	RHEB-275	INVERTER 3	VARIABLE	70 AMP	MOTOR SW ISOLATED, IDLES AT 112.0 WATTS DC
CB5/FLIGHT & POSTLANDING MAIN A	RHEB-275	POSTLDG BUS	VARIABLE	10 AMP	DIODE (1) ISOLATED
CB10/FUEL CELL 1 PURGE	RHEB-226	1. H ₂ PURGE VALVE 2. O ₂ PURGE VALVE 3. H ₂ PURGE HEATER	1. 17.5 2. 17.5 3. 4.0	5 AMP	DIODE (1) ISOLATED SW ISOLATED, SHARED BY MAIN BUS B
CB11/FUEL CELL 2 PURGE	RHEB-226	1. H ₂ PURGE VALVE 2. O ₂ PURGE VALVE 3. H ₂ PURGE HEATER	1. 17.5 2. 17.5 3. 4.0	5 AMP	DIODE (1) ISOLATED SW ISOLATED, SHARED BY MAIN BUS B
CB12/FUEL CELL 3 PURGE	RHEB-226	1. H ₂ PURGE VALVE 2. O ₂ PURGE VALVE	1. 17.5 2. 17.5	5 AMP	DIODE (1) ISOLATED SW ISOLATED, SHARED BY MAIN BUS B
CB16/BATTERY CHARGER MN A	MDC-5	BATTERY CHARGER	19.0 (NOM)	5 AMP	1. DIODE (1) ISOLATED, RELAY ISOLATED 2. DRAWS 21.0 WAC (NOM) 3. SHARED BY MAIN BUS B THROUGH CB17 4. DRAWS 49.0 WDC AND 48.0 WAC AT MAX CHARGE
CB30/LIGHTING FLOOD MN A	RHEB-226	FLOOD LTS 1. LEB 2. RH 3. LH	1. 7.0 2. 7.0 3. 7.0	15 AMP	1. QTY - 2 2. QTY - 2 3. QTY - 2

CB NO./NOMENCLATURE	PANEL NO.	COMPONENT	POWER WATTS DC @28 VDC	CB RATING	REMARKS
<u>SEQUENTIAL</u>					
CB28/LIGHTING COAS/TUNNEL RNDZ/SPOT MN A	RHEB-226	1. TUNNEL FLOOD- LIGHTS 2. OPTICAL ALIGN SIGHT 3. RH DOCKING WINDOW	1. 3.0 2. 8.4	5 AMP	1. QTY - 2
CB44/TIMERS MN A	RHEB-229	1. DIGITAL EVENT TIMER 2. MISSION TIMER	1.A. 5.0 B. 1.0 2. 11.2	5 AMP	1.A. OPERATE } QTY - 2 B. STANDBY } 2. QTY - 2
CB76/DOCK PROBE MN A	MDC-8	DOCKING PROBE	1. 100 2. 127 3. 1.12	10 AMP	1. EXTEND SOLENOID 2. RELAY MOTORS 3. INDICATORS
<u>CRYO</u>					
CB16/CRYOGENIC H ₂ HTR 1 MN A	RHEB-226	H ₂ TANK HEATER	20.0	5 AMP	QTY - 2
CB18/CRYOGENIC O ₂ HTR 1 MN A	RHEB-226	O ₂ TANK HEATER	155.0	15 AMP	QTY - 2
<u>ECS</u>					
CB26/ECS POT H ₂ O HTR MN A	MDC-5	1. POT H ₂ O HTR 2. GLYCOL EVAP CNTL VALVE	1. 45.0 2. 6.0	5 AMP	DIODE COUPLED TO MN B
CB28/ECS H ₂ O ACCUM MN A	MDC-5	1. CYCLIC ACCUMU- LATOR VALVE 2. SENSOR ELECT	1. 2.6	5 AMP	
CB30/ECS TRANSDUCER WASTE POT H ₂ O MN A	MDC-5	POTABLE AND WASTE WATER QTY XDUCERS	2.24 (TOTAL)	5 AMP	
CB32/ECS TRANSDUCER PRESS GROUPS 1 MN A	MDC-5	TRANSDUCERS (GLY ACCUM, GLY PMP, SUIT COMP ΔP, SUIT PRESS.)	4.34 (TOTAL)	5 AMP	

CB NO./NOMENCLATURE	PANEL NO.	COMPONENT	POWER WATTS DC @28 VDC	CB RATING	REMARKS
<u>ECS (CONTINUED)</u>					
CB34/ECS TRANSDUCER PRESS. GROUPS 2 MN A	MDC-5	TRANSDUCERS (CABIN P, EVAP BACK P, O ₂ MANIF P, CO ₂ P P, O ₂ FLOW)	8.68 (TOTAL)	5 AMP	
CB36/ECS TRANSDUCER TEMP MN A	MDC-5	CABIN T XDUCER TEMP XDUCER PWR SUPPLY	11.65 (TOTAL)	5 AMP	
CB46/ECS SECONDARY COOLANT LOOP XDUCERS MN A	MDC-5	SEC LOOP TRANSDUCERS	2.52 (TOTAL)	5 AMP	
CB50/ECS STEAM URINE DUCT HTR MN A	MDC-5	1. STEAM DUCT HTR 2. URINE DUMP HTR	1. 3.0 1. 5.7	5 AMP	
CB67/ECS RADIATORS CONT HTRS MN A	MDC-5	PRIMARY RADIATOR HTR CNTL ELEC- TRONICS	11.48 (MAX)	5 AMP	
CB71/ECS SECONDARY COOLANT LOOP RAD HTR MN A	MDC-5	SECONDARY RADIATOR HTR CNTL ELECTRONICS	14.84 (MAX)	5 AMP	
<u>COMM AND INST</u>					
CB3/TELECOM FLT BUS MN A	RHEB-225	FLT BUS	VARIABLE	20 AMP	FEEDS ALL COMMUNICATIONS EQUIP.
CB19/INSTRUMENTS ESS MN A	MDC-5	INSTRUMENTS PWR CON- TROL CIRCUIT BREAKER	127.1	15 AMP	FEEDS CB1, CB2, CB3, CB4 (SEE MISC LIST), DIODE COUPLED TO MN B FROM CB20
CB21/TELECOM CENTRAL TIMING EQUIP MN A	RHEB-225	CTE PWR SUPPLY NO. 1	20.0	5 AMP	
CB52/C&W MN A	MDC-5	C&W LIGHTS AND DE- TECTOR	3.75	10 AMP	DIODE COUPLED TO MN A FROM CB53

A. MAIN BUS A (CONTINUED)

CSM 103

CB NO./NOMENCLATURE	PANEL NO.	COMPONENT	POWER WATTS DC @28 VDC	CB RATING	REMARKS
<u>G&N</u>					
CB56/G&N IMU MN A	MDC-5	1. NBA STBY IMU 2. PSA IMU STBY 3. SIG COND C	1. 25.5 2. 13.0 3. 2.1	25.0	DIODE ISOLATED WITH MN B
CB58/G&N IMU HTR MN A	MDC-5	1. NBA OPER IMU 2. CDU IMU ON 3. PSA IMU OPER 4. PIPA ELECT 5. SIGNAL COND A	1. 78.6 2. 33.0 3. 64.0 4. 25.6 5. 8.7	7.5	DIODE ISOLATED WITH MN B
CB60/G&N COMPUTER MN A	MDC-5	CMC	1. 70.0 2. 15.0	10	1. OPERATE } DIODE ISOLATED 2. STANDBY } WITH MN B
CB62/G&N OPTICS MN A	MDC-5	1. NBA OBA ON 2. CDU OBA ON 3. PSA OBA ON 4. SIGNAL COND B 5. SIGNAL COND D	1. 27.3 2. 19.3 3. 40.4 4. 10.8 5. 2.2	10	DIODE ISOLATED WITH MN B
<u>SCS</u>					
CB11/SCS SYSTEM MN A	MDC-8	1. GYRO DSPY CUPLR 2. REACT JET DRIVER 3. ELECT DSPY ASS'Y	1. 49.1 2. 1.4 3. 8.0	15 AMP	
CB13/SCS CONTR/DIRECT 1 MN A	MDC-8	SCS DIRECT RCS	112	10 AMP	FED BY CB34 (RHEB-229)
CB15/SCS AC ROLL MN A	MDC-8	SCS AC ROLL 1	216	15 AMP	FED BY CB28 (RHEB-229)
CB17/SCS BD ROLL MN A	MDC-8	SCS BD ROLL 1	216	15 AMP	FED BY CB32 (RHEB-229)
CB19/SCS PITCH MN A	MDC-8	SCS PITCH	216	15 AMP	FED BY CB26 (RHEB-229)
CB21/SCS YAW MN A	MDC-8	SCS YAW	216	15 AMP	FED BY CB30 (RHEB-229)
CB23/LOGIC BUS MN A 3/4	MDC-8	SCS LOGIC PWR 1	44	3 AMP	FED BY CB26 (RHEB-229)
CB52/EMS MN A	MDC-8	EMS	70	5 AMP	
CB63/SCS LOGIC BUS MN A 1/2	MDC-8	SCS LOGIC PWR 2	5.4	3 AMP	FED BY CB32 (RHEB-229)

CB NO./NOMENCLATURE	PANEL NO.	COMPONENT	POWER WATTS DC @28 VDC	CB RATING	REMARKS
<u>SCS (CONTINUED)</u>					
CB70/SCS CONTR/DIRECT 2 MN A	MDC-8	DIRECT RCS		5 AMP	
CB72/SCS DIRECT ULL MN A	MDC-8	DIRECT ULLAGE		5 AMP	
CB74/SCS CONTR/AUTO MN A	MDC-8	AUTO RCS		3 AMP	
<u>SPS</u>					
CB25/SPS HTRS GAUGING MN A	MDC-8	1. PUGS (PRIMARY) 2. SPS LINE HTRS	1. 12.4 2. 2.0	3 AMP	1. DRAWS 49.5 WAC 2. QTY - 12
CB29/SPS HE. VALVE MN A	MDC-8	HELIUM ISOLATION VALVE A	55.0	7.5 AMP	
CB68/SPS PILOT VLVS MN A	MDC-8	SPS PILOT VALVES	23.0	7.5 AMP	
<u>RCS</u>					
CB39/RCS SM HEATERS B MN A	MDC-8	1. QUAD B HTRS 2. CM RCS HTR CIR- CUITRY	1. 36.0	7.5 AMP	1. QTY - 2
CB40/RCS SM HEATERS D MN A	MDC-8	QUAD D HTRS	36.0	7.5 AMP	QTY - 2
CB41/RCS PRPLNT ISOL MN A	MDC-8	1. QUAD B PROP ISOL VALVES 2. QUAD D PROP ISOL VALVES 3. QUAD B HELIUM ISOL VALVES 4. QUAD D HELIUM ISOL VALVES	49.0 49.0 54.0 54.0	10 AMP	1. QTY - 2 2. QTY - 2 3. QTY - 2 4. QTY - 2

A. MAIN BUS A (CONCLUDED)

CSM 103

CB NO./NOMENCLATURE	PANEL NO.	COMPONENT	POWER WATTS DC @28 VDC	CB RATING	REMARKS
<u>RCS (CONTINUED)</u>					
CB43/RCS CM SM TRNFR MN A	MDC-8	1. RCS TRANS SW 2. DIRECT ULLAGE PUSHBUTTON 3. CM PROP JETT SM 4. CM PROP JETT LOGIC SW 5. CM PROP PURGE SW 6. CM RCS HELIUM DUMP PUSHBUTTON		15 AMP	
CB67/RCS CM HEATERS 1 MN A	MDC-8		302.4 (336 MAX)	20 AMP	

3-11

CB NO./NOMENCLATURE	PANEL NO.	COMPONENT	POWER WATTS DC @28 VDC	CB RATING	REMARKS
EPS					
CB2/EPS SENSOR SIGNAL MN B	MDC-5	DC UNDERVOLTAGE SENSOR	.25	5 AMP	
CB2/INVERTER POWER 2 MAIN B	RHEB-275	INVERTER 2	VARIABLE	70 AMP	MOTOR SW ISOLATED, IDLES AT 112.0 WATTS DC
CB4/INVERTER POWER 3 MAIN B	RHEB-275	INVERTER 3	VARIABLE	70 AMP	MOTOR SW ISOLATED, IDLES AT 112.0 WATTS DC
CB6/FLIGHT & POSTLANDING MAIN B	RHEB-275	POSTLDG BUS	VARIABLE	10 AMP	DIODE (1) ISOLATED
C10/FUEL CELL 1 PURGE	RHEB-226	1. H ₂ PURGE VLV 2. O ₂ PURGE VLV 3. H ₂ PURGE HTR	1. 17.5 2. 17.5 3. 4.0	5 AMP	DIODE (1) ISOLATED SW ISOLATED, SHARED BY MAIN BUS A
CB11/FUEL CELL 2 PURGE	RHEB-226	1. H ₂ PURGE VLV 2. O ₂ PURGE VLV 3. H ₂ PURGE HTR	1. 17.5 2. 17.5 3. 4.0	5 AMP	DIODE (1) ISOLATED SW ISOLATED, SHARED BY MAIN BUS A
CB12/FUEL CELL 3 PURGE	RHEB-226	1. H ₂ PURGE VLV 2. O ₂ PURGE VLV	1. 17.5 2. 17.5	5 AMP	DIODE (1) ISOLATED SW ISOLATED, SHARED BY MAIN BUS A
CB17/BATTERY CHARGER MN B	MDC-5	BATTERY CHARGER	19.0 (NOM)	5 AMP	1. DIODE (1) ISOLATED, RELAY ISOLATED 2. DRAWS 21.0 WAC (NOM) 3. SHARED BY MAIN BUS A THROUGH CB16 4. DRAWS 49.0 WDC AND 48.0 WAC AT MAX CHARGE
CB31/LIGHTING FLOOD MN B	RHEB-226	FLOOD LTS A. LEB B. RH C. LH	7.0 7.0 7.0	15 AMP	A. QTY - 2 B. QTY - 2 C. QTY - 2
CB66/LM PWR - 2 MN B	MDC-5			2 AMP	
CB74/LM PWR - 1 MN B	MDC-5			7.5 AMP	

CB NO./NOMENCLATURE	PANEL NO.	COMPONENT	POWER WATTS DC @28 VDC	CB RATING	REMARKS
<u>SEQUENTIAL</u>					
CB29/LIGHTING COAS/TUNNEL RNDZ/SPOT MN B	RHEB-226	1. TUNNEL FLOOD LIGHTS 2. OPTICAL ALIGN SIGHT 3. RH DOCKING WINDOW	1. 3.0 2. 8.4	5 AMP	QTY - 2
CB45/TIMERS MN B	THEB-229	1. DIGITAL EVENT TIMER 2. MISSION TIMER	1.A. 5.0 B. 1.0 2. 11.2	5 AMP	1.A. OPERATE } B. STANDBY } QTY - 2 2. QTY - 2
CB77/DOCK PROBE MN B	MDC-8	DOCKING PROBE	1. 100 2. 127 3. 1.12	10 AMP	1. EXTEND SOLENOID 2. RELAY MOTORS 3. INDICATORS
<u>CRYO</u>					
CB17/CRYOGENIC H ₂ HTR 2 MN B	RHEB-226	H ₂ TANK HTR	20.0	5 AMP	QTY - 2
CB19/CRYOGENIC O ₂ HTR 2 MN B	RHEB-226	O ₂ TANK HRS	155.0	15 AMP	QTY - 2
<u>ECS</u>					
CB27/ECS POT H ₂ O HTR MN B	MDC-5	1. POT H ₂ O HTR 2. GLYCOL EVAP CNTL VALVE	1. 45.0 2. 6.0	5 AMP	DIODE COUPLED TO MN A
CB29/ECS H ₂ O ACCUM MN B	MDC-5	CYCLIC ACCUMULATOR VALVE AND SENSOR ELECT	3.05 (TOTAL) (MAX)	5 AMP	
CB31/ECS TRANSDUCER WASTE POT H ₂ O MN B	MDC-5	POTABLE AND WASTE WATER QTY XDUCERS	2.24 (TOTAL)	5 AMP	
CB33/ECS TRANSDUCER PRESS GROUP 1 MN B	MDC-5	XDUCERS (GLY ACCUM, GLY PUMP SUIT COMP ΔP, SUIT P)	4.34 (TOTAL)	5 AMP	

CB NO./NOMENCLATURE	PANEL NO.	COMPONENT	POWER WATTS DC @28 VDC	CB RATING	REMARKS
<u>ECS (CONTINUED)</u>					
CB35/ECS TRANSDUCER PRESS. GROUPS 2 MN B	MDC-5	XDUCERS (CABIN P, EVAP BACK P, O ₂ MANIF P, CO ₂ P P, O ₂ FLOW)	8.12 (TOTAL)	5 AMP	
CB37/ECS TRANSDUCER TEMP MN B	MDC-5	CABIN T XDUCER	11.65	5 AMP	
CB47/ECS SECONDARY COOLANT LOOP XDUCERS MN B	MDC-5	SECONDARY LOOP XDUCERS	2.52 (TOTAL)	15 AMP	
CB51/ECS STEAM URINE DUCT HTR MN A	MDC-5	1. STEAM DUCT HTR 2. URINE DUMP HTR	1. 3.0 2. 5.7	5 AMP	
CB70/ECS RADIATORS CONT HTRS MN B	MDC-5	PRIMARY RADIATOR HTR CNTL ELECTRONICS	11.48	5 AMP	
<u>COMM AND INST</u>					
CB4/TELECOM FLT BUS MN B	RHEB-225	FLIGHT BUS	VARIABLE	20 AMP	
CB20/INSTRUMENTS ESS MN B	MDC-5	INSTRUMENTS PWR CONTROL CIRCUIT BREAKER BOX	127.1	15 AMP	FEED CB1, CB2, CB3, CB4 (SEE MISC LIST), DIODE COUPLED TO MN A FROM CB19
CB22/TELECOM CENTRAL TIMING EQUIP MN B	RHEB-225	CTE PWR SUPPLY NO. 2		5 AMP	
CB53/C&W MN B	MDC-5	C&W LIGHTS AND DE- TECTOR	3.75	10 AMP	DIODE COUPLED TO MN B FROM CB52
<u>G&N</u>					
CB57/G&N IMU MN B	MDC-5	1. NBA STBY IMU 2. PSA IMU STBY 3. SIGNAL COND C	1. 25.5 2. 13.0 3. 2.1	25.0	DIODE ISOLATED WITH MN A

CB NO./NOMENCLATURE	PANEL NO.	COMPONENT	POWER WATTS DC @28 VDC	CB RATING	REMARKS
<u>G&N (CONTINUED)</u>					
CB59/G&N IMU HTR MN B	MDC-5	1. NBA OPER IMU 2. CDU IMU ON 3. PSA IMU OPER 4. PIPA ELECT 5. SIGNAL COND A	1. 78.6 2. 33.0 3. 64.0 4. 25.6 5. 8.7	7.5	DIODE ISOLATED WITH MN A
CB61/G&N COMPUTER MN B	MDC-5	CMC	1. 70.0 2. 15.0	10.0	1. OPERATE } DIODE ISOLATED 2. STANDBY } WITH MN A
CB63/G&N OPTICS MN B	MDC-5	1. NBA OBA ON 2. CDU OBA ON 3. PSA OBA ON 4. SIGNAL COND B 5. SIGNAL COND D	1. 27.3 2. 19.3 3. 40.4 4. 10.8 5. 2.2	10.0	DIODE ISOLATED WITH MN A
CB64/ORDEAL MN B	MDC-8	ORDEAL	4.0	5	DRAWS 4.0 WAC
<u>SCS</u>					
CB12/SCS SYSTEM MN B	MDC-8	1. GYRO DSPY CUPLR 2. REACT JET DRIVER 3. ELECT DSPY ASS'Y	1. 49.1 2. 1.4 3. 8.0	15 AMP	DC PWR FED BY CB29 (RHEB-229)
CB14/SCS CONT/DIRECT 2 MN B	MDC-8	SCS DIRECT RCS	112	5 AMP	FED BY CB35 (RHEB-229)
CB16/SCS AC ROLL MN B	MDC-8	SCS AC ROLL 2	216	15 AMP	FED BY CB29 (RHEB-229)
CB18/SCS BD ROLL MN B	MDC-8	SCS BD ROLL 2	216	15 AMP	FED BY CB33 (RHEB-229)
CB20/SCS PITCH MN B	MDC-8	SCS PITCH	216	15 AMP	FED BY CB27 (RHEB-229)
CB22/SCS YAW MN B	MDC-8	SCS YAW	216	15 AMP	FED BY CB31 (RHEB-229)
CB24/SCS LOGIC BUS MN B 2/3	MDC-8	SCS LOGIC PWR 1	30	3 AMP	FED BY CB27 (RHEB-229)
CB53/EMS MN B	MDC-8	EMS	70	5 AMP	
CB62/SCS LOGIC BUS MN B 1/4	MDC-8	SCS LOGIC PWR 2		3 AMP	FED BY CB31 (RHEB-229)

CB NO./NOMENCLATURE	PANEL NO.	COMPONENT	POWER WATTS DC @28 VDC	CB RATING	REMARKS
<u>SCS (CONTINUED)</u>					
CB71/SCS CONTR/DIRECT 2 MN B	MDC-8	DIRECT RCS		10 AMP	
CB73/SCS DIRECT ULL MN B	MDC-8	DIRECT ULLAGE		5 AMP	
CB75/SCS CONTR/AUTO MN B	MDC-8	AUTO RCS		3 AMP	
<u>SPS</u>					
CB26/SPS HTRS GAUGING MN B	MDC-8	1. PUGS (AUXILIARY) 2. SPS LINE HTRS	1. 12.4 2. 2.0	5 AMP	1. DRAWS 49.5 WAC 2. QTY - 12
CB30/SPS HE VALVE MN B	MDC-8	HELIUM ISOLATION VALVE B	55.0	7.5 AMP	
CB69/SPS PILOT VLVS MN B	MDC-8	SPS PILOT VALVES	23.0	7.5 AMP	
<u>RCS</u>					
CB37/RCS SM HEATERS A MN B	MDC-8	1. QUAD A HTRS 2. CM RCS HTR CIR- CUITRY	1. 36.0	7.5 AMP	1. QTY - 2
CB38/RCS SM HEATERS C MN B	MDC-8	QUAD A HTRS	36.0	7.5 AMP	QTY - 2
CB42/RCS PRPLNT ISOL MN B	MDC-8	1. QUAD A PROP ISOL VALVES 2. QUAD C PROP ISOL VALVES 3. QUAD A HELIUM ISOL VALVES 4. QUAD C HELIUM ISOL VALVES	49.0 49.0 54.0 54.0	10 AMP	1. QTY - 2 2. QTY - 2 3. QTY - 2 4. QTY - 2
CB66/RCS CM HEATERS 2 MN B	MDC-8	RCS CM HEATERS	302.4 (336 MAX)	20 AMP	

B. MAIN BUS B (CONCLUDED)

CSM 103

CB NO./NOMENCLATURE	PANEL NO.	COMPONENT	POWER WATTS DC @28 VDC	CB RATING	REMARKS
<u>RCS (CONTINUED)</u> CB44/RCS CM SM TRNFR MN B	MDC-8	1. RCS TRANS SW 2. DIRECT ULLAGE PUSHBUTTON 3. CM PROP JETT SW 4. CM PROP JETT LOGIC SW 5. CM PROP PURGE SW 6. CM RCS HELIUM DUMP PUSHBUTTON		15 AMP	

3-17

CB NO./NOMENCLATURE	PANEL NO.	COMPONENT	POWER WATTS DC @28 VDC	CB RATING	REMARKS
<u>EPS</u>					
CB7/FLIGHT AND POSTLANDING BAT. BUS A	RHEB-275	FLIGHT AND POSTLDG BUS	VARIABLE	7.5 AMP	DIODE ISOLATED
CB9/MAIN A BAT. BUS A	RHEB-275	MAIN BUS A	VARIABLE	80 AMP	DIODE ISOLATED
CB12/BAT. RLY BUS BAT. A	MDC-5	BATTERY RELAY BUS	VARIABLE	15 AMP	BAT. RLY BUS ALSO POWERED THROUGH CB13 FROM BAT. BUS B, DIODE ISOLATED
CB14/BATTERY CHARGER BAT. A CHG	MDC-5	1. BATTERY CHARGER 2. BUS TIE SW BAT. A/C	1. N/A 2. 150.0	10 AMP	1. CHARGER FEEDS BAT. BUS A 2. AVERAGE FOR 50 MICROSECONDS
CB20/BAT. A PWR ENTRY AND POST- LANDING	RHEB-250	BATTERY A	N/A	80 AMP	BAT. BUS A FED BY BAT. A THROUGH CB20
<u>SEQUENTIAL</u>					
CB1/SEQ EVENTS CONT SYS ARM A BAT. A	MDC-8	SEQ SW LOGIC BUS	9.08	5 AMP	
CB1/UPRIGHTING SYSTEM COMPRESSOR NO. 1	RHEB-278	PUMP NO. 1	560.0	25 AMP	
CB3/SEQ EVENTS CONT SYS LOGIC A BAT. A	MDC-8	SEQ LOGIC BUS	66.9	15 AMP	
CB6/FLOAT BAG 1 BAT. A	MDC-8	BAG CONTROL VALVE	30.0	5 AMP	
CB45/ELS BAT. A	MDC-8	EARTH LANDING SYS- TEM	12.6	5 AMP	1. APEX JETT 2. DROGUE DEPLOY 3. MAIN DEPLOY
CB49/EDS 1 BAT. A	MDC-8	EDS PWR SW	36.96 (49.0 MAX)	5 AMP	

C. BATTERY BUS A (CONCLUDED)

CSM 103

CB NO./NOMENCLATURE	PANEL NO.	COMPONENT	POWER WATTS DC @28 VDC	CB RATING	REMARKS
<u>SPS</u>					
CB31/SPS PITCH 1 BAT. A	MDC-8	GIMBAL MOTOR NO. 1	6.0	15 AMP	
CB33/SPS YAW 1 BAT. A	MDC-8	GIMBAL MOTOR NO. 1	6.0	15 AMP	
<u>ECS</u>					
CB72/ECS RADIATORS HTRS OVLD BAT. A	MDC-5	PRIMARY OVERLD CIRCUIT FOR HTRS		10 AMP	

3-19

D. BATTERY BUS B

CSM 103

CB NO./NOMENCLATURE	PANEL NO.	COMPONENT	POWER WATTS DC @28 VDC	CB RATING	REMARKS
<u>EPS</u>					
CB8/FLIGHT AND POSTLANDING BAT. BUS B	RHEB-275	FLIGHT AND POSTLDG BUS (VFL)	VARIABLE	7.5 AMP	DIODE ISOLATED
CB10/MAIN B BAT. BUS B	RHEB-275	MAIN BUS B	VARIABLE	80 AMP	DIODE ISOLATED
CB13/BAT. RLY BUS BAT. B	MDC-5	BATTERY RELAY BUS	VARIABLE	15 AMP	BAT. RLY BUS ALSO POWERED THROUGH CB12 FROM BAT. BUS A, DIODE ISOLATED
CB15/BATTERY CHARGER BAT. B CHG	MDC-5	1. BATTERY CHARGER 2. BUS TIE SW BAT. B/C	1. N/A 2. 150.0	10 AMP	1. CHARGER FEEDS BAT. BUS B 2. AVERAGE FOR 50 MICROSECONDS
CB21/BAT. B PWR ENTRY AND POST-LANDING	RHEB-250	BATTERY B	N/A	80 AMP	BAT. BUS A FED BY BAT. A THROUGH CB21
<u>SEQUENTIAL</u>					
CB2/SEQ EVENTS CONT SYS ARM B BAT. B	MDC-8	SEQ SW LOGIC PWR	9.08	5 AMP	
CB2/UPRIGHTING SYSTEM COMPRESSOR NO. 2	RHEB-278	PUMP NO. 2	560.0	25 AMP	
CB4/SEQ EVENTS CONT SYS LOGIC B BAT. B	MDC-8	SEQ LOGIC BUS	66.9	15 AMP	
CB7/FLOAT BAG 2 BAT. B	MDC-8	BAT. CONTROL VALVE	30.0	5 AMP	
CB46/ELS BAT. B	MDC-8	EARTH LANDING SYSTEM	12.6	5 AMP	1. APEX JETT 2. DROGUE DEPLOY 3. MAIN DEPLOY
CB51/EDS 3 BAT. B	MDC-8	EDS PWR SW	37.8 (49.84 MAX)	5 AMP	

D. BATTERY BUS B (CONCLUDED)

CSM 103

CB NO./NOMENCLATURE	PANEL NO.	COMPONENT	POWER WATTS DC @28 VDC	CB RATING	REMARKS
<u>SPS</u> CB32/SPS PITCH 2 BAT. B	MDC-8	GIMBAL MOTOR NO. 2	1.4	15 AMP	
CB34/SPS YAW 2 BAT. B	MDC-8	GIMBAL MOTOR NO. 2	1.4	15 AMP	
<u>ECS</u> CB73/ECS RADIATORS HTRS OVLD BAT. B	MDC-5	PRIMARY OVERLD CIR- CUIT FOR HTRS		10 AMP	

CB NO./NOMENCLATURE	PANEL NO.	COMPONENT	POWER WATTS DC @28 VDC	CB RATING	REMARKS
<u>EPS</u>					
CB4/FUEL CELL 1 REACS	RHEB-226	1. O ₂ REACTANT VALVE	140 (BOTH)	10 AMP	MAX TIME TO THROW IS 10 SEC.
		2. H ₂ REACTANT VALVE	347.2 (MAX FOR BOTH)		
CB5/FUEL CELL 2 REACS	RHEB-226	1. O ₂ REACTANT VALVE	140 (BOTH)	10 AMP	MAX TIME TO THROW IS 10 SEC.
		2. H ₂ REACTANT VALVE	347.2 (MAX FOR BOTH)		
CB5/INVERTER CONTROL 1	MDC-5	INVERTER NO. 1		10 AMP	COLDPLATED, 560 WATT TRANSIENT FOR 85 M.S. (MAX)
CB6/FUEL CELL 3 REACS	RHEB-226	1. O ₂ REACTANT VALVE	140 (BOTH)	10 AMP	MAX TIME TO THROW IS 10 SEC.
		2. H ₂ REACTANT VALVE	347.2 (MAX FOR BOTH)		
CB6/INVERTER CONTROL 2	MDC-5	INVERTER NO. 2		10 AMP	COLDPLATED, 560 WATT TRANSIENT FOR 85 M.S. (MAX)
CB7/INVERTER CONTROL 3	MDC-5	INVERTER NO. 3		10 AMP	COLDPLATED, 560 WATT TRANSIENT FOR 85 M.S. (MAX)
CB7/FUEL CELL 1 BUS CONT	RHEB-226	1. F/C 1 MN A DISCONNECT CIRCUIT	1.4 (FLAG)	10 AMP	FLAG DRAWS 40 MA WHEN F/C IS OFF BUS
		2. F/C 1 MN B DISCONNECT CIRCUIT	1.4 (FLAG)		
CB8/FUEL CELL 2 BUS CONT	RHEB-226	1. F/C MN A DISCONNECT	1.4 (FLAG)	10 AMP	FLAG DRAWS 40 MN WHEN F/C IS
		2. F/C 2 MN B DISCONNECT CIRCUIT	1.4 (FLAG)		OFF BUS

E. BATTERY RELAY BUS (CONCLUDED)

CSM 103

CB NO./NOMENCLATURE	PANEL NO.	COMPONENT	POWER WATTS DC @28 VDC	CB RATING	REMARKS
<u>EPS (CONTINUED)</u>					
CB8/EPS SENSOR UNIT DC BUS A	MDC-5	DC UNDERVOLTAGE SENSOR UNIT MN A	0.25	5 AMP	DRAWS POWER FROM V _{MA} NORMALLY
CB9/FUEL CELL 3 BUS CONT	RHEB-226	1. F/C 3 MN A DIS- CONNECT CIRCUIT	1.4 (FLAG)	10 AMP	FLAG DRAWS 40 MN WHEN F/C IS OFF BUS
		2. F/C 3 MN B DISCONNECT CIRCUIT	1.4 (FLAG)		
CB9/EPS SENSOR UNIT DC BUS B	MDC-5	DC UNDERVOLTAGE SENSOR UNIT (MN B)	0.25	5 AMP	DRAWS POWER FROM V _{MB} NORMALLY
CB10/EPS SENSOR UNIT AC BUS 1	MDC-5	AC BUS 1 OVER/UNDER VOLTAGE SENSOR UNIT	.75	5 AMP	
CB11/EPS SENSOR UNIT AC BUS 2	MDC-5	AC BUS 2 OVER/UNDER VOLTAGE SENSOR UNIT	.75	5 AMP	
CB13/FUEL CELL 1 RAD	RHEB-226	F/C 1 RADIATOR VALVE	1.18	5 AMP	
CB14/FUEL CELL 2 RAD	RHEB-226	F/C 2 RADIATOR VALVE	1.18	5 AMP	
CB15/FUEL CELL 3 RAD	RHEB-226	F/C 3 RADIATOR VALVE	1.18	5 AMP	

CB NO./NOMENCLATURE	PANEL NO.	COMPONENT	POWER WATTS DC @28 VDC	CB RATING	REMARKS
<u>COMMUNICATIONS</u>					
CB10/TELECOM UDL FLT BUS	RHEB-225	UPDATA LINK	14.0	10 AMP	
CB11/TELECOM PMP POWER PRIM FLT BUS	RHEB-225	PRE MOD PROCESSOR	8.96	5 AMP	
CB12/TELECOM PMP POWER AUX FLT BUS	RHEB-225	PRE MOD PROCESSOR	8.96	5 AMP	
CB13/TELECOM S-BAND FM XMTR DATA STORAGE EQUIP FLT BUS	RHEB-225	1. DATA STORAGE 2. TELEVISION 3. S-BAND FM XMTR	1. 6.0 2. 6.75	5 AMP	1. DRAWS 33.0 WAC
CB15/TELECOM RNDZ XPNDR FLT BUS	RHEB-225	RENDEZVOUS TRANSPONDER	1. 69.0 2. 15.0	10 AMP	1. OPERATE 2. HEATER (ONLY)
CB16/TELECOM SIG COND FLT BUS	RHEB-225	SIGNAL CONDITIONING EQUIPMENT	35.0 (MAX)	5 AMP	
CB17/TELECOM S-BAND PWR AMPL PHASE MOD XPNDR 1 FLT BUS	RHEB-225	1. S-BAND PRIM PA 2. S-BAND PRIM XPNDR	20.61 (TOTAL)	5 AMP	
CB19/TELECOM S-BAND PWR AMPL PHASE MOD XPNDR 2 FLT BUS	RHEB-225	1. S-BAND SEC PA 2. S-BAND SEC XPNDR	20.61 (TOTAL)	5 AMP	
CB5/HIGH GAIN ANTENNA FLT BUS	RHEB-225	HIGH GAIN ANTENNA		5 AMP	

3-24

G. FLIGHT AND POSTLANDING BUS

CSM 103

CB NO./NOMENCLATURE	PANEL NO.	COMPONENT	POWER WATTS DC @28 VDC	CB RATING	REMARKS
<u>EPS</u> CB38/LIGHTING FLOOD FLT PL	RHEB-226	FLOODLIGHTS	7.0	5 AMP	LH INTERIOR FLOODLIGHTS QTY - 2 BULBS
<u>COMMUNICATIONS</u> CB7/TELECOM CREW STATION AUDIO L FLT POSTLDG BUS	RHEB-225	1. SR PILOT RIGHT MIKE 2. CMD PILOT LEFT MIKE 3. CMD PILOT AUDIO STATION	28.84 (MAX) (TOTAL)	5 AMP	
CB8/TELECOM CREW STATION AUDIO CTR FLT POSTLDG BUS	RHEB-225	1. SR PILOT LEFT MIKE 2. PILOT RIGHT MIKE 3. SR PILOT AUDIO STA 4. VHF AM TRANS- CEIVER	76.16 (MAX) (TOTAL)	5 AMP	
CB9/TELECOM CREW STATION AUDIO R FLT POSTLDG, BUS	RHEB-225	1. PILOT LEFT MIKE 2. CMD PILOT RIGHT MIKE 3. PILOT AUDIO STATION 4. HF TRANSCEIVER	68.88 (MAX) (TOTAL)	5 AMP	
<u>SEQUENTIAL</u> CB5/PL VENT FLT PL	MDC-8	1. PLV FAN 2. PLV GATE VALVE	1.A. 17.0 (HI) 1.B. 8.0 (LO) 2. 50.4	5 AMP	

CB NO./NOMENCLATURE	PANEL NO.	COMPONENT	POWER WATTS DC @28 VDC	CB RATING	REMARKS
<u>SEQUENTIAL (CONCLUDED)</u> CB8/FLOAT BAG 3 FLT PL	MDC-8	1. SEA DYE MARKER 2. BAG CONTROL VALVE	1. 140.0 2. 30.0	5 AMP	

CB NO./NOMENCLATURE	PANEL NO.	COMPONENT	POWER WATTS DC @28 VDC	CB RATING	REMARKS
<u>EPS</u> CB22/BAT. C PWR ENTRY AND POST- LANDING	RHEB-250	FLIGHT AND POSTLDG BUS	VARIABLE	80 AMP	SEE NEXT PAGE, CB22 FEEDS SIX EPS CIRCUIT BREAKERS

I. BATTERY C PWR, POSTLANDING AND ENTRY CIRCUIT BREAKER (CB22)

CSM 103

CB NO./NOMENCLATURE	PANEL NO.	COMPONENT	POWER WATTS DC @28 VDC	CB RATING	REMARKS
<u>EPS</u>					
CB11/MAIN A BAT. C	RHEB-275	MAIN BUS A	VARIABLE	80 AMP	
CB12/MAIN B BAT. C	RHEB-275	MAIN BUS B	VARIABLE	80 AMP	
CB13/FLIGHT AND POSTLANDING BAT. C	RHEB-275	FLIGHT AND POSTLDG BUS	VARIABLE	7.5 AMP	
CB23/BAT. C BAT. CHGR AND EDS	RHEB-250	BATTERY CHARGER	N/A	10 AMP	
CB15/BAT. C TO BAT. BUS A	RHEB-250	BAT. BUS A	VARIABLE	80 AMP	
CB24/BAT. C TO BAT. BUS B	RHEB-250	BAT. BUS B	VARIABLE	80 AMP	

J. NON-ESSENTIAL BUS 1

CSM 103

CB NO./NOMENCLATURE	PANEL NO.	COMPONENT	POWER WATTS DC @28 VDC	CB RATING	REMARKS
CB22/INSTRUMENTS NONESS	MDC-5	INSTRUMENTS POWER CONTROL CIRCUIT BREAKER BOX - FLIGHT QUAL	97.8 (CM) 2.2 (SM)	30 AMP	FEEDS CB5, CB6, CB7, CB8, CB9, CB10 (SEE MISCELLANEOUS CIRCUIT BREAKER LIST)

3-29

CB NO./NOMENCLATURE	PANEL NO.	COMPONENT	POWER WATTS DC @28 VDC	CB RATING	REMARKS
<u>EXPERIMENTS</u>					
CB23/INSTRUMENTS SCI EQUIP SEB 1	MDC-5		4.48	5 AMP	GSE MEASUREMENT
CB24/INSTRUMENTS SCI EQUIP SEB 2	MDC-5			5 AMP	

L. PYRO BUS A

CSM 103

CB NO./NOMENCLATURE	PANEL NO.	COMPONENT	POWER WATTS DC @28 VDC	CB RATING	REMARKS
<u>SEQUENTIAL</u> CB16/PYRO A SEQ A	RHEB-250	1. VLQA 2. VMQA 3. VRQA		20 AMP	
CB3/LM/SLA SEP PYRO A	RHEB-278				
<u>RCS</u> CB18/PYRO A BAT. BUS A TO PYRO BUS TIE	RHEB-250	1. VLQA 2. VMQA 3. VRQA		20 AMP	

3-31

CB NO./NOMENCLATURE	PANEL NO.	COMPONENT	POWER WATTS DC @28 VDC	CB RATING	REMARKS
<u>SEQUENTIAL</u> CB17/PYRO B SEQ B	RHEB-250	1. VLQB 2. VMOB 3. VRQB		20 AMP	
CB4/LM/SLA SEP PYRO B	RHEB-278				
<u>RCS</u> CB19/PYRO B BAT. B TO PYRO BUS TIE	RHEB-250	1. VLQB 2. VMOB 3. VRQB		20 AMP	

CB NO./NOMENCLATURE	PANEL NO.	COMPONENT	POWER WATTS AC @115 VDC	CB RATING	REMARKS
<u>EPS</u>					
CB1/FUEL CELL 1 PUMPS - AC	RHEB-226	1. H ₂ PUMP 2. GLYCOL PUMP 3. pH SENSOR (φA) 4. PF CORR BOX	1. 80 (HI) 65 (LO) 2. 80 (HI) 65 (LO) 3. 2.0 4. 5.0	2 AMP	PUMP PWR VARIES WITH FUEL CELL TEMP, CAN BE SWITCHED TO AC2 (3φ EXCEPT pH)
CB2/FUEL CELL 2 PUMPS - AC	RHEB-226	1. H ₂ PUMP 2. GLYCOL PUMP 3. pH SENSOR (φA)	1. 80 (HI) 65 (LO) 2. 80 (HI) 65 (LO) 3. 2.0	2 AMP	PUMP PWR VARIES WITH FUEL CELL TEMP, CAN BE SWITCHED TO AC2 (3φ EXCEPT pH)
CB3/FUEL CELL 3 PUMPS - AC	RHEB-226	1. H ₂ PUMP 2. GLYCOL PUMP 3. pH SENSOR (φA) 4. PF CORR BOX	1. 80 (HI) 65 (LO) 2. 80 (HI) 65 (LO) 3. 2.0 4. 5.0	2 AMP	PUMP PWR VARIES WITH FUEL CELL TEMP, CAN BE SWITCHED TO AC2 (3φ EXCEPT pH)
CB3/EPS SENSOR SIGNAL AC 1	MDC-5	AC BUS 1 OVER/UNDER VOLTAGE SENSOR	0.00	2 AMP	SENSOR DRAWS CONTINUOUS POWER FROM BAT. RLY BUS (3φ)
CB18/BATTERY CHARGER AC PWR	MDC-5	BATTERY CHARGER	21.0 (NOM)	2 AMP	CAN BE SWITCHED TO AC2, DRAWS 19 WDC (NOM) (3φ)
CB34/LIGHTING NUMERICS INTEGRAL RMDC-AC 1	RHEB-226	STATION 2 PANEL LIGHTS	17.1 (TOTAL)	2 AMP	MDC PANELS 2, 3, 4, 5, AND 6 (φB USED)
CB40/LIGHTING EXTERNAL AC1	RHEB-226	RUNNING LIGHTS AND TRANSFORMER	12.6 (TOTAL)	2 AMP	QTY - 22 BULBS (φA USED)
CB37/LIGHTING NUMERICS INTEGRAL LMDC-AC 1	RHEB-226	NUMERICS LIGHTING	8.5 (TOTAL)	2 AMP	φA USED

CB NO./NOMENCLATURE	PANEL NO.	COMPONENT	POWER WATTS AC @115 VDC	CB RATING	REMARKS
<u>CRYO</u>					
CB22/CRYOGENIC FAN MOTORS TANK 1 AC 1 ϕ A	RHEB-226	1. O ₂ TANK 1 FAN 2. H ₂ TANK 1 FAN	1. 20.5 2. 3.5	2 AMP	0.8 PF
CB23/CRYOGENIC FAN MOTORS TANK 1 AC 1 ϕ B	RHEB-226			2 AMP	1. QTY - 2 2. QTY - 2
CB24/CRYOGENIC FAN MOTORS TANK 1 AC 1 ϕ C	RHEB-226			2 AMP	
CB20/CRYOGENIC QTY AMPL 1 AC 1	RHEB-226	1. O ₂ SIGNAL COND 2. H ₂ SIGNAL COND	1. 3.7 2. 3.1	2 AMP	ϕ C USED
<u>ECS</u>					
CB1/SUIT COMPRESSORS AC 1 ϕ A	MDC-4	SUIT COMPRESSOR	79.7 (ORBIT) 195.0 (GRND)	2 AMP	0.8 - PF QTY - 2 EITHER UNIT CAN BE POWERED FROM EITHER AC BUS
CB2/SUIT COMPRESSORS AC 1 ϕ B	MDC-4			2 AMP	
CB3/SUIT COMPRESSORS AC 1 ϕ C	MDC-4			2 AMP	
CB7/ECS GLYCOL PUMPS AC 1 ϕ A	MDC-4	GLYCOL PUMP	50.0	2 AMP	0.8 - PF QTY - 2 EITHER UNIT CAN BE POWERED FROM EITHER AC BUS
CB8/ECS GLYCOL PUMPS AC 1 ϕ B	MDC-4			2 AMP	
CB9/ECS GLYCOL PUMPS AC 1 ϕ C	MDC-4			2 AMP	
CB38/ECS CABIN FAN 1 AC 1 ϕ A	MDC-5	CABIN FAN		2 AMP	

CB NO./NOMENCLATURE	PANEL NO.	COMPONENT	POWER WATTS AC @115 VDC	CB RATING	REMARKS
<u>ECS (CONTINUED)</u>					
CB39/ECS CABIN FAN 1 AC 1 φB	MDC-5	CABIN FAN	19.0 (ORBIT) 30.0 (GRND)	2 AMP	0.8 - PF
CB40/ECS CABIN FAN 1 AC 1 φC				2 AMP	
CB44/ECS SECONDARY COOLANT LOOP AC 1	MDC-5	1. SECONDARY GLYCOL PUMP 2. EVAP TEMP CNTL UNIT	1. 50.0 2. 23.8	2 AMP	3φ
CB68/ECS RADIATORS CONTROLLER AC 1	MDC-5	1. PRIMARY POWER SUPPLY 2. SS SWITCHES FOR PRIMARY RADIATOR		2 AMP	φC USED
<u>G&N</u>					
CB54/G&N POWER AC 1	MDC-5			2 AMP	φB USED
<u>SCS</u>					
CB89/SCS AC 1	MDC-8	1. ELECT DSPY ASS'Y 2. GYRO ASS'Y NO. 1 3. FDAI NO. 1	1. 27.0 2. 34.6 3. 6.6	2 AMP	1. DRAWS 46.2 WDC 2. DRAWS 60.0 WDC } 3φ
CB55/SCS TVC AC 1	MDC-8	SERVO AMPL ASS'Y TV	21.9	2 AMP	DRAWS 12.7 WDC, φA USED
<u>SPS</u>					
CB27/SPS GAUGING AC 1	MDC-8	PUG SYSTEM	49.5	2 AMP	DRAWS 12.4 WDC, φC USED

CB NO./NOMENCLATURE	PANEL NO.	COMPONENT	POWER WATTS AC @115 VDC	CB RATING	REMARKS
<u>COMMUNICATIONS</u>					
CB1/TELECOM PCM TM GROUP 1	RHEB-225	PCM EQUIP	18.9	2 AMP	CAN BE SWITCHED TO AC2 (3 ϕ)
CB2/TELECOM PCM TM GROUP 2	RHEB-225	PCM EQUIP	18.9	2 AMP	CAN BE SWITCHED TO AC2 (3 ϕ)
CB14/TELECOM S-BAND FM XMTR DATA STORAGE EQUIP GROUP 1	RHEB-225	1. DATA STORAGE 2. S-BAND FM XMTR	1. 33.0 2. 6.7	2 AMP	DSE DRAWS 6.0 WDC, CAN BE SWITCHED TO AC2 (3 ϕ)
CB18/TELECOM S-BAND PWR AMPL PHASE MOD XPNDR 1 GROUP 1	RHEB-225	1. S-BAND PRIM PWR AMPL 2. S-BAND PRIM XPNDR	1. HI 90.0 LO 40.0 2. 16.5	2 AMP	CAN BE SWITCHED TO AC2 (3 ϕ)
CB20/TELECOM S-BAND PWR AMPL PHASE MOD XPNDR 2 GROUP 2	RHEB-225	1. S-BAND SEC PWR AMPL 2. S-BAND SEC XPNDR	1. HI 90.0 2. 16.5	2 AMP	CAN BE SWITCHED TO AC2 (3 ϕ)
CB24/TELECOM FLT QUAL RCDR GROUP 1	RHEB-225	FLT QUAL RCDR	14.4	2 AMP	CAN BE SWITCHED TO AC2 (3 ϕ)

CB NO./NOMENCLATURE	PANEL NO.	COMPONENT	POWER WATTS AC @115 VDC	CB RATING	REMARKS
<u>EPS</u>					
CB1/FUEL CELL 1 PUMPS - AC	RHEB-226	1. H ₂ PUMP	1. 80 (HI) 65 (LO)	2 AMP	PUMP PWR VARIES WITH FUEL CELL TEMP, CAN BE SWITCHED TO AC1 (3φ EXCEPT pH)
		2. GLYCOL PUMP	2. 80 (HI) 65 (LO)		
		3. pH SENSOR (φA)	3. 2.0		
		4. PF CORR BOX	4. 5.0		
CB2/FUEL CELL 2 PUMPS - AC	RHEB-226	1. H ₂ PUMP	1. 80 (HI) 65 (LO)	2 AMP	PUMP PWR VARIES WITH FUEL CELL TEMP, CAN BE SWITCHED TO AC1 (3φ EXCEPT pH)
		2. GLYCOL PUMP	2. 80 (HI) 65 (LO)		
		3. pH SENSOR (φA)	3. 2.0		
CB3/FUEL CELL 3 PUMPS - AC	RHEB-226	1. H ₂ PUMP	1. 80 (HI) 65 (LO)	2 AMP	PUMP PWR VARIES WITH FUEL CELL TEMP, CAN BE SWITCHED AT AC1 (3φ EXCEPT pH)
		2. GLYCOL PUMP	2. 80 (HI) 65 (LO)		
		3. pH SENSOR (φA)	3. 2.0		
		4. PF CORR BOX	4. 5.0		
CB4/EPS SENSOR SIGNAL AC 2	MDC-5	AC BUS 2 OVER/UNDER VOLTAGE SENSOR	0.00	2 AMP	SENSOR DRAWS CONTINUOUS POWER FROM BAT. RLY BUS (3φ)
CB18/BATTERY CHARGER AC PWR	MDC-5	BATTERY CHARGER	21.0 (NOM)	2 AMP	CAN BE SWITCHED TO AC 1, DRAWS 19 WDC (NOM) (3φ)
CB33/LIGHTING NUMERICS INTEGRAL LEB - AC 2	RHEB-226	STATION 3 PANEL LIGHTS	6.0 (TOTAL)	2 AMP	LEB PANELS (φA USED)
CB39/LIGHTING EXTERNAL AC 2	RHEB-226	RUNNING LIGHTS AND TRANSFORMER	12.6 (TOTAL)	2 AMP	QTY - 22 BULBS (φB USED)

CB NO./NOMENCLATURE	PANEL NO.	COMPONENT	POWER WATTS AC @115 VDC	CB RATING	REMARKS
<u>CRYO</u>					
CB21/CRYOGENIC QTY AMPL 2 AC 2	RHEB-226	1. O ₂ SIGNAL COND	1. 3.7	2 AMP	φC USED
CB25/CRYOGENIC FAN MOTORS TANK 2 AC 2 φA	RHEB-226	2. H ₂ SIGNAL COND	2. 3.1	2 AMP	0.8 - PF
CB26/CRYOGENIC FAN MOTORS TANK 2 AC 2 φB	RHEB-226	1. O ₂ TANK 2 FAN	1. 14.5	2 AMP	1. QTY - 2
CB27/CRYOGENIC FAN MOTORS TANK 2 AC 2 φC	RHEB-226	2. H ₂ TANK 2 FAN	2. 3.5	2 AMP	2. QTY - 2
<u>ECS</u>					
CB4/SUIT COMPRESSORS AC 2 φA	MDC-4	SUIT COMPRESSOR	79.7 (ORBIT) 195.0 (GRND)	2 AMP	0.8 - PF QTY - 2 EITHER UNIT CAN BE POWERED FROM EITHER BUS
CB5/SUIT COMPRESSORS AC 2 φB	MDC-4			2 AMP	
CB6/SUIT COMPRESSORS AC 2 φC	MDC-4			2 AMP	
CB10/ECS GLYCOL PUMP AC 2 φA	MDC-4	GLYCOL PUMP	50.0	2 AMP	0.8 - PF QTY - 2 EITHER UNIT CAN BE POWERED FROM EITHER BUS
CB11/ECS GLYCOL PUMP AC 2 φB	MDC-4			2 AMP	
CB12/ECS GLYCOL PUMP AC 2 φC	MDC-4			2 AMP	
CB41/ECS CABIN FAN 2 AC 2 φA	MDC-5	CABIN FAN	19.0	2 AMP	0.8 PF
CB42/ECS CABIN FAN 2 AC 2 φB	MDC-5			2 AMP	
CB43/ECS CABIN FAN 2 AC 2 φC	MDC-5			2 AMP	
CB45/ECS SECONDARY COOLANT LOOP AC 2	MDC-5	SECONDARY GLYCOL PUMP	50.0	2 AMP	3φ
CB69/ECS RADIATORS CONTROLLER AC 2	MDC-5	1. PRIMARY POWER SUPPLY 2. SS SWITCHES FOR PRIM RAD		2 AMP	φC USED

CB NO./NOMENCLATURE	PANEL NO.	COMPONENT	POWER WATTS AC @115 VDC	CB RATING	REMARKS
<u>G&N</u> CB55/G&N POWER AC 2	MDC-5	G&N SYS PWR		2 AMP	φB USED
<u>SCS</u> CB10/SCS AC 2	MDC-8	1. ELECT DSKY ASS'Y 2. GYRO ASS'Y NO. 2 3. FDAI NO. 2	1. 27.0 2. 34.6 3. 6.6	2 AMP	1. DRAWS 46.2 WDC } 2. DRAWS 60.0 WDC } 3φ
CB54/SCS ECA TVC AC 2	MDC-8	ECA TVC		2 AMP	φC USED
CB65/ORDEAL AC 2	MDC-8	ORDEAL	4.0	2 AMP	DRAWS 4.0 WDC (3φ)
<u>SPS</u> CB28/SPS GAUGING AC 2	MDC-8	PUG SYSTEM	49.5	2 AMP	DRAWS 12.4 WDC, φC USED
<u>COMMUNICATIONS</u> CB1/TELECOM PCM TM GROUP 1	RHEB-225	PCM EQUIP	18.9	2 AMP	CAN BE SWITCHED TO AC 1 (3φ)
CB2/TELECOM PCM TM GROUP 2	THEB-225	PCM EQUIP	18.9	2 AMP	CAN BE SWITCHED TO AC 1 (3φ)
CB14/TELECOM S-BAND FM XMTR DATA STORAGE EQUIP GROUP 1	RHEB-225	1. DATA STORAGE 2. S-BAND FM XMTR	1. 33.0 2. 6.7	2 AMP	DSE DRAWS 6.0 WDC, CAN BE SWITCHED TO AC 1 (3φ)
CB18/TELECOM S-BAND PWR AMPL PHASE MOD XPNDR 1 GROUP 1	RHEB-225	1. S-BAND PRIM PWR AMPL 2. S-BAND PRIM XPNDR	1. HI 90.0 LO 40.0 2. 16.5	2 AMP	CAN BE SWITCHED TO AC 1 (3φ)
CB20/TELECOM S-BAND PWR AMPL PHASE MOD XPNDR 2 GROUP 2	RHEB-225	1. S-BAND SEC PWR AMPL 2. S-BAND SEC XPNDR	1. HI 90.0 LO 40.0 2. 16.5	2 AMP	CAN BE SWITCHED TO AC 1 (3φ)
CB24/TELECOM FLT QUAL RCDR GROUP 1	RHEB-225	FLT QUAL RCDR	14.4	2 AMP	CAN BE SWITCHED TO AC 1 (3φ)

CB NO./NOMENCLATURE	PANEL NO.	COMPONENT	POWER WATTS DC @28 VDC	CB RATING	REMARKS
<u>EPS</u>					
CB36/EPS UTILITY R STA	RHEB-229	PORTABLE FLOODLIGHT	14.0	2 AMP	FED BY VMA
CB37/EPS UTILITY LEB	RHEB-229	1. SEQ CAMERA 2. PORTABLE FLOOD- LIGHT	17.0 (TOTAL)	2 AMP	FED BY VMB
CB41/BATTERY A (NO NOMENCLATURE)	ON BAT. A	BAT. BUS A	VARIABLE	100 AMP	INACCESSIBLE TO CREW
CB42/BATTERY B (NO NOMENCLATURE)	ON BAT. B	BAT. BUS B	VARIABLE	100 AMP	INACCESSIBLE TO CREW
CB43/BATTERY C (NO NOMENCLATURE)	ON BAT. C	CB22 (RHEB-250)	VARIABLE	100 AMP	INACCESSIBLE TO CREW
<u>SEQUENTIAL</u>					
CB38/EPS BAT. BUS A	RHEB-229	SEQUENTIAL AND SPS CIRCUIT BREAKERS		20 AMP	FEEDS CB1, CB3, CB6, CB31, CB33, CB45, CB49 (MDC-8)
CB39/EPS BAT. BUS B	RHEB-229	SEQUENTIAL AND SPS CIRCUIT BREAKERS		20 AMP	FEEDS CB2, CB4, CB7, CB32, CB34, CB46, AND CB51 (MDC-8)
CB50/EDS 2 BAT. C	MDC-8	EDS PWR SW		5 AMP	FED BY CB23 (BAT. CHGR BAT. C CIRCUIT BREAKER)
<u>SCS-RCS-SPS</u>					
CB26/EPS MN A GROUP 1	RHEB-229	SCS AND RCS CIRCUIT BREAKER		30 AMP	FEEDS CB19, CB23, CB40, CB74 AND CB41 (MDC-8)
CB27/EPS MN B GROUP 1	RHEB-229	SCS, ORDEAL AND RCS CIRCUIT BREAKERS		30 AMP	FEEDS CB20, CB24, CB38, CB42, CB75 AND CB64 (MDC-8)
CB28/EPS MN A GROUP 2	RHEB-229	SCS CIRCUIT BREAKERS		30 AMP	FEEDS CB11, AND CB15 (MDC-8)
CB29/EPS MN B GROUP 2	RHEB-229	SCS CIRCUIT BREAKERS		30 AMP	FEEDS CB12, AND CB16 (MDC-8)
CB30/DPS MN A GROUP 3	RHEB-229	SCS, SPS, RCS, AND EMS CIRCUIT BREAKERS		30 AMP	FEEDS CB21, CB39, AND CB63

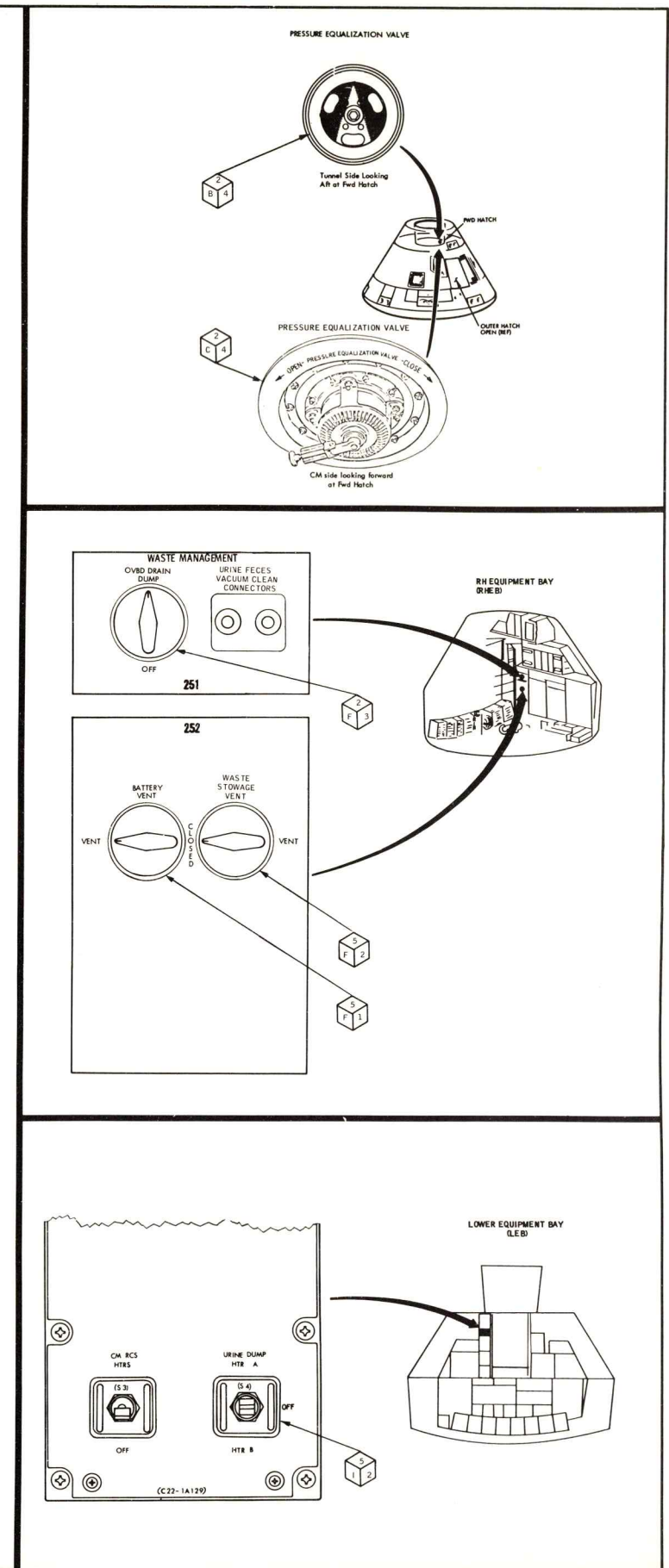
P. MISCELLANEOUS CIRCUIT BREAKERS (CONTINUED)

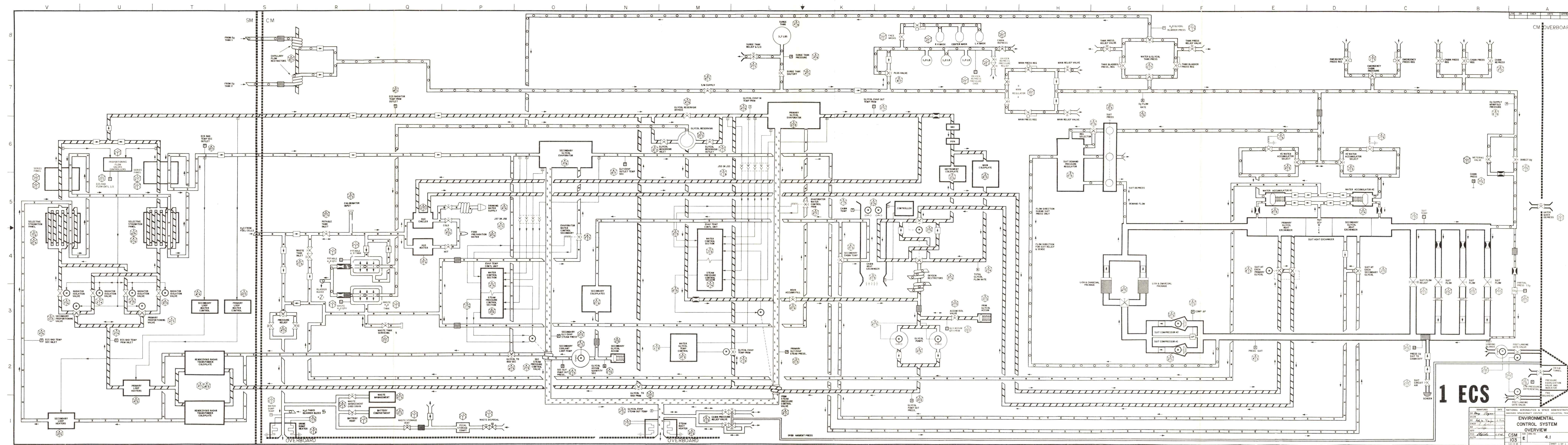
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CB NO./NOMENCLATURE	PANEL NO.	COMPONENT	POWER WATTS DC @28 VDC	CB RATING	REMARKS
<u>SCS-RCS-SPS</u>					
CB31/EPS MN B GROUP 3	RHEB-229	SCS, SPS, RCS AND EMS CIRCUIT BREAKERS		30 AMP	FEEDS CB22, CB37, CB64 AND CB62 (MDC-8)
CB32/EPS MN A GROUP 4	RHEB-229	SPS, SCS AND CLOCK CIRCUIT BREAKERS		30 AMP	FEEDS CB17, CB25, CB76, CB52, AND CB29 (MDC-8)
CB33/EPS MN B GROUP 4	RHEB-229	SPS, SCS AND CLOCK CIRCUIT BREAKERS		30 AMP	FEEDS CB18, CB26, CB77, CB53, AND CB30 (MDC-8)
CB34/EPS MN A GROUP 5	RHEB-229	SPS, SCS AND RCS CIRCUIT BREAKERS		30 AMP	FEEDS CB13, CB43, CB70, CB72, CB67, AND CB68 (MDC-8)
CB35/EPS MN B GROUP 5	RHEB-229	SPS, SCS AND RCS CIRCUIT BREAKERS		30 AMP	FEEDS CB14, CB44, CB71, CB73, CB66, AND CB69 (MDC-8)
<u>INST</u>					
CB1/INSTRUMENTATION POWER CONTROL OPERATIONAL	RHEB-276	V1		5 AMP	FED BY CB19 (MN A) OR CB20 (MN B)
CB2/INSTRUMENTATION POWER CONTROL OPERATIONAL	RHEB-276	V2		5 AMP	FED BY CB19 (MN A) OR CB20 (MN B)
CB3/INSTRUMENTATION POWER CONTROL OPERATIONAL	RHEB-276	V3S		5 AMP	FED BY CB19 (MN A) OR CB20 (MN B)
CB4/INSTRUMENTATION POWER CONTROL OPERATIONAL	RHEB-276	V4S		5 AMP	FED BY CB19 (MN A) OR CB20 (MN B)
CB5/INST POWER CONTROL FLIGHT QUALIFICATION	RHEB-277	V5		5 AMP	FED BY CB22 FROM VNE1
CB6/INST POWER CONTROL FLIGHT QUALIFICATION	RHEB-277	V6		5 AMP	FED BY CB22 FROM VNE1
CB7/INST POWER CONTROL FLIGHT QUALIFICATION	RHEB-277	V7		5 AMP	FED BY CB22 FROM VNE1

CB NO./NOMENCLATURE	PANEL NO.	COMPONENT	POWER WATTS DC @28 VDC	CB RATING	REMARKS
<u>INST (CONTINUED)</u>					
CB8/INST POWER CONTROL FLIGHT QUALIFICATION	RHEB-277	1. V8 2. V8S 3. PBW MODULATION		10 AMP	FED BY CB22 FROM V _{NE1}
CB9/INST POWER CONTROL FLIGHT QUALIFICATION	RHEB-277	V9		10 AMP	FED BY CB22 FROM V _{NE1}
CB10/INST POWER CONTROL FLIGHT QUALIFICATION	RHEB-277	V10		10 AMP	FED BY CB22 FROM V _{NE1}

