Lousma

JSC-09085
PA-N6-10100-1

ASTP

1 STANDARDS
2 SEQUENTIAL EVENTS SYSTEM
3 ELECTRICAL SYSTEM
4 ENVIRONMENTAL CONTROL SYSTEM
5 FUEL CELL/ CRYOGENIC SYSTEM
6 COMMUNICATIONS SYSTEM
7 INSTRU-MENTATION
8 GUIDANCE AND CONTROL SYSTEM
9 SERVICE PROPULSION SYSTEM
10 REACTION CONTROL SYSTEM
11 CM AND DM EXPERIMENTS
12 SM EXPERIMENTS
13 MISCELLANEOUS

Command/ Service Module

and Docking Module

SYSTEMS HANDBOOK - CSM 111

I used these schematics on training for the ASTP mission as Backup Docking Module Pilot.

AUGUST 1, 1974

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CPT, Skylab II
CPR, STS-3

Prepared by
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Houston, Texas

PA-N6-10100-1

JSC-09085

CSM

AND DOCKING MODULE SYSTEMS HANDBOOK

CSM 111

DC-1

FEBRUARY 20, 1975

ASTP

COMMAND/SERVICE MODULE AND DOCKING MODULE
SYSTEMS HANDBOOK
CSM 111

DC-1

FEBRUARY 20, 1975

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1 STANDARDS

SECTION 1

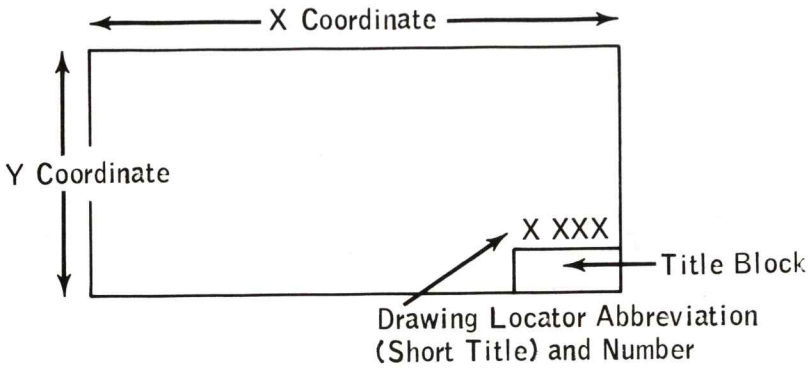
STANDARDS

1.1 GENERAL DRAWING INFORMATION

1.1.1 Cross-indexing

1.1.1.1 General drawing configuration

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



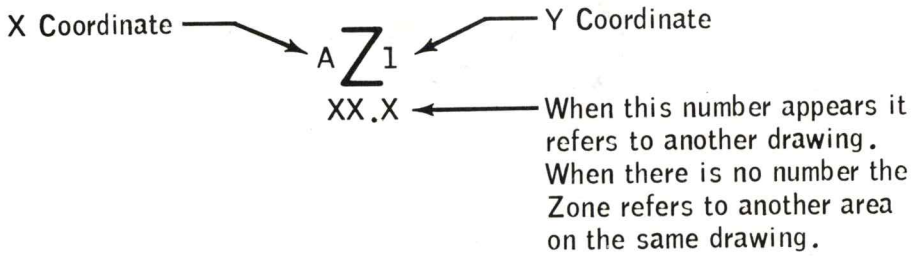
1.1.1.2 Component location code

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

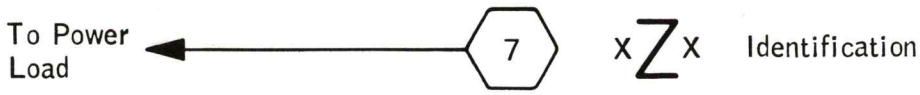
3 - Drawing Locator Number for the given detail subsystem drawing
K - X Coordinate
4 - Y Coordinate

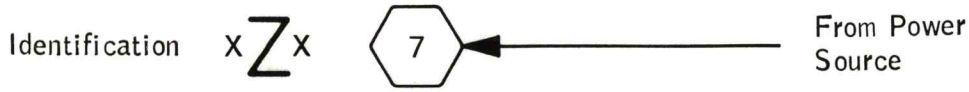
1.1.2 Technical Zone References

1.1.2.1 Zone reference

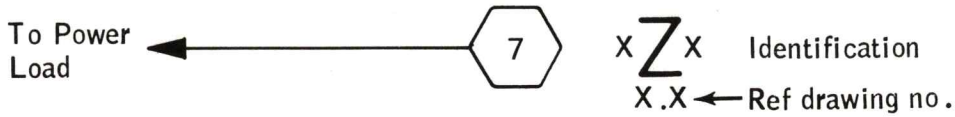


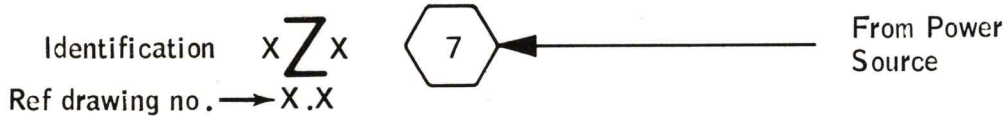
1.1.2.2 Power intra-drawing
(Section to section within the same drawing)





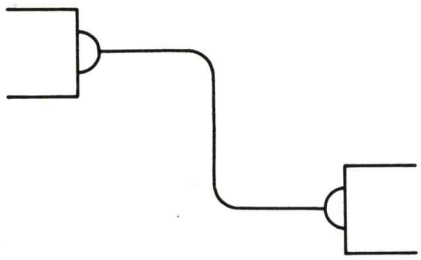
1.1.2.3 Power inter-drawings
(Drawing to drawing)





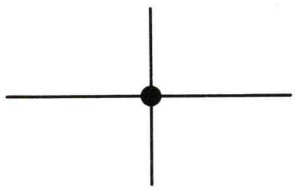
1.2 LINE LEGEND

1.2.1 RF Cable

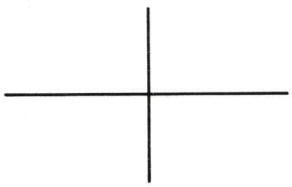


1.2.2 Electrical Line, Power and control

1.2.2.1 Electrical connected

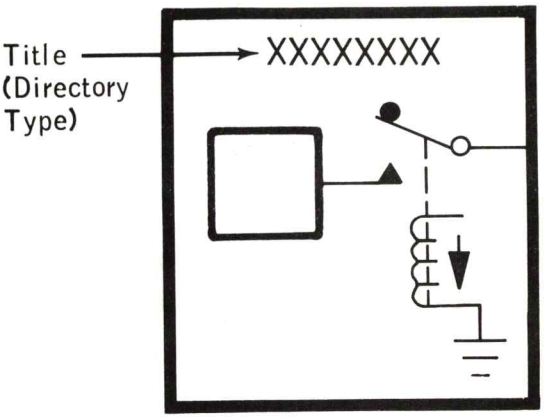


1.2.2.2 Electrical crossover



1.2.3 Directional Flow Arrows

1.2.4 Component Enclosures



1.2.4.1 Main enclosure
1/16-inch solid black line

1.2.4.2 Sub enclosure
1/32-inch solid black line

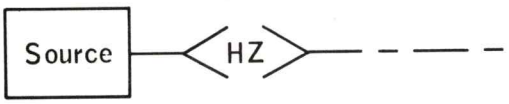
1.2.4.3 Component enclosure with crew (manual control)
1/16-inch dashed black line

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

CM SM

1.2.5 Mechanical Linkage

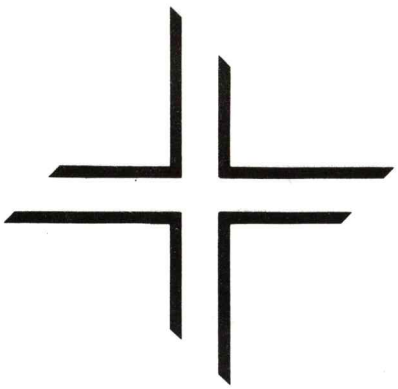
1.2.6 Timing Pulses



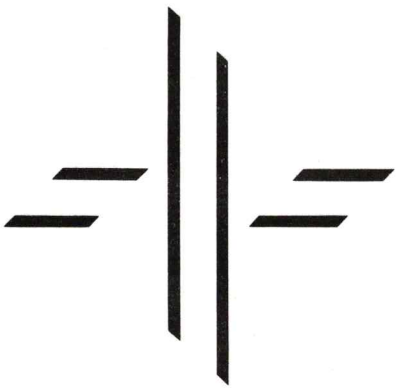
1.3 PIPE LEGEND

1.3.1 General

1.3.1.1 Plumbing connected



1.3.1.2 Plumbing crossover



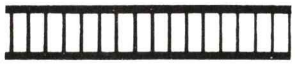
1.3.2 Line designation

1.3.2.1 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

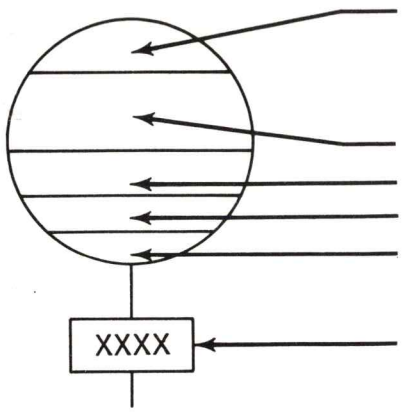
1.3.2.11 Sense Lines

1.3.2.12 Oxidizer

1.3.2.13 Others

1.4 TELEMETRY SYMBOLS

1.4.1 Measurements Telemetered



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

Measurement Name

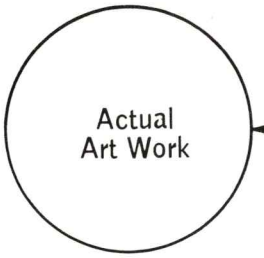
Measurement Range

High Bit Sample Rate

Low Bit Sample Rate

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

1.4.2 Onboard Meters



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

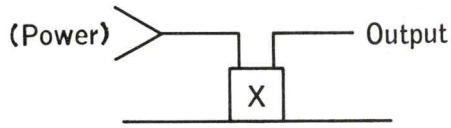
From Drive Source

XXXX ← Meter Number

PNL X ← Panel number

1.4.3 Sensors

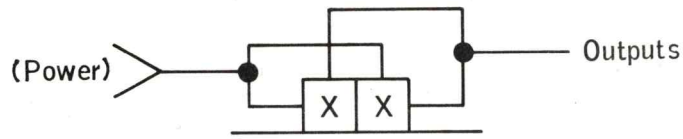
1.4.3.1 Single source



Example: Letter indicates the type:

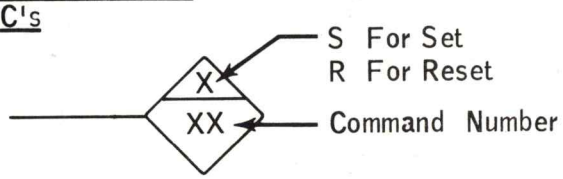
P - Pressure
T - Temperature
Q - Quantity
W - Wetness
R - Rate

1.4.3.2 Double source



1.4.4 Ground Commands (Contents Optional by Vehicle)

1.4.4.1 RTC's



S For Set

R For Reset

Command Number

1.5 ELECTRICAL SYMBOLS

1.5.1 Switches

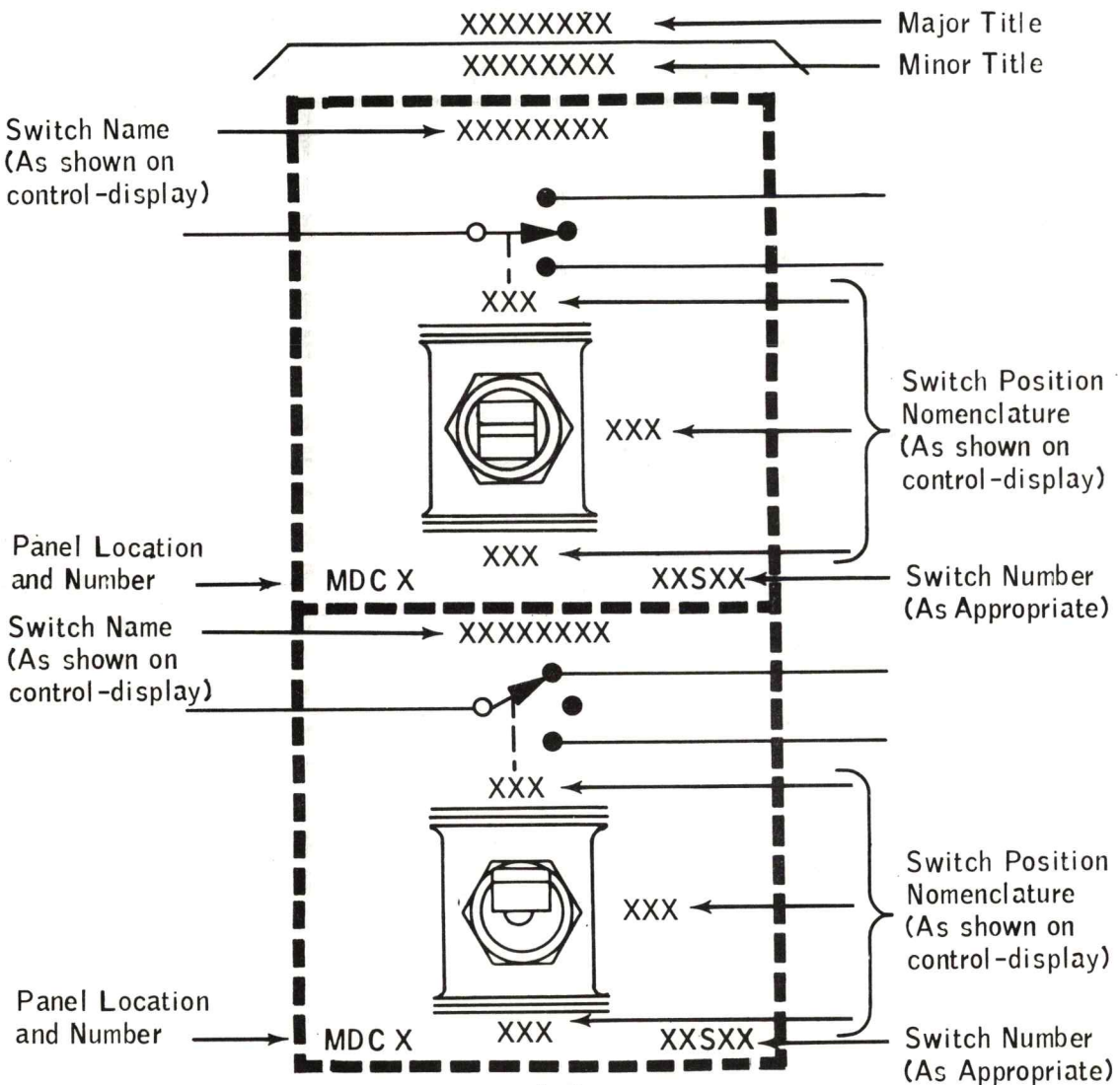
All switches will be shown in the de-energized position (if possible). When a switch has more than one set of contacts, only one set needs to have switch contact nomenclature.

1.5.1.1 Switch nomenclature

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

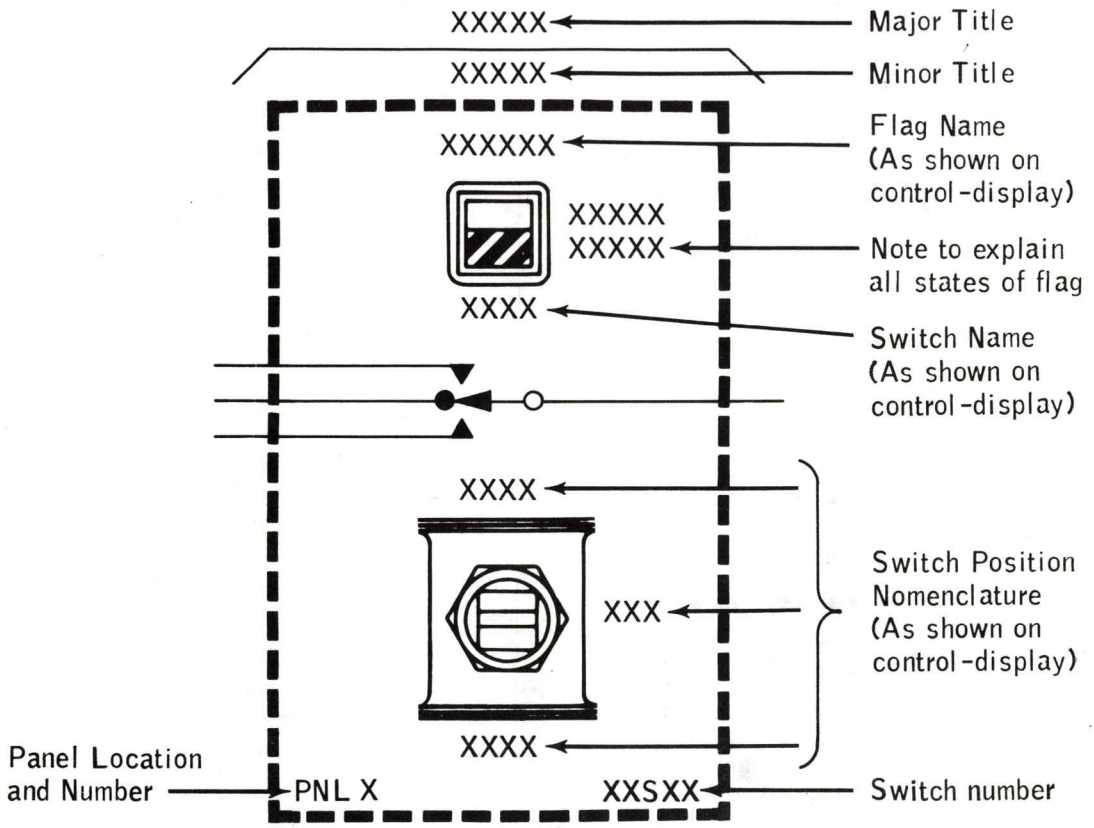
Minor Title: The title given to a sub-group of switches

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

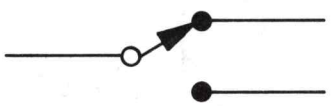


1.5.1.2 Switch controlled flag

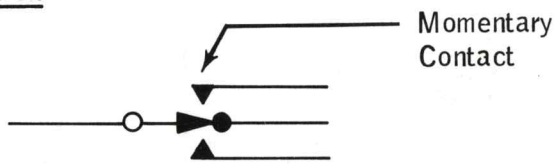
If a flag is directly controlled by a switch, it may be shown in the following manner:



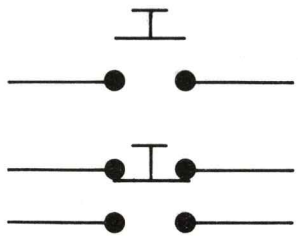
1.5.1.3 Two-position



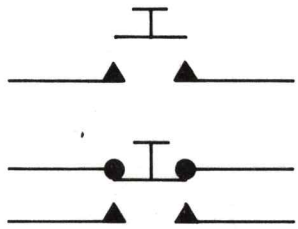
1.5.1.4 Three-position



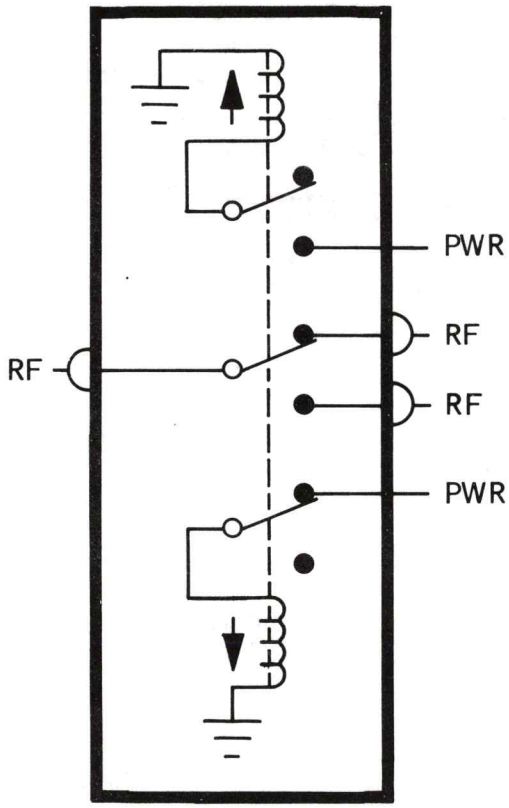
1.5.1.5 Pushbutton
1.5.1.5.1 Latching



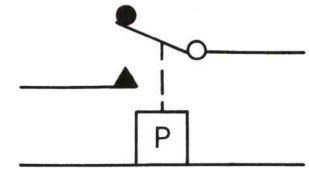
1.5.1.5.2 Momentary



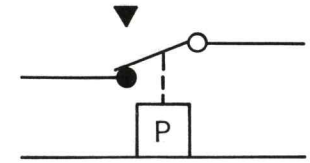
1.5.1.6 Coax



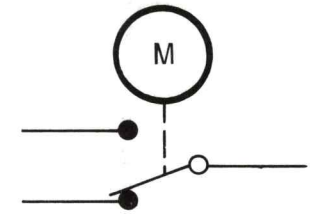
1.5.1.7 Pressure
1.5.1.7.1 Closed decreased pressure



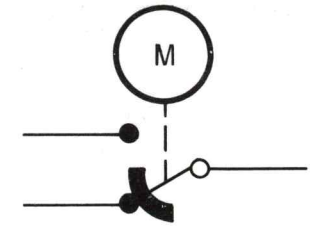
1.5.1.7.2 Closed increased pressure



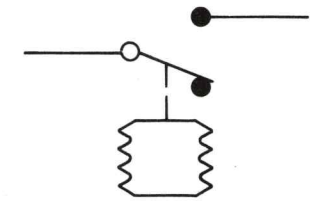
1.5.1.8 Motor
1.5.1.8.1 Break before make



1.5.1.8.2 Make before break



1.5.1.9 Baro



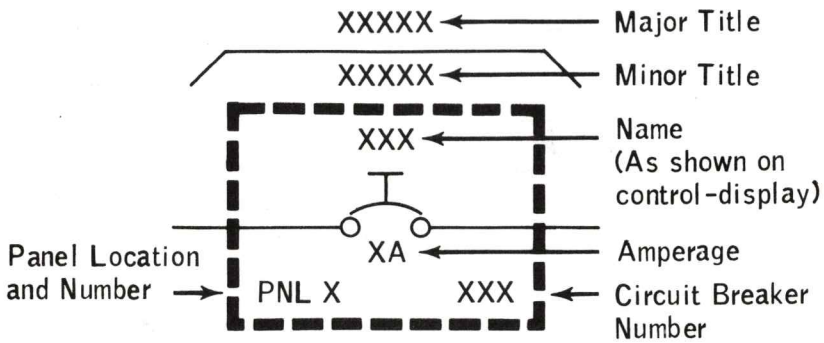
Close XXX psi or altitude

Open XXX psi or altitude

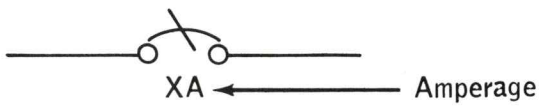
1.5.2 Circuit Breakers

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

1.5.2.1 Pushbutton

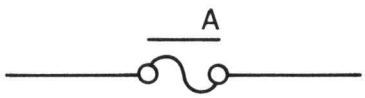


1.5.2.2 Automatic



1.5.3 Fuses

1.5.3.1 General

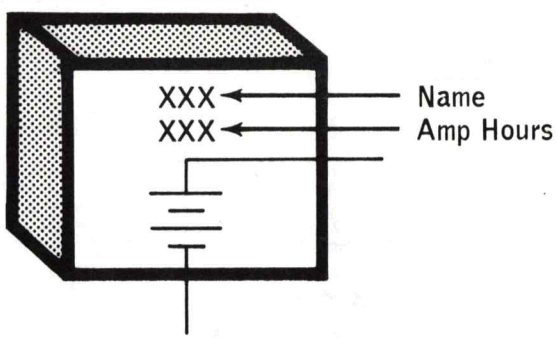


1.5.3.2 Fusistor

1.5.4 Battery

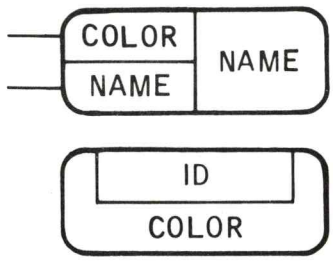
1/16-inch black tape

Size varies with number of cells and drawing arrangement.

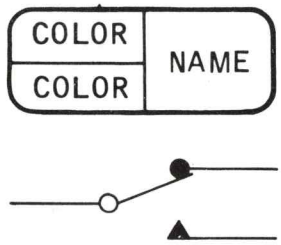


1.5.5 Lights

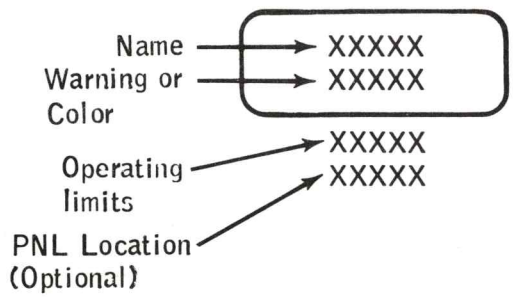
1.5.5.1 Telelights



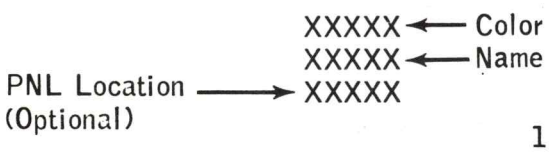
1.5.5.2 Switching



1.5.5.3 Caution and warning

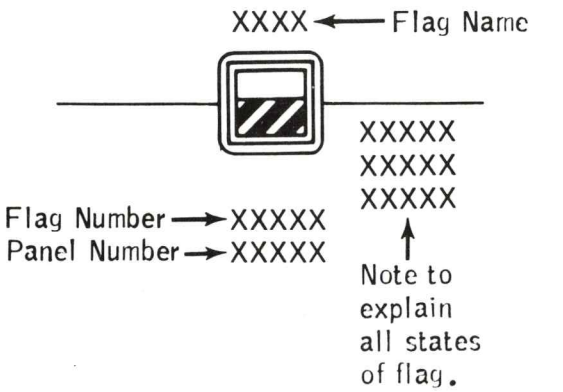


1.5.5.4 Component



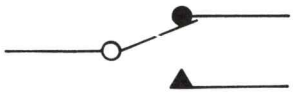
1.5.6 Annunciator Flag

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

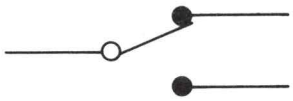


1.5.7 Relays

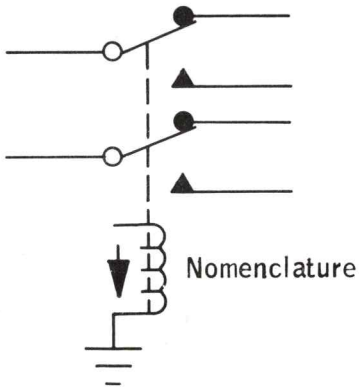
1.5.7.1 Momentary contact



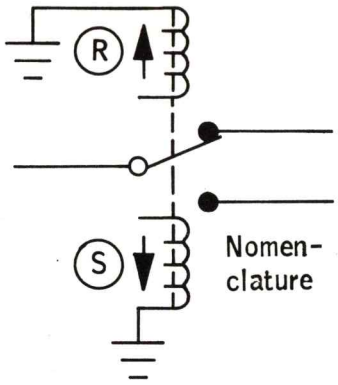
1.5.7.2 Latching contacts



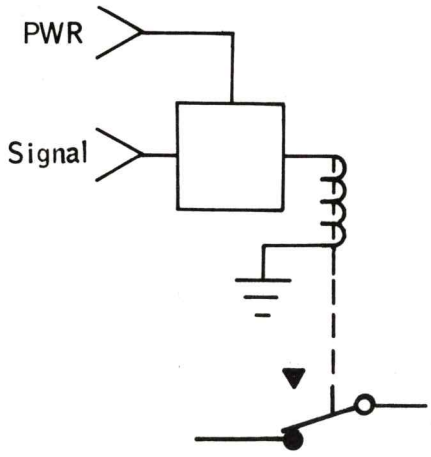
1.5.7.3 Non-Latching relay



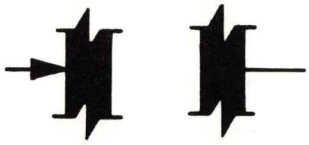
1.5.7.4 Latching relay



1.5.8 Relay or Solenoid Driver



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

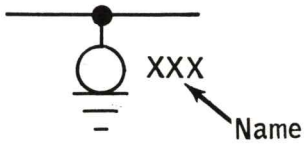


1.5.9.2 Designation
See bus designation list.

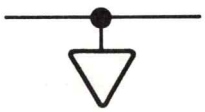
1.5.10 Grounds
1.5.10.1 System

1.5.10.2 Frame

1.5.10.3 Floating or Controlled



1.5.10.4 Signal



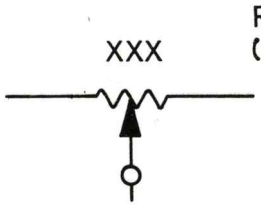
1.5.11 Diodes
1.5.11.1 General

1.5.11.2 Zener

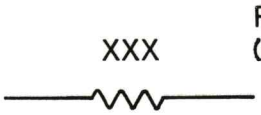
1.5.11.3 Tunnel

1.5.11.4 Control rectifier (SCR)

1.5.12 Potentiometer



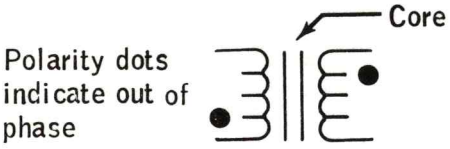
1.5.13 Fixed Resistor

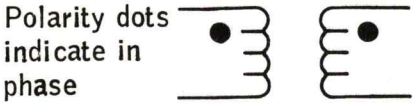


1.5.14 Heater

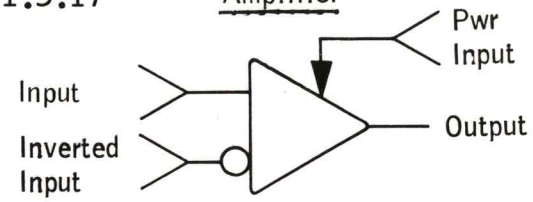
1.5.15 Thermostat

1.5.16 Transformers

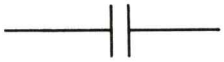




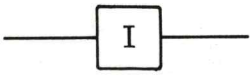
1.5.17 Amplifier



1.5.18 Capacitor



1.5.19 Digital Inverter



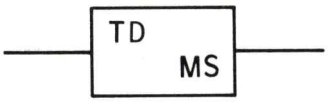
1.5.20 Wire Resolver

= Sine Winding

= Minus Sine

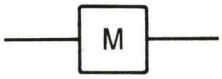
= Cosine Winding

1.5.21 Time Delay



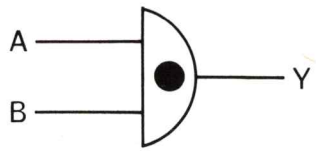
1.5.22 Electrical Filter

1.5.23 Modulator



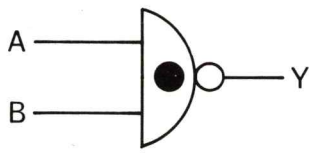
1.5.24 Gates

1.5.24.1 And



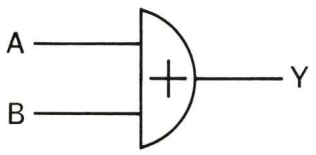
A	B	Y
1	1	1
1	0	0
0	1	0
0	0	0

1.5.24.2 Nand



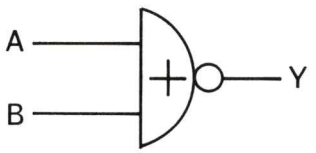
A	B	Y
1	1	0
1	0	1
0	1	1
0	0	1

1.5.24.3 Or



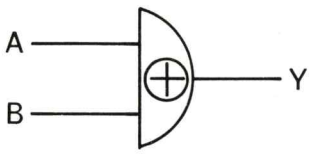
A	B	Y
1	1	1
1	0	1
0	1	1
0	0	0

1.5.24.4 Nor



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

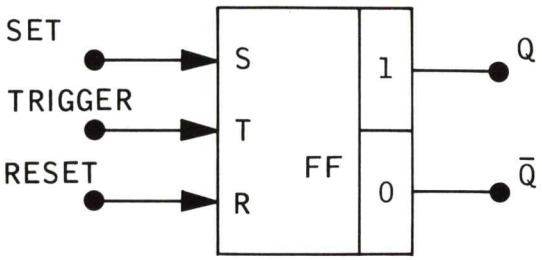
1.5.24.5 Exclusive Or



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

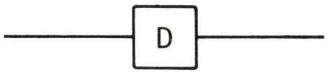
Open circle means it is an inverter and may appear on any of the lines on the gate.

1.5.24.6 SRT Flip-Flop

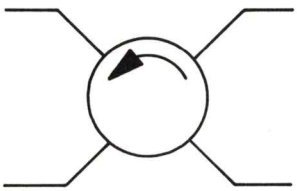


INPUT	OUTPUT
S	Sets Q to "1" Sets $\bar{Q}$ to "0"
T	Q and $\bar{Q}$ Change States
R	Resets Q to "0" Resets $\bar{Q}$ to "1"

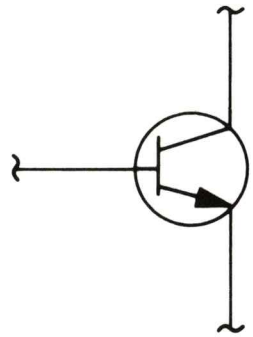
1.5.25 Demodulator



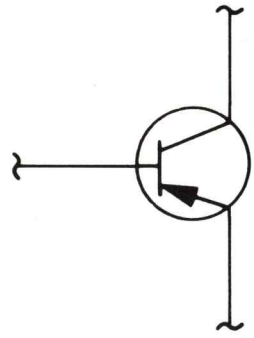
1.5.26 RF Circulator



1.5.27 Transistor
1.5.27.1 NPN



1.5.27.2 PNP

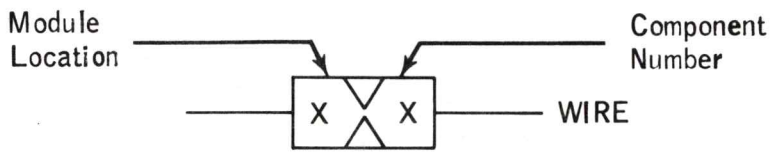


1.5.28 Antenna

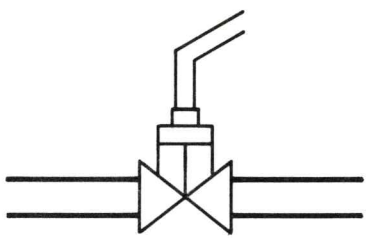
Name
(Type or Function)

1.6 PYROTECHNIC SYMBOLS

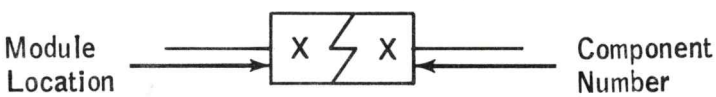
1.6.1 Pyro Guillotine



1.6.2 Pyro Valve with Single Initiator



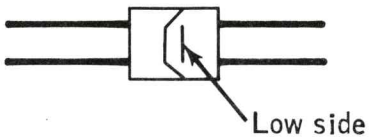
1.6.3 Electrical Circuit Interrupter



1.7 MECHANICAL SYMBOLS

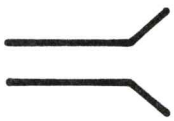
1.7.1 Mechanical Filter

1.7.2 Burst Diaphragm

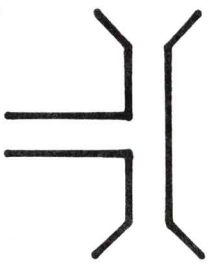


1.7.3 Venturi

1.7.4 Vent

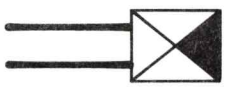


1.7.5 Thrust Neutralized Vent

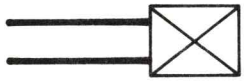


1.7.6 Disconnects

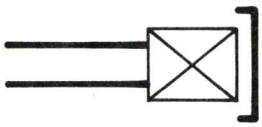
1.7.6.1 Self-sealing



1.7.6.2 Quick

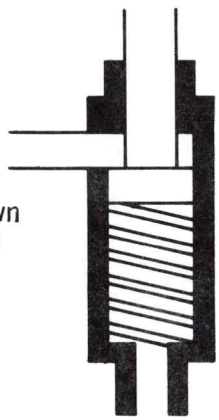


1.7.7 Quick Disconnect Fill and Drain



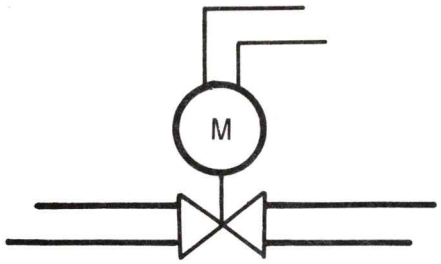
1.7.8 Fill and Drain

1.7.9 Ball Valve Actuator



1.7.10 Valves

1.7.10.1 Motor Control



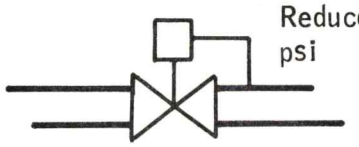
1.7.10.2 Manual Control

1.7.10.3 Check Valve

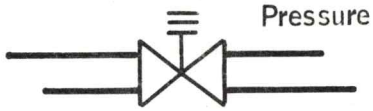
1.7.10.4 Orifice

(Flow Rate)

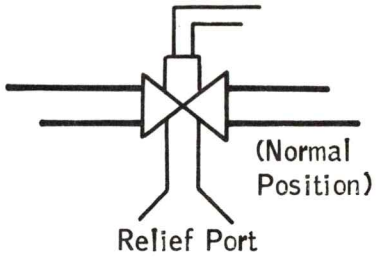
1.7.10.5 Pressure regulator



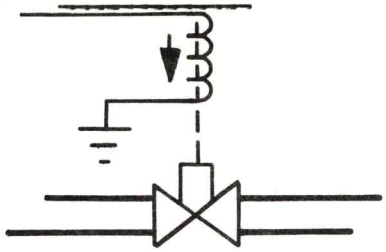
1.7.10.6 Relief Valve



1.7.10.7 Pneumatic controlled valve with line bleed



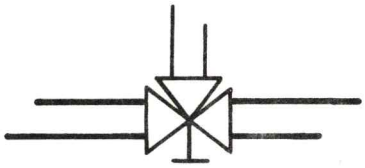
1.7.10.8 Solenoid valve



Name (Normal Position)

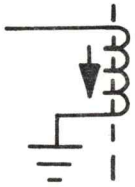
1.7.10.9 Three-way valve

1.7.10.9.1 Manual



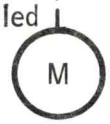
1.7.10.9.2 Solenoid

Or



Or

1.7.10.9.3 Motor controlled



1.7.10.10 Ball valve

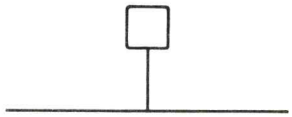
1.8 MISCELLANEOUS SYMBOLS

1.8.1 Drawing Note Reference

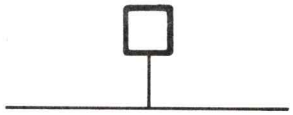
1.8.2 Overview Drawing Instrumentation Legend

1.8.2.1 Automatic control only

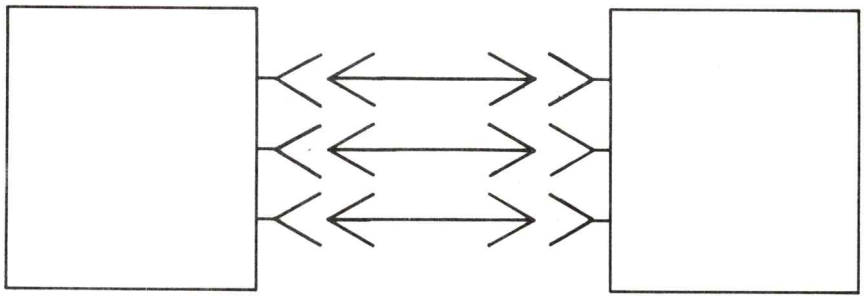
1.8.2.2 PCM only



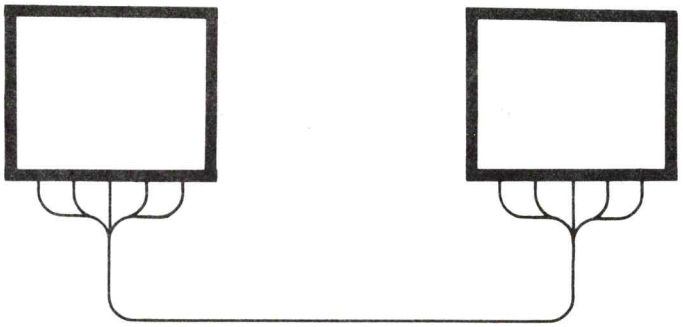
1.8.2.3 PCM and/or onboard display



1.8.3 Two-unit Interface



1.8.4 Two-unit Cable Connection



1.8.5 Buses

1.8.5.1 Power buses.-

		Prime CSH generation dwg No.
V_{MA}	- MAIN BUS A	3.2
V_{MB}	- MAIN BUS B	3.2
V_{BA}	- BATTERY BUS A	3.2
V_{BB}	- BATTERY BUS B	3.2
V_{BR}	- BATTERY RELAY BUS	3.2
V_{FP}	- FLIGHT AND POSTLANDING BUS	3.2
V_{E}	- EXPERIMENT BUS	3.2
V_{AC1}	- AC BUS 1	3.3
V_{AC2}	- AC BUS 2	3.3
V_{F}	- FLIGHT BUS	3.2
V_{SMA}	- SERVICE MODULE BUS A	3.2
V_{SMB}	- SERVICE MODULE BUS B	3.2
V_{DMA}	- DOCKING MODULE BUS A	3.2
V_{DMB}	- DOCKING MODULE BUS B	3.2

1.8.5.2 Sequential buses.-

		Prime CSH generation dwg No.
V_{SQA}	- SEQUENTIAL PYRO BUS A	2.2
V_{RQA}	- RCS CONTROLLER PYRO BUS A	2.2
V_{RLA}	- RCS CONTROLLER LOGIC BUS A	2.2
V_{SLA}	- SEQUENTIAL LOGIC BUS A	2.2
V_{SAA}	- SEQUENTIAL ARM BUS A	2.2
V_{ELA}	- EARTH LANDING BUS A	2.5
V_{SQB}	- SEQUENTIAL PYRO BUS B	2.2
V_{RQB}	- RCS CONTROLLER PYRO BUS B	2.2
V_{RLB}	- RCS CONTROLLER LOGIC BUS B	2.2
V_{SLB}	- SEQUENTIAL LOGIC BUS B	2.2
V_{SAB}	- SEQUENTIAL ARM BUS B	2.2
V_{ELB}	- EARTH LANDING BUS B	2.5
$V_{ED\ 1}$	- EMERGENCY DETECTION SYSTEM BUS NO 1	2.3
$V_{ED\ 2}$	- EMERGENCY DETECTION SYSTEM BUS NO 2	2.3

Sequential buses (cont'd) .-

		Prime CSH generation dwg No.
$V_{ED\ 3}$	- EMERGENCY DETECTION SYSTEM BUS NO 3	2.3
V_{6D95}	- IU ABORT BUS	2.3

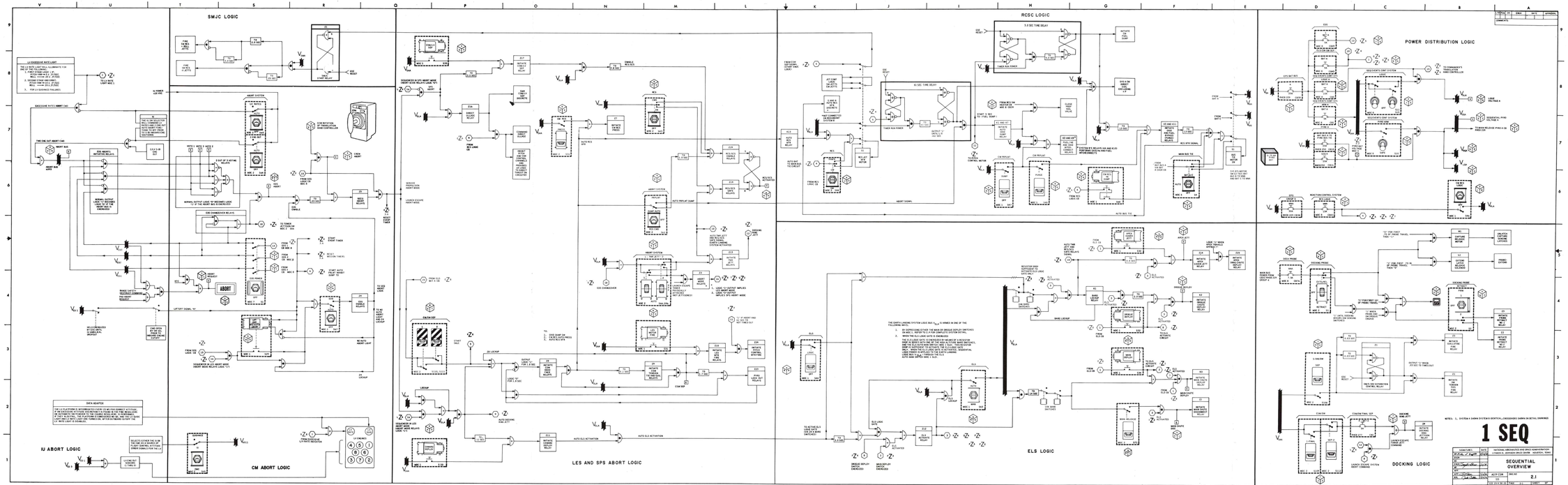
1.8.5.3 Instrumentation buses.-

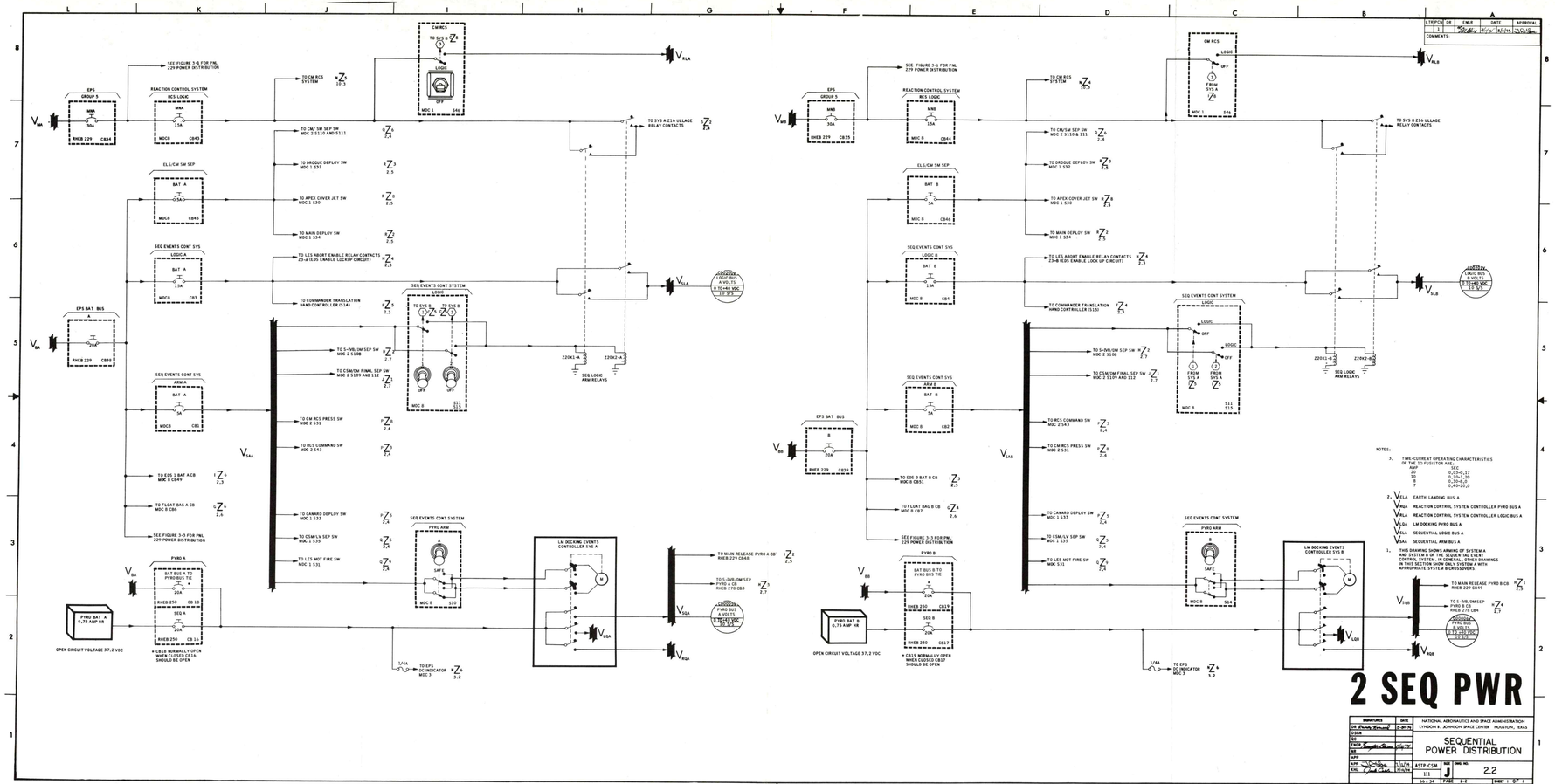
V_1	- CM ESS INST BUS PWR FROM RHEB PNL 276-CB1	7.1
V_2	- CM ESS INST BUS PWR FROM RHEB PNL 276-CB2	7.1
V_{3S}	- SM ESS INST BUS PWR FROM RHEB PNL 276-CB3	7.1
V_{4S}	-SM ESS INST BUS PWR FROM RHEB PNL 276-CB4	7.1
V_{SC}	- SCE PWR REQ'D FOR SIGNAL CONDITIONING (+20, -20, and/or +10Vdc)	7.1 and Page 7-18
V_{SC5}	- SCE CM +5Vdc PWR	7.1
V_{RCS}	- SM RCS INDICATOR BUS POWER FROM SM MAIN BUS	10.2
V_{RCS}	- SM RCS INDICATOR BUS POWER FROM SM MAIN BUS	10.2

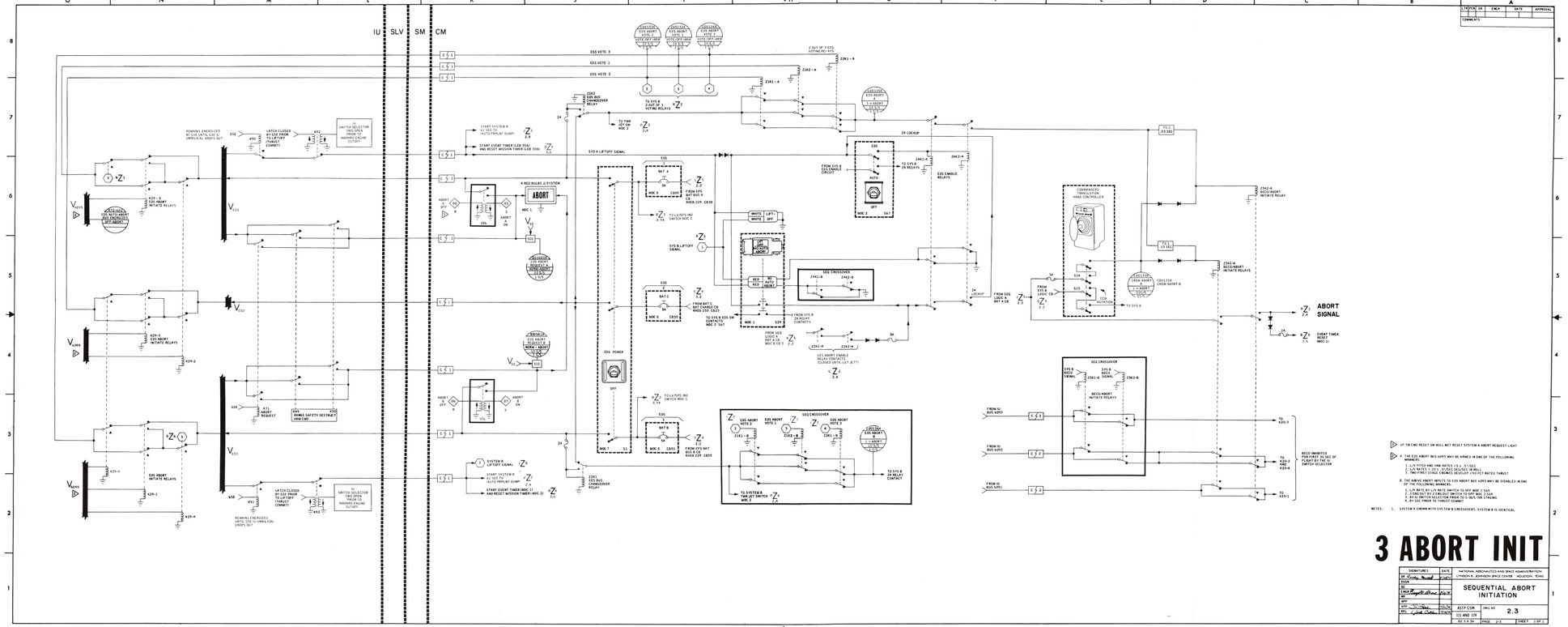
1.8.5.4 SCS logic buses .-

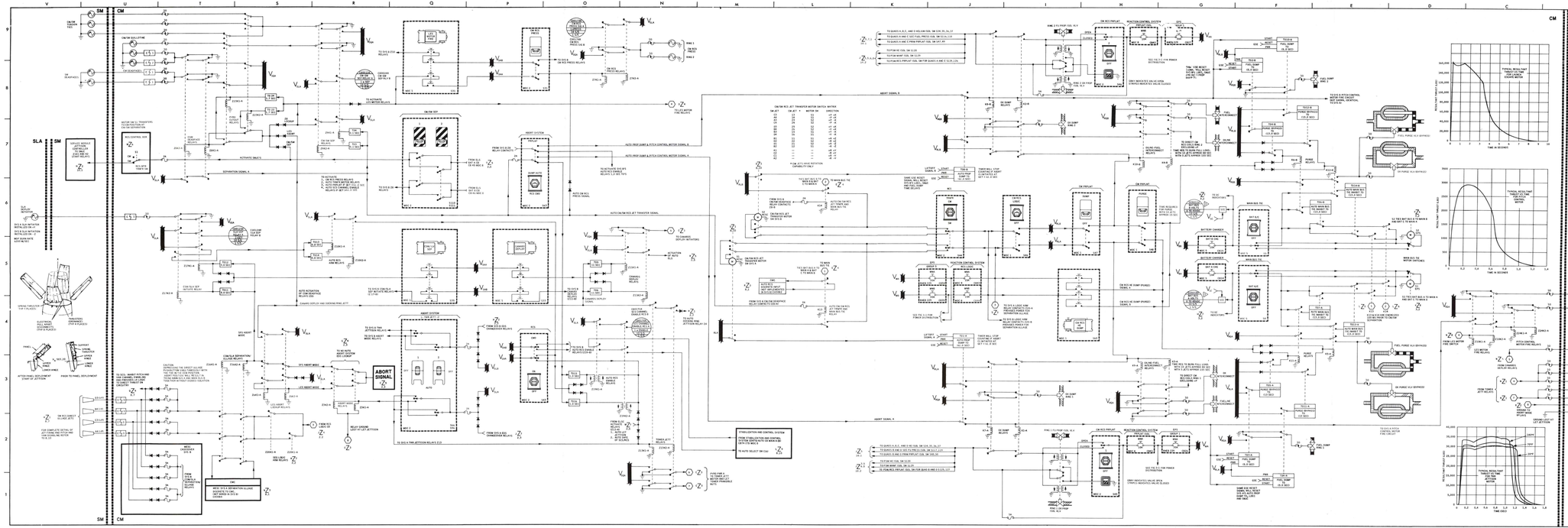
		Prime CSH generation dwg No.
V_{LB1}	- LOGIC BUS 1	8.2
V_{LB2}	- LOGIC BUS 2	8.2
V_{LB3}	- LOGIC BUS 3	8.2
V_{LB4}	- LOGIC BUS 4	8.2