4 ENVIRONMENTAL
CONTROL SYS





1 ECS

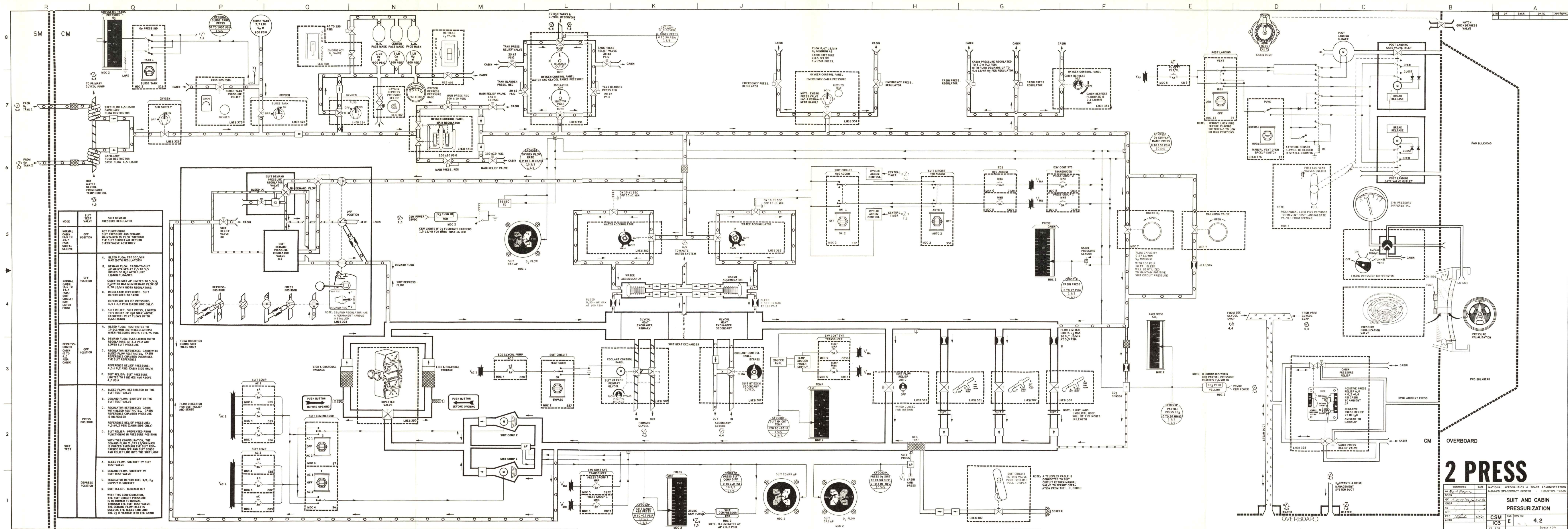
ENVIRONMENTAL CONTROL SYSTEM OVERVIEW

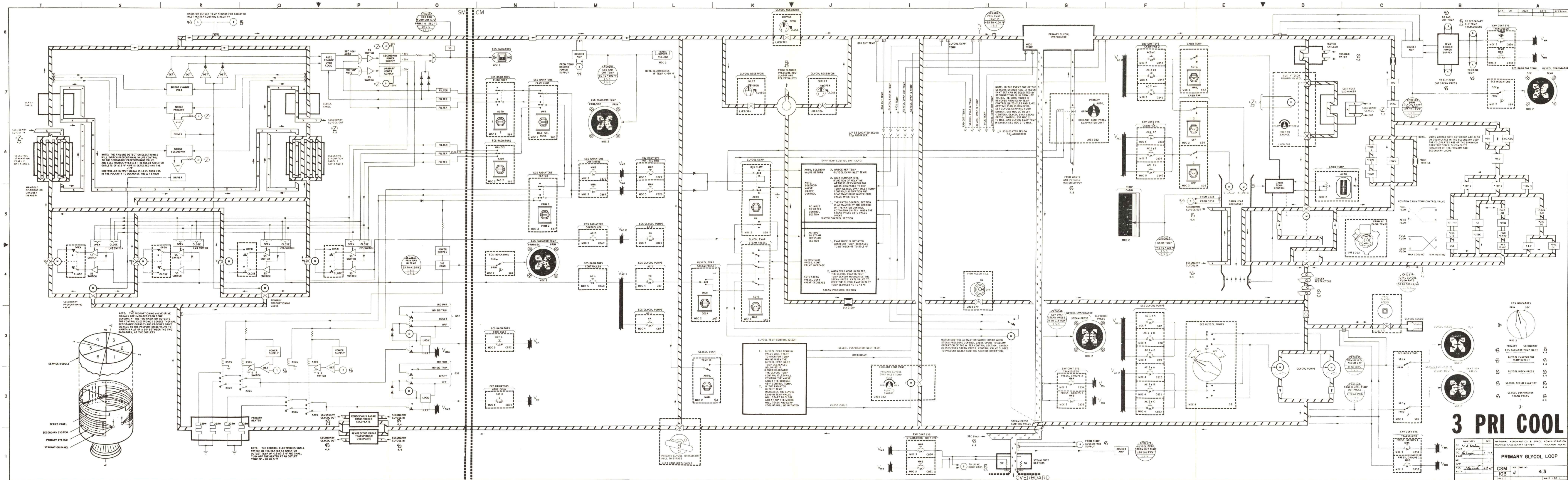
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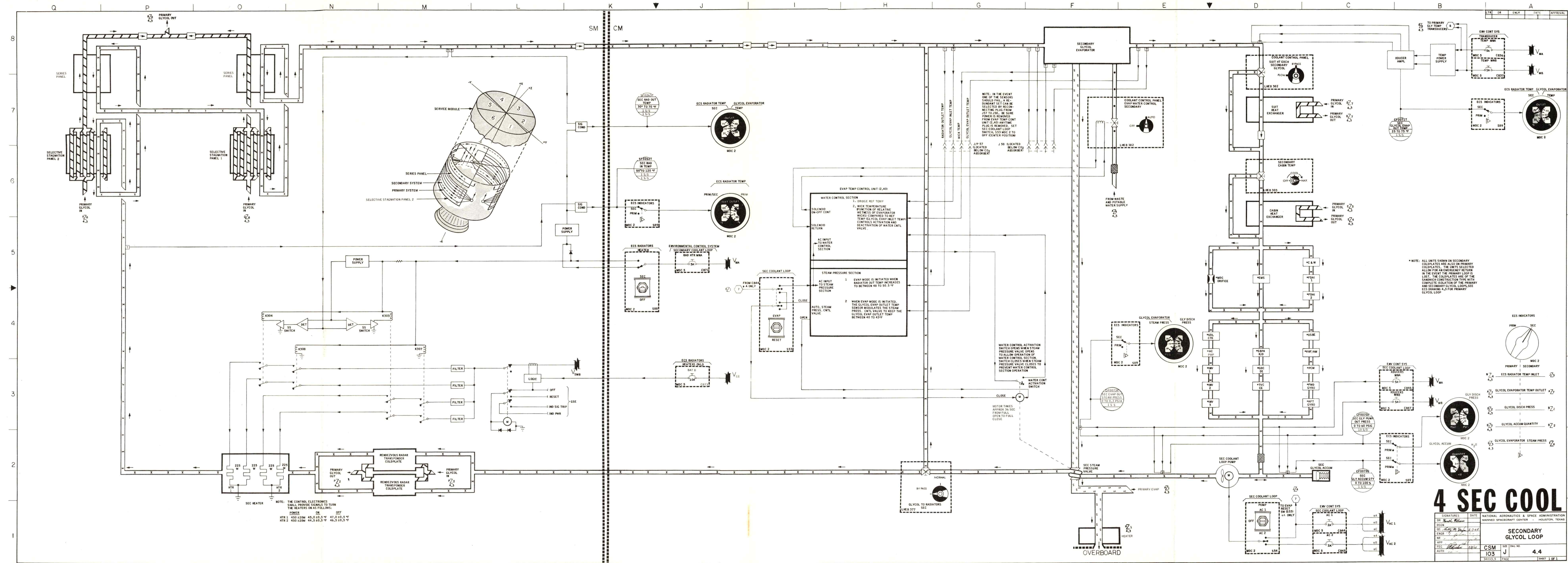
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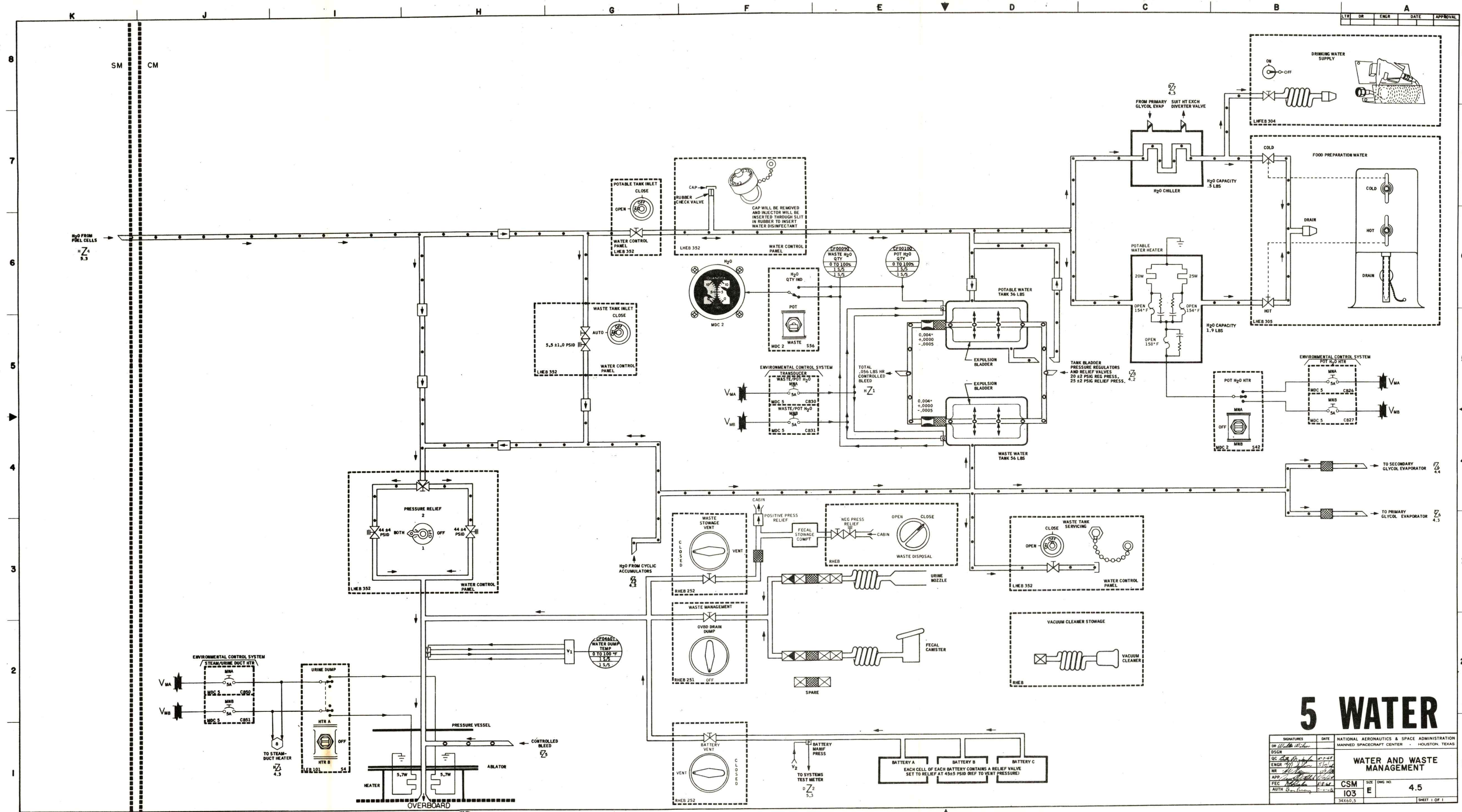
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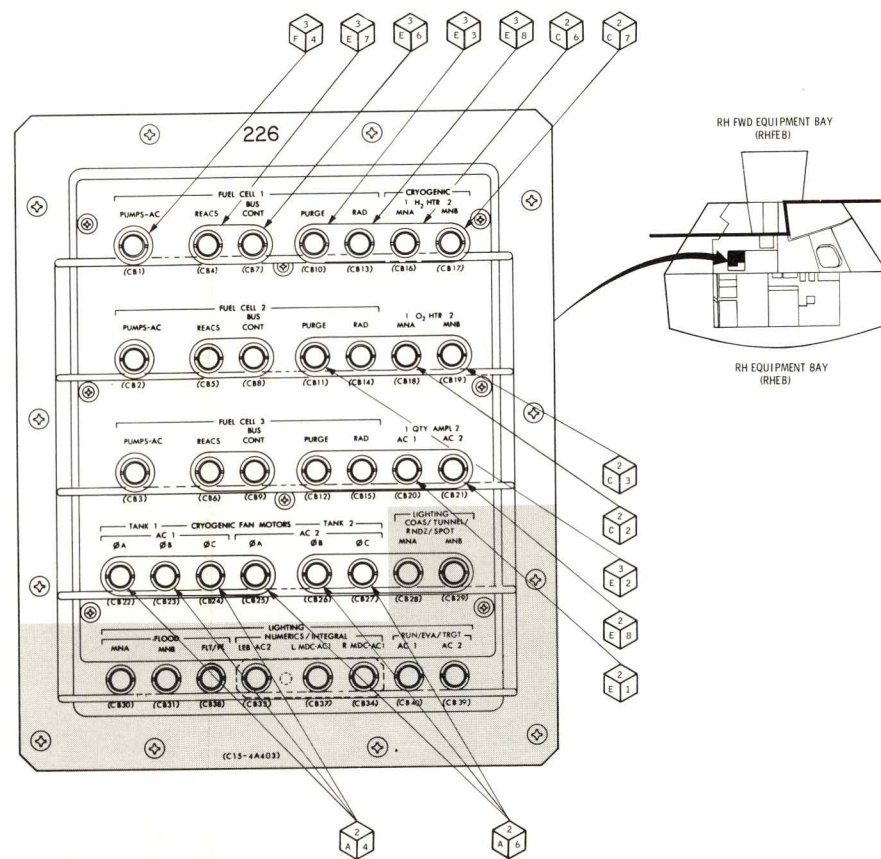
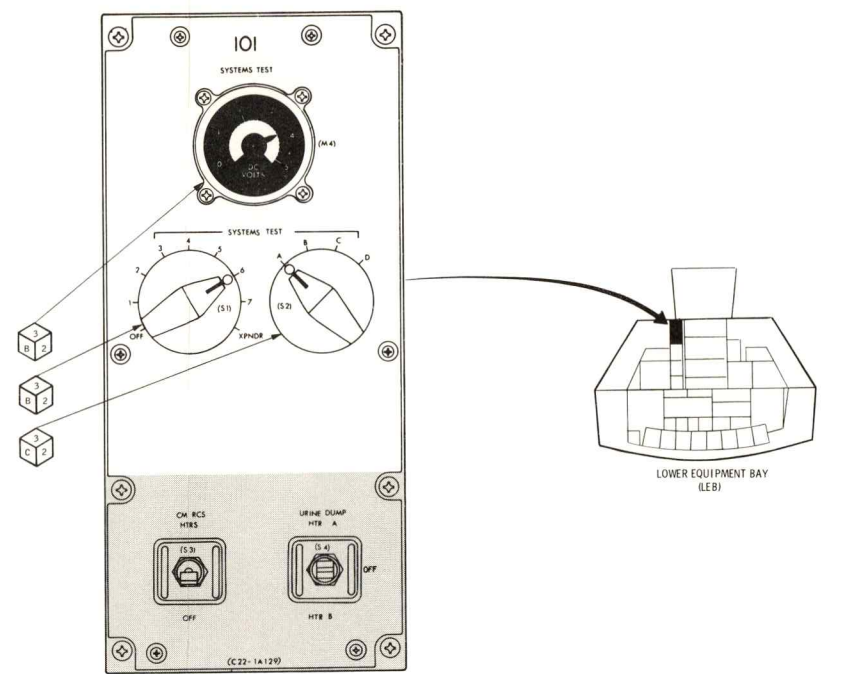
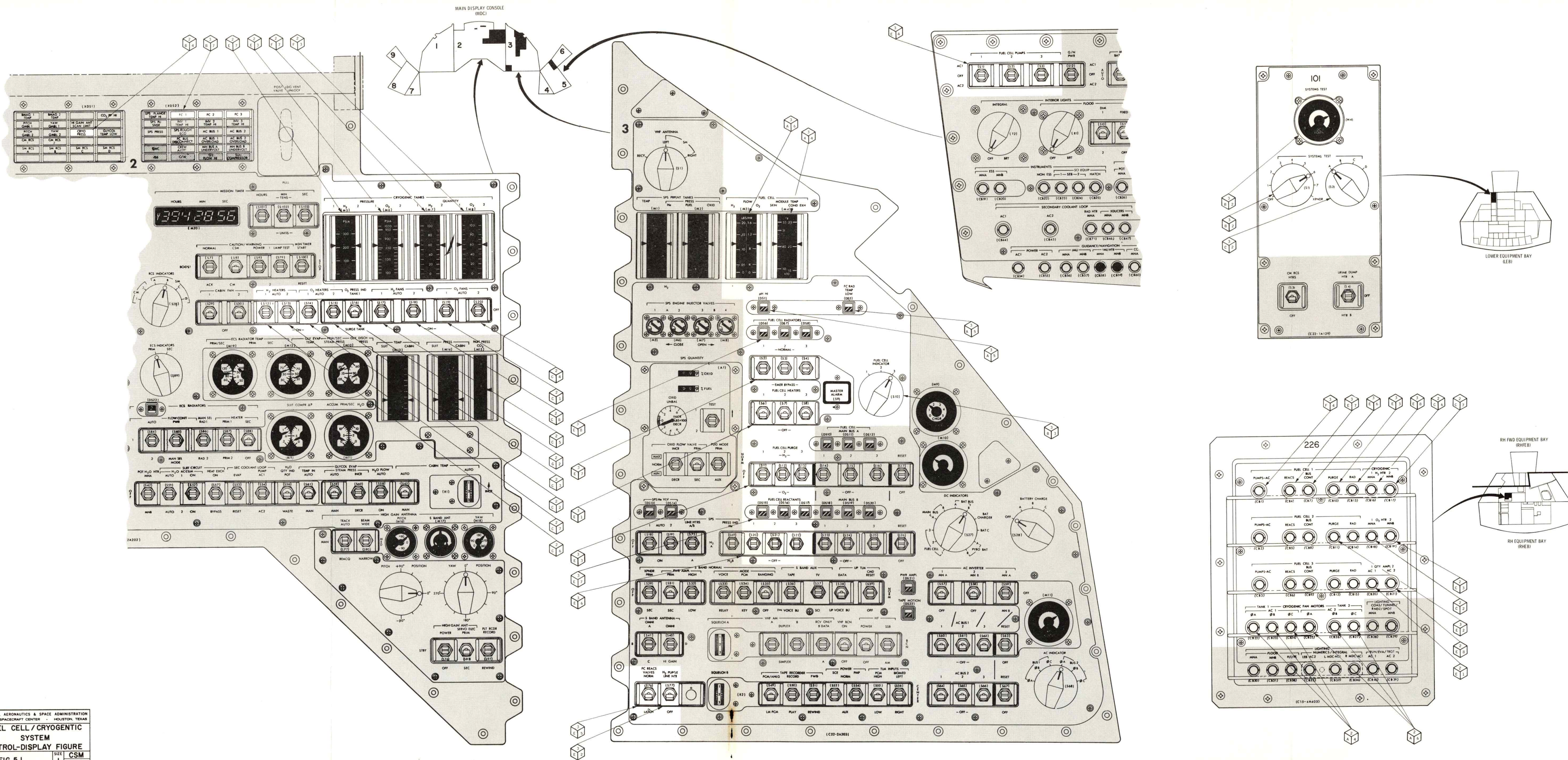


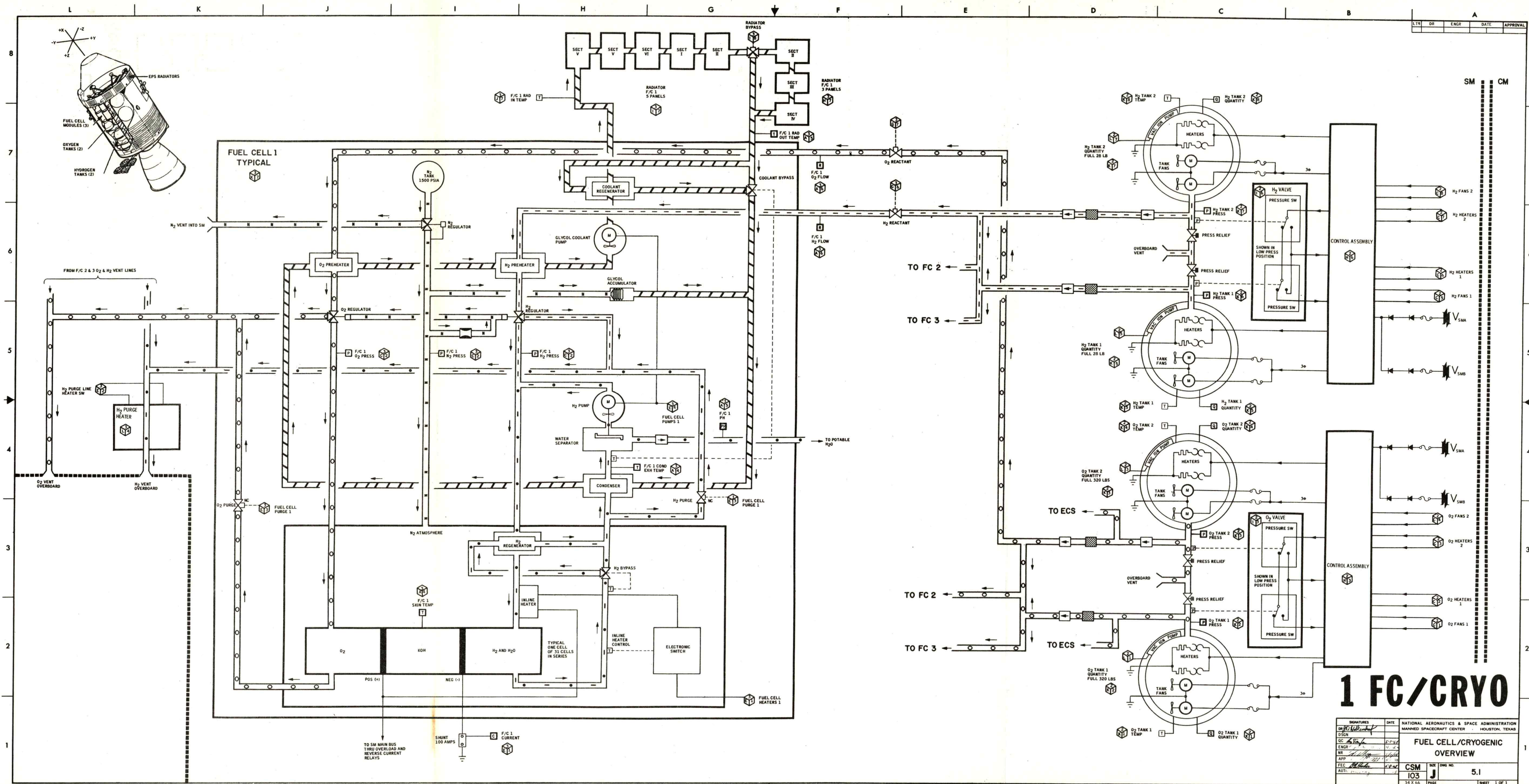


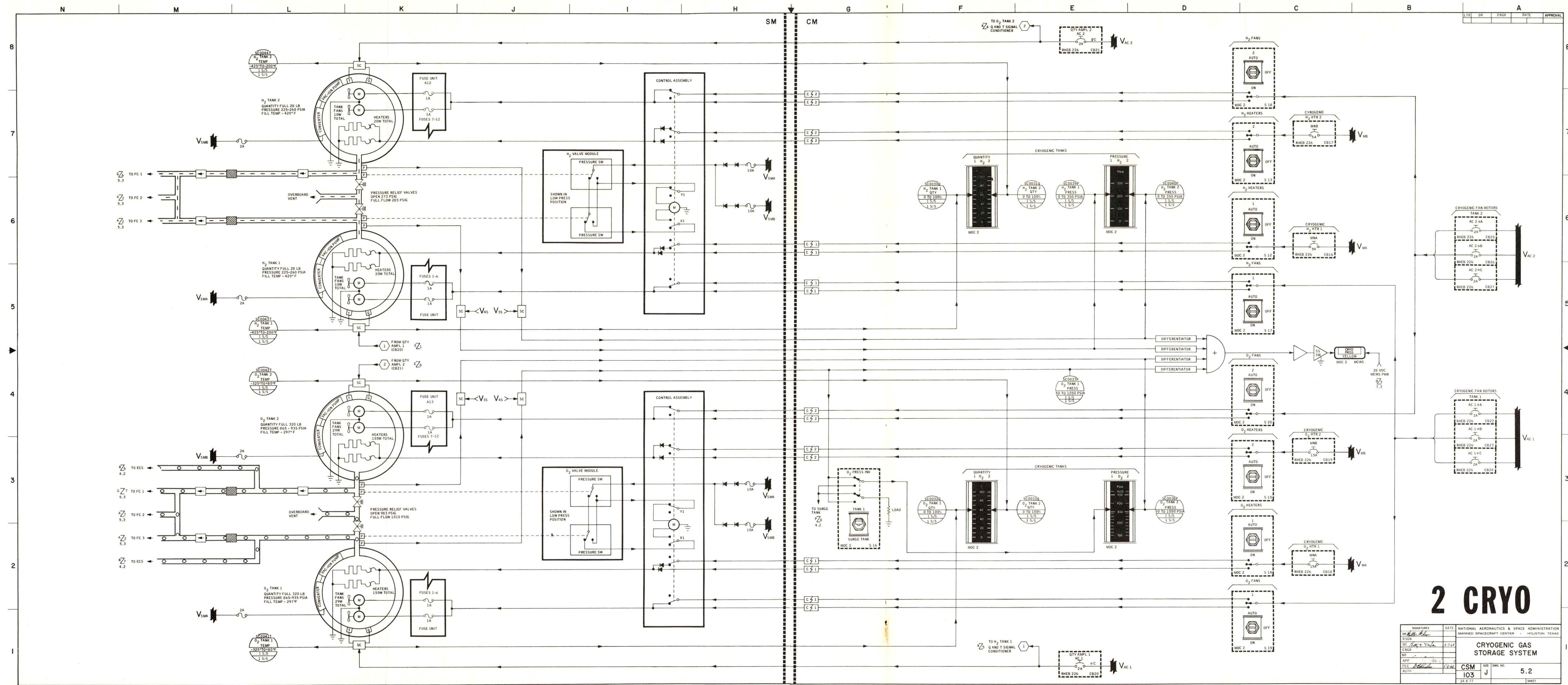


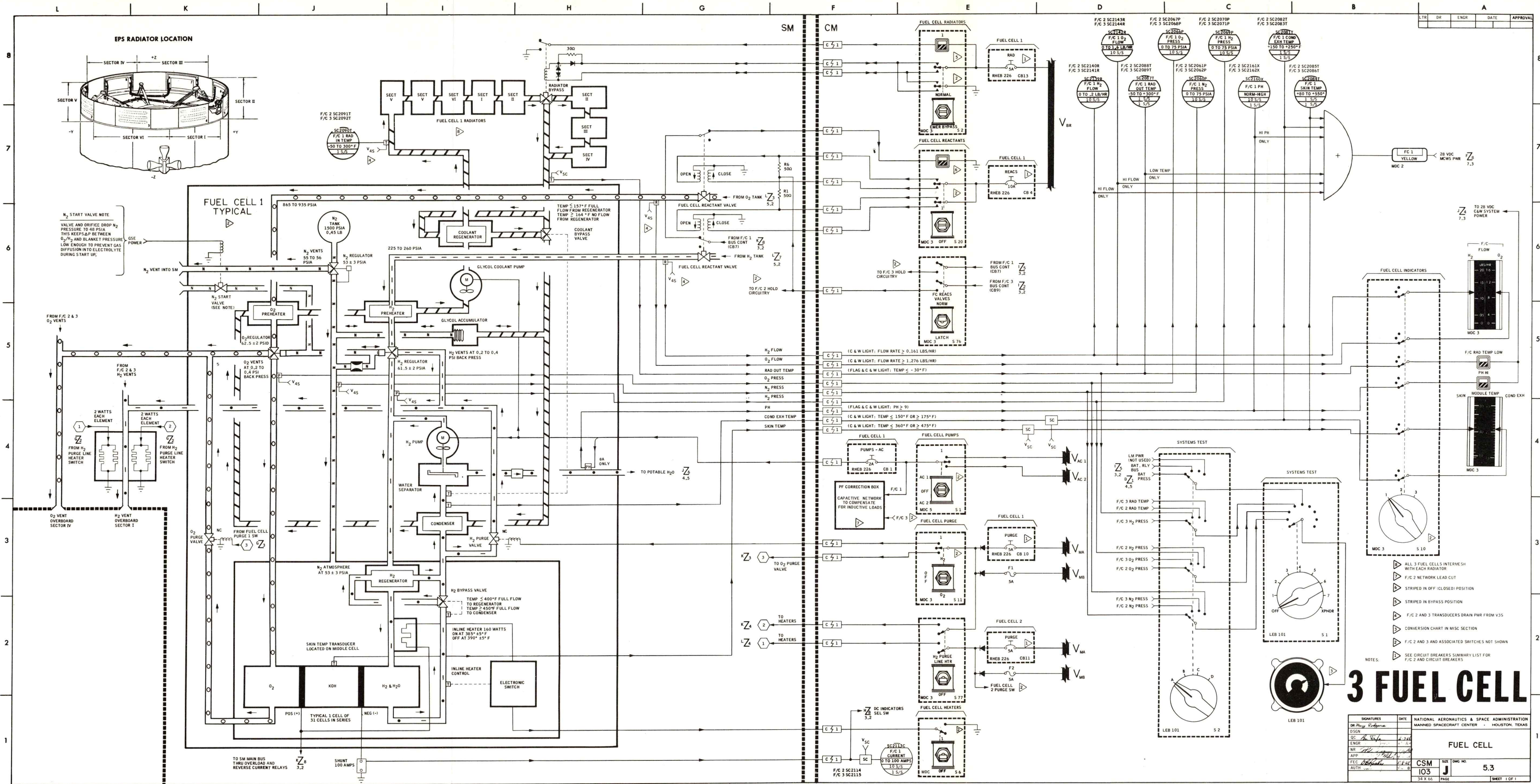


5 FUEL CELL/
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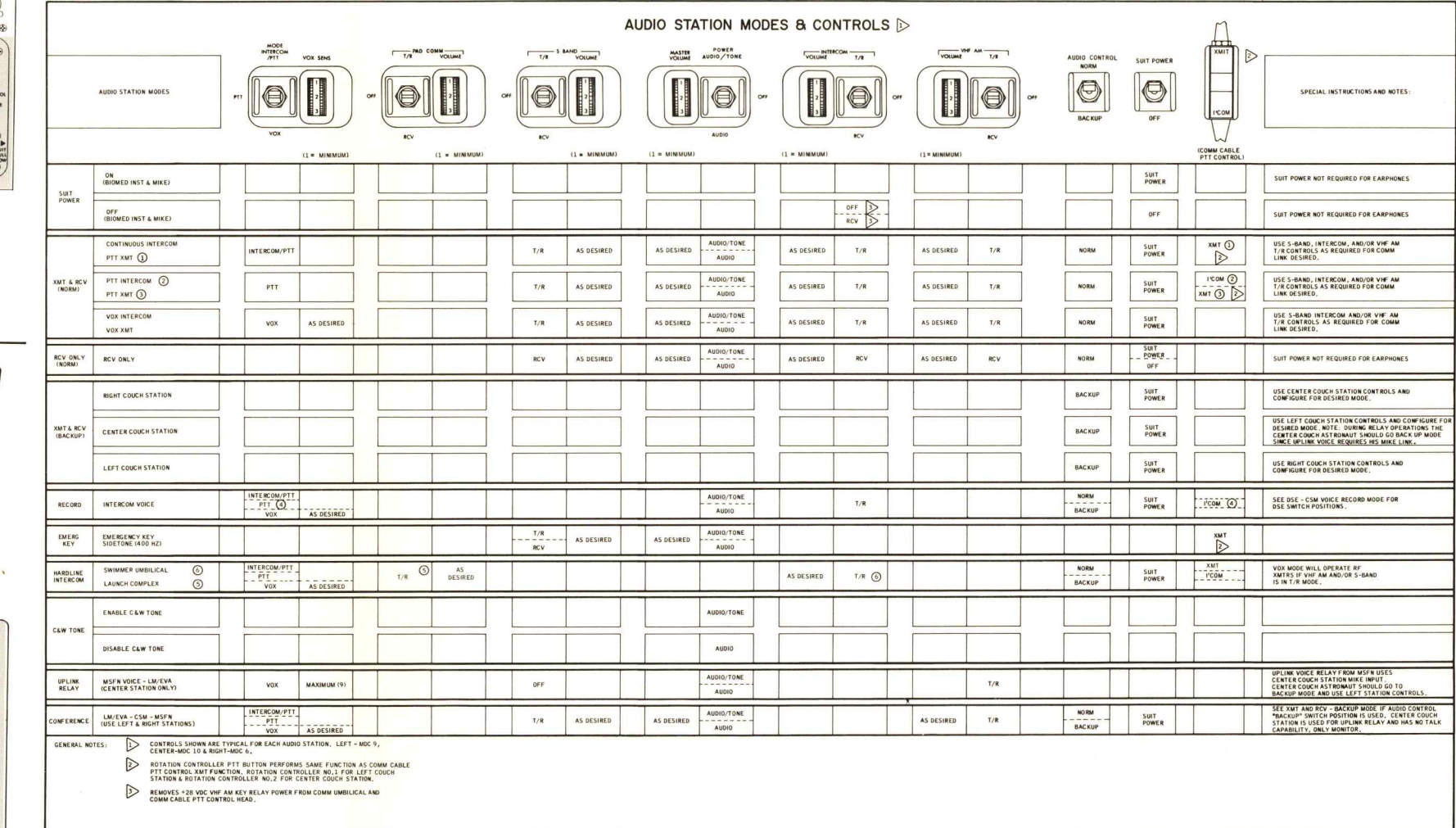


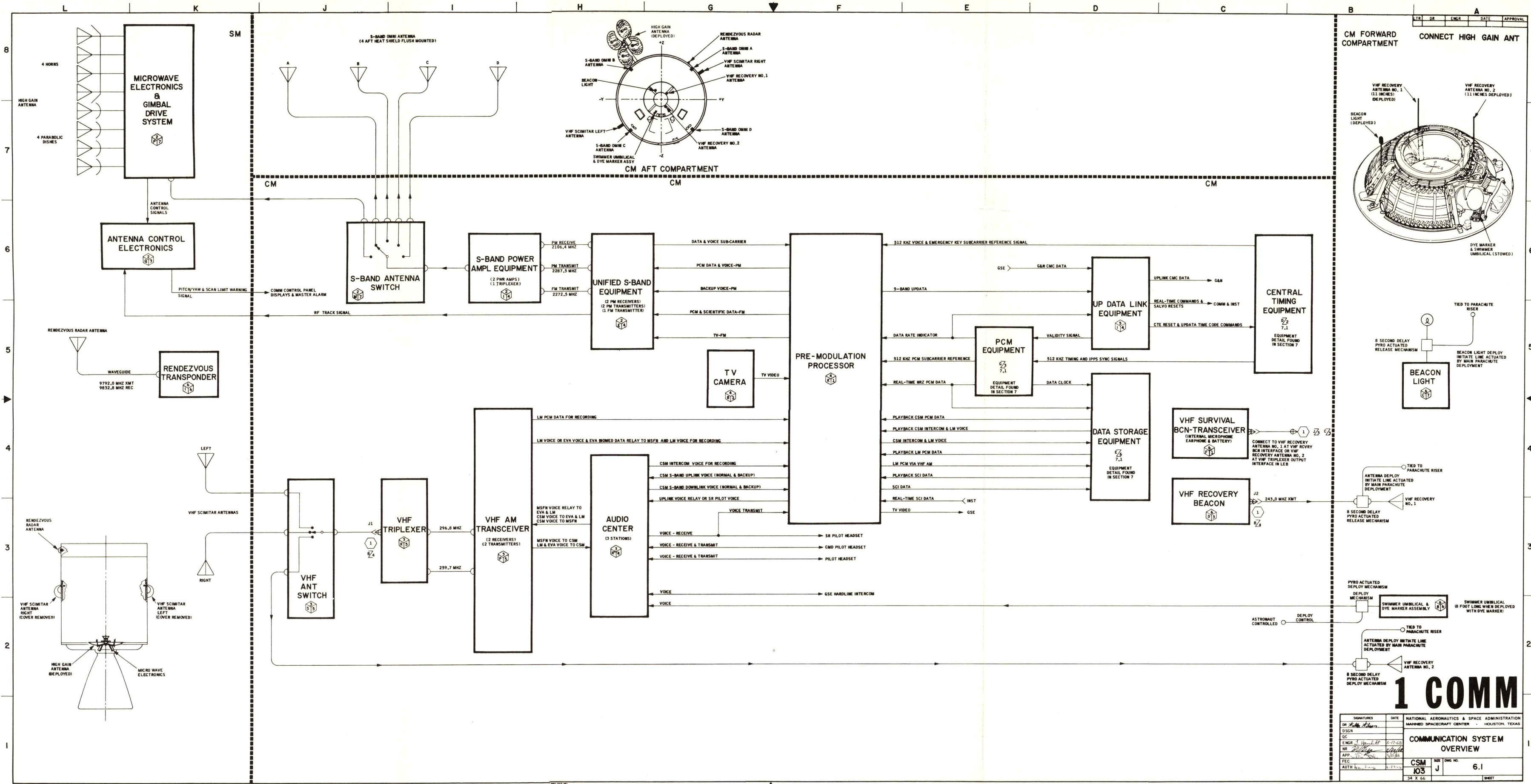


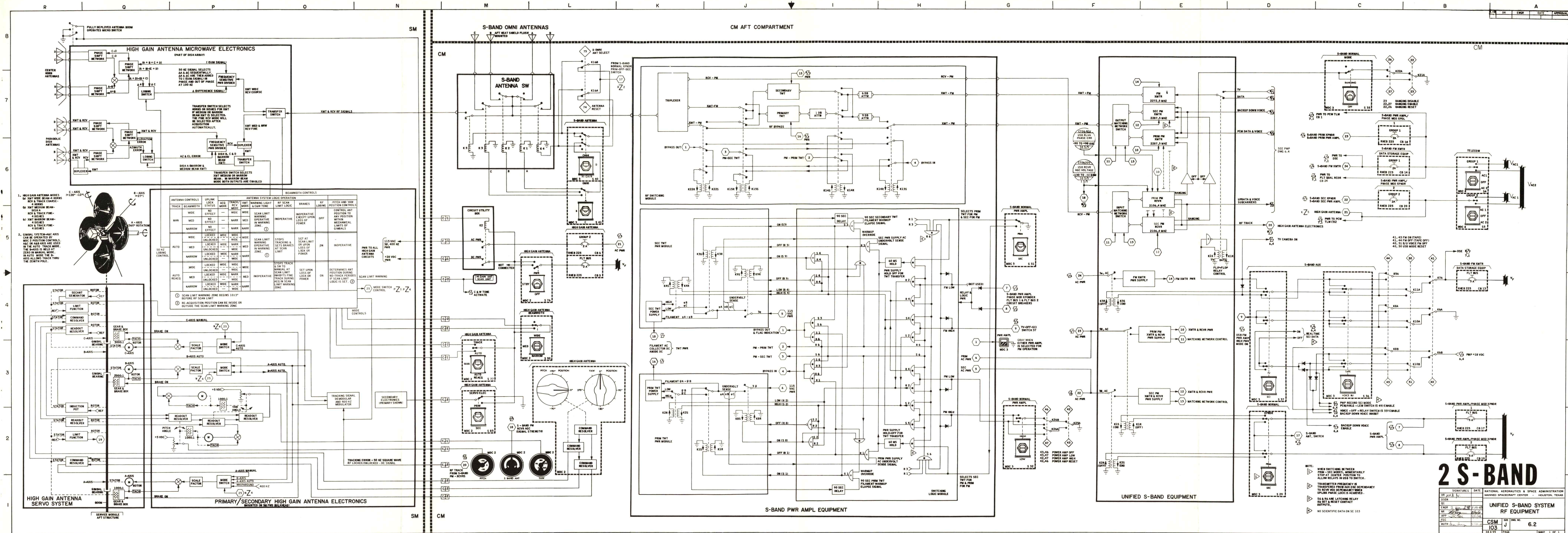


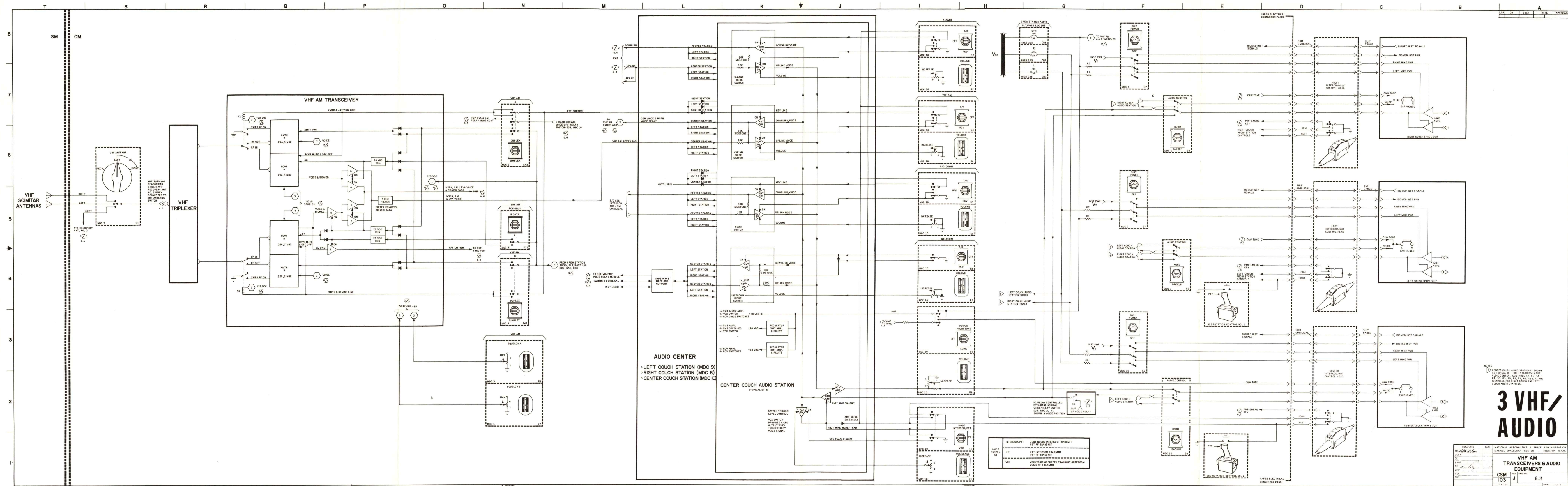


6 COMMUNI-
CATIONS
SYSTEM



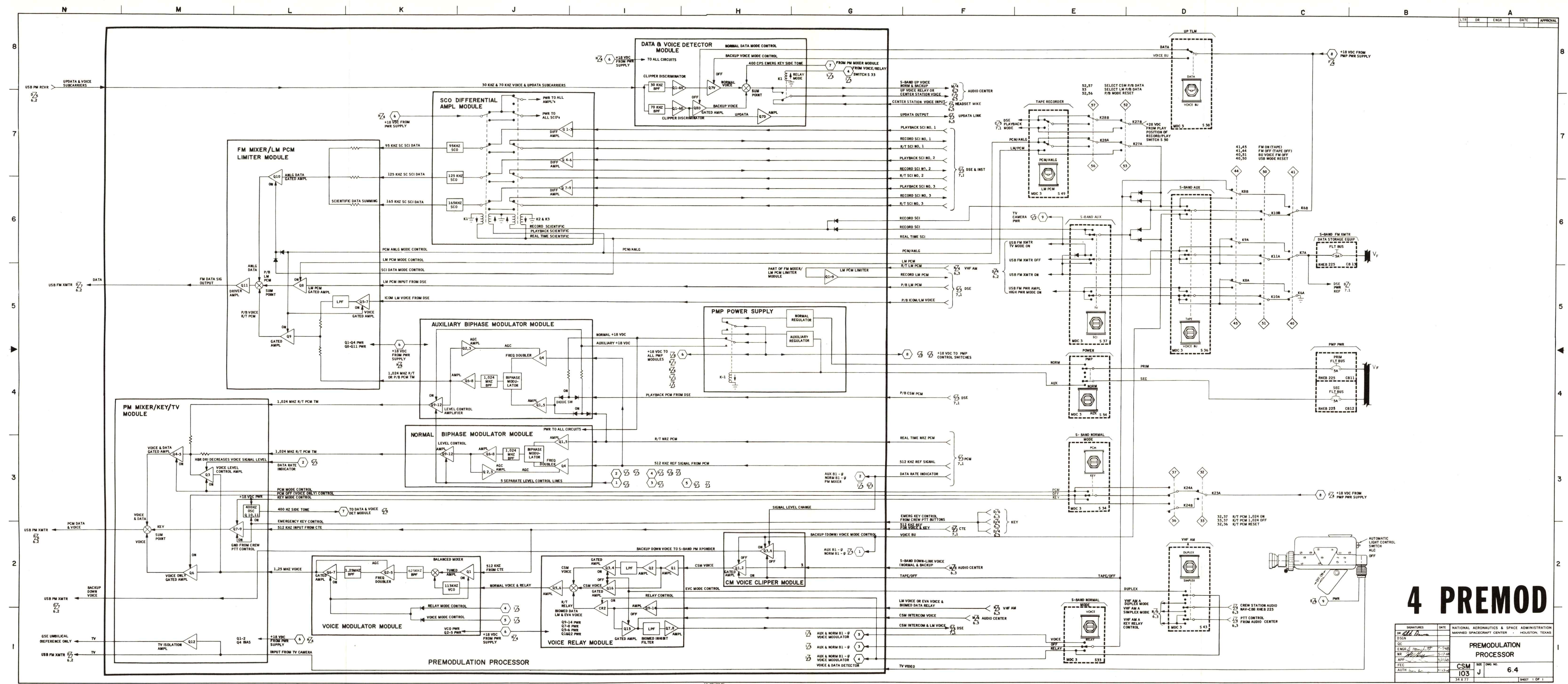






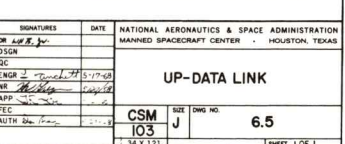
3 VHF/ AUDIO

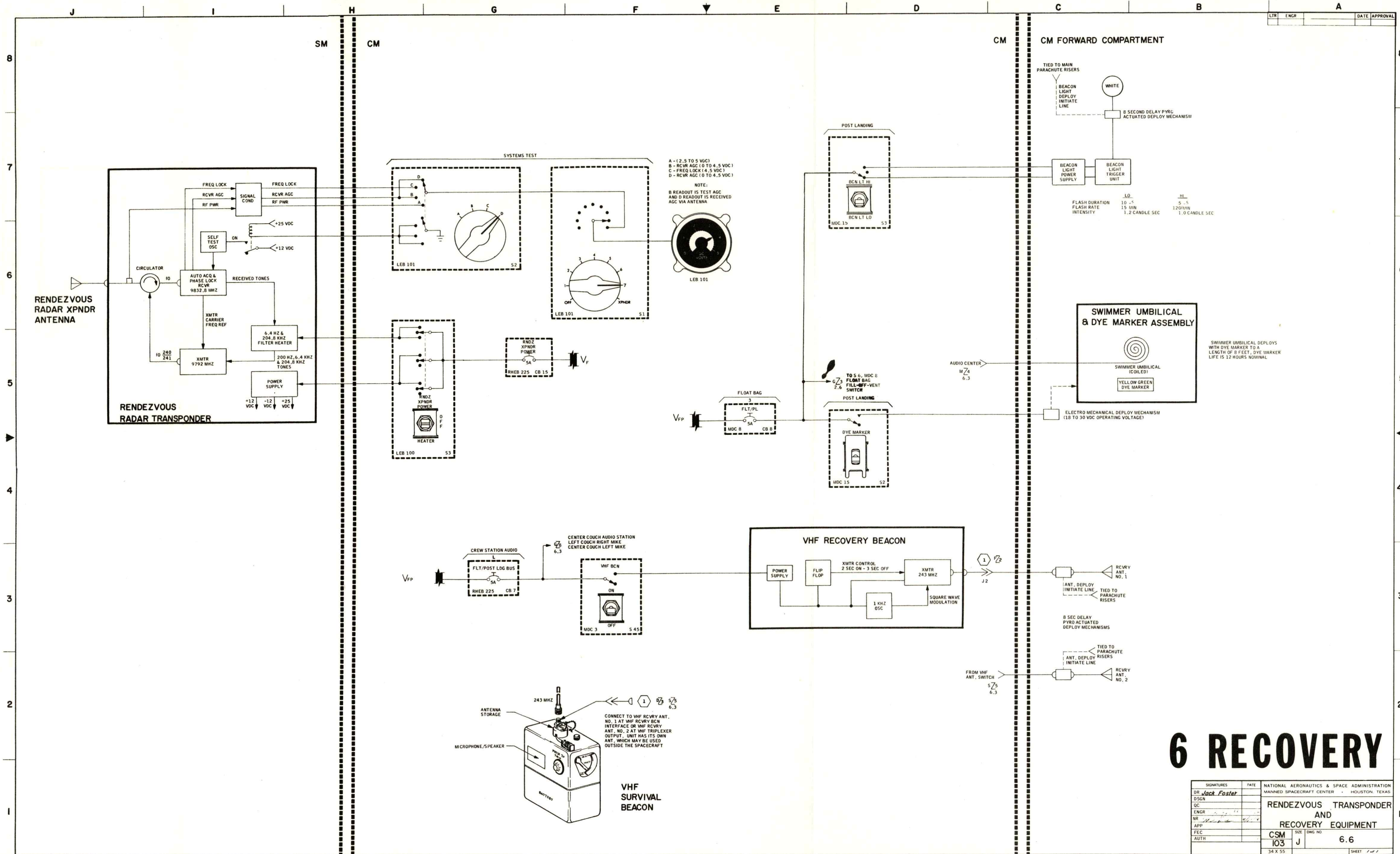
SIGNATURES		DATE	NATIONAL AERONAUTICS & SPACE ADMINISTRATION MANNED SPACECRAFT CENTER - HOUSTON TEXAS		
DR. <i>W. L. Rouse</i>			VHF AM TRANSCIVERS & AUDIO EQUIPMENT		
DSGN					
QC					
ENGR					
WR					
APP					
FIC			CSM	SIZE	DWG NO
APPR			103	J	6.3



4 PREMOD

SIGNATURES		DATE	NATIONAL AERONAUTICS & SPACE ADMINISTRATION
DESIGN			MANNED SPACECRAFT CENTER - HOUSTON, TEXAS
QC			
ENGR.			
APP.			
REC.			
CSM 103		REV. NO. 6.4	DATE 10-1-64





6 RECOVERY

SIGNATURES	DATE	NATIONAL AERONAUTICS & SPACE ADMINISTRATION
DR. Jack Foster		MANNED SPACECRAFT CENTER • HOUSTON, TEXAS
DSGN		RENDEZVOUS TRANSPONDER
QC		AND
ENGR		RECOVERY EQUIPMENT
NR		
APP		
FLC		
ANTH		
CSM	SIZE	DRG NO
103	J	6.6
34 X 55		SHEET 1 of 1

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

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

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

ITEM	FUNCTION and/or PARAMETERS
e. Automatic Gain Control (AGC)	
(1) Attack Time	TBD
(2) Decay	TBD
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 Squarewave)
(5) PRN Code Length	5,456,682 bits (Lunar Code)
g. High-Gain Antenna Track Channel	
(1) Pointing Error Signal	50 Hz amplitude modulated signal derived from the coherent AGC detector.
(2) Earth Presence Signal	DC signal superimpose on pointing error signal when RCVR is locked to incoming RF signal.
h. Outputs	(See Table 6-IV Modes)
6. PM Transmitter (Prim/Sec)	
a. Type	PM, S-Band
b. Frequency	2287.5 MHz (Aux OSC Mode) or 240/221 times RCVR frequency when RCVR is phase locked to uplink RF signal. (See Auto OSC Control)
c. RF Output Power	301 to 374 milliwatts (Test Data)
d. Auto OSC Control	XMTR frequency is derived from XMTR Aux OSC prior to acquisition and RCVR VCO after acquisition. Switching is controlled using RCVR AGC signal.
(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)

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

ITEM	FUNCTION and/or PARAMETERS
(3) Switching Threshold	-127 dbm
e. Inputs	(See Table 6-III Modes)
7. FM Transmitter	
a. Type	FM, S-Band
b. Frequency	2272.5 MHz
c. RF Output	111 to 138 milliwatts (Test Data)
d. Inputs	(See Table 6-III Modes)
8. Special Operating Instructions	When switching between primary and secondary transponders, momentarily stop at the OFF (Center) position to allow control relays to operate.

TABLE 6-II.- S-BAND POWER AMPLIFIER

ITEM	FUNCTION and/or PARAMETERS
1. Weight	32 pounds maximum
2. Cooling	ECS Primary and/or Secondary Glycol Loop
3. Electrical Power	
a. Input Voltage	28 $\pm$ 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	High Pwr Ampl Mode 81 Watts Low Pwr Ampl Mode 32 Watts Off/Bypass 0 Watts Sum ac power values to obtain simul- taneous power level operation of Prim and Sec power amplifiers.
4. Power Amplification Activation Time	No RF amplification until 90 second nominal filament warm-up period complete. RF transfer (PM or FM) from one power amplifier to the other, with a 60 millisecond RF amplification dropout, is possible without an additional 90 second delay (filament warm-up) if the desired power amplifier is operating at the time of transfer.
5. RF Output	
a. PM Output - Prim or Sec Power Amplifier	High Pwr Mode: 11.2 Watts min Low Pwr Mode: 2.8 Watts min Bypass Mode: Less than 2.5 db below input
b. FM Output - Prim or Sec Power Amplifier	High Pwr Mode: 11.2 Watts min
6. RF Input	
a. PM	275 to 400 milliwatts
b. FM	100 to 145 milliwatts (For rated output)

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

ITEM	FUNCTION and/or PARAMETERS
7. Under Voltage Protection	Under voltage protection circuit will remove ac pwr from power amplifier TWT if any phase of the ac input voltage falls below 95 Vac for 15 milliseconds or more. If this condition exists for 1 second or more a 90 second filament warm-up delay will occur when ac voltage is restored.
8. Special Operating Instructions	DC power should be applied before ac power and removed after ac power removal to prevent possible damage.

- (a) Or voice and biomed.
- (b) In the event of an EVA, the EVA biomed data is relayed via the CSM S-Band link on the voice subcarrier; otherwise the biomed data comes back as PCM telemetry.
- (c) Varies with the received uplink.
- (d) Scientific data not used on SC-103.
- (e) Auxiliary PMP mode will provide real time PCM with same USB-FM characteristics as playback PCM.

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

FM UPLINK MODES AVAILABLE	MODE NUMBER	1	2	3	4	5	6	7	8	9	0
	Channels Included	Carrier	Carrier	Carrier	Carrier	Carrier	Carrier	Carrier	Carrier	Carrier	--
		PRN	--	--	PRN	PRN	PRN	--	--	--	--
		--	Voice	--	Voice	--	Voice	Voice	Backup Voice	--	--
		--	--	Update	--	Update	Update	Update	--	--	--

FM UPLINK MODULATION PROCESS	Modulation Schemes; Subcarrier Character- istics	PRN : PM directly on carrier									
		Voice : FM/PM; 30-kHz subcarrier deviated ± 7.5 kHz (peak)									
		Update : PSK/FM/PM; 70-kHz subcarrier deviated ± 5.0 kHz (peak)									
		Backup Voice: FM/PM; 70-kHz subcarrier deviated ± 5.0 kHz (peak)									
		MODE NUMBER	1	2	3	4	5	6	7	8	9
Carrier Phase Deviation (Radians- Peak)	PRN	1.34	--	--	0.80	0.80	0.50	--	--	NA	NA
	Voice	--	1.85	--	1.85	--	1.00	1.10	--		
	Update	--	--	1.85	--	1.85	0.76	1.10	--		
	Backup Voice	--	--	--	--	--	--	--	1.85		

TABLE 6-V.- PREMODULATION PROCESSOR

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

TABLE 6-V.- PREMODULATION PROCESSOR - Continued

ITEM	FUNCTION and/or PARAMETERS
8. LM PCM Output Channel	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 (Real-Time 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
10. Scientific Data Channel (Real-Time)	
a. Response	Flat within 2 db
	<u>Channel</u>
	1 0 to 2850 Hz
	2 0 to 3750 Hz
	3 0 to 4950 Hz
b. Frequency and Deviation	<u>Channel</u>
	1 95 kHz +7.5% f_o
	2 125 kHz +7.5% f_o
	3 165 kHz +7.5% f_o
11. Scientific Data Channel (Playback)	
a. Response	Flat within 2 db
	<u>Channel</u> <u>32:1 Playback</u> <u>1:1 Playback</u>
	1 12.5 to 89 Hz 50 to 2850 Hz
	2 12.5 to 117 Hz 50 to 3750 Hz
	3 12.5 to 154 Hz 50 to 4950 Hz
	(Recorded data bandwidths)
12. Tape Recorder Input - LM PCM Channel	
a. Response	15 to 90 kHz flat within 1 db.
13. Uplink Subcarrier Detectors	
a. Up Voice	30 kHz (Normal) 70 kHz (Backup)
b. Updata	70 kHz
c. Response	300 to 4,000 kHz flat within 3 db.

TABLE 6-V.- PREMODULATION PROCESSOR - Concluded

ITEM	FUNCTION and/or PARAMETERS
14. Emergency Key Control	512 kHz signal derived from CTE 512 kHz timing signal baseband modulates S-Band PM carrier when key is depressed. A 400 Hz sidetone output to the audio center is provided when key is depressed.
15. Data Rate Indicator Control	DC signal from PCM to control modulation levels to PM & FM modulator modules. HBR = 5.3 Vdc LBR = 0 Vdc
16. Television Channel	
a. Direct Output	To S-Band FM transmitter
b. Response	DC to 500 kHz flat within 0.5 db.
c. Isolated Output	To GSE hardline
d. Response	10 to 500,000 Hz flat within 3 db.

TABLE 6-VI.- VHF AM TRANSCEIVER EQUIPMENT

ITEM	FUNCTION and/or PARAMETERS																						
1. Weight	13 pounds Maximum																						
2. Cooling	ECS Primary and/or Secondary Glycol Loop																						
3. Electrical Power																							
a. Input Voltage	28 $\pm$ 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. XMTR Frequency	XMTR A 296.8 MHz $\pm$ 8.90 kHz XMTR B 259.7 MHz $\pm$ 7.79 kHz																						
d. Modulation	Modulated by clipped speech between 300 and 2000 Hz combined with a 30 kHz signal such that the ON-OFF duty cycle of the RF carrier (50 $\pm$ 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).																						

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

ITEM	FUNCTION and/or PARAMETERS
b. RCVR RF Input	2 to 625,000 Microvolts
c. A&B Output Response	
(1) Output to Audio Center (Voice)	300 to 3000 Hz, + 2db - 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	300 to 13,000 Hz (2 db).
e. RCVR Squelch	Adjustable by MDC2 controls for between 0 and 10 to 25 microvolts. 9 on squelch control is maximum squelch (10 to 25 microvolt level)

TABLE 6-VII.- AUDIO CENTER EQUIPMENT

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

TABLE 6-VII.- AUDIO CENTER EQUIPMENT - Concluded

ITEM	FUNCTION and/or PARAMETERS
8. Intercom Bus a. GSE Output b. Swimmer Output c. Tape Recorder 9. Spacecraft/GSE Facility Hardline Voice Interface	Prelaunch voice via hardline For recovery voice to recovery swimmers Output for voice recording on DSE The HF Control Switch and Volume Control are used to operate each audio stations input/output voice links with the checkout and launch facilities. <u>NOTE</u> The above capabilities not implemented on SC 101.

*

TABLE 6-VIII.- UPDATA LINK EQUIPMENT

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

TABLE 6-VIII.- UPDATA LINK EQUIPMENT - Continued

ITEM	FUNCTION and/or PARAMETERS																																		
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 five 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. 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><td>PCM BIT</td><td>B1</td><td>B2</td><td>B3</td><td>B4</td></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-VII.- UPDATA LINK EQUIPMENT - Concluded

ITEM	FUNCTION and/or PARAMETERS
9. Internal Relays a. Type b. Rating c. Actuation Time	32 double-pole double-throw relays 2 ampere, minimum, contact rating Opening or closure less than 10 milliseconds.

TABLE 6-IX.- TELEVISION CAMFRA, SLOW SCAN

ITEM	FUNCTION and/or PARAMETERS
1. Weight	6.8 pounds maximum
2. Cooling	Not required
3. Electrical Power	
a. Input Voltage	24 to 31 Vdc
b. Input Power	6.75 Watts
4. Activation Time	TBD
5. Resolution	250 EIA Test Pattern Lines (Electronic Industries Association)
6. Scanning Rates	
a. Lines	320 Lines-per-Frame
b. Frames	10 Frames-per-Second
7. Video Bandwidth	40 to 400,000 Hz (3 db) 400 kHz to 500 kHz (+3, -12 db) 20 db Roll - Off
8. Gray Scales	5 minimum (Black to white is positive signal)
9. Illumination levels	0.1 to 30 foot candles
10. Automatic Light Control Switch	
a. "ALC" Position	Camera will operate in specification over light levels in Item 8.
b. "OFF" Position	Camera will operate in specification over light levels of 6.3 to 22 foot candles. (20 Watt flourescent lamp $\approx$ 4870 foot candles)
11. Optics	
a. Fixed Focal Length Lens	80 degrees field of view and 25 to 90 inches depth of view at lens aperature of f2.
b. Variable Focal Length Lens and View Finder	Adjustable from 20 to 80 millimeters with f2.5 minimum aperature.

TABLE 6-X.- RENDEZVOUS RADAR TRANSPONDER AND ANTENNA

ITEM	FUNCTION and/or PARAMETERS
1. Weight	13.63 pounds
2. Cooling	ECS SM Primary and/or Secondary Glycol Loops.
3. Electrical Power	
a. DC Voltage	25 to 31.5 Vdc
b. Power	70.5 Watts (Transponder) 14 Watts (Heater)
4. Activation Time	TBD
5. Receiver	
a. Type	Solid state coherent radar transponder
b. Frequency	9832.8 MHz $\pm$ 30 kHz Offset by doppler $\pm$ 49 kHz with maximum
c. Modulation	3 sinusoidal tones (PM on carrier) 204.8 kHz $\pm$ 0.0015%, 20 $\pm$ 2 degrees 6.4 kHz $\pm$ 0.0015%, 20 $\pm$ 2 degrees 0.2 kHz $\pm$ 0.0015%, 24 $\pm$ 2 degrees
d. Dynamic Range	-123 dbm to -18 dbm at antenna terminals.
e. Acquisition	Acquires rendezvous radar in 1.3 seconds at -123 dbm or greater.
6. Transmitter	
a. Type	Solid state coherent radar transponder
b. Frequency	
(1) Search	9792 MHz $\pm$ 25 kHz and swept $\pm$ 104 kHz minimum.
(2) Transpond	240/241 times receive frequency.
c. RF Output Power	Greater than 240 milliwatts
d. Modulation	Received tones transponded with modulation index same as received except $\pm$ 4 degree tolerance.
7. Mode Operation	
a. Transponder	In operation at all times a signal is being received.
b. Signal Search	In operation when no signal is being received. Transmit frequency is swept $\pm$ 104 kHz with a saw-tooth function at 200 kHz rate.

TABLE 6-X.- RENDEZVOUS RADAR TRANSPONDER AND ANTENNA - Concluded

ITEM	FUNCTION and/or PARAMETERS
c. Self Test	In operation when selected by systems test switch S1, LEB 101. Test checks receiver operation by inserting 40.8 MHz signal between mixer stage and preamp input to first IF.
8. Display Outputs	
a. AGC Monitor	0 to 5 Vdc
b. Frequency Lockup	0 ± 0.4 Vdc (Search Mode) 4.5 ± 0.45 Vdc (Transponder Mode)
c. RF Power	2.5 ± 0.4 Vdc
9. Range	Between 50 feet and 400 n.mi.
a. Range Accuracy	200 Hz tone $\pm 12,044.74$ feet 64 kHz tone ± 425.22 feet 204.8 kHz tone ± 57.63 feet
b. Range Rate Accuracy	0.25 percent or 1 foot per second (which ever is greater) based on LM Guidance Computer sampling period of 100 milliseconds.

TABLE 6-XI.- VHF RECOVERY BEACON

ITEM	FUNCTION and/or PARAMETERS
1. Weight	2.7 pounds maximum
2. Cooling	Not required
3. Electrical power	
a. Input Voltage	28 ± 4 Vdc
b. Input Power	6.9 Watts maximum average over interruption cycle
4. RF Output Power	3 Watts minimum during the ON time of the interruption cycle
5. XMT Frequency	243 ± 0.0126 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-XII.- VHF SURVIVAL BEACON - TRANSCEIVER

ITEM	FUNCTION and/or PARAMETERS
1. Weight	5 pounds maximum including battery pack.
2. Cooling	Not required
3. Electrical	
a. DC Voltage	-30 Vdc and -20 Vdc from attachable battery pack.
b. Power	Battery pack life is 24 hours in 100% beacon operation with 40% duty cycle.
4. Activation Time	No appreciable warm-up period
5. Receiver	
a. Type	Portable, VHF AM Beacon - transceiver with integral microphone, speaker, PTT pushbutton battery and antenna.
b. Frequency	243 MHz
c. Dynamic Range (Sensitivity)	7.5 microvolts at $\frac{S+N}{N} \geq 10$ db when 30% modulated by 1 kHz.
d. Selectivity	6 db at $f_c \pm 1.5$ MHz, 60 db at $f_c \pm 9$ MHz
e. Audio Output	103 db SPL with 1000 microvolt input
6. Transmitter	
a. Frequency	243 MHz
b. RF Output	(Short circuit protection)
(1) Beacon	2 Watts (0 hrs), 0.9 Watts (24 hrs)
(2) Voice	1.4 Watts minimum (90% modulation)
c. Modulation	
(1) Beacon	1 kHz, tone on carrier. Carrier duty cycle is 2 ± 0.2 seconds on and 3 ± 0.3 seconds off.
(2) Voice	0 - 90% from 300 to 3000 MHz

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

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

TABLE 6-XIV.- ANTENNA SWITCH, VHF

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

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

ITEM	FUNCTION and/or PARAMETERS								
1. Type	Helix in loaded cavity								
2. Frequency	2100 MHz to 2300 MHz								
3. Gain	Greater than -3 db relative to isotropic source between $\theta \geq 45^\circ$ and $\theta \geq 145^\circ$ (See Coverage)								
4. Polarization	Right-hand circular								
5. Coverage	The following coverage is applicable with sequential selection of the four antennas: <table> <tr> <td><u>*GAIN</u></td><td><u>SOLID ANGLE</u></td></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 nozzel. *Applicable for $\phi = 0^\circ$ to 360°	<u>*GAIN</u>	<u>SOLID ANGLE</u>	≥ -3 db	between $\theta = 45^\circ$ and 145°	≥ -20 db	between $\theta = 15^\circ$ and 165°	≥ -24 db	between $\theta = 10^\circ$ and 170°
<u>*GAIN</u>	<u>SOLID ANGLE</u>								
≥ -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								

TABLE 6-XVI.- ANTENNA, VHF SCIMITAR

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

TABLE 6-XVII.- ANTENNA, VHF RECOVERY

ITEM	FUNCTION and/or PARAMETERS
1. Type	10 inch erectible tape
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 degrees azimuth
6. Power Rating	50 Watts continuous

TABLE 6-XVIII.- ANTENNA, RENDEZVOUS RADAR TRANSPONDER

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

ITEM	FUNCTION and/or PARAMETERS																								
1. Type	Multi-mode, variable gain, beamwidth, steerable antenna, consisting of four parabolas, a central horn, three-axis gimbal system and control logic.																								
2. Frequency	Transmit: 2272.5 + 2.5 MHz 2287.5 + 2.5 MHz Receive: 2106.4 + 2 MHz																								
3. Gain (On Axis) and Beamwidth (3 db)	<table><tr><td><u>XMT MODE</u></td><td><u>GAIN</u></td><td><u>BEAMWIDTH</u></td></tr><tr><td>Wide</td><td>9.2 db</td><td>40.0°</td></tr><tr><td>*Narrow</td><td>20.7 db</td><td>11.3°</td></tr><tr><td>ΔNarrow</td><td>26.7 db</td><td>3.9°</td></tr></table> <table><tr><td><u>RCV MODE</u></td><td><u>GAIN</u></td><td><u>BEAMWIDTH</u></td></tr><tr><td>Wide</td><td>3.8 db</td><td>40.0°</td></tr><tr><td>*Narrow</td><td>22.8 db</td><td>4.5°</td></tr><tr><td>ΔNarrow</td><td>23.3 db</td><td>4.5°</td></tr></table>	<u>XMT MODE</u>	<u>GAIN</u>	<u>BEAMWIDTH</u>	Wide	9.2 db	40.0°	*Narrow	20.7 db	11.3°	ΔNarrow	26.7 db	3.9°	<u>RCV MODE</u>	<u>GAIN</u>	<u>BEAMWIDTH</u>	Wide	3.8 db	40.0°	*Narrow	22.8 db	4.5°	ΔNarrow	23.3 db	4.5°
<u>XMT MODE</u>	<u>GAIN</u>	<u>BEAMWIDTH</u>																							
Wide	9.2 db	40.0°																							
*Narrow	20.7 db	11.3°																							
ΔNarrow	26.7 db	3.9°																							
<u>RCV MODE</u>	<u>GAIN</u>	<u>BEAMWIDTH</u>																							
Wide	3.8 db	40.0°																							
*Narrow	22.8 db	4.5°																							
ΔNarrow	23.3 db	4.5°																							
4. Polarization	Right-Hand Circular																								
5. Coverage	Spherical except for pointing angles where the MSFN to the high gain antenna (HGA) line of site is shadowed by the CSM. Shadow area covers approximately 40 percent of sphere.																								
6. RF Power Rating	15 Watts Continuous																								
7. Electrical Power																									
a. DC Voltage	28 + 2, - 4 Vdc																								
b. AC Voltage	115/200 Vac, 400 Hz, 3-Phase																								
c. Power	72 Watts average total AC plus DC																								
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.																								

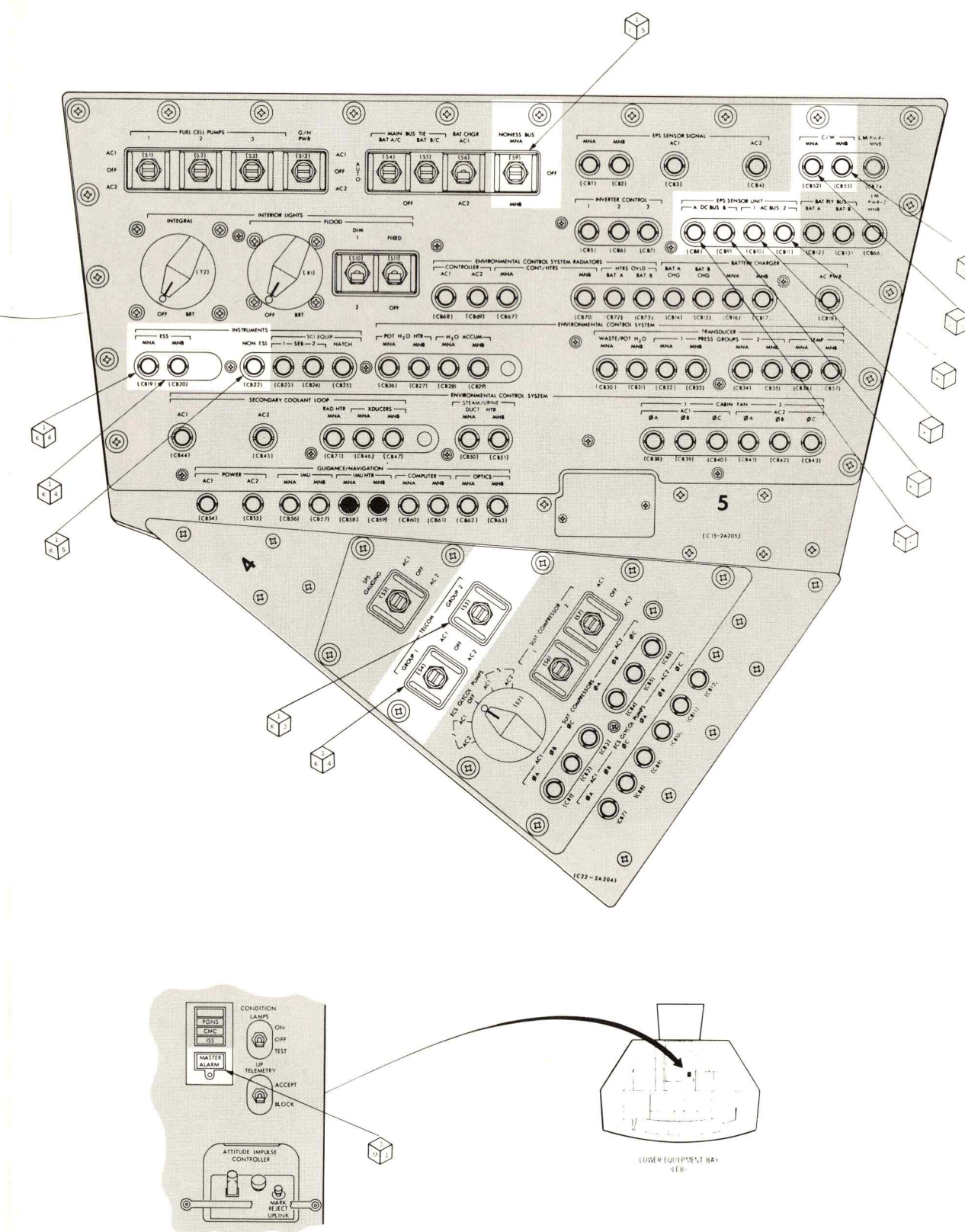
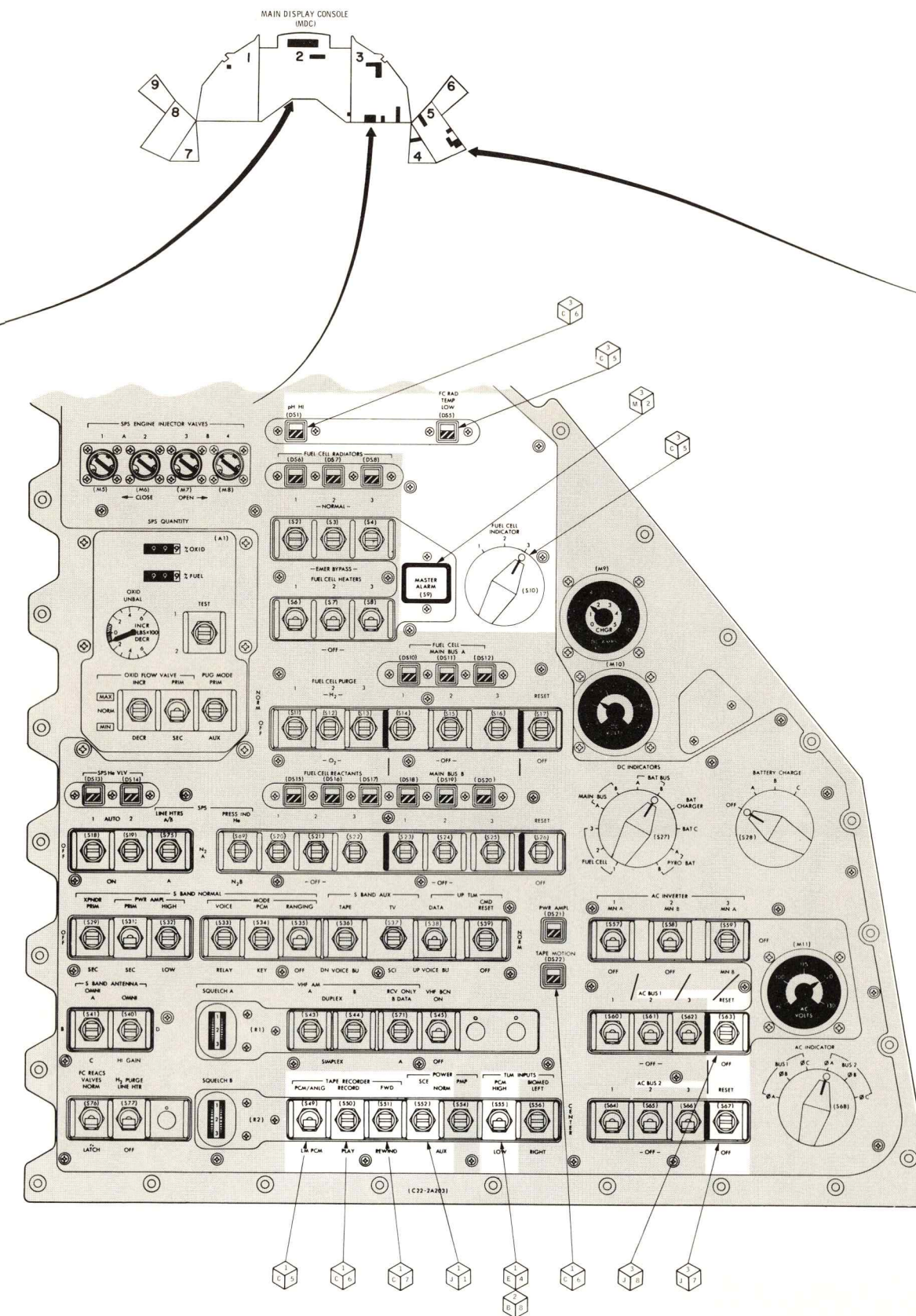
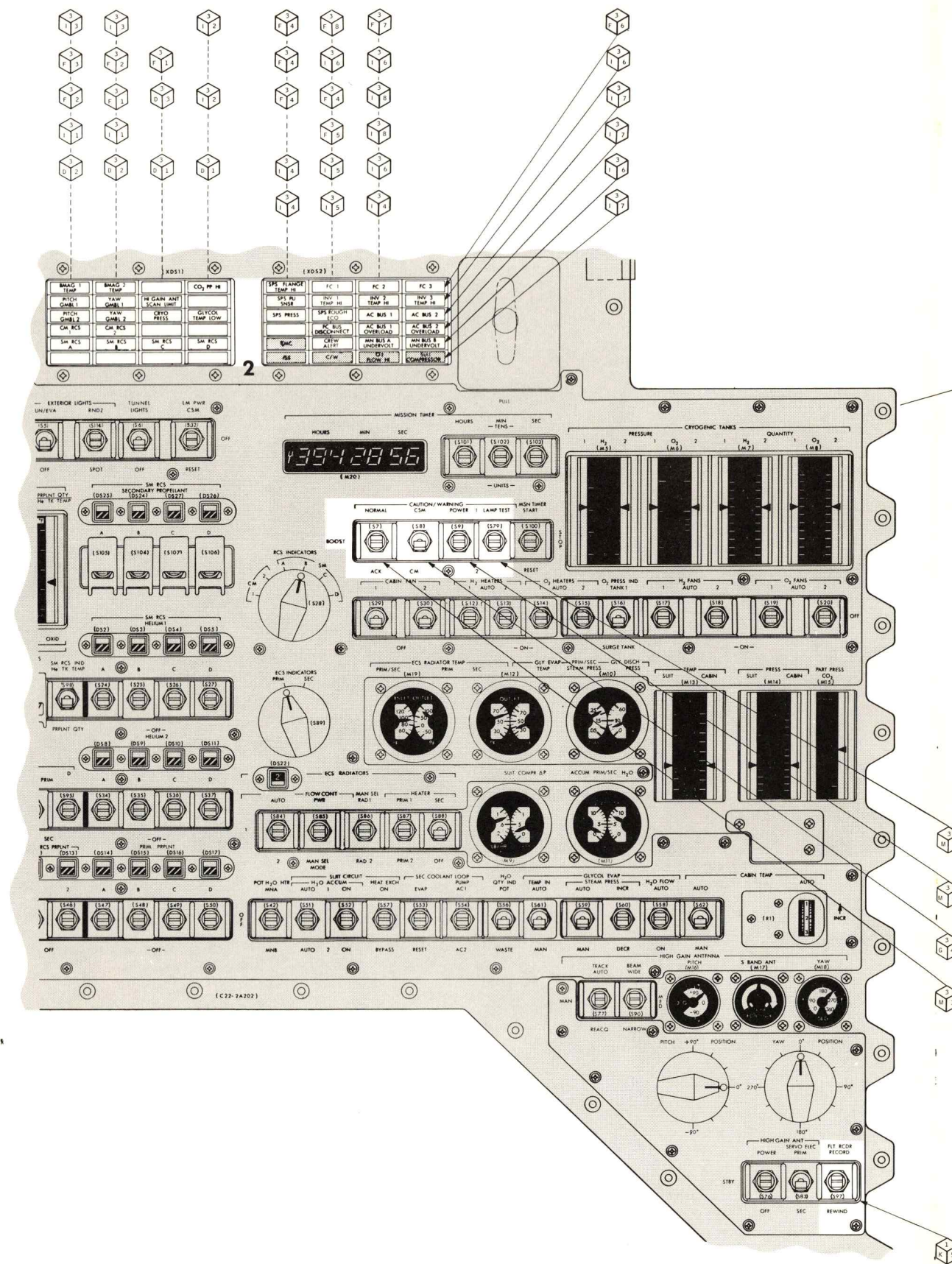
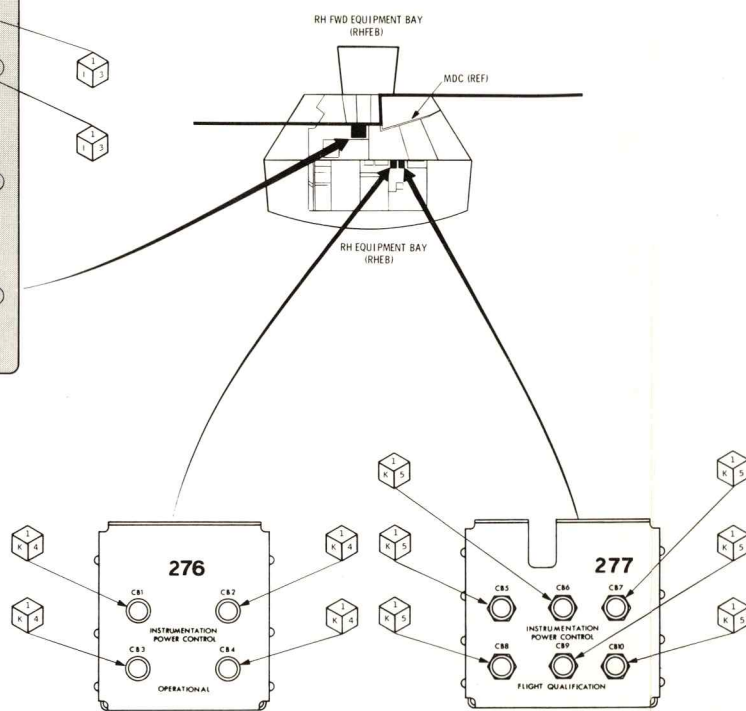
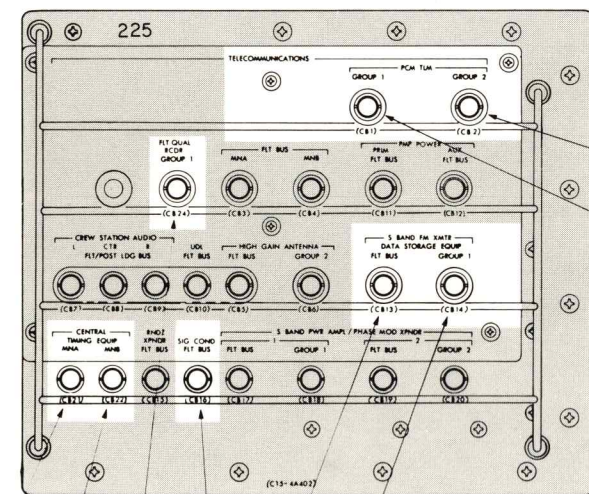
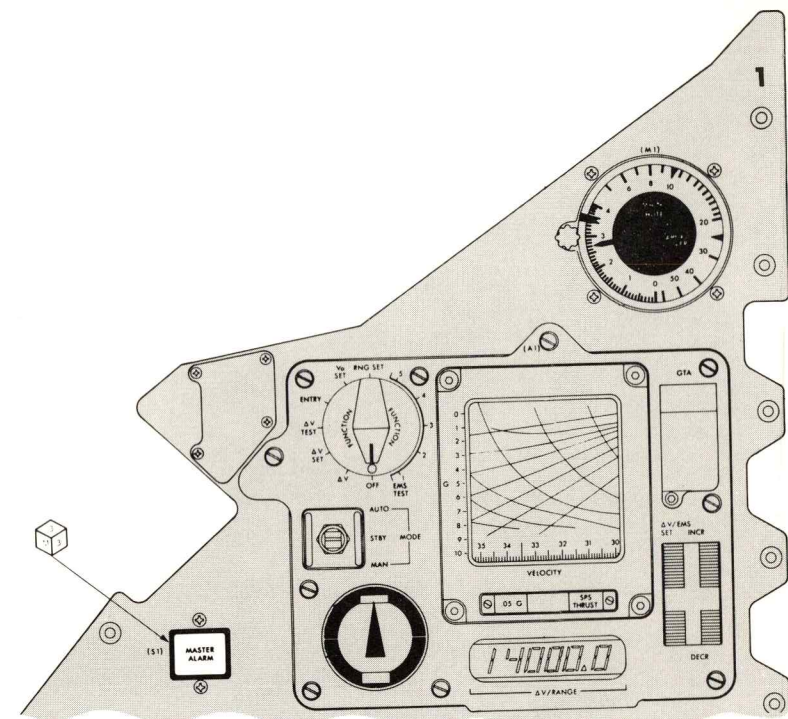
*

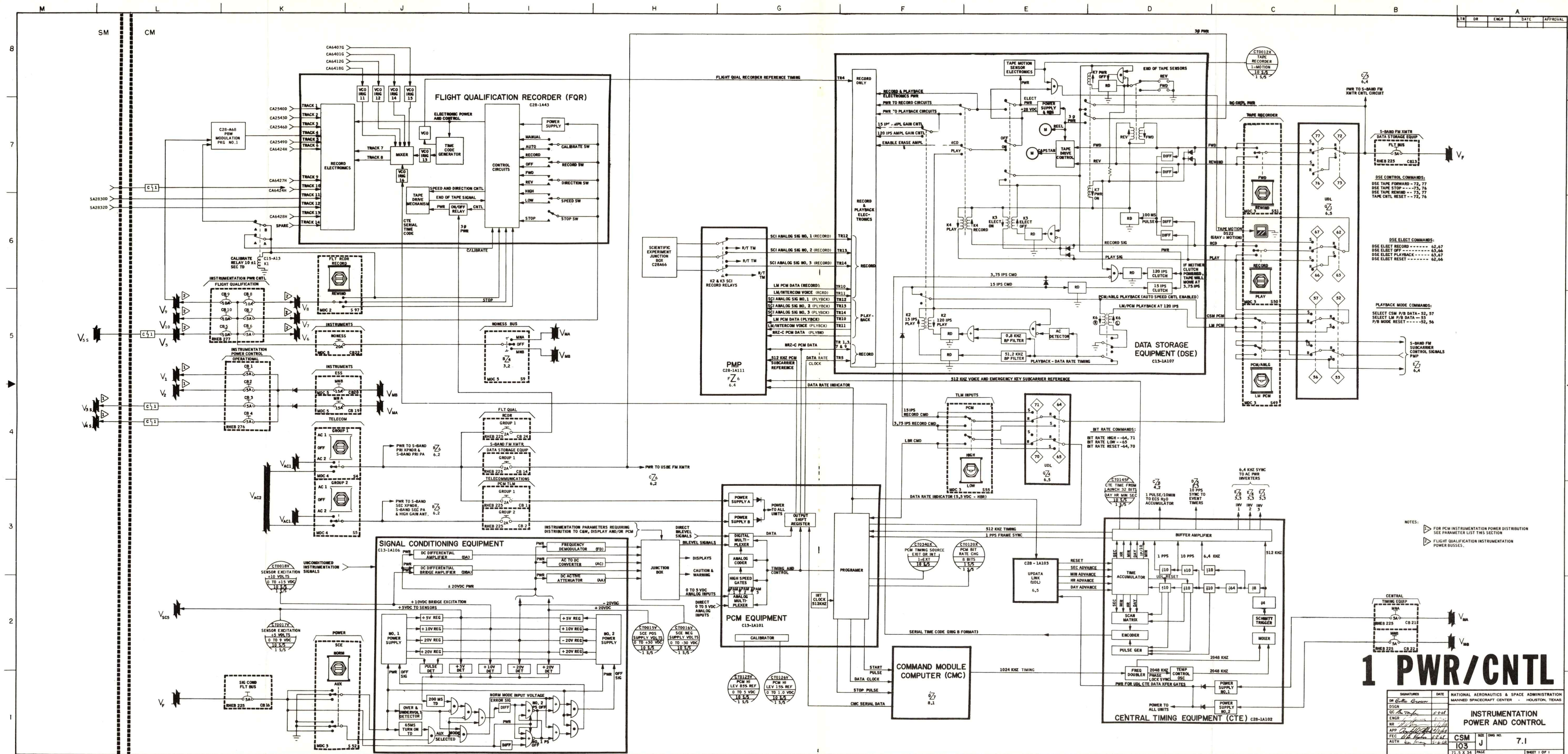
TABLE 6-XIX.- ANTENNA, HIGH-GAIN - Concluded

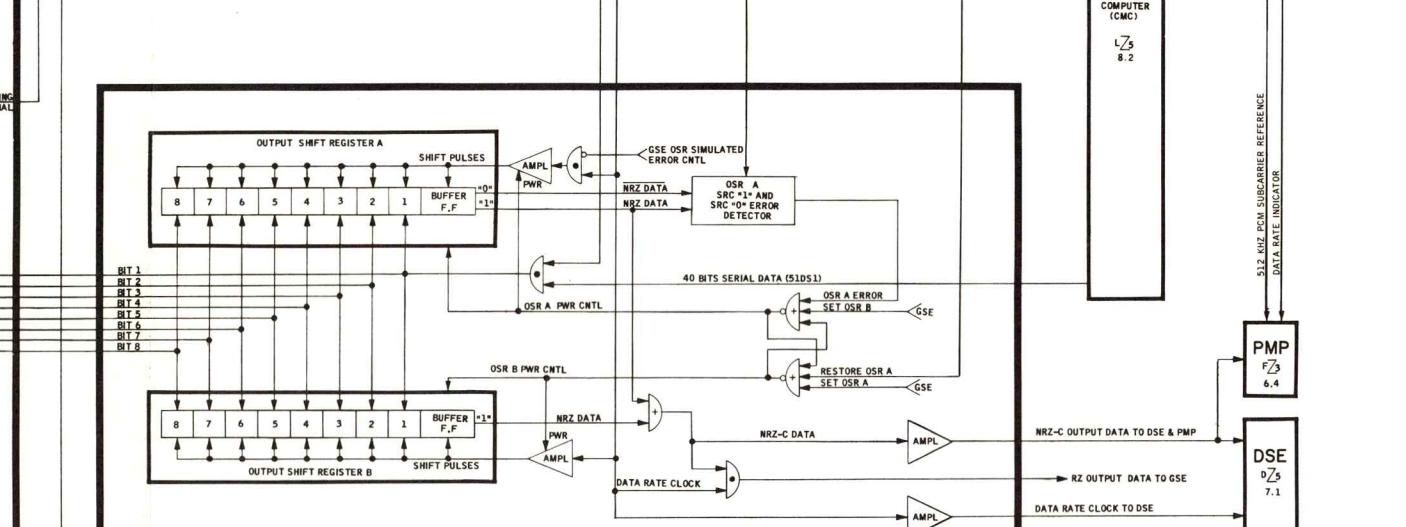
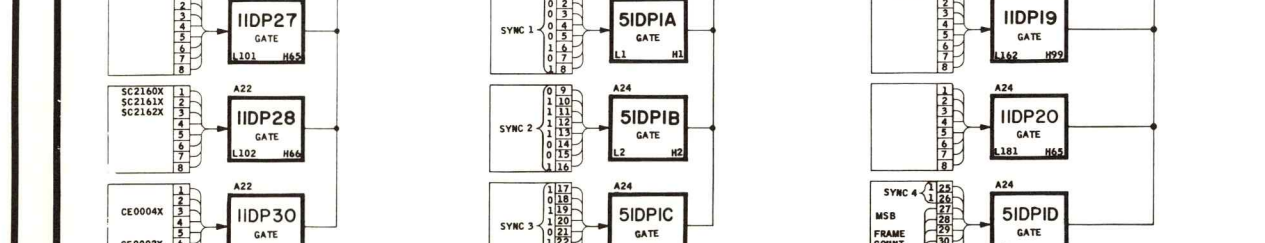
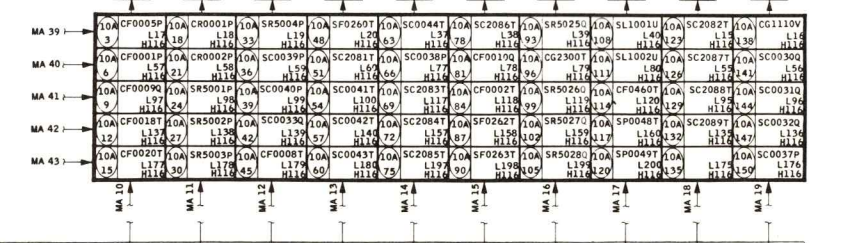
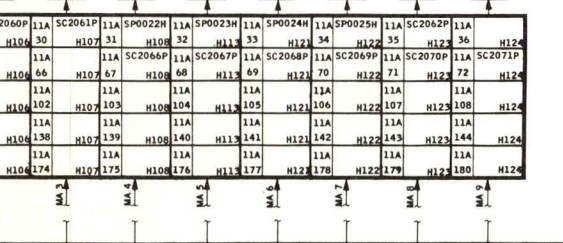
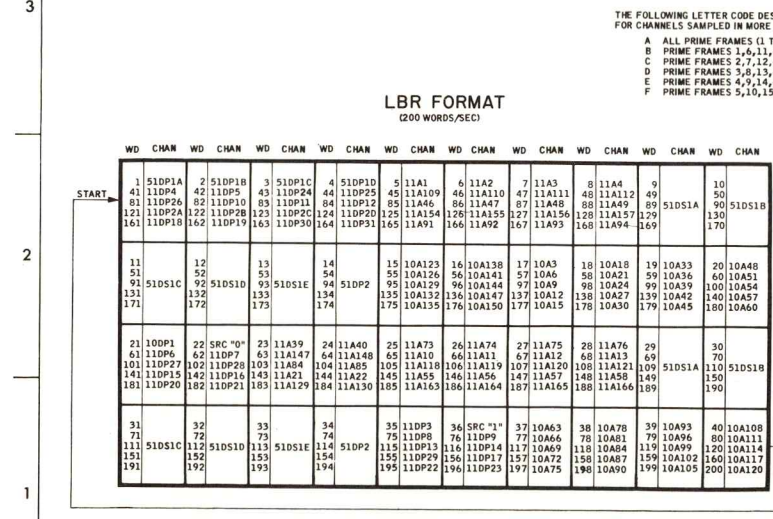
CSM 103

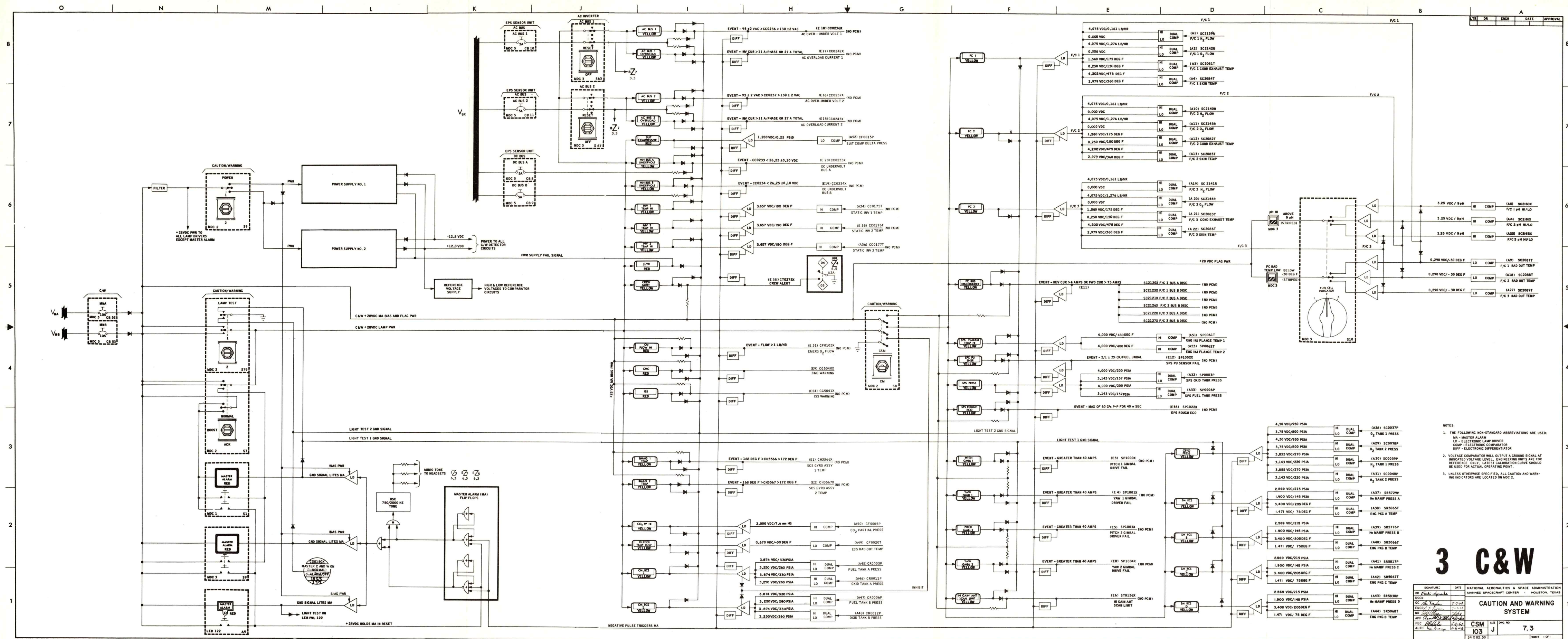
ITEM	FUNCTION and/or PARAMETERS
12. Gimbal Limits A-axis B-axis C-axis	360° Rotation +27° +180°, -12° A-, B-, and C-axis are at 0 degrees when C-axis is parallel to CSM X-axis and B-axis forms a right angle with A-axis.
13. Scan Warning Light	Warning limit is set 10 ± 3 degrees outside RF Scan Limit.
14. Deployment	Deployment is initiated by SLA Panel Deployment. The HGA boom is pivoted in the deployment mechanism by spring-loaded push arms. Deployment period is nominally 10 seconds.

7 INSTRU-
MENTATION









7.4 INSTRUMENTATION SYSTEM NOTES

7.4.1 PCM Signal Capabilities

Each analog and digital input to the PCM equipment is assigned to a channel and given a channel code number. A fixed program is provided for HBR and for LBR sampling. In HBR, all inputs will be sampled at least once during a subframe at sampling rates from 1 s/s to 200 s/s. In LBR, only selected inputs will be sampled during a subframe at a sample rate of 1 s/s (except channel codes 51DS1 [AGC parameters] and 51DP2 [UDL validity], which will be sampled at 10 s/s). The sampling sequence for HBR and for LBR are shown in the HBR format and LBR format respectively.

In the HBR mode the PCM equipment is capable of handling the following input signals:

- A. High Level Analog (0-5 Vdc) - 365 channels (4 at 200 s/s, 16 at 100 s/s, 15 at 50 s/s, 180 at 10 s/s, and 150 at 1 s/s).
- B. Parallel Digital - 1 - 16 bit channel at 200 s/s
 - 1 - 8 bit channel at 50 s/s
 - 1 - 32 bit channel at 10 s/s
 - 1 - 24 bit channel at 10 s/s
 - 31 - 8 bit channel at 10 s/s
- C. Serial Digital - 1 - 40 bit channel at 50 s/s

In the LBR mode the PCM equipment is capable of handling the following input signals:

- A. High Level Analog (0-5 Vdc) - 100 channels at 1 s/s (these channels are not necessarily the same as the HBR 1 s/s channels).
- B. Parallel Digital - 1 - 32 bit channel at 1 s/s
 - 1 - 8 bit channel at 10 s/s
 - 29 - 8 bit channel at 1 s/s

C. Serial Digital - 1 - 40 bit channel at 10 s/s

7.4.2 PCM Telemetry Formats

The HBR format, shown on Drawing 7.2, gives the bit stream word and prime frame location for each channel. The 128 word blocks make up a prime frame. A 200 s/s channel will appear in 4 word blocks, a 100 s/s channel will appear in 2 word blocks and a 50 s/s channel will appear in 1 word block in each prime frame. The 10 s/s channels will appear in every fifth prime frame. The 1 s/s channels will appear in only one prime frame. Prime frame locations are given in the word blocks by the following code:

- A. A - All prime frames
- B. B - Prime Frames 1, 6, 11, 16...46
- C. C - Prime Frames 2, 7, 12, 17...47
- D. D - Prime Frames 3, 8, 13, 18...48
- E. E - Prime Frames 4, 9, 14, 19...49
- F. F - Prime Frames 5, 10, 15, 20...50
- G. 1, 2, 3,...50 - Prime Frames 1, 2, 3,...50.

The LBR format gives the word location (1 through 200) of each channel appearing in the LBR bit stream.

7.4.3 Programmer

The programmer maintains primary control of all functioning units of the PCM equipment. It uses CTE or internal clock pulses to generate gating and control signals for sampling and processing data.

7.4.4 Analog Data

Each analog data input is connected to an analog gate. The analog gates are grouped in matrix combinations, basically arranged such that five channel inputs (columns) are provided

per row with multiple rows used to form the desired matrices. The five analog gates in each column utilize a common Sequencer Gate (SG). Drawing 7.2 shows the matrix combinations used for analog signals. A row command and a column command must both be present for an analog gate to transfer the data signal via the sequencer gate and high-speed gate to an analog coder.

The selected coder uses a successive approximation technique to code the analog 0 to 5 Vdc signal into an 8-bit binary coded word. This 8-bit word is fed to the digital multiplexer where it is transferred to the output shift register when the coder gate is interrogated.

7.4.5 Parallel Digital Data

Each parallel digital (or event) signal is connected to a gate in the digital multiplexer. When the digital multiplexer gate is interrogated, the output shift register will be loaded with a "1" if the input signal is greater than 3.5 Vdc or if the input is open circuited. The output shift register will remain a zero provided the input signal is less than 0.5 Vdc and the input impedance is less than 5K ohms.

7.4.6 PCM Telemetry Parameters

Tables 7-1 through 7-14 list the PCM telemetry parameters that will be available for real-time analysis. Analog parameters recorded on the flight qualification recorder and the data storage equipment are not listed. Also, onboard display and GSE parameters are not listed. Information on parameters not listed is available in the Apollo Baseline Master Measurements list and/or the Apollo Instrumentation Equipment List for Spacecraft 103.

7.4.6.1 Column definitions for tables 7-I through 7-XIV.-

A. Column 1 - Meas ID

The Measurement ID consists of seven characters:

Two letters follow by four numbers and one letter.

1. Module Code

The first letter designates the measurement location by module.

- a. A - ADAPTER
- b. B - BOOSTER
- c. C - COMMAND MODULE
- d. L - LAUNCH ESCAPE TOWER
- e. S - SERVICE MODULE

2. Functional Subsystem Code

The second letter denotes the subsystem wherein the measurement originates.

- a. A - STRUCTURES
- b. C - ELECTRICAL POWER
- c. D - MASTER EVENTS SEQUENCE CONTROLLER
- d. E - EARTH LANDING SEQUENCE CONTROLLER
- e. F - ENVIRONMENTAL CONTROL
- f. G - GUIDANCE & NAVIGATION
- g. H - STABILIZATION & CONTROL
- h. J - CREW EQUIPMENT
- i. K - FLIGHT TECHNOLOGY
- j. L - SCIENTIFIC EQUIPMENT
- k. P - SERVICE PROPULSION
- l. R - REACTION CONTROL
- m. S - L/V EMERGENCY DETECTION
- n. T - COMMUNICATIONS & INSTRUMENTATION

3. Discrete Number

Characters three through six are discrete numbers listed sequentially within each subsystem.

B. Column 2 - Meas Description

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

C. Column 3 - TM

The telemetry column contains two characters. The first character indicates the type of signal measured as follows:

H - High level analog

E - Event (one bit)

D - Digital word (more than one bit)

S - Serial digital word (more than one bit)

The second character indicates the telemetry format as follows:

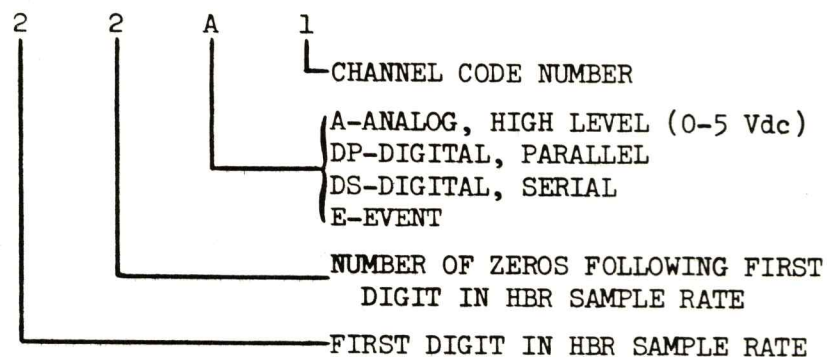
1 - HBR format only

2 - HBR and LBR formats

D. 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.

EXAMPLE:



E. Column 5 - Data Range

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

F. Column 6 - Inst Bus

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 EPS, LES, EDS, ECS, G&N, S&C, SPS, C&W, and C&I.

The instrumentation system distributes +28 Vdc power directly to certain sensors and signal conditioners. These instrumentation power buses are shown on Drawing 7.1 and are designated.

- V1 - CM ESS INST BUS PWR FROM RHEB PNL 276-CB1
- V2 - CM ESS INST BUS PWR FROM RHEB PNL 276-CB2
- V3S - SM ESS INST BUS PWR FROM RHEB PNL 276-CB3
- V4S - SM ESS INST BUS PWR FROM RHEB PNL 276-CB4
- V5 - CM NON ESS INST BUS PWR FROM RHEB PNL 277-CB5
- V5S - SM NON ESS INST BUS PWR FROM RHEB PNL 277-CB5
- V6 - CM NON ESS INST BUS PWR FROM RHEB PNL 277-CB6
- V7 - CM NON ESS INST BUS PWR FROM RHEB PNL 277-CB7
- V8 - CM NON ESS INST BUS PWR FROM RHEB PNL 277-CB8
- V9 - CM NON ESS INST BUS PWR FROM RHEB PNL 277-CB9
- V10 - CM NON ESS INST BUS PWR FROM RHEB PNL 277-CB10
- VSC - SCE PWR REQ'D FOR SIGNAL CONDITIONING (+20, -20, and/or +10 Vdc)
- VSC5- SCE CM +5 Vdc PWR

G. Column 7 - Sig Cond

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

- AA - dc Active Attenuator
- DA - dc Differential Amplifier
- DBA - dc Differential Bridge Amplifier
- AC - ac to dc Converter
- PD - Bi-phase Demodulator
- FD - Frequency Demodulator

H. Column 8 - Pwr Rqmts

The PWR requirement column gives dc power required for signal conditioner and sensor unless otherwise indicated. The power may or may not include onboard display requirements depending on whether the display is driven directly from the sig cond or not.

I. Column 9 - O. B. Displ

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

* - Displayed on 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

J. Column 10 - Sig Dist

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

CS - Common Signal Drives Display and PCM

SS - Separate Signal Drives Display and PCM

TSC - Common Sensor but PCM is Signal Conditioned

K. Column 11 - DWG CSMSH

This column will reference the CSMSH drawing for system information.

TABLE 7-1.- PCM TELEMETRY - STRUCTURES

CSM
S/C 103

MEAS I.D.	MEAS DESCRIPTION	TM	CHAN CODE	DATA RANGE LOW HIGH	UNITS	INST BUS	SIG COND	PWR RQMTS	O. B. DISPL	SIG DIST	DWG CSM SH
CA1800T	SIDE HS BOND LOC 1 TEMP	H1	10A65	-260 +600	DEG F	V2	--	120 MA TOTAL	--	--	--
CA1803T	SIDE HS BOND LOC 4 TEMP	H1	10A70	-260 +600	DEG F	V2	--		--	--	--
CA1806T	SIDE HS BOND LOC 7 TEMP	H1	10A74	-260 +600	DEG F	V2	--		--	--	--
CA1809T	SIDE HS BOND LOC 10 TEMP	H1	10A79	-260 +600	DEG F	V2	--		--	--	--
SA2377T	BAY 2 OX TK SURFACE TEMP	H1	10A142	-100 +200	DEG F	V3S	--	56 MA	--	--	--
SA2378T	BAY 3 OX TK SURFACE TEMP	H1	10A137	-100 +200	DEG F	V4S	--	56 MA	--	--	--
SA2379T	BAY 5 FU TK SURFACE TEMP	H1	10A139	-100 +200	DEG F	V3S	--	56 MA	--	--	--
SA2380T	BAY 6 FU TK SURFACE TEMP	H1	10A140	-100 +200	DEG F	V4S	--	56 MA	--	--	--
SA2400T	OX LINE ENTRY SUMP TK TEMP	H1	10A143	-100 +200	DEG F	V3S	--	56 MA	--	--	--
SA2401T	FU LINE ENTRY SUMP TK TEMP	H1	10A145	-100 +200	DEG F	V4S	--	56 MA	--	--	--

TABLE 7-II.- PCM TELEMETRY - ELECTRICAL POWER SYSTEM

CSM
S/C 103

MEAS I.D.	MEAS DESCRIPTION	TM	CHAN CODE	LOW	DATA RANGE HIGH	UNITS	INST BUS	SIG COND	PWR RQMTS	O. B. DISPL	SIG DIST	DWG CSM SH
SC0030Q	H ₂ TK 1 QTY	H2	10A141	0	100	PCT	EPS	--	4W AC	M	CS	5.2
SC0031Q	H ₂ TK 2 QTY	H2	10A144	0	100	PCT	EPS	--	4W AC	M	CS	5.2
SC0032Q	O ₂ TK 1 QTY	H2	10A147	0	100	PCT	EPS	--	4W AC	M	CS	5.2
SC0033Q	O ₂ TK 2 QTY	H2	10A42	0	100	PCT	EPS	--	4W AC	M	CS	5.2
SC0037P	O ₂ TK 1 PRESS	H2	10A150	50	1050	PSIA	V _{4S}	--	25 MA	SM**	CS	5.2
SC0038P	O ₂ TK 2 PRESS	H2	10A66	50	1050	PSIA	V _{3S}	--	25 MA	M**	CS	5.2
SC0039P	H ₂ TK 1 PRESS	H2	10A36	0	350	PSIA	V _{4S}	--	25 MA	M**	CS	5.2
SC0040P	H ₂ TK 2 PRESS	H2	10A39	0	350	PSIA	V _{3S}	--	25 MA	M**	CS	5.2
SC0041T	O ₂ TK 1 TEMP	H2	10A54	-325	+80	DEG F	EPS	--	SC0032	--	--	5.2
SC0042T	O ₂ TK 2 TEMP	H2	10A57	-325	+80	DEG F	EPS	--	SC0033	--	--	5.2
SC0043T	H ₂ TK 1 TEMP	H2	10A60	-425	-200	DEG F	EPS	--	SC0030	--	--	5.2
SC0044T	H ₂ TK 2 TEMP	H2	10A63	-425	-200	DEG F	EPS	--	SC0031	--	--	5.2
CC0200V	AC BUS 1 ϕ A VOLTS	H2	11A147	0	150	VAC	V _{SC}	AC	--	SM	TSC	3.2
CC0203V	AC BUS 2 ϕ A VOLTS	H2	11A56	0	150	VAC	V _{SC}	AC	--	SM	TSC	3.2
CC0206V	MAIN BUS A VOLTS	H2	11A57	0	+45	VDC	V _{SC}	AA	--	SM	TSC	3.2
CC0207V	MAIN BUS B VOLTS	H2	11A58	0	+45	VDC	V _{SC}	AA	--	SM	TSC	3.2
CC0175T	INVERTER 1 TEMP	H1	10A86	+32	+248	DEG F	V _{SC}	DBA	--	L**	CS	
CC0176T	INVERTER 2 TEMP	H1	10A88	+32	+248	DEG F	V _{SC}	DBA	--	L**	CS	
CC0177T	INVERTER 3 TEMP	H1	10A89	+32	+248	DEG F	V _{SC}	DBA	--	L**	CS	
CC0210V	BAT BUS A VOLTS	H1	11A23	0	+45	VDC	V _{SC}	AA	--	SM	TSC	3.2
CC0211V	BAT BUS B VOLTS	H1	11A24	0	+45	VDC	V _{SC}	AA	--	SM	TSC	3.2
CC0215C	BAT CHGR	H2	11A73	0	+5	AMPS	V _{SC}	DA	--	SM	TSC	3.2
CC0222C	BAT A CUR	H2	11A74	0	+100	AMPS	V _{SC}	DA	--	SM	TSC	3.2
CC0223C	BAT B CUR	H1	11A27	0	+100	AMPS	V _{SC}	DA	--	SM	TSC	3.2
CC0224C	BAT C CUR	H1	11A28	0	+100	AMPS	V _{SC}	DA	--	SM	TSC	3.2
CC0232V	BAT RELAY BUS VOLTS	H2	11A75	0	+45	VDC	V _{SC}	AA	--	SM	CS	3.2
SC2060P	FC 1 N ₂ PRESS	H1	11A29	0	75	PSIA	V _{4S}	--		SM	CS	5.3
SC2061P	FC 2 N ₂ PRESS	H1	11A30	0	75	PSIA	V _{3S}	--		SM	CS	5.3
SC2062P	FC 3 N ₂ PRESS	H1	11A35	0	75	PSIA	V _{3S}	--		SM	CS	5.3

TABLE 7-II.- PCM TELEMETRY - ELECTRICAL POWER SYSTEM - CONTINUED

MEAS I.D.	MEAS DESCRIPTION	TM	CHAN CODE	DATA RANGE		UNITS	INST BUS	SIG COND	PWR RQMTS	O. B. DISPL	SIG DIST
				LOW	HIGH						
SC2066P	FC 1 O ₂ PRESS	H1	11A67	0	75	PSIA	V _{4S}	--		SM	CS
SC2067P	FC 2 O ₂ PRESS	H1	11A68	0	75	PSIA	V _{3S}	--		SM	CS
SC2068P	FC 3 O ₂ PRESS	H1	11A69	0	75	PSIA	V _{3S}	--		SM	CS
SC2069P	FC 1 H ₂ PRESS	H1	11A70	0	75	PSIA	V _{4S}	--		SM	CS
SC2070P	FC 2 H ₂ PRESS	H1	11A71	0	75	PSIA	V _{3S}	--		SM	CS
SC2071P	FC 3 H ₂ PRESS	H1	11A72	0	75	PSIA	V _{3S}	--		SM	CS
SC2081T	FC 1 COND EXH TEMP	H2	10A51	+150	+250	DEG F	V _{5C}	DBA	--	SM**	CS
SC2082T	FC 2 COND EXH TEMP	H2	10A123	+150	+250	DEG F	V _{5C}	DBA	--	SM**	CS
SC2083T	FC 3 COND EXH TEMP	H2	10A69	+150	+250	DEG F	V _{5C}	DBA	--	SM**	CS
SC2084T	FC 1 SKIN TEMP	H2	10A72	+80	+550	DEG F	V _{5C}	DBA	--	SM**	CS
SC2085T	FC 2 SKIN TEMP	H2	10A75	+80	+550	DEG F	V _{5C}	DBA	--	SM**	CS
SC2086T	FC 3 SKIN TEMP	H2	10A78	+80	+550	DEG F	V _{5C}	DBA	--	SM**	CS
SC2087T	FC 1 RAD OUT TEMP	H2	10A126	-50	+300	DEG F	V _{4S}	--	56 MA	SMB**	CS
SC2088T	FC 2 RAD OUT TEMP	H2	10A129	-50	+300	DEG F	V _{3S}	--	56 MA	SMB**	CS
SC2089T	FC 3 RAD OUT TEMP	H2	10A132	-50	+300	DEG F	V _{3S}	--	56 MA	SMB**	CS
SC2090T	FC 1 RAD IN TEMP	H1	10A130	-50	+300	DEG F	V _{4S}	--	56 MA	--	--
SC2091T	FC 2 RAD IN TEMP	H1	10A131	-50	+300	DEG F	V _{3S}	--	56 MA	--	--
SC2092T	FC 3 RAD IN TEMP	H1	10A67	-50	+300	DEG F	V _{3S}	--	56 MA	--	--
SC2113C	FC 1 CUR	H2	11A76	0	+100	AMPS	V _{5C}	DA	--	SM	TSC
SC2114C	FC 2 CUR	H2	11A84	0	+100	AMPS	V _{5C}	DA	--	SM	TSC
SC2115C	FC 3 CUR	H2	11A85	0	+100	AMPS	V _{5C}	DA	--	SM	TSC
SC2139R	FC 1 H ₂ FLOW	H1	11A77	0	0.2	LB/HR	V _{4S}	--	56 MA	SM**	CS
SC2140R	FC 2 H ₂ FLOW	H1	11A78	0	0.2	LB/HR	V _{3S}	--	56 MA	SM**	CS
SC2141R	FC 3 H ₂ FLOW	H1	11A79	0	0.2	LB/HR	V _{3S}	--	56 MA	SM**	CS
SC2142R	FC 1 O ₂ FLOW	H1	11A80	0	1.6	LB/HR	V _{4S}	--	56 MA	SM**	CS
SC2143R	FC 2 O ₂ FLOW	H1	11A81	0	1.6	LB/HR	V _{3S}	--	56 MA	SM**	CS
SC2144R	FC 3 O ₂ FLOW	H1	11A82	0	1.6	LB/HR	V _{3S}	--	56 MA	SM**	CS

TABLE 7-II.- PCM TELEMETRY - ELECTRICAL POWER SYSTEM - CONCLUDED

CSM
S/C 103

MEAS I.D.	MEAS DESCRIPTION	TM	CHAN CODE	DATA RANGE		UNITS	INST BUS	SIG COND	PWR RQMTS	O. B. DISPL	SIG DIST	DWG CSMSH
				LOW	HIGH							
SC2160X	FC 1 PH	E2	11E28-1	NORM	HIGH	EVENT	EPS	--		STB*	CS	5.3
SC2161X	FC 2 PH	E2	11E28-2	NORM	HIGH	EVENT	EPS	--		STB*	CS	5.3
SC2162X	FC 3 PH	E2	11E28-3	NORM	HIGH	EVENT	EPS	--		STB*	CS	5.3

TABLE 7-III.- PCM TELEMETRY - LAUNCH ESCAPE SYSTEM

CSM
S/C 103

MEAS I.D.	MEAS DESCRIPTION	TM	CHAN CODE	DATA RANGE			INST BUS	SIG COND	PWR RQMTS	O. B. DISPL	SIG DIST	DWG CSM SH
				LOW	HIGH	UNITS						
CD0005V	PYRO BUS A VOLTS	H1	11A9	0	+40	VDC	SEQ	--	1 MA	--	--	2.2
CD0006V	PYRO BUS B VOLTS	H1	11A5	0	+40	VDC	SEQ	--	1 MA	--	--	2.2
CD0023X	CM-SM SEP RELAY A	E2	11E22-1		SEP	EVENT	SEQ	--		--	--	
CD0024X	CM-SM SEP RELAY B	E2	11E23-1		SEP	EVENT	SEQ	--		--	--	
CD0123X	SLA SEP RELAY A	E2	11E22-5		SEP	EVENT	SEQ	--		--	--	
CD0124X	SLA SEP RELAY B	E2	11E23-7		SEP	EVENT	SEQ	--		--	--	
CD0130X	CREW ABORT A	E2	11E13-3		ABORT	EVENT	SEQ	--	300 MA	--	--	2.3
CD0131X	CREW ABORT B	E2	11E13-6		ABORT	EVENT	SEQ	--	300 MA	--	--	2.3
CD0132X	EDS ABORT VOTE 1	E2	11E14-1	VOTE/OFF	ARM	EVENT	EDS	--	300 MA	--	--	2.3
CD0133X	EDS ABORT VOTE 2	E2	11E14-2	VOTE/OFF	ARM	EVENT	EDS	--	300 MA	--	--	2.3
CD0134X	EDS ABORT VOTE 3	E2	11E14-4	VOTE/OFF	ARM	EVENT	EDS	--	300 MA	--	--	2.3
CD0135X	EDS ABORT A	E2	11E13-7		ABORT	EVENT	EDS	--	2 MA	--	--	2.3
CD0136X	EDS ABORT B	E2	11E13-4		ABORT	EVENT	EDS	--	2 MA	--	--	2.3
CD0170X	SCS CHANNEL ENABLE RCS A	E2	11E22-3		ENABLE	EVENT	SEQ	--		--	--	
CD0171X	SCS CHANNEL ENABLE RCS B	E2	11E23-3		ENABLE	EVENT	SEQ	--		--	--	
CD0173X	CM RCS PRESS SIG A	E2	11E22-7		PRESS	EVENT	SEQ	--		--	--	
CD0174X	CM RCS PRESS SIG B	E2	11E23-5		PRESS	EVENT	SEQ	--		--	--	
CD0200V	LOGIC BUS A VOLTS	H1	11A8	0	+40	VDC	SEQ	--	1 MA	--	--	2.2
CD0201V	LOGIC BUS B VOLTS	H1	11A6	0	+40	VDC	SEQ	--	1 MA	--	--	2.2
CD0230X	FWD HS JET A	E2	11E24-1		JETT	EVENT	SEQ					
CD0231X	FWD HS JET B	E2	11E26-5		JETT	EVENT	SEQ					
CD1150X	PROBE RET 1 RELAY A	E2	11E13-1		RETRACT	EVENT	SEQ	--		--	--	2.7
CD1151X	PROBE RET 1 RELAY B	E2	11E13-8		RETRACT	EVENT	SEQ	--		--	--	2.7
CD1152X	PROBE RET 2 RELAY A	E2	11E15-1		RETRACT	EVENT	SEQ	--		--	--	2.7
CD1153X	PROBE RET 2 RELAY B	E2	11E15-5		RETRACT	EVENT	SEQ	--		--	--	2.7
CD1154X	CSM-LM LOCK RING SEP RELAY A	E2	11E15-6		SEP	EVENT	SEQ	--		--	--	2.7
CD1155X	CSM-LM LOCK RING SEP RELAY B	E2	11E15-7		SEP	EVENT	SEQ	--		--	--	2.7

TABLE 7-IV.- PCM TELEMETRY - EARTH LANDING SEQUENCE CONTROLLER.

CSM
S/C 103

MEAS I.D.	MEAS DESCRIPTION	TM	CHAN CODE	DATA RANGE		UNITS	INST BUS	SIG COND	PWR RQMTS	O. B. DISPL	SIG DIST	DWG CSM SH
				LOW	HIGH							
CE0001X	DROGUE DEP RELAY A	E2	11E29-1		DEPLOY	EVENT	V ₂	---		--	---	
CE0002X	DROGUE DEP RELAY B	E2	11E30-6		DEPLOY	EVENT	V ₂	---		--	---	
CE0003X	MAIN DEPLOY RELAY A	E2	11E29-8		DEPLOY	EVENT	V ₂	---		--	---	
CE0004X	MAIN DEPLOY RELAY B	E2	11E30-3		DEPLOY	EVENT	V ₂	---		--	---	
CE0321X	MAIN CHUTE DISC RELAY A	E2	11E29-5		DISC	EVENT	V ₂	--		--	--	
CE0322X	MAIN CHUTE DISC RELAY B	E2	11E30-8		DISC	EVENT	V ₂	--		--	--	

TABLE 7-V.- PCM TELEMETRY - ENVIRONMENTAL CONTROL SYSTEM

CSM
S/C 103

MEAS I.D.	MEAS DESCRIPTION	TM	CHAN CODE	DATA RANGE		UNITS	INST BUS	SIG COND	PWR RQMTS	O. B. DISPL	SIG DIST	DWG CSM SH
CF0001P	CABIN PRESS	H2	10A6	0	17	PSIA	ECS	--	25 MA	M	CS	4.2
CF0002T	CABIN TEMP	H2	10A84	+40	+125	DEG F	ECS	--	80 MA	M	CS	4.3
CF0003P	SUIT-CABIN DELTA PRESS	H1	11A37	-5	+5	IN H ₂ O	V ₂	--	10 MA	M	CS	4.2
CF0005P	CO ₂ PARTIAL PRESS	H2	10A3	0	30	MM HG	ECS	--	100 MA	M**	SS	4.2
CF0006P	SURGE TANK PRESS	H1	10A2	50	1050	PSIA	V ₂	--	56 MA	SM	CS	4.2
CF0008T	SUIT AIR HX OUT TEMP	H2	10A45	+20	+95	DEG F	ECS	--	356 MA	M	CS	4.2
CF0009Q	WASTE H ₂ O QTY	H2	10A9	0	100	PCT	ECS	--	40 MA	SM	CS	4.4
CF0010Q	POTABLE H ₂ O QTY	H2	10A81	0	100	PCT	ECS	--	40 MA	SM	CS	4.4
CF0012P	SUIT MANF ABS PRESS	H2	11A1	0	17	PSIA	ECS	--	25 MA	M	CS	4.2
CF0015P	SUIT COMP DELTA P	H2	11A2	0	1	PSID	ECS	--	40 MA	M**	CS	4.2
CF0016P	GLY PUMP OUT PRESS	H2	11A3	0	60	PSIG	ECS	--	25 MA	SM	CS	
CF0017T	GLY EVAP OUT STEAM TEMP	H1	10A133	+20	+95	DEG F	ECS	--	CF0008T	--	--	4.3
CF0018T	GLY EVAP OUT TEMP	H2	10A12	+25	+75	DEG F	ECS	--	CF0008T	SM	CS	4.3
CF0019Q	GLY ACCUM QTY	H1	10A134	0	100	PCT	ECS	--	25 MA	SM	CS	4.3
CF0020T	ECS RAD OUT TEMP	H2	10A15	-50	+100	DEG F	ECS	--	CF0008T	M**	CS	4.3
CF0034P	GLY EVAP BACK PRESS	H1	10A4	+0.05	+0.25	PSIA	ECS	--	40 MA	SM	CS	4.3
CF0035R	ECS O ₂ FLOW O ₂ SUPPLY MANF	H2	11A4	0.2	1.0	LB/HR	ECS	--	120 MA	M**	CS	4.2
CF0036P	O ₂ SUPPLY MANF PRESS	H1	11A14	0	150	PSIG	ECS	--	25 MA	--	--	4.2
CF0070P	SEC GLY PUMP OUT PRESS	H1	11A86	0	60	PSIG	ECS	--	25 MA	SM	CS	4.4
CF0071T	SEC EVAP OUT LIQ TEMP	H1	10A25	+25	+75	DEG F	ECS	--	CF0008T	SM	CS	4.4
CF0072Q	SEC GLY ACCUM QUANTITY	H1	10A64	0	100	PCT	ECS	--	25 MA	SM	CS	4.4
CF0073P	SEC EVAP OUT STEAM PRESS	H1	10A8	0	0.3	PSIA	ECS	--	25 MA	SM	CS	4.4
CF0120P	H ₂ O TANK - GLY RES PRESS	H1	10A101	0	50	PSIA	V ₂	--	56 MA	--	--	
CF0157R	PRI GLYCOL FLOW RATE	H1	11A87	+150	+300	LB/HR	V ₂	--	10 MA	--	--	4.3
CF0181T	PRI EVAP INLET TEMP	H1	10A100	+35	+100	DEG F	V ₂	--	56 MA	--	--	4.3
SF0260T	PRI RAD IN TEMP	H2	10A48	+55	+120	DEG F	ECS	--	--	SM	CS	4.3
SF0262T	SEC RAD IN TEMP	H2	10A87	+55	+120	DEG F	ECS	--	--	SM	CS	4.4
SF0263T	SEC RAD OUT TEMP	H2	10A90	+30	+70	DEG F	ECS	--	--	M	CS	4.4

TABLE 7-V.- PCM TELEMETRY - ENVIRONMENTAL CONTROL SYSTEM - CONCLUDED

CSM
S/C 103

MEAS I.D.	MEAS DESCRIPTION	TM	CHAN CODE	DATA RANGE		UNITS	INST BUS	SIG COND	PWR RQMTS	O. B. DISPL	SIG DIST	DWG CSM SH
				LOW	HIGH							
SF0266X CF0460T	RAD FLOW CONT SYS 1 OR 2 H ₂ O DUMP TEMP	E2 H2	11E4-8 10A114	PRI	SEC	EVENT DEG F	V _{SC} V ₂	AA --	-- 56 MA	TB --	TSC --	4.3 4.5
				0	100							

TABLE 7-VI.- PCM TELEMETRY - GUIDANCE AND NAVIGATION SYSTEM

CSM
S/C 103

MEAS I.D.	MEAS DESCRIPTION	TM	CHAN CODE	DATA RANGE LOW HIGH	UNITS	INST BUS	SIG COND	PWR RQMTS	O. B. DISPL	SIG DIST	DWG CSMH
CG0001V	CPTR DIG DATA - 40 BITS	S2	51DS1			--	--	--	--	--	8.2
CG1040V	PIPA +120 VDC	H1	10A83	+85	+135	VDC	G&N	--	--	--	8.2
CG1110V	TM BIAS 2.5 VDC	H2	10A138	0	5	VDC	G&N	--	--	--	8.2
CG1201V	IMU 28 VAC 800HZ	H1	10A91	0	31.1	VRMS	G&N	--	--	--	8.2
CG1331V	3.2 KHZ 28V SUPPLY	H1	10A85	0	31.1	VRMS	G&N	--	--	--	8.2
CG1513X	IMU HTR +28 VDC	E2	11E15-2	OFF	STBY	EVENT	V _{SC5}	--	--	T _{SC}	8.2
CG1523X	CMC OPERATE +28 VDC	E2	11E15-3	OFF	OPR	EVENT	V _{SC5}	--	--	T _{SC}	8.2
CG1533X	OPTX OPERATE 28 VAC	E2	11E15-4	OFF	OPR	EVENT	V _{SC5}	--	--	T _{SC}	8.2
CG2112V	IG 1X RSVR OUT SIN	H1	11A54	-50/+230	+50/+130	DEG	G&N	--	--	--	8.2
CG2113V	IG 1X RSVR OUT COS	H1	11A59	+130/+230	+50/+310	DEG	G&N	--	--	--	8.2
CG2117V	IGA SERVO ERR IN PHASE	H1	12A2	-2.5	+2.5	MRAD	G&N	--	--	--	8.2
CG2142V	MG 1X RSVR OUT SIN	H1	11A60	-50/+230	+50/+130	DEG	G&N	--	--	--	8.2
CG2143V	MG 1X RSVR OUT COS	H1	11A61	+130/+230	+50/+310	DEG	G&N	--	--	--	8.2
CG2147V	MGA SERVO ERR IN PHASE	H1	12A1	-2.5	+2.5	MRAD	G&N	--	--	--	8.2
CG2172V	OG 1X RSVR OUT SIN	H1	11A62	-50/+230	+50/+130	DEG	G&N	--	--	--	8.2
CG2173V	OG 1X RSVR OUT COS	H1	11A63	+130/+230	+50/+310	DEG	G&N	--	--	--	8.2
CG2177V	OGA SERVO ERR IN PHASE	H1	12A3	-2.5	+2.5	MRAD	G&N	--	--	--	8.2
CG2300T	PIPA TEMP	H2	10A96	+120	+140	DEG F	G&N	--	--	--	8.2
CG3721V	SHAFT CDU DAC OUT	H1	11A52	-10	+10	VRMS	G&N	--	--	--	8.2
CG3722V	TRUNNION CDU OUT	H1	11A53	-10	+10	VRMS	G&N	--	--	--	8.2
CG5040X	CMC WARNING	E2	11E19-1		WARN	EVENT	V _{SC5}	--	--	L _{SC}	8.2

TABLE 7-VII.- PCM TELEMETRY - STABILIZATION AND CONTROL SYSTEM

CSM
S/C 103

MEAS I.D.	MEAS DESCRIPTION	TM	CHAN CODE	LOW	DATA RANGE HIGH	UNITS	INST BUS	SIG COND	PWR RQMTS	O. B. DISPL	SIG DIST	DWG CSMH
CH3500H	PITCH ATT ERR	H1	51A5	0	5/5/15	DEG	S&C	--	--	M	CS	8.3
CH3501H	YAW ATT ERR	H1	51A6	0	5/5/15	DEG	S&C	--	--	M	CS	8.3
CH3502H	ROLL ATT ERR	H1	12A4	0	5/5/50	DEG	S&C	--	--	M	CS	8.3
CH3503R	SCS PITCH BODY RATE	H1	12A5	0	1/5/10	DEG/S	S&C	--	--	M	CS	8.3
CH3504R	SCS YAW BODY RATE	H1	12A6	0	1/5/10	DEG/S	S&C	--	--	M	CS	8.3
CH3505R	SCS ROLL BODY RATE	H1	12A7	0	1/5/10	DEG/S	S&C	--	--	M	CS	8.3
CH3517H	PITCH GMBL POS 1 OR 2	H1	12A8	-5.0	+5.0	DEG	S&C	--	--	SM	CS	8.3
CH3518H	YAW GMBL POS 1 OR 2	H1	12A10	-5.0	+5.0	DEG	S&C	--	--	SM	CS	8.3
CH3546X	+PITCH/+X JET	E1	22E1-1	FIRE/OFF	ARM	EVENT	S&C	--	--	--	--	8.3
CH3547X	-PITCH/+X JET	E1	22E2-2	FIRE/OFF	ARM	EVENT	S&C	--	--	--	--	8.3
CH3548X	+PITCH/-X JET	E1	22E3-3	FIRE/OFF	ARM	EVENT	S&C	--	--	--	--	8.3
CH3549X	-PITCH/-X JET	E1	22E4-4	FIRE/OFF	ARM	EVENT	S&C	--	--	--	--	8.3
CH3550X	+YAW/+X JET	E1	22E5-5	FIRE/OFF	ARM	EVENT	S&C	--	--	--	--	8.3
CH3551X	-YAW/+X JET	E1	22E6-6	FIRE/OFF	ARM	EVENT	S&C	--	--	--	--	8.3
CH3552X	+YAW/-X JET	E1	22E7-7	FIRE/OFF	ARM	EVENT	S&C	--	--	--	--	8.3
CH3553X	-YAW/-X JET	E1	22E8-8	FIRE/OFF	ARM	EVENT	S&C	--	--	--	--	8.3
CH3554X	+ROLL/+Z JET	E1	22E9-1	FIRE/OFF	ARM	EVENT	S&C	--	--	--	--	8.3
CH3555X	-ROLL/+Z JET	E1	22E13-5	FIRE/OFF	ARM	EVENT	S&C	--	--	--	--	8.3
CH3556X	+ROLL/-Z JET	E1	22E14-6	FIRE/OFF	ARM	EVENT	S&C	--	--	--	--	8.3
CH3557X	-ROLL/-Z JET	E1	22E10-2	FIRE/OFF	ARM	EVENT	S&C	--	--	--	--	8.3
CH3558X	+ROLL/+Y JET	E1	22E15-7	FIRE/OFF	ARM	EVENT	S&C	--	--	--	--	8.3
CH3559X	-ROLL/+Y JET	E1	22E11-3	FIRE/OFF	ARM	EVENT	S&C	--	--	--	--	8.3
CH3560X	+ROLL/-Y JET	E1	22E12-4	FIRE/OFF	ARM	EVENT	S&C	--	--	--	--	8.3
CH3561X	-ROLL/-Y JET	E1	22E16-8	FIRE/OFF	ARM	EVENT	S&C	--	--	--	--	8.3
CH3574X	TRANS CNTL +X CMD	E2	11E22-4	OFF	ON	EVENT	S&C	--	--	--	--	
CH3575X	TRANS CNTL -X CMD	E2	11E22-6	OFF	ON	EVENT	S&C	--	--	--	--	
CH3576X	TRANS CNTL +Y CMD	E2	11E22-8	OFF	ON	EVENT	S&C	--	--	--	--	
CH3577X	TRANS CNTL -Y CMD	E2	11E23-6	OFF	ON	EVENT	S&C	--	--	--	--	

TABLE 7-VII.- PCM TELEMETRY - STABILIZATION AND CONTROL SYSTEM - CONTINUED

CSM
S/C 103

MEAS I.D.	MEAS DESCRIPTION	TM	CHAN CODE	LOW	DATA RANGE HIGH	UNITS	INST BUS	SIG COND	PWR RQMTS	O. B. DISPL	SIG DIST	DWG CSM SH
CH3578X	TRANS CNTL +Z CMD	E2	11E23-8	OFF	ON	EVENT	S&C	--	--	--	--	
CH3579X	TRANS CNTL -Z CMD	E2	11E24-2	OFF	ON	EVENT	S&C	--	--	--	--	
CH3582V	SCS TVC PITCH AUTO CMD	H1	12A15	-10	+10	VDC	S&C	--	--	--	--	
CH3583V	SCS TVC YAW AUTO CMD	H1	12A13	-10	+10	VDC	S&C	--	--	--	--	
CH3585H	MTVC PITCH CMD	H1	51A11	-11.5	+11.5	DEG	S&C	--	--	--	--	
CH3586H	MTVC YAW CMD	H1	51A12	-11.5	+11.5	DEG	S&C	--	--	--	--	
CH3587H	ROT ROLL CMD	H1	51A13	-11.5	+11.5	DEG	S&C	--	--	--	--	
CH3588X	ATT DEADBAND MIN	E2	11E8-2	MAX	MIN	EVENT	S&C	--	--	--	--	8.3
CH3590X	HI RATE LIMIT	E2	11E8-4	LOW	HIGH	EVENT	S&C	--	--	--	--	8.3
CH3592X	FDAI ERR 5 RATE 5	E2	11E8-5	OFF	ON	EVENT	S&C	--	--	--	--	8.3
CH3593X	FDAI SCALE ERR 50/15	E2	11E8-6	OFF	ON	EVENT	S&C	--	--	--	--	8.3
CH3600X	ΔV CG LM/CSM	E2	11E9-3	CSM	LM/CSM	EVENT	S&C	--	--	--	--	
CH3601X	DIRECT RCS NO. 1	E2	11E24-3	OFF	ENABLE	EVENT	S&C	--	--	--	--	
CH3602X	DIRECT RCS NO. 1	E2	11E24-4	OFF	ENABLE	EVENT	S&C	--	--	--	--	
CH3604X	SPS SOL DRIVER 1	E2	11E4-4	FIRE/OFF	ARM	EVENT	S&C	--	--	--	--	8.3
CH3605X	SPS SOL DRIVER 2	E2	11E9-4	FIRE/OFF	ARM	EVENT	S&C	--	--	--	--	8.3
CH3606X	LIMIT CYCLE SWITCH	E2	11E25-1	ON	OFF	EVENT	S&C	--	--	--	--	8.3
CH3607X	S/C CNTL SCS	E2	11E9-5	CMC	SCS	EVENT	S&C	--	--	--	--	8.3
CH3609X	MANUAL ROLL ACCEL CMD	E2	11E25-7	OFF	ON	EVENT	S&C	--	--	--	--	
CH3610X	MANUAL ROLL MIN IMP CMD	E2	11E25-8	OFF	ON	EVENT	S&C	--	--	--	--	
CH3612X	MANUAL PITCH ACCEL CMD	E2	11E25-3	OFF	ON	EVENT	S&C	--	--	--	--	
CH3613X	MANUAL PITCH MIN IMP CMD	E2	11E25-4	OFF	ON	EVENT	S&C	--	--	--	--	
CH3615X	MANUAL YAW ACCEL CMD	E2	11E25-5	OFF	ON	EVENT	S&C	--	--	--	--	
CH3616X	MANUAL YAW MIN IMP CMD	E2	11E25-6	OFF	ON	EVENT	S&C	--	--	--	--	
CH3623X	GYRO 1 COMB SMRD	E2	11E8-7	LOW	NORM	EVENT	S&C	--	--	--	--	8.3
CH3624X	GYRO 2 COMB SMRD	E2	11E8-8	LOW	NORM	EVENT	S&C	--	--	--	--	8.3
CH3635X	BMAG MODE SW-ROLL ATT 1 RT 2	E1	11E33-1	OFF	ON	EVENT	VSC	AA	--	--	--	8.3
CH3636X	BMAG MODE SW-ROLL RATE 2	E1	11E33-2	OFF	ON	EVENT	VSC	AA	--	--	--	8.3

TABLE 7-VII.- PCM TELEMETRY - STABILIZATION AND CONTROL SYSTEM - CONCLUDED

CSM
S/C 103

MEAS I.D.	MEAS DESCRIPTION	TM	CHAN CODE	DATA RANGE		UNITS	INST BUS	SIG COND	PWR RQMTS	O. B. DISPL	SIG DIST	DWG CSMSH
				LOW	HIGH							
CH3638X	BMAG MODE SW-PITCH ATT 1 RT 2	E1	11E33-3	OFF	ON	EVENT	VSC	AA	--	--	--	8.3
CH3639X	BMAG MODE SW-PITCH RATE 2	E1	11E33-4	OFF	ON	EVENT	VSC	AA	--	--	--	8.3
CH3641X	BMAG MODE SW-YAW ATT 1 RT 2	E1	11E33-5	OFF	ON	EVENT	VSC	AA	--	--	--	8.3
CH3642X	BMAG MODE SW-YAW RATE 2	E1	11E33-6	OFF	ON	EVENT	VSC	AA	--	--	--	8.3
CH3666C	PITCH DIFF CLUTCH CURRENT	H1	22A4	-0.835	+0.835	AMP	S&C	--	--	--	--	
CH3667C	YAW DIFF CLUTCH CURRENT	H1	12A16	-0.835	+0.835	AMP	S&C	--	--	--	--	

TABLE 7-VIII.- PCM TELEMETRY - LIFE SYSTEM

CSM
S/C 103

MEAS I.D.	MEAS DESCRIPTION	TM	CHAN CODE	LOW	DATA RANGE HIGH	UNITS	INST BUS	SIG COND	PWR RQMTS	O. B. DISPL	SIG DIST	DWG CSMSH
CJ0060J	ASTRO 1 EKG AXIS 1	H1	22A3	0.1	5	MV	V ₂	--	150 MA	--	--	
CJ0061J	ASTRO 2 EKG AXIS 1	H1	22A3	0.1	5	MV	V ₂	--	CJ0060	--	--	
CJ0062J	ASTRO 3 EKG AXIS 1	H1	22A3	0.1	5	MV	V ₂	--	CJ0060	--	--	
CJ0200R	ASTRO 1 RESPIR	H1	51A7	-5	+5	OHMS	V ₂	--	CJ0060	--	--	
CJ0201R	ASTRO 2 RESPIR	H1	51A7	-5	+5	OHMS	V ₂	--	CJ0060	--	--	
CJ0202R	ASTRO 3 RESPIR	H1	51A7	-5	+5	OHMS	V ₂	--	CJ0060	--	--	
CJ0210X	ASTRO 1 SEL SW POS	E2	11E14-6	OFF	LH	EVENT	V ₂	--	6 MA	--	--	
CJ0211X	ASTRO 2 SEL SW POS	E2	11E14-7	OFF	CTR	EVENT	V ₂	--	6 MA	--	--	
CJ0212X	ASTRO 3 SEL SW POS	E2	11E14-8	OFF	RH	EVENT	V ₂	--	6 MA	--	--	

TABLE 7-IX.- PCM TELEMETRY - FLIGHT TECHNOLOGY

CSM
S/C 103

MEAS I.D.	MEAS DESCRIPTION	TM	CHAN CODE	DATA RANGE		UNITS	INST BUS	SIG COND	PWR RQMTS	O. B. DISPL	SIG DIST	DWG CSMSH
				LOW	HIGH							
CK0026A	CM X-AXIS ACCEL	H1	12A9	-2	+10	G	V2	--	50 MA	--	--	
CK0027A	CM Y-AXIS ACCEL	H1	12A11	-2	+2	G	V2	--	45 MA	--	--	
CK0028A	CM Z-AXIS ACCEL	H1	12A12	-2	+2	G	V2	--	45 MA	--	--	
CK1051K	DOSIMETER 1 RADIATION	H1	11A169	0	1K	RAD/H	V2	--		--	--	
CK1052K	DOSIMETER 2 RADIATION	H1	11A16	0	1K	RAD/H	V2	--		--	--	
CK1053R	DOSIMETER RATE	H1	10A149	0	5	VDC	V2	--		--	--	