2 SEQUENTIAL
EVENTS SYSTEM


SMJC LOGIC
IU ABORT LOGIC
CM ABORT LOGIC
LES AND SPS ABORT LOGIC
RCSC LOGIC
ELS LOGIC
POWER DISTRIBUTION LOGIC
DOCKING LOGIC
SEQUENTIAL OVERVIEW
1 SEQ
ABORT
LIFTOFF SIGNAL "H"
LAUNCH ESCAPE VEHICLE
ABORT SIGNAL
LOCKUP
ENABLE ROLLOUT
AUTO ELS ACTIVATION
AUTO DOCKING FINAL SEP
AUTO RCS OFF
AUTO ENTRY
AUTO PARACHUTE DEPLOY
AUTO LANDING
AUTO POST LANDING
AUTO ELS DEACTIVATION
AUTO ELS DEACTIVATION
AUTO ELS DEACTIVATION


2 SEQ PWR
SEQUENTIAL POWER DISTRIBUTION
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
ASTP-CSM
SIZE J
DWG NO. 2.2
SCALE NONE
PAGE 2-2
SHEET 1 OF 1
EPS GROUP 5
REACTION CONTROL SYSTEM
RCS LOGIC
EPS BAT BUS
SEQ EVENTS CONT SYS
LOGIC A
LOGIC B
ARM A
ARM B
PYRO ARM
PYRO A
PYRO B
CM RCS
SEQ EVENTS CONT SYSTEM
LM DOCKING EVENTS CONTROLLER SYS B
TO CM RCS SYSTEM
TO CM/SM SEP SW MDC 2 5110 & 111
TO DROGUE DEPLOY SW MDC 1 532
TO APEX COVER JET SW MDC 1 530
TO MAIN DEPLOY SW MDC 1 534
TO LES ABORT ENABLE RELAY CONTACTS 23-A (E.05 ENABLE LOCKUP CIRCUIT)
TO COMMANDER TRANSLATION HAND CONTROLLER (S16)
TO S-IVB/LM SEP SW MDC 2 5108
TO CSM/LM FINAL SEP SW MDC 2 5109 AND 112
TO RCS COMMAND SW MDC 2 543
TO CM RCS PRESS SW MDC 2 531
TO CANARD DEPLOY SW MDC 1 533
TO CSM/LV SEP SW MDC 1 535
TO LES MOT FIRE SW MDC 531
TO EPS DC INDICATOR MDC 3
TO SYS A Z16 ULLAGE RELAY CONTACTS
TO SYS B Z16 ULLAGE RELAY CONTACTS
SEQ LOGIC ARM RELAYS
TO MAIN RELEASE PYRO A CB RHEB 229 CB48
TO S-IVB/LM SEP PYRO A CB RHEB 270 CB3
TO MAIN RELEASE PYRO B CB RHEB 229 CB49
TO S-IVB/LM SEP PYRO B CB RHEB 270 CB4
TO EPS BAT A CB MDC B CB45
TO FLOAT BAG A CB MDC B CB6
SEE FIGURE 3-3 FOR PNL 229 POWER DISTRIBUTION
TO EPS BAT B CB MDC B CB51
TO FLOAT BAG B CB MDC B CB7
SEE FIGURE 3-1 FOR PNL 229 POWER DISTRIBUTION
PYRO BAT A 0.75 AMP HR
PYRO BAT B 0.75 AMP HR
OPEN CIRCUIT VOLTAGE 37.2 VDC
+ CB15 NORMALLY OPEN WHEN CLOSED CB16 SHOULD BE OPEN
+ CB19 NORMALLY OPEN WHEN CLOSED CB17 SHOULD BE OPEN
NOTES:
3. TIME-CURRENT OPERATING CHARACTERISTICS OF THE 30 FUSISTOR ARE:
AMP SEC
20 0.03-0.17
15 0.04-0.20
10 0.05-0.30
7 0.40-20.0
2. VLLA EARTH LANDING BUS A
VLBA REACTION CONTROL SYSTEM CONTROLLER PYRO BUS A
VLCA REACTION CONTROL SYSTEM CONTROLLER LOGIC BUS A
VLDA LM DOCKING PYRO BUS A
VLEA SEQUENTIAL LOGIC BUS A
VLFA SEQUENTIAL ARM BUS A
1. THIS DRAWING SHOWS ARMING OF SYSTEM A AND SYSTEM B OF THE SEQUENTIAL EVENT CONTROL SYSTEM. IN GENERAL, OTHER DRAWINGS IN THIS SECTION SHOW ONLY SYSTEM A WITH APPROPRIATE SYSTEM B CROSSOVERS.


IU
SLV
SM
CM
ABORT SIGNAL
EVENT TIMER RESET
3 ABORT INIT
SEQUENTIAL ABORT INITIATION
2.3
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
ASTP CSM
ASTP-10-73
2MG-40
EO AND I/F
SHEET 1 OF 1



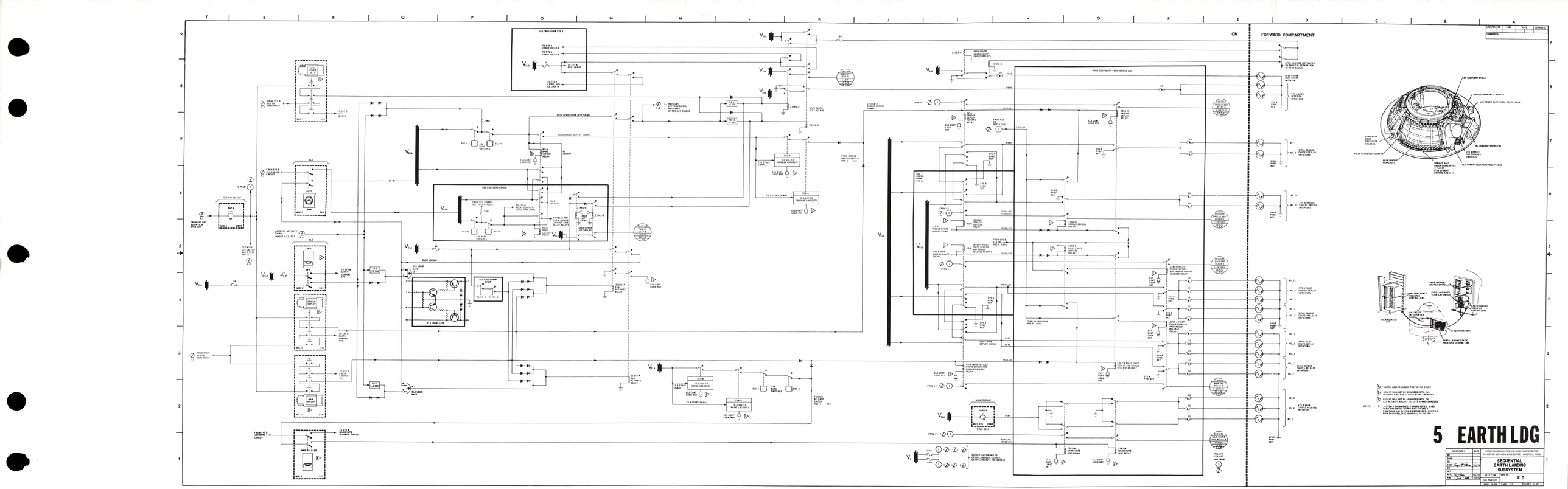
4 ABORT

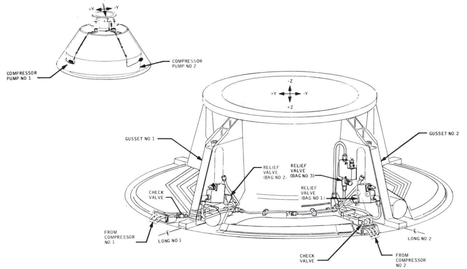
SIGNATURES	DATE
ORIGINATOR	
CHIEF DESIGNER	
LM	
MIT	
CONTRACTOR	

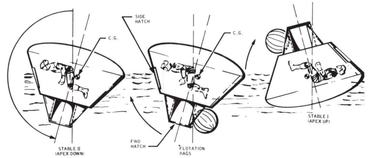
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER, HOUSTON, TEXAS

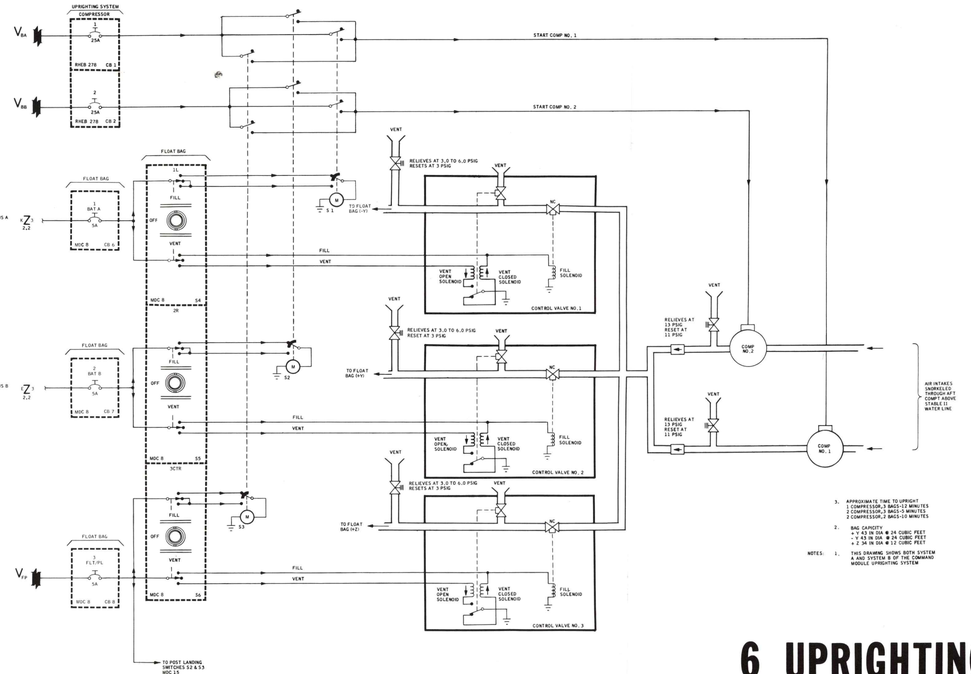
SEQUENTIAL LES AND SPS ABORT SUBSYSTEM

ASCP CODE	DWG NO	2.4
22 & 23		
23 & 24.25	PAGE 4-1	SHEET 1 OF 1


CM
FORWARD COMPARTMENT
SEQ CROSSOVER SYS B
SEQ CROSSOVER SYS A
ELS LOGIC GATE
PYRO CONTINUITY VERIFICATION BOX
AUTO APEX COVER JETT SIGNAL
AUTO DROGUE DEPLOY SIGNAL
ELS LOGIC
ELS LOGIC SAFE
MAIN RELEASE
MAIN DISPLAY
DROGUE DEPLOY
LOGIC
APEX COVER JETT RELAYS
SYS A MAIN CHUTES RELEASE INITIATORS
SYS B MAIN CHUTES RELEASE INITIATORS
SYS A DROGUE CHUTES RELEASE INITIATORS
SYS B DROGUE CHUTES RELEASE INITIATORS
SYS A PILOT CHUTES DEPLOY INITIATORS
SYS B PILOT CHUTES DEPLOY INITIATORS
SYS A MAIN CHUTES DEPLOY INITIATORS
SYS B MAIN CHUTES DEPLOY INITIATORS
LES TOWER ELECTRICAL RECEPTACLE
RCS ENGINE PROTECTOR
LES TOWER ELECTRICAL RECEPTACLE
LINEAR SHAPED CHARGE CONTROLLER
MASTER EVENTS CONTROLLER
MAIN EQUIPMENT BAY
LEFT LANDING STATIC PRESSURE SENSING LINE
SWITCH LOCATED UNDER PROTECTIVE COVER
RELAYS WILL NOT BE ENERGIZED UNTIL ELS ACTIVATE RELAYS 212 SYS A AND ENERGIZED
RELAYS WILL NOT BE ENERGIZED UNTIL THE ELS ACTIVATE RELAYS 212 SYS B ARE ENERGIZED
SYSTEM A SHOWN EXCEPT WHERE NOTED. PYRO CONTINUITY VERIFICATION BOX PERFORMS FUNCTIONS FOR SYSTEM A CROSSOVERS. SYSTEM B MAIN CHUTE RELEASE MONITORS TO SYSTEM A
5 EARTH LDG
SEQUENTIAL EARTH LANDING SUBSYSTEM
2.5
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS







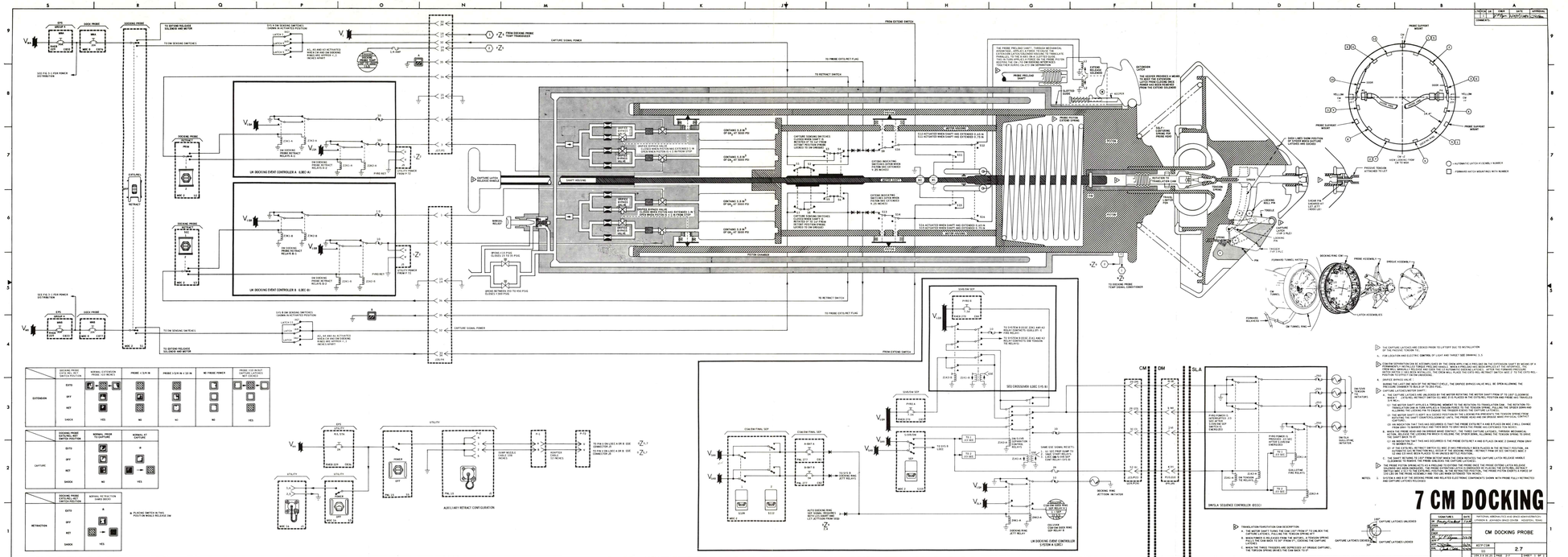
NOTES:
1. THIS DRAWING SHOWS BOTH SYSTEM 1 AND SYSTEM 2 OF THE COMMAND MODULE UPRIGHTING SYSTEM
2. BAG CAPACITY
   - + Y 43 IN DIA @ 24 CUBIC FEET
   - + Z 43 IN DIA @ 24 CUBIC FEET
   - - Z 34 IN DIA @ 12 CUBIC FEET
3. APPROXIMATE TIME TO UPRIGHT
   1 COMPRESSOR,3 BAGS-12 MINUTES
   2 COMPRESSOR,1 BAGS-5 MINUTES
   2 COMPRESSOR,2 BAGS-10 MINUTES

6 UPRIGHTING

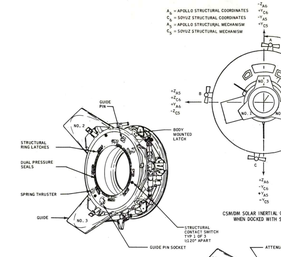
SIGNATURES	DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
DR Randy Brown	8-14-68	LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
DSGN		
SC		SEQUENTIAL UPRIGHTING SYSTEM
ENGR Lloyd Allen Slayton		
SE		
APP		
APP Jack Wilson	7/25/70	ASTP CSM ORIG NO 2.6
KHL Jack Cook	7/16/70	111 & 119
		34 X 46 PAGE 2-6 SHEET 1 OF 1

ULTR	CK	DR	ENGR	DATE	APPROVAL

COMMENTS:

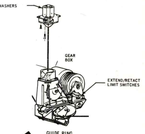

7 CM DOCKING
CM DOCKING PROBE
CAPTURE LATCHES UNLOCKED
CAPTURE LATCHES LOCKED
CAPTURE LATCHES DRIVEN
PROBE SUPPORT MOUNT
PROBE ASSEMBLY-1
PROBE ASSEMBLY-2
LATCH ASSEMBLIES
DOCKING RING CM-1
DOCKING RING CM-2
FORWARD BULKHEAD
FORWARD TUNNEL MATCH
CM TUNNEL RING
CM TUNNEL
CAPTURE LATCH (4 PLACES)
DOCKING RING ATTITUDE INDICATOR
DOCKING RING CM-1 SEP SIGNAL
DOCKING RING CM-2 SEP SIGNAL
CM DOCKING EVENT CONTROLLER SYSTEM A (LEC)
CM DOCKING EVENT CONTROLLER SYSTEM B (LEC)
LM DOCKING EVENT CONTROLLER A (LEC-A)
LM DOCKING EVENT CONTROLLER B (LEC-B)
SEQUENCE CONTROLLER (SCC)
AUXILIARY RETRACT CONFIGURATION
CAPTURE LATCH RELEASED HANDLE
MANUAL RELEASE
PISTON CHAMBER
SHAFT HOUSING
SHAFT
PISTON
PROBE PRELOAD SHAFT
PROBE PRELOAD SPRING
PROBE TORSION ATTACHING TIE LET
DOCKING PROBE RETRACT RELAYS
DOCKING PROBE EXTEND RELAYS
DOCKING PROBE RETRACT MOTOR
DOCKING PROBE EXTEND MOTOR
DOCKING PROBE RETRACT SWITCH
DOCKING PROBE EXTEND SWITCH
DOCKING PROBE CAPTURE SWITCH
DOCKING PROBE CAPTURE RELAY
DOCKING PROBE RETRACT SWITCH
DOCKING PROBE EXTEND FLAG
DOCKING PROBE RETRACT FLAG
DOCKING PROBE TEMP SIGNAL CONDITIONER
DOCKING RING JETTISON INITIATOR
DOCKING RING JETT RELAYS
DOCKING RING SEP SIGNAL SEQUENCE
DOCKING RING SEP RELAY
DOCKING RING JETT SIGNAL
DOCKING RING SEP SIGNAL
AUTO DOCKING RING SEP SIGNAL SEQUENCE
1ST JETTISON PYRO FIRE
2ND JETTISON PYRO FIRE
CAPTURE LATCH RELEASE SOLENOID
CAPTURE LATCH RELEASE HANDLE
CAPTURE LATCH RELEASE SWITCH
CAPTURE LATCH RELEASE RELAY
CAPTURE LATCH RELEASE SOLENOID
CAPTURE SIGNAL POWER
CAPTURE LATCH RELEASE SWITCHES
CAPTURE LATCH RELEASE RELAYS
CAPTURE LATCH RELEASE SOLENOIDS
CAPTURE LATCH RELEASE SOLENOID
CAPTURE LATCH RELEASE SWITCH
CAPTURE LATCH RELEASE RELAY
CAPTURE LATCH RELEASE SOLENOID
CAPTURE LATCH RELEASE SOLENOIDS

X_A = APOLLO STRUCTURAL COORDINATES
Y_S, Z_S = SOYUZ STRUCTURAL COORDINATES
Y_A, Z_A = APOLLO STRUCTURAL MECHANISM
Y_S, Z_S = SOYUZ STRUCTURAL MECHANISM

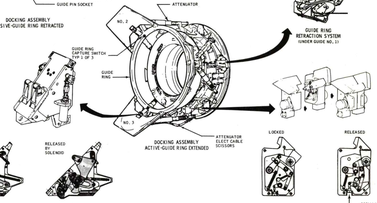


DOCKING ASSEMBLY
PASSIVE-GUIDE RING RETRACTED

CSM/SM SOLAR ORIENTAL ORIENTATION WHEN DOCKED WITH SOYUZ



GUIDE RING RETRACTION SYSTEM UNDER GUIDE NO. 1?