TABLE 7-X.- PCM TELEMETRY - SCIENTIFIC EQUIPMENT

CSM
S/C 103

MEAS I.D.	MEAS DESCRIPTION	TM	CHAN CODE	DATA RANGE LOW HIGH	UNITS	INST BUS	SIG COND	PWR RQMTS	O. B. DISPL	SIG DIST	DWG CSMSH
SL1001U	SCI EXP NO. 1	H2	10A108								
SL1002U	SCI EXP NO. 2	H2	10A111								
SL1003U	SCI EXP NO. 3	H1	10A104								
SL1004U	SCI EXP NO. 4	H1	10A106								
SL1005U	SCI EXP NO. 5	H1	10A107								
SL1006U	SCI EXP NO. 6	H1	10A109								
SL1007U	SCI EXP NO. 7	H1	10A110								
SL1008U	SCI EXP NO. 8	H1	10A112								
SL1009U	SCI EXP NO. 9	H1	10A113								
SL1010U	SCI EXP NO. 10	H1	10A115								
SL1011U	SCI EXP NO. 11	H1	10A116								
SL1012U	SCI EXP NO. 12	H1	10A118								
SL1013U	SCI EXP NO. 13	H1	10A119								
SL1014U	SCI EXP NO. 14	H1	10A121								
SL1015U	SCI EXP NO. 15	H1	10A122								
SL1016U	SCI EXP NO. 16	D2	11D16								
SL1017U	SCI EXP NO. 17	D2	11D3								
SL1018U	SCI EXP NO. 18	D2	11D5								
SL1019U	SCI EXP NO. 19	D2	11D6								
SL1020U	SCI EXP NO. 20	D2	11D7								
SL1021U	SCI EXP NO. 21	D2	11D10								
SL1022U	SCI EXP NO. 22	D2	11D11								
SL1023U	SCI EXP NO. 23	D2	11D12								
SL1024U	SCI EXP NO. 24	D2	11D17								
SL1025U	SCI EXP NO. 25	D2	11D18								

TABLE 7-XI.- PCM TELEMETRY - SERVICE PROPULSION SYSTEM

CSM
S/C 103

MEAS I.D.	MEAS DESCRIPTION	TM	CHAN CODE	DATA RANGE		UNITS	INST BUS	SIG COND	PWR RQMTS	O. B. DISPL	SIG DIST	DWG CSM SH
				LOW	HIGH							
SP0001P	HE TK PRESS	H2	11A10	0	5K	PSIA	V3S	--	56 MA	--	--	9.1
SP0002T	HE TK TEMP	H1	10A16	-100	+200	DEG F	V4S	--	56 MA	--	--	9.1
SP0003P	OX TK PRESS	H2	11A11	0	250	PSIA	V3S	--	56 MA	M*	CS	9.1
SP0006P	FU TK PRESS	H2	11A12	0	250	PSIA	V4S	--	56 MA	M*	CS	9.1
SP0022H	FU/OX VLV 1 POS	H1	11A31	0	90	DEG	V3S	--	--	--	--	9.1
SP0023H	FU/OX VLV 2 POS	H1	11A32	0	90	DEG	V4S	--	--	--	--	9.1
SP0024H	FU/OX VLV 3 POS	H1	11A33	0	90	DEG	V3S	--	--	--	--	9.1
SP0025H	FU/OX VLV 4 POS	H1	11A34	0	90	DEG	V4S	--	--	--	--	9.1
SP0045T	SPS VLV BODY TEMP	H1	10A37	0	+200	DEG F	V4S	--	56 MA	--	--	9.1
SP0048T	SPS FU FEED LINE TEMP	H2	10A117	0	+200	DEG F	V3S	--	56 MA	M	CS	9.1
SP0049T	SPS OX FEED LINE TEMP	H2	10A120	0	+200	DEG F	V4S	--	56 MA	SM	CS	9.1
SP0054T	OX LINE 1 TEMP	H1	10A44	0	+200	DEG F	V3S	--	56 MA	--	--	9.1
SP0057T	FU LINE 1 TEMP	H1	10A59	0	+200	DEG F	V4S	--	56 MA	--	--	9.1
SP0061T	SPS INJECTOR FLANGE TEMP 1	H1	10A47	0	+500	DEG F	V5C	DBA	--	L*	CS	9.1
SP0062T	SPS INJECTOR FLANGE TEMP 2	H1	10A49	0	+500	DEG F	V5C	DBA	--	L*	CS	9.1
SP0600P	SPS VLV ACT PRESS PRI	H1	10A10	0	5K	PSIA	V3S	--	56 MA	SM	CS	9.1
SP0601P	SPS VLV ACT PRESS SEC	H1	10A11	0	5K	PSIA	V4S	--	56 MA	SM	CS	9.1
SP0655Q	OX TK 1 QTY -TOTAL AUX	H1	10A26	0	50	PCT	SPS	--	--	--	--	9.2
SP0656Q	OX TK 2 QTY	H1	10A28	0	60	PCT	SPS	--	--	--	--	9.2
SP0657Q	FU TK 1 QTY-TOTAL AUX	H1	10A29	0	50	PCT	SPS	--	--	--	--	9.2
SP0658Q	FU TK 2 QTY	H1	10A31	0	60	PCT	SPS	--	--	--	--	9.2
SP0661P	ENG CHAMBER PRESS	H1	12A14	0	150	PSIA	V3S	--	56 MA	SM	CS	9.1
SP0930P	FUEL SM/ENG INTERFACE P	H1	11A152	0	300	PSIA	V3S	--	56 MA	--	--	9.1
SP0931P	OX SM/ENG INTERFACE P	H1	11A161	0	300	PSIA	V4S	--	56 MA	--	--	9.1

TABLE 7-XII.-- PCM TELEMETRY - REACTION CONTROL SYSTEM

CSM
S/C 103

MEAS I.D.	MEAS DESCRIPTION	TM	CHAN CODE	DATA RANGE LOW HIGH	UNITS	INST BUS	SIG COND	PWR RQMTS	O. B. DISPL	SIG DIST	DWG CSM SH
CR0001P	CM HE TK A PRESS	H2	10A18	0 5K	PSIA	V1	--	56 MA	SM	CS	10.2
CR0002P	CM HE TK B PRESS	H2	10A21	0 5K	PSIA	V2	--	56 MA	SM	CS	10.2
CR0003T	CM HE TK A TEMP	H1	10A103	0 300	DEG F	V1	--	56 MA	SM	CS	10.2
CR0004T	CM HE TK B TEMP	H1	10A148	0 300	DEG F	V2	--	56 MA	SM	CS	10.2
CR0005P	CM FU TK A PRESS	H2	11A13	0 400	PSIA	V1	--	56 MA	SM**	CS	10.2
CR0006P	CM FU TK B PRESS	H2	11A21	0 400	PSIA	V2	--	56 MA	SM**	CS	10.2
CR0011P	CM OX TK A PRESS	H2	11A22	0 400	PSIA	V1	--	56 MA	SM**	CS	10.2
CR0012P	CM OX TK B PRESS	H2	11A55	0 400	PSIA	V2	--	56 MA	SM**	CS	10.2
SR5001P	SM HE TK A PRESS	H2	10A24	0 5K	PSIA	V3S	--	56 MA	SM	CS	10.1
SR5002P	SM HE TK B PRESS	H2	10A27	0 5K	PSIA	V4S	--	56 MA	SM	CS	10.1
SR5003P	SM HE TK C PRESS	H2	10A30	0 5K	PSIA	V3S	--	56 MA	SM	CS	10.1
SR5004P	SM HE TK D PRESS	H2	10A33	0 5K	PSIA	V4S	--	56 MA	SM	CS	10.1
SR5013T	SM HE TK A TEMP	H2	11A163	0 +100	DEG F	V3S	--	56 MA	SM	CS	10.1
SR5014T	SM HE TK B TEMP	H2	11A164	0 +100	DEG F	V4S	--	56 MA	SM	CS	10.1
SR5015T	SM HE TK C TEMP	H2	11A165	0 +100	DEG F	V3S	--	56 MA	SM	CS	10.1
SR5016T	SM HE TK D TEMP	H2	11A166	0 +100	DEG F	V4S	--	56 MA	SM	CS	10.1
SR5025U	SM HE PRESS/TEMP RATIO A	H2	10A93	0 100	PCT	V3S	--	56 MA	SM	CS	10.1
SR5026U	SM HE PRESS/TEMP RATIO B	H2	10A99	0 100	PCT	V4S	--	56 MA	SM	CS	10.1
SR5027U	SM HE PRESS/TEMP RATIO C	H2	10A102	0 100	PCT	V3S	--	56 MA	SM	CS	10.1
SR5028U	SM HE PRESS/TEMP RATIO D	H2	10A105	0 100	PCT	V4S	--	56 MA	SM	CS	10.1
SR5065T	SM ENG PACKAGE A TEMP	H1	10A136	0 +300	DEG F	V3S	--	56 MA	SM**	CS	10.1
SR5066T	SM ENG PACKAGE B TEMP	H1	10A17	0 +300	DEG F	V4S	--	56 MA	SM**	CS	10.1
SR5067T	SM ENG PACKAGE C TEMP	H1	10A19	0 +300	DEG F	V3S	--	56 MA	SM**	CS	10.1
SR5068T	SM ENG PACKAGE D TEMP	H1	10A20	0 +300	DEG F	V4S	--	56 MA	SM**	CS	10.1
SR5729P	SM HE MANF A PRESS	H2	11A39	0 400	PSIA	V3S	--	56 MA	SM**	CS	10.1
SR5733P	SM OX MANF A PRESS	H2	11A91	0 300	PSIA	V3S	--	56 MA	--	--	10.1
SR5737P	SM FU MANF A PRESS	H2	11A92	0 300	PSIA	V3S	--	56 MA	--	--	10.1

TABLE 7-XII.- PCM TELEMETRY - REACTION CONTROL SYSTEM

CSM
S/C 103

MEAS I.D.	MEAS DESCRIPTION	TM	CHAN CODE	DATA RANGE		UNITS	INST BUS	SIG COND	PWR RQMTS	O. B. DISPL	SIG DIST	DWG CSMSH
				LOW	HIGH							
SR5776P	SM HE MANF B PRESS	H2	11A40	0	400	PSIA	V _{4S}	--	56 MA	SM*	CS	10.1
SR5780P	SM OX MANF B PRESS	H2	11A93	0	300	PSIA	V _{4S}	--	56 MA	--	--	10.1
SR5784P	SM FU MANF B PRESS	H2	11A94	0	300	PSIA	V _{4S}	--	56 MA	--	--	10.1
SR5817P	SM HE MANF C PRESS	H2	11A46	0	400	PSIA	V _{3S}	--	56 MA	SM*	CS	10.1
SR5820P	SM OX MANF C PRESS	H2	11A109	0	300	PSIA	V _{3S}	--	56 MA	--	--	10.1
SR5821P	SM OX MANF D PRESS	H2	11A110	0	300	PSIA	V _{4S}	--	56 MA	--	--	10.1
SR5822P	SM FU MANF C PRESS	H2	11A111	0	300	PSIA	V _{3S}	--	56 MA	--	--	10.1
SR5823P	SM FU MANF D PRESS	H2	11A112	0	300	PSIA	V _{4S}	--	56 MA	--	--	10.1
SR5830P	SM HE MANF D PRESS	H2	11A130	0	400	PSIA	V _{4S}	--	56 MA	SM*	CS	10.1

TABLE 7-XIII.- PCM TELEMETRY - CREW SAFETY SYSTEM

CSM
S/C 103

MEAS I.D.	MEAS DESCRIPTION	TM	CHAN CODE	DATA RANGE LOW HIGH	UNITS	INST BUS	SIG COND	PWR RQMTS	O. B. DISPL	SIG DIST	DWG CSM SH
BS0080X	SM EDS ABORT REQUEST A	E2	11E4-5	NORM	ABORT	EVENT	V _{SC}	AA	--	L	TSC 2.3, 6.6
BS0081X	SM EDS ABORT REQUEST B	E2	11E4-3	NORM	ABORT	EVENT	V _{SC}	AA	--	L	TSC 2.3, 6.6
CS0100X	CM/SM SEP A	E2	11E4-2	SEP/OFF	NO SEP	EVENT	V ₂ &V _{SC}	AA	100 MA	--	-- 2.4
SS0140X	SLA/SM SEP A	E2	11E4-7	SEP/OFF	NO SEP	EVENT	V _{3S} &V _{SC}	AA	100 MA	--	-- 2.4
CS0150X	MASTER CAUTION WARNING ON	E2	11E4-6	WARN/OFF	NORM	EVENT	V _{SC}	AA	--	L*	TSC 7.3
LS0200H	ANGLE OF ATTACK	H1	11A51	0	+5	VDC	EDS	--	--	SM	CS
CS0220T	DOCKING PROBE TEMP	H1	10A22	-100	+300	DEG F	V ₂	--	56 MA	--	--

TABLE 7-XIV.--PCM TELEMETRY - COMMUNICATION AND INSTRUMENTATION

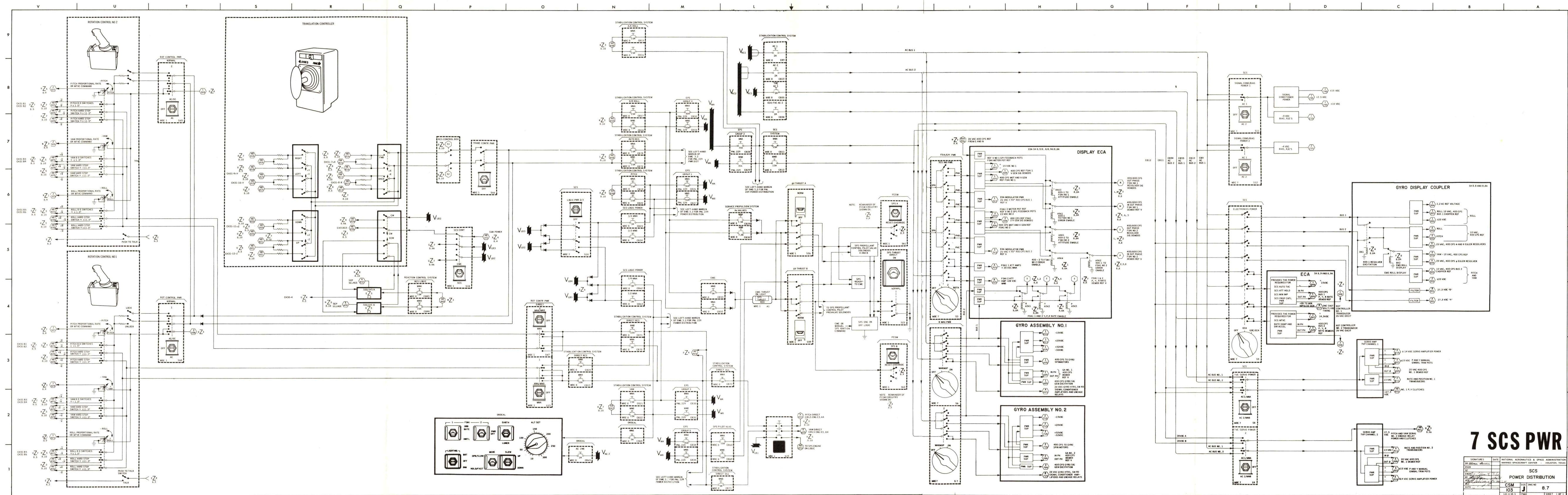
CSM
S/C 103

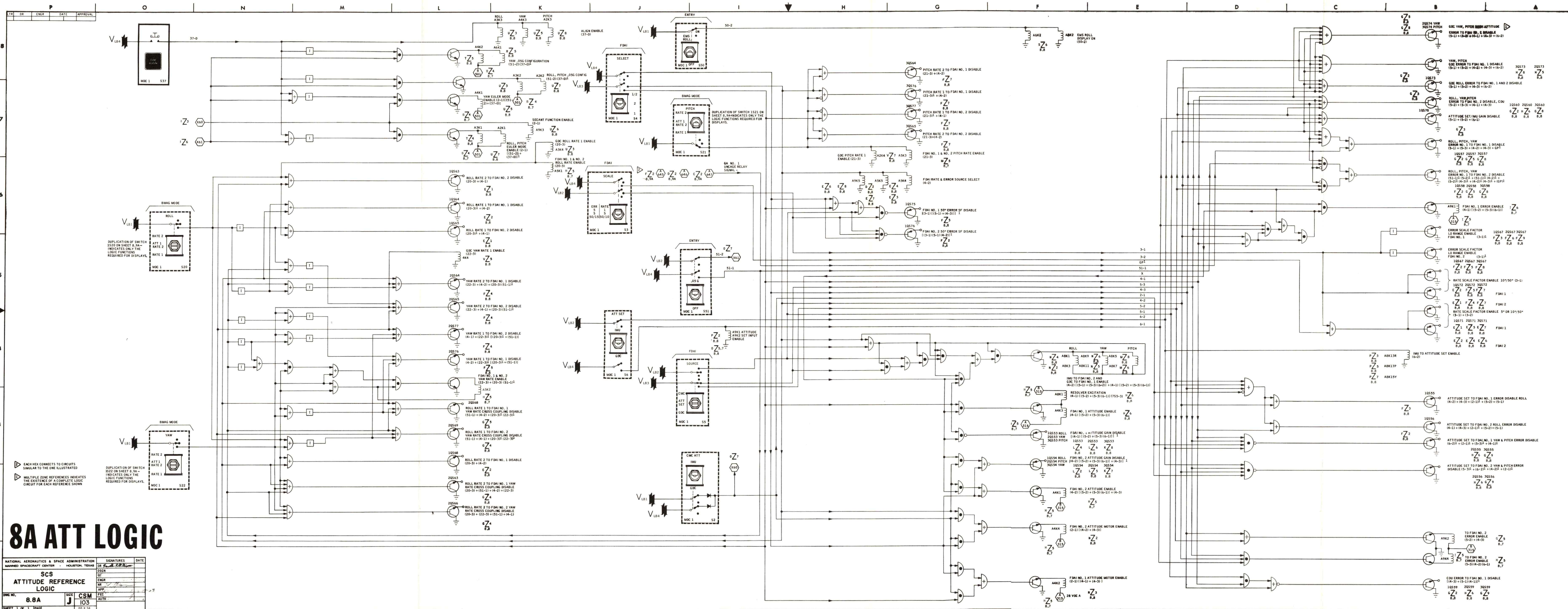
MEAS I.D.	MEAS DESCRIPTION	TM	CHAN CODE	DATA RANGE		UNITS	INST BUS	SIG COND	PWR RQMTS	O. B. DISPL	SIG DIST	DWG CSM SH
CT0012X	DSE TAPE MOTION	E2	11E14-5		MOTION	EVENT	DSE	--	--	--	--	7.1
CT0015V	SCE POS SUPPLY VOLTS	H2	11A148	0	+30	VDC	SCE	--	--	--	--	7.1
CT0016V	SCE NEG SUPPLY VOLTS	H2	11A154	0	-30	VDC	SCE	--	--	--	--	7.1
CT0017V	SENSOR EXCITATION 5 VOLTS	H2	11A119	0	+9	VDC	SCE	--	--	--	--	7.1
CT0018V	SENSOR EXCITATION 10 VOLTS	H2	11A120	0	+15	VDC	SCE	--	--	--	--	7.1
CT0120X	PCM BIT RATE CHANGE 8-BIT	D2	--				PCM	--	--	--	--	7.1
CT0125V	PCM HI LEVEL 85 PCT REF	H2	11A48	0	+5	VDC	PCM	--	--	--	--	7.1
CT0126V	PCM HI LEVEL 15 PCT REF	H2	11A49	0	+1.0	VDC	PCM	--	--	--	--	7.1
CT0145F	CTE TIME FROM LAUNCH 32-BIT	D2	11D2				CTE	--	--	--	--	7.1
CT0262V	UDL VALIDITY SIG 4-BIT	D2	51D				UDL	--	--	--	--	6.6
CT0340X	PCM SYNC SOURCE EXT OR INT	E1	11E32-3	INT	EXT	EVENT	PCM	--	--	--	--	7.1
CT0620E	USB RCVR AGC VOLTAGE	H2	11A121	-130	-50	DBM	S-BND	--	--	M	SS	6.2
CT0640F	USB RCVR PHASE ERR	H1	11A50	-90K	+90K	HZ	S-BND	--	--	--	--	6.2
ST0820K	PROTON CT RATE CHAN 1	H1	11A17	1	100K	C/S	V3S	--	--	--	--	
ST0821K	PROTON CT RATE CHAN 2	H1	11A18	0.1	10K	C/S	V3S	--	--	--	--	
ST0822K	PROTON CT RATE CHAN 3	H1	11A19	0.1	10K	C/S	V3S	--	--	--	--	
ST0823K	PROTON CT RATE CHAN 4	H1	11A20	0.1	10K	C/S	V3S	--	--	--	--	
ST0830K	ALPHA CT RATE CHAN 1	H1	11A38	0.1	10K	C/S	V3S	--	--	--	--	
ST0831K	ALPHA CT RATE CHAN 2	H1	11A41	0.1	10K	C/S	V3S	--	--	--	--	
ST0832K	ALPHA CT RATE CHAN 3	H1	11A42	0.1	10K	C/S	V3S	--	--	--	--	
ST0838K	PROTON INTEG CT RATE	H1	11A43	1	100K	C/S	V3S	--	--	--	--	
ST0840T	NUCLEAR PARTICLE DET TEMP	H1	10A61	-109	+140	DEG F	V4S	--	--	--	--	
ST0841T	NUCLEAR PARTICLE ANAL TEMP	H1	10A62	-109	+140	DEG F	V4S	--	--	--	--	

*

SCS SIGNAL AND POWER CODE

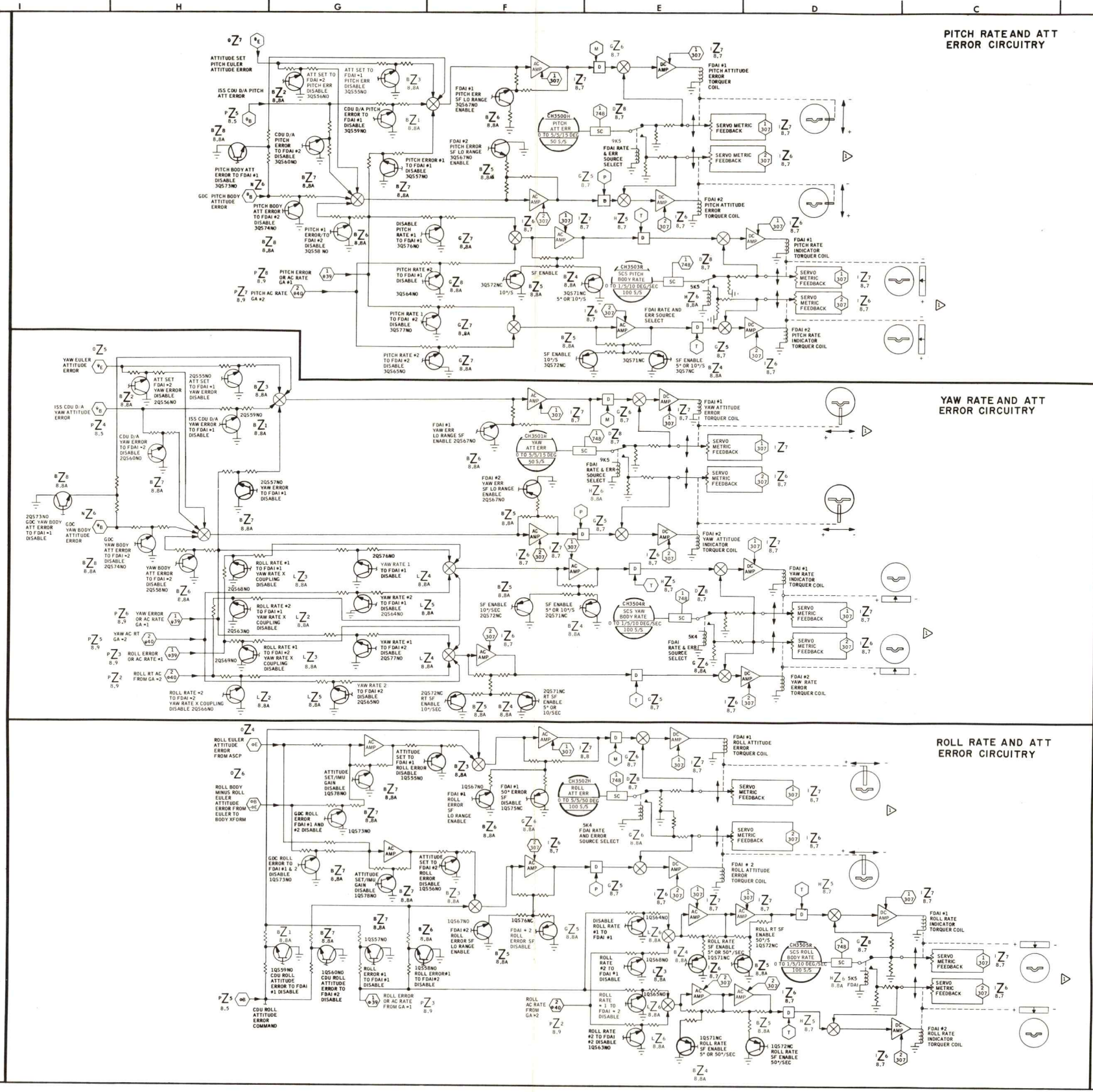
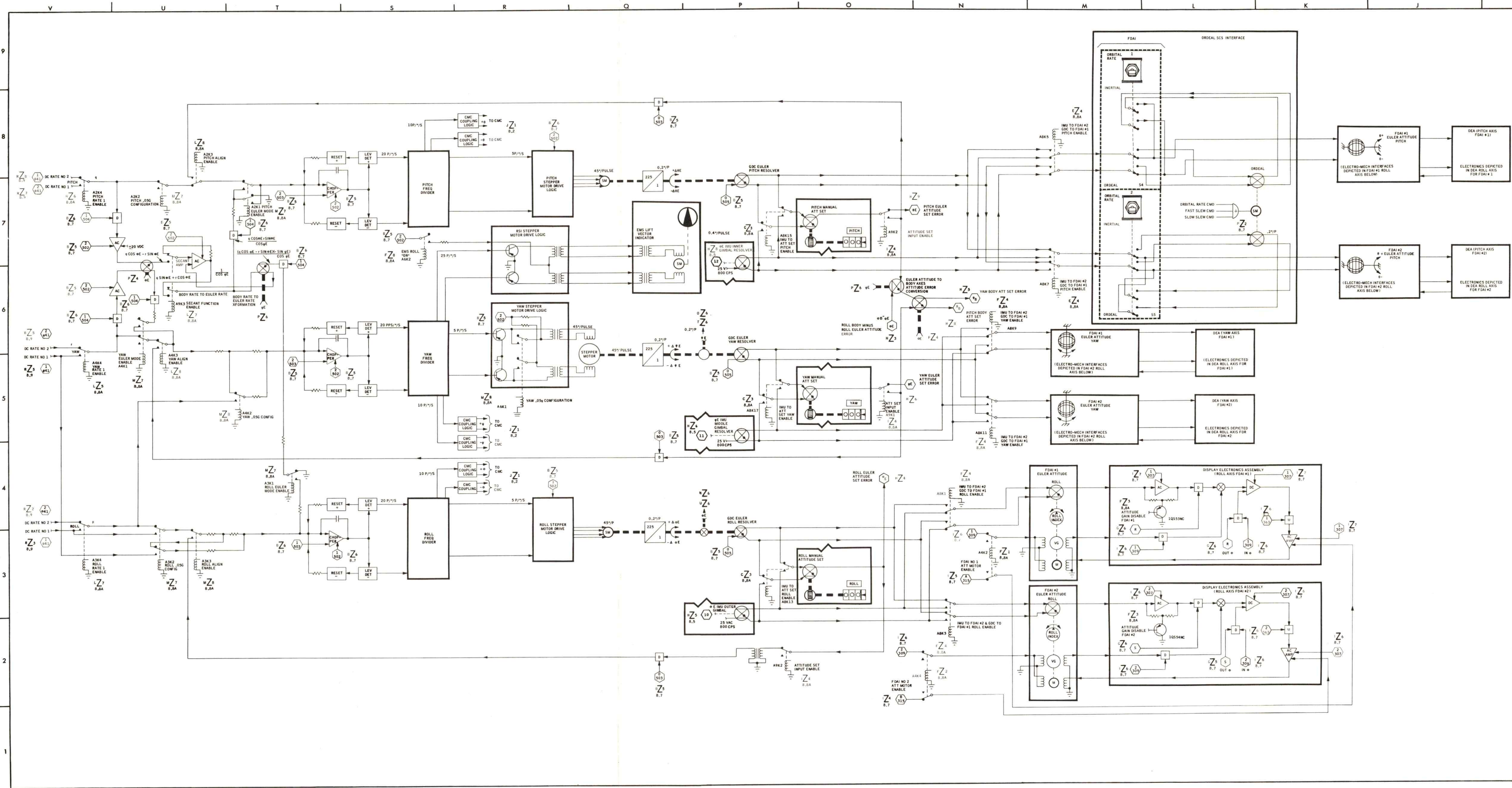
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01	27.5 VDC	37	SCS CONTROL MODE
02	+20 VDC	38	RCS ERROR
03	10 VAC	39	GA1 AC RATE OR ATTITUDE ERROR
04	2.2 KHz	40	GA2 AC RATE
05	25 VAC	41	DC RATE
06	+15 VDC	42	ENGINE ON WITH 1 SECOND DELAYED OFF
07	+14.5 VDC	43	ENGINE ON/OFF 1 SECOND DELAY
08	400 Hz SPIN MOTOR POWER	44	MODE SELECTED SCS
09	26 VAC 400 Hz REFERENCE	45	PITCH GYRO UNCAGE
10	14 VDC	46	YAW GYRO UNCAGE
11	13 VDC	47	ROLL GYRO UNCAGE
12	-15 VDC	48	SIG COND POWER +15.0, -2.5 & -10 VDC
13	+20 VDC	49	115 V 400 Hz PHASE A
14	+32 VDC	50	MODE SELECTED CMC
15	28 VDC	51	PITCH AUTO CNTL DISABLE
M	400 Hz 26 V BUS 1 SWITCH 3 OR 800 Hz 0 PHASE IMU	52	YAW AUTO CNTL DISABLE
N	400 Hz 26 VAC BUS 2 SWITCH 3 OR 800 Hz 0 PHASE IMU	53	ROLL AUTO CNTL DISABLE
P	400 Hz 26 VAC BUS 2 SWITCH 3 OR 400 Hz 26 VAC BUS 1 SWITCH 6 OR 800 Hz 0 PHASE IMU	54	PITCH ACCEL CMD ENABLE
16	+X TRANSLATION	55	YAW ACCEL CMD ENABLE
17	-X TRANSLATION	56	ROLL ACCEL CMD ENABLE
18	+Y TRANSLATION	57	DIRECT ULLAGE PITCH JETS
19	-Y TRANSLATION	58	DIRECT ULLAGE YAW JETS
20	+Z TRANSLATION	59	.05g OFF
21	-Z TRANSLATION	60	GDC EULER
22	PITCH RATE COMMAND	61	.05g ON
23	YAW RATE COMMAND	R	400/800 CPS OUT PHASE FDAI #1 RESOL- VER SIG DEMOD
24	ROLL RATE COMMAND	S	400/800 CPS OUT PHASE FDAI #2 RESOL- VER SIG DEMOD
25	PITCH MIN IMP	T	FDAI 1 & 2 PYR RATE DEMOD REF VOLTAGE
26	YAW MIN IMP	62	115 V 400 Hz
27	ROLL MIN IMP	63	26 VAC <90°, 400 Hz REACTION
28	PITCH DIRECT	64	A/C ROLL ENGINE POWER CB15 & CB16 MDC 8
29	YAW DIRECT	65	B/D ROLL REACTION ENGINE POWER CB17 & CB18 MDC 8
30	ROLL DIRECT	66	PITCH REACTION ENGINE POWER CB19 & CB20 MDC 8
31	SCS LOGIC BUS 1	67	YAW REACTION ENGINE POWER CB21 & CB22 MDC 8
32	SCS LOGIC BUS 2	68	REACTION ENGINE SOLENOID DRIVER ENABLE POWER CB74 & CB75 MDC 8 (AUTO RCS)
33	SCS LOGIC BUS 3	69	RCS LOGIC POWER FROM CB34 & CB35 PNL 229
34	SCS LOGIC BUS 4		
35	-4 VDC		
36	TRANSLATION CONTROL CLOCKWISE		





8A ATT LOGIC

NATIONAL AERONAUTICS & SPACE ADMINISTRATION MANHATTAN SPACECRAFT CENTER • HOUSTON, TEXAS		SIGNATURES		DATE
SCS ATTITUDE REFERENCE LOGIC		DR <i>W. B. R. H. M.</i>		
		DSSN		
		QC		
		ENGR		
		NR		
DWG NO.	8.8A	SIZE	J	CSM 103
SHEET 1 OF 1 PAGE		APPROVED		
		FEC		
		AUTH		



8 ATT REF

NOTE: ALL POLARITIES INDICATE VEHICLE DYNAMICS AND ARE NOT REQUIRED TO BE THE SAME.

ROLL RATE AND ATTITUDE ERROR CIRCUITRY

YAW RATE AND ATTITUDE ERROR CIRCUITRY

PITCH RATE AND ATTITUDE ERROR CIRCUITRY

CSM 103 J 8.8

DATE: 12/1/75

BY: [Signature]

FOR: [Signature]

APPROVED: [Signature]

REVIEWED: [Signature]

DESIGNED: [Signature]

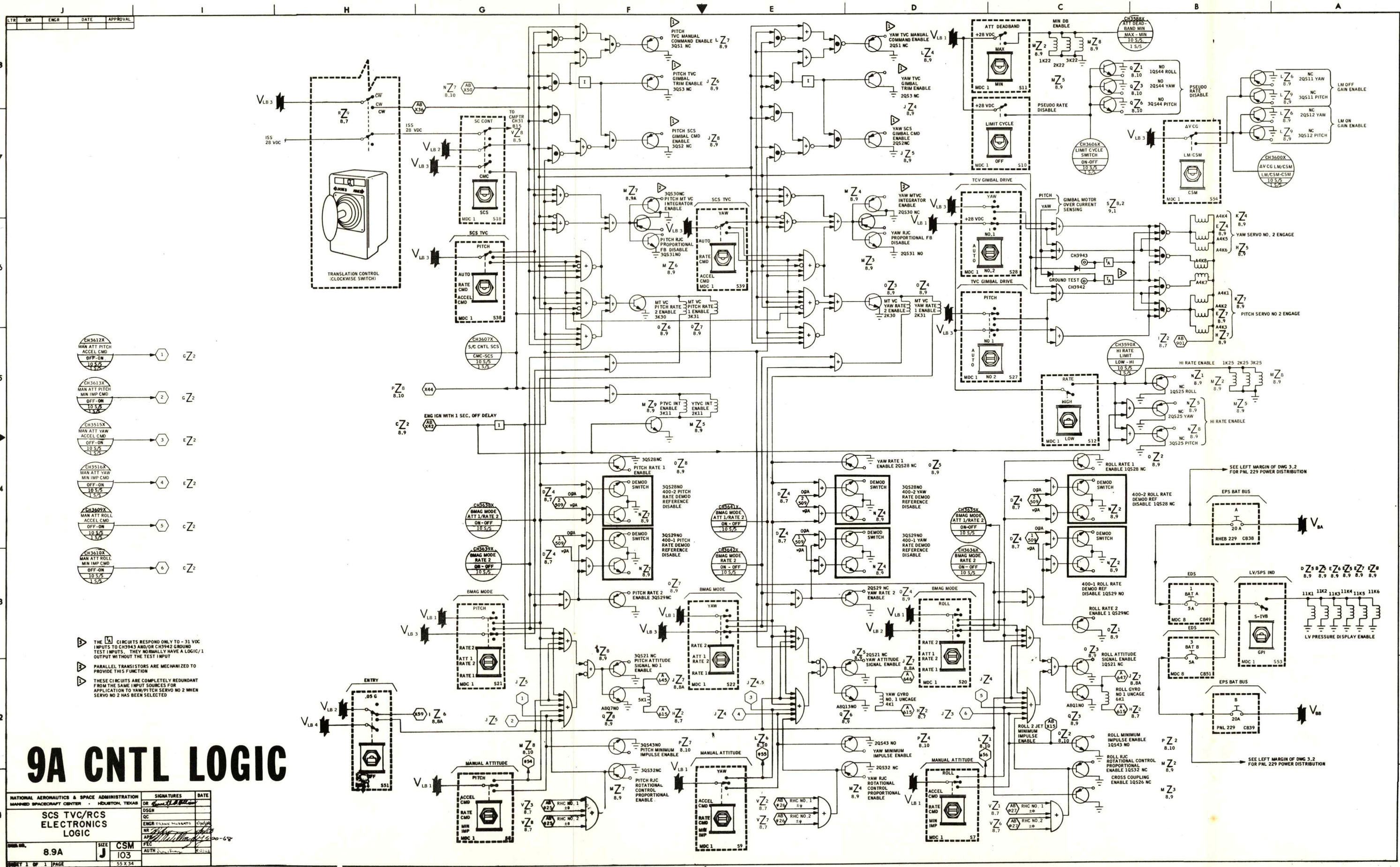
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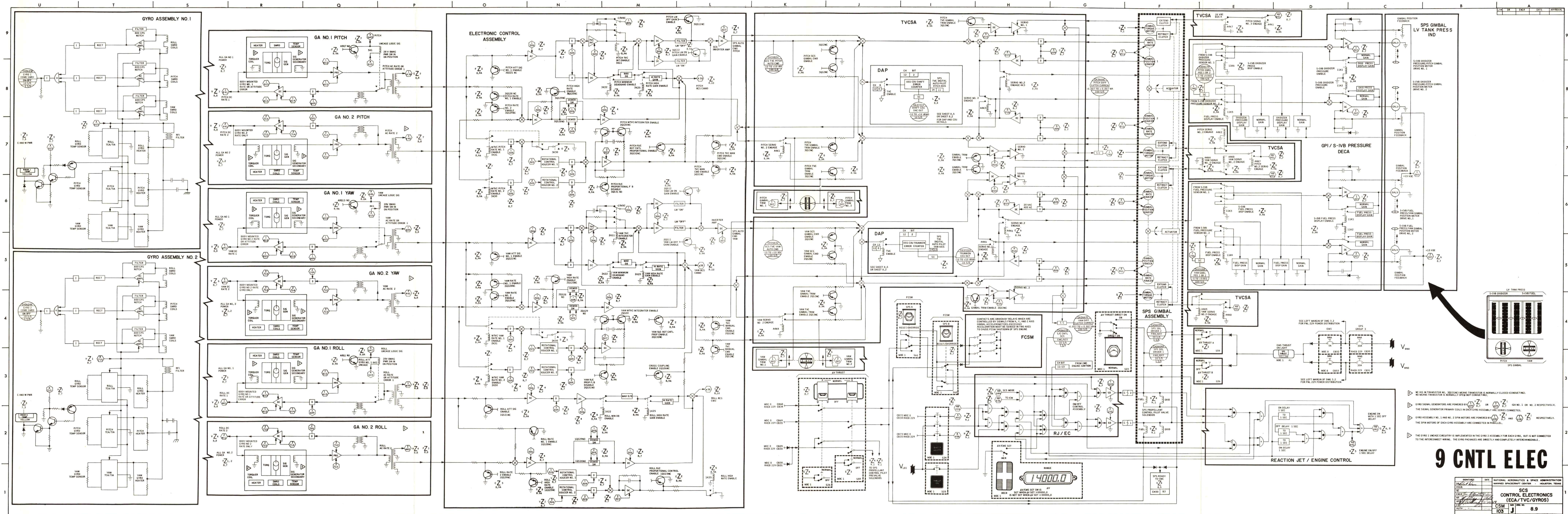
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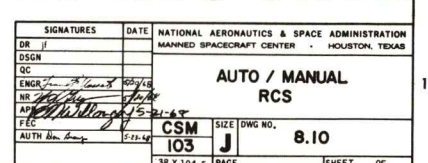
9A CNTL LOGIC

NATIONAL AERONAUTICS & SPACE ADMINISTRATION		SIGNATURES		DATE	
MANAGED SPACECRAFT CENTER		DR <i>James H. Bell</i>			
SCS TVC/RCS ELECTRONICS LOGIC		DSGN			
		QC			
		ENGR <i>FRANK M. BARTO</i>		<i>8/2/60</i>	
		NIP			
		APR <i>W. H. Thompson</i>		<i>8/2/60</i>	
8.9A		AUTH <i>James H. Bell</i>		<i>8/2/60</i>	
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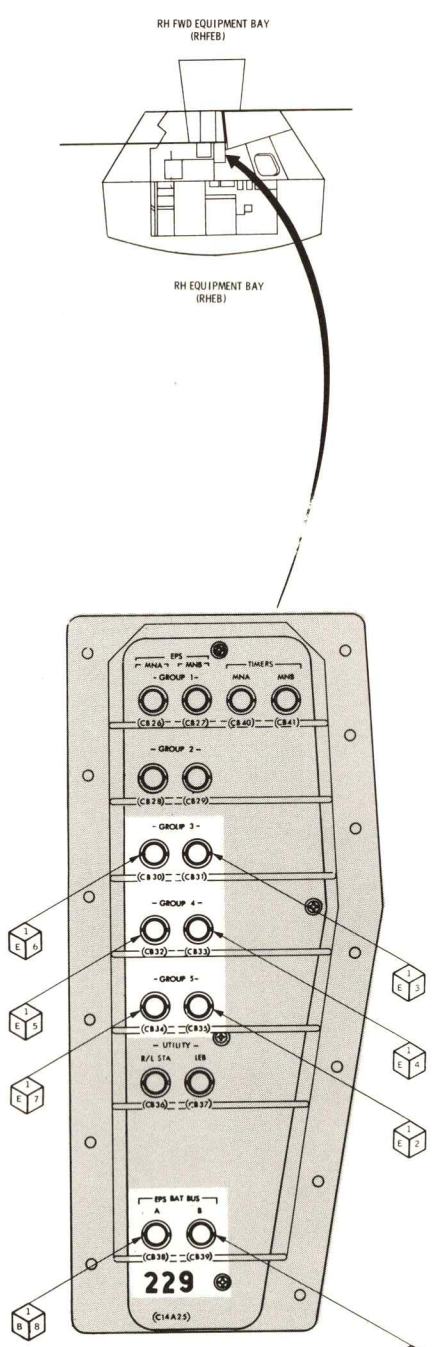
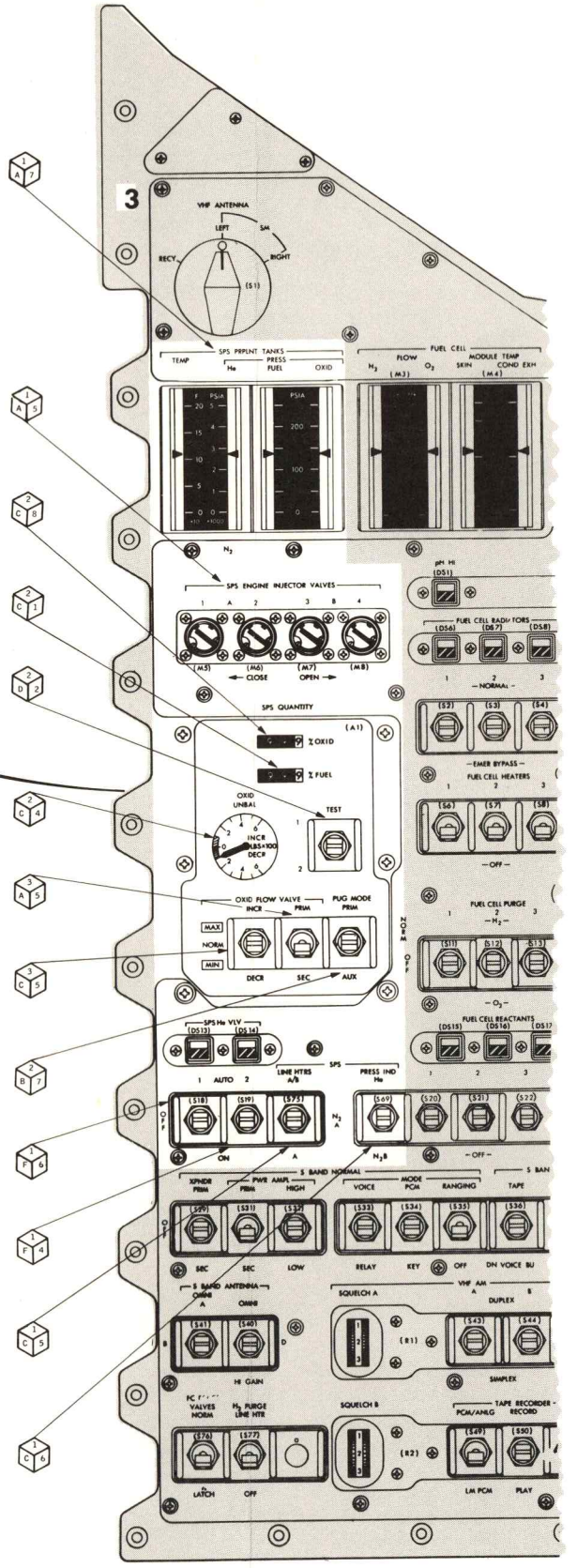
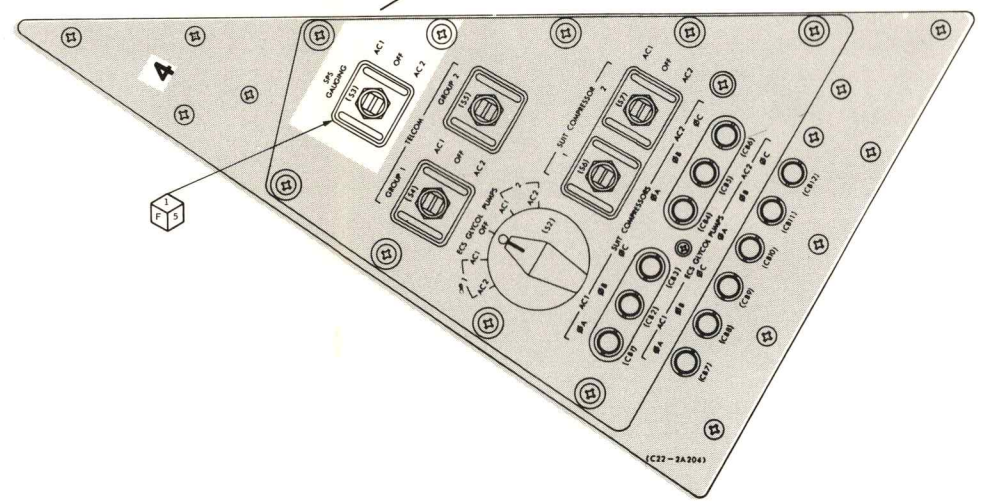
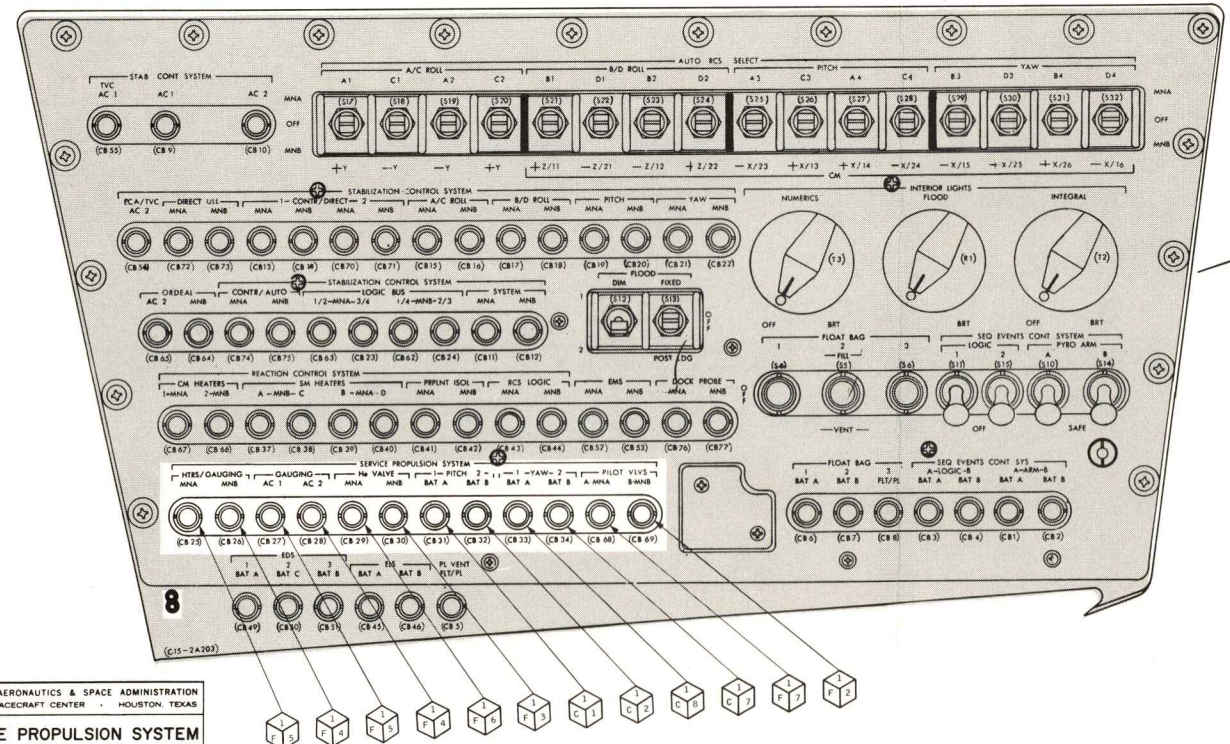
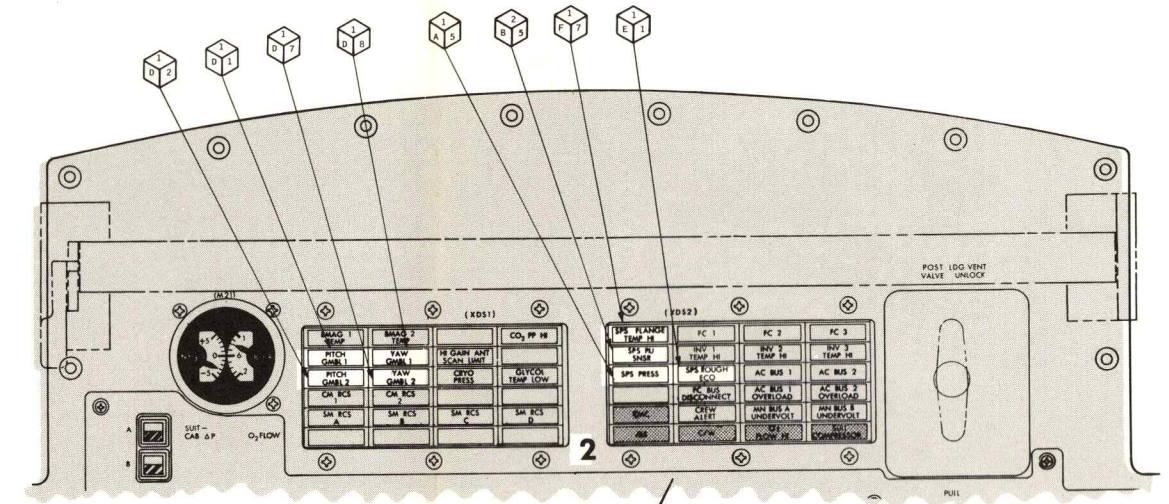
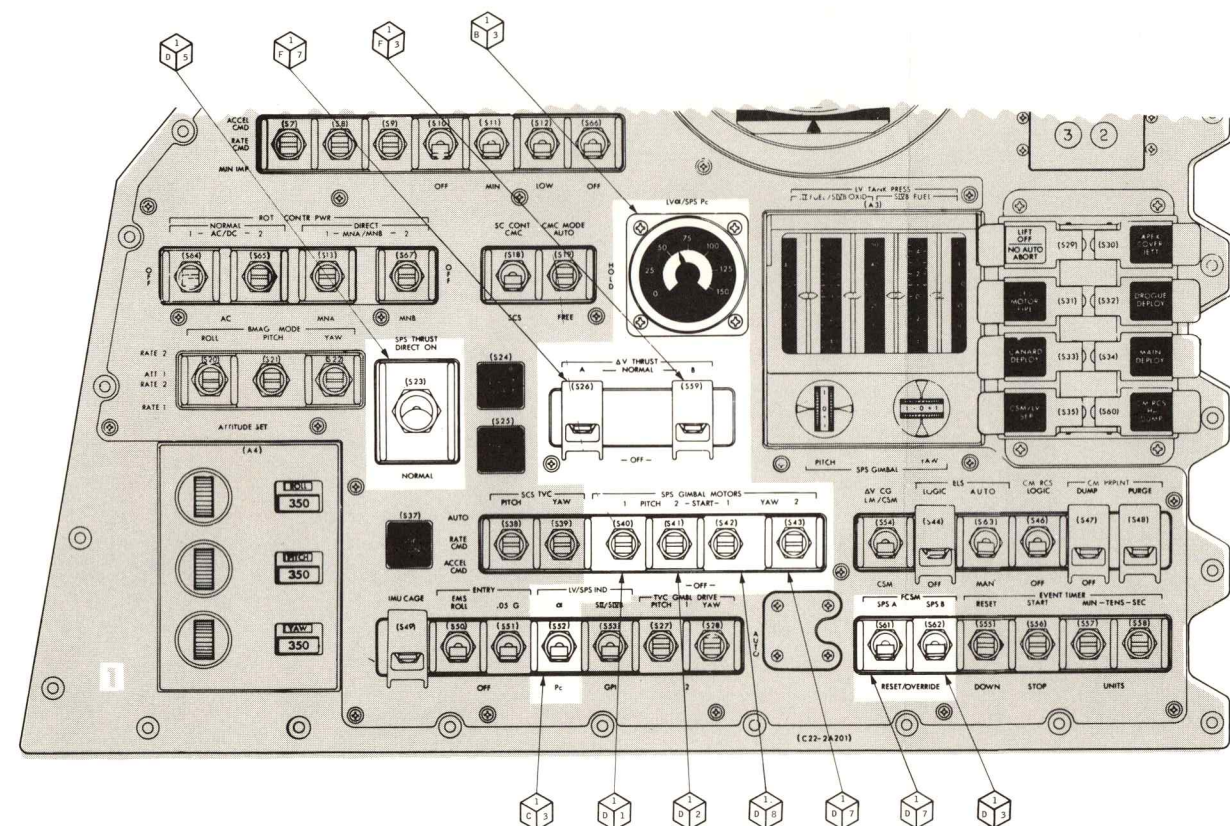


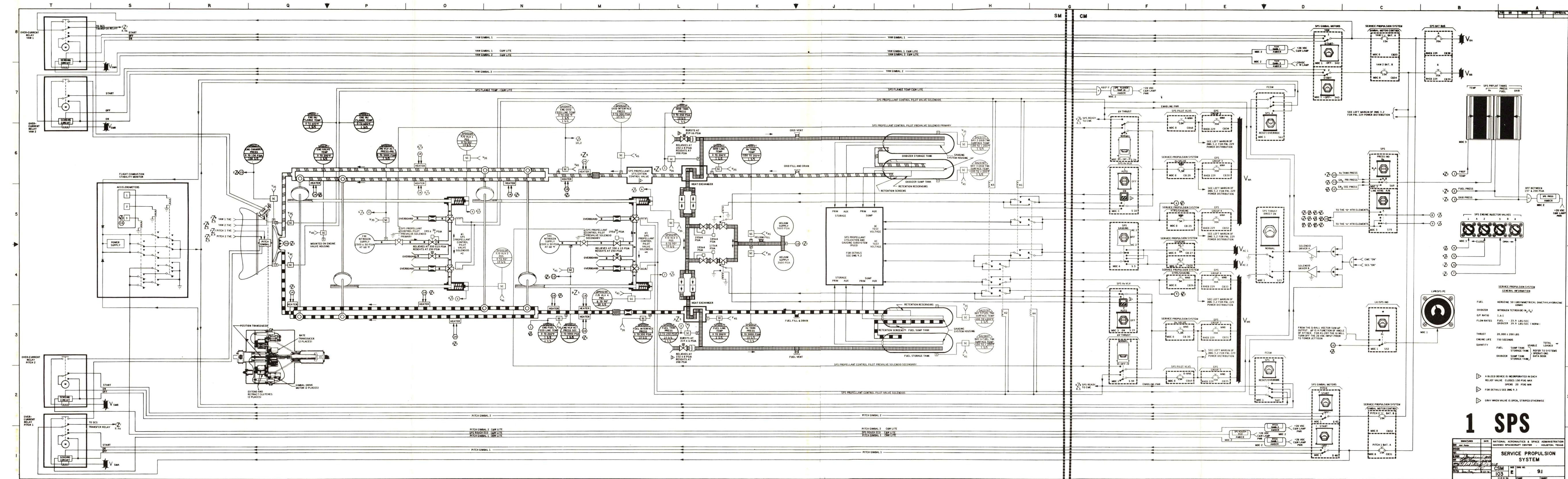
9 CNTL ELEC

REVISED	DATE	BY	REASON
1	11-13-68	W. J. H.	INITIAL DESIGN
2	1-15-69	W. J. H.	REVISIONS
3	1-15-69	W. J. H.	REVISIONS
4	1-15-69	W. J. H.	REVISIONS
5	1-15-69	W. J. H.	REVISIONS
6	1-15-69	W. J. H.	REVISIONS
7	1-15-69	W. J. H.	REVISIONS
8	1-15-69	W. J. H.	REVISIONS
9	1-15-69	W. J. H.	REVISIONS
10	1-15-69	W. J. H.	REVISIONS



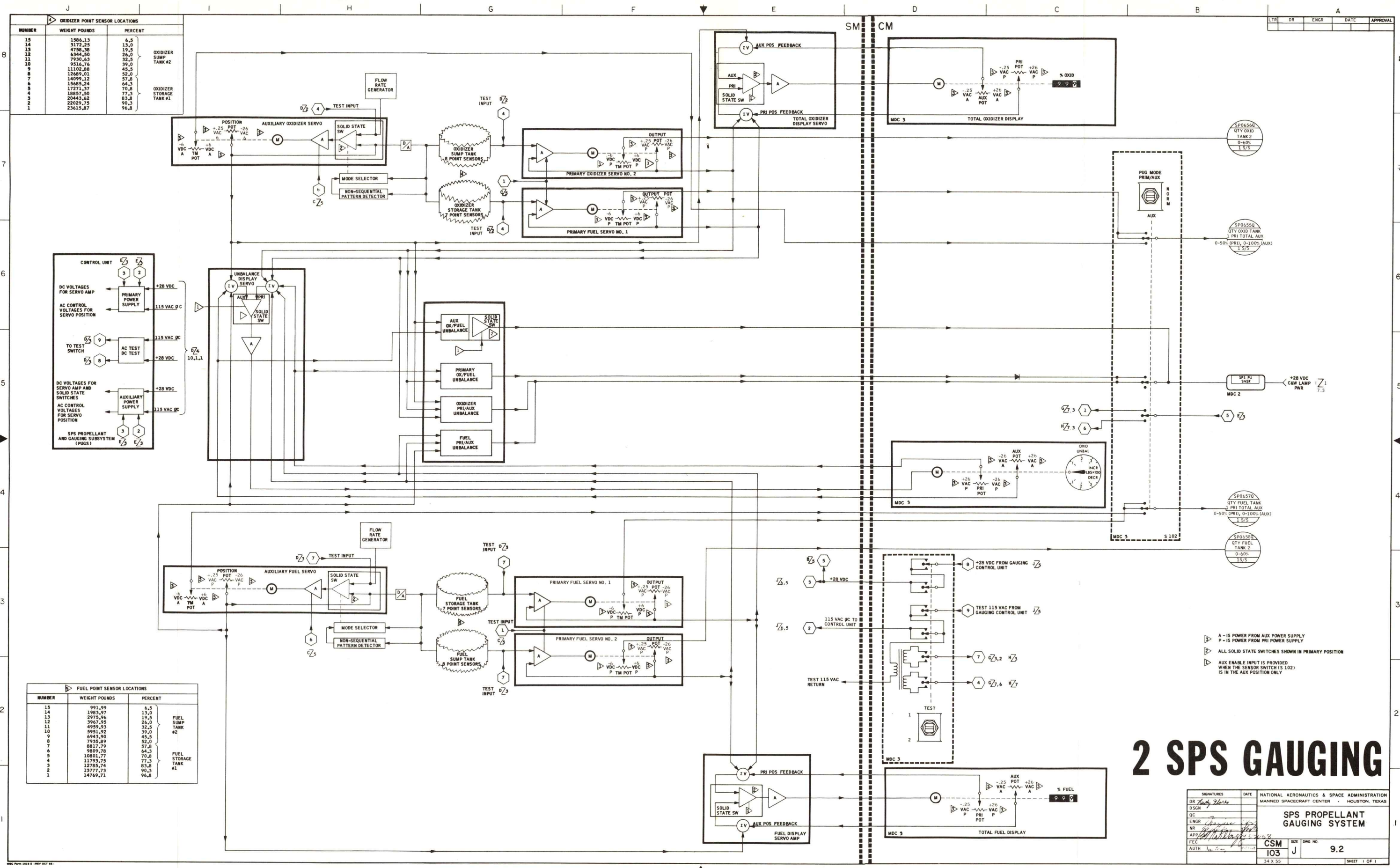
9 SERVICE
PROPULSION
SYSTEM





1 SPS

SIGNATURES		DATE		NATIONAL AERONAUTICS & SPACE ADMINISTRATION MANNED SPACECRAFT CENTER - HOUSTON, TEXAS	
DR <i>Alan Rutherford</i>				SERVICE PROPULSION SYSTEM	
GSC					
SC					
E-MAIL <i>Alan Rutherford</i>					
TELEPHONE <i>281-463-1234</i>					
APPROVAL <i>Alan Rutherford</i>		DATE <i>2-11-74</i>		CSM 103 SIZE E 9.1	
AUTH <i>Alan Rutherford</i>		DATE <i>2-11-74</i>		US-14 103 PAGE 1	



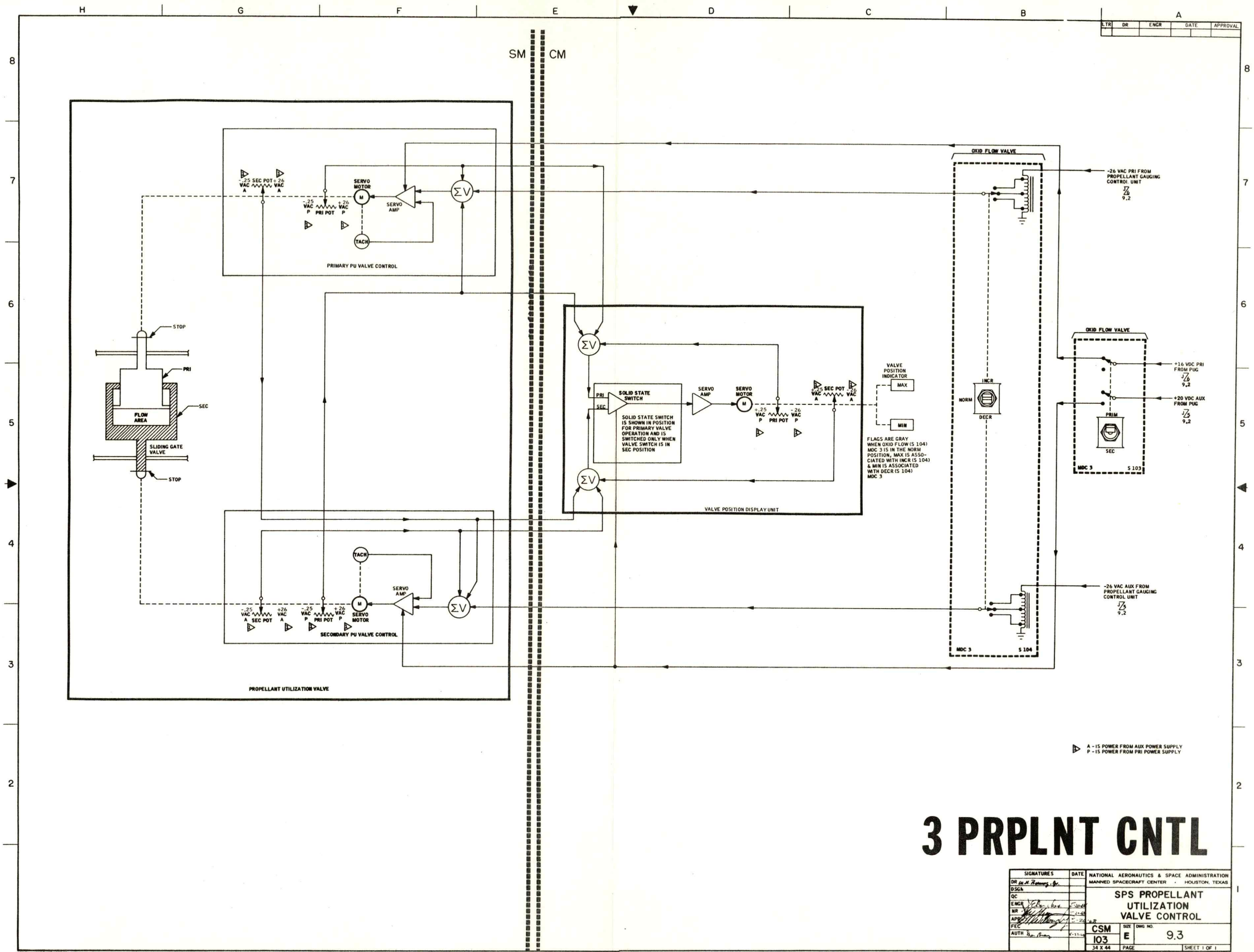
OXIDIZER POINT SENSOR LOCATIONS			
NUMBER	WEIGHT POUNDS	PERCENT	
15	1368.13	6.5	OXIDIZER SUMP TANK #2
14	3172.25	13.0	
13	4756.58	19.5	
12	5545.50	26.0	
11	7930.00	32.5	
10	9510.79	39.0	OXIDIZER STORAGE TANK #1
9	11109.00	45.5	
8	12689.01	52.0	
7	14091.12	57.5	
6	15685.24	64.3	
5	17271.37	70.8	OXIDIZER STORAGE TANK #1
4	18857.50	77.3	
3	20443.63	83.8	
2	22029.75	90.3	
1	23615.87	96.8	

FUEL POINT SENSOR LOCATIONS		
NUMBER	WEIGHT POUNDS	PERCENT
15	991.99	6.5
14	1983.97	13.0
13	2975.96	19.5
12	3967.95	26.0
11	4959.93	32.5
10	5951.92	39.0
9	6943.90	45.5
8	7935.89	52.0
7	8927.87	57.5
6	9919.86	64.0
5	10801.77	70.5
4	11793.75	77.3
3	12785.74	83.5
2	13777.73	90.3
1	14769.71	96.8

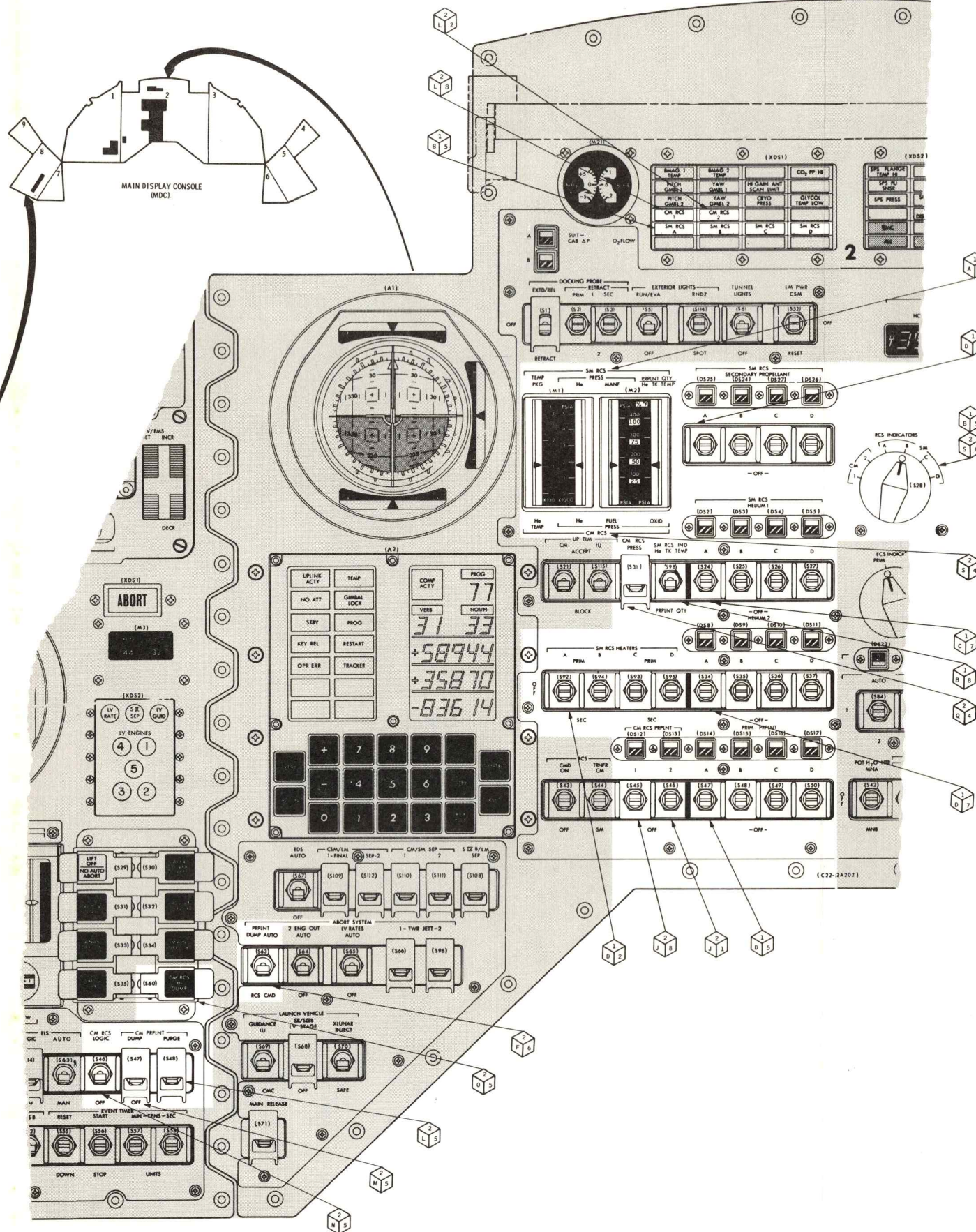
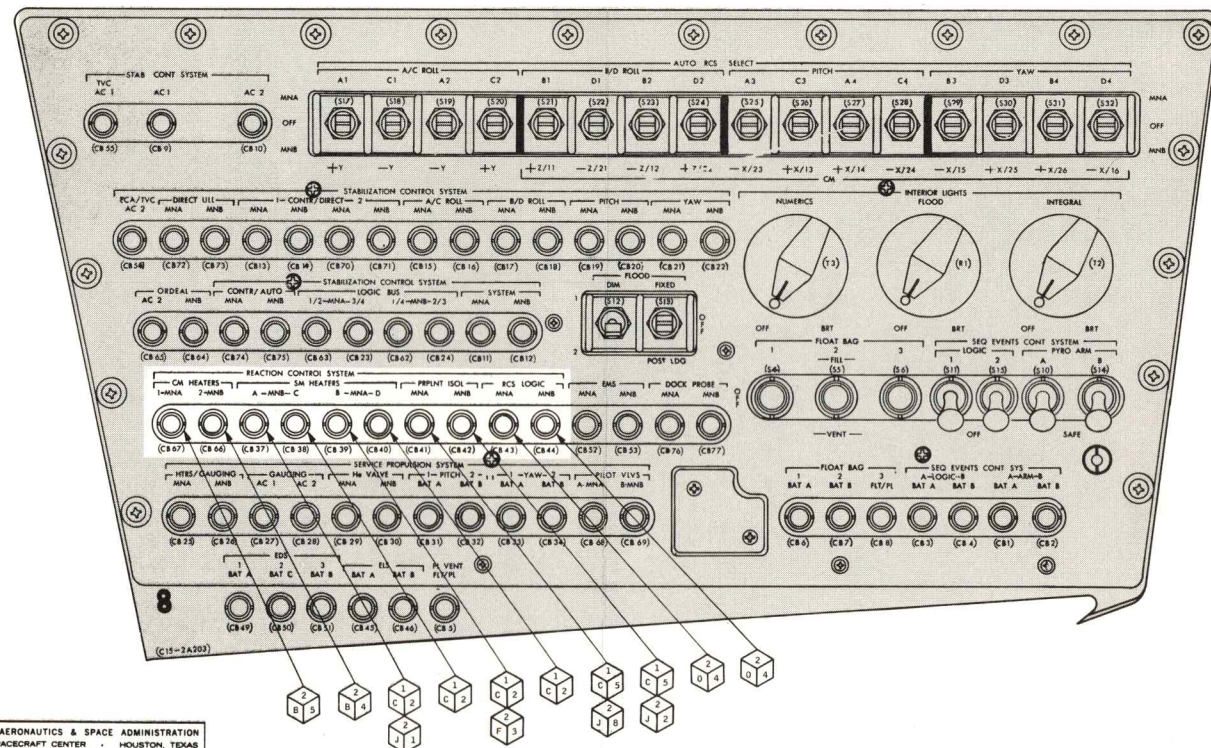
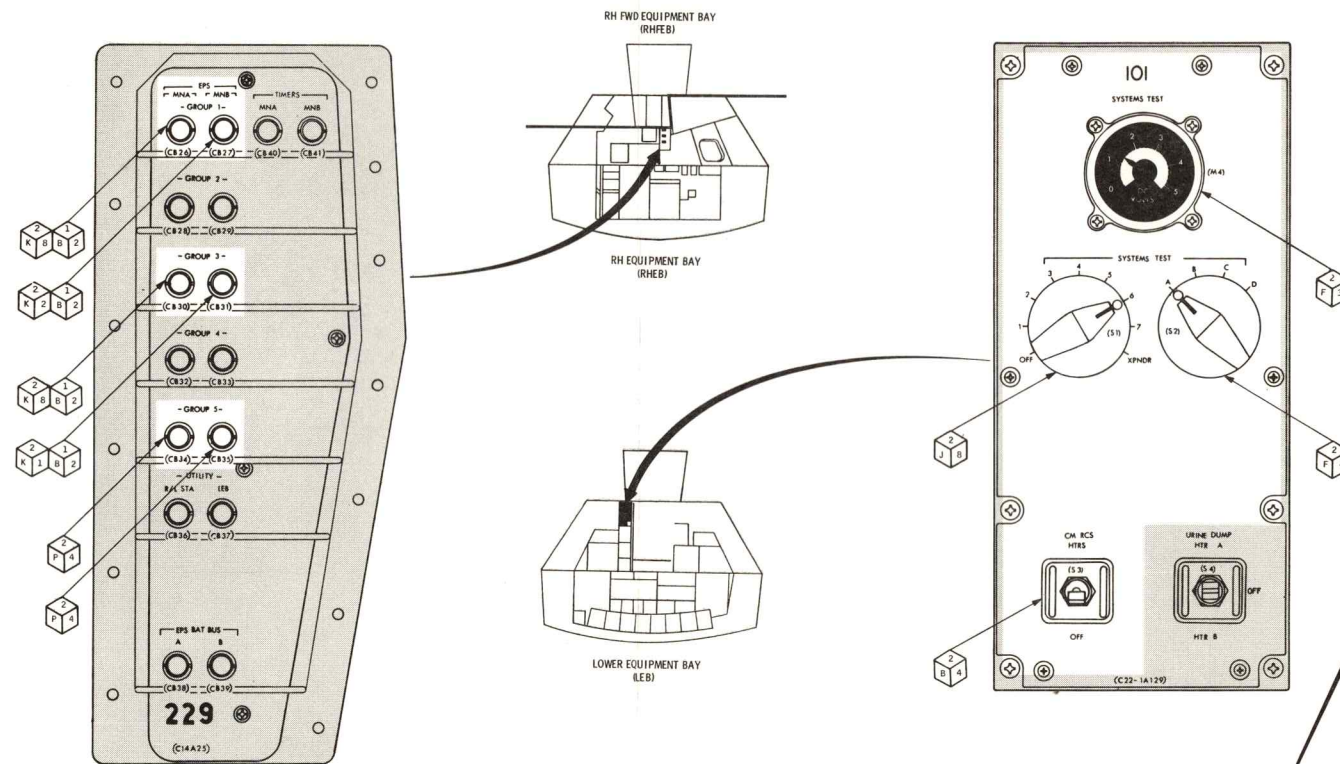
2 SPS GAUGING

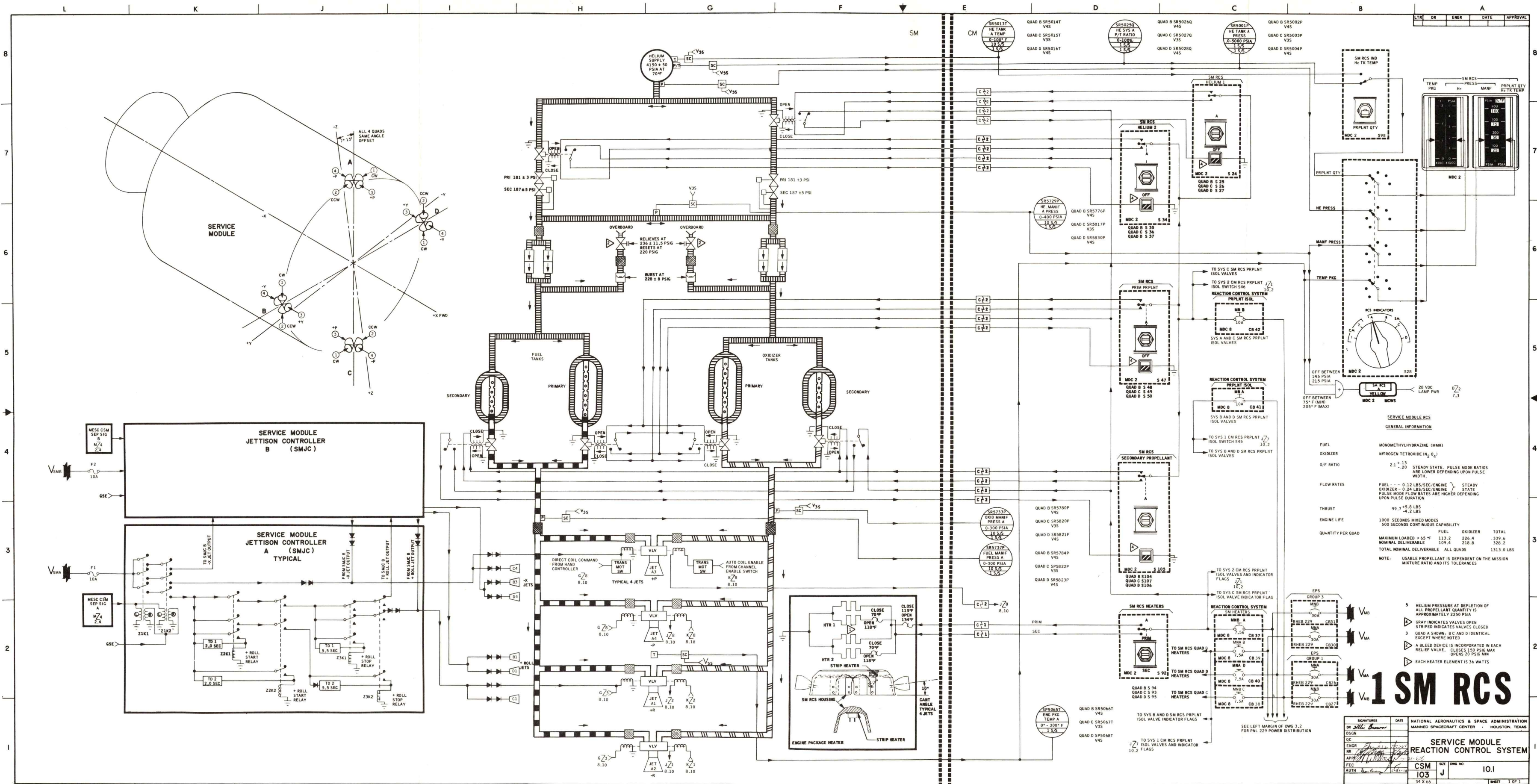
- A - IS POWER FROM AUX POWER SUPPLY
- P - IS POWER FROM PRI POWER SUPPLY
- ALL SOLID STATE SWITCHES SHOWN IN PRIMARY POSITION
- AUX ENABLE INPUT IS PROVIDED WHEN THE SENSOR SWITCH IS 102 IS IN THE AUX POSITION ONLY

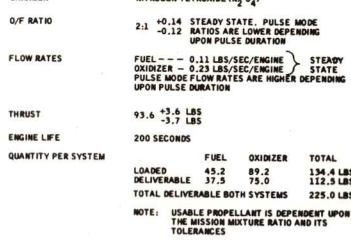
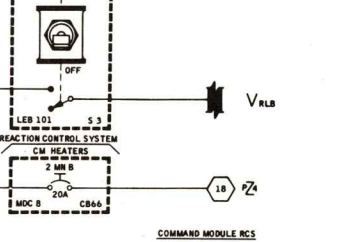
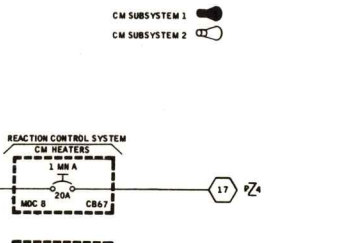
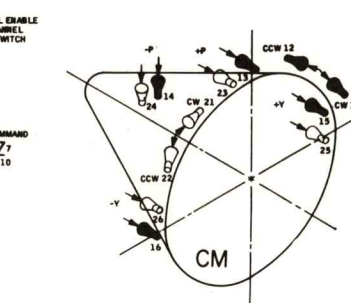
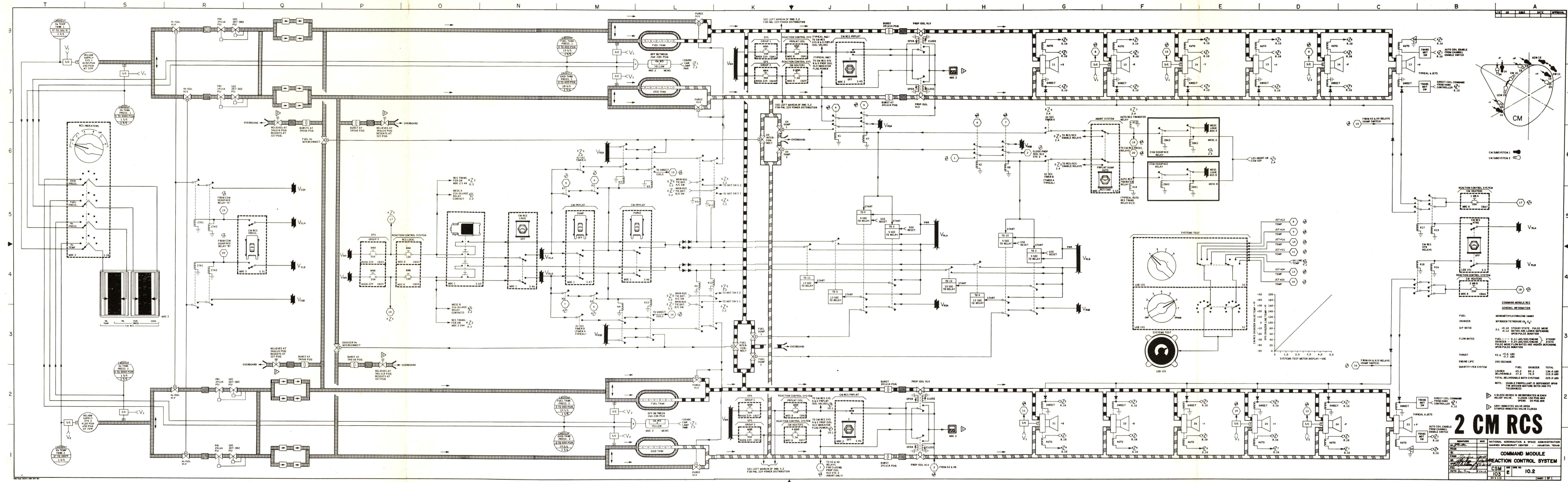
SIGNATURES	DATE	NATIONAL AERONAUTICS & SPACE ADMINISTRATION
DESIGN		MANNE SPACECRAFT CENTER - HOUSTON, TEXAS
QC		
ENGR		
NO		
APPROVAL		
FILE		
AUTH		
CSM	103	9.2
103	J	
34 X 55		SHEET 1 OF 1



10 REACTION
CONTROL
SYSTEM

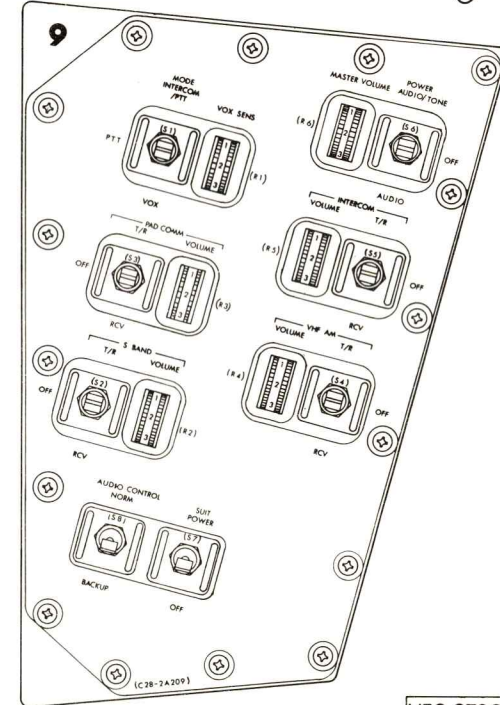
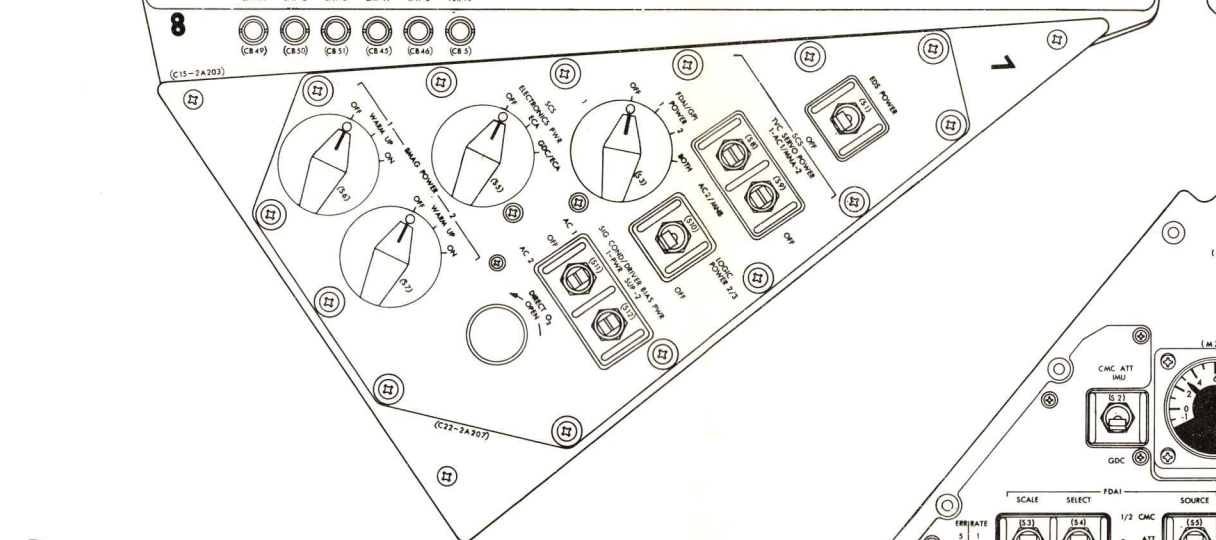
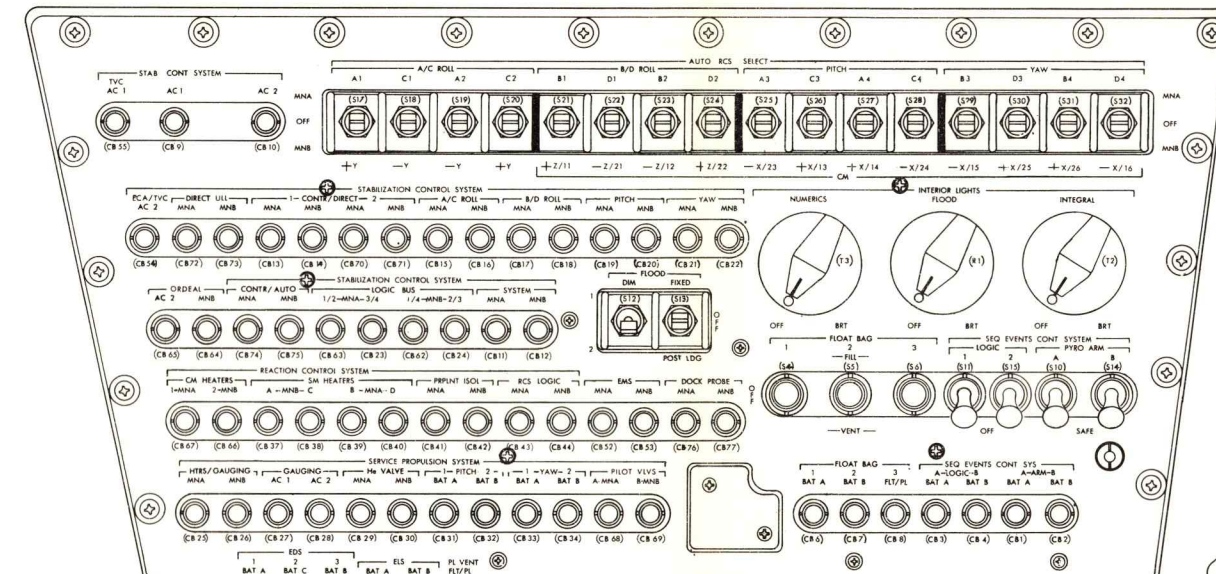




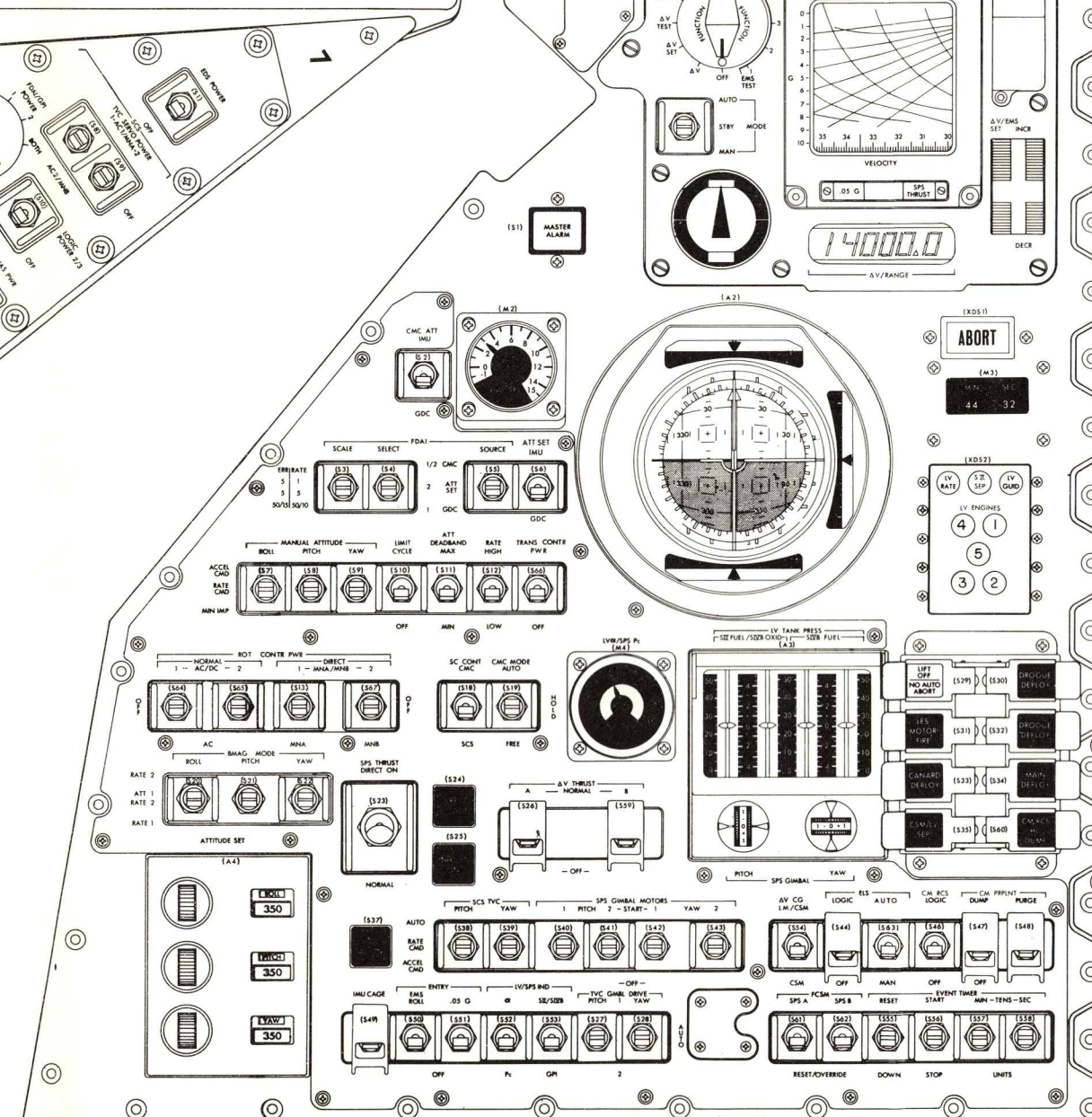


GENERAL INFORMATION	
FUEL	MONOMETHYLHYDRAZINE (MMH)
OXIDIZER	NITROGEN TETROXIDE (N ₂ O ₄)
OX/FUEL RATIO	2.1 ± 0.14 STEADY STATE, PULSE MODE -0.12 ± 0.02 PULSE MODE
FLOW RATES	FUEL - 0.13 LB/SEC/ENGINE STANDBY OXIDIZER - 0.22 LB/SEC/ENGINE STANDBY PULSE MODE FLOW RATES ARE HIGHER DEPENDING UPON PULSE DURATION
THRUST	93 ± 1.5 LBS
ENGINE LIFE	200 SECONDS
QUANTITY PER SYSTEM	FUEL OXIDIZER TOTAL 42.2 87.2 129.4 LBS DELIVERABLE 37.5 75.5 113.0 LBS TOTAL DELIVERABLE BOTH SYSTEMS 125.9 LBS
NOTE: USABLE PROPELLANT IS DEPENDENT UPON THE REACTION CONTROL SYSTEM AND ITS TOLERANCES	