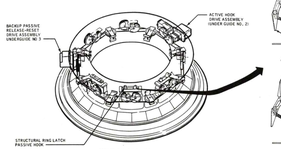


DOCKING ASSEMBLY
ACTIVE-GUIDE RING EXTENDED

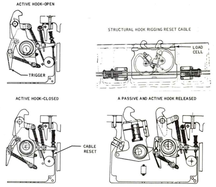
ATTENUATOR ELECT CABLE SCISSORS

CAPTURE LATCH

BODY MOUNTED LATCH

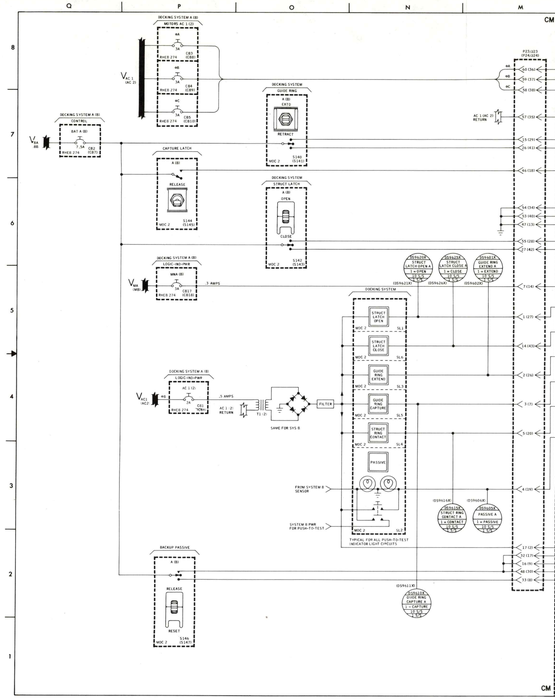


STRUCTURAL RING LATCH ACTIVATION MECHANISM



STRUCTURAL RING LATCH

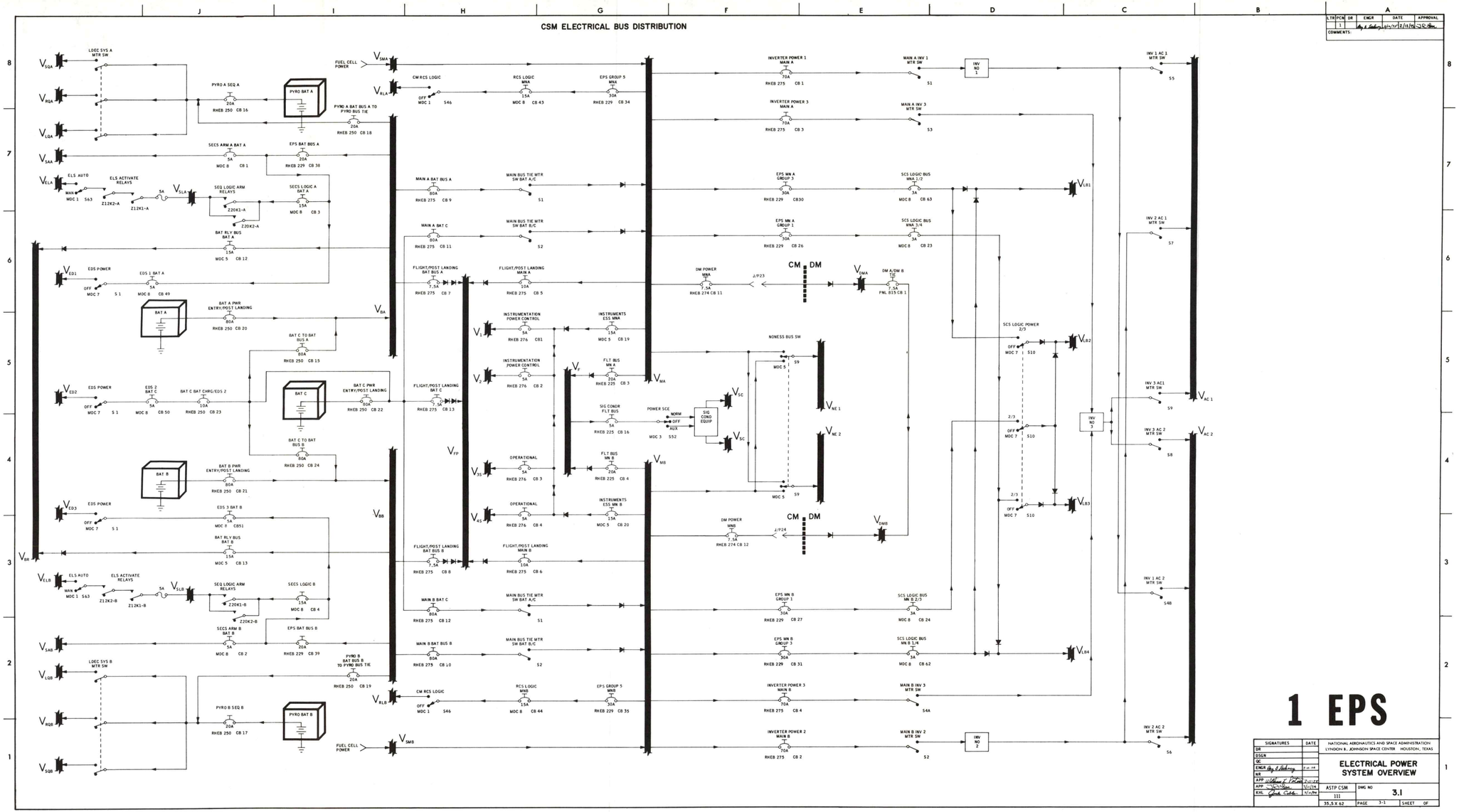
APRON ITEM 2.8

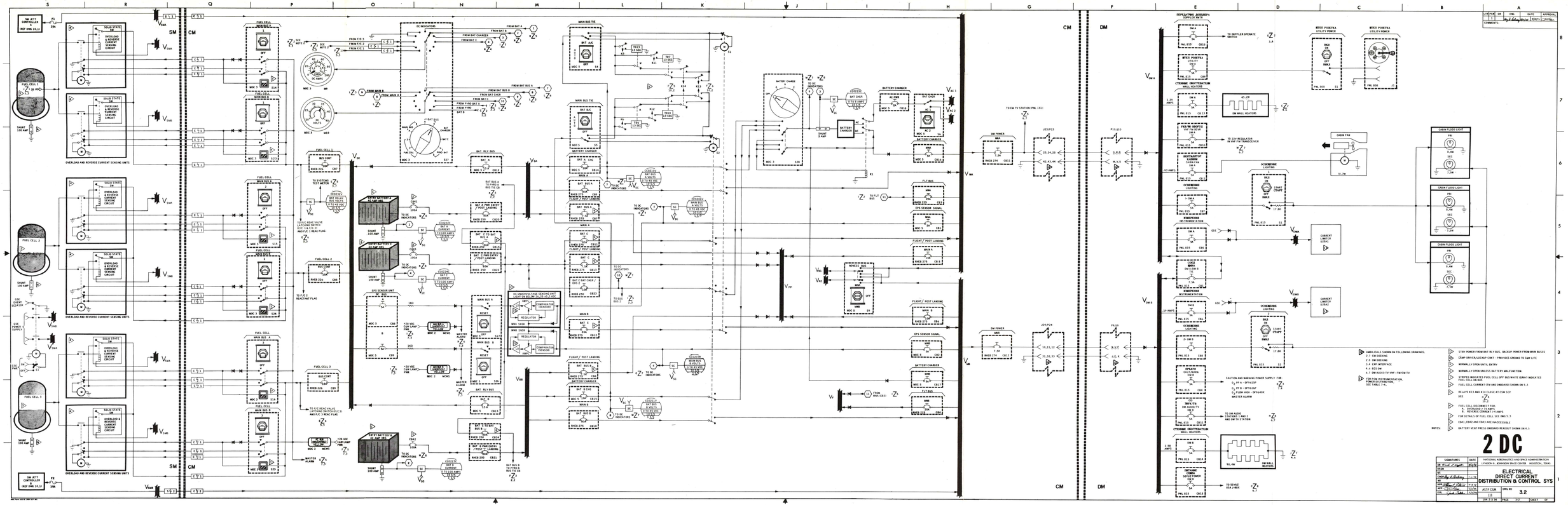


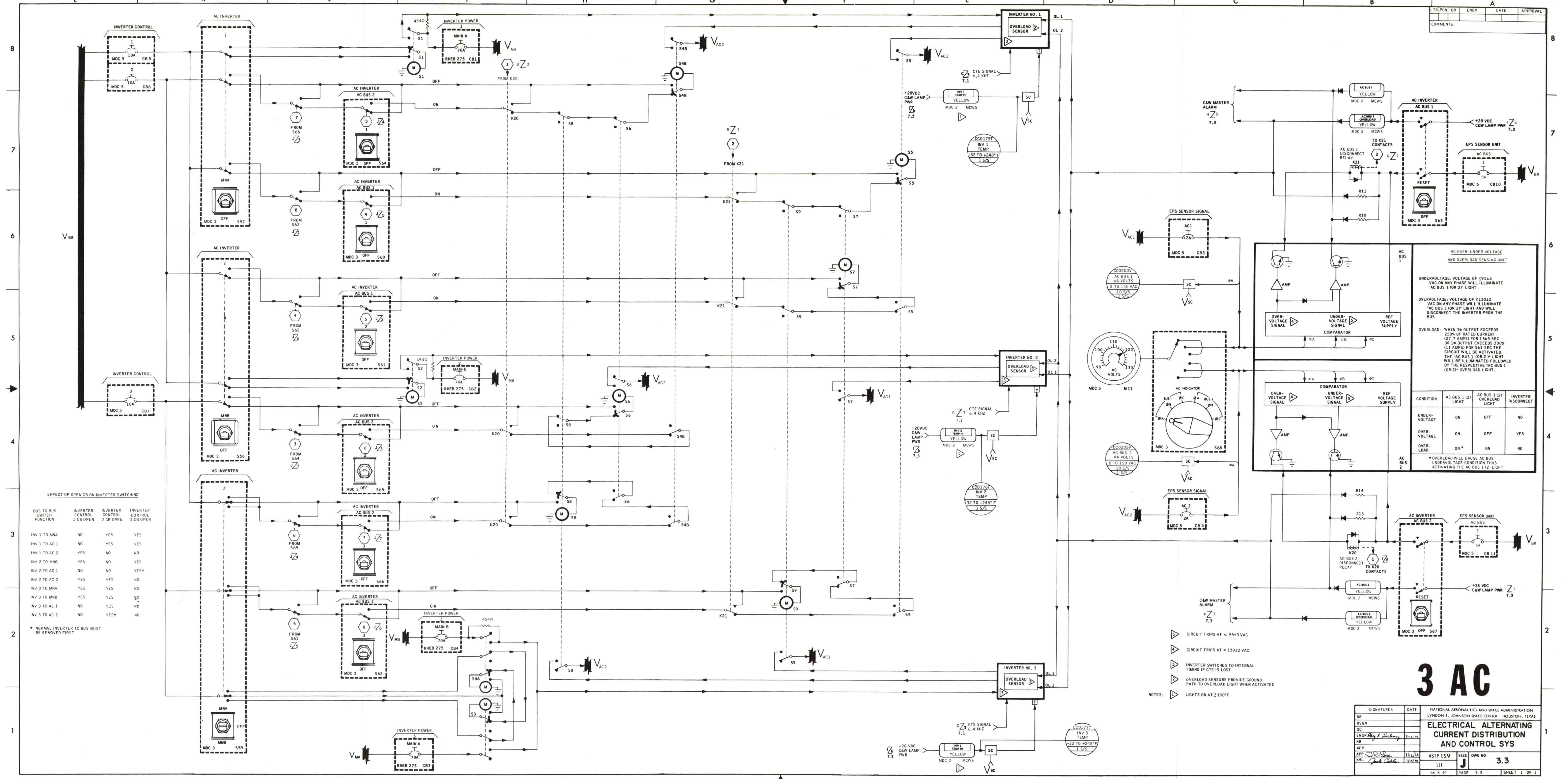
SIGNATURES	DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Prep'd by [illegible]	2-8-71	LYNDON B. JOHNSON SPACE CENTER, HOUSTON, TEXAS
Chk'd by		
Des'd by		
Mech'l by [illegible]	2-8-71	ASTP DOCKING SYSTEM
Elec'l by [illegible]	2-8-71	ASTP CSM
Sys Engr by [illegible]	2-8-71	DWG NO. 2.8
SIZE D		SHEET 1 OF 1

CONTRACTOR	DATE	APPROVAL
CONNECTED TO		

3 ELECTRICAL SYSTEM


CSM ELECTRICAL BUS DISTRIBUTION
LTR PCN DR ENGR DATE APPROVAL
COMMENTS:
1 EPS
SIGNATURES DATE
DR
DSGN
QC
ENGR
NR
APP
APP
KHL
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
ELECTRICAL POWER SYSTEM OVERVIEW
ASTP CSM
111
DWG NO 3.1
35.5 X 62
PAGE 3-1 SHEET OF


SM
CM
DM
FUEL CELL 1
FUEL CELL 2
FUEL CELL 3
OVERLOAD AND REVERSE CURRENT SENSING UNITS
SOLID STATE OR OVERLOAD & REVERSE CURRENT SENSING CIRCUIT
DC INDICATORS
DC VOLTS
DC AMPS
BAT BUS
FUEL CELL
BATTERY CHARGER
MAIN BUS TIE
BAT A/C
BAT A CHG
BAT B CHG
BAT C CHG
BAT A
BAT B
BAT C
BAT RLY BUS
MAIN BUS A
MAIN BUS B
FLIGHT / POST LANDING
MAIN A
MAIN B
EPS SENSOR UNIT
DC UNDERVOLTAGE SENSING UNIT
COMPARATOR (SENSOR)
REGULATOR
BATTERY VENT PRESS
BATTERY CHARGER
FLT BUS
EPS SENSOR SIGNAL
CAUTION AND WARNING POWER SUPPLY
CABIN FAN
CABIN FLOOD LIGHT
OCEANBORNE LIGHTING
INSTRUMENTATION
CURRENT LIMITER (LOAD)
2 DC



EFFECT OF OPEN CB ON INVERTER SWITCHING

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

* NORMAL INVERTER TO BUS MUST BE REMOVED FIRST

AC OVER-UNDER VOLTAGE AND OVERLOAD SENSING UNIT

UNDERVOLTAGE: VOLTAGE OF ≤95±3 VAC ON ANY PHASE WILL ILLUMINATE "AC BUS 1 (OR 2)" LIGHT.

OVERVOLTAGE: VOLTAGE OF ≥130±2 VAC ON ANY PHASE WILL ILLUMINATE "AC BUS 1 (OR 2)" LIGHT AND WILL DISCONNECT THE INVERTER FROM THE BUS

OVERLOAD: WHEN 3Φ OUTPUT EXCEEDS 250% OF RATED CURRENT (27.7 AMPS) FOR 15±5 SEC OR 1Φ OUTPUT EXCEEDS 300% (11 AMPS) FOR 5±1 SEC THE CIRCUIT WILL BE ACTIVATED. THE "AC BUS 1 (OR 2)" LIGHT WILL BE ILLUMINATED FOLLOWED BY THE RESPECTIVE "AC BUS 1 (OR 2)" OVERLOAD LIGHT.

CONDITION	AC BUS 1 (2) LIGHT	AC BUS 1 (2) OVERLOAD LIGHT	INVERTER DISCONNECT
UNDER-VOLTAGE	ON	OFF	NO
OVER-VOLTAGE	ON	OFF	YES
OVER-LOAD	ON *	ON	NO

* OVERLOAD WILL CAUSE AC BUS UNDERVOLTAGE CONDITION THUS ACTIVATING THE AC BUS 1 (2) LIGHT

NOTES:

1. LIGHTS ON AT ≥190°F
2. OVERLOAD SENSORS PROVIDE GROUND PATH TO OVERLOAD LIGHT WHEN ACTIVATED
3. INVERTER SWITCHES TO INTERNAL TIMING IF CTE IS LOST
4. CIRCUIT TRIPS AT > 130±2 VAC
5. CIRCUIT TRIPS AT < 95±3 VAC

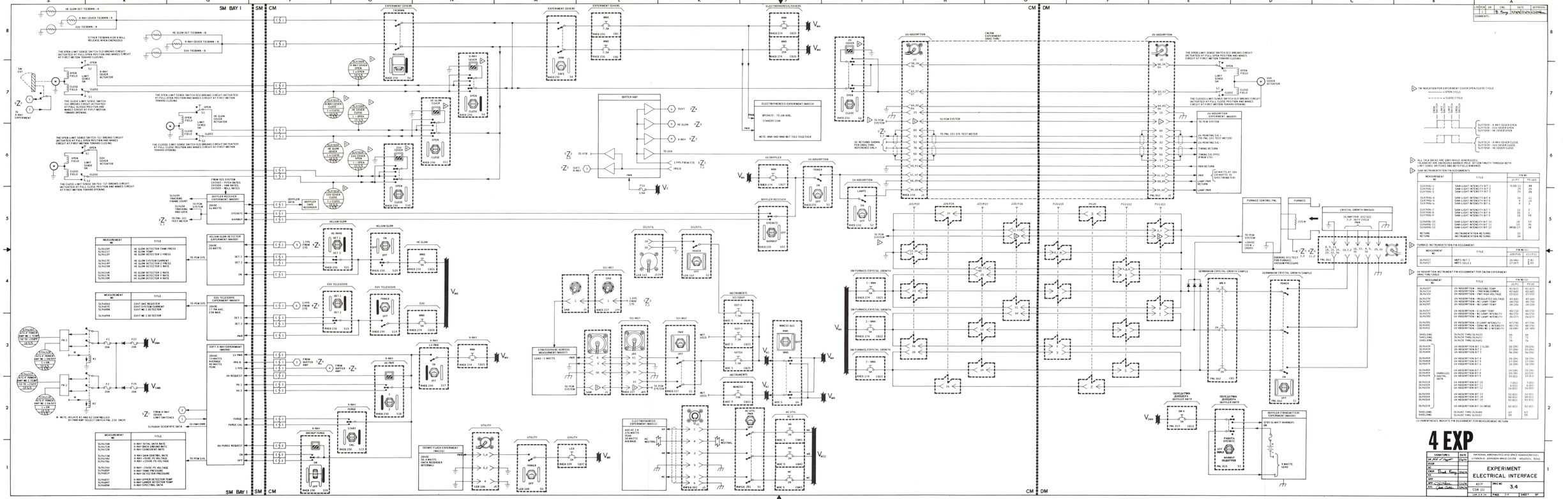
3 AC

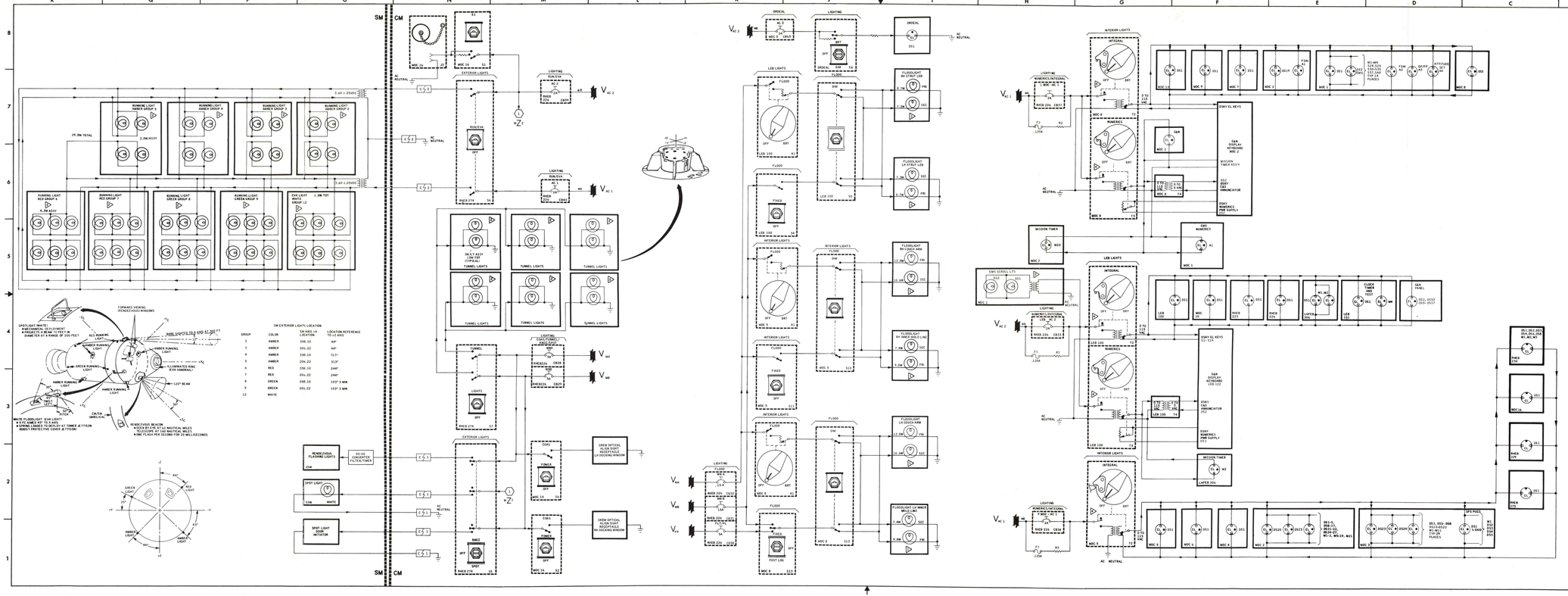
SIGNATURES	DATE
DR	
DSGN	
QC	
ENGR Ray B Lachney	7-12-74
NR	
APP	
APP J R Roe	7/12/74
KHL Jack Cable	7/12/74

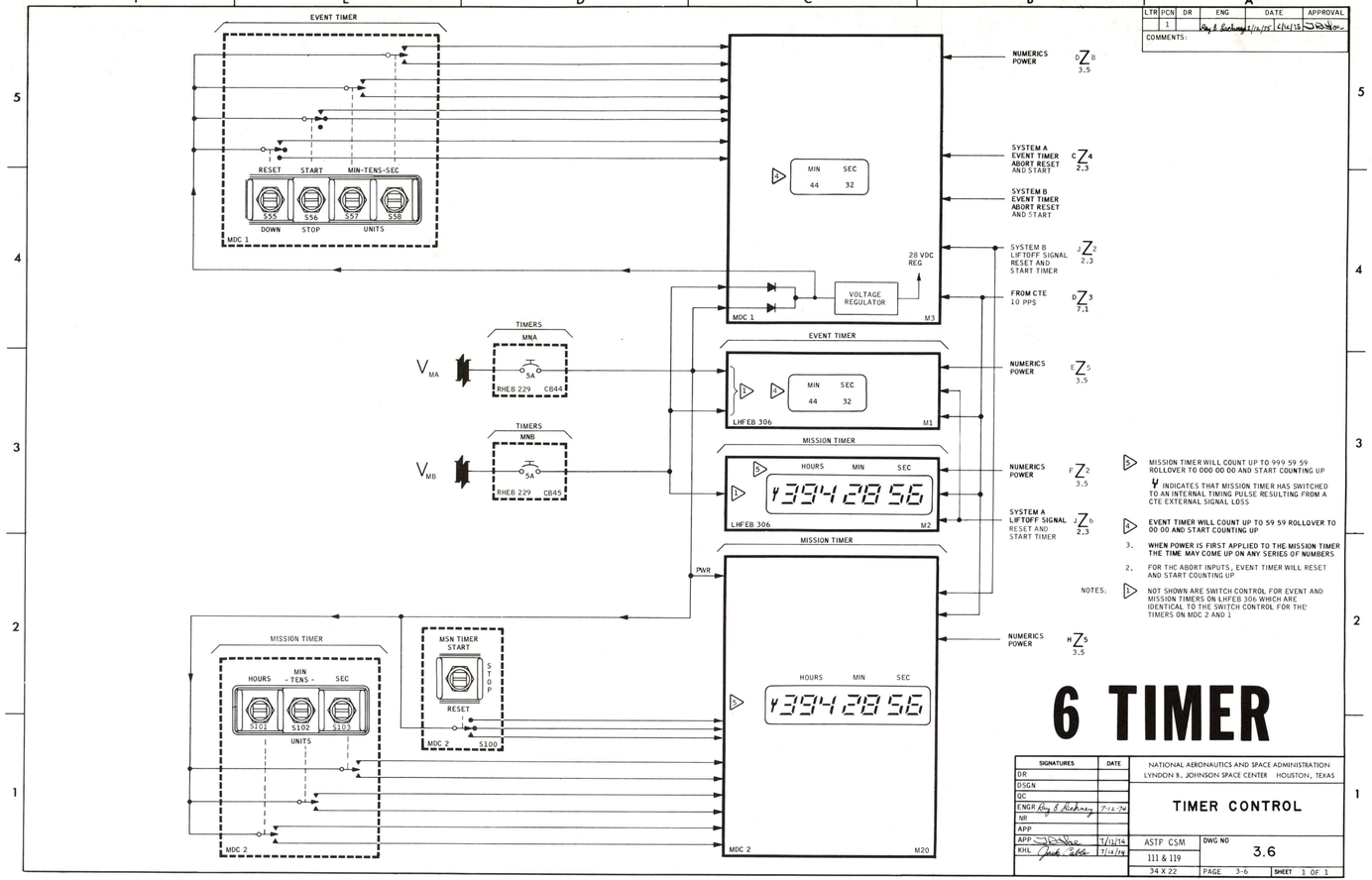
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS

ELECTRICAL ALTERNATING CURRENT DISTRIBUTION AND CONTROL SYS

ASTP CSM 111 | SIZE J | DWG NO 3.3
66 X 34 | PAGE 3-3 | SHEET 1 OF 1


SM BAY I
SM CM
CM DM
4 EXP
EXPERIMENT ELECTRICAL INTERFACE
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
CSM 113
3.4
PAGE 3-4
SHEET 69
SIGNATURES
DR
CHCK
APP
APP
APP
APP
DATE
CHANGE NO.
HE GLOW DET TIEDOWN - A
X-RAY COVER TIEDOWN - A
EVV TIEDOWN - A
EITHER TIEDOWN A OR B WILL RELEASE WHEN ENERGIZED
HE GLOW DET TIEDOWN - B
X-RAY COVER TIEDOWN - B
EVV TIEDOWN - B
THE OPEN LIMIT SENSE SWITCH (S3) BREAKS CIRCUIT ACTUATED AT FULL OPEN POSITION AND MAKES CIRCUIT AT FIRST MOTION TOWARD CLOSING.
THE CLOSE LIMIT SENSE SWITCH (S4) BREAKS CIRCUIT ACTUATED AT FULL CLOSED POSITION AND MAKES CIRCUIT AT FIRST MOTION TOWARD OPENING.
THE OPEN LIMIT SENSE SWITCH (S1) BREAKS CIRCUIT ACTUATED AT FULL OPEN POSITION AND MAKES CIRCUIT AT FIRST MOTION TOWARD CLOSING.
THE CLOSED LIMIT SENSE SWITCH (S2) BREAKS CIRCUIT ACTUATED AT FULL CLOSE POSITION AND MAKES CIRCUIT AT FIRST MOTION TOWARD OPENING.
THE OPEN LIMIT SENSE SWITCH (S1) BREAKS CIRCUIT ACTUATED AT FULL OPEN POSITION AND MAKES CIRCUIT AT FIRST MOTION TOWARD CLOSING.
THE CLOSE LIMIT SENSE SWITCH (S2) BREAKS CIRCUIT ACTUATED AT FULL CLOSE POSITION AND MAKES CIRCUIT AT FIRST MOTION TOWARD OPENING.
EXPERIMENT COVERS
EXPERIMENT COVERS
ELECTROPHORESIS COVERS
UV ABSORPTION
UV ABSORPTION EXPERIMENT (MA051)
UV ABSORPTION
CM/SM EXPERIMENT DRAG TANK
ELECTROPHORESIS EXPERIMENT (MA014)
OPERATE: 70.6W AVE.
STANDBY:16W
NOTE: MNA AND MNB NOT TIED TOGETHER
BUFFER AMP
DOPPLER RECEIVER EXPERIMENT (MA007)
DOPPLER RECEIVER
UV/DOPPLER
UV ABSORPTION
UV ABSORPTION
LAMPS
SM FURNACE/CRYSTAL GROWTH
SM FURNACE/CRYSTAL GROWTH
SM FURNACE/CRYSTAL GROWTH
FURNACE CONTROL PNL
FURNACE
CRYSTAL GROWTH (MA060)
GERMANIUM CRYSTAL GROWTH SAMPLE
GERMANIUM CRYSTAL GROWTH SAMPLE
DEPLOYMENT SWITCH DOPPLER ANTENNA
DEPLOYMENT SWITCH DOPPLER ANTENNA
DOPPLER TRANSMITTER EXPERIMENT (MA009)
HELIUM GLOW
HELIUM GLOW
HE GLOW
HELIUM GLOW DETECTOR EXPERIMENT (MA050)
SCI/UTIL
SCI/UTIL
SCI INST
SCI INST
SCI INST
EVV TELESCOPE
EVV TELESCOPE
EVV
EVV TELESCOPE EXPERIMENT (MA052)
INSTRUMENTS
SO CORO
INSTRUMENTS
NONESS BUS
NONESS
NONESS
STRATOSPHERIC AEROSOL MEASUREMENT (MA007)
LOAD = 5 WATTS
ELECTROPHORESIS EXPERIMENT (MA011)
400 HZ, 3 Φ 250 WATTS 208 VOLTS AVERAGE
AC NEUTRAL
AC CTRL
AC NEUTRAL
GEMINI FLASH EXPERIMENT (MA035)
UTILITY
UTILITY
UTILITY
UTILITY
X-RAY
X-RAY
X-RA


SM
CM
RUNNING LIGHT WHITE GROUP 1
RUNNING LIGHT RED GROUP 4
RUNNING LIGHT RED GROUP 5
RUNNING LIGHT GREEN GROUP 6
RUNNING LIGHT GREEN GROUP 7
RUNNING LIGHT WHITE GROUP 8
EVA LIGHT WHITE GROUP 12
29.2W TOTAL
2.2W/ASSY
7.2W TEST
5.4W ASSY
3.6A ± 20VAC
SPOTLIGHT (WHITE)
• MECHANICAL OSCILLATION ±7.5° AT 6 CPM WITH 2.5 IN DIAMETER AT A RANGE OF 200 FEET
FORWARD VIEWING DEHAZE/VISOR WINDOWS
RED RUNNING LIGHT
AMBER RUNNING LIGHT
GREEN RUNNING LIGHT
ILLUMINATED RING (EVA HANDRAIL)
120° BEAM
CM/SM UMBILICAL
RENDEZVOUS BEACON
• 1 FLASH PER SECOND FOR 12 NAUTICAL MILES VISIBILITY AT 150 NAUTICAL MILES
• ONE FLASH PER SECOND FOR 20 MILLISECONDS
WHITE FLOODLIGHT (EVA LIGHT)
• 5 FLUSHES SET TO 5 AMPS
• EXPOSE CABLES TO RECEIVE AT TOWER AT TITON (SEE) PROTECTIVE COVER AT TITON
SW EXTERIOR LIGHTS LOCATION
GROUP
COLOR
SW ASSY +X LOCATION
LOCATION REFERENCE TO +Z AXIS
2 AMBER 358.10 44°
3 AMBER 206.22 44°
4 AMBER 358.10 315°
5 AMBER 206.22 315°
6 RED 358.10 244°
7 RED 206.22 244°
8 GREEN 358.10 103° 3 MIN
9 GREEN 206.22 103° 3 MIN
12 WHITE
RENDEZVOUS FLASHING LIGHTS
DC-DC CONVERTER FILTER/TIMER
SPOT LIGHT
SPOT LIGHT DOOR INITIATOR
EXTERIOR LIGHTS
INTERIOR LIGHTS
TUNNEL LIGHTS
LIGHTING CONTROL/PANEL ILLUMINATION
CREW OPTICAL ALIGNMENT RECEPTACLE VIA DOCKING WINDOW
LIGHTING
ORDEAL
LED LIGHTS
FLOODLIGHT
INTERIOR LIGHTS
INTEGRAL
NUMERICS
MISSION TIMER
EWS SCROLL LTS
CLOCK TIMER
GSE PANEL
GSE PANEL
GSE PANEL


EVENT TIMER
RESET
START
MIN-TENS-SEC
S55
S56
S57
S58
DOWN
STOP
UNITS
MDC 1
MIN SEC
44 32
28 VDC REG
VOLTAGE REGULATOR
MDC 1 M5
NUMERICS POWER D Z8 3.5
SYSTEM A EVENT TIMER ABORT RESET AND START C Z4 2,3
SYSTEM B EVENT TIMER ABORT RESET AND START
SYSTEM B LIFTOFF SIGNAL RESET AND START TIMER J Z2 2.3
FROM CTE 10 PPS D Z3 7,1
TIMERS MNA
VMA
5A
RHEB 229 CB44
TIMERS MNB
VMB
5A
RHEB 229 CB45
EVENT TIMER
MIN SEC
44 32
LHFEB 306 M1
NUMERICS POWER E Z5 3.5
MISSION TIMER
HOURS MIN SEC
394 28 56
LHFEB 306 M2
NUMERICS POWER F Z2 3.5
SYSTEM A LIFTOFF SIGNAL RESET AND START TIMER J Z6 2,3
MISSION TIMER
PWR
HOURS MIN SEC
394 28 56
MDC 2 M20
NUMERICS POWER H Z5 3.5
MISSION TIMER
HOURS MIN - TENS - SEC
S101
S102
S103
UNITS
MDC 2
MSN TIMER START
STOP
RESET
S100
MDC 2
MISSION TIMER WILL COUNT UP TO 999 59 59 ROLLOVER TO 000 00 00 AND START COUNTING UP
INDICATES THAT MISSION TIMER HAS SWITCHED TO AN INTERNAL TIMING PULSE RESULTING FROM A CTE EXTERNAL SIGNAL LOSS
EVENT TIMER WILL COUNT UP TO 59 59 ROLLOVER TO 00 00 AND START COUNTING UP
NOTES:
3. WHEN POWER IS FIRST APPLIED TO THE MISSION TIMER THE TIME MAY COME UP ON ANY SERIES OF NUMBERS
2. FOR THC ABORT INPUTS, EVENT TIMER WILL RESET AND START COUNTING UP
NOT SHOWN ARE SWITCH CONTROL FOR EVENT AND MISSION TIMERS ON LHFEB 306 WHICH ARE IDENTICAL TO THE SWITCH CONTROL FOR THE TIMERS ON MDC 2 AND 1
LTR PCN DR ENG DATE APPROVAL
1
COMMENTS:
6 TIMER
SIGNATURES DATE
DS
DSGN
QC
ENGR Roy E Hackney 7-12-74
NP
APP
APP 7/12/74
KHL 7/12/74
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
TIMER CONTROL
ASTP CSM 111 & 119
DWG NO 3.6
34 X 22
PAGE 3-6
SHEET 1 OF 1

LTR	PCN	DR	ENGR	DATE	APPROVAL
	1		Roy A Ackroyd	8/14/72	8/16/72 J.R.Sloan

COMMENTS

SYSTEM TEST METER DISPLAY (VOLTS)

0,0	0,2	0,4	0,6	0,8	1,0	1,2	1,4	1,6	1,8	2,0	2,2	2,4	2,6	2,8	3,0	3,2	3,4	3,6	3,8	4,0	4,2	4,4	4,6	4,8	5,0
								<0,5V = UNLOCKED, >3,5V = LOCKED																	
-1,5	-1,38	-1,26	-1,14	-1,02	-,90	-,78	-,66	-,54	-,42	-,30	-,18	-,06	,06	,18	,30	,42	,54	,66	,78	,90	1,02	1,14	1,26	1,38	1,5
0	35,2	70,4	105,6	140,8	176,0	211,2	246,4	281,6	316,8	352,0	387,2	422,4	457,6	492,8	528,0	563,2	598,4	633,6	668,8	704,0	739,2	774,4	809,6	844,8	880,0
0	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380	400	420	440	460	480	500
0	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	144	152	160	168	176	184	192	200
0,0	0,8	1,6	2,4	3,2	4,0	4,8	5,6	6,4	7,2	8,0	8,8	9,6	10,4	11,2	12,0	12,8	13,6	14,4	15,2	16,0	16,8	17,6	18,4	19,2	20,0
-50	**-46**	**-42**	**-38**	**-34**	**-30**	**-26**	**-22**	**-18**	**-14**	**-10**	**-6**	**-4**	**0**	**+4**	**+10**	**+14**	**+18**	**+22**	**+26**	**+30**	**+34**	**+38**	**+42**	**+46**	**+50**
0	1,8	3,6	5,4	7,2	9,0	10,8	12,6	14,4	16,2	18,0	19,8	21,6	23,4	25,2	27,0	28,8	30,6	32,4	34,2	36,0	37,8	39,6	41,4	43,2	45,0
0	8	16	24	32	**40**	**48**	**56**	**64**	**72**	**80**	**88**	**96**	**104**	**112**	**120**	**128**	**136**	**144**	**152**	**160**	**168**	**176**	**184**	**192**	**200**
0	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80	84	88	92	96	100
-50	**-36**	**-22**	**-8**	**+6**	**+20**	**+34**	**+48**	**+62**	**+76**	**+90**	**+104**	**+118**	**+132**	**+146**	**+160**	**+174**	**+188**	**+202**	**+216**	**+230**	**+244**	**+258**	**+272**	**+286**	**+300**
0	**3**	**6**	**9**	**12**	**15**	**18**	**21**	**24**	**27**	**30**	**33**	**36**	**39**	**42**	**45**	**48**	**51**	**54**	**57**	**60**	**63**	**66**	**69**	**72**	**75**
-300	-264	-228	-192	-156	-120	-84	-48	-12	24	60	96	132	168	204	240	276	312	348	384	420	456	492	528	564	600
0	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380	400	420	440	460	480	500
-300	-264	-228	-192	-156	-120	-84	-48	-12	24	60	96	132	168	204	240	276	312	348	384	420	456	492	528	564	600
0,0	0,2	0,4	0,6	0,8	1,0	1,2	1,4	1,6	1,8	2,0	2,2	2,4	2,6	2,8	3,0	3,2	3,4	3,6	3,8	4,0	4,2	4,4	4,6	4,8	5,0

SYSTEMS TEST METER DISPLAY (VOLTS)

DOPPLER PHASE LOCK (EVENT) — J Z 7,8 12,4
UV POINTING ERROR (DEG) — W Z 3 11,1
DM CABIN P (MMHG) — F Z 6 4,6
DM O_2 PPA (MMHG) — F Z 4 4,6
HE PRESS PNL TEMP (°F) — F Z 3 10,3
BATTERY MANIFOLD PRESSURE (PSIA) — J Z 4 4,5
CM-RCS OXIDIZER VALVE TEMPERATURE (°F) — F Z 4 10,3
BATTERY RELAY BUS (VDC) — P Z 5 3,2
SPS TEMPERATURE (°F) — F Z 6 10,3
DM N_2 AND O_2 QTY (PCT) — M Z 8, N Z 8, F Z 8, H Z 8 4,6
EPS RADIATOR OUTLET TEMPERATURE (°F) — C Z 3 5,3
O_2, H_2 PRESSURE (PSIA) — C Z 3 5,3
O_2 TANK 2 HTR TEMP (°F) — P Z 3 5,2
DM O_2 PPB (MMHG) — D Z 5 4,6
O_2 TANK 1 HTR TEMP (°F) — P Z 2 5,2

SYSTEM TEST

SIG RETURN — RETURN

DOPPLER PHASE LOCK
UV POINTING ERROR
DM CABIN P
DM O_2 PPA
HE PRESS PNL TEMP
PRESS BAT COMPARTMENT (MANIF)
TEMP CW ENG INJECTOR SYS B
TEMP -Y ENG INJECTOR SYS A
TEMP -P ENG INJECTOR SYS A
TEMP CCW ENG INJECTOR SYS A
TEMP +Y ENG INJECTOR SYS B
TEMP -P ENG INJECTOR SYS B
DC VOLTAGE BATTERY RELAY BUS
SPS OXID TEMP
DM N_2 TK 2 QTY
DM N_2 TK 1 QTY
DM O_2 TK 2 QTY
DM O_2 TK 1 QTY
TEMP FC 3 RADIATOR OUTLET
TEMP FC 2 RADIATOR OUTLET
TEMP FC 1 RADIATOR OUTLET
N_2 PRESSURE FC 3 REGULATED
H_2 PRESSURE FC 2 REGULATED
N_2 PRESSURE FC 1 REGULATED
O_2 PRESSURE FC 3 REGULATED
O_2 PRESSURE FC 2 REGULATED
O_2 PRESSURE FC 1 REGULATED
O_2 TANK 2 HTR TEMP
DM O_2 PPB
O_2 TANK 1 HTR TEMP

LEB 101 S2

SYSTEM TEST

OFF

LEB 101 S1

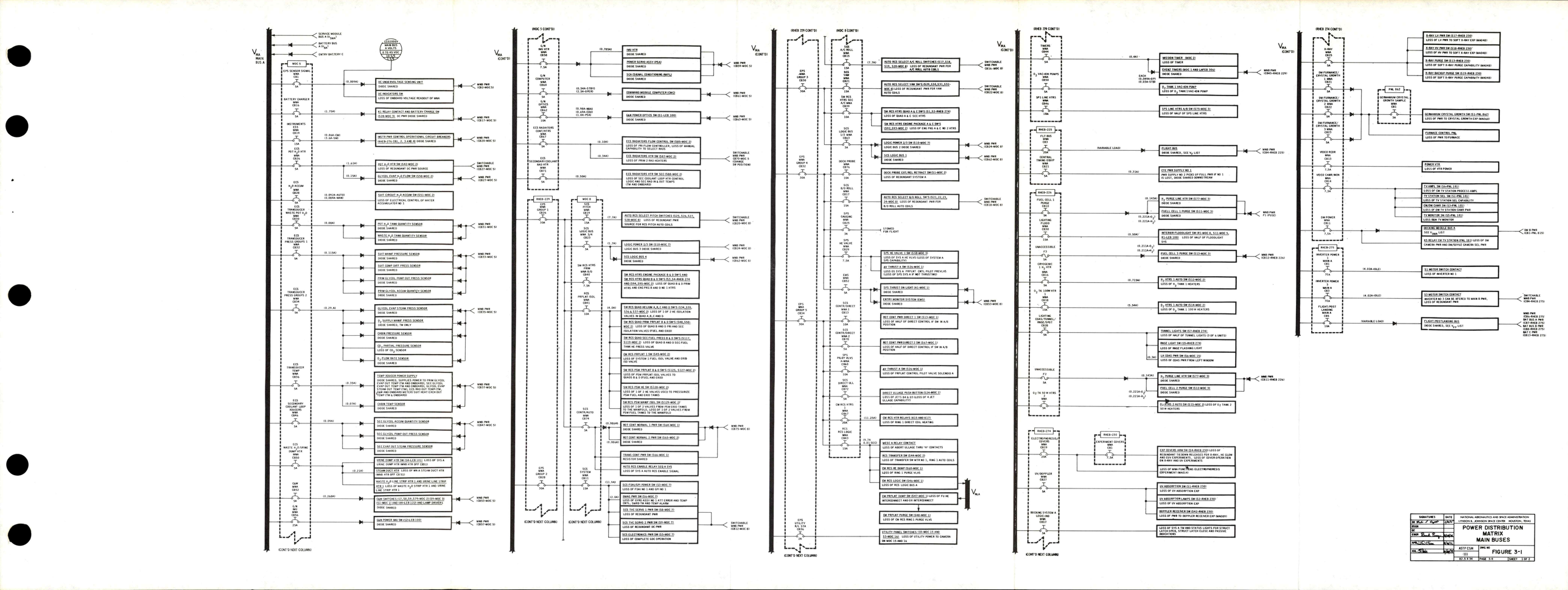
SYSTEMS TEST

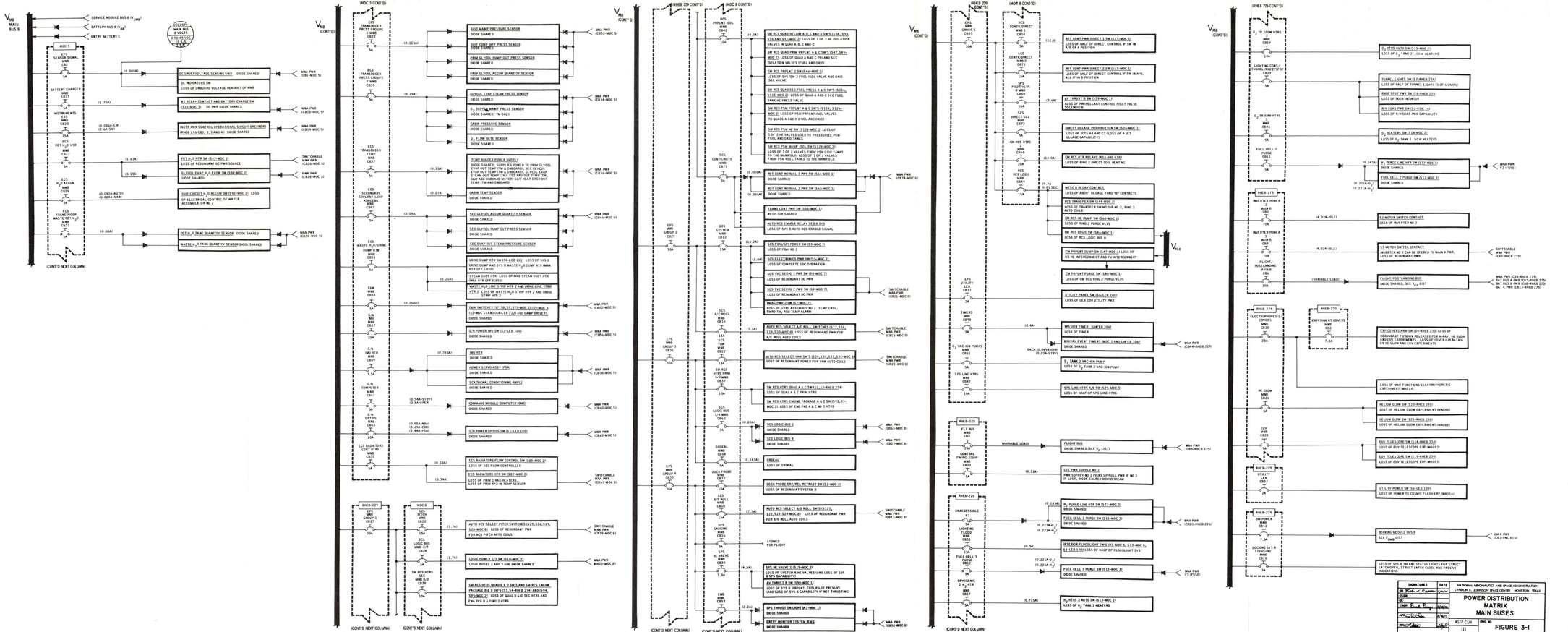
DC VOLTS

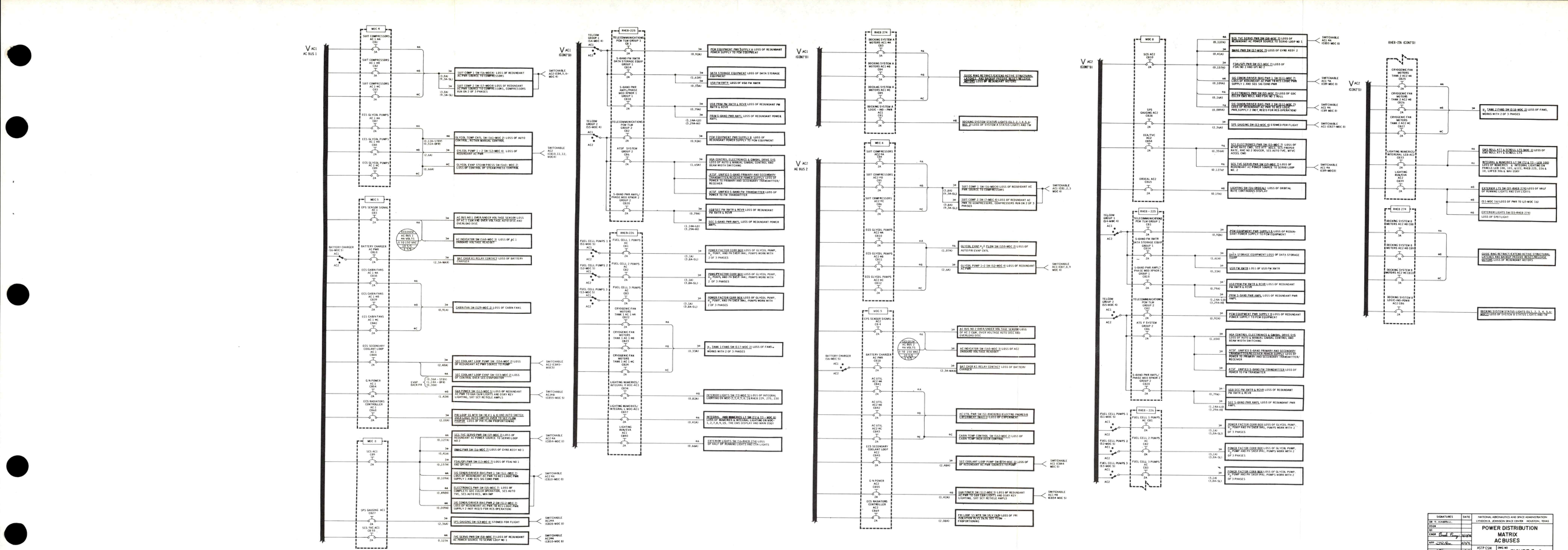
LEB 101

7 SYS TEST

SIGNATURES	DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
DR Richard L Engle	8/4/72	
DSGN		
QC		
ENGR Roy A Ackroyd	7/13/72	SYSTEM TEST METER
NR		
APP	7/21/72	
KHL Jack Cobb	7/13/72	ASTP CSM 111 — DWG NO 3.7
		44 x 29.75 — PAGE 3-7 — SHEET 1 OF 1

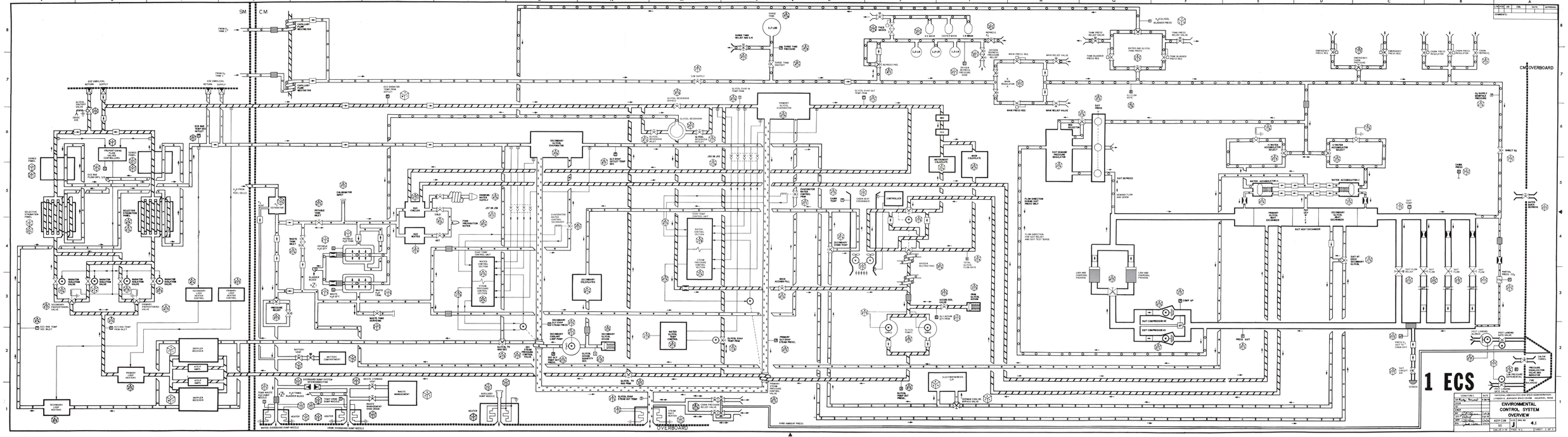

V_{MA} MAIN BUS A
SERVICE MODULE BUS A (V_{SMA})
BATTERY BUS A (V_{BA})
ENTRY BATTERY C
LOCATION MAIN BUS A VOLTS 24 TO 45 VDC 28 NOMINAL
MDC 5
EPS SENSOR SIGNAL MNA CB1 5A
(0.009A)
DC UNDERVOLTAGE SENSING UNIT DIODE SHARED
DC INDICATORS SW
MAIN PWR (CB2-MDC 5)
BATTERY CHARGER MNA CB16 5A
(1.75A)
K1 RELAY CONTACT AND BATTERY CHARGE SW (S35-MDC 3) DC PWR DIODE SHARED
MAIN PWR (CB17-MDC 5)
INSTRUMENTS ESS MNA CB19 5A
(0.66A-CM) (3.4A-SM)
WSTE PWR CONTROL OPERATIONAL CIRCUIT BREAKERS RHEB-276 CB(__) 3.3ARC @ DIODE SHARED
MAIN PWR (CB20-MDC 5)
ECS H2O ACCUM MTR MNA CB26 5A
(1.61A)
PDT H_2O HTR SW (S42-MDC 3) LOSS OF REDUNDANT DC PWR SOURCE
SWITCHABLE MAIN PWR (CB27-MDC 5)
GLYCOL EVAP H_2O FLOW SW (S58-MDC 2) DIODE SHARED
(0.15A)
MAIN PWR (CB27-MDC 5)
ECS H_2O ACCUM MNA CB28 5A
(0.092A-MAN) (0.084A-MANI)
SUIT CIRCUIT H_2O ACCUM SW (S51-MDC 2) LOSS OF ELECTRICAL CONTROL OF WATER ACCUMULATOR NO 1
ECS TRANSDUCER WASTE WT H_2O CB30 5A
(0.08A)
PDT H_2O TANK QUANTITY SENSOR DIODE SHARED
WASTE H_2O TANK QUANTITY SENSOR DIODE SHARED
MAIN PWR (CB33-MDC 5)
ECS TRANSDUCER PRESS GROUPS 1 MNA CB32 5A
(0.115A)
SUIT MANF PRESSURE SENSOR DIODE SHARED
SUIT COMP DIFF PRESS SENSOR DIODE SHARED
MAIN PWR (CB33-MDC 5)
PRIM GLYCOL PUMP OUT PRESS SENSOR DIODE SHARED
PRIM GLYCOL ACCUM QUANTITY SENSOR DIODE SHARED
ECS TRANSDUCER PRESS GROUPS 2 MNA CB31 5A
(0.29.A)
GLYCOL EVAP STEAM PRESS SENSOR DIODE SHARED
MAIN PWR (CB35-MDC 5)
O_2 SUPPLY MANF PRESS SENSOR DIODE SHARED, TM ONLY
CABIN PRESSURE SENSOR DIODE SHARED
CO_2 PARTIAL PRESSURE SENSOR LOSS OF CO_2 SENSOR
O_2 FLOW RATE SENSOR DIODE SHARED
ECS TRANSDUCER TEMP MNA CB36 5A
TEMP XDUCER POWER SUPPLY DIODE SHARED, SUPPLIES POWER TO PRIM GLYCOL EVAP OUT TEMP (TM & ONBOARD), SEC GLYCOL EVAP OUT TEMP (TM AND ONBOARD), GLYCOL EVAP STEAM OUT TEMP (TM), ECS RAD OUT TEMP (TM, CAUTION AND ONBOARD METER) SUIT HEAT EXCH OUT TEMP (TM & ONBOARD)
MAIN PWR (CB37-MDC 5)
(0.35A)
(0.07A)
CABIN TEMP SENSOR DIODE SHARED
ECS SECONDARY COOLANT LOOP ASSEMBLIES GMA CB41 5A
(0.09A)
SEC GLYCOL ACCUM QUANTITY SENSOR DIODE SHARED
MAIN PWR (CB47-MDC 5)
SEC GLYCOL PUMP OUT PRESS SENSOR DIODE SHARED
SEC EVAP OUT STEAM PRESSURE SENSOR DIODE SHARED
ECS WASTE H_2O TURBINE DUMP HTR MNA CB33 5A
(0.21A)
URINE DUMP HTR SW (S4-LEB 101) LOSS OF SYS A URINE DUMP HTR WHEN HTR OFF (S8 S1)
STEAM DUCT HTR LOSS OF WM A STEAM DUCT HTR WHEN HTR OFF (S8 S1)
WASTE H_2O LINE STRIP HTR 1 AND URINE LINE STRIP HTR 1 LOSS OF WASTE H_2O STRIP HTR 1 AND URINE LINE STRIP HTR 1
G&N MNA CB52 5A
(0.268A)
G&N SWITCHES (S7,S8,S9,S79-MDC 3) (S39-MDC 3) (S1-MDC 1) AND (M4-LEB 122) AND LAMP DRIVERS DIODE SHARED
MAIN PWR (CB53-MDC 5)
G&N MNA CB51 5A
G&N PWR MD SW (S2-LEB 110) DIODE SHARED
MAIN PWR (CB57-MDC 5)
25A
(CONT'D NEXT COLUMN)
V_{MA} (CONT'D)
(MDC 5 CONT'D)
G/N IMU HTR MNA CB58 5A
G/N COMPUTER MNA CB59 5A
G/N OPTICS MNA CB60 10A
ECS RADIATORS CONTR/PRS MNA CB62 5A
ECS SECONDARY COOLANT RAD HTR MNA CB71 5A
(0.785A)
IMU HTR DIODE SHARED
POWER SERVO ASSY (PSA) DIODE SHARED
SCA (SIGNAL CONDITIONING UNIT) DIODE SHARED
MAIN PWR (CB58-MDC 5)
(0.54A-STBY) (2.5A-OPER)
DOWNMOD MODULE COMPUTER (DMC) DIODE SHARED
MAIN PWR (CB61-MDC 5)
(0.98A-MBA) (0.64A-CDU) (1.66-PSA)
G&N POWER OPTICS SW (S1-LEB 108) DIODE SHARED
MAIN PWR (CB63-MDC 5)
(0.10A)
ECS RADIATORS FLOW CONTROL SW (S85-MDC 2) LOSS OF PRI FLOW CONTROLLER, LOSS OF MANUAL CAPABILITY TO SELECT RADS
SWITCHABLE MAIN PWR (CB64-MDC 5 SW POSITION)
(0.34A)
ECS RADIATORS HTR SW (S87-MDC 2) LOSS OF PRIM 2 RAD HEATERS
ECS RADIATORS HTR SW SEC (S88-MDC 2) LOSS OF SEC COOLANT LOOP HTR CONTROL LOGIC AND SEC RAD IN & OUT TEMPS (TM AND ONBOARD)
(0.50A)
(CONT'D NEXT COLUMN)
RHEB-229 EPS MNA GROUP 1 CB23 30A
MDC 8
ECS PITCH MNA CB35 15A
SCS LOGIC BUS 1/2 MNA CB33 3A
SM RCS HTRS MNA B/D CB40 7.5A
RCS PRPLNT ISOL MNA CB41 10A
(7.7A)
AUTO RCS SELECT PITCH SWITCHES (S25, S26, S27, S28-MDC 8) LOSS OF REDUNDANT PWR SOURCE FOR RCS PITCH AUTO COILS
SWITCHABLE MAIN PWR (CB20-MDC 8)
(1.7A)
LOGIC POWER 2/3 SM (S10-MDC 7) LOGIC BUS 3 DIODE SHARED
MAIN PWR (CB24-MDC 8)
SCS LOGIC BUS 4 DIODE SHARED
MAIN PWR (CB42-MDC 8)
SM RCS HTRS ENGINE PACKAGE A & D SW'S AND SM RCS HTRS QUAD B & C SW'S (S3,S4-RHEB 274 AND (S94,S95-MDC 2) LOSS OF QUAD B & D PRIM HTRS AND ENG PKG B AND D MI 3 HTRS
(4.0A)
SM RCS QUAD HELIUM A ,B, C AND D SW'S (S34,S35, S36,S37-MDC 2) LOSS OF 1 OF 2 HE ISOLATION VALVES IN QUAD A,B, C AND D
SM RCS QUAD PRIM PRPLNT A & B, D SW'S (S48, S50-MDC 2) LOSS OF QUAD D AND D PRI AND SEC ISOLATION VALVES (FEEL AND EXIST)
SM RCS QUAD SEC FUEL PRESS A & D SW'S (S117, S119-MDC 2) LOSS OF QUAD B AND D SEC FUEL TANK HE PRESS VALVE
CM RCS PRPLNT 1 SW (S45-MDC 2) LOSS OF SYSTEM 1 FUEL ISOL VALVE AND OXID ISO VALVE
SM RCS FSSM HE SW (S120-MDC 2) LOSS OF 1 OF 2 HE VALVES USED TO PRESSURIZE FSSM FUEL AND OXID TANKS
SM RCS FSSM MANIF ISOL SW (S120-MDC 2) LOSS OF 1 OF 2 VALVES FROM FSSM OXID TANKS TO THE MANIFOLD, LOSS OF 1 OF 2 VALVES FROM FSSM FUEL TANKS TO THE MANIFOLD
SCS CONTR/AUTO MNA CB57 5A
(0.586A)
RGT CONT NORMAL 1 PWR SW (S46-MDC 1)
MAIN PWR (CB75-MDC 8)
(0.004A)
RGT CONT NORMAL 2 PWR SW (S65-MDC 2) DIODE SHARED
TRANS CONT PWR SW (S66-MDC 1) RESS SHARED
SCS SYSTEM MNA CB11 15A
AUTO RCS CANBLE RELAY SCS A SYS LOSS OF SYS A AUTO RCS ENABLE SIGNAL
(12.5A)
SCS FSM/SPS POWER SW (S3-MDC 7) LOSS OF FSM NO 1 AND SPS NO 1
(2.0A)
EMAG PWR SW (S16-MDC 7) LOSS OF G/MD ASCS NO 1 ATT ERROR AND TEMP CNTL, SAFD TH AND TEMP ALARM
SCS TVC SERVO 1 PWR SW (S8-MDC 7) LOSS OF REDUNDANT PWR
SCS TVC SERVO 2 PWR SW (S9-MDC 7) LOSS OF REDUNDANT DC PWR
SCS ELECTRONICS PWR SW (S5-MDC 7) LOSS OF COMPLETE GDC OPERATION
SWITCHABLE MAIN PWR (CB12-MDC 8)
(CONT'D NEXT COLUMN)
V_{MA} (CONT'D)
(RHEB 229 CONT'D)
EPS MNA GROUP 3 CB32 30A
EPS MNA GROUP 4 CB33 30A
EPS MNA GROUP 5 CB34 30A
EPS MNA GROUP 2 CB28 30A
EPS UTILITY R/L 15A CB36 5A
(MDC 8 CONT'D)
SCS A/C ROLL MNA CB15 15A
SCS TMP MNA CB21 5A
SM RCS HTRS SEC A/C MNA CB22 15A
SCS LOGIC BUS 1/2 MNA CB63 5A
DOCK PROBE MNA CB76 10A
SCS B/D ROLL MNA CB17 15A
SPS GIMBAL MNA CB25 1A
SPS HE VALVE MNA CB29 7.5A
EMG MNA CB57 10A
SCS CONTR/DIRECT MNA CB69 10A
SCS CONTR/DIRECT MNA CB70 10A
SPS PILOT VLVS MNA CB67 10A
SCS DIRECT RR/L MNA CB72 10A
CM RCS HTRS MNA CB67 20A
RCS LOGIC MNA CB73 15A
(7.7A)
AUTO RCS SELECT A/C ROLL SWITCHES (S17,S18, S19, S20-MDC 8) LOSS OF REDUNDANT PWR FOR A/C ROLL AUTO COILS
SWITCHABLE MAIN PWR (CB16-MDC 8)
AUTO RCS SELECT YAW SW'S (S29,S30,S31,S32-MDC 8) LOSS OF REDUNDANT PWR FOR YAW AUTO COILS
SWITCHABLE MAIN PWR (CB22-MDC 8)
SM RCS HTRS QUAD A & C SW'S (S1,S2-RHEB 274) LOSS OF QUAD A & C SEC HTRS
SM RCS HTRS ENGINE PACKAGE A & C SW'S (S92,S93-MDC 2) LOSS OF ENG PKG A & C MI 2 HTRS
LOGIC POWER 2/3 SM (S10-MDC 7) LOGIC BUS 2 DIODE SHARED
MAIN PWR (CB24-MDC 8)
SCS LOGIC BUS 3 DIODE SHARED
MAIN PWR (CB42-MDC 8)
DOCK PROBE EXT/REL RETRACT SW (S13-MDC 2) LOSS OF REDUNDANT SYSTEM A
AUTO RCS SELECT B/D ROLL SW'S (S21,22,23, 24-MDC 8) LOSS OF REDUNDANT PWR FOR B/D ROLL AUTO COILS
SWITCHABLE MAIN PWR (CB18-MDC 8)
STOWED FOR FLIGHT
SPS HE VALVE 1 SW (S10-MDC 3) LOSS OF SYS A HE VLVS (LOSS OF SYSTEM A SPS CAPABILITY)
SWITCHABLE MAIN PWR (CB31-MDC 8)
AV THRUST A SW (S26-MDC 3) LOSS OF SYS A FBYLAT LMEL PILOT PREVLVS LOSS OF SPS SYS A VF MVT THRUSTING
SPS THRUST ON LIGHT (A1-MDC 1) DIODE SHARED
ENTRY MONITOR SYSTEM (EMS) DIODE SHARED
MAIN PWR (CB51-MDC 8)
RGT CONT PWR DIRECT 1 SW (S13-MDC 3) LOSS OF HALF OF DIRECT CONTROL OF SM A/B POSITION
RGT CONT PWR DIRECT 2 SW (S67-MDC 3) LOSS OF HALF OF DIRECT CONTROL OF SM A/B POSITION
AV THRUST A SW (S26-MDC 3) LOSS OF FBYLAT CONTROL PILOT VALVE SOLENOID A
DIRECT ULLAGE PUSH BUTTON (S24-MDC 3) LOSS OF ATTS M/L & D/I LOSS OF A JET ULLAGE CAPABILITY
CM RCS HTR RELAYS (K13 AND K17) LOSS OF RING 1 DIRECT COIL HEATING
(11.25A)
(9.7A 0.01 SEC)
MESC A RELAY CONTACT LOSS OF ABORT ULLAGE THRU "A" CONTACTS
RCS TRANSFER SW (S44-MDC 3) LOSS OF TRANSFER SW WTR NO 1, RING 1 AUTO COILS
CM RCS HE SOAP (S45-MDC 1) LOSS OF RING 1 PURGE VLVS
CM RCS LOGIC SW (S54-MDC 1) LOSS OF RCS LOGIC BUS A
CM PRPLNT DUMP SW (S47-MDC 1) LOSS OF FU HE INTERCONNECT AND SY INTERCONNECT
CM PRPLNT PURGE SW (S46-MDC 1) LOSS OF CM RCS RING 1 PURGE VLVS
UTILITY PANEL SWITCHES (S9-MDC 1) AND (S1-MDC 16) LOSS OF UTILITY POWER TO CAMERA SM MDC 15 AND 16
V_{MA}
(CONT'D NEXT COLUMN)
V_{MA} (CONT'D)
(RHEB 229 CONT'D)
TIMERS MNA CB44 5A
O_2 VAC-HIK POWPS MNA CB66 5A
SPS LINE HTRS MNA CB46 5A
RHEB-225 FLT BUS MNA CB3 20A
CENTRAL TIMING EQUIP MNA CB21 5A
RHEB-226 FUEL CELL 1 PURGE CB10 5A
LIGHTING FLOOD MNA CB36 15A
UNACCESSIBLE F3 CRYOGENIC H_2 HTR MNA CB16 5A
O_2 TK 1OOW HTR MNA CB18 5A
LIGHTING COMPARTMENT/ MAGE/SUIT CB28 5A
UNACCESSIBLE F3 O_2 TK 50 W HTRS MNA CB19 5A
RHEB-274 ELECTROPHORESIS COVERS MNA CB75 20A
UV/DOPPLER MNA CB27 5A
DOCKING SYSTEM A LOGIC MNA CB17 5A
(0.4A)
EACH (0.049A-GPT) (0.034-STBY)
MISSION TIMER (MDC 2) LOSS OF TIMER
EVENT TIMERS (MDC 1 AND LMP28 30A) DIODE SHARED
MAIN PWR (CB45-RHEB 229)
O_2 TANK 1 VAC-HIK PUMP LOSS OF O_2 TANK 1 VAC-HIK PUMP
SPS LINE HTRS A/B SW (S75-MDC 3) LOSS OF HALF OF SPS LINE HTRS
INVARIABLE LOAD
FLIGHT BUS DIODE SHARED, SEE V_F LIST
MAIN PWR (CB4-RHEB 225)
(0.31A)
CSM PWR SUPPLY NO 2 PWR SUPPLY NO 2 PICKS UP FULL PWR IF NO 1 IS LOST, DIODE SHARED DOWNSTREAM
(0.143A)
O_2 PURGE LINE HTR SW (S77-MDC 3) DIODE SHARED
FUEL CELL 1 PURGE SW (S11-MDC 3) DIODE SHARED
MAIN PWR F1 (FUSE)
(0.221A-O_2) (0.221A-H_2)
(0.50A)
INTERIOR FLOODLIGHT SW (S1-MDC 8, S11-MDC 5) (S1-LEB 108) LOSS OF HALF OF FLOODLIGHT SYS
(0.211A-O_2) (0.211A-H_2)
FUEL CELL 3 PURGE SW (S13-MDC 3) DIODE SHARED
MAIN PWR (CB32-RHEB 226)
(0.715A)
O_2 HTRS 1 AUTO SW (S12-MDC 2) LOSS OF O_2 TANK 1 HEATERS
(5.54A)
O_2 HTRS 1 AUTO SW (S14-MDC 2) LOSS OF O_2 TANK 1 100 W HEATERS
TUNNEL LIGHTS SW (S7-RHEB 274) LOSS OF HALF OF TUNNEL LIGHTS (3 OF 6 UNITS)
MAGE LIGHT SW (S5-RHEB 274) LOSS OF MAGE FLASHING LIGHT
(0.5A)
LR LOAS PWR SW (S6-MDC 15) LOSS OF LOAS PWR FROM LEFT WINDOW
(0.143A)
O_2 PURGE LINE HTR SW (S77-MDC 3) DIODE SHARED
FUEL CELL 2 PURGE SW (S12-MDC 3) DIODE SHARED
MAIN PWR (CB11-RHEB 226)
(0.221A-O_2) (0.221A-H_2)
O_2 HTRS 2 AUTO SW (S15-MDC 2) LOSS OF O_2 TANK 2 50 W HEATERS
RHEB-230 EXPERIMENT COVERS MNA CB71 5A
EXP COVERS ARM SW (S4-RHEB 230) LOSS OF REDUNDANT TIEDOWN RELEASE FOR X-RAY, HE GLOW AND UV EXPERIMENTS, LOSS OF COVER OPERATION ON X-RAY AND UV EXPERIMENTS
LOSS OF MM FUNCTIONS ELECTROPHORESIS EXPERIMENT (MA014)
UV ABSORPTION SW (S1-RHEB 230) LOSS OF UV ABSORPTION EXP
UV ABSORPTION LAMPS SW (S2-RHEB 230) LOSS OF UV ABSORPTION EXP
DOPPLER RECEIVER SW (S42-RHEB 230) LOSS OF PWR TO DOPPLER RECEIVER EXP (MA059)
LOSS OF SYS A TM AND STATUS LIGHTS FOR STRUCT LATCH OPEN, STRUCT LATCH CLOSE AND PASSIVE INDICATIONS.
V_{MA} (CONT'D)
(RHEB 274 CONT'D)
X-RAY MNA CB72 5A
DM FURNANCE/ CRYSTAL GROWTH 1 MNA CB73 5A
DM FURNANCE/ CRYSTAL GROWTH 2 MNA CB74 5A
DM FURNANCE/ CRYSTAL GROWTH 3 MNA CB75 5A
VIDEO RCDR MNA CB13 7.5A
VIDEO CAMR/MON MNA CB14 7.5A
DM POWER MNA CB11 7.5A
RHEB-275 INVERTER POWER MAIN A CB1 70A
INVERTER POWER MAIN B CB3 70A
FLIGHT-PRIST LANDING MNA CB5 10A
(0.72A)
(4.02A-ISLE)
S1 MOTOR SWITCH CONTACT LOSS OF INVERTER NO 1
(4.02A-ISLE)
S3 MOTOR SWITCH CONTACT INVERTER NO 3 CAN BE XFERED TO MAIN B PWR, LOSS OF REDUNDANT PWR
SWITCHABLE MAIN PWR (CB6-RHEB 275)
(VARIABLE LOAD)
FLIGHT/INSTRUMENTING BUS DIODE SHARED, SEE V_{FI} LIST
MAIN PWR (CB5-RHEB 275) (CB7-RHEB 275) (CB17-RHEB 275) BAT BUS B PWR (CB8-RHEB 275) (CB1-RHEB 275)
PNL 552
GERMANIUM CRYSTAL GROWTH SAMPLE MNA CB1 5A
X-RAY LV PWR SW (S17-RHEB 230) LOSS OF LV PWR TO SOFT X-RAY EXP (MA048)
X-RAY HV PWR SW (S18-RHEB 230) LOSS OF HV PWR TO SOFT X-RAY EXP (MA048)
X-RAY PURGE SW (S13-RHEB 230) LOSS OF SOFT X-RAY PURGE CAPABILITY (MA048)
X-RAY BACKUP PURGE SW (S19-RHEB 230) LOSS OF SOFT X-RAY PURGE CAPABILITY (MA048)
GERMANIUM CRYSTAL GROWTH SW (S11-PNL 862) LOSS OF PWR TO CRYSTAL GROWTH EXP (MA060)
FURNACE CONTROL PNL LOSS OF PWR TO FURNACE
POWER VTR LOSS OF VTR POWER
TV AMPL SW (S6-PNL 101) LOSS OF CM TV STATION PROCESS AMPL
TV STATION SEL SW (S1-PNL 101) LOSS OF TV STATION SEL CAPABILITY
CM/DK CAMR SW (S3-PNL 101) LOSS OF DM TV STATION CAMR PWR
TV MONITOR SW (S5-PNL 101) LOSS SOM TV MONITOR
DOCKING MODLE BUS A SEE V_{DMA} LIST
DM D PWR (CB1-PNL 815)
K3 RELAY CM TV STATION (PNL 101) LOSS OF DM CAMERA PWR AND SM/DSTVC CAMERA SEL PWR
SIGNATURES
DATE
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
POWER DISTRIBUTION MATRIX MAIN BUSES
ASTP CSM
DRG NO
111
SI 3.3.74
PAGE 3-9
SHEET 1 OF 2
FIGURE 3-1

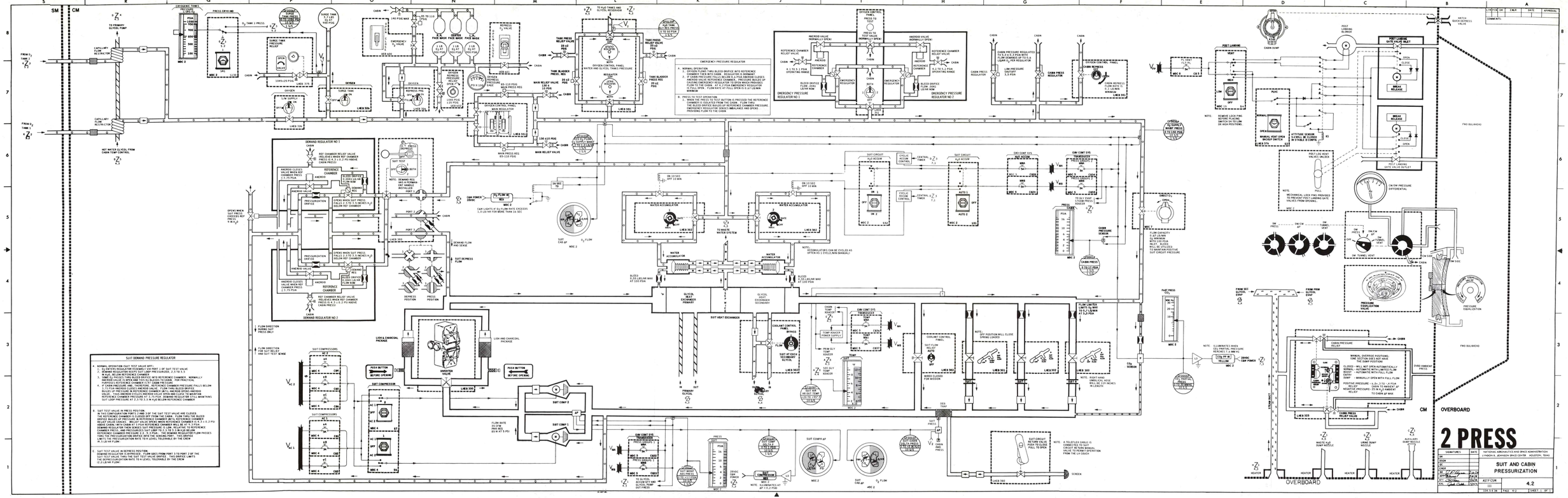

MAIN BUS B
SERVICE MODULE BUS B
BATTERY BUS B
ENTRY BATTERY C
(CONT'D NEXT COLUMN)
(INDC 5 CONT'D)
(CONT'D NEXT COLUMN)
(MDC E CONT'D)
(CONT'D NEXT COLUMN)
(RHEB 276 CONT'D)
(CONT'D NEXT COLUMN)
(CONT'D NEXT COLUMN)
(MDP 3 CONT'D)
(CONT'D NEXT COLUMN)
(RHEB 276 CONT'D)
(RHEB 275)
(RHEB 274)
(RHEB 270)
(RHEB 229)
(MDC B)
(CONT'D NEXT COLUMN)
(CONT'D NEXT COLUMN)
SIGNATURES
DATE
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
POWER DISTRIBUTION MATRIX MAIN BUSES
ASTP CSM
DRG NO
FIGURE 3-1
SHEET 2 OF 2
PAGE 3-10

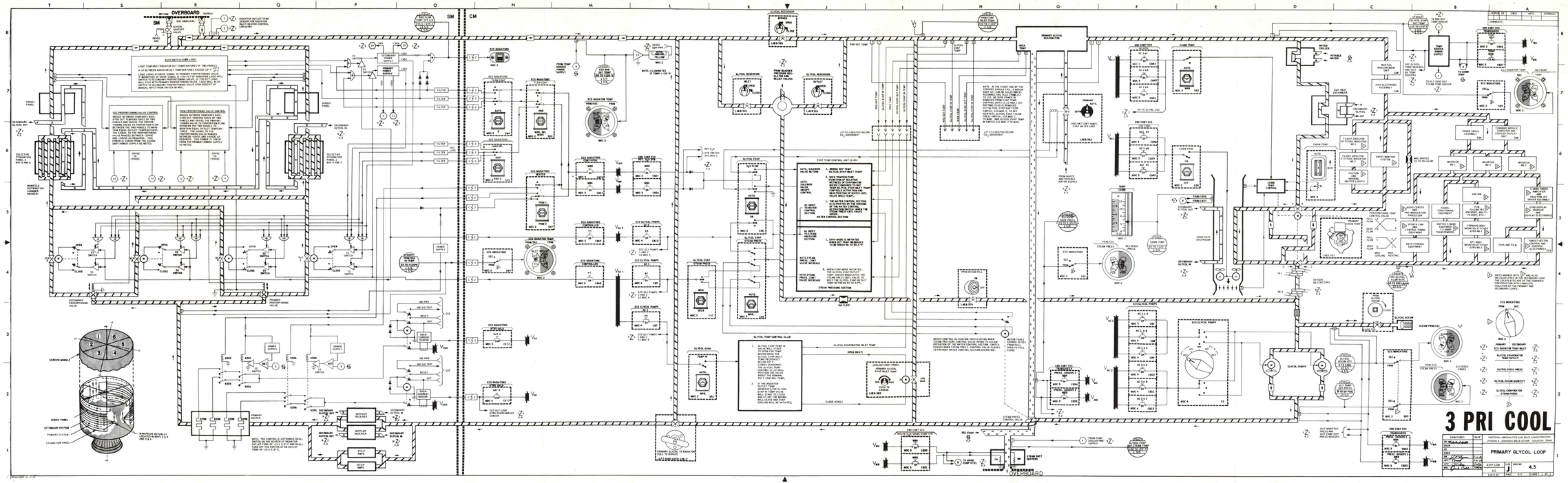

AC1 BUS 1
MDC 4
SUIT COMPRESSORS AC 1 HA CB1
SUIT COMPRESSORS AC 1 HB CB2
SUIT COMPRESSORS AC 1 HC CB3
SUIT COMP 1 SW (S6-MDC4) LOSS OF REDUNDANT AC PWR SOURCE TO COMPRESSORS
SUIT COMP 2 SW (S7-MDC4) LOSS OF REDUNDANT AC PWR SOURCE TO COMPRESSORS, COMPRESSORS RUN ON 2 OF 3 PHASES
SWITCHABLE AC2 (CB4,5,6-MDC 4)
ECS GLYCOL PUMPS AC 1 HA CB7
ECS GLYCOL PUMPS AC 1 HB CB8
ECS GLYCOL PUMPS AC 1 HC CB9
GLYCOL TEMP CNTL SW (1A1-MDC 2) LOSS OF AUTO CONTROL WITHIN MANUAL CONTROL
GLYCOL PUMP 1-2 SW (S2-MDC 4) LOSS OF REDUNDANT AC PWR
GLYCOL EVAP STEAM PRESS SW (S6A5- MDC 2) LOSS OF CONTROL OF STEAM PRESS CONTROL
SWITCHABLE AC2 (CB10,11,12, MDC4)
MDC 5
EPS SENSOR SIGNAL AC 1 CB1
BATTERY CHARGER AC PWR CB18
ECS CABIN FANS AC 1 HA CB38
ECS CABIN FANS AC 1 HB CB39
ECS CABIN FANS AC 1 HC CB40
ECS SECONDARY COOLANT LOOP AC 1 CB46
G N2 POWER AC 1 CB55
ECS RADIATORS CONTROLLER AC 1 CB60
AC BUS NO 1 OVER/UNDER VOLTAGE SENSOR LOSS OF AC 1 CAN CNT OVER VOLTAGE AUTO DISC AND OVERLOAD DISC
AC INDICATOR SW (1A2-MDC 3) LOSS OF pic 1 INDICATOR VOLTAGE READOUT
BAT CHGR K1 RELAY CONTACT LOSS OF BATTERY CHARGER
CABIN FAN SW (S29-MDC 2) LOSS OF CABIN FANS
SEC COOLANT LOOP PUMP SW (S54-MDC 2) LOSS OF REDUNDANT AC PWR SOURCE TO PUMP
SEC COOLANT LOOP EVAP SW (S5-MDC 2) LOSS OF CONTROL OVER SEC EVAPORATOR
GAS POWER SW (S12-MDC 5) LOSS OF REDUNDANT AC PWR TO GAS CAN LIGHTS AND DEKY KEY LIGHTING, SXT SET RETICLE AMPS 1
FWL LOOP SYS MTR SW (A/B 3 & 4) AND AUTO SWITCH OVER & MAN/AUTO SW SWITCH OVER TO SEC FLOW FAILURE LOSS OF PRI FLOW PROPORTIONING
SWITCHABLE AC2 (CB54-MDC 5)
SWITCHABLE AC2 (CB61-MDC 5)
SWITCHABLE AC2 (CB5,6-MDC 5)
MDC 8
SCS AC3 CB9
SCS TVC AC1 CB35
SPS GAUGING AC2 CB27
SCS TVC SERVO PWR SW (S9-MDC 7) LOSS OF REDUNDANT AC POWER SOURCE TO SERVO LOOP NO 1
SMAD PWR SW (S6-MDC 7) LOSS OF GYRO ASSY NO 1
FDAI/GPI PWR SW (S3-MDC 7) LOSS OF FDAI NO 1 AND GPI NO 1
SEC CONFIG/ERROR BIAS PWR 1 SW (S11-MDC 7) LOSS OF REDUNDANT AC PWR TO SEC LIGHTING SUPPLY 2 AND SCS SEC COMD PWR
ELECTRONICS PWR SW (S5-MDC 7) LOSS OF ELECTRONICS SEC CULR OPERATION, SCS AUTO TVC, SCS AUTO PICS, MPA IMP
SEC CONFIG/ERROR BIAS PWR 2 SW (S12-MDC 7) LOSS OF REDUNDANT AC PWR TO SEC LIGHTING PWR SUPPLY 2 UNIT REQ'D FOR RCS OPERATION
SPS GAUGING SW (S3-MDC 4) STOWED FOR FLIGHT
SWITCHABLE AC2MA (CB30-MDC 8)
SWITCHABLE AC2MA (CB13-MDC 8)
AC2 (CONT'D)
RHEB-225
TELECOMMUNICATIONS PCM TLM GROUP 1 CB1
S-GAND FM XMTR DATA STORAGE EQUIP GROUP 1 CB13
S-GAND PWR AMPL & PHASE MOD SPNDR GROUP 1 CB18
TELECOMMUNICATIONS PCM TLM GROUP 2 CB2
ATS F SYSTEM GROUP 2 CB5
S-BAND PWR AMPL/ PHASE MOD XPNDR 2 CB20
TELCOM CONFIG (S5-MDC 4)
PCM EQUIPMENT PWR SUPPLY A LOSS OF REDUNDANT POWER SUPPLY TO PCM EQUIPMENT
DATA STORAGE EQUIPMENT LOSS OF DATA STORAGE EQUIPMENT
USB FM XMTR LOSS OF USB FM XMTR
USB FRM FM XMTR & RCVR LOSS OF REDUNDANT FM XMTR & RCVR
PRIM S-BAND PWR AMPL LOSS OF REDUNDANT POWER AMPL
PCM EQUIPMENT PWR SUPPLY B LOSS OF REDUNDANT POWER SUPPLY TO PCM EQUIPMENT
HGA CONTROL ELECTRONICS & GIMBAL DRIVE SYS LOSS OF AUTO & MANUAL GIMBAL CONTROL AND BEAM WIDTH SWITCHING
ATSF UNIFIED S-BAND PRIMARY AND SECONDARY TRANSMITTER/RECEIVER POWER SUPPLY LOSS OF POWER TO PRIMARY AND SECONDARY TRANSMITTER/ RECEIVER
ATSF UNIFIED S-BAND FM TRANSMITTER LOSS OF POWER TO FM TRANSMITTER
USB S/C FM XMTR & RCVR LOSS OF REDUNDANT FM XMTR & RCVR
SEC S-GAND PWR AMPL LOSS OF REDUNDANT POWER AMPL
RHEB-226
FUEL CELL 1 PUMPS AC1 CB1
FUEL CELL 2 PUMPS AC CB2
FUEL CELL 3 PUMPS AC CB3
CRYOGENIC FAN MOTORS TANK 1 AC 1 HA CB23
CRYOGENIC FAN MOTORS TANK 1 AC 1 HB CB24
CRYOGENIC FAN MOTORS TANK 1 AC 1 HC CB25
LIGHTING NUMERICS/ INTEGRAL E MDC-AC1 CB34
LIGHTING NUMERICS/ INTEGRAL L MDC-AC1 CB41
LIGHTING AC1 CB43
POWER FACTOR CORR BOX LOSS OF GLYCOL PUMP, P2 PUMPS AND PH BASE TRAIL PUMPS WORK WITH 2 OF 3 PHASES
POWER FACTOR CORR BOX LOSS OF GLYCOL PUMP, P2 PUMPS AND PH BASE TRAIL PUMPS WORK WITH 2 OF 3 PHASES
POWER FACTOR CORR BOX LOSS OF GLYCOL PUMP, P2 PUMP AND PH BASE TRAIL PUMPS WORK WITH 2 OF 3 PHASES
P2 TANK 2 FANS SW (S17-MDC 2) LOSS OF FANS, WORKS WITH 2 OF 3 PHASES
INTEGRAL LIGHTS SW (S7-MDC 3) LOSS OF INTEGRAL LIGHTING IN MDC-2,3,4,5,7,8,11&12 PNLS 229, 235, 236
EXTERIOR LIGHTS SW (S4-RHEB 274) LOSS OF HALF OF RUNNING LIGHTS AND EVA LIGHTS
AC1 (CONT'D)
RHEB 274
DOCKING SYSTEM A MOTORS AC1 HA CB3
DOCKING SYSTEM A MOTORS AC1 HB CB4
DOCKING SYSTEM A MOTORS AC1 HC CB5
DOCKING SYSTEM A LOGIC-IND-PWR AC1 CB1
GUIDE RING RETRACT/EXTEND ACTIVE STRUCTURAL LATCHES AND BERTHING ASSIST RELEASE RELEASE LOSS OF BERTHING MOTORS
DOCKING SYSTEM STATOR LIGHTS (S1-2,3,4,5,6-MDC2) LOSS OF SYSTEM'S STATUS LIGHTS AND TM
AC2 BUS 2
MDC 4
SUIT COMPRESSORS AC2 HA CB5
SUIT COMPRESSORS AC2 HB CB6
SUIT COMPRESSORS AC2 HC CB7
SUIT COMP 1 SW (S6-MDC4) LOSS OF REDUNDANT AC PWR SOURCE TO COMPRESSORS
SUIT COMP 2 SW (S7-MDC 4) LOSS OF REDUNDANT AC PWR TO COMPRESSORS, COMPRESSORS RUN ON 2 OF 3 PHASES
SWITCHABLE AC1 (CB1,2,3 MDC 4)
ECS GLYCOL PUMPS AC2 HA CB10
ECS GLYCOL PUMPS AC2 HB CB11
ECS GLYCOL PUMPS AC2 HC CB12
GLYCOL EVAP P-F FLOW SW (S10-MDC 2) LOSS OF AUTO P/H EVAP CNTL
GLYCOL PUMP 1-2 SW (S2-MDC 4) LOSS OF REDUNDANT AC PWR
SWITCHABLE AC1 (CB7,8,9 MDC 4)
MDC 5
EPS SENSOR SIGNAL AC2 CB14
BATTERY CHARGER AC PWR CB18
AC STRL AC1 HA CB41
AC STRL AC1 HB CB42
AC STRL AC1 HC CB43
ECS SECONDARY COOLANT LOOP AC2 CB51
G N2 POWER AC2 CB55
ECS RADIATORS CONTROLLER AC2 CB63
AC BUS NO 2 OVER/UNDER VOLTAGE SENSOR LOSS OF AC 2 CAN OVER VOLTAGE AUTO DISC AND OVERLOAD DISC
AC INDICATOR SW (S4-MDC 3) LOSS OF AC2 INDICATOR VOLTAGE READOUT
BAT CHGR K1 RELAY CONTACT LOSS OF BATTERY CHARGER
AC STRL PWR SW (S7-RHEB/RHEB) ELECTRO PNEUM/ELEC PNEUM SEC DISCONNECT LOSS OF EXPERIMENT
CABIN TEMP CONTROL SW (S52-MDC 2) LOSS OF CABIN TEMP MOTOR VALVE CONTROL
SEC COOLANT LOOP PUMP SW (S54-MDC 2) LOSS OF REDUNDANT AC PWR SOURCE TO PUMP
GAS POWER SW (S12-MDC 5) LOSS OF REDUNDANT AC PWR TO GAS CAN LIGHTS AND DEKY KEY LIGHTING, SXT SET RETICLE AMPS 2
FWL LOOP SYS MTR SW (A/B 1&2) AND AUTO SWITCH OVER & MAN/AUTO SW SWITCH OVER TO SEC FLOW FAILURE LOSS OF PRI FLOW PROPORTIONING
SWITCHABLE AC1 MA (CB54 MDC 5)
SWITCHABLE AC1 MA (CB61 MDC 5)
AC2 (CONT'D)
MDC 8
SCS AC2 CB10
SPS GAUGING AC2 CB27
ECA/TVC AC2 CB34
ORDEAL AC2 CB62
SCS TVC SERVO PWR SW (S9-MDC 7) LOSS OF REDUNDANT AC POWER SOURCE TO SERVO LOOP NO 1
SMAD PWR SW (S7-MDC 7) LOSS OF GYRO ASSY 2
FDAI/GPI PWR SW (S3-MDC 7) LOSS OF FDAI NO 2 AND GPI NO 2
SEC CONFIG/ERROR BIAS PWR 1 SW (S11-MDC 7) LOSS OF REDUNDANT AC PWR TO SEC LIGHTING PWR SUPPLY 1 AND SCS SEC COMD PWR
ELECTRONICS PWR SW (S5-MDC 7) LOSS OF ELECTRONICS SEC CULR OPERATION, SCS AUTO TVC, SCS AUTO PICS, MPA IMP
SEC CONFIG/ERROR BIAS PWR 2 SW (S12-MDC 7) LOSS OF REDUNDANT AC PWR TO SEC LIGHTING PWR SUPPLY 2 UNIT REQ'D FOR RCS OPERATION
SPS GAUGING SW (S3-MDC 4) STOWED FOR FLIGHT
SCS TVC SERVO PWR SW (S9-MDC 7) LOSS OF REDUNDANT AC POWER SOURCE TO SERVO LOOP NO 2
LIGHTING SW (S6-ORDEAL) LOSS OF ORBITAL & CSM HANDLEDISPLAY
SWITCHABLE AC2 MA (CB9-MDC8)
EXTERIOR LIGHTS SW (S3-RHEB 274) LOSS OF S/XT FLIGHT
RHEB-225 (CONT'D)
CRYOGENIC FAN MOTORS TANK 2 ACT HA CB25
CRYOGENIC FAN MOTORS TANK 2 ACT HB CB26
CRYOGENIC FAN MOTORS TANK 2 ACT HC CB27
LIGHTING NUMERICS/ INTEGRAL LEB-AC2 CB39
LIGHTING AC2 CB39
P2 TANK 2 FANS SW (S18 MDC 2) LOSS OF FANS, WORKS WITH 2 OF 3 PHASES
END BELL ATT & SCREEN S/S (MDC 2) LOSS OF ATTITUDE & SCREEN S/S
INTEGRAL & NUMERICS L1 SW (S13 & S3) LOSS OF INTEGRAL LIGHTING IN MDC-2,3,4,5,7,8,11&12 PNLS 229, 235, 236 & NUMERICS LIGHTING IN PNELS LEB 106, 101, &122, RHEB 225, 229 & 10, LAPEB 304 & MAY DSKY
EXTERIOR LTS SW (S7-RHEB 274) LOSS OF HALF OF RUNNING LIGHTS AND EVA LIGHTS
S3 MDC 1&2 LOSS OF PWR TO LB MDC 1&2
EXTERIOR LIGHTS SW (S3-RHEB 274) LOSS OF S/XT FLIGHT
RHEB 274
DOCKING SYSTEM B MOTORS AC2 HA CB8
DOCKING SYSTEM B MOTORS AC2 HB CB9
DOCKING SYSTEM B MOTORS AC2 HC CB10
DOCKING SYSTEM B LOGIC-IND-POWER AC2 CB6
GUIDE RING RETRACT/EXTEND ACTIVE STRUCTURAL LATCHES AND BERTHING ASSIST RELEASE RELEASE LOSS OF BERTHING MOTORS
DOCKING SYSTEM STATUS LIGHTS (S1-2,3,4,5,6-MDC2) LOSS OF SYSTEM'S STATUS LIGHTS AND TM
SIGNATURES
DR
DSCM
SD
EMDR
APP
APP
DATE
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
POWER DISTRIBUTION MATRIX AC BUSES
ASTP CSM
DWG NO
111
FIGURE 3-2
85 3 24
PAGE
SHEET OF

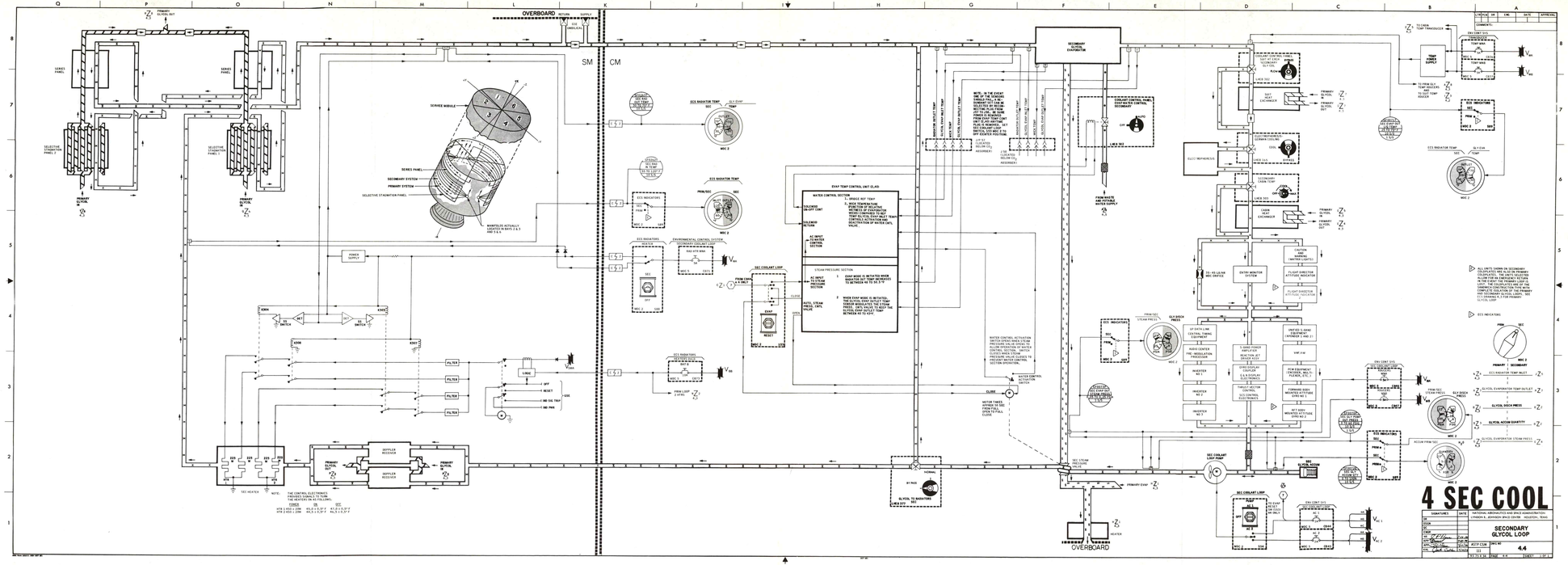
SIGNATURES	DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
DR [signature]	2-10-75	POWER DISTRIBUTION MATRIX MISCELLANEOUS BUSES
DSGN		
QC		
ENGR [signature]	2/13/75	
[signature]	2/13/75	
APP [signature]	2/13/75	
KHL [signature]	2/14/75	ASTP CSM 111 — DWG NO FIGURE 3-3
127.4 X 34		PAGE — SHEET OF

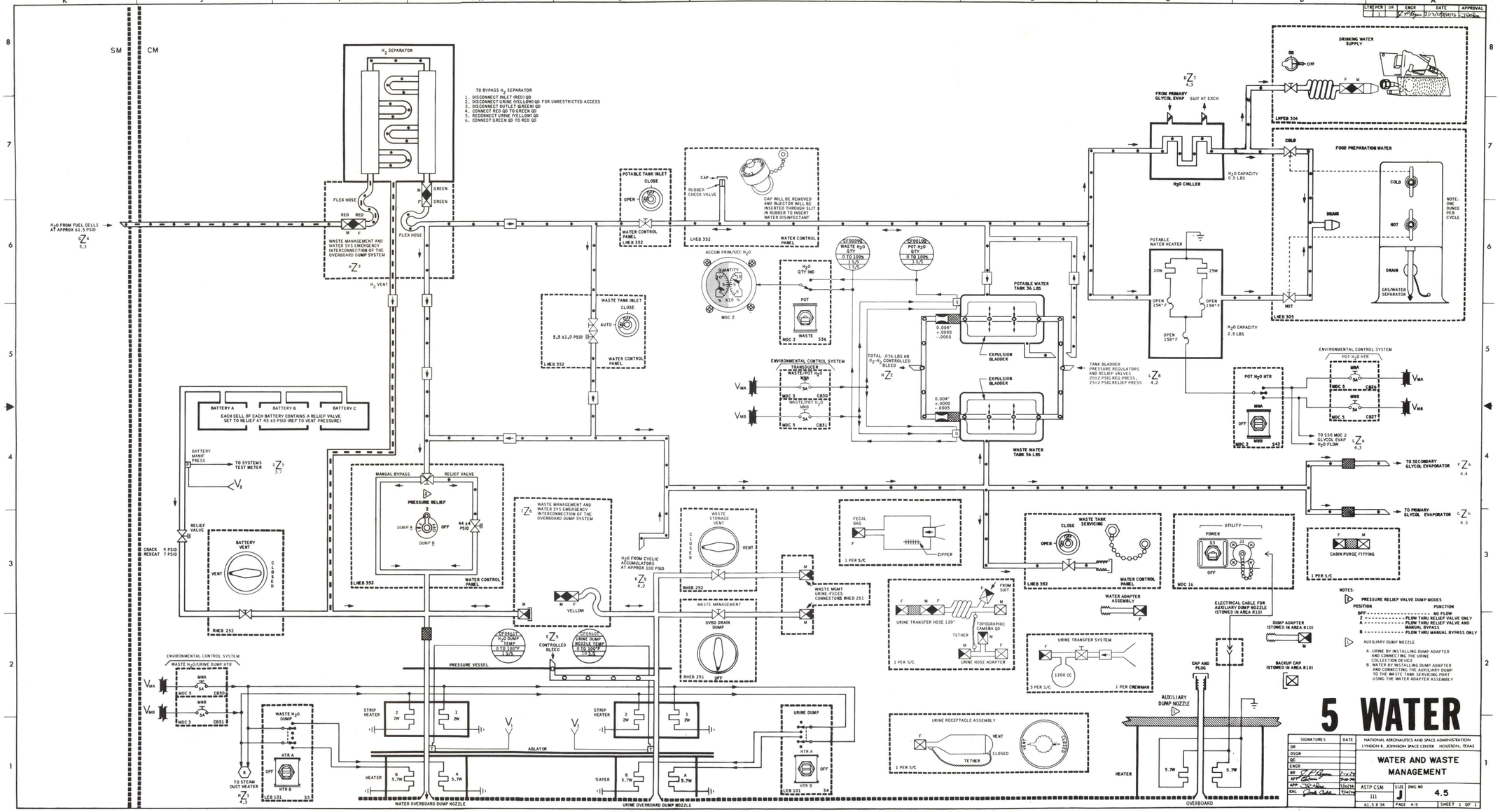
4 ENVIRONMENTAL CONTROL SYSTEM


SM
CM
CM OVERBOARD
OVERBOARD
1 ECS
ENVIRONMENTAL CONTROL SYSTEM OVERVIEW
ASSY CDR
4.1
SHEET 1 OF 1


SUIT DEMAND PRESSURE REGULATOR
A. NORMAL OPERATION (SUIT TEST VALVE OFF):
1. SUIT TEST VALVE IN NORMAL POSITION. PORT 2 OF SUIT TEST VALVE
2. DEMAND REGULATOR ACCEPTS SUIT LOOP PRESSURIZED, 2.0 TO 3.5 IN H2O, BELOW REFERENCE CHAMBER
3. SUIT LOOP PRESSURE ACTS ON DIAPHRAGM, ANTI-REFERENCE CHAMBER. NORMALLY HARDED VALVE IS OPEN AND THIS O2 BLEEDS TO CABIN. FOR PRACTICAL PURPOSES, REFERENCE CHAMBER IS AT CABIN PRESSURE
4. WHEN SUIT LOOP PRESSURE EXCEEDS CABIN PRESSURE BY REFERENCE PRESSURE FALLS BELOW 0.75 PSIA ANDROID CLOSES (ANDROID VALVE FLOW THRU BLEED ORIFICE BUILDS UP PRESSURE IN REFERENCE CHAMBER (MTL) REFERENCE CHAMBER VALVE. THIS ANDROID CYCLES ANDROID VALVE OPEN AND CLOSES TO MAINTAIN REFERENCE CHAMBER PRESSURE 0.75 PSIA. DEMAND REGULATOR STILL MAINTAINS SUIT LOOP PRESSURE AT 2.3 TO 2.5 IN H2O BELOW REFERENCE CHAMBER.
B. SUIT TEST VALVE IN PRESS POSITION
DEMAND REGULATOR IS BYPASSED. PORTS 2 &3F THE SUIT TEST VALVE ARE CLOSED THE REFERENCE CHAMBER IS CLOSED OFF FROM THE CABIN. FLOW THRU THE BLEED ORIFICE BUILDS UP PRESSURE IN REFERENCE CHAMBER (MTL) REFERENCE CHAMBER VALVE. THIS ANDROID CYCLES ANDROID VALVE OPEN AND CLOSED TO MAINTAIN 3.2 PSI ABOVE CABIN. WITH CABIN AT 5 PSIA REFERENCE CHAMBER WILL BE AT 5.3 PSIA. DEMAND REGULATOR THEN SENSES SUIT PRESSURE IS LOW. RELATIVE TO REFERENCE CHAMBER PRESSURE AND OPENS SUIT LOOP TO VACUUM. SUIT LOOP PRESSURE AND REFERENCE CHAMBER PRESSURE 0.3 - 0.7 PSIA. THE DEMAND REGULATOR FLOW PASSES THRU THE PRESSURIZATION ORIFICE INTO THE SENSING PORT. THIS ORIFICE LIMITS THE DEPRESSURIZATION RATE TO A LEVEL TOLERABLE BY THE CREW (4 - 5 LB/HR FLOW).
C. SUIT TEST VALVE IN DEPRESS POSITION
DEMAND REGULATOR IS BYPASSED. FLOW GOES FROM PORT 3 TO PORT 2 OF THE SUIT TEST VALVE AND DIRECTLY TO VACUUM. THE DEPRESSURIZATION ORIFICE LIMITS THE DEPRESSURIZATION RATE TO A LEVEL TOLERABLE BY THE CREW (2.0 LB/HR FLOW).
EMERGENCY PRESSURE REGULATOR
A. NORMAL OPERATION
1. OXYGEN FLOWS THRU BLEED ORIFICE INTO REFERENCE CHAMBER. REFERENCE CHAMBER VALVE IS OPEN AND CLOSED TO CABIN. IF CABIN PRESSURE FALLS BELOW 4.6 PSIA ANEROID CLOSES ANEROID VALVE. REFERENCE CHAMBER (PRESSURE BUILDS UP TO 4.6 PSIA AND ANEROID OPENS ANEROID VALVE. FLOW THRU BLEED ORIFICE FLOWS TO THE CABIN. AT 4.3 PSIA EMERGENCY REGULATOR OPENS AND SUPPLIES OXYGEN. FLOW RATE AT FULL OPEN IS 0.67 LB/MIN MINIMUM
B. PRESS TO TEST OPERATION
1. WHEN THE PRESS TO TEST BUTTON IS PRESSED THE REFERENCE CHAMBER VALVE IS HELD CLOSED AND THE FLOW THRU THE BLEED ORIFICE BUILDS UP REFERENCE CHAMBER PRESSURE EMERGENCY REGULATOR SENSES IMBALANCE AND OPENS PROVIDING FLOW TO THE CABIN
ANDROID VALVE NORMALLY OPEN
REFERENCE CHAMBER RELIEF VALVE
4.3 TO 4.5 PSIA OPERATING RANGE
REFERENCE CHAMBER
ANEROID
BLEED ORIFICE FLOW .0045 LB/MIN
EMERGENCY REGULATOR
EMERGENCY PRESSURE REGULATOR NO 1
EMERGENCY PRESSURE REGULATOR NO 2
CABIN PRESS REGULATOR
CABIN PRESSURE REGULATED TO 5.0 ± 0.3 PSIA WITH CABIN AT 5.0 PSIA LEAK O2 PER REGULATOR
LOW PRESSURE SWITCH 3.5 PSIA
CABIN REPRESS
CABIN REPRESS FLOW RATE IS 0.2 LB/MIN MAXIMUM
MANUAL CONTROL PANEL
CABIN REPRESS SWITCH
CM/SM SEPARATION
CM/SM SEPARATION PYRO BOLT
CM/SM SEPARATION PYRO BOLT
CM/SM SEPARATION PYRO BOLT


3 PRI COOL
PRIMARY GLYCOL LOOP
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
ASTP CSM
4.3
OVERBOARD
SM
CM
SERVICE MODULE
COMMAND MODULE
PRIMARY GLYCOL EVAPORATOR
SECONDARY GLYCOL EVAPORATOR
GLYCOL RESERVOIR
GLYCOL PUMPS
SUIT HEAT EXCHANGER
CABIN HEAT EXCHANGER
WATER CONTROL SECTION
STEAM PRESSURE SECTION
GLYCOL EVAP TEMP CONTROL (2 LEV)
EVAP TEMP CONTROL UNIT (2 LEV)
ECS RADIATORS
ECS RADIATOR TEMP PRIM/SEC
ECS GLYCOL PUMPS
ECS INDICATORS
CABIN TEMP
CABIN TEMP CONTROL
SUIT TEMP
SUIT MANIFOLD PRESS AND SUIT GAS PRESS REGULATORS
WATER TANKS
POTABLE H2O
WASTE H2O
PRIMARY GLYCOL EVAP
COOLANT CONT PANEL EVAP WATER CONT
FROM WASTE H2O WATER SUPPLY
FROM CSTS
FROM CSTS
FROM CSTS


OVERBOARD
SM
CM
4 SEC COOL
SECONDARY GLYCOL LOOP
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
SIZE B
CODE IDENT NO. 73174
DRAWING NO. 4.4
SCALE NONE
SHEET 1 OF 1



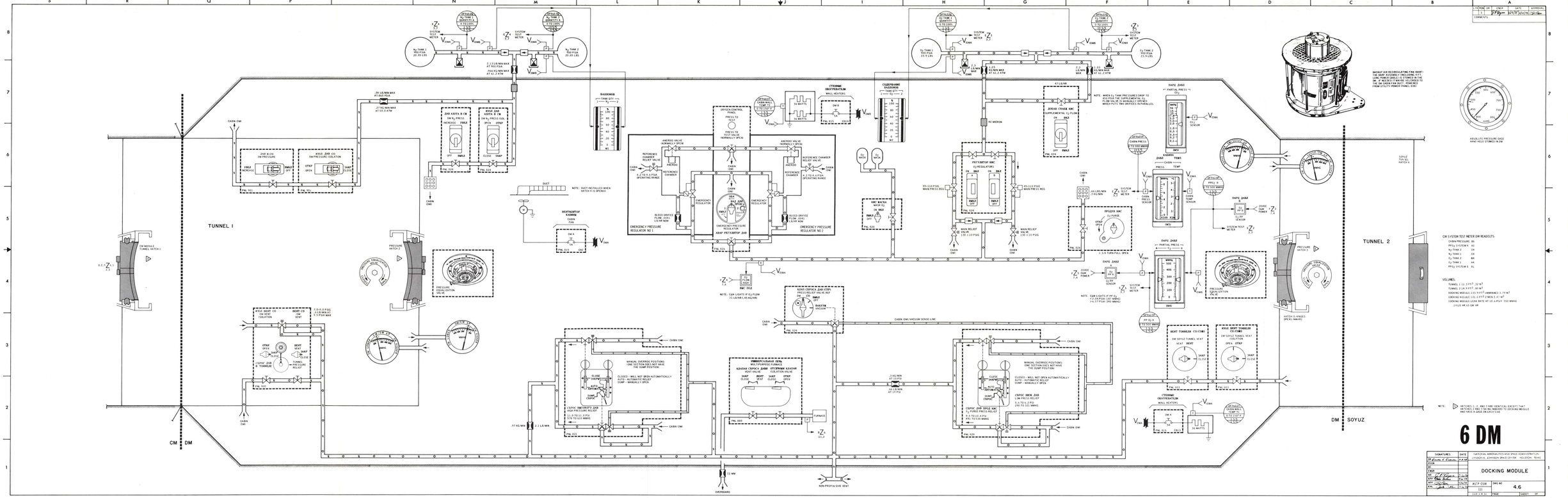
5 WATER

SIGNATURES	DATE
DR	
DSGN	
QC	
ENGR	
NR	7/14/16
APP	7/14/16
APP	7/14/16
KHL	7/14/16

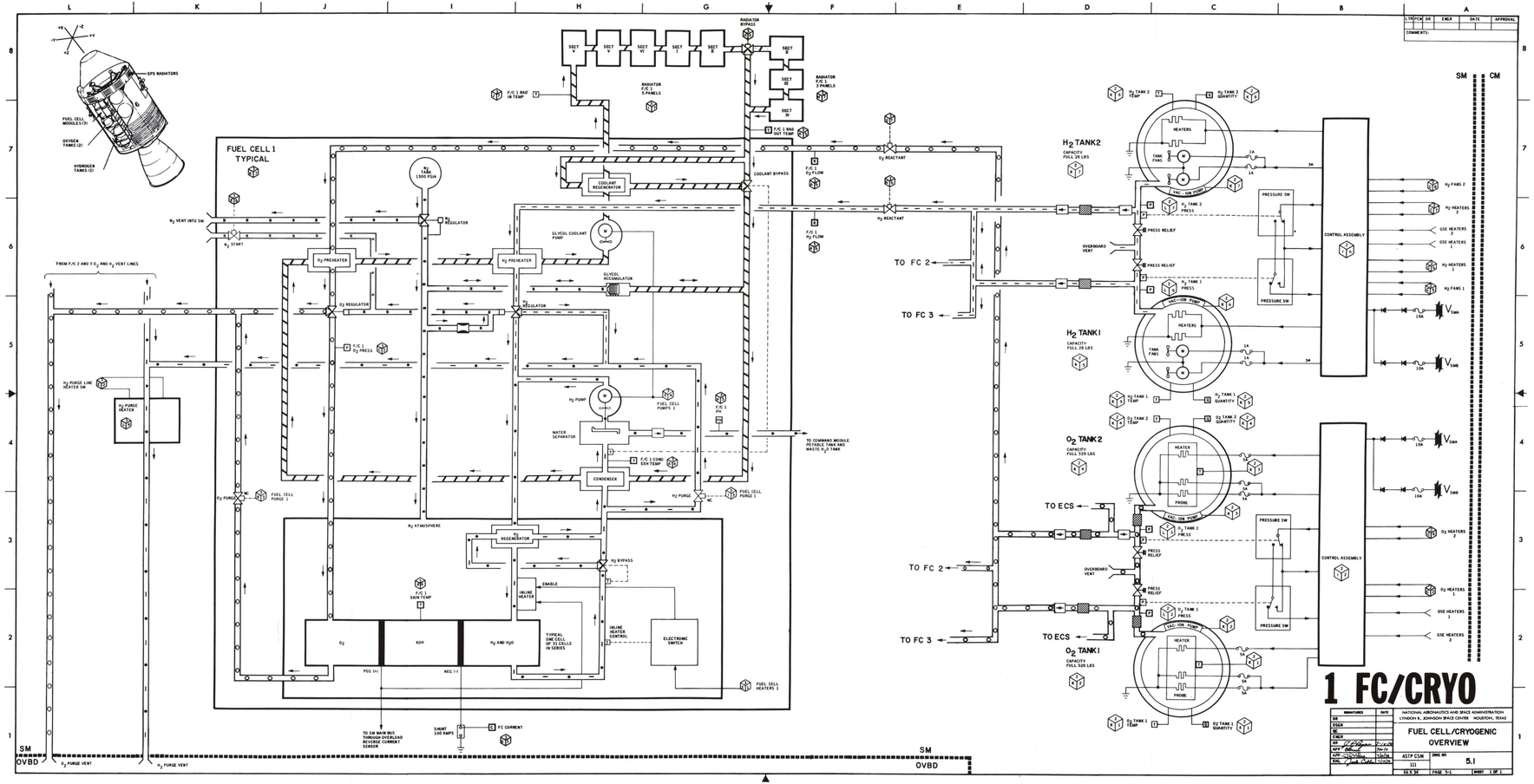
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS

WATER AND WASTE MANAGEMENT

ASTP CSM	SIZE	DWG NO	
111	J	4.5	
61.5 X 34	PAGE 4-5		SHEET 1 OF 1


6 DM
DOCKING MODULE
TUNNEL 1
TUNNEL 2
CM - DM
DM - SOYUZ
CM SYSTEM TEST METER DM READOUTS:
VOLUMES:
BACKUP AIR RECIRCULATING FAN (BARF)
ABSOLUTE PRESSURE GAGE HAND-HELD STOWED IN DM
NOTE: HATCHES 1, 2, AND 3 ARE IDENTICAL EXCEPT THAT HATCH 3 IS MODIFIED TO ACCOMMODATE DOCKING MODULE AND HAS A GRILLE ON EACH SIDE.
ACCEPTED
ACTP CSM
DMG NO 4.6
SHEET OF

5 FUEL CELL/
CRYOGENIC
SYSTEM



ULTRONIC DR	EMER	DATE	APPROVAL

COMMENTS:

SIGNATURES	DATE
DE	
DSER	
RE	
EMER	
AD	
APP	Dec 71
APP	12/6/71
PUB	12/6/71

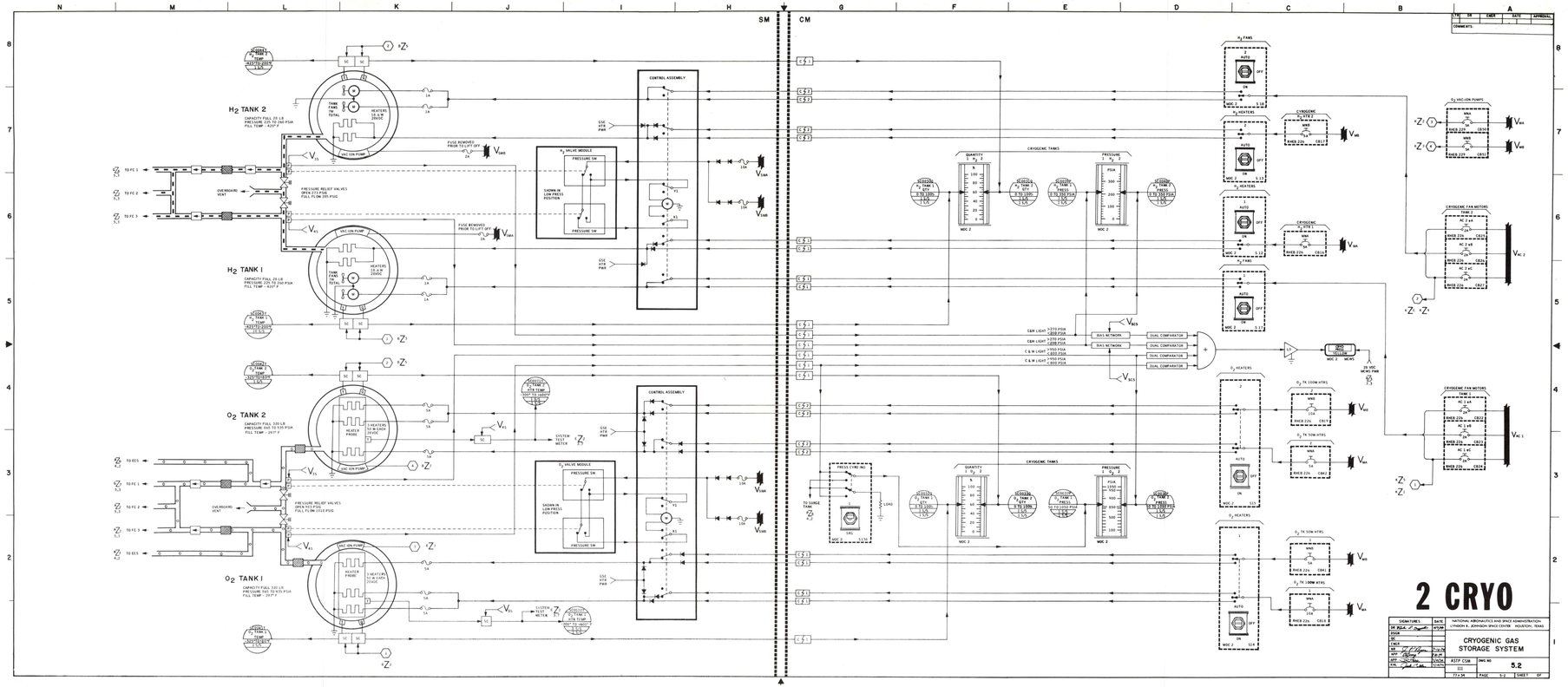
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS

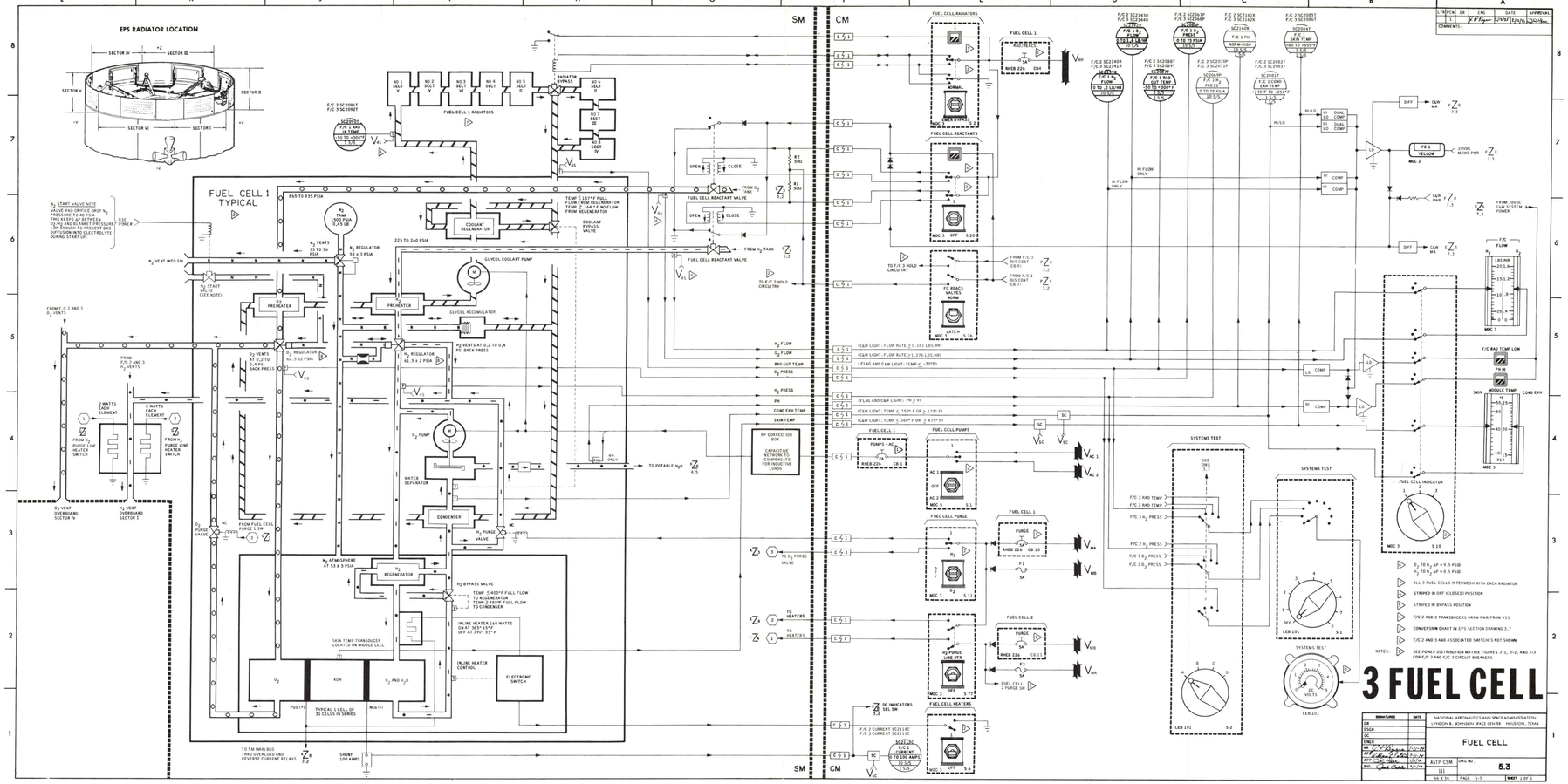
FUEL CELL/CRYOGENIC OVERVIEW

ASTP CSM | DRAWING NO. 5.1

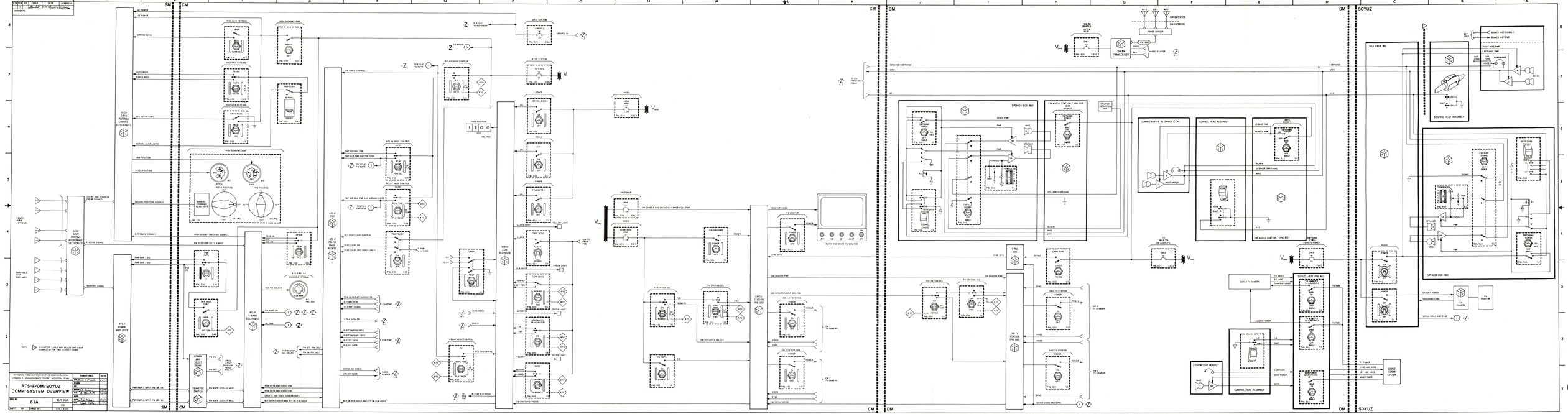
III

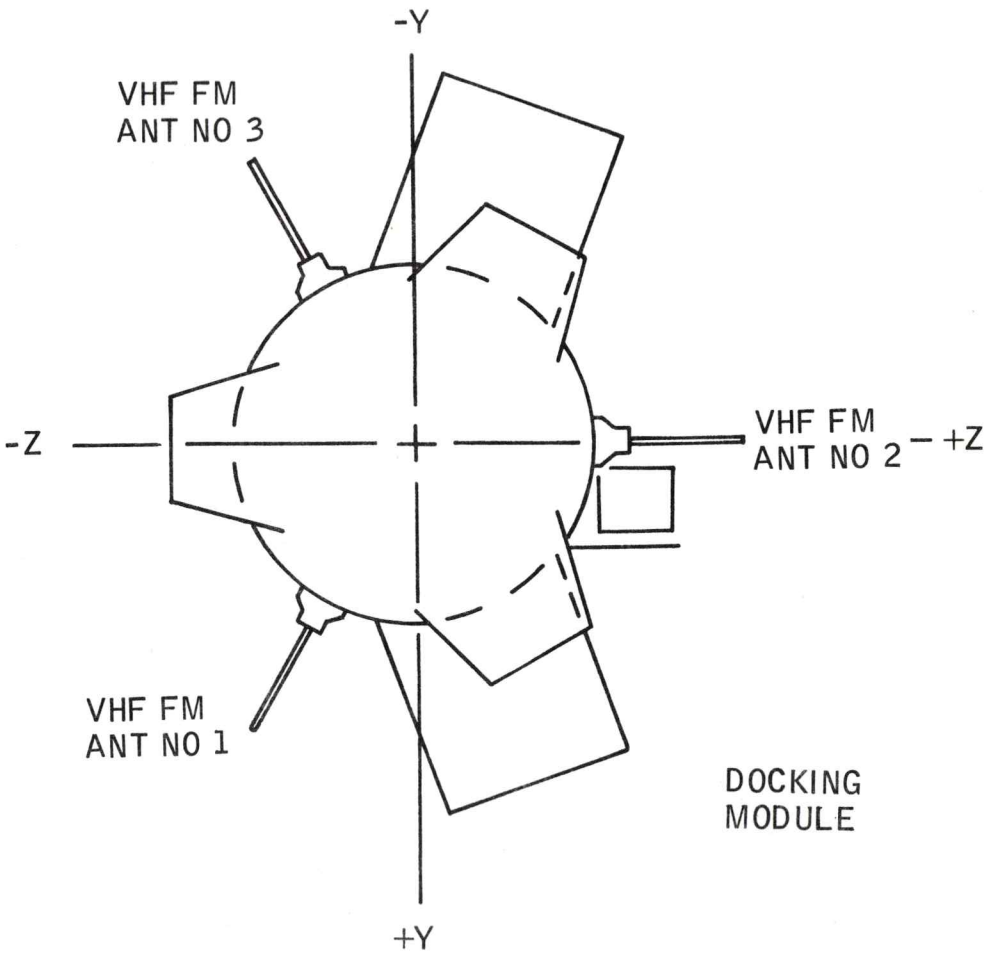
SD 5 34 | PAGE 5-1 | SHEET 1 OF 1


SM
CM
H_2 TANK 2
CAPACITY FULL 28 LB
PRESSURE 220 TO 260 PSIA
FILL TEMP - 420° F
H_2 TANK 1
CAPACITY FULL 28 LB
PRESSURE 220 TO 260 PSIA
FILL TEMP - 420° F
O_2 TANK 2
CAPACITY FULL 320 LB
PRESSURE 865 TO 935 PSIA
FILL TEMP - 221° F
O_2 TANK 1
CAPACITY FULL 320 LB
PRESSURE 865 TO 935 PSIA
FILL TEMP - 221° F
CONTROL ASSEMBLY
H_2 VALVE MODULE
O_2 VALVE MODULE
PRESSURE SW
SHOWN IN LOW PRESS POSITION
CRYOGENIC TANKS
QUANTITY
PRESSURE
H_2 FANS
O_2 HEATERS
O_2 TK 1 IOOW HTRS
O_2 TK 50W HTRS
CRYOGENIC FAN MOTORS
O_2 VAC-ION PUMPS
CRYOGENIC H_2 HTRS
CRYOGENIC O_2 HTRS
AUTO
ON
OFF
DUAL COMPARATOR
BIAS NETWORK
C&W LIGHT 1270 PSIA
1208 PSIA
C&W LIGHT 1270 PSIA
1208 PSIA
C & W LIGHT 950 PSIA
1000 PSIA
C & W LIGHT 950 PSIA
1000 PSIA
2 CRYO
CRYOGENIC GAS STORAGE SYSTEM
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
ASTP CSM
DWG NO
5.2
SIZE
77 x 34
PAGE 5-2
SHEET OF


EPS RADIATOR LOCATION
SECTOR IV
SECTOR III
SECTOR V
SECTOR II
SECTOR VI
SECTOR I
FUEL CELL 1 TYPICAL
FUEL CELL 1 RADIATORS
RADIATOR BYPASS
FUEL CELL REACTANT VALVE
FUEL CELL REACTANTS
FUEL CELL RADIATORS
FUEL CELL 1 RAD HEATER
FUEL CELL PUMPS
FUEL CELL PURGE
FUEL CELL HEATERS
FUEL CELL INDICATOR
SYSTEMS TEST
PREHEATER
GLYCOL ACCUMULATOR
GLYCOL COOLANT PUMP
COOLANT REGENERATOR
WATER SEPARATOR
CONDENSER
REGENERATOR
KOH
ELECTRONIC SWITCH
SHUNT 100 AMPS
3 FUEL CELL
FUEL CELL
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
ASTP CSM
5.3

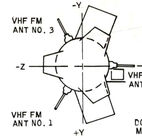
6 COMMUNICATIONS SYSTEM

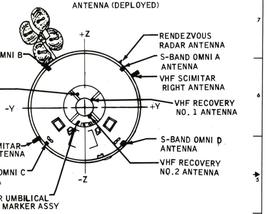

ATS-F/DM/SOYUZ
COMM SYSTEM OVERVIEW
6.1A
SM
CM
DM
SOYUZ
HIGH GAIN ANTENNA CONTROL ELECTRONICS
HIGH GAIN ANTENNA ASSEMBLY
OMNI ANTENNAS
PARABOLIC ANTENNAS
ATS-F POWER AMPLIFIERS
ATS-F S-BAND EQUIPMENT
POWER AMP SELECT RELAY
TRANSFER SWITCH
ATS-F PM-FM MODE ELECTRONICS
ATS-F TWT
ATS-F PM-FM MODE ANTENNA
ATSAT SYSTEM
RELAY MODE CONTROL
TAPE RECORDER
VIDEO RECORDER
CM TV STATION SEL
SYNC BOX
SM/DM TV SELECT
SM/DM TV CAMERA
SM TV CAMERA
DM TV CAMERA
SM TV MONITOR
DM TV MONITOR
SM AUDIO STATION
DM AUDIO STATION
COMM CARRIER ASSEMBLY (CCA)
CONTROL HEAD ASSEMBLY
SPEAKER/MIKE BOX (MB)
LIGHTWEIGHT HEADSET
USA J-BOX 961
SOYUZ J-BOX
SPLICE BOX (SB)
SOYUZ COMM S/SYSTEM
VHF EXTERIOR
VHF INTERIOR
VHF/FM TRANSCEIVER
AUDIO CENTER
ANTENNA SWITCH
POWER DIVIDER
EVA/TM UMBILICAL
EVA/TM TRANSCEIVER
EVA/TM ANTENNA
EVA/TM AUDIO CENTER
EVA/TM SPEAKER/MIKE
EVA/TM ANTENNA SWITCH
EVA/TM POWER DIVIDER
EVA/TM VOICE
EVA/TM KEY
EVA/TM PTT
EVA/TM SQUELCH
EVA/TM ANTENNA
EVA/TM SPEAKER
EVA/TM MIKE
EVA/TM ALARM
EVA/TM SPEAKER/EARPHONE
EVA/TM EARPHONE
EVA/TM MIKE POWER
EVA/TM SYNC AND VIDEO
EVA/TM KEY AND VOICE
EVA/TM MIKE POWER
EVA/TM TV POWER
EVA/TM SYNC AND VIDEO
EVA/TM KEY AND VOICE
EVA/TM MIKE POWER
EVA/TM TV PWR
SOYUZ VIDEO AND SYNC
SOYUZ VIDEO AND SYNC
SOYUZ VIDEO AND SYNC
SOYUZ VIDEO AND SYNC
SOYUZ TV CAMERA
SOYUZ TV MONITOR
SOYUZ TV PWR

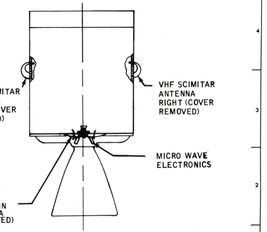


APRON ITEM

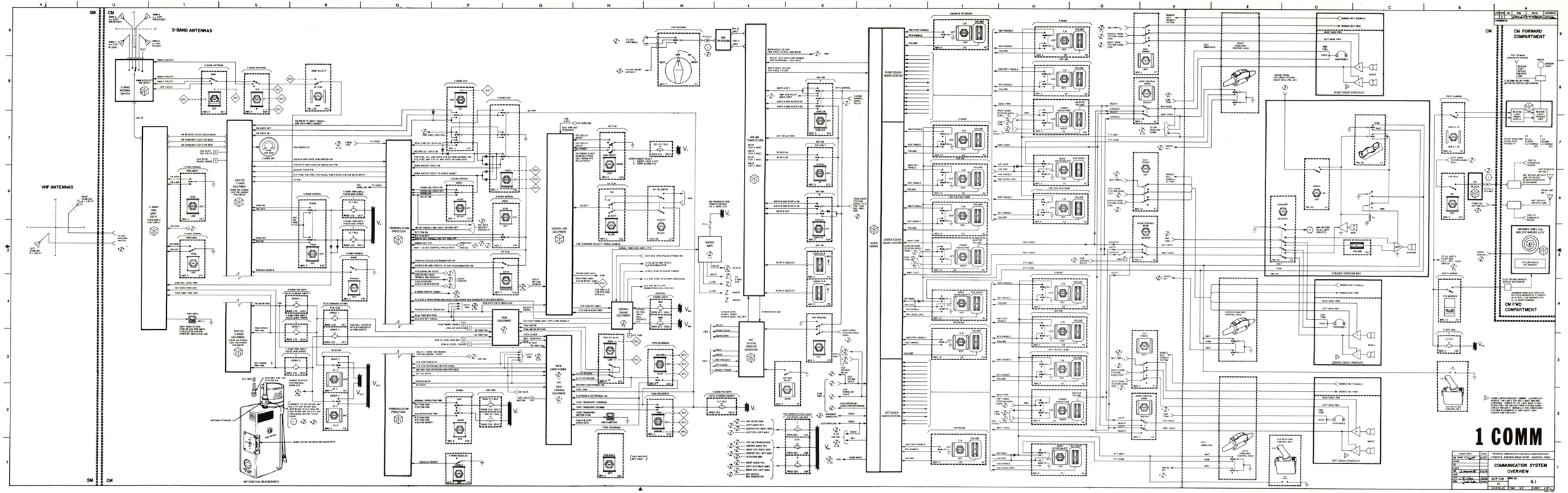
← Relates To Dwg 6.1A ←

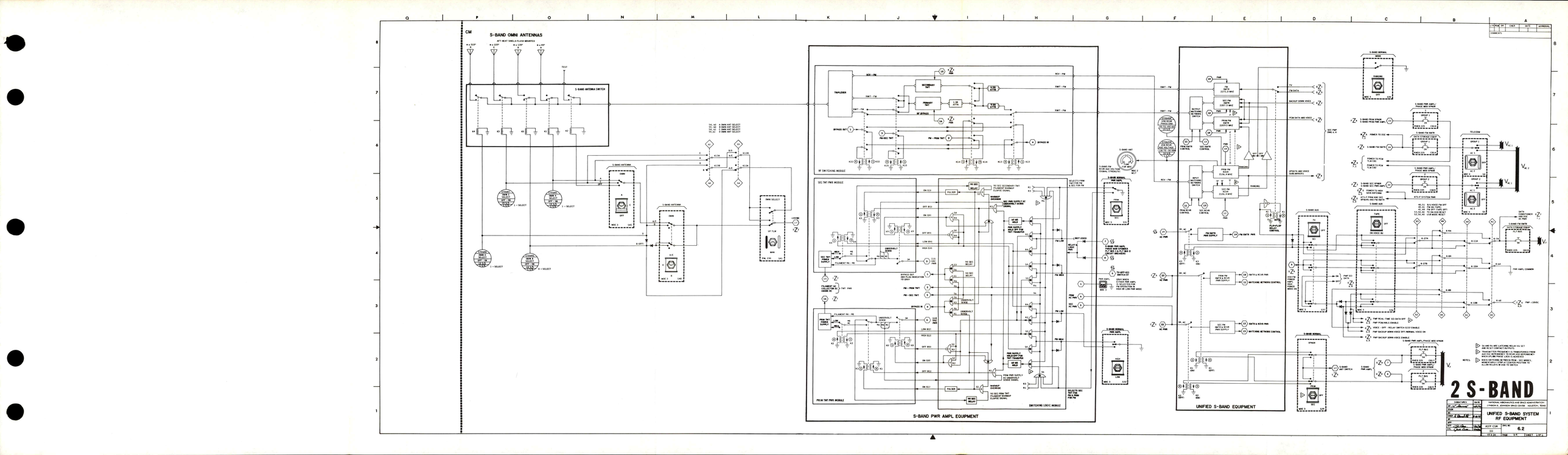


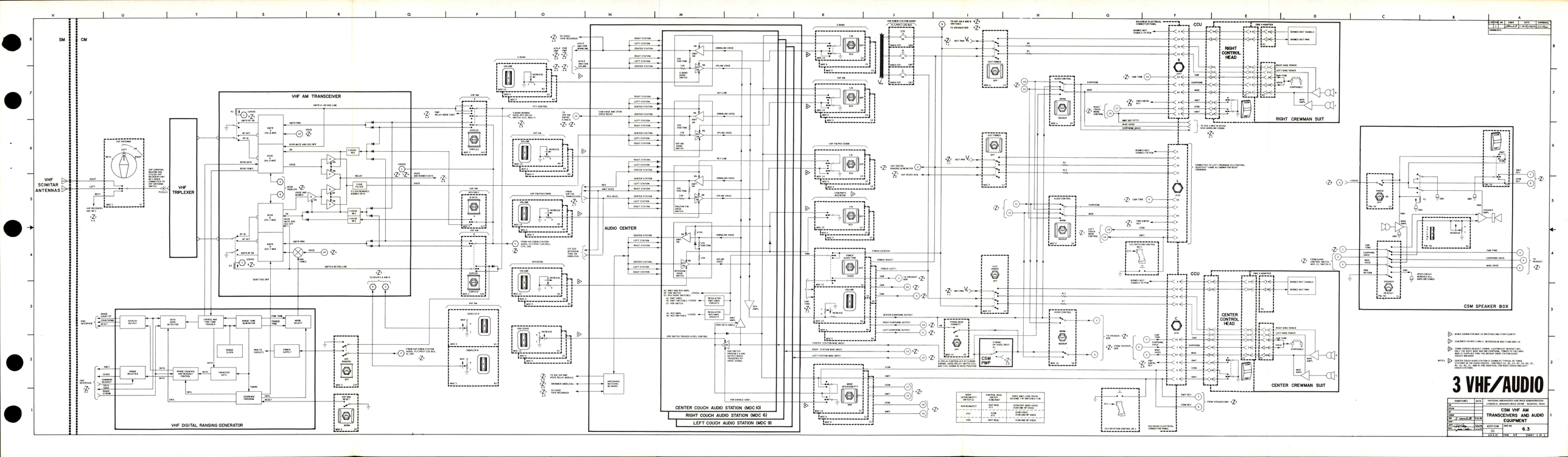


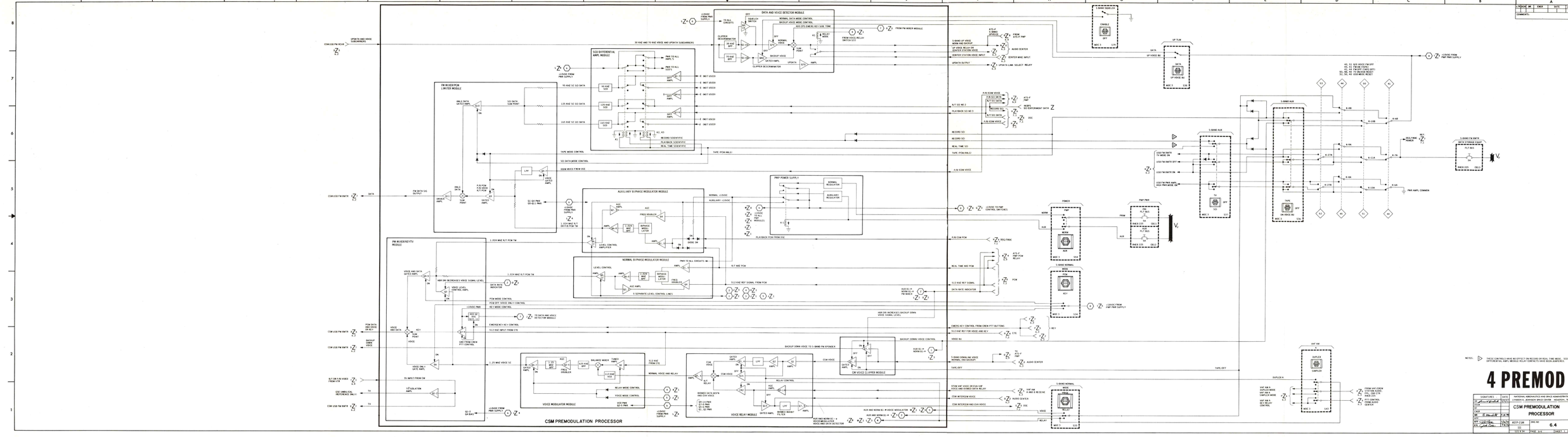