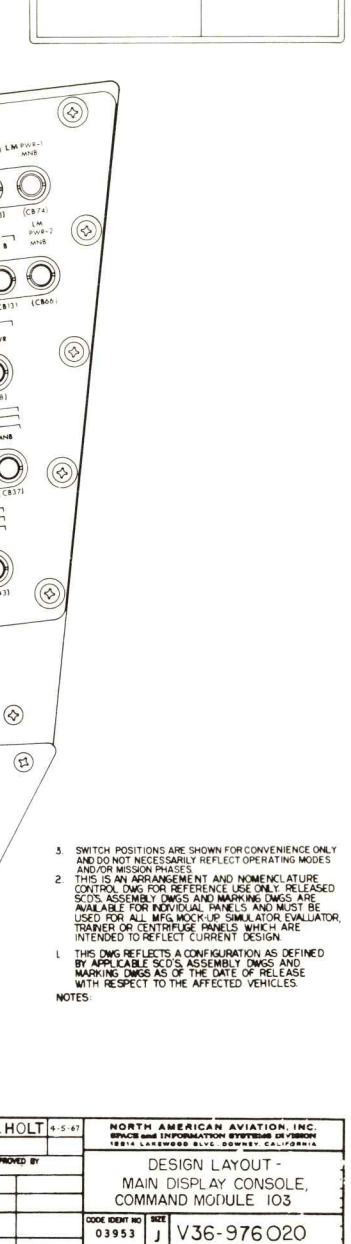
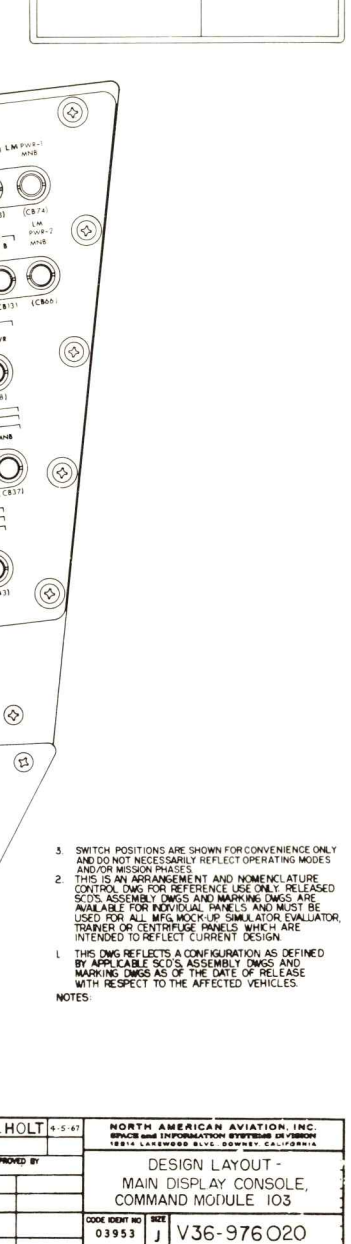
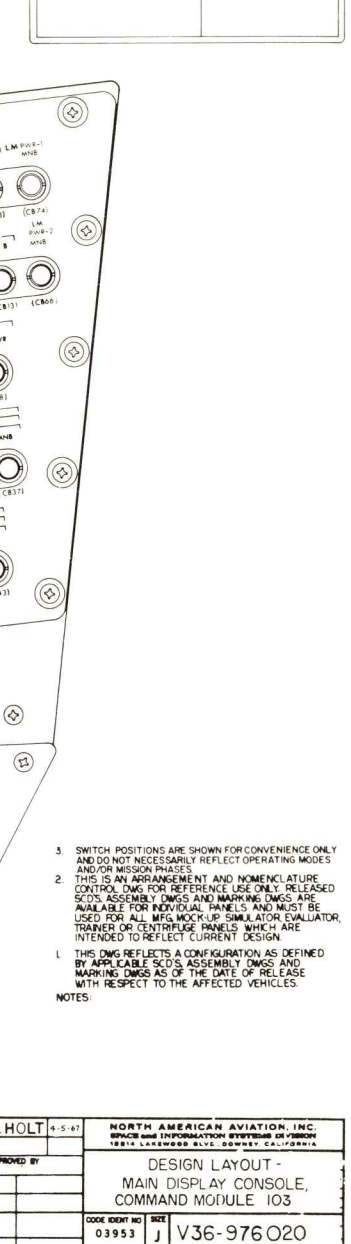
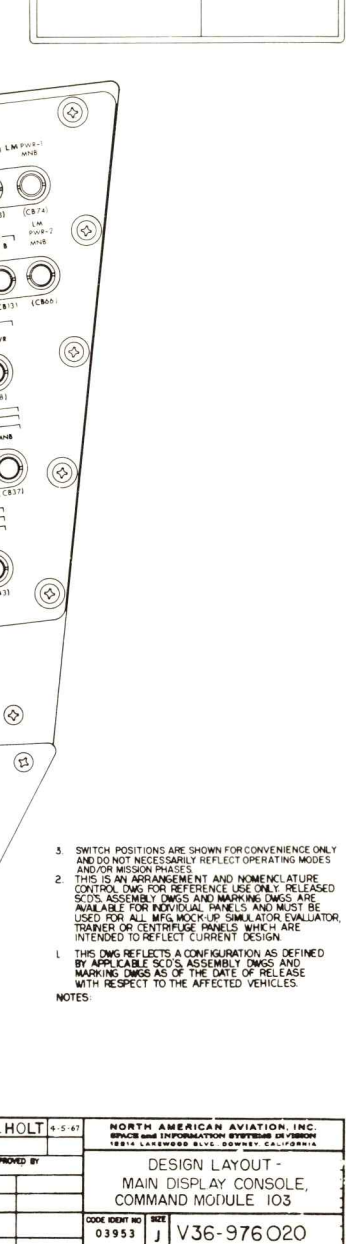
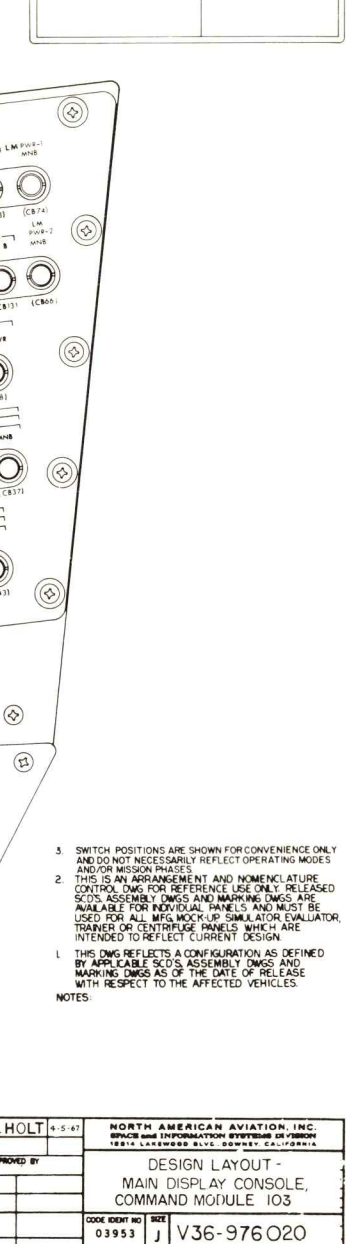
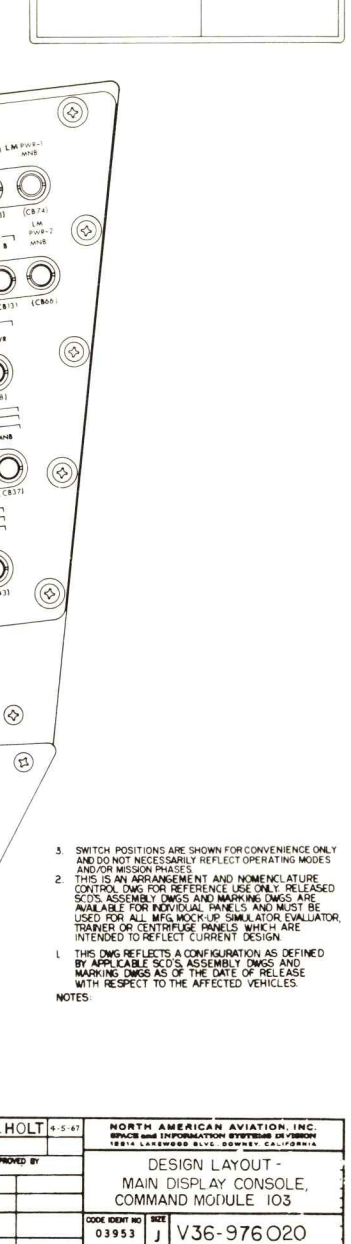
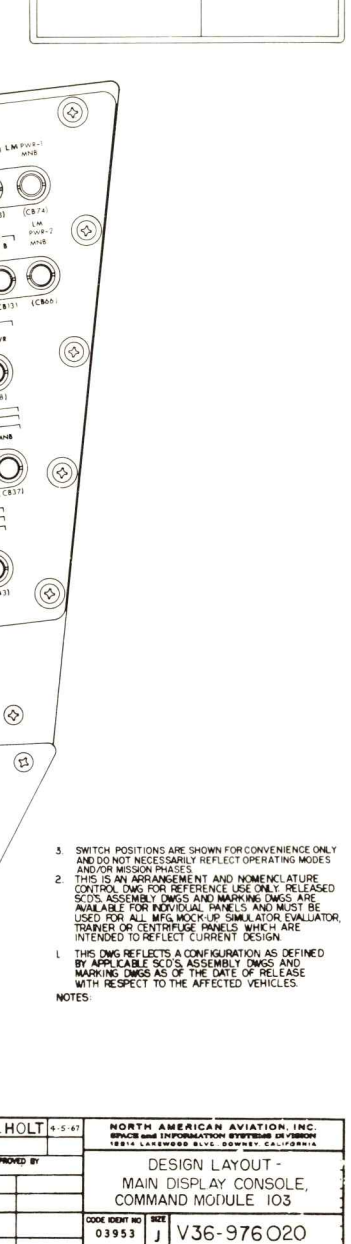
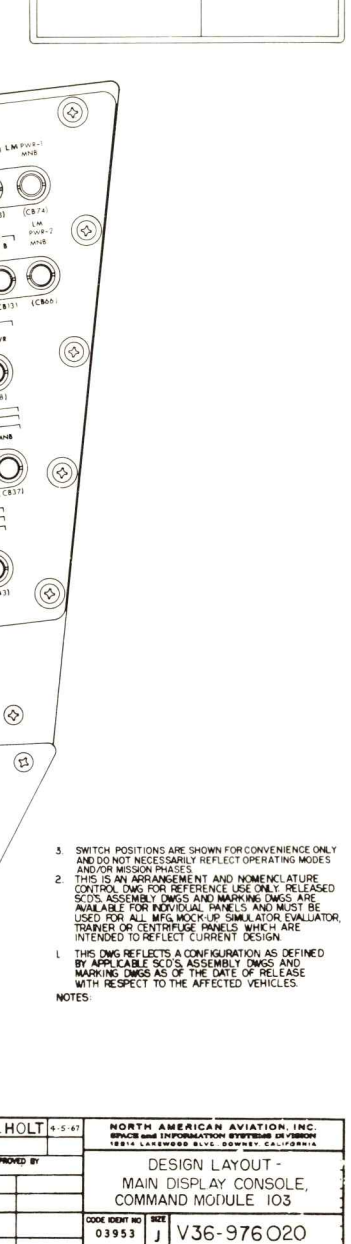
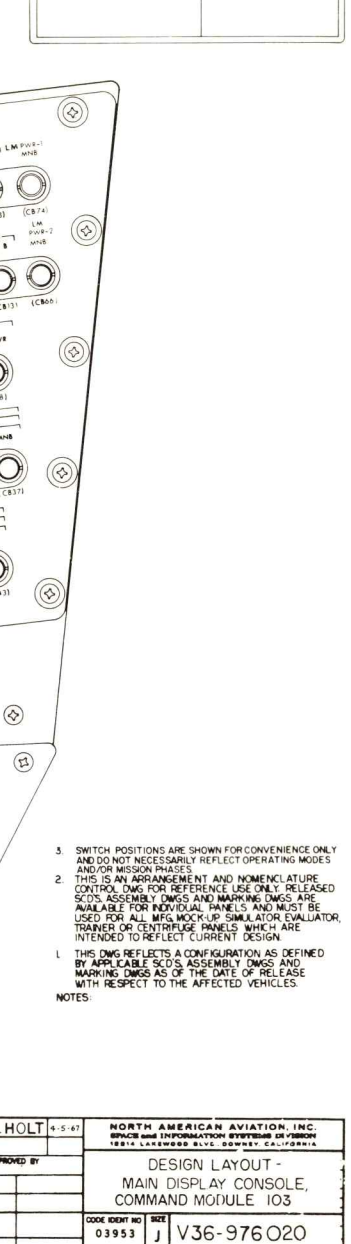
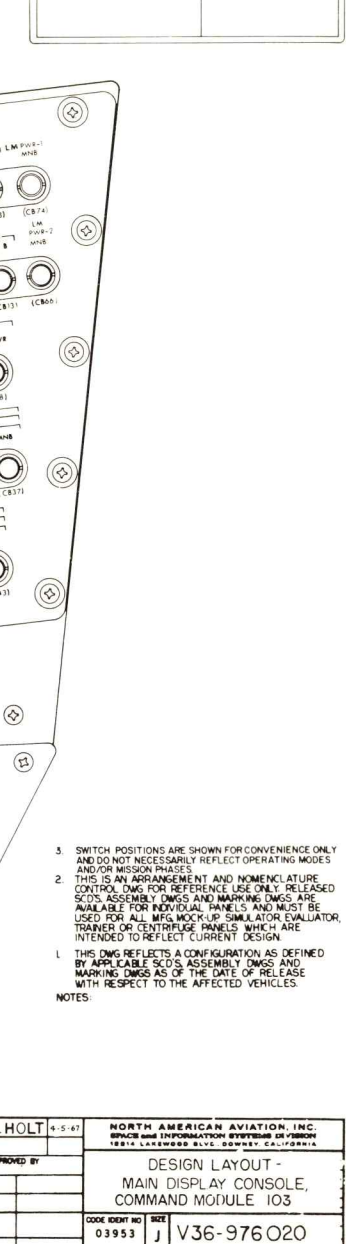
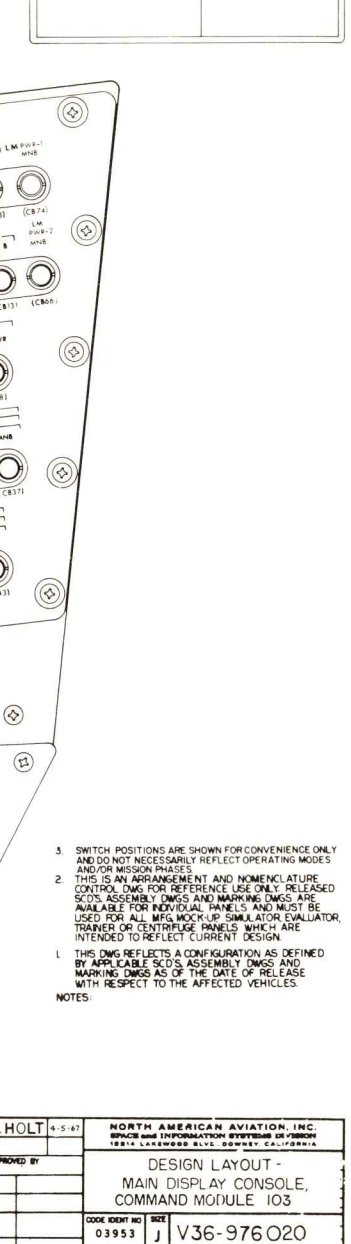
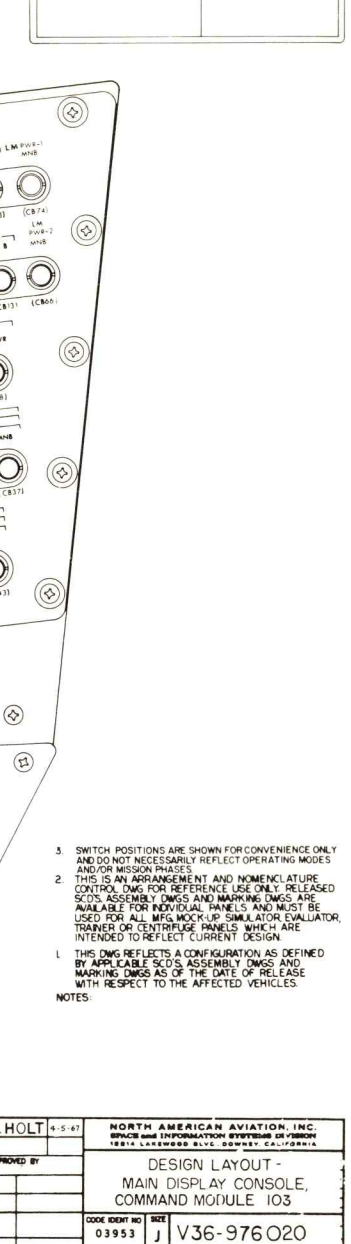
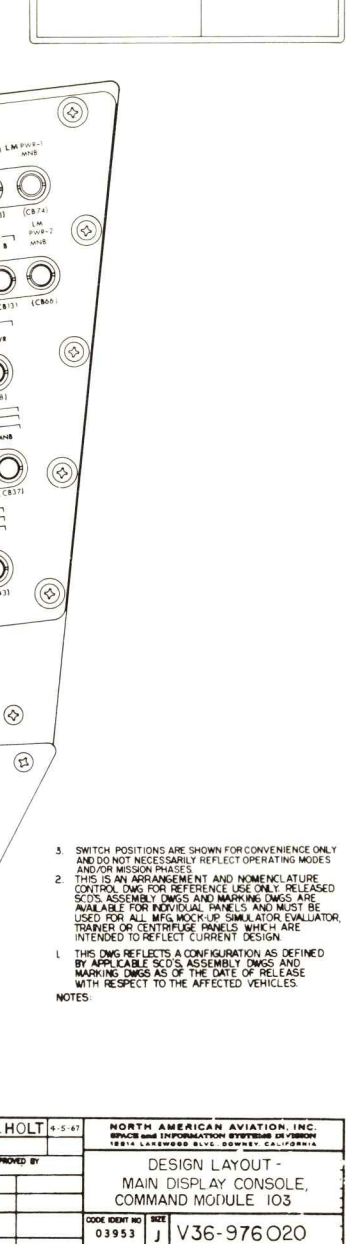
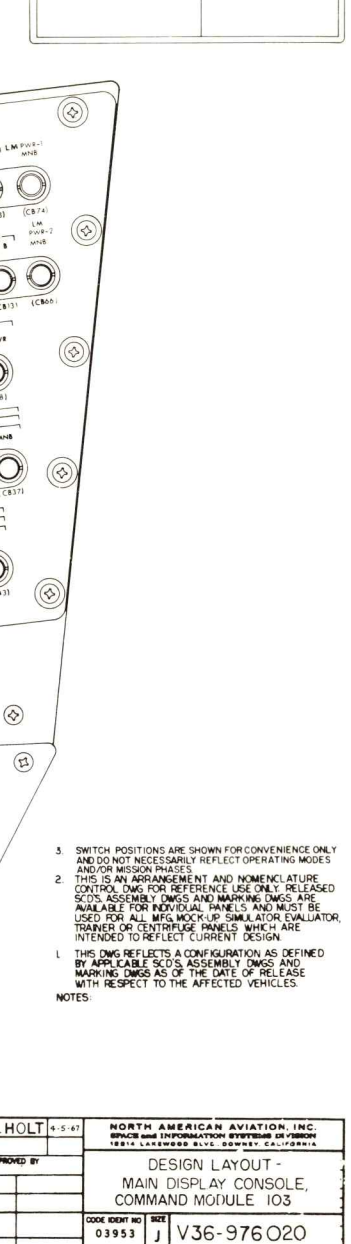
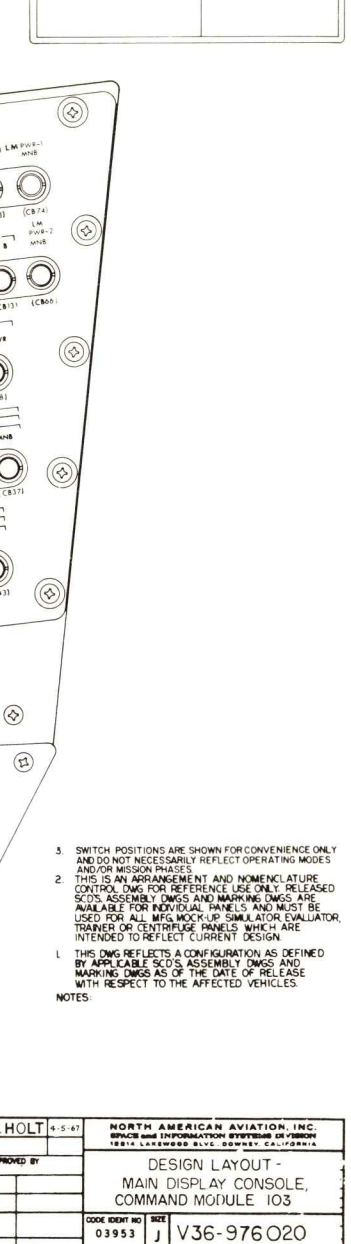
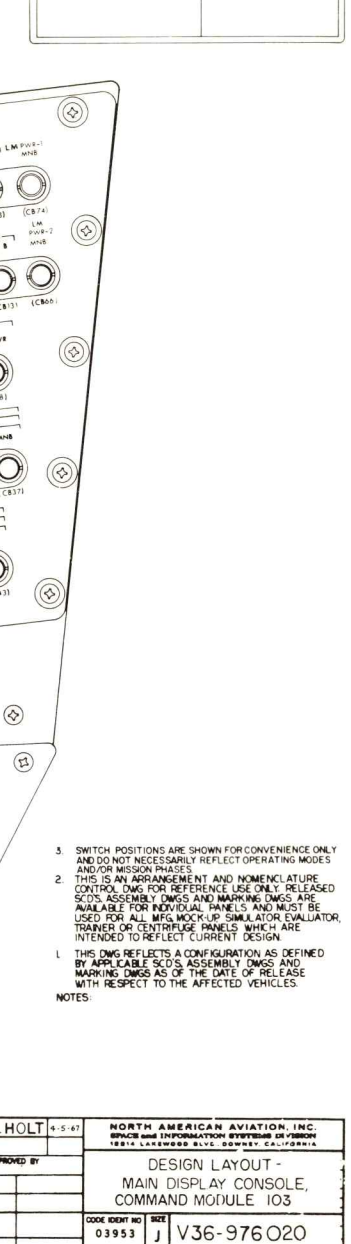
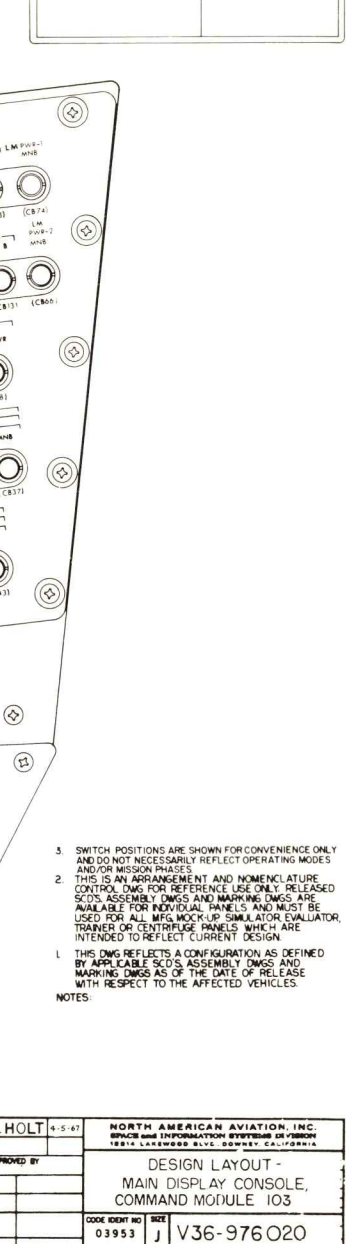
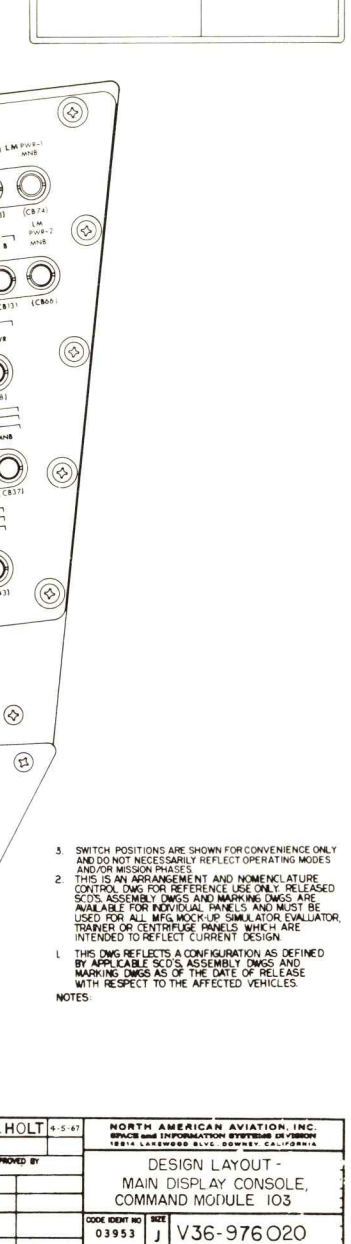
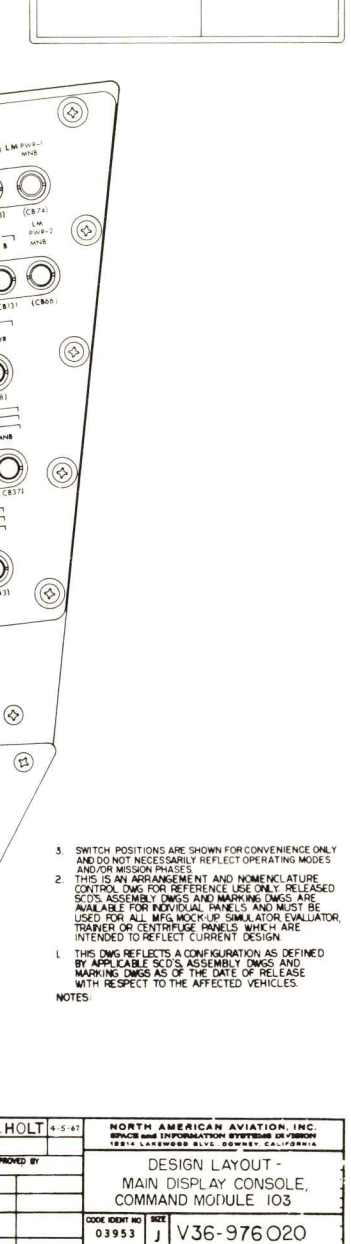
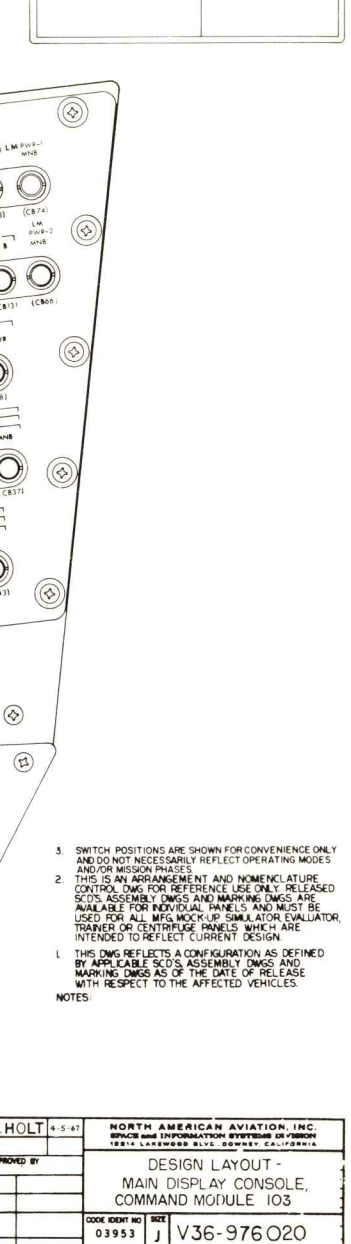
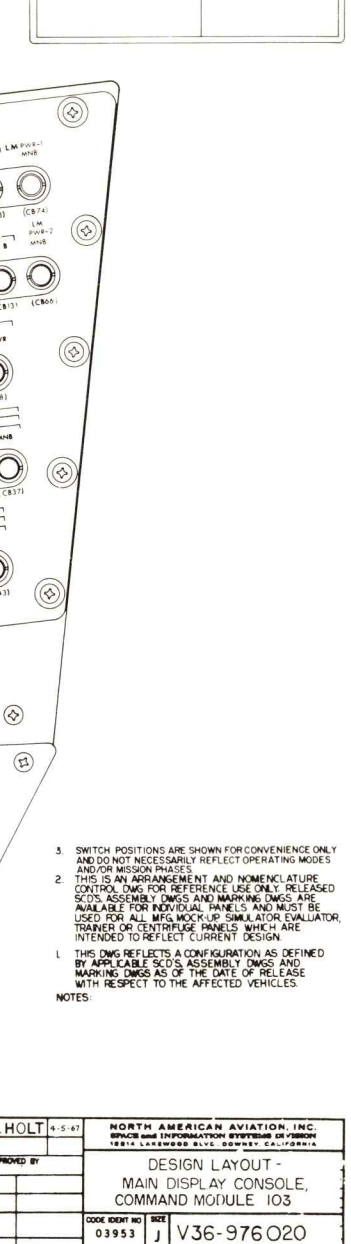
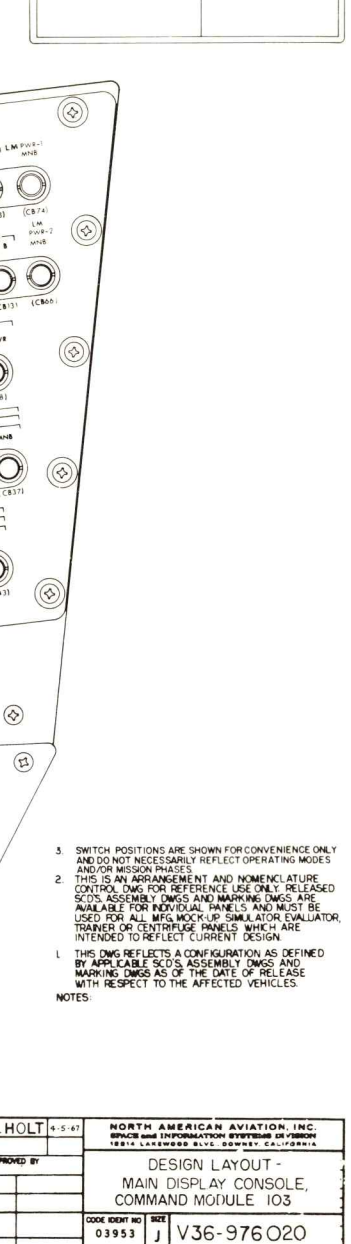
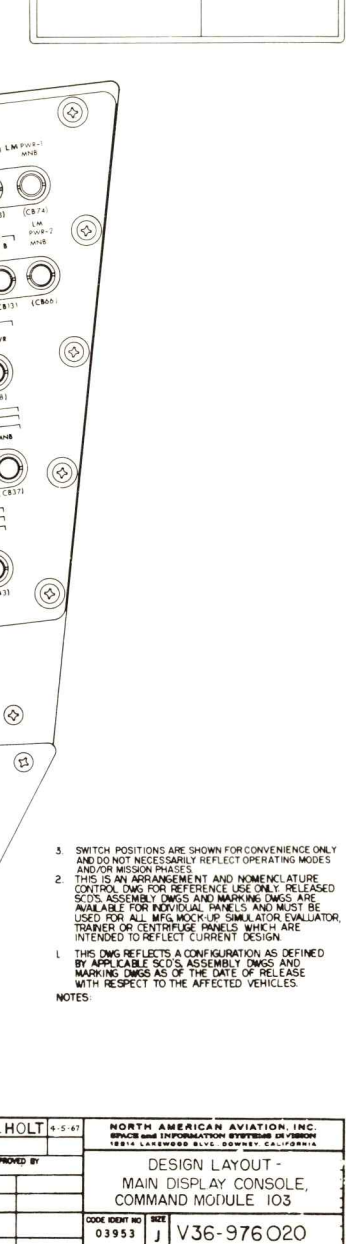
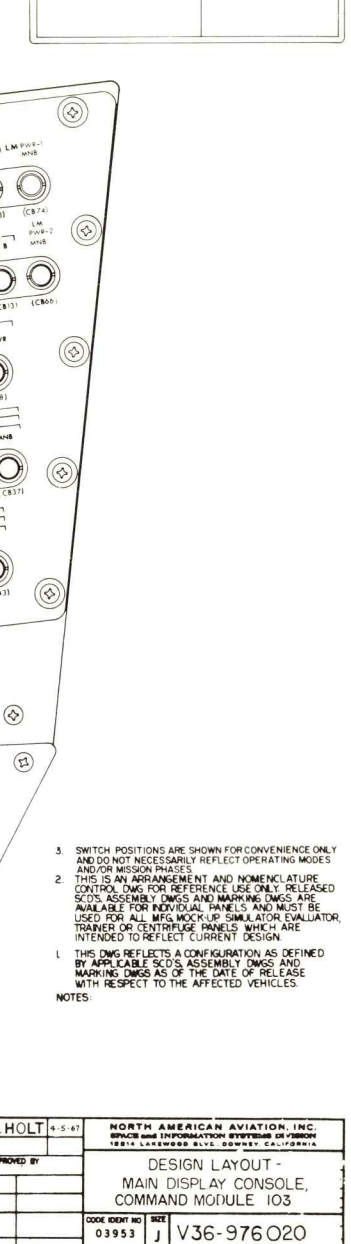
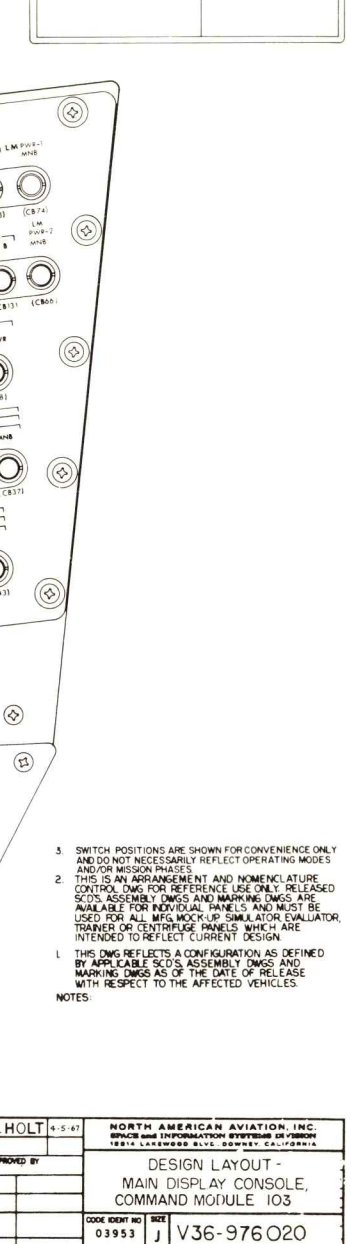
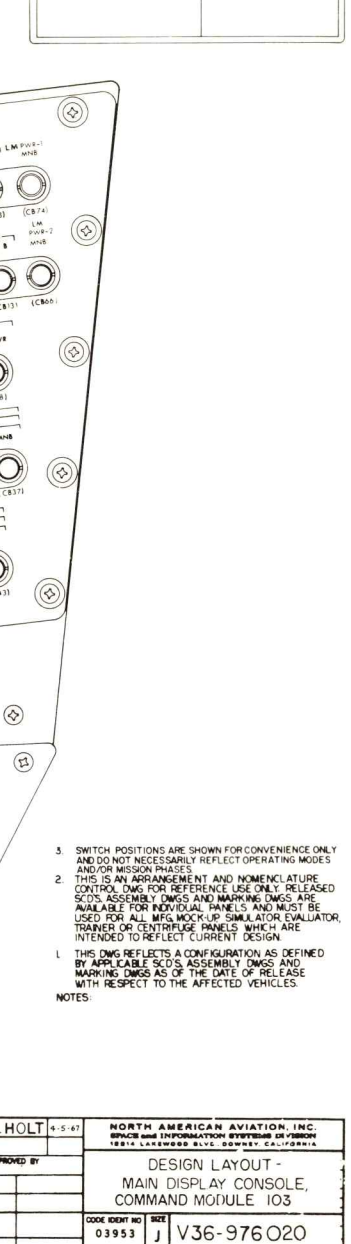
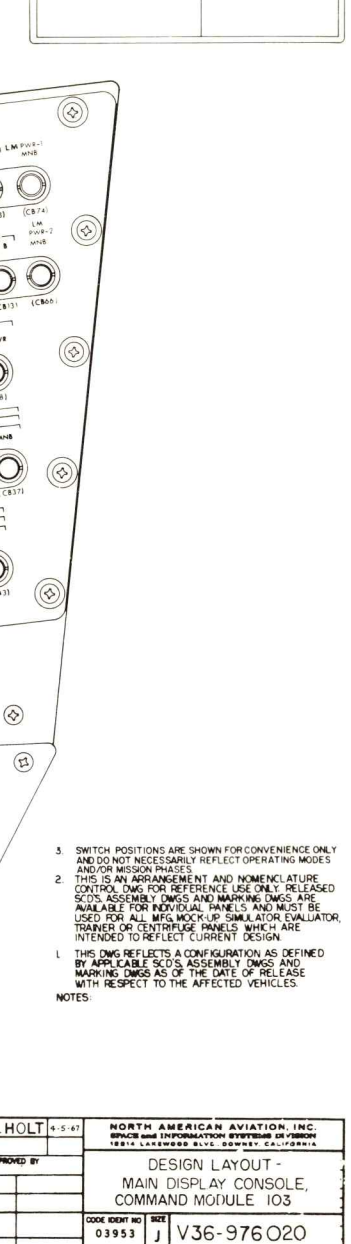
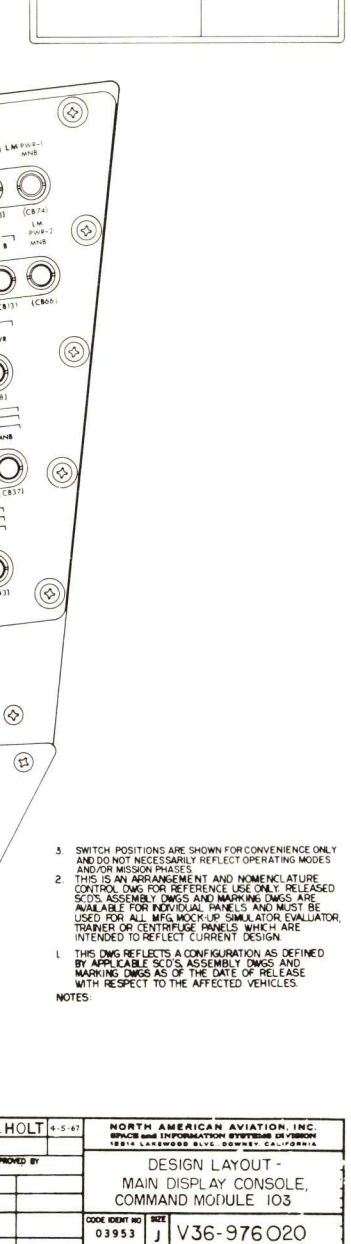
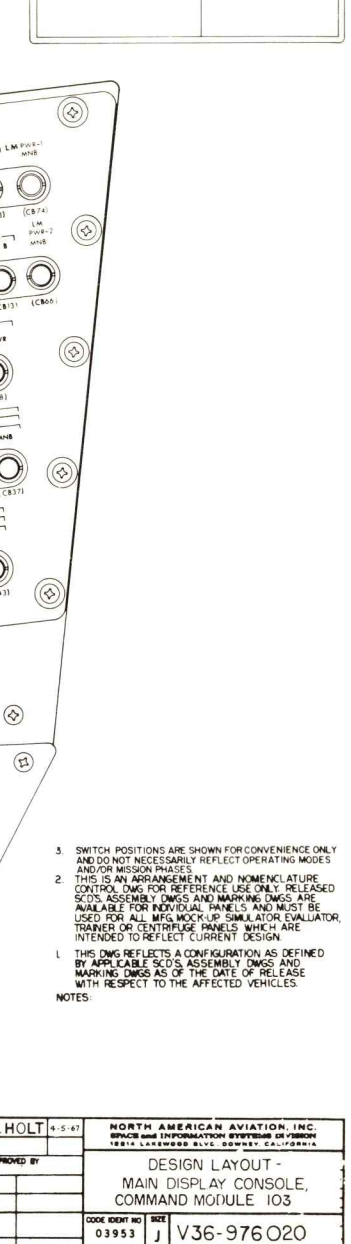
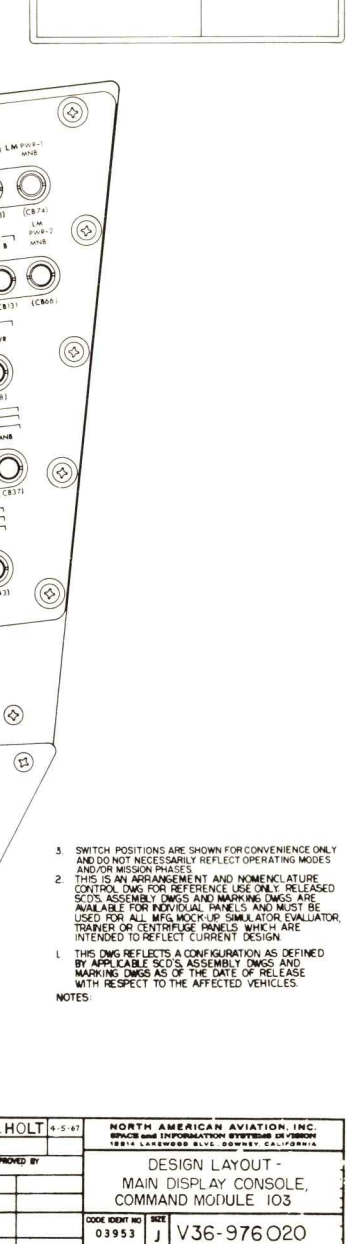
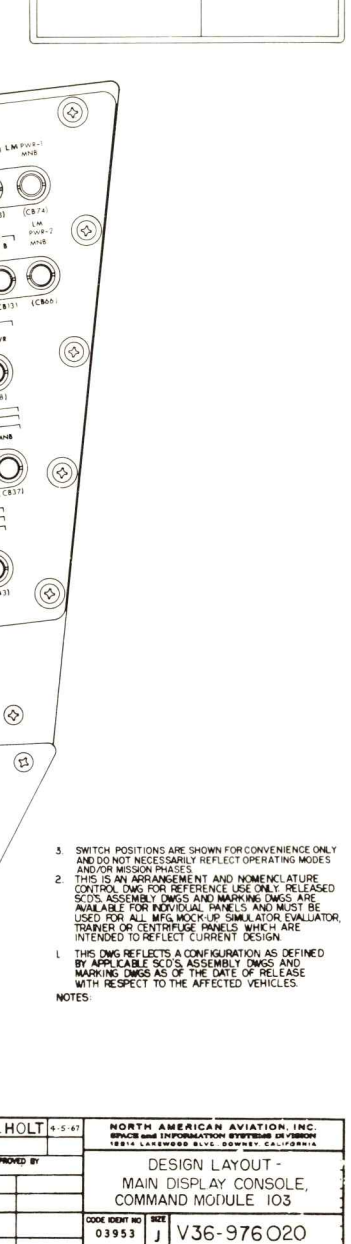
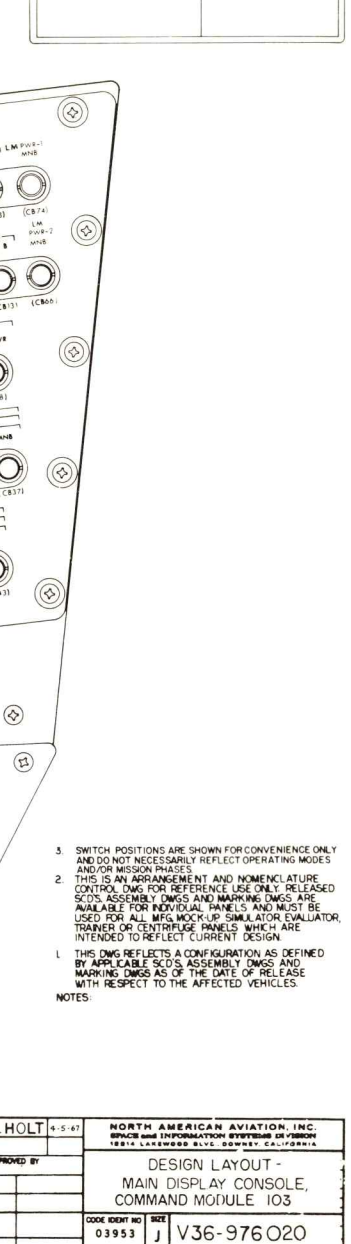
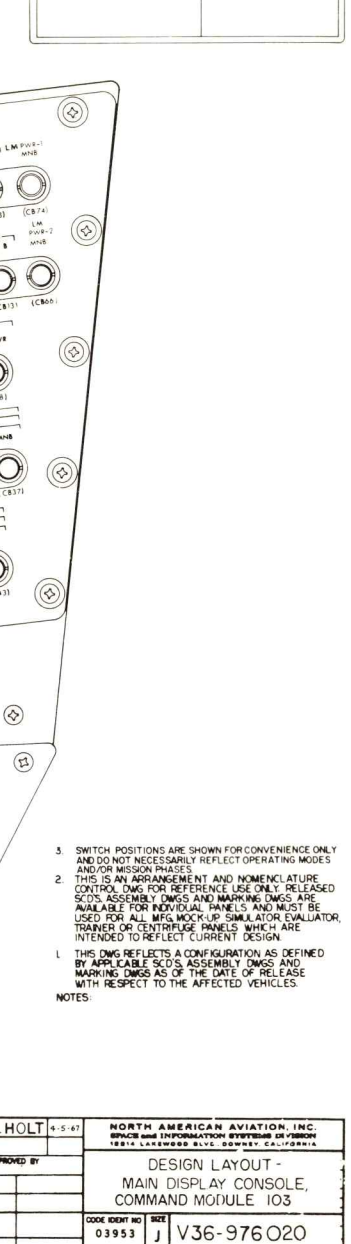
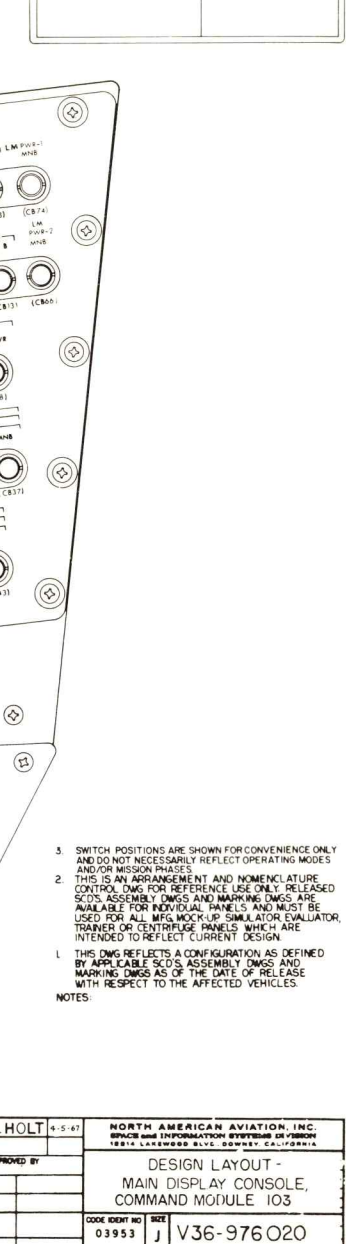
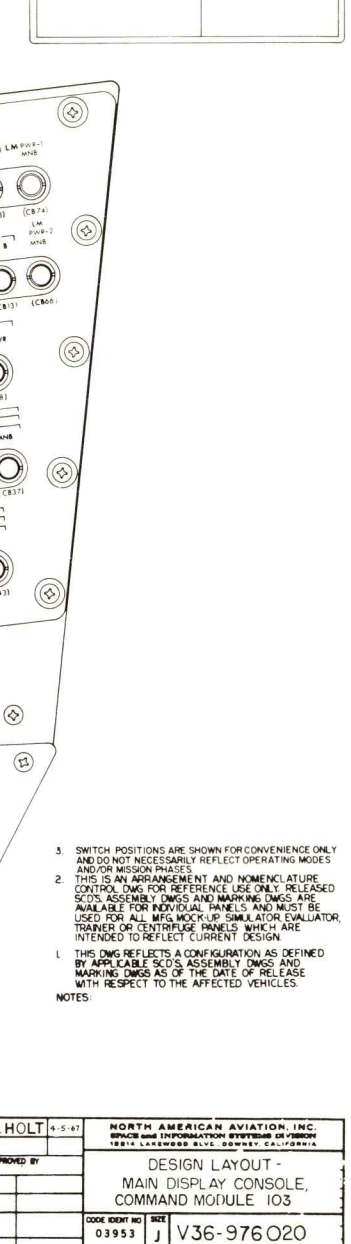
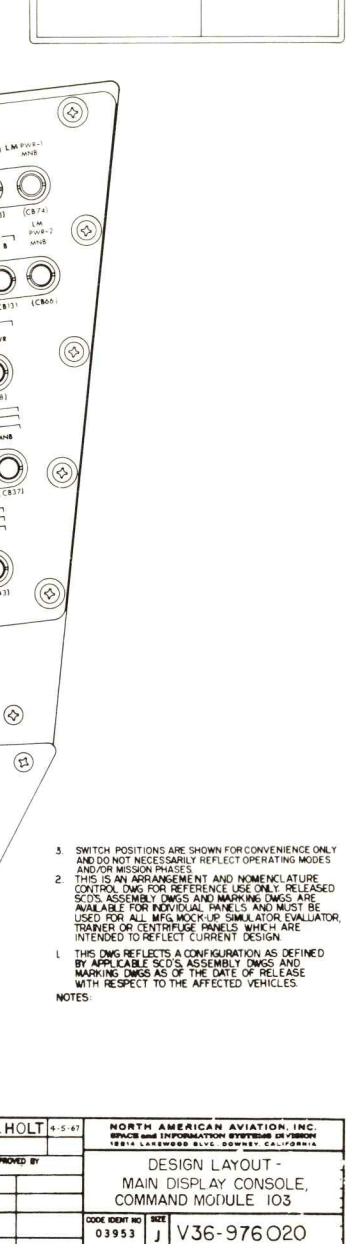
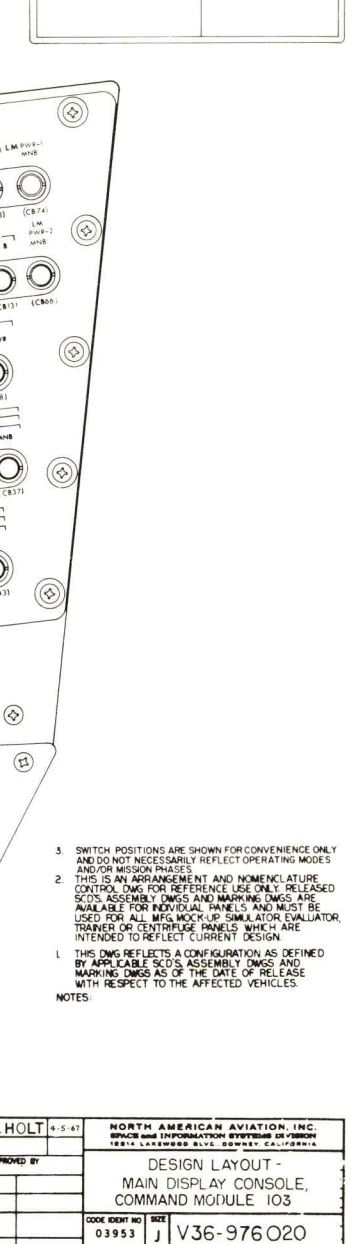
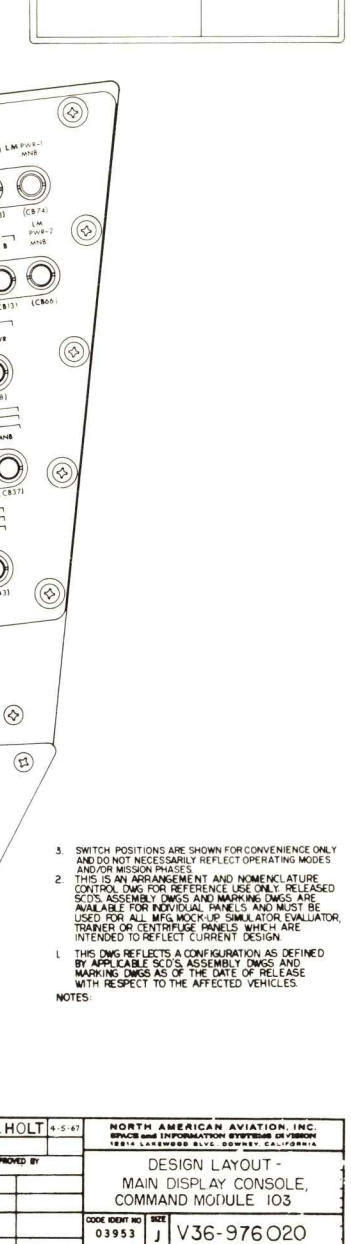
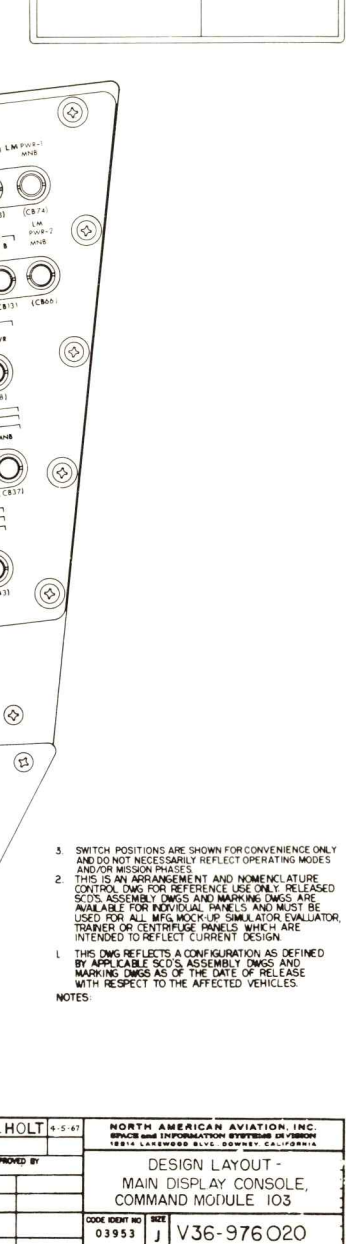
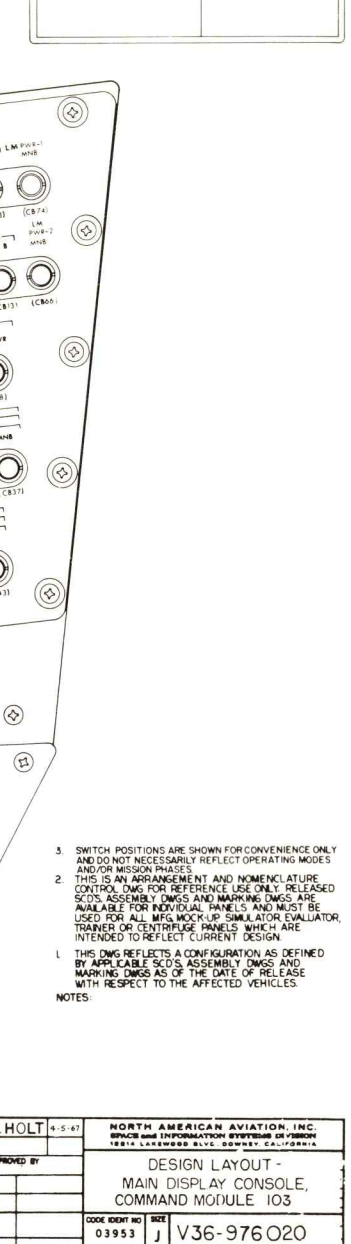
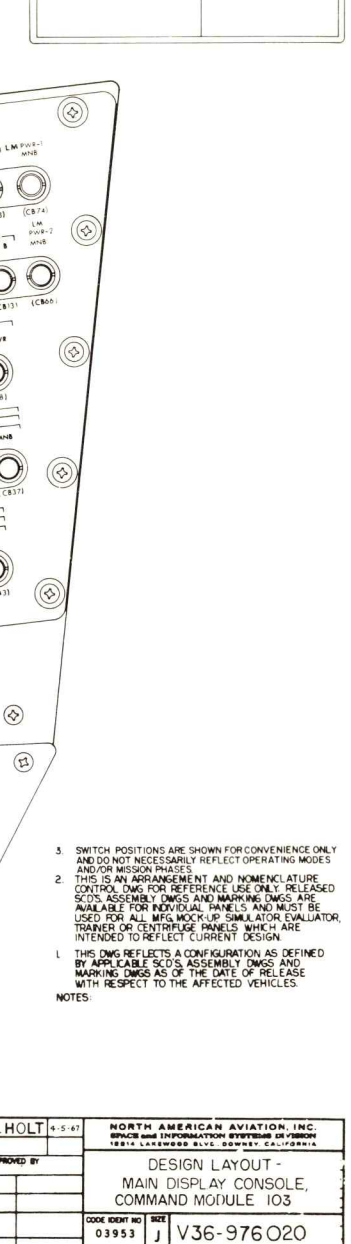
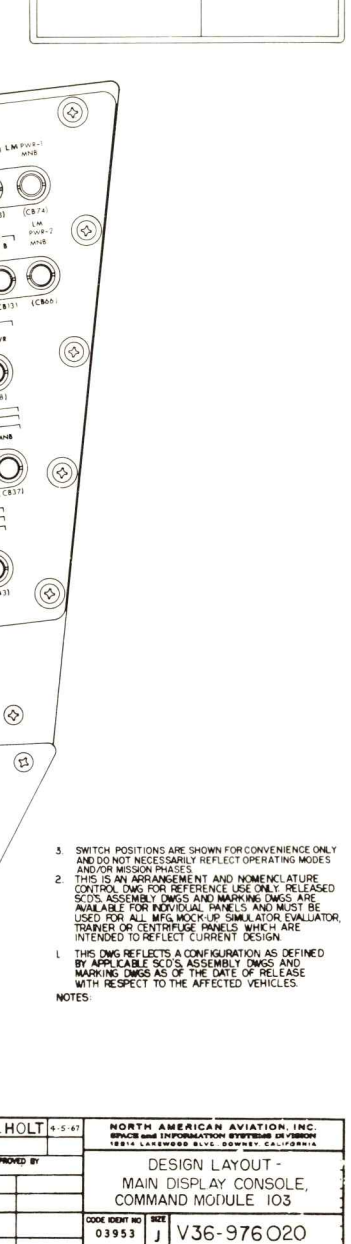
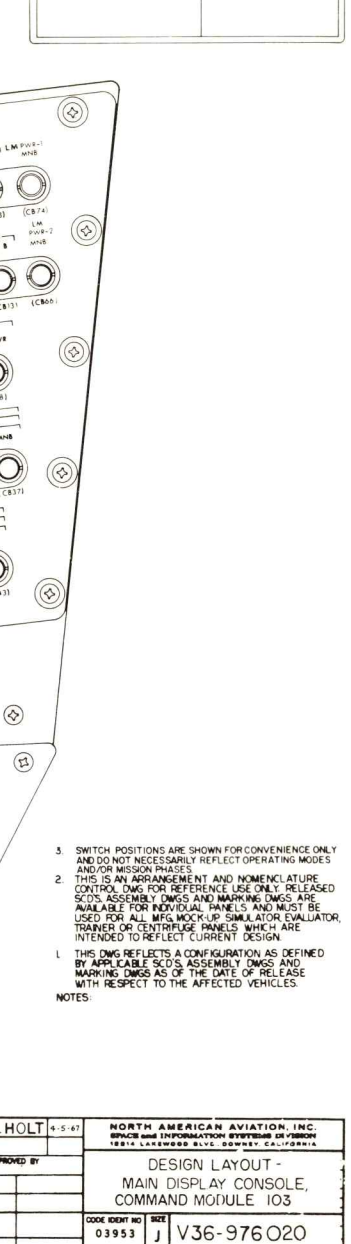
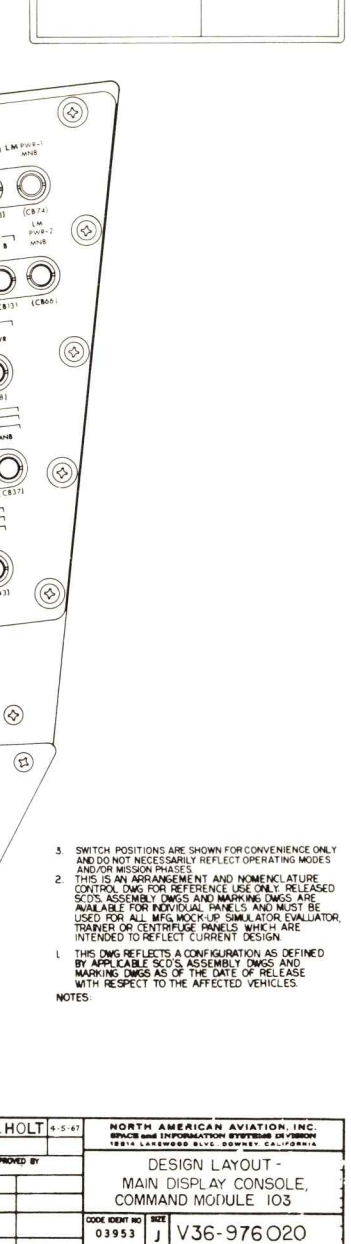
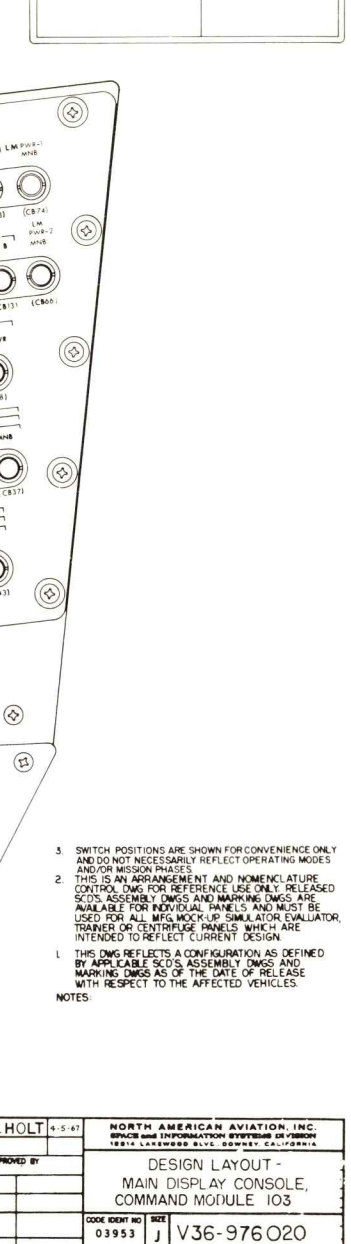
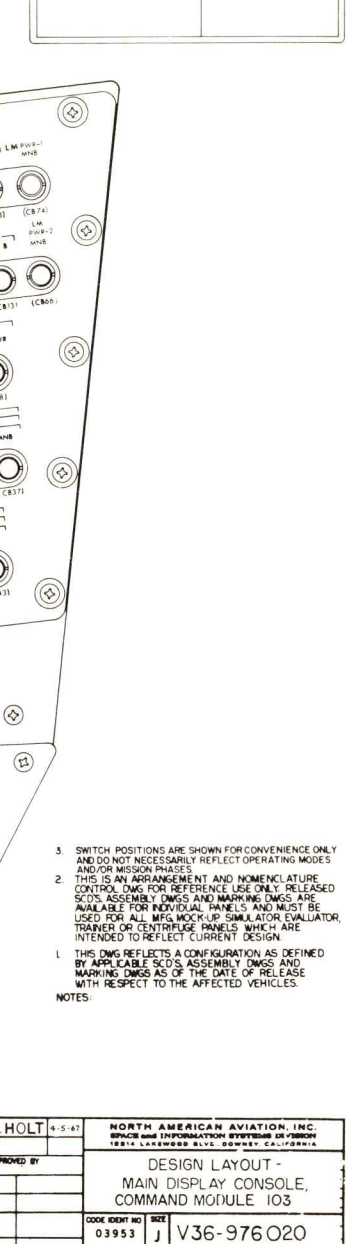
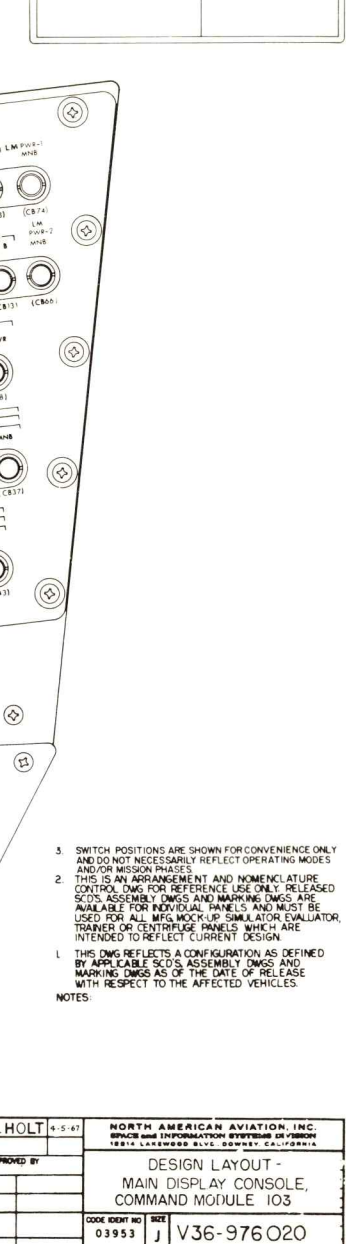
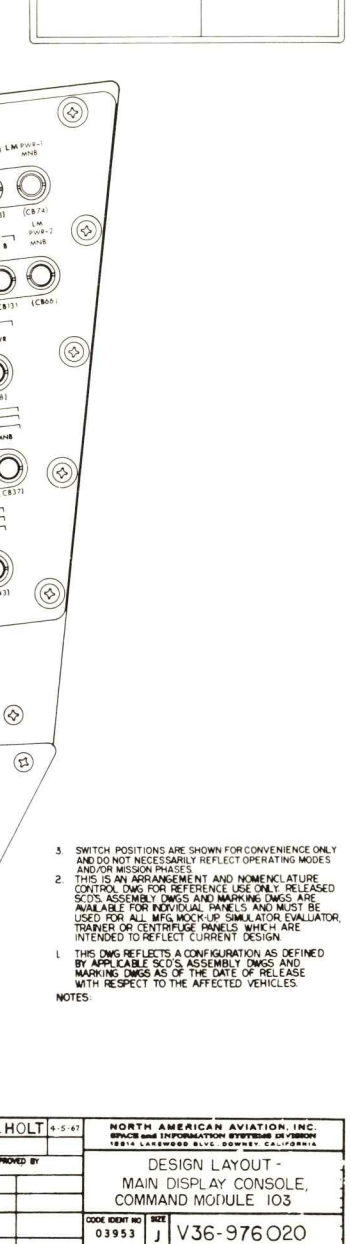
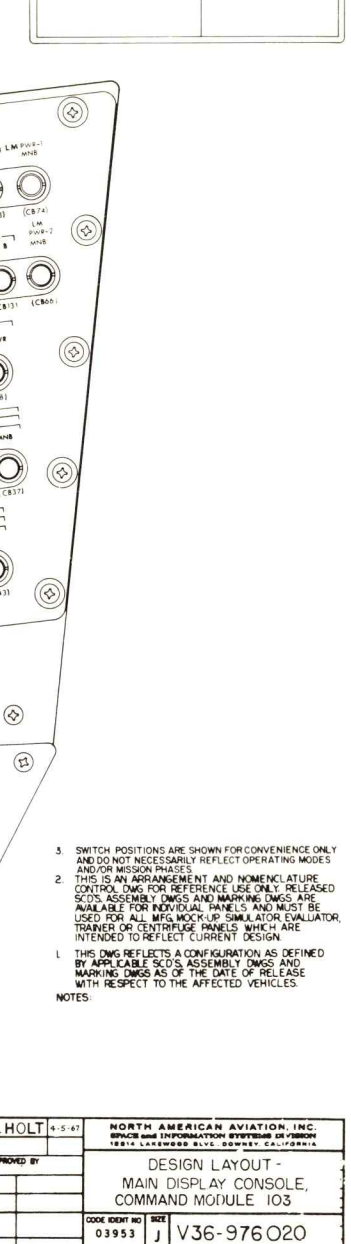
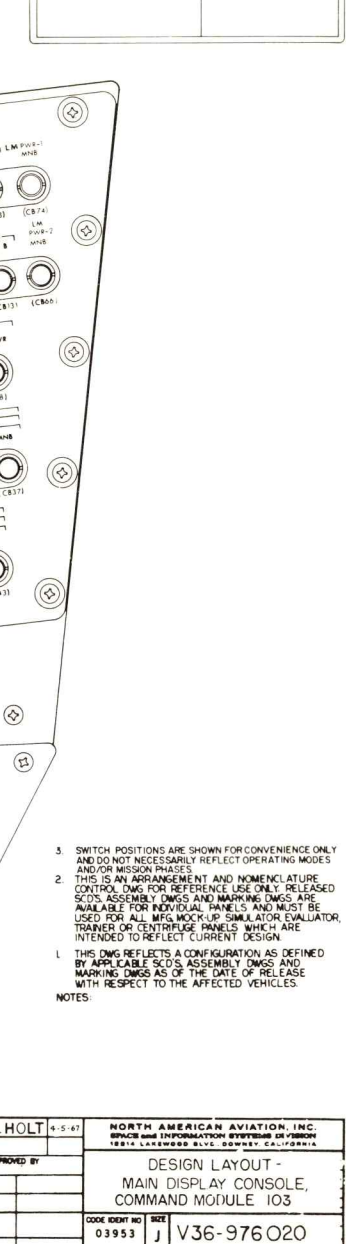
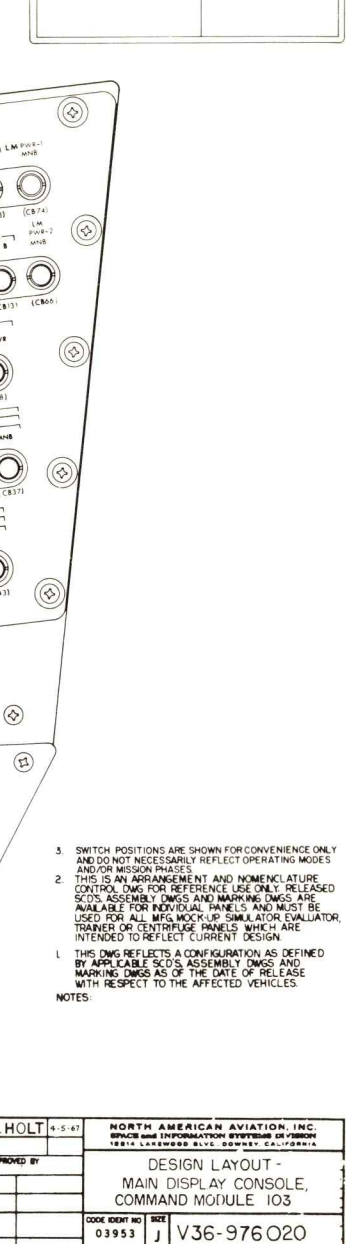
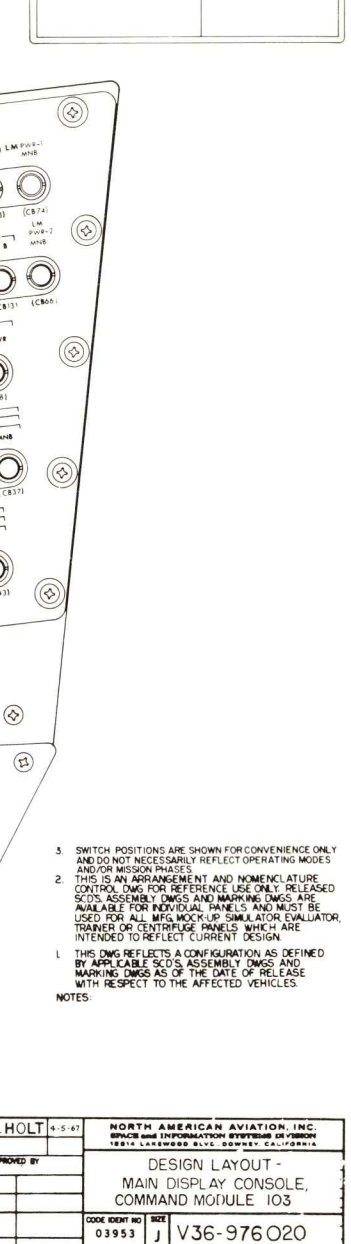
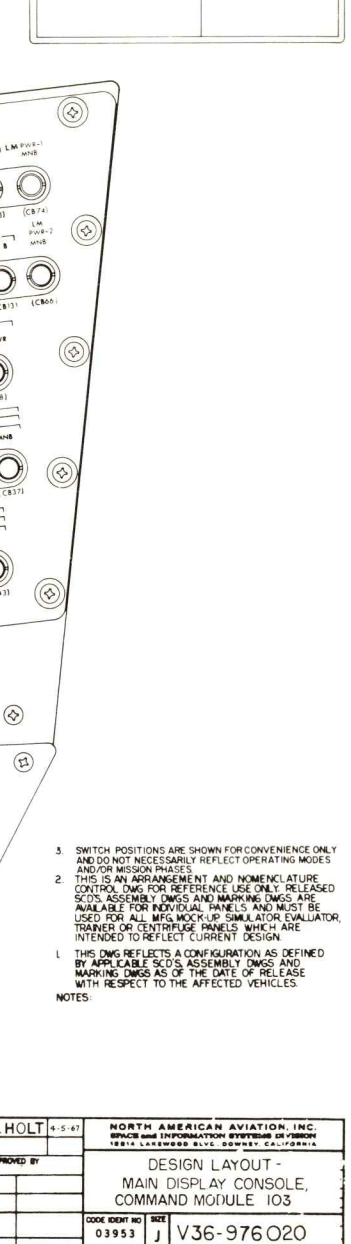
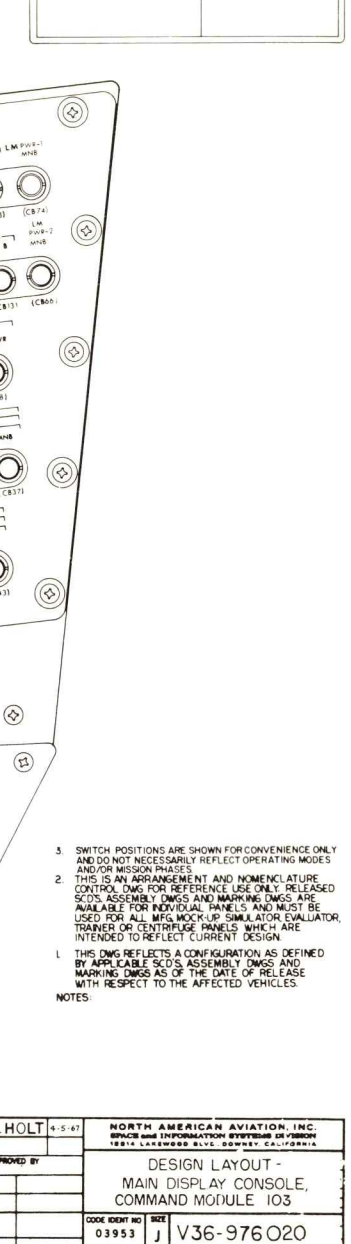
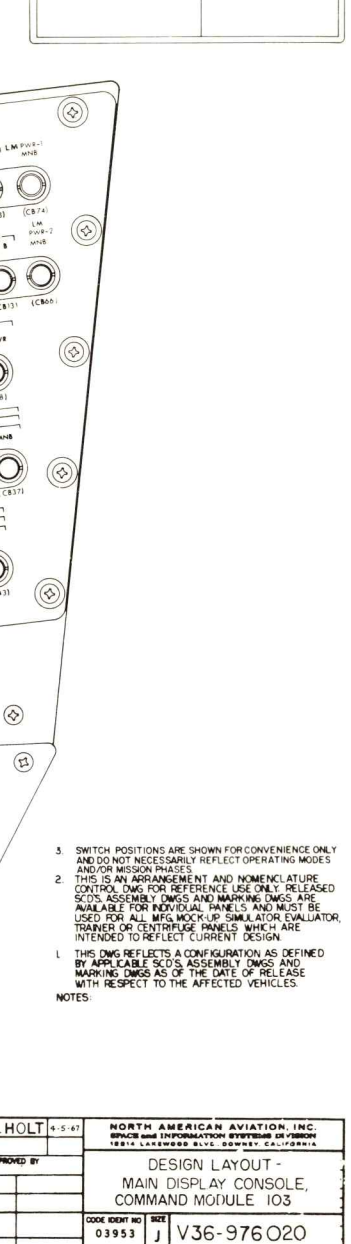
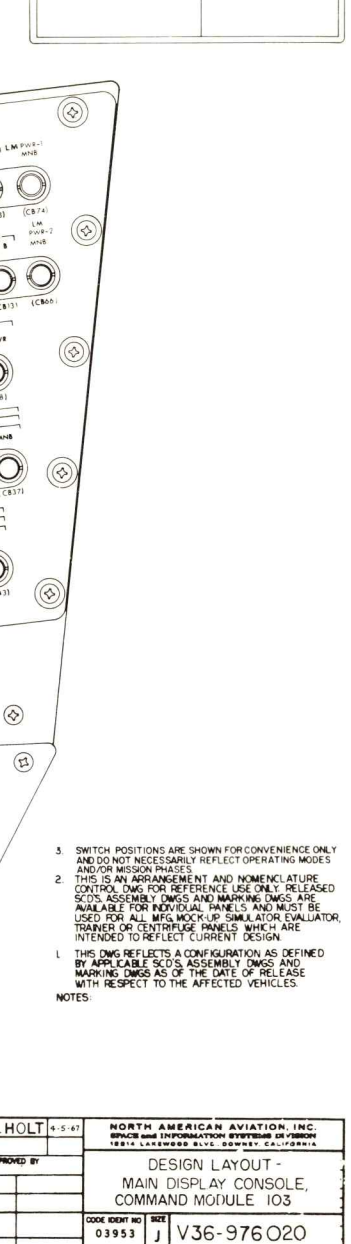
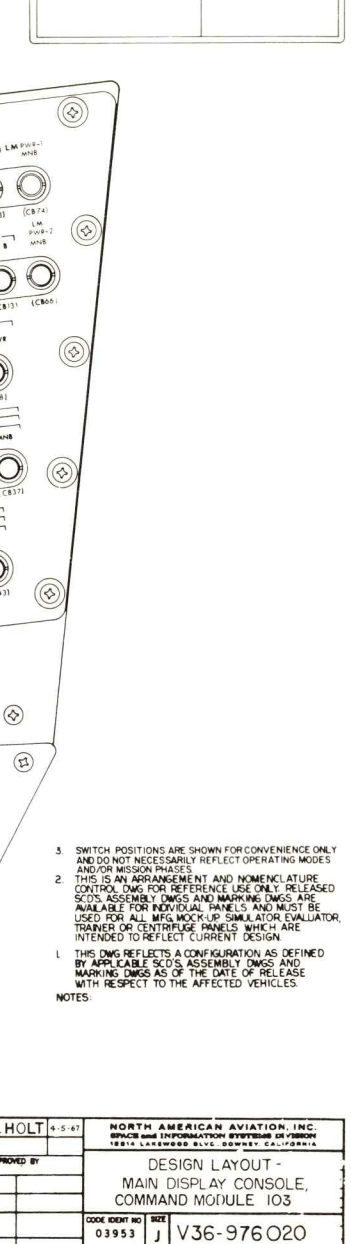
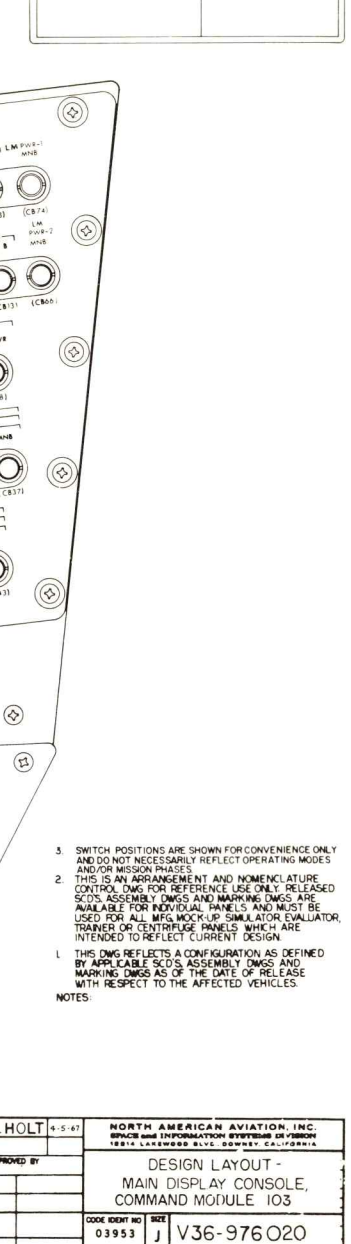
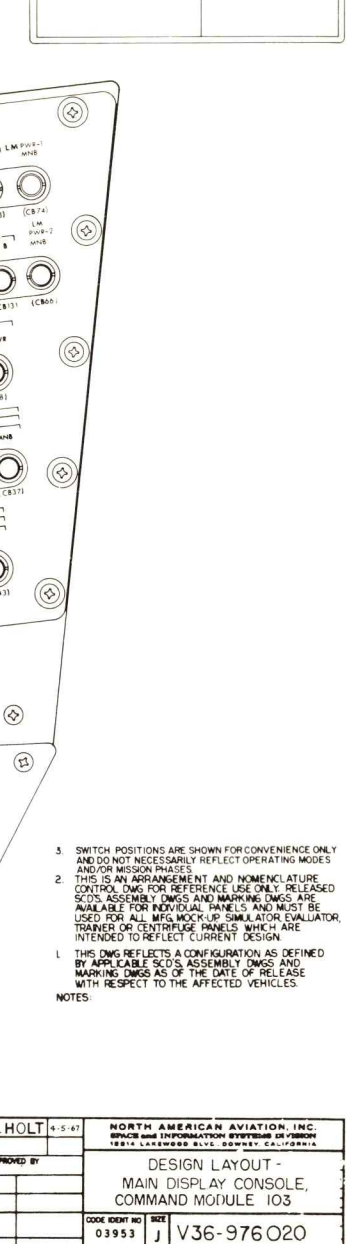
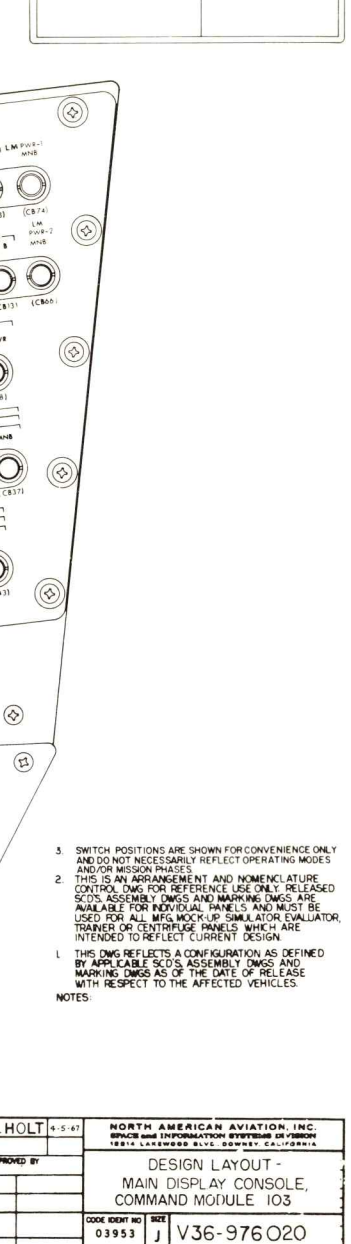
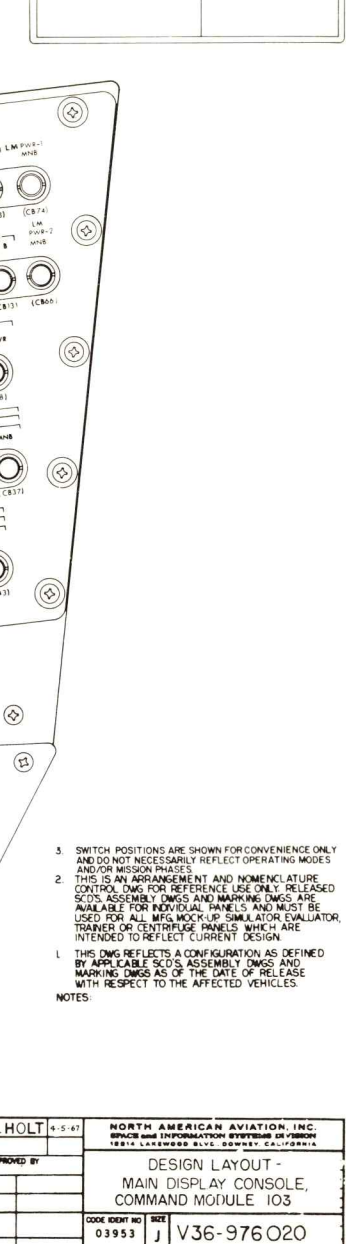
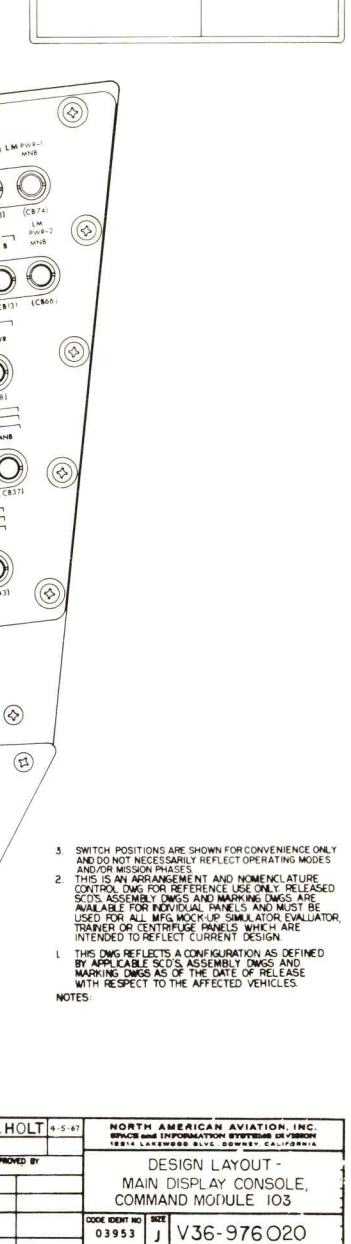
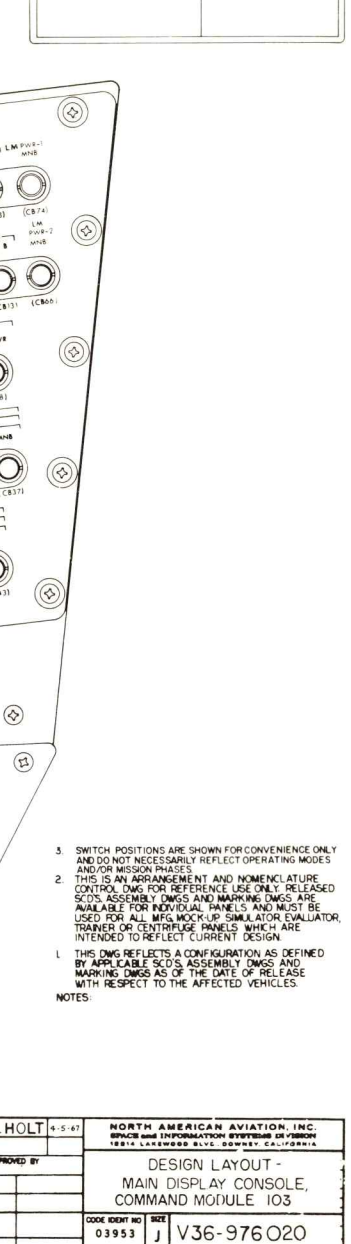
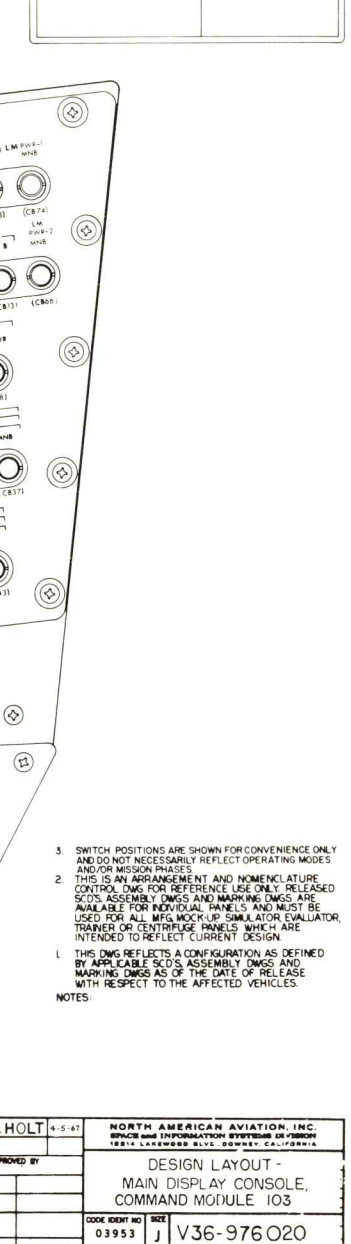
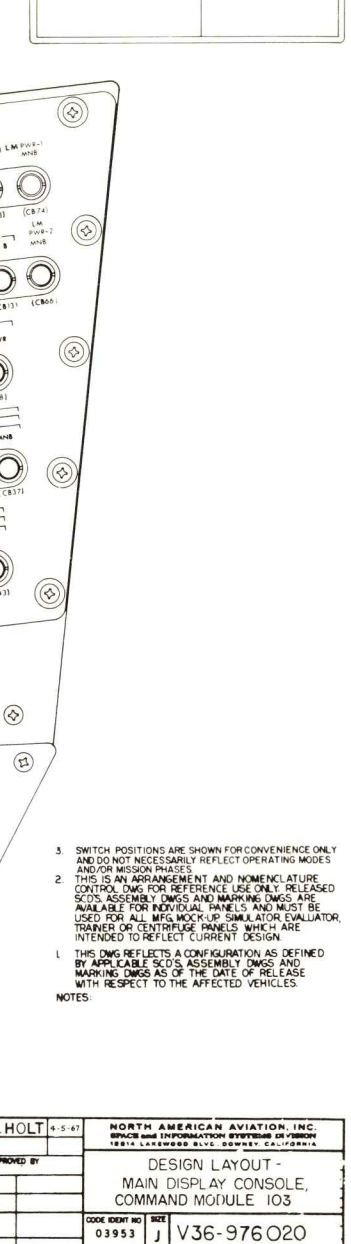
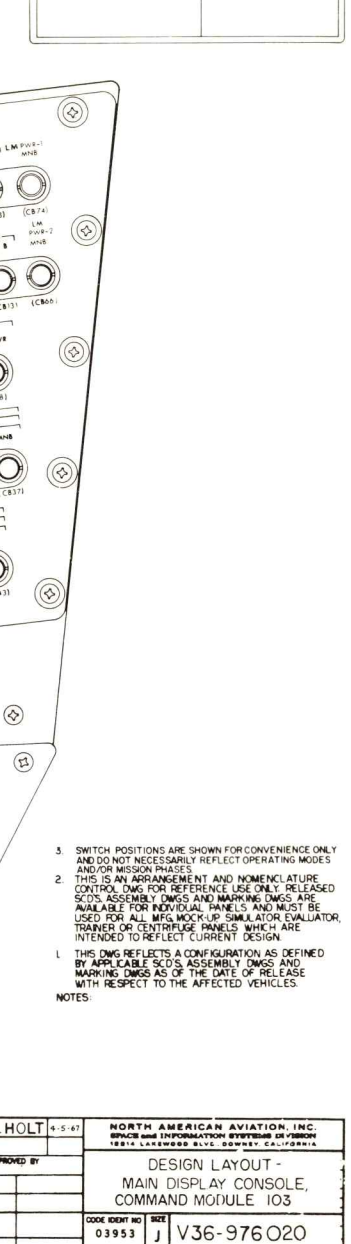
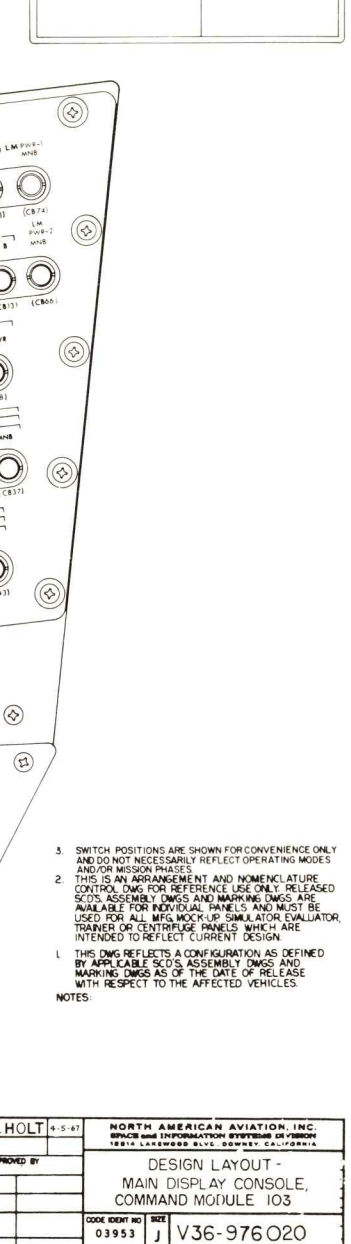
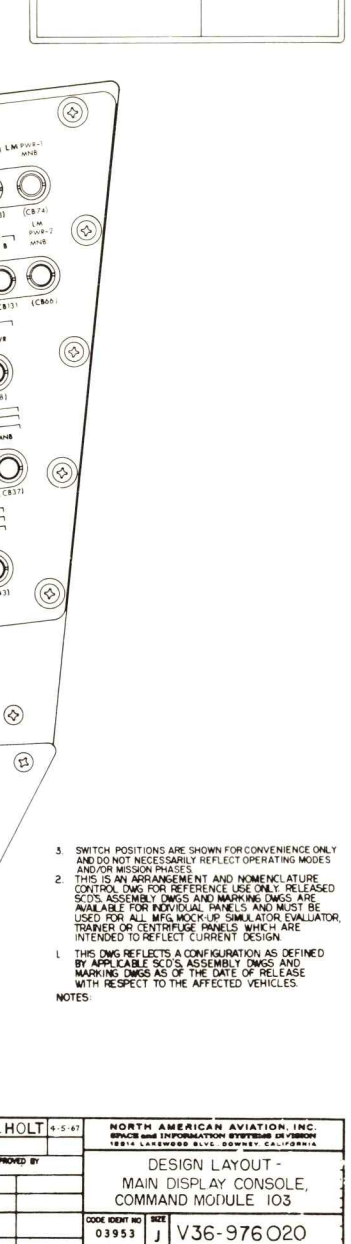
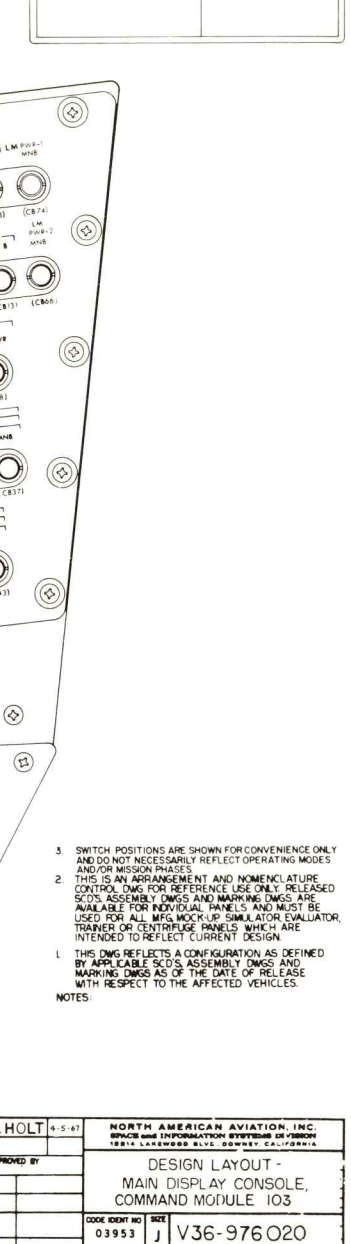
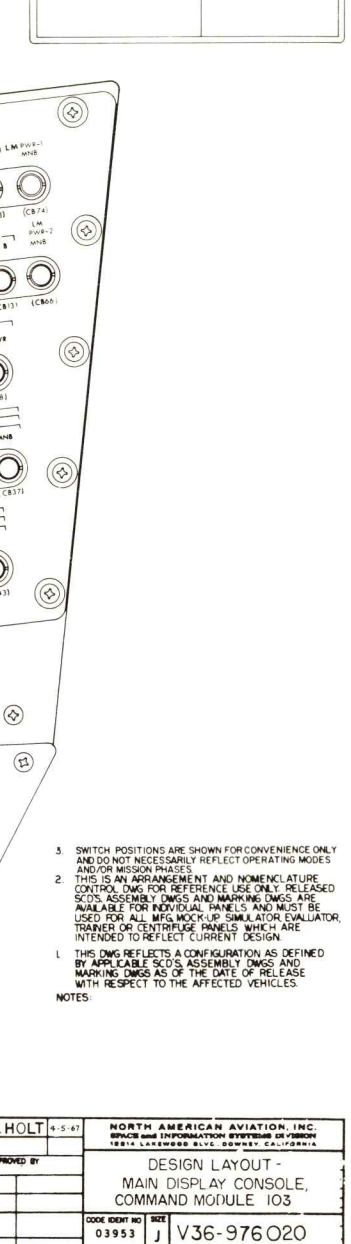
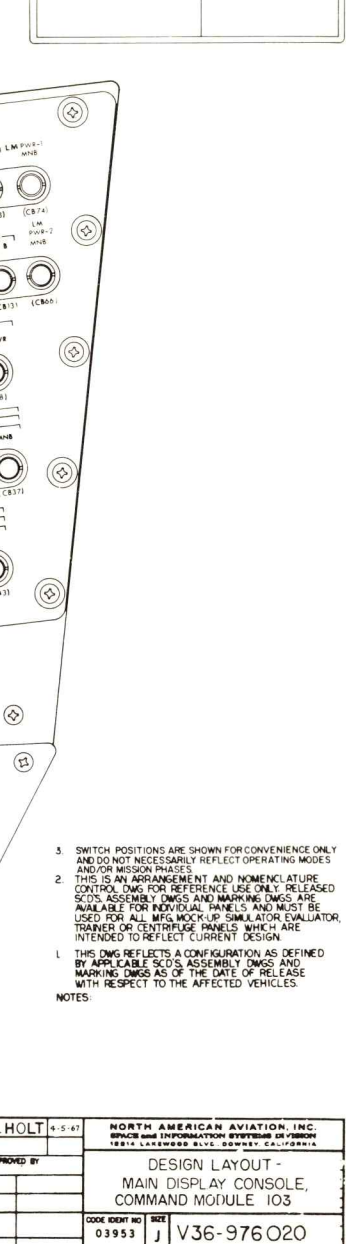
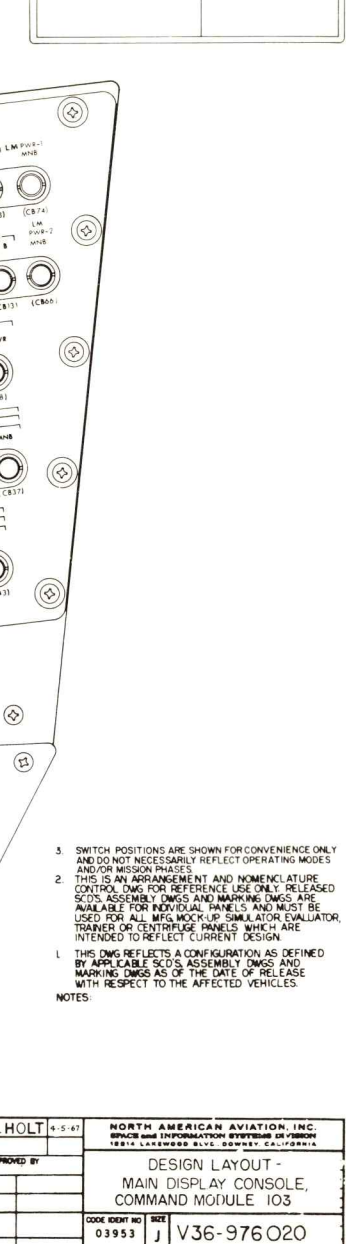
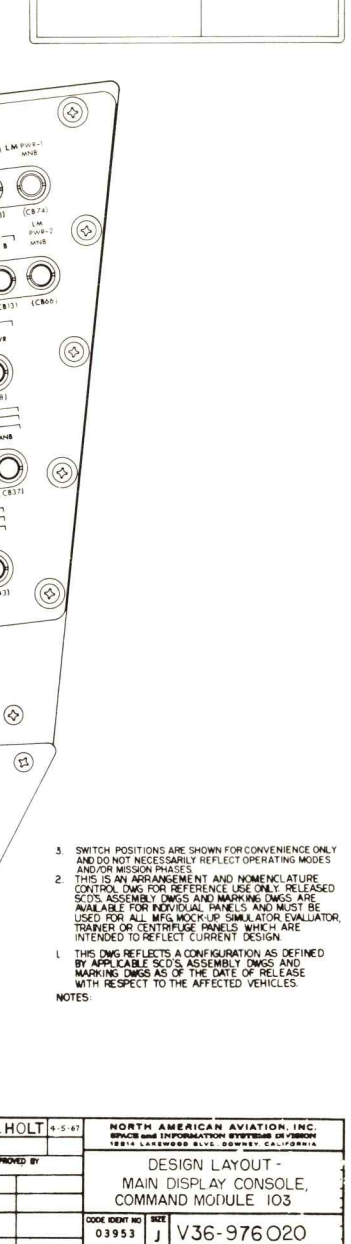
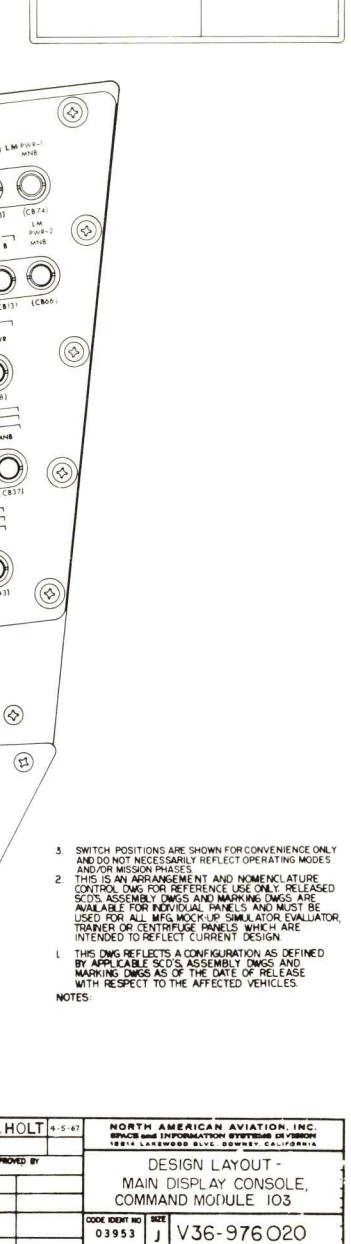
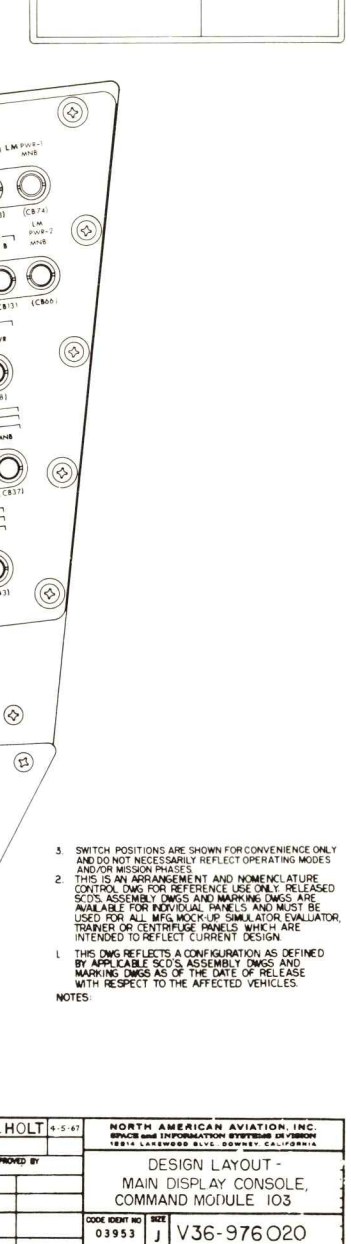
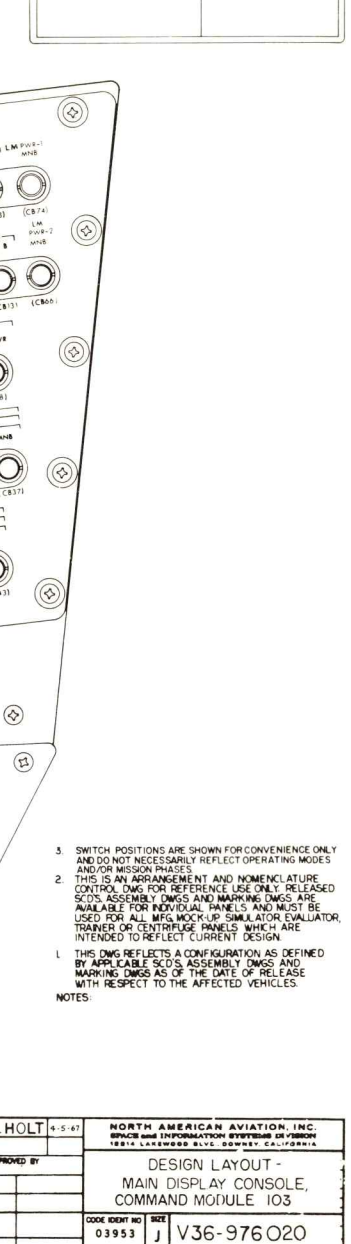
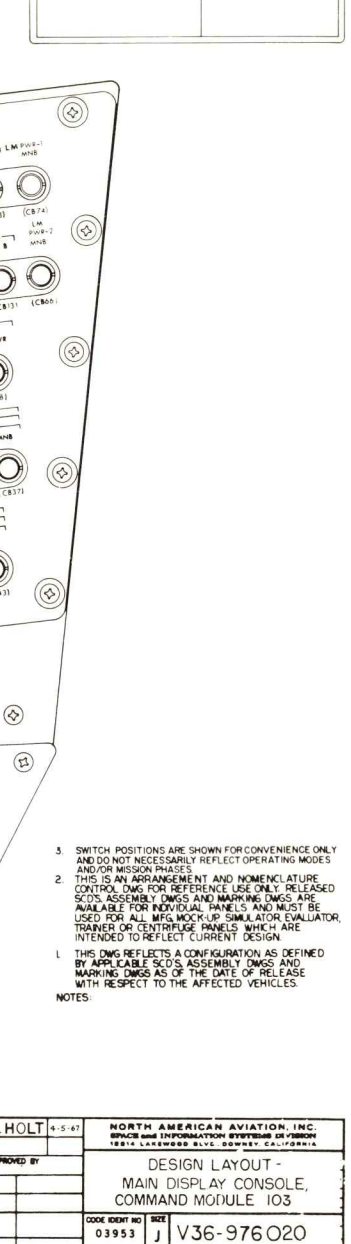
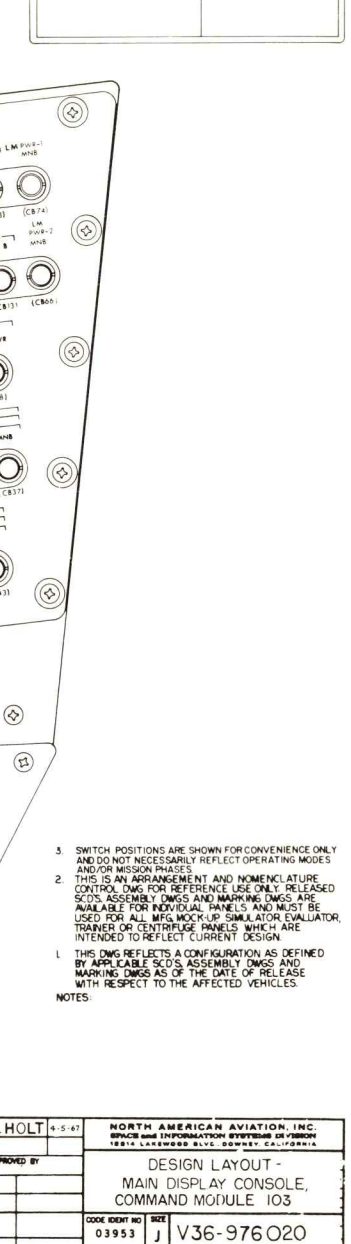
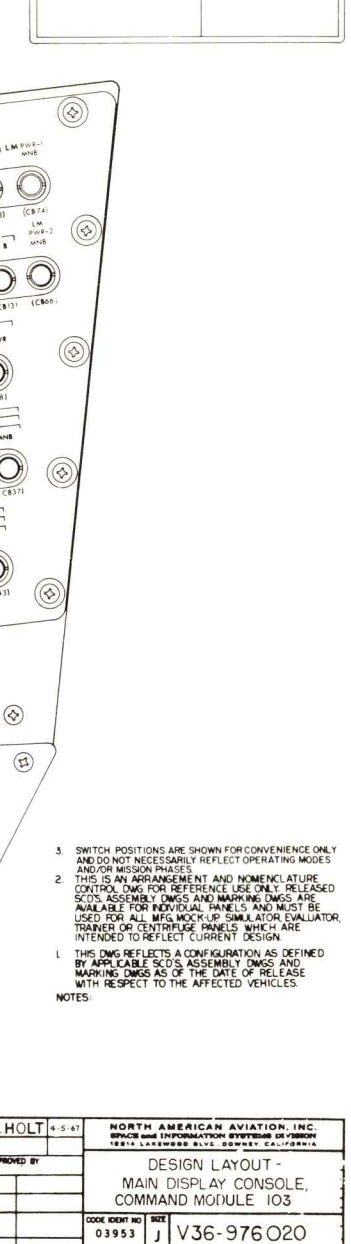
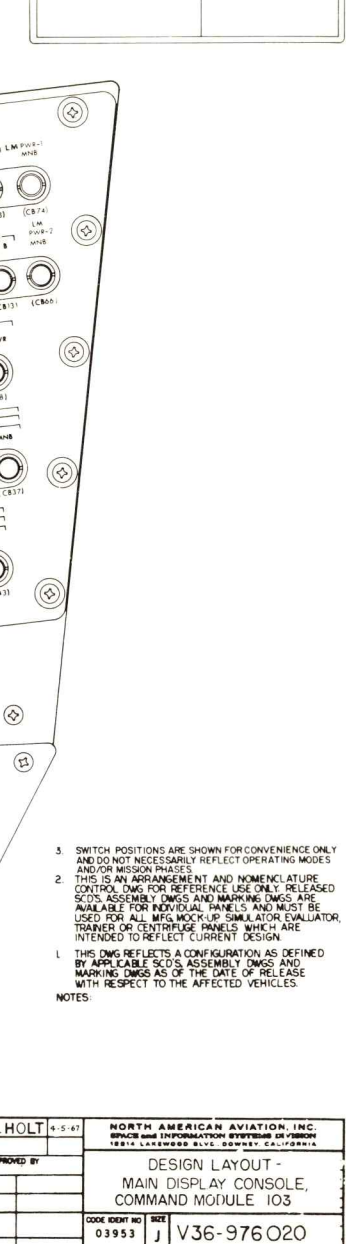
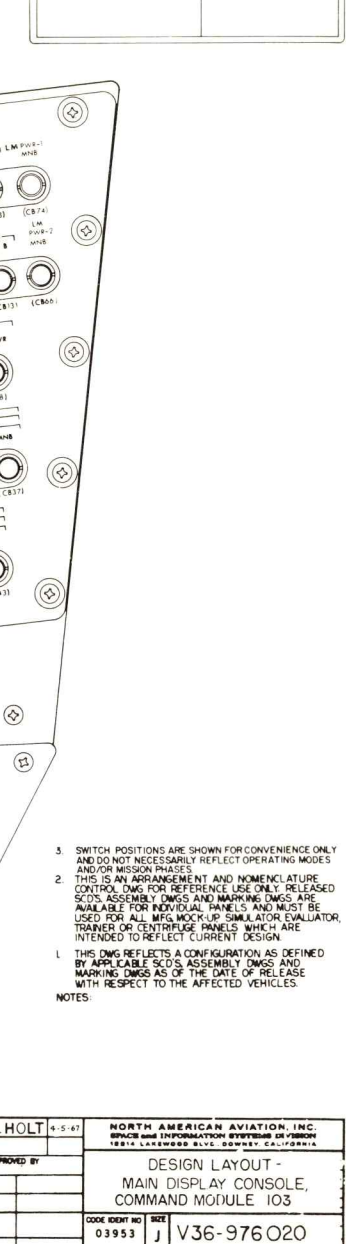
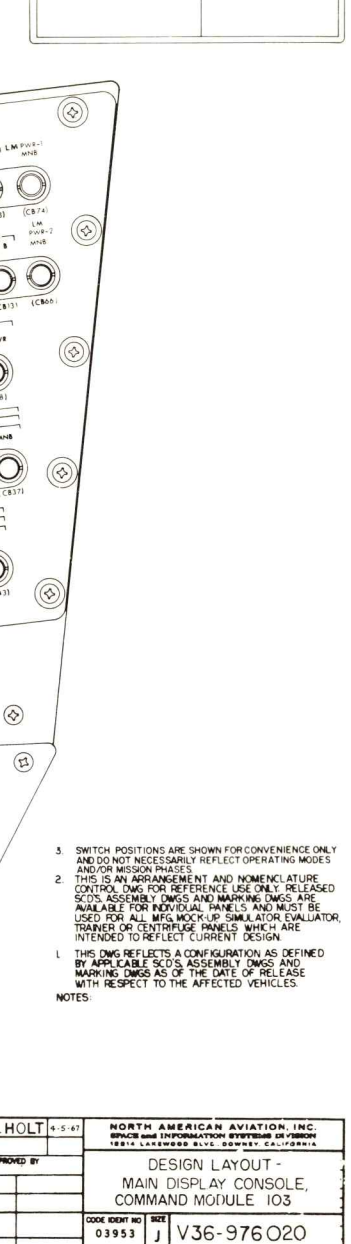
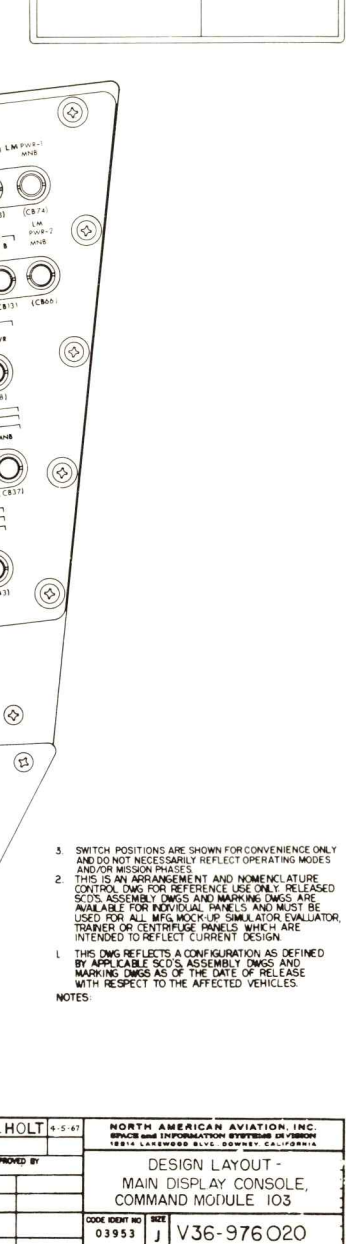
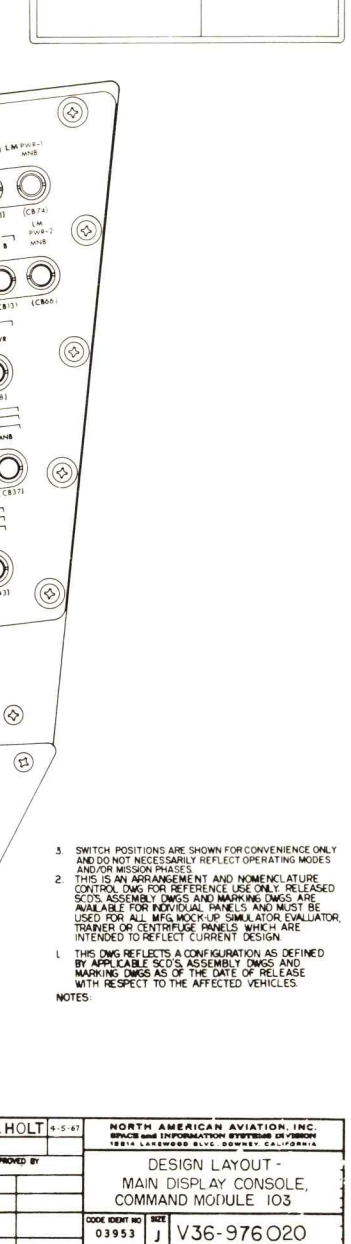
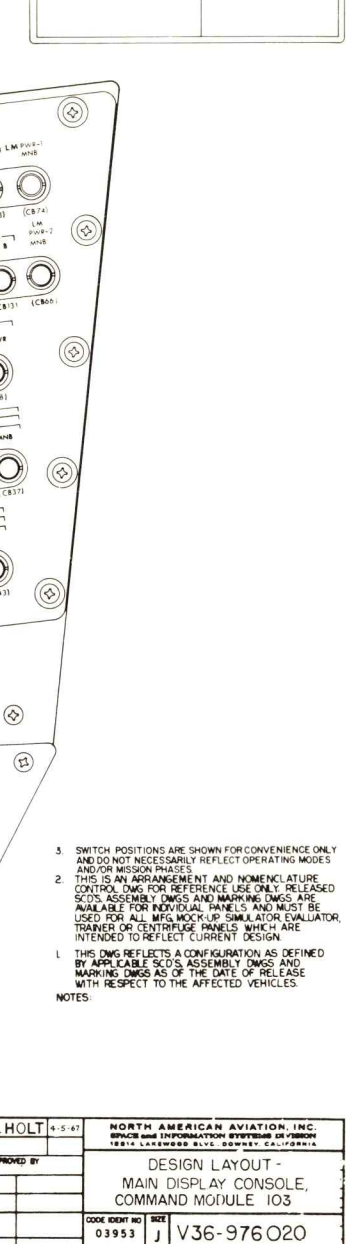
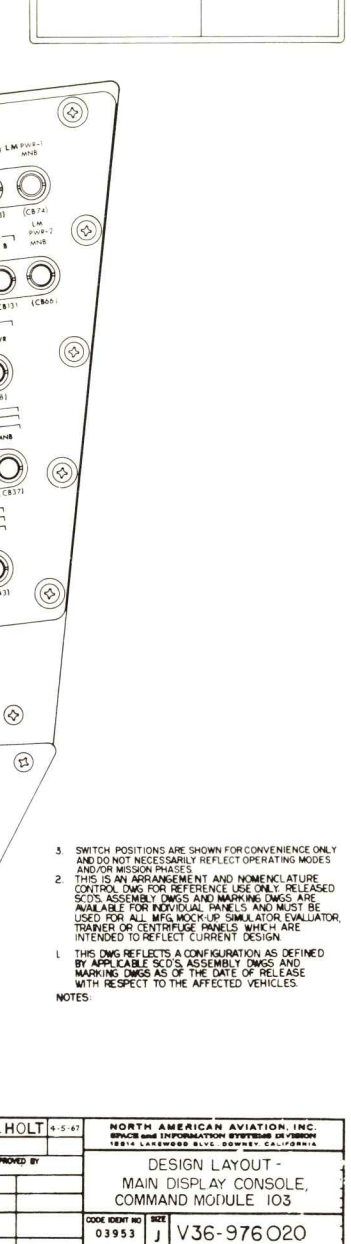
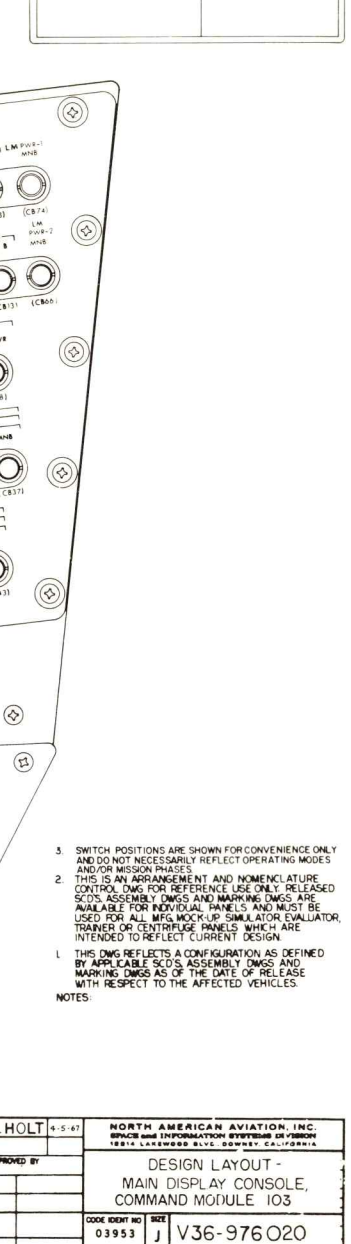
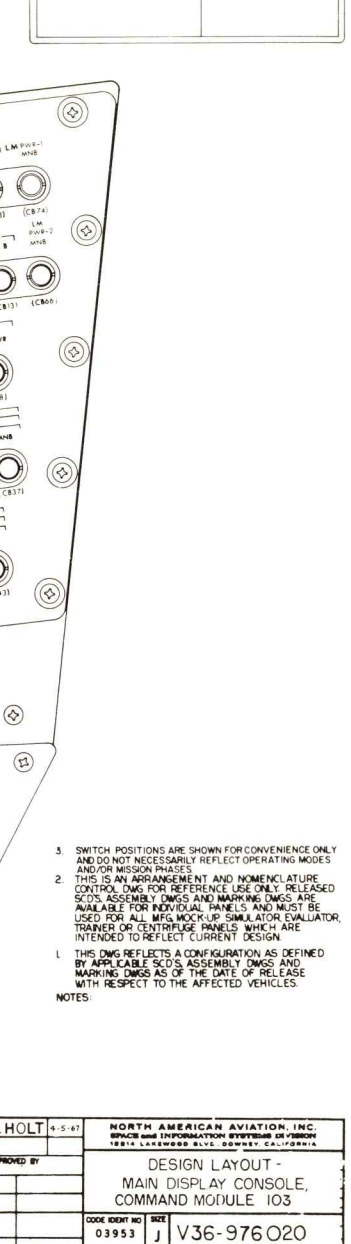
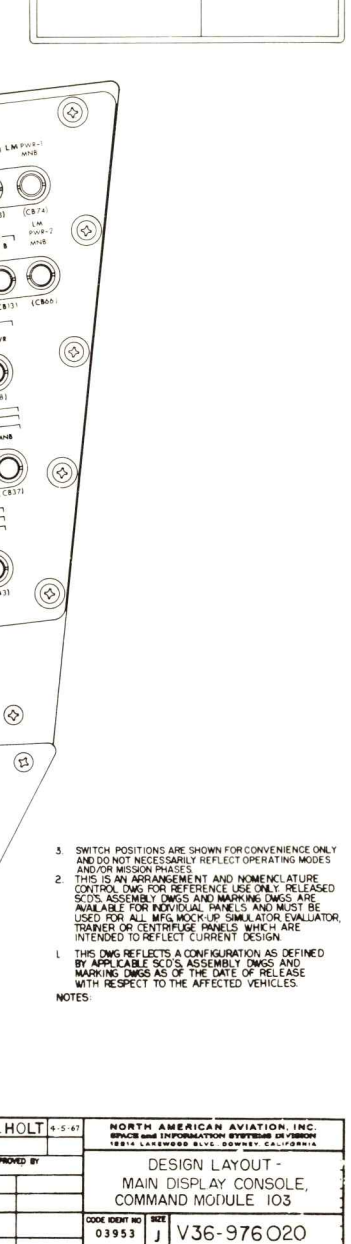
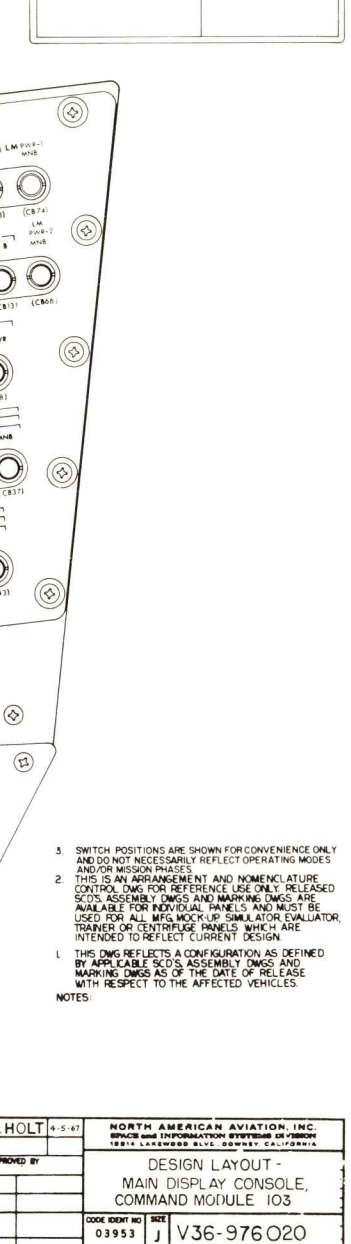
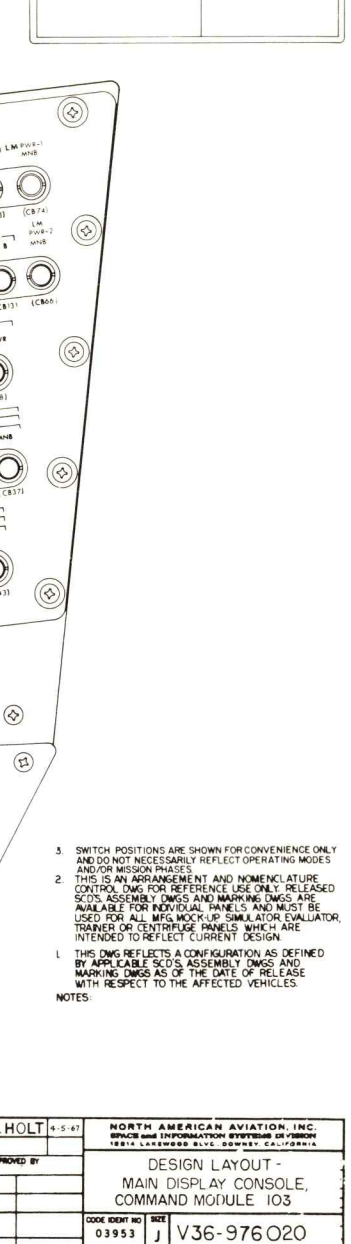
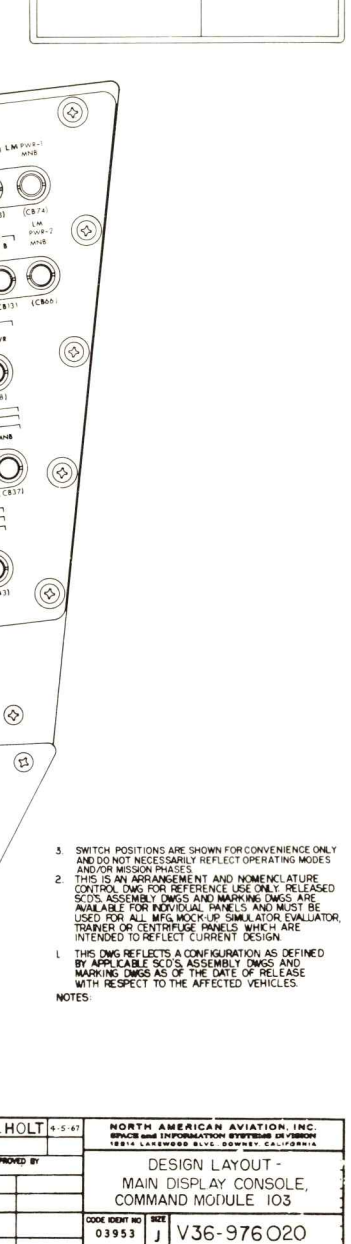
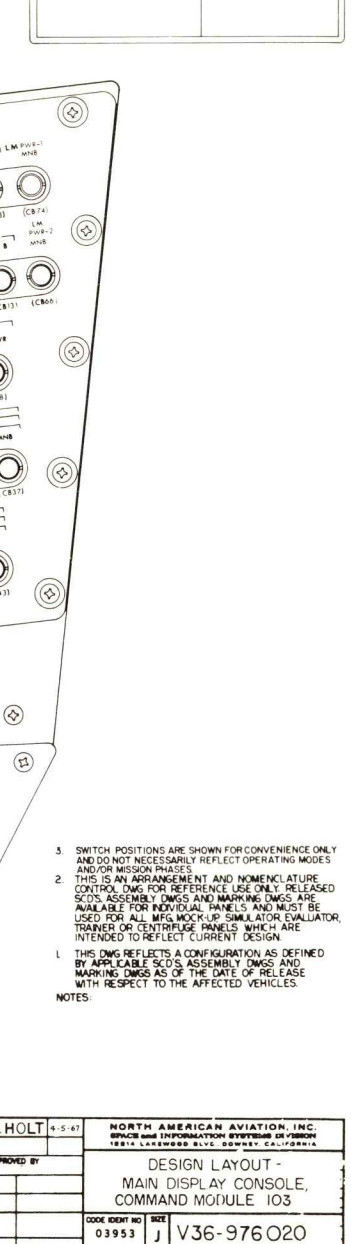
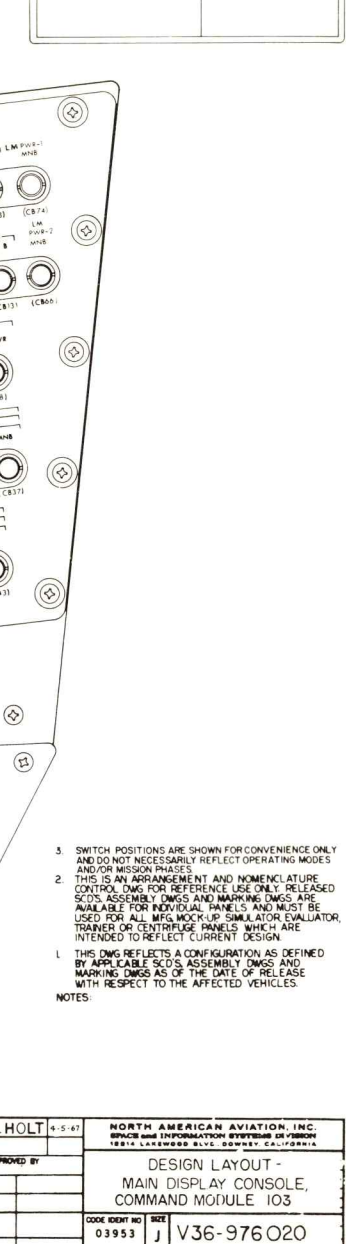
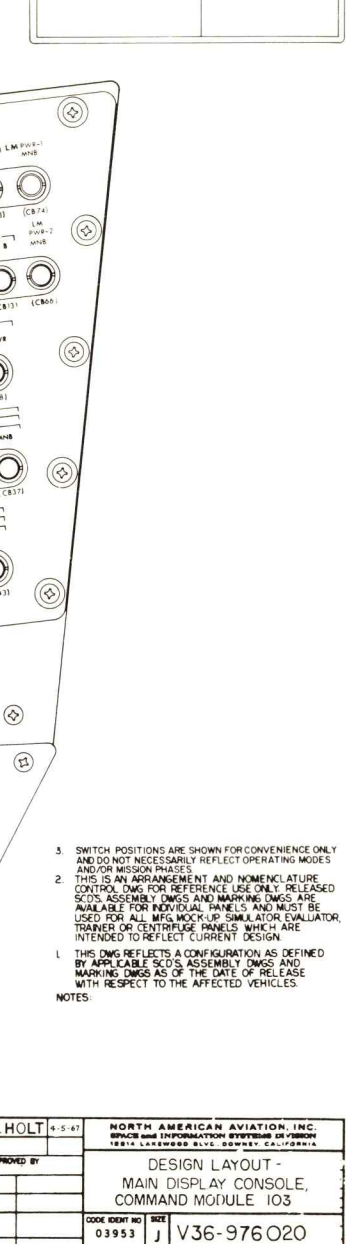
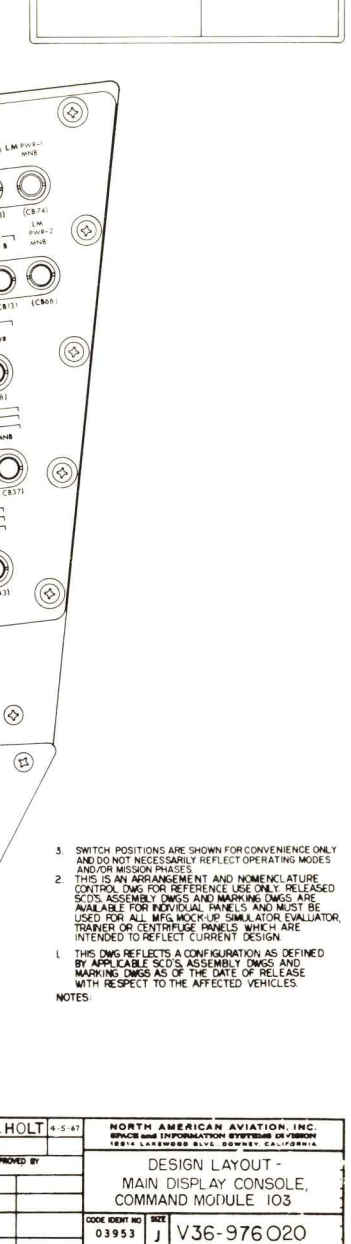
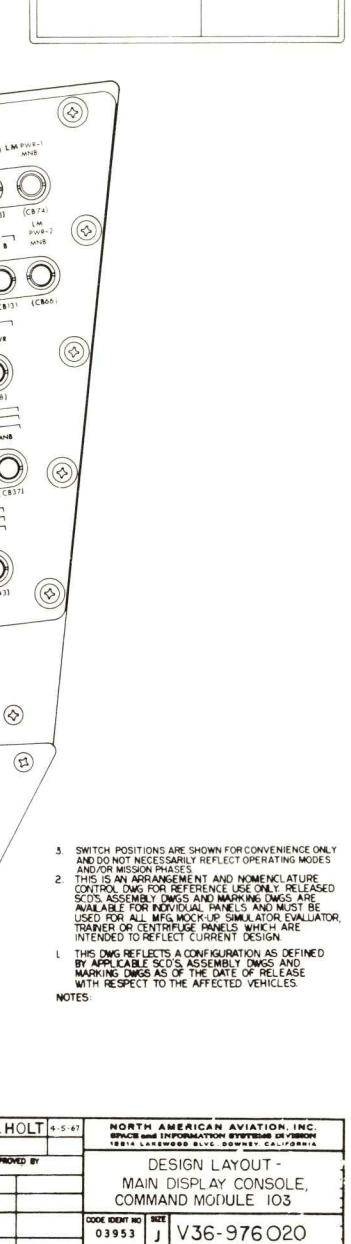
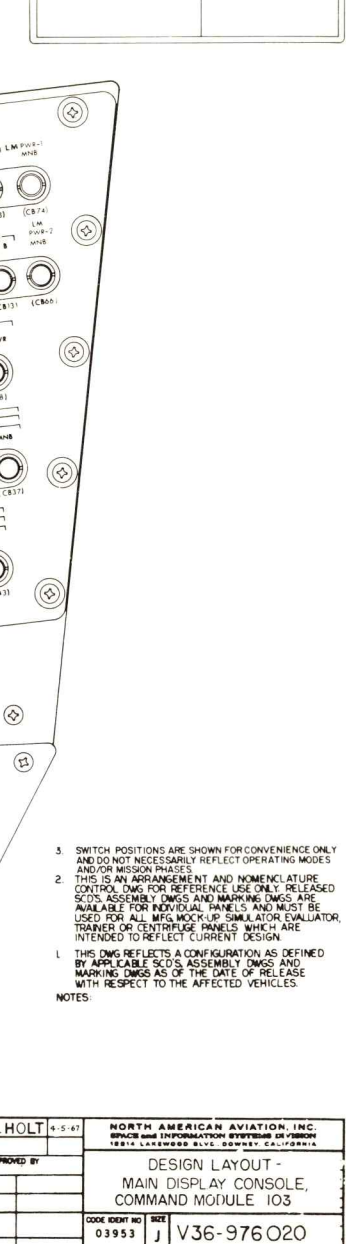
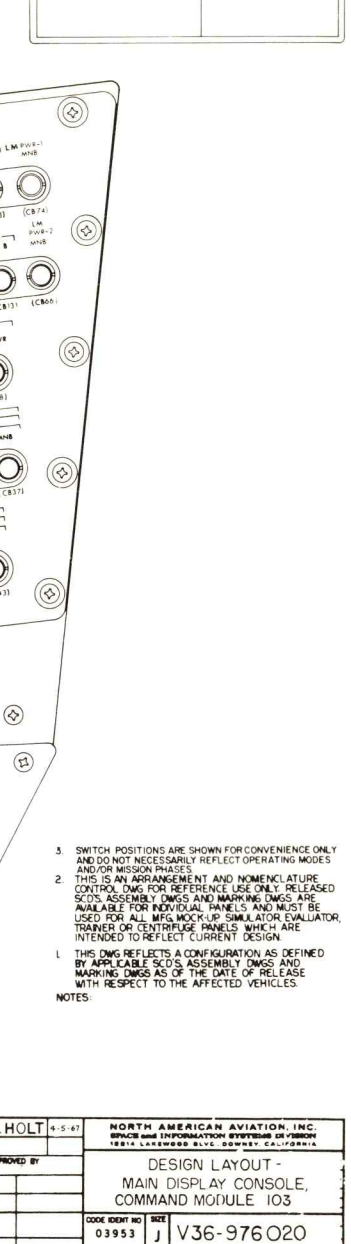
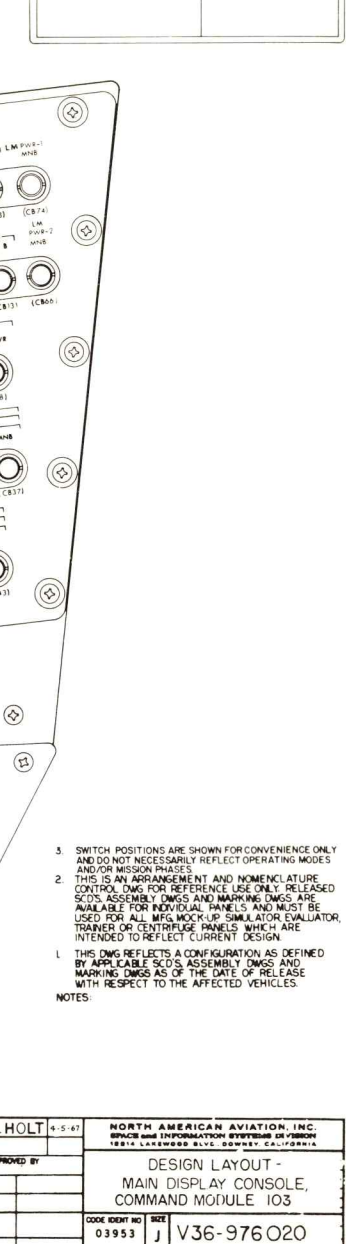
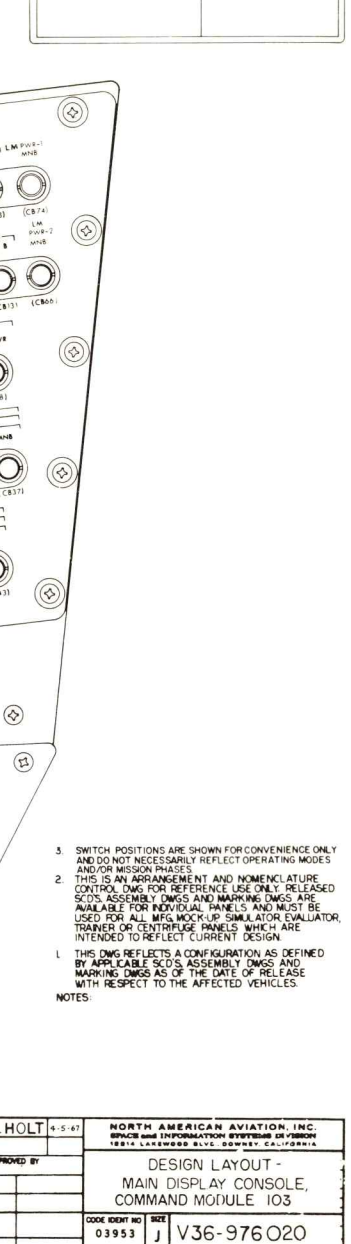
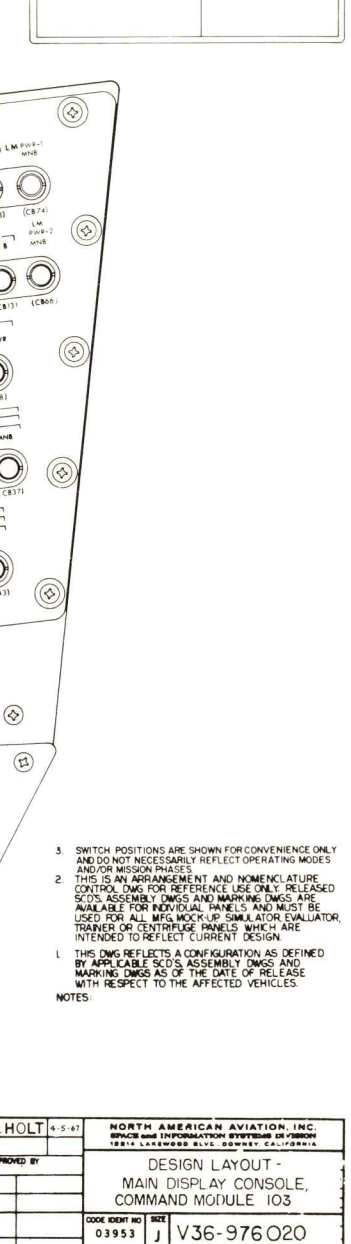
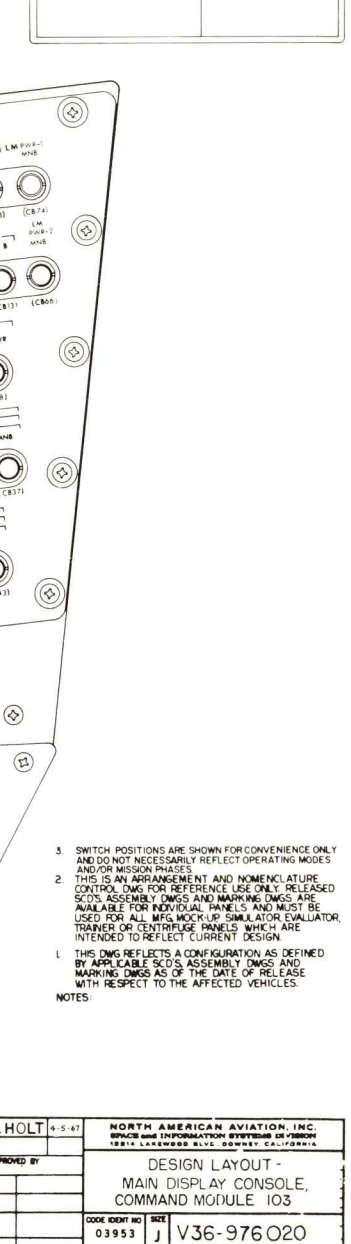
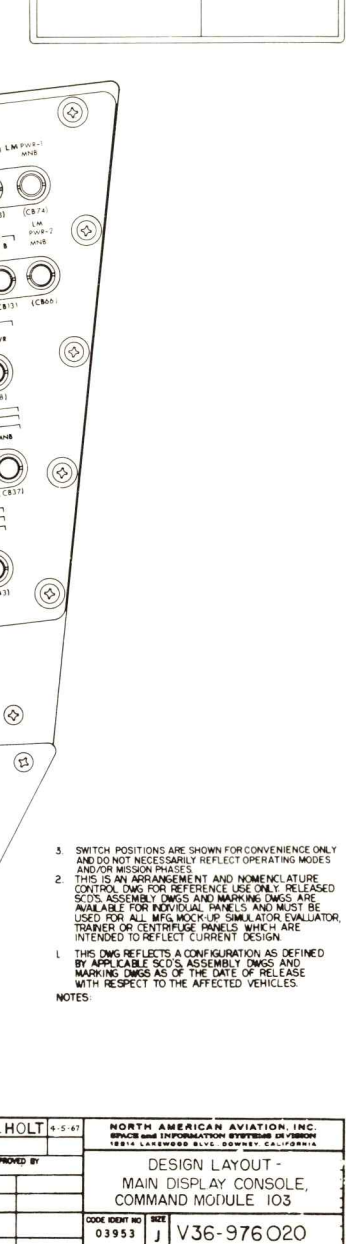
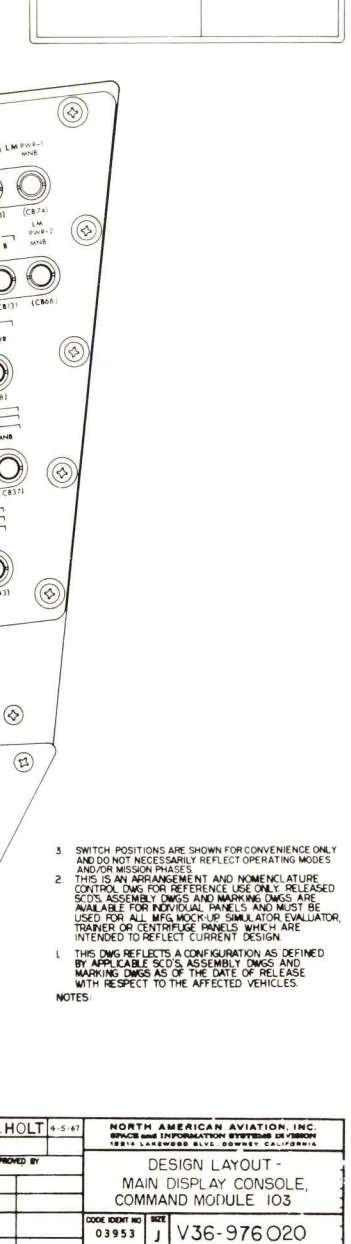
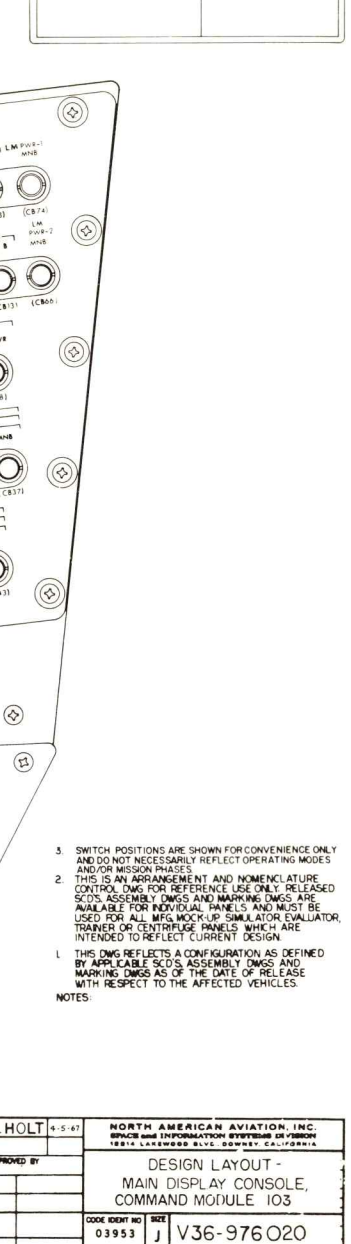
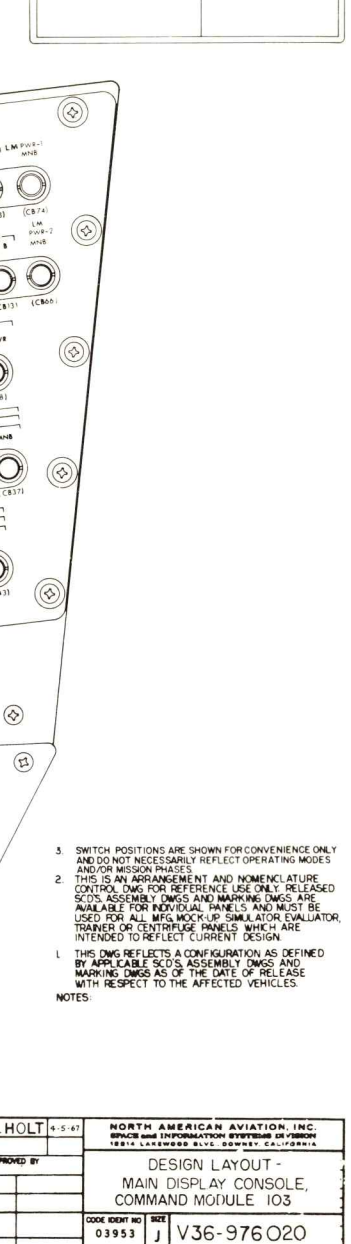
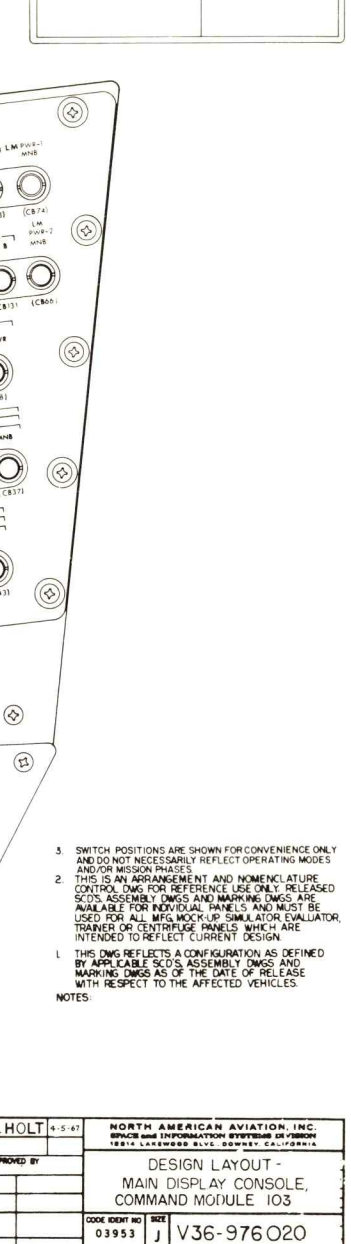
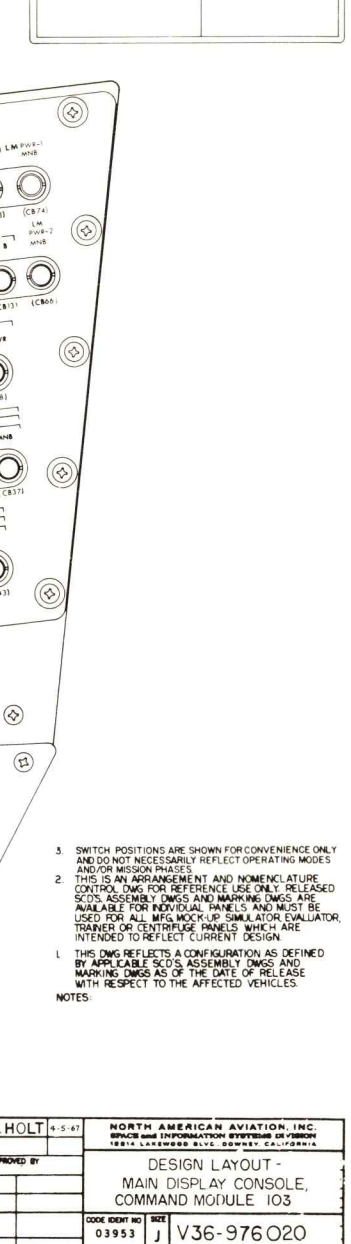
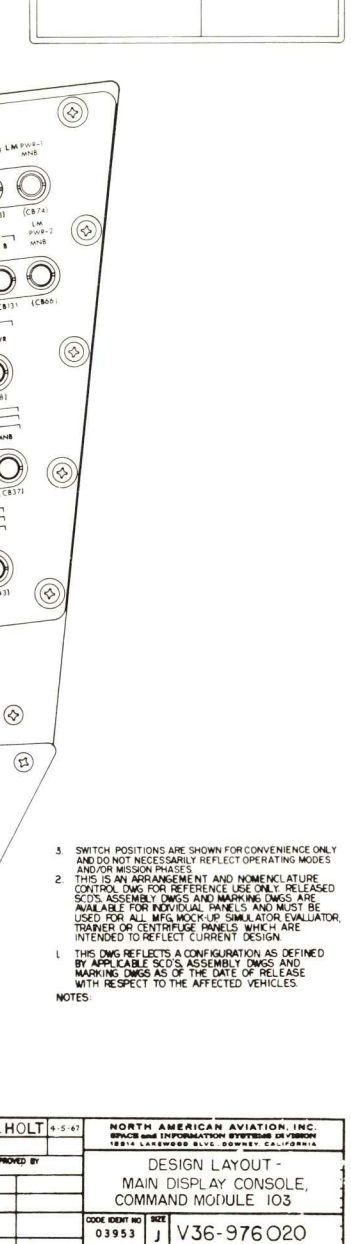
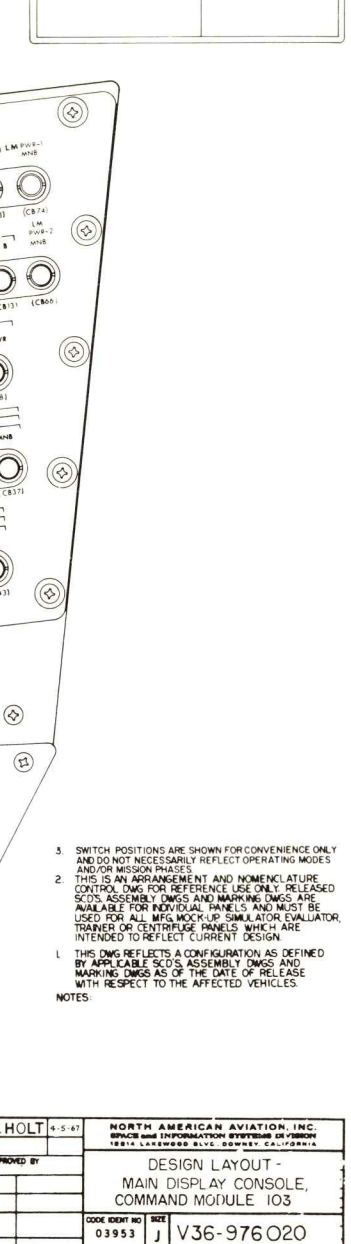
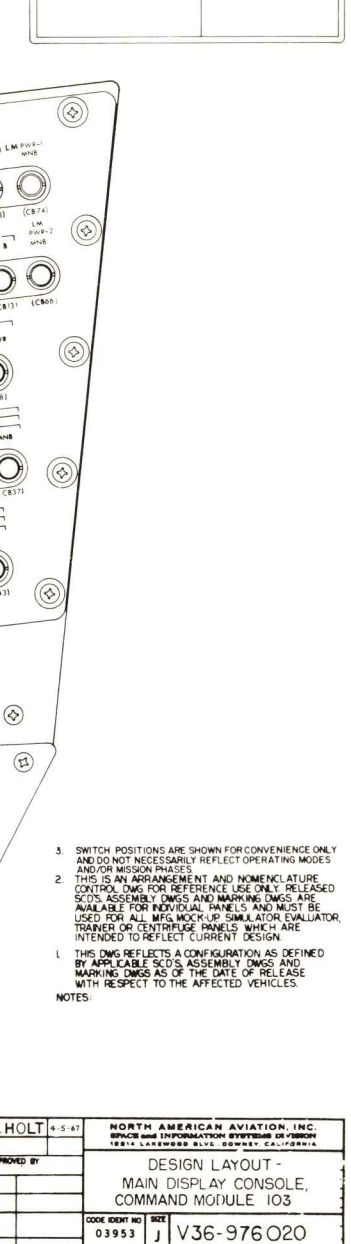
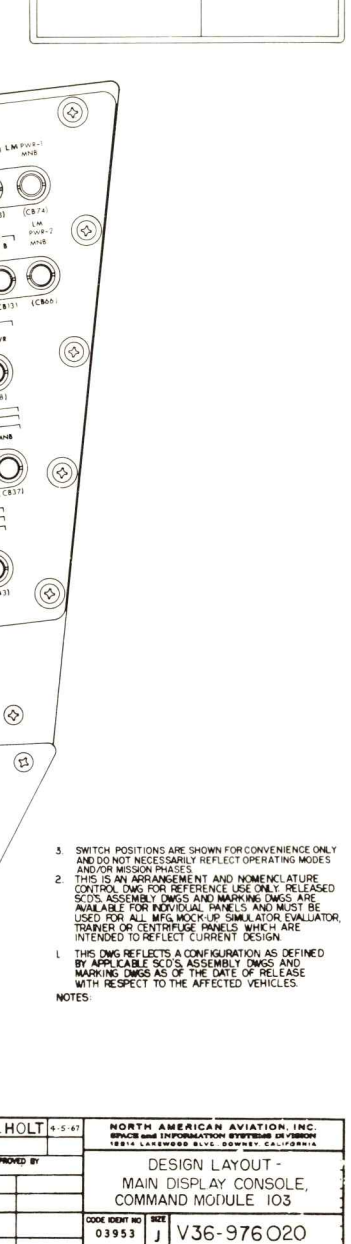
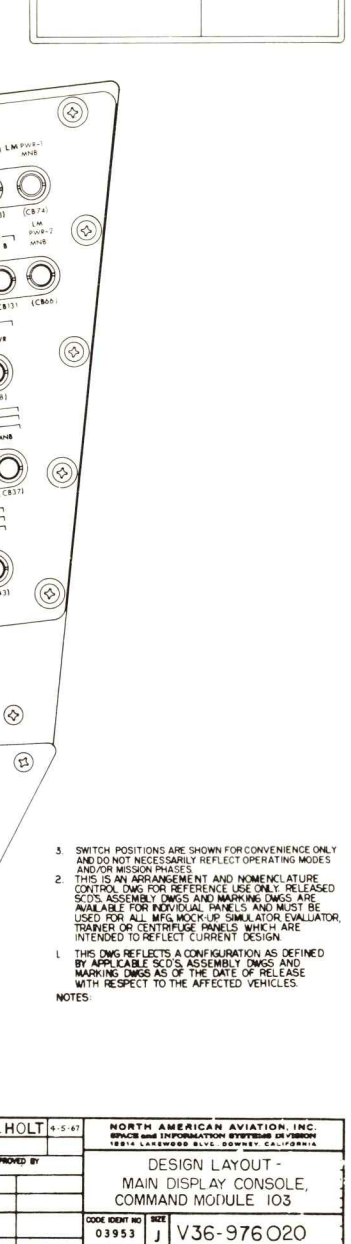
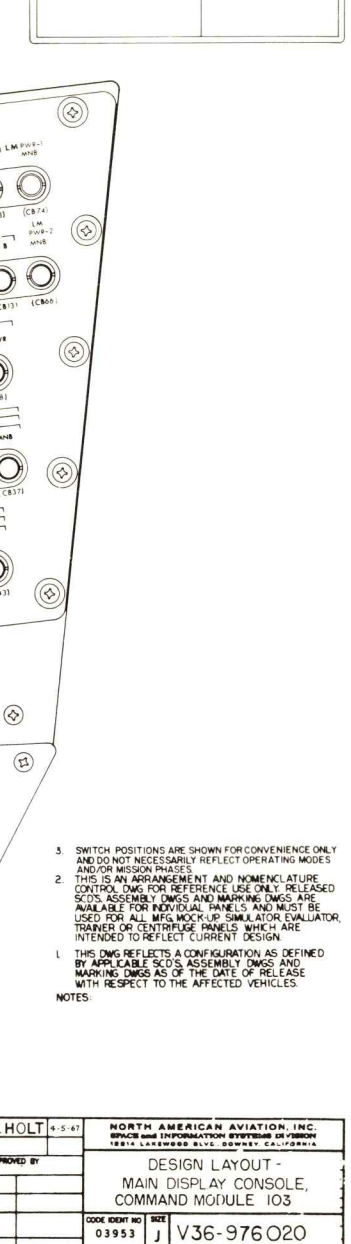
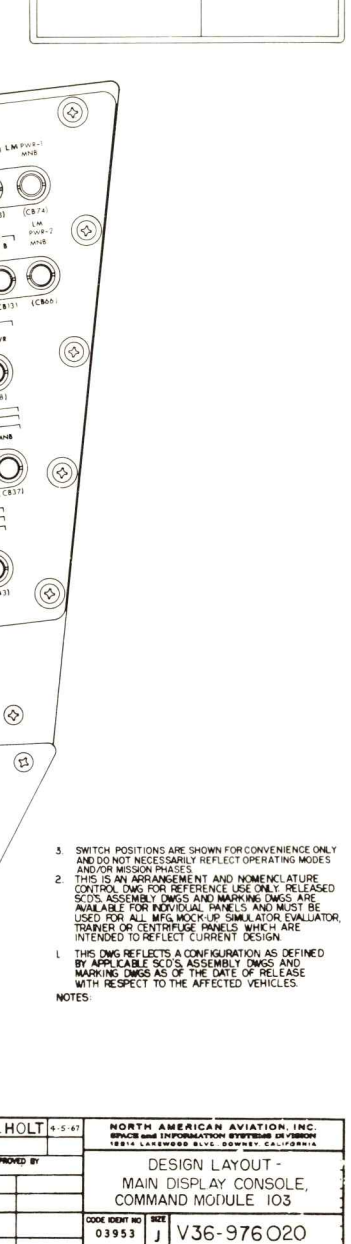
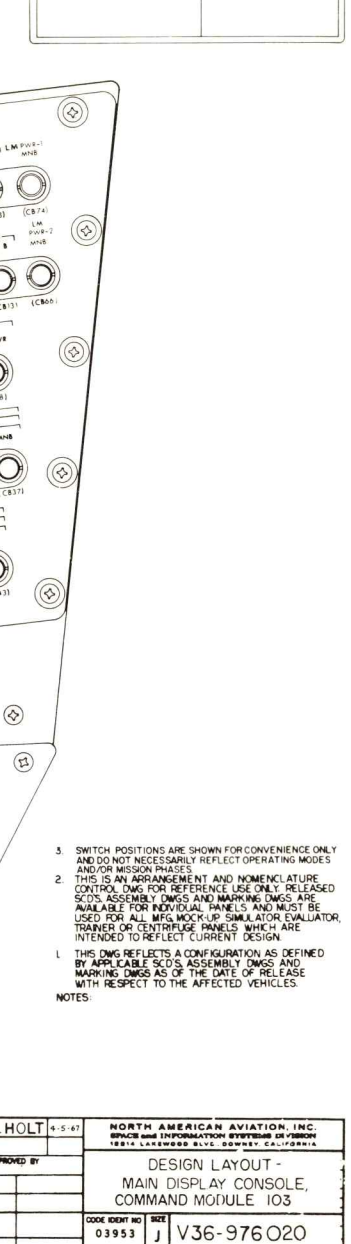
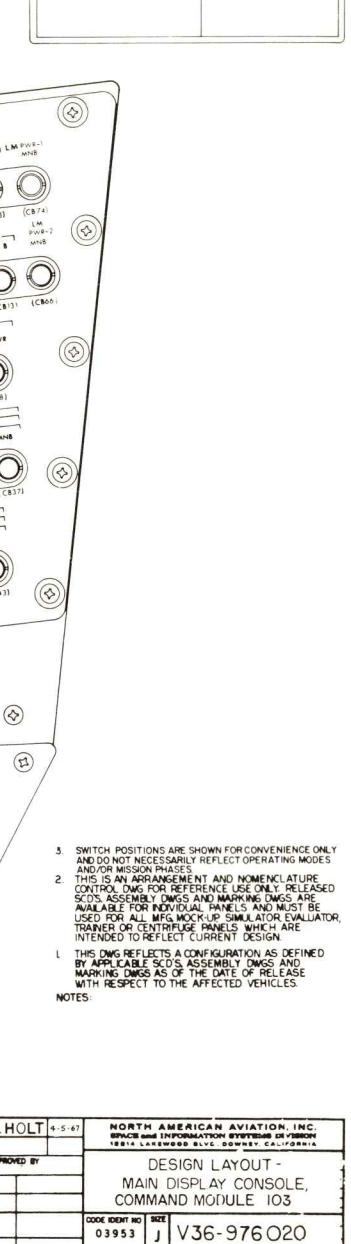
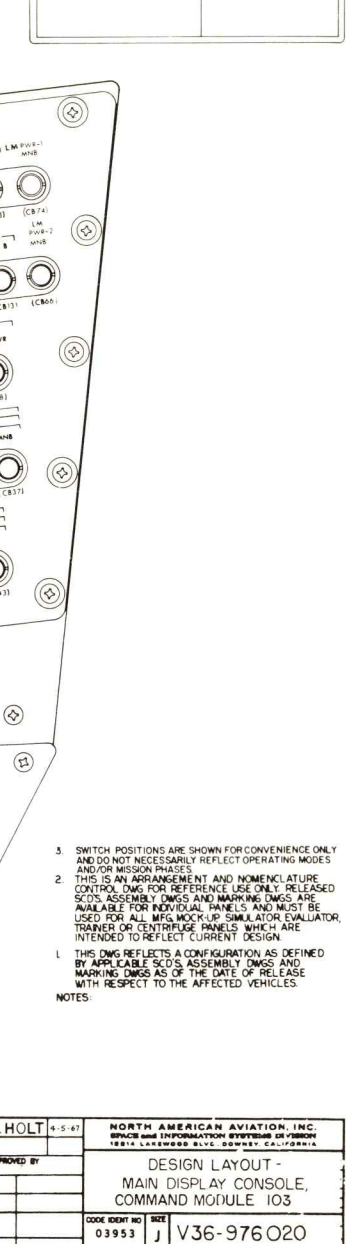
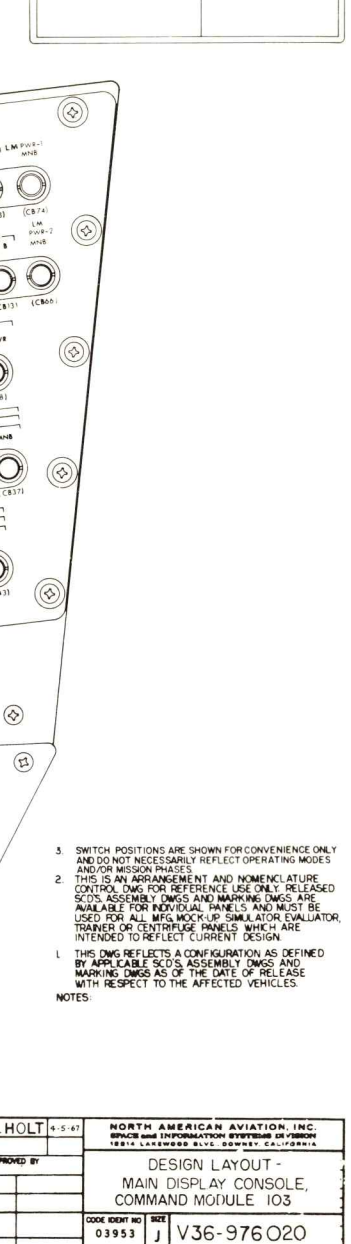
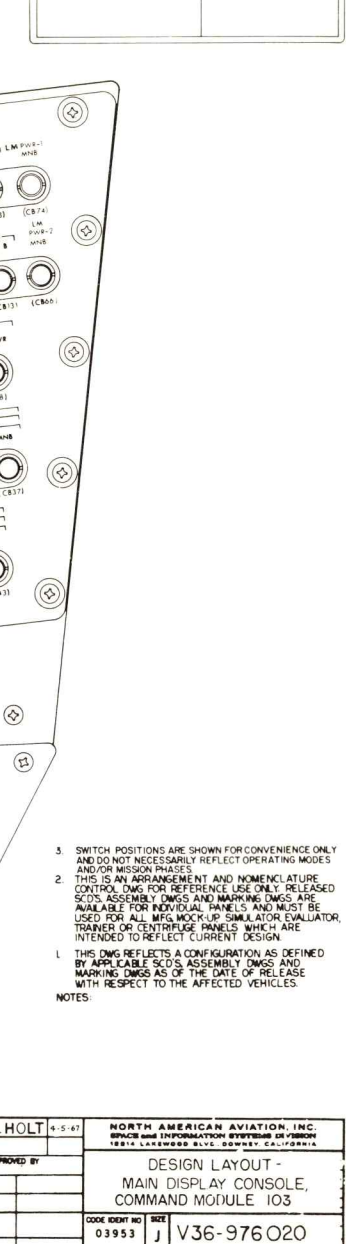
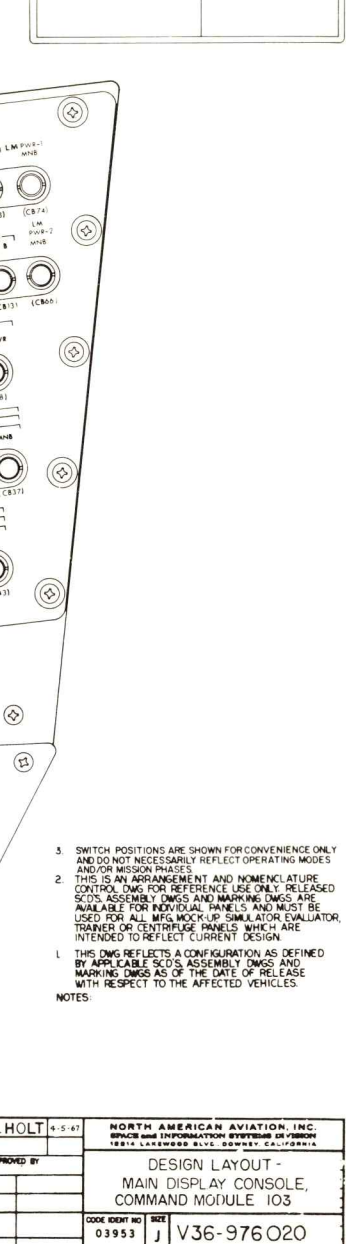
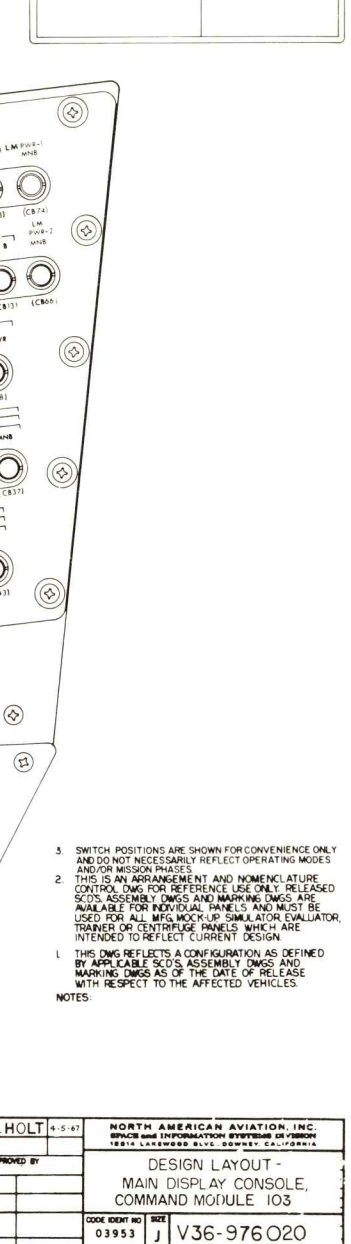
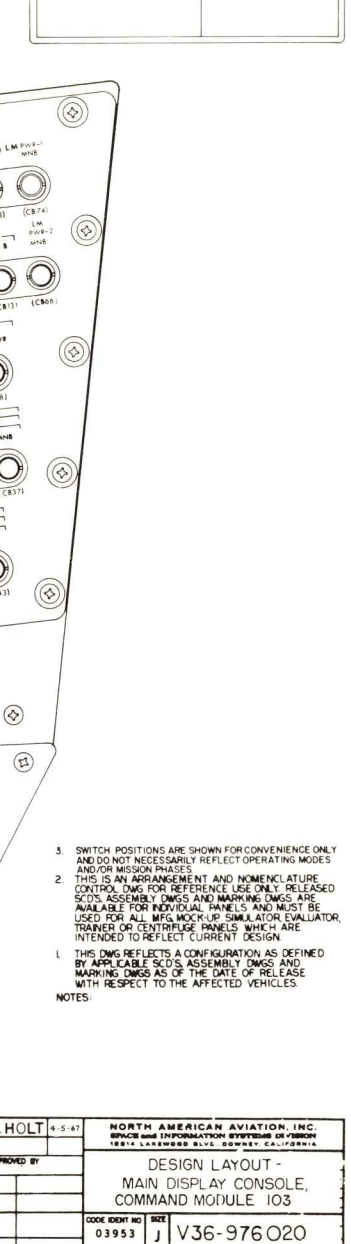
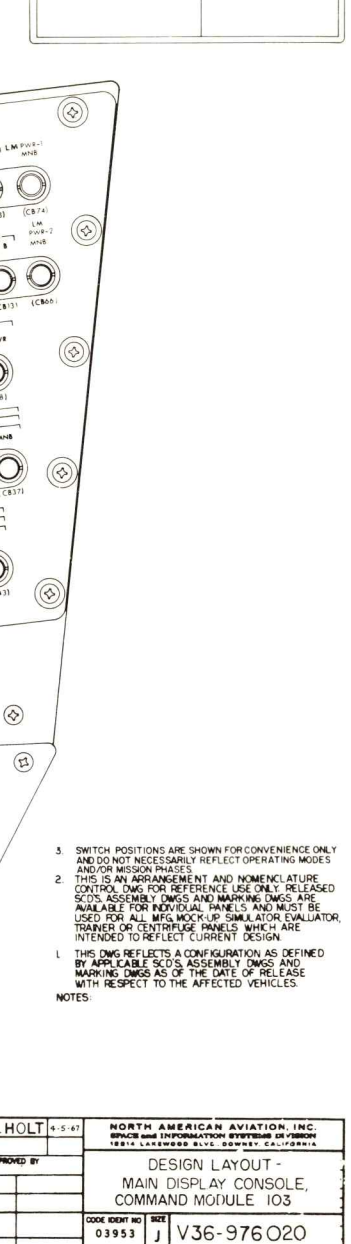
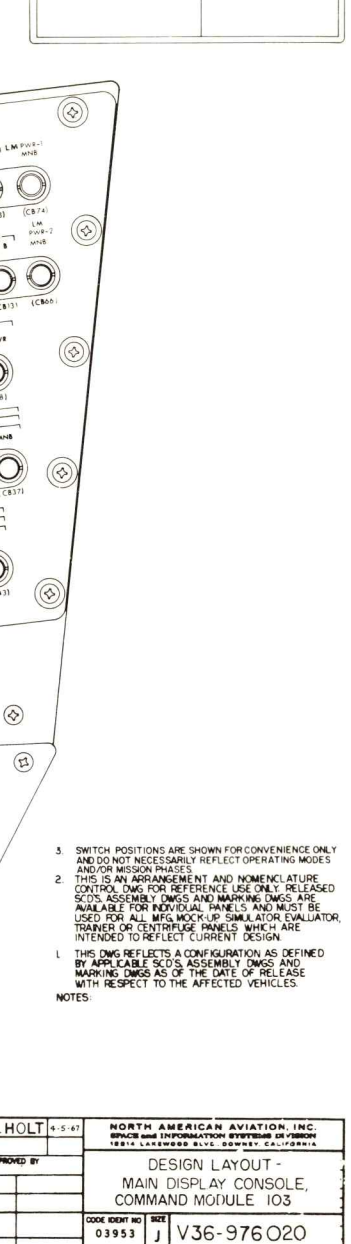
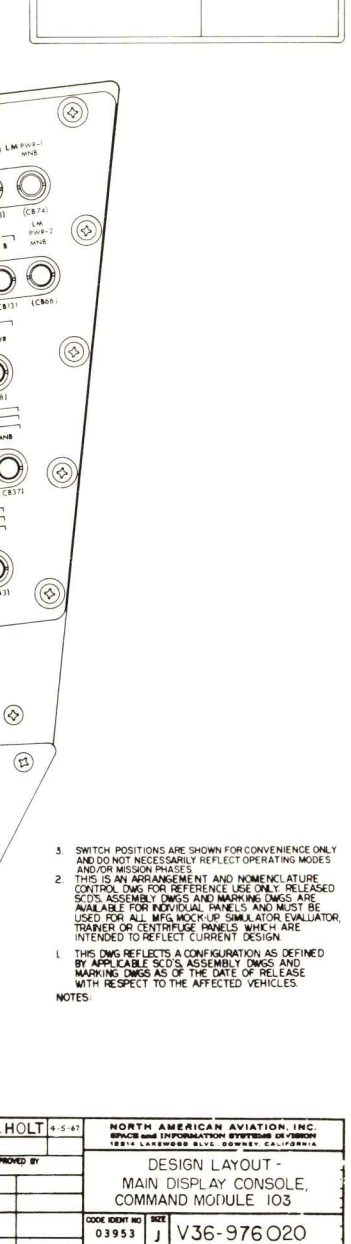
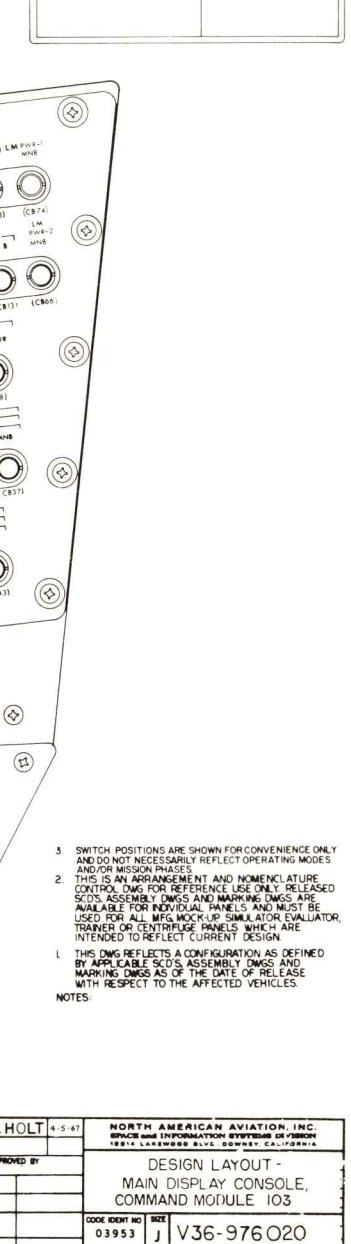
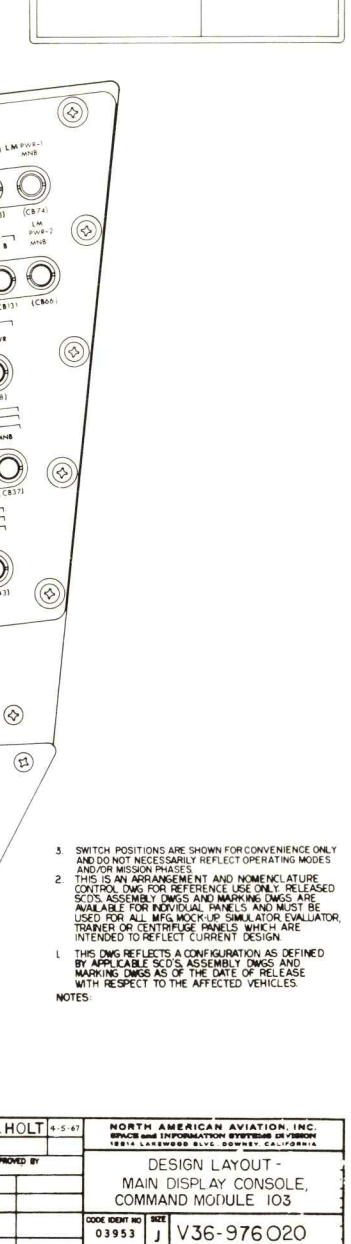
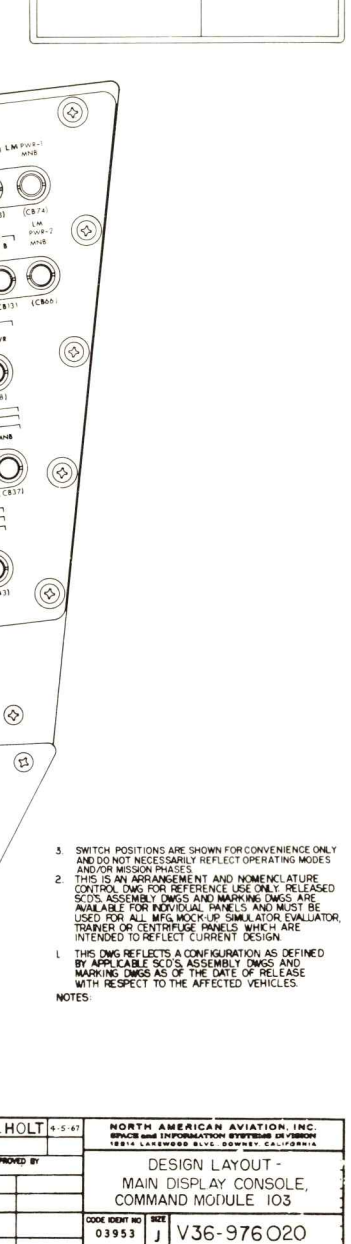
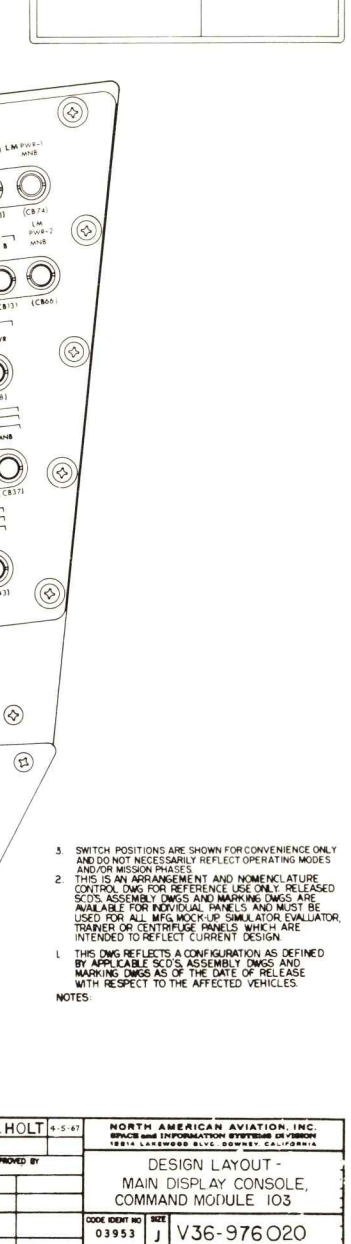
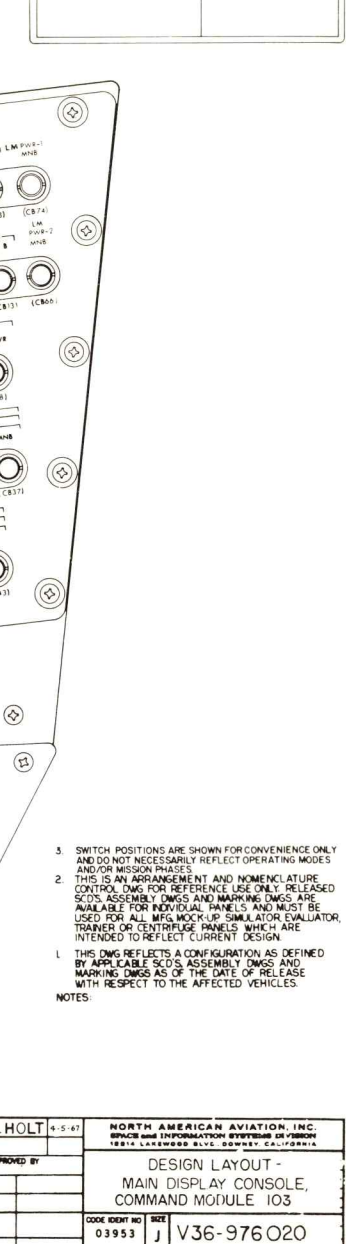
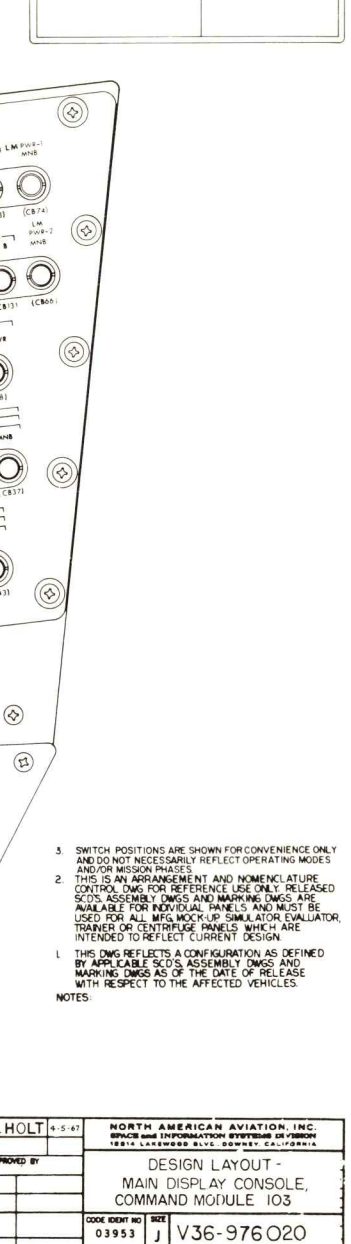
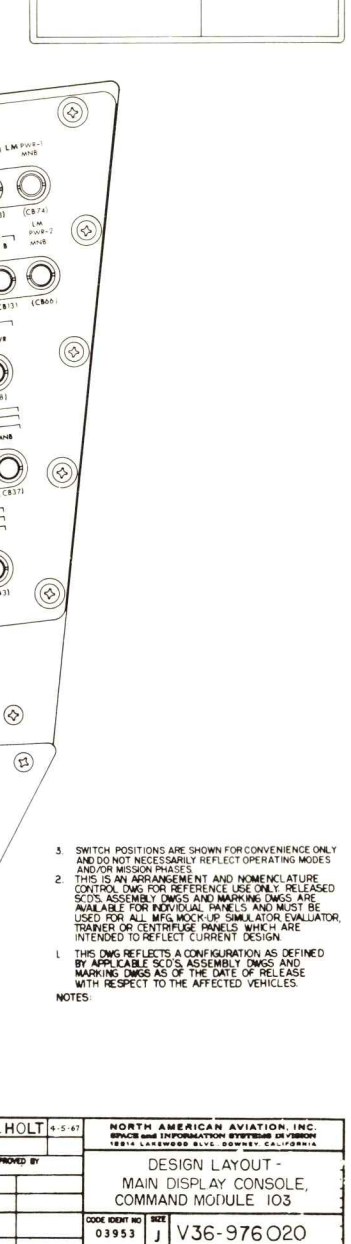
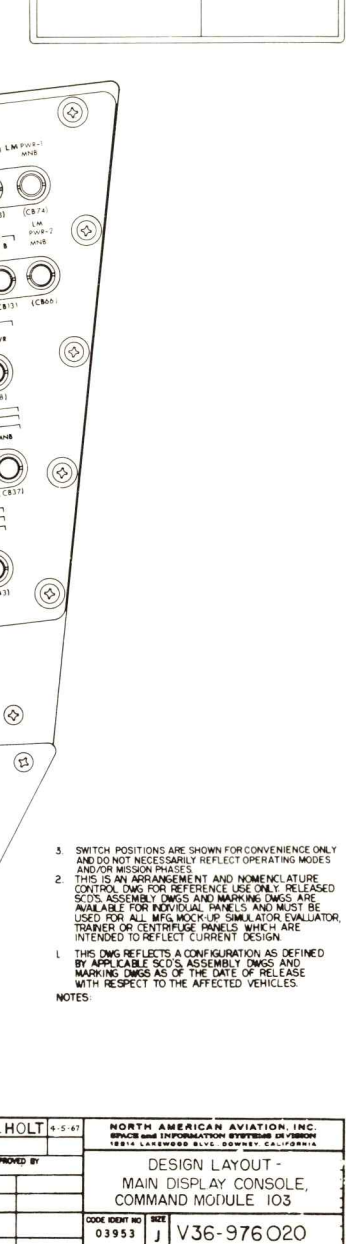
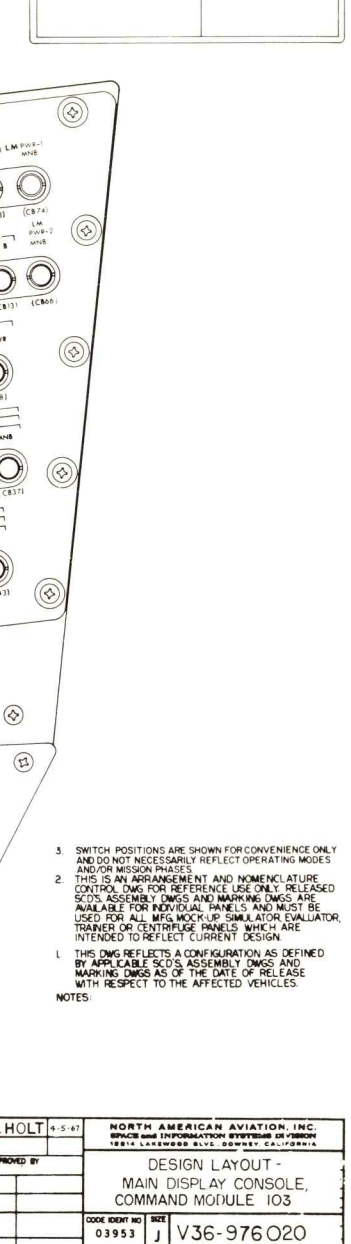
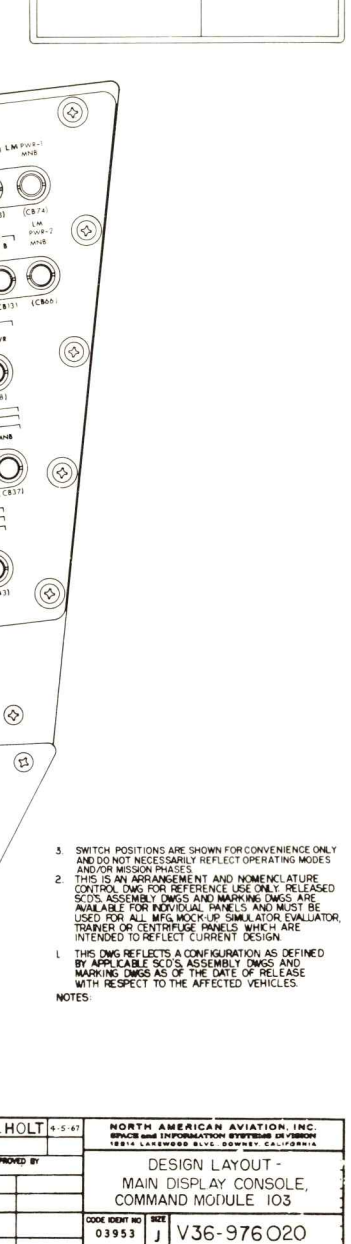
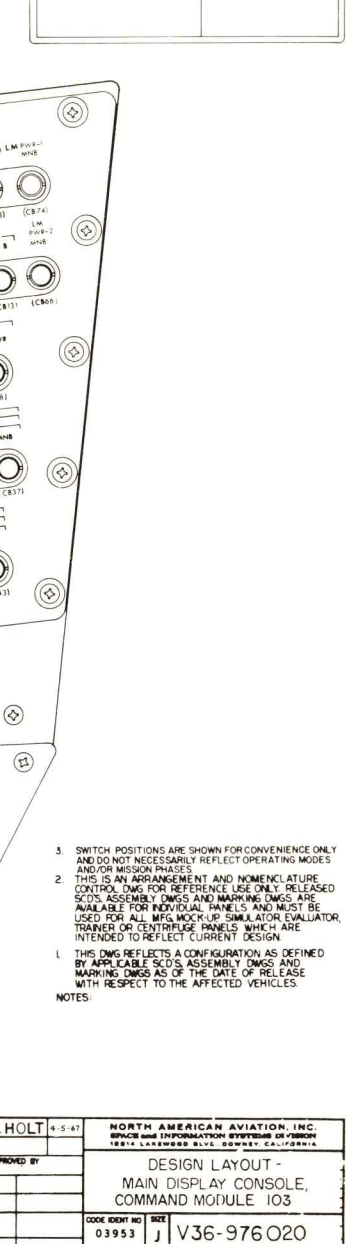
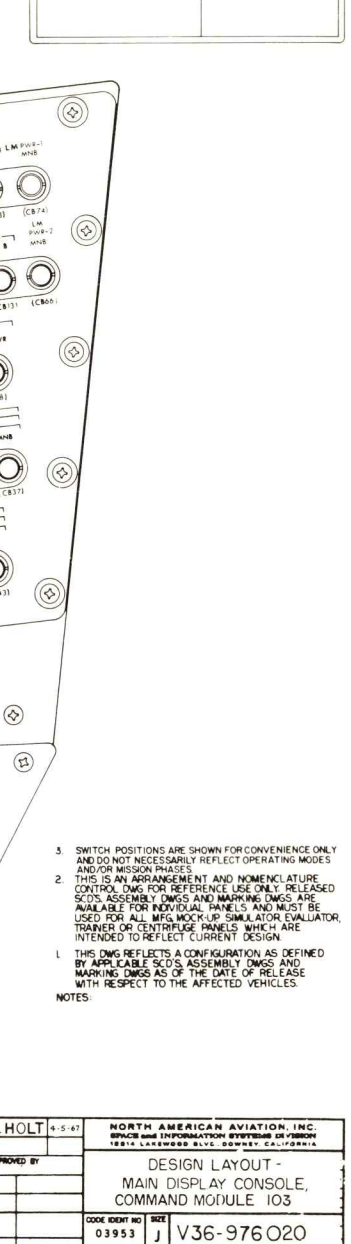
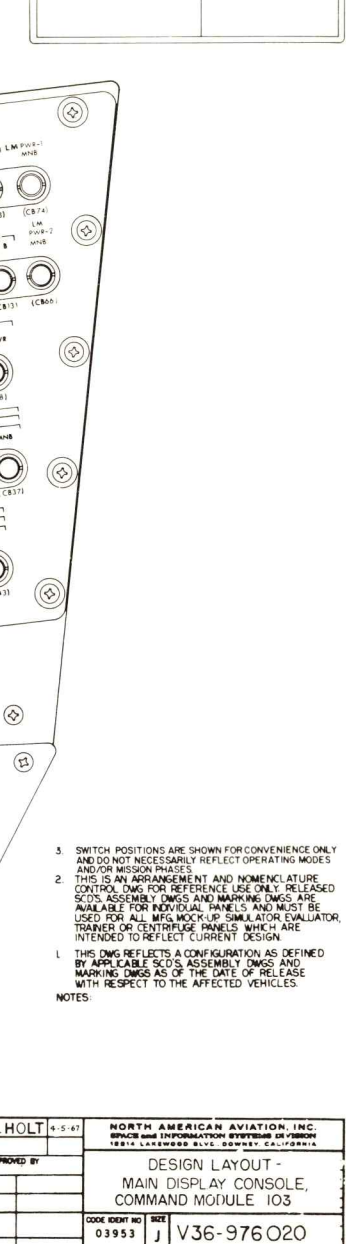
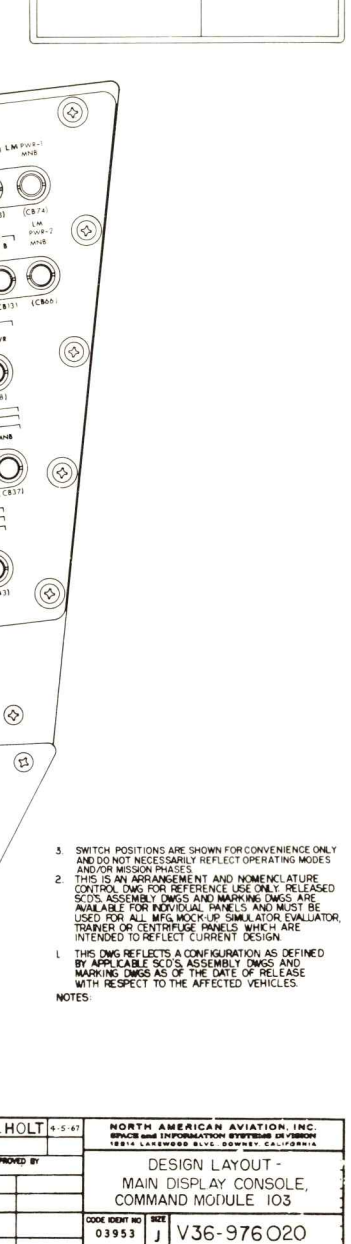
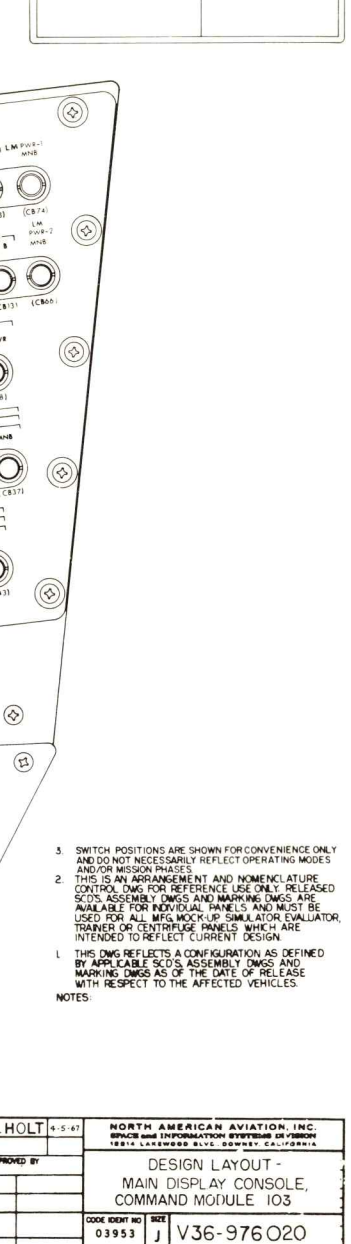
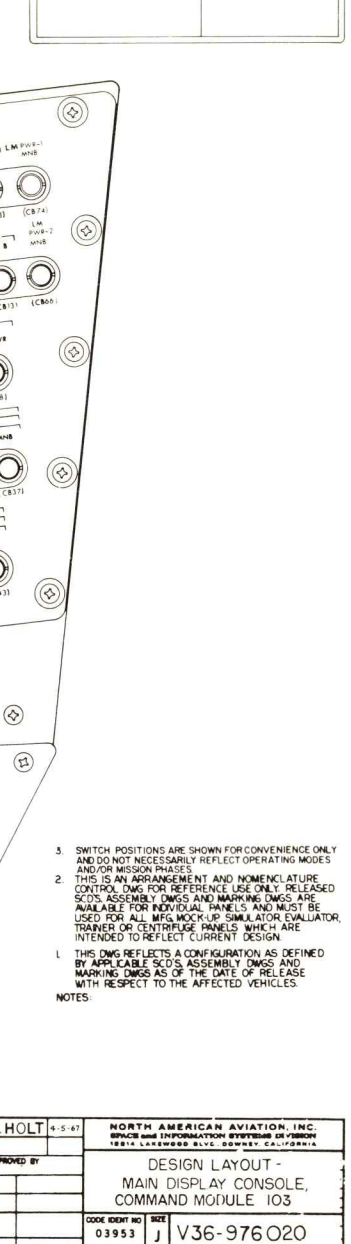
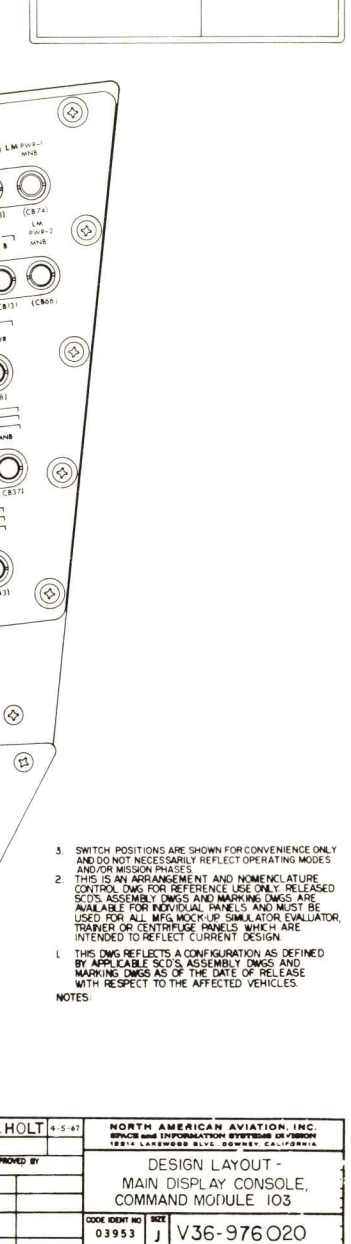
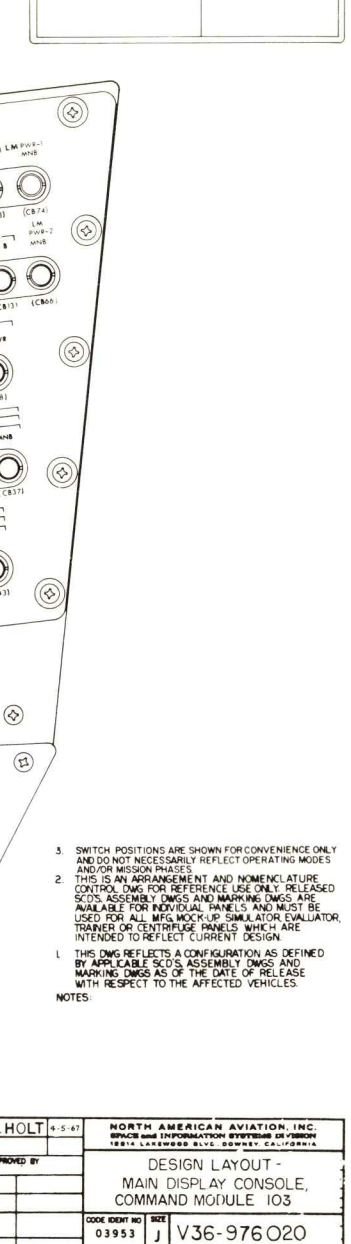
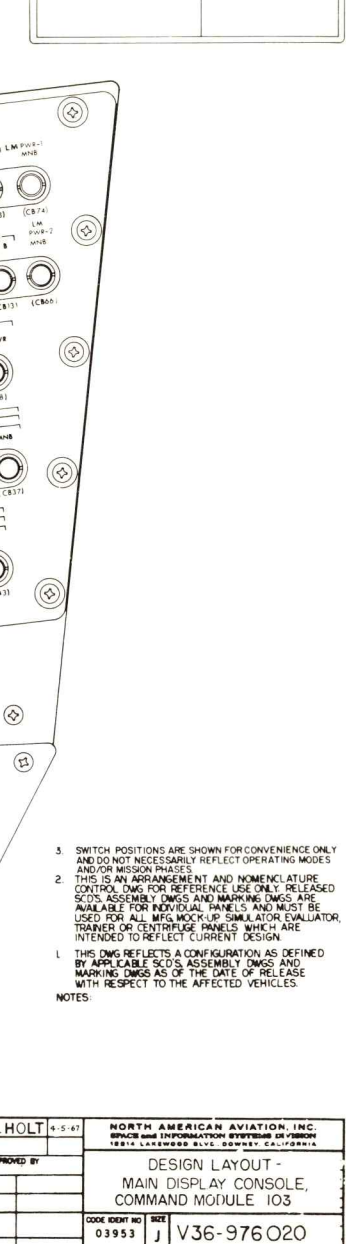
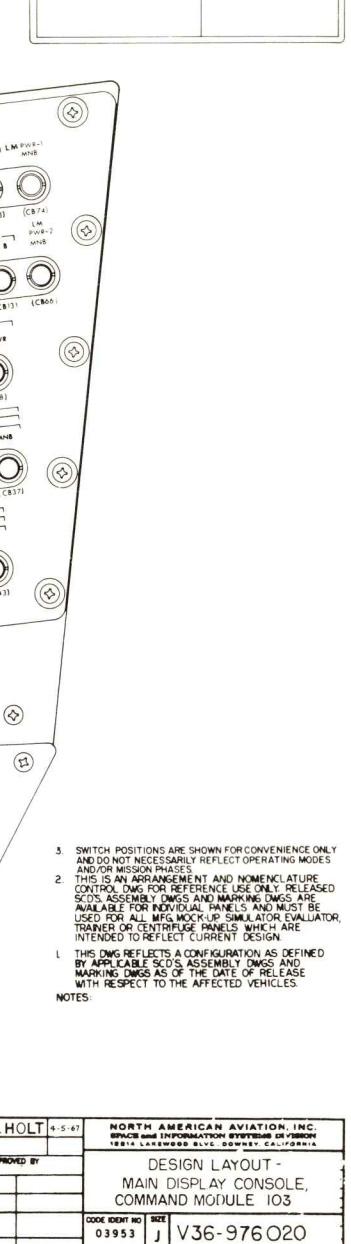
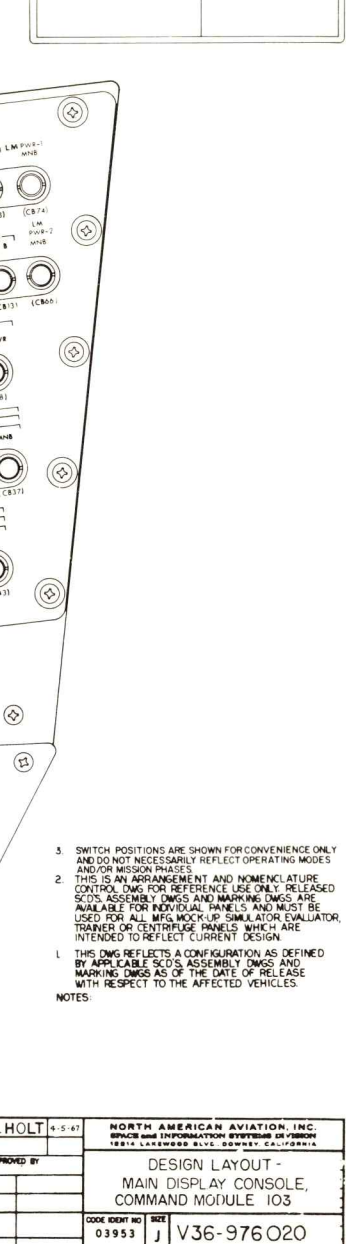
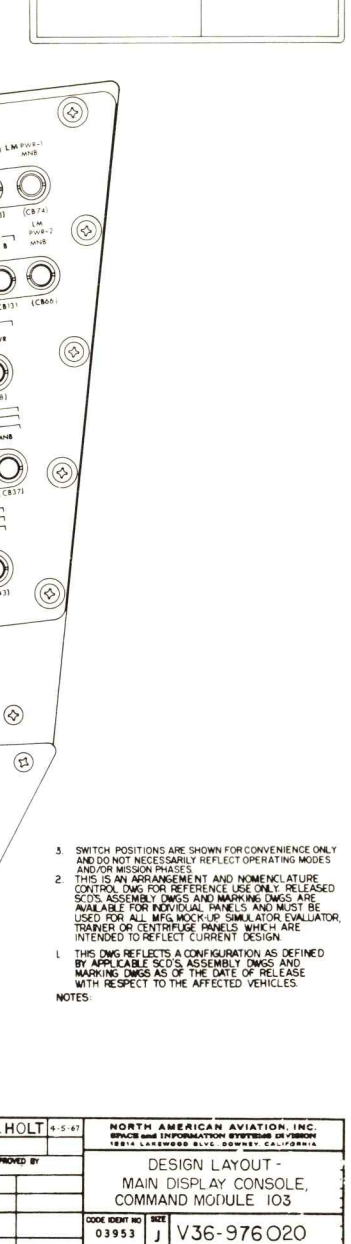
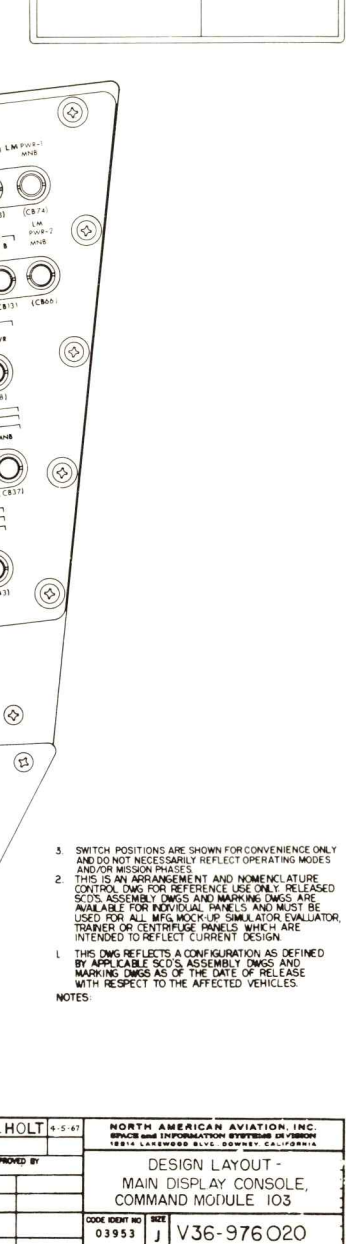
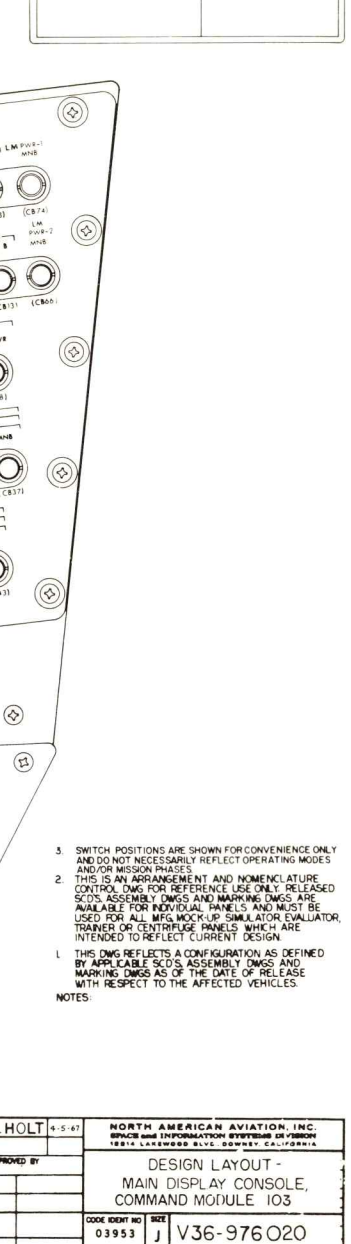
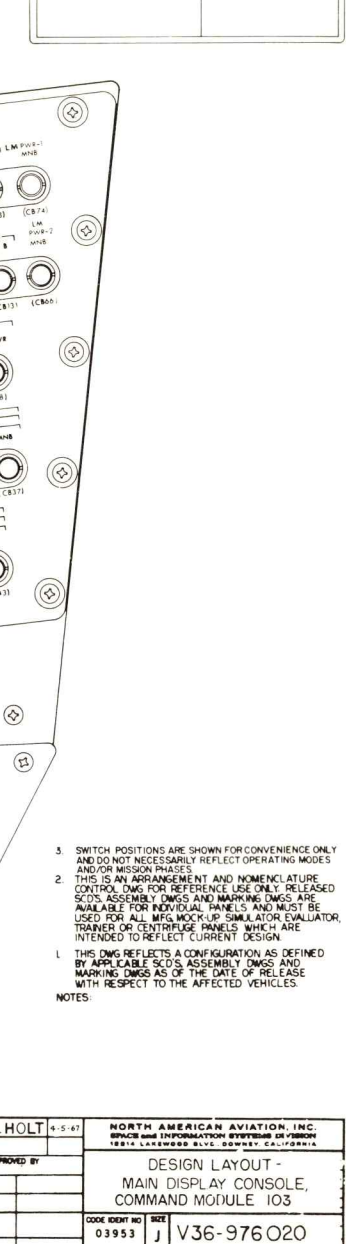
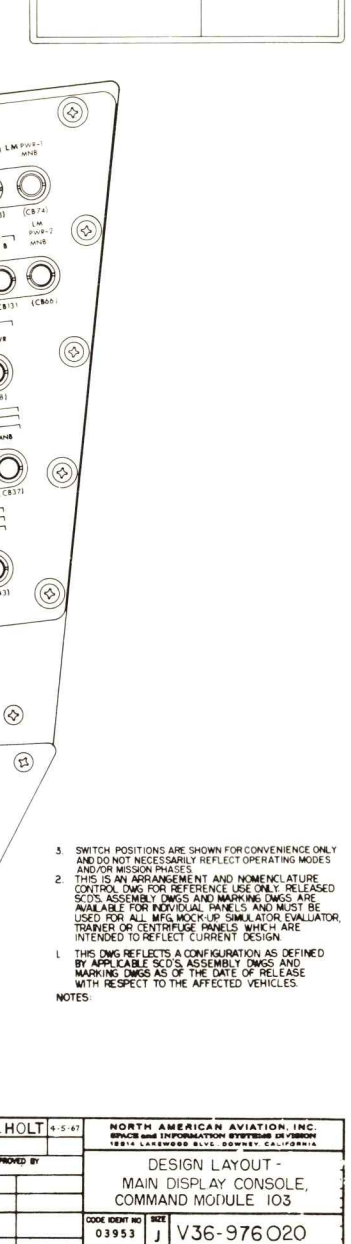
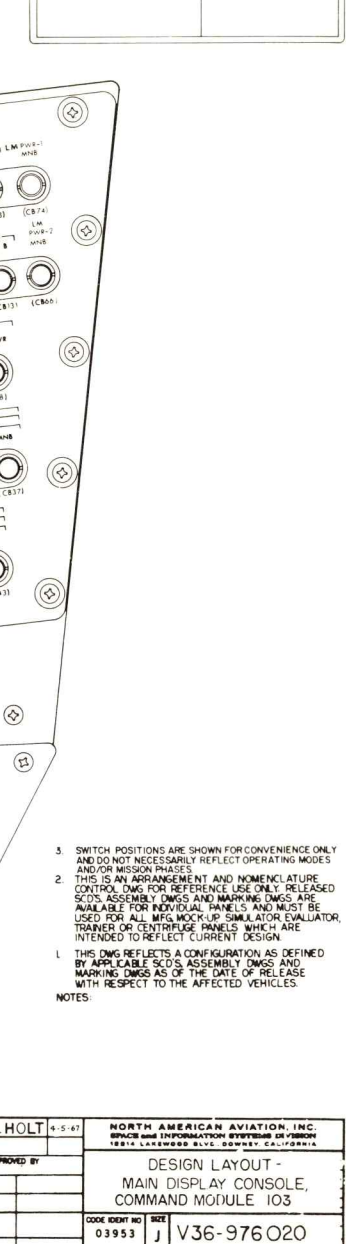
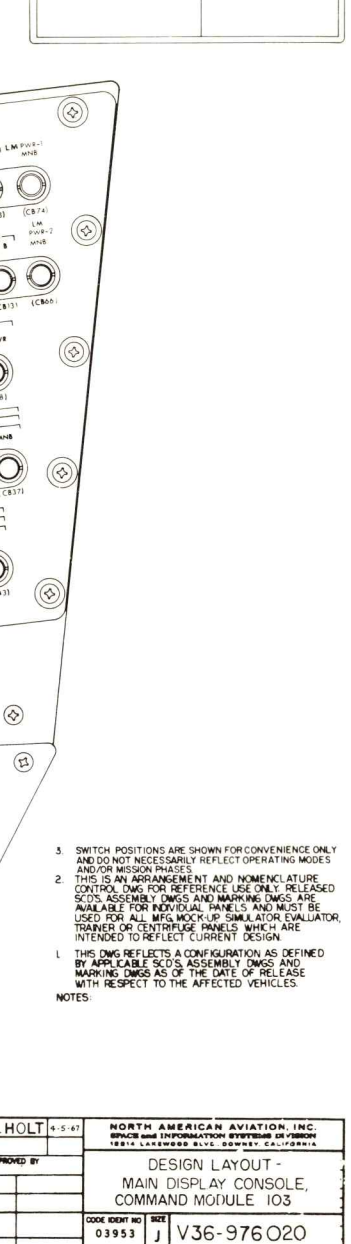
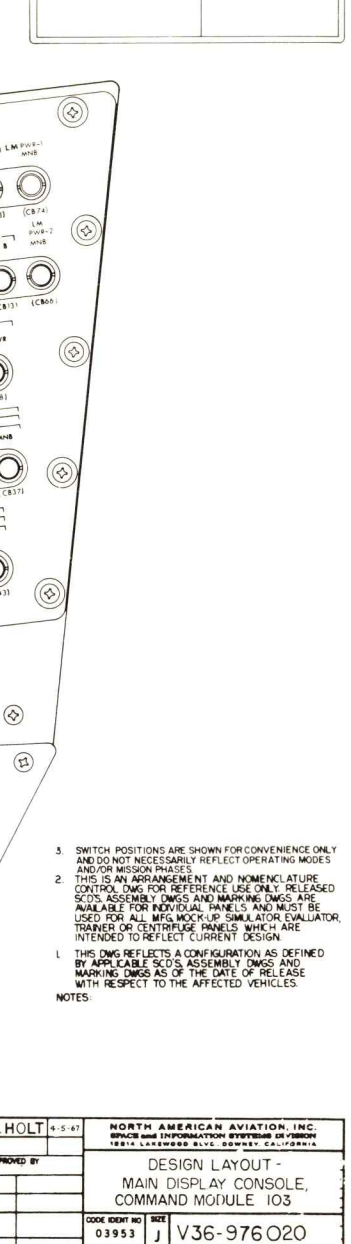
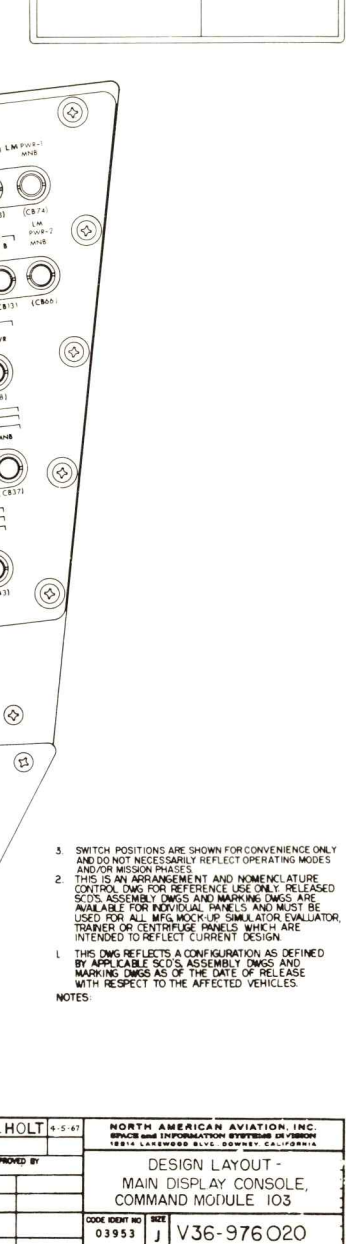
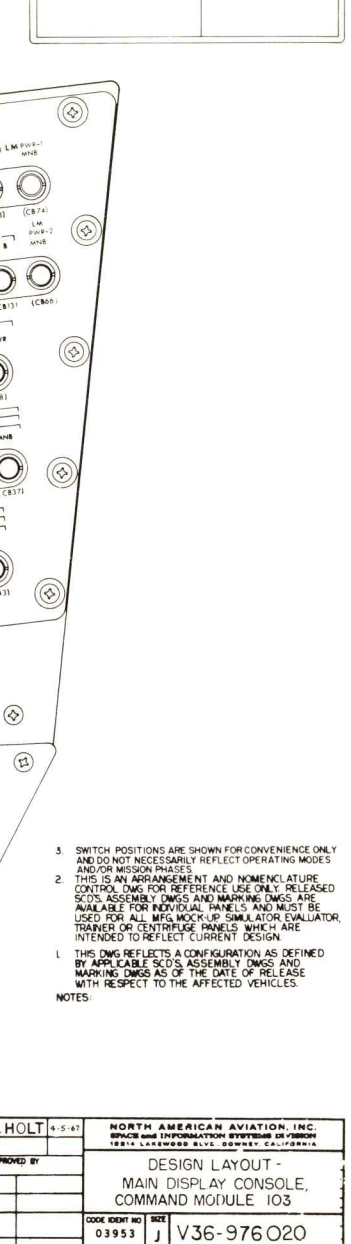
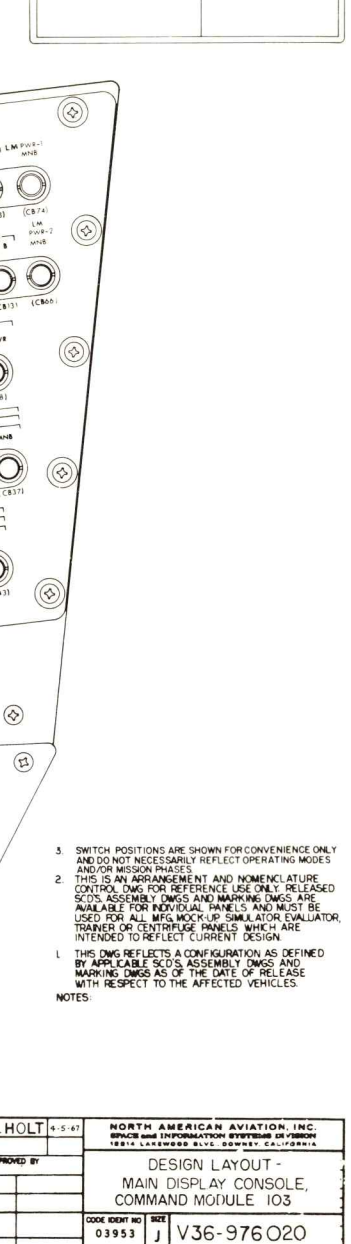
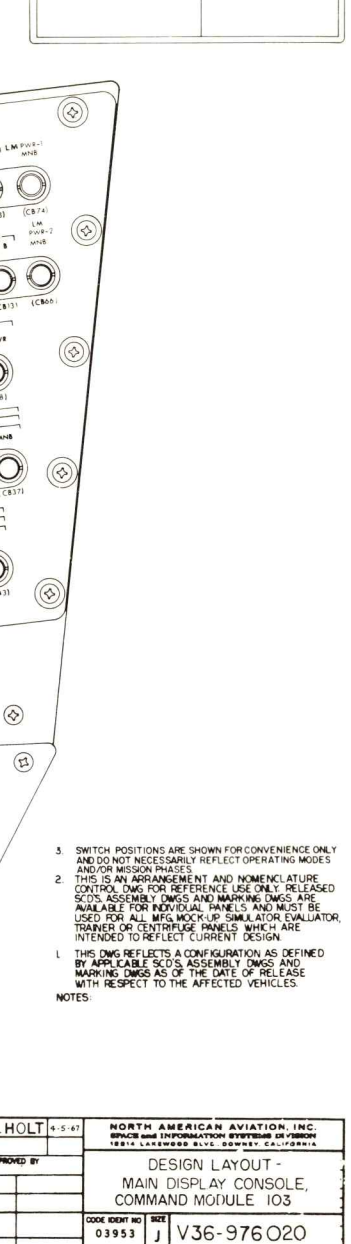
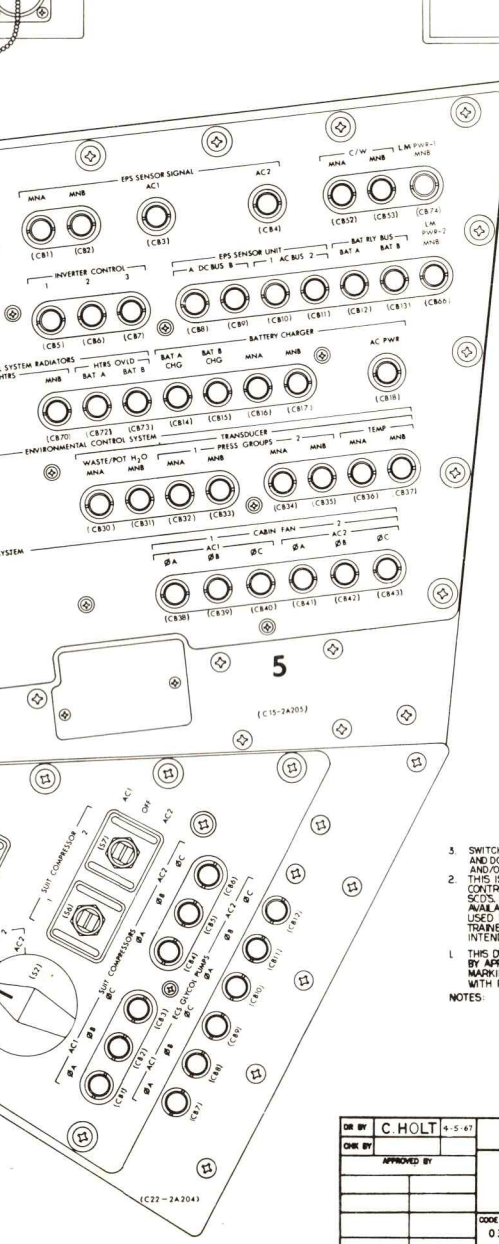
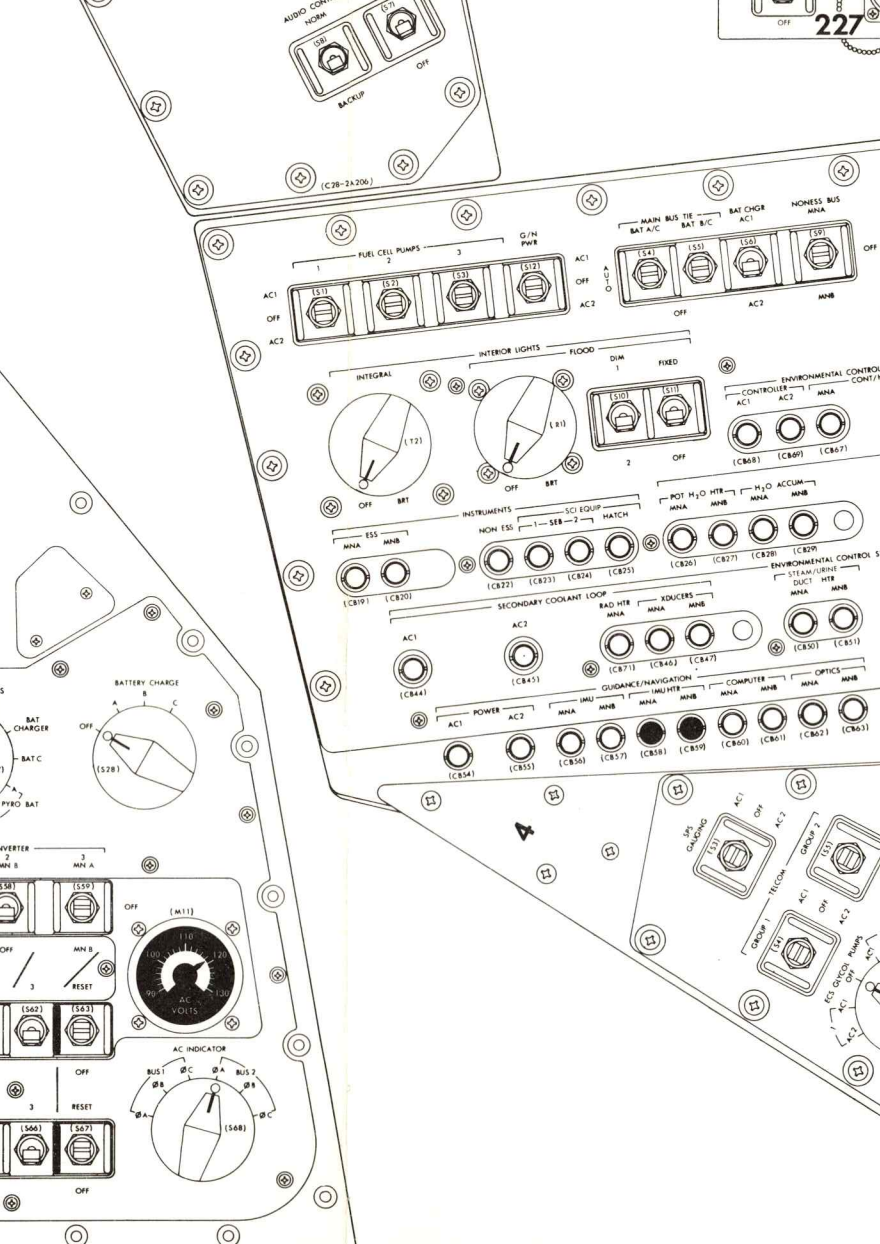
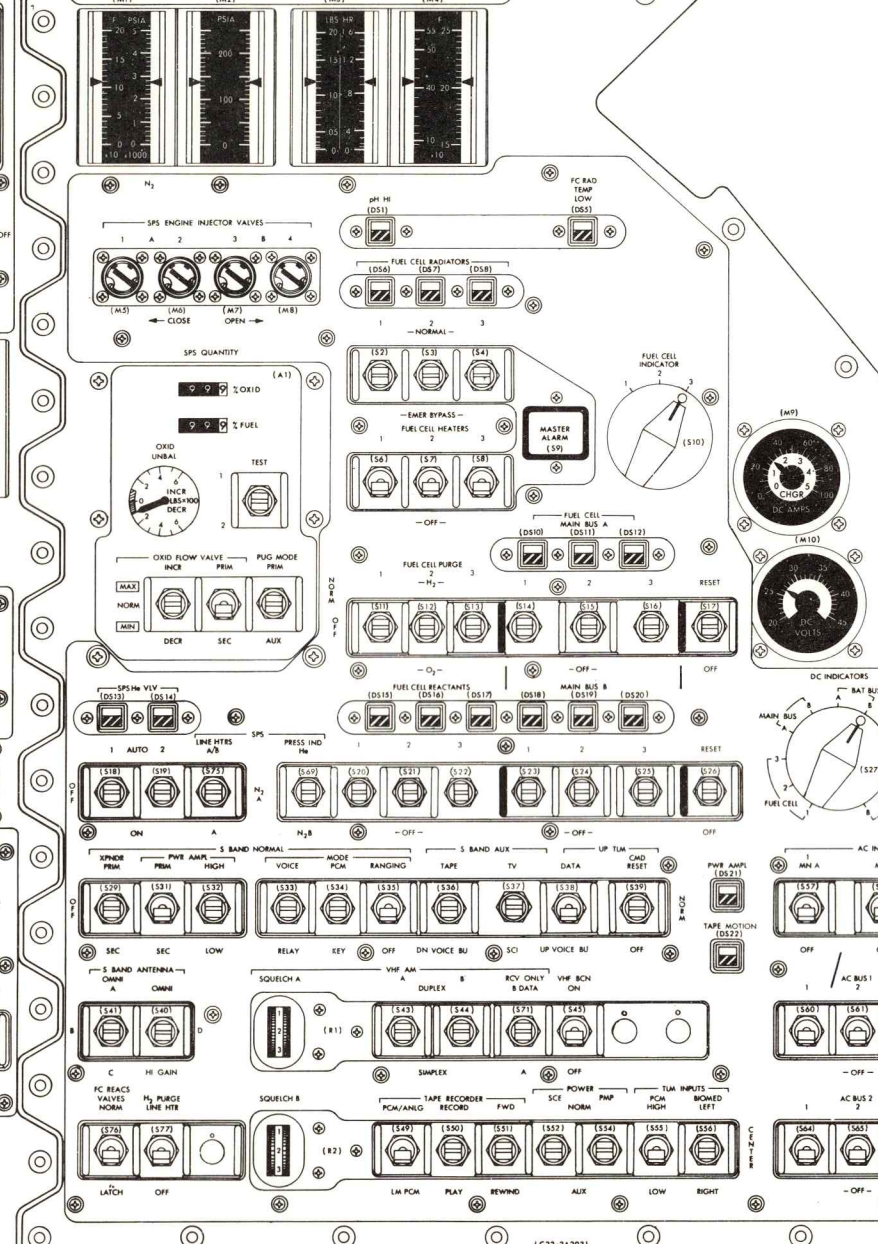
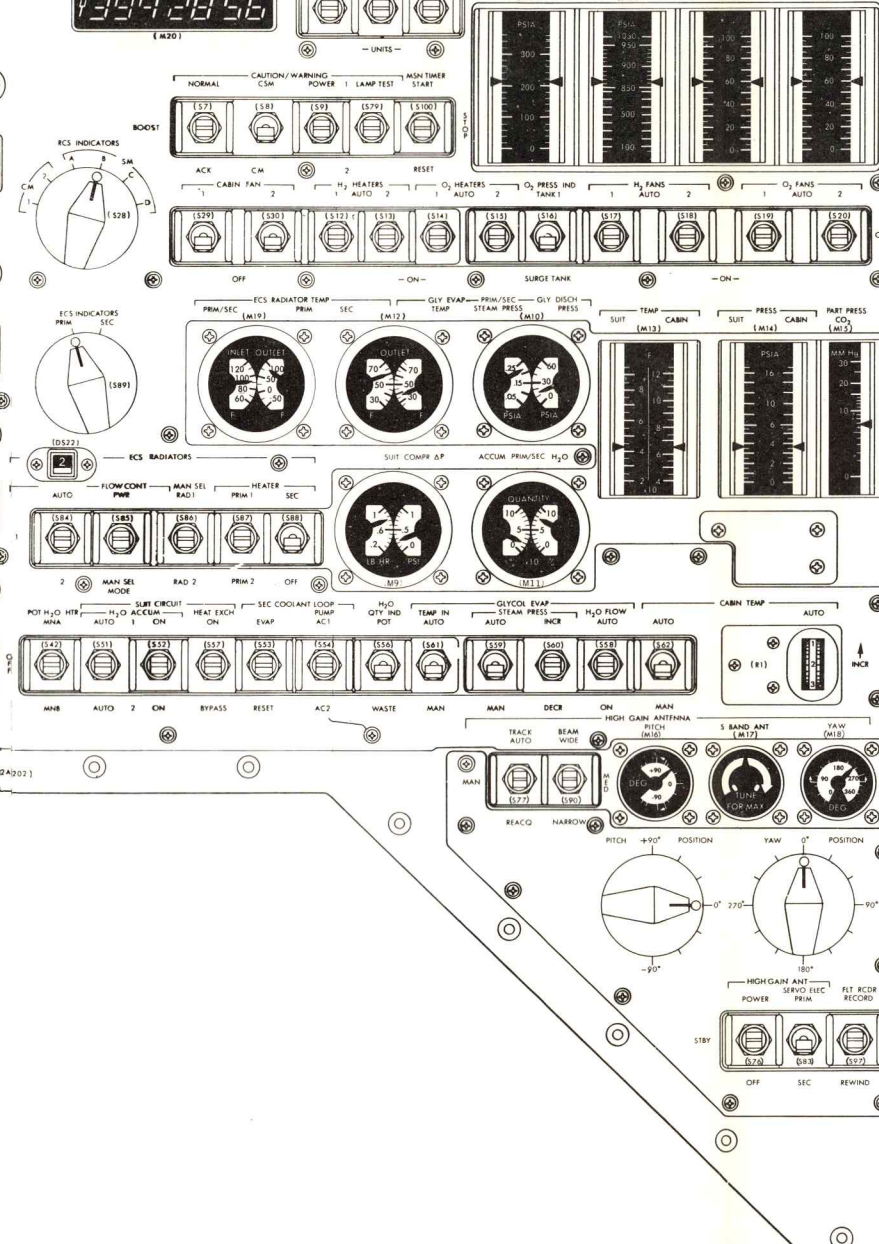
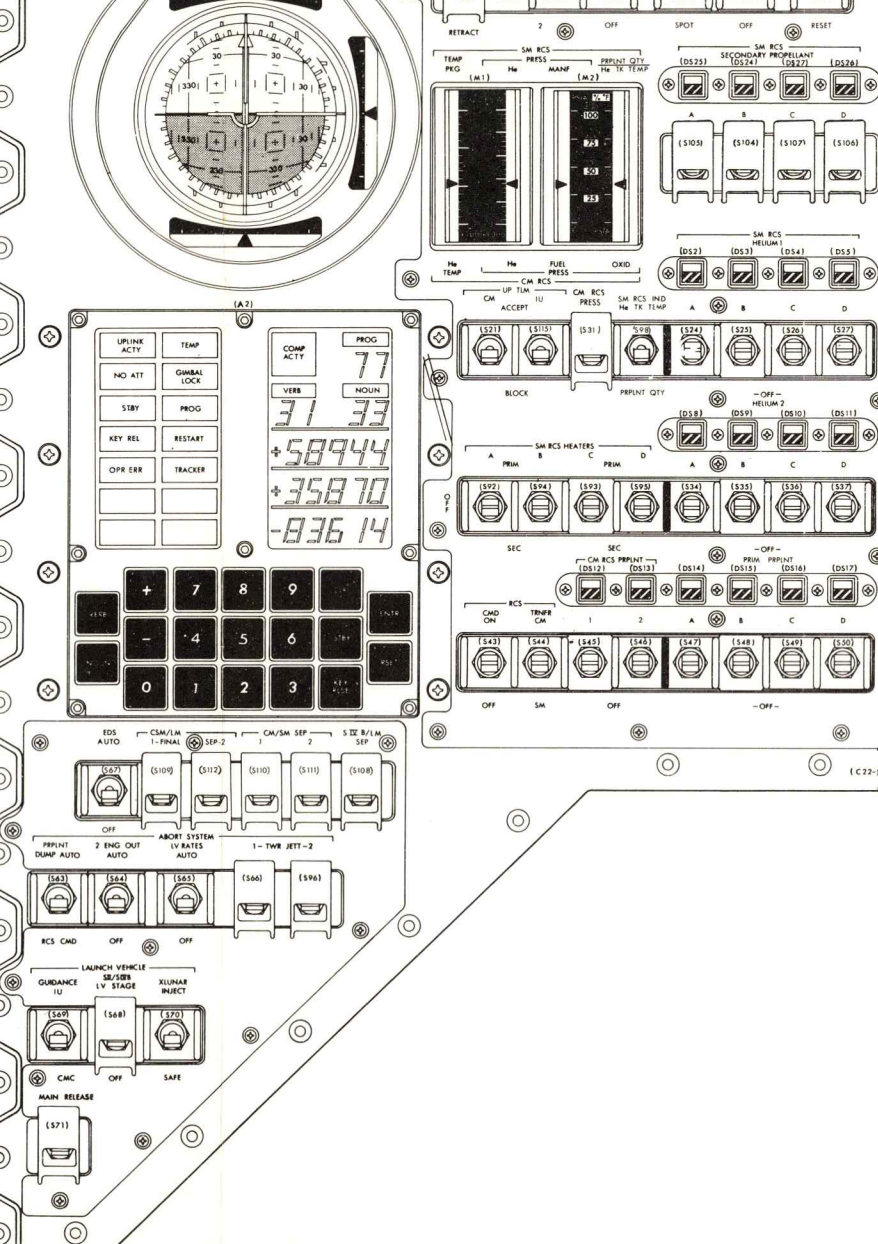
2 CM RCS	
REVISION	DATE
1.0	10.2
NATIONAL AERONAUTICS & SPACE ADMINISTRATION HOUSTON SPACE CENTER HOUSTON, TEXAS	
COMMAND MODULE	
REACTION CONTROL SYSTEM	
CM	10.2
DATE	10.2
BY	10.2
CHKD	10.2
APP'D	10.2
SHEET 1 OF 1	

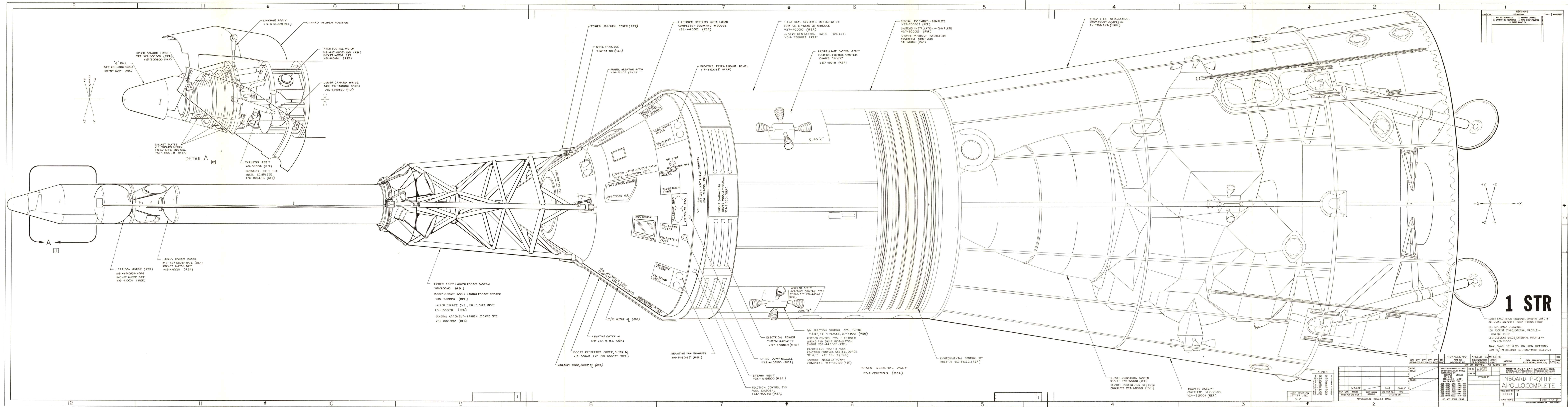


V36-976020



V36-976020



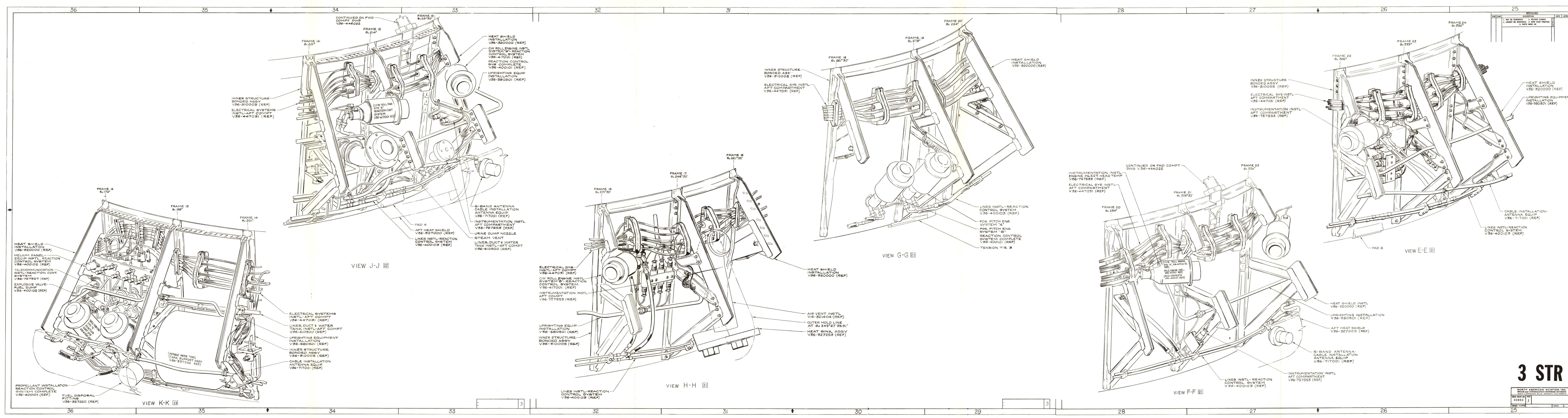


1 STR

LUNAR EXCURSION MODULE, MANUFACTURED BY
GRUMMAN AIRCRAFT ENGINEERING CORP
SEE GRUMMAN DRAWINGS
LUNAR ASSEMBLY STAGE, INTERNAL PROFILE -
LUNAR DESCENT STAGE, EXTERNAL PROFILE -
LUNAR DESCENT STAGE, EXTERNAL PROFILE -
LUNAR DESCENT STAGE, EXTERNAL PROFILE -
NAR. SPACE SYSTEMS DIVISION DRAWING
03953 J

COMPLETE					
REVISION	CODE IDENT	MATERIAL	DATA, SPECIFICATION	SIZES, NOTES, SUPPLIERS	ZONE
OR PARTS	LIST				
REV	NORTH AMERICAN AVIATION, INC.				
BY	SPACE AND AERONAUTICS DIVISION				
	2875 LAWRENCE BLVD. DOWNEY, CALIFORNIA				
	INBOARD PROFILE				
	APOLLO COMPLETE				
	CODE IDENT NO	SHEET			
	33953	J			
	SCALE NONE				
	1		SHEET 1 OF 1		

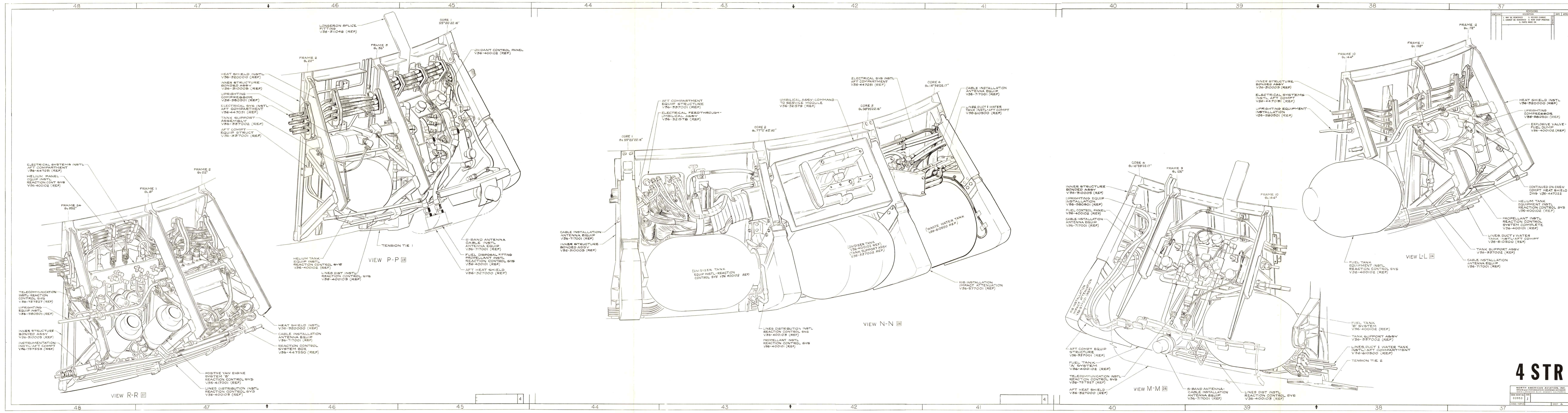


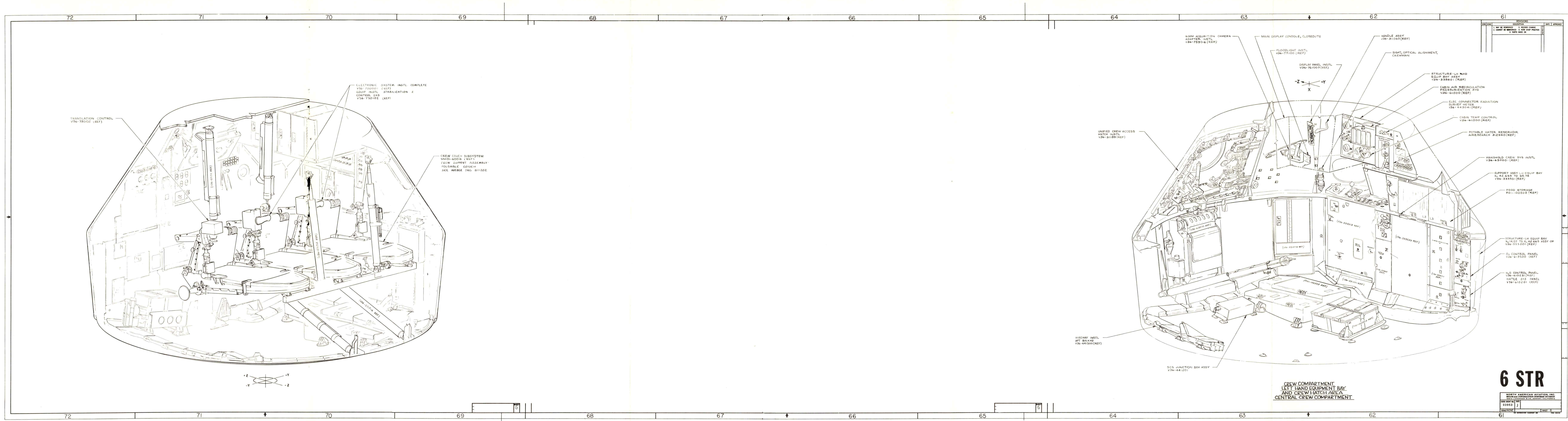


REVISIONS		DATE	APPROVED
1	MAY BE REMOVED	1	RECORD CHANGE
2	CANNOT BE REMOVED	4	NEW SHIP PARTS
3	PARTS MADE OK		

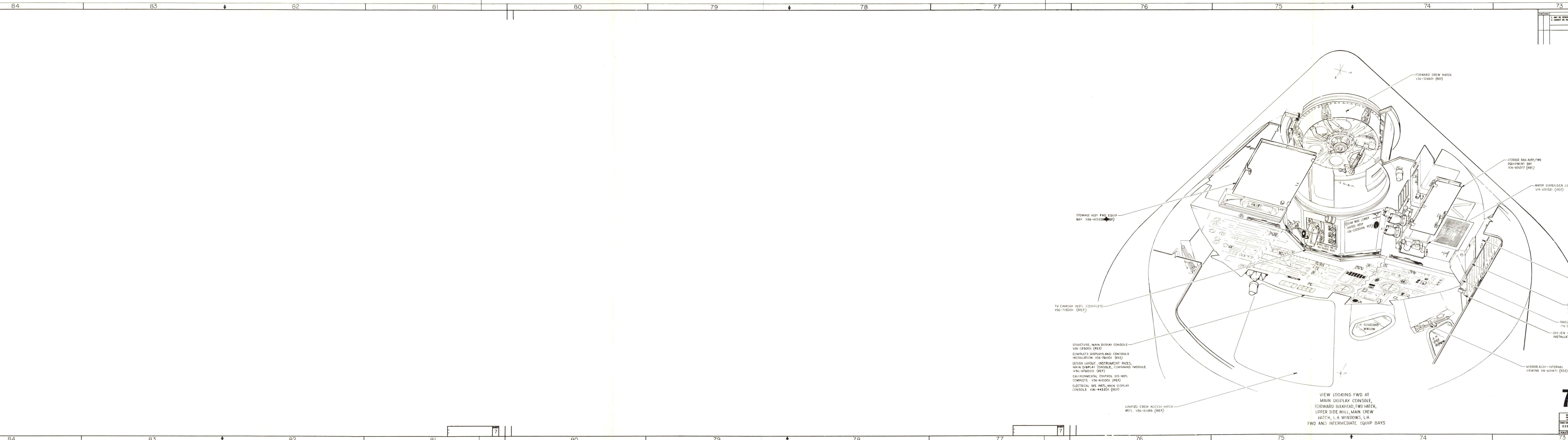
3 STR

NORTH AMERICAN AVIATION, INC.
ENGINE AND INFORMATION SYSTEMS DIVISION
3955 J
01953
SCALE NONE
SHEET 3





73



STOWAGE ASSY FWD EQUIP
BAY V36-60123 (REF)

TV CAMERA INSTL COMPLETE
V36-715001 (REF)

STRUCTURE, MAIN DISPLAY CONSOLE
V36-335001 (REF)
COMPLETE DISPLAYS AND CONTROLS
INSTALLATION V36-761101 (REF)
DESIGN LAYOUT, INSTRUMENT FACES,
MAIN DISPLAY CONSOLE, COMMAND MODULE
V36-976000 (REF)
ENVIRONMENTAL CONTROL SYS INSTL
COMPLETE V36-610001 (REF)
ELECTRICAL SYS INSTL, MAIN DISPLAY
CONSOLE V36-445201 (REF)

UNIFIED CREW ACCESS HATCH
INSTL V36-311009 (REF)

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

FORWARD CREW HATCH
V36-324601 (REF)

STORAGE BAG ASSY, FWD
EQUIPMENT BAY
V36-601277 (REF)

WATER DISPENSER ASSY
V16-601521 (REF)

DOOR-LH INTERMEDIATE
BAY, STOWAGE COMPARTMENT
V36-335013 (REF)
L.H. INTERMEDIATE STRUCTURE
V36-335001 (REF)

COVER-ELECTRICAL CONNECTOR
SUPPORT, LH EQUIP BAY
V36-443236 (REF)

PANEL CLOSEOUT
V16-333614 (REF)

OXY JEN UMBILICAL STRAP
INSTALLATION V36-601089 (REF)

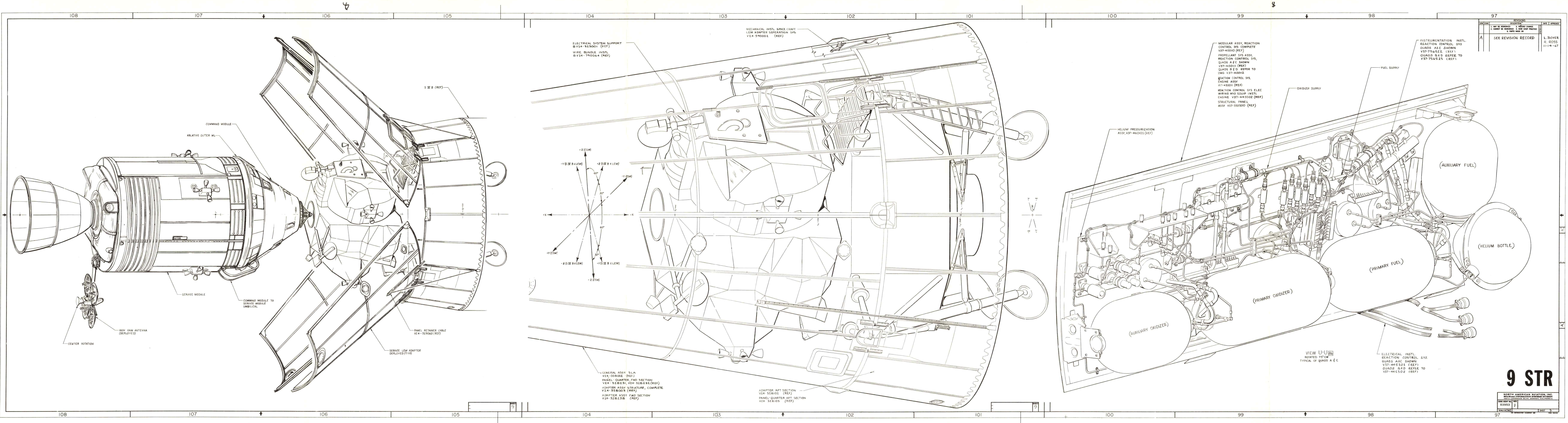
MIRROR ASSY-INTERNAL
VIEWING V16-601471 (REF)

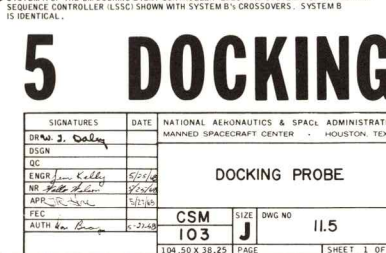
REVISIONS			DATE	APPROVED
REV	DATE	DESCRIPTION		
1		1. MAY BE REMOVED		
2		2. CANNOT BE REMOVED		
3		3. MAY BE REMOVED		
4		4. MAY BE REMOVED		
5		5. MAY BE REMOVED		
6		6. MAY BE REMOVED		
7		7. MAY BE REMOVED		
8		8. MAY BE REMOVED		
9		9. MAY BE REMOVED		
10		10. MAY BE REMOVED		

7 STR

NORTH AMERICAN AVIATION, INC.		REVISION AND INFORMATION SYSTEMS DIVISION	
CODE	DATE	REV	DATE
01855	1		
SIGNATURE		DATE	
		7	







APOLLO

C/SMSH

**COMMAND/
SERVICE
MODULE
SYSTEMS
HANDBOOK**

CSM 103



**FCD
MSC
NASA**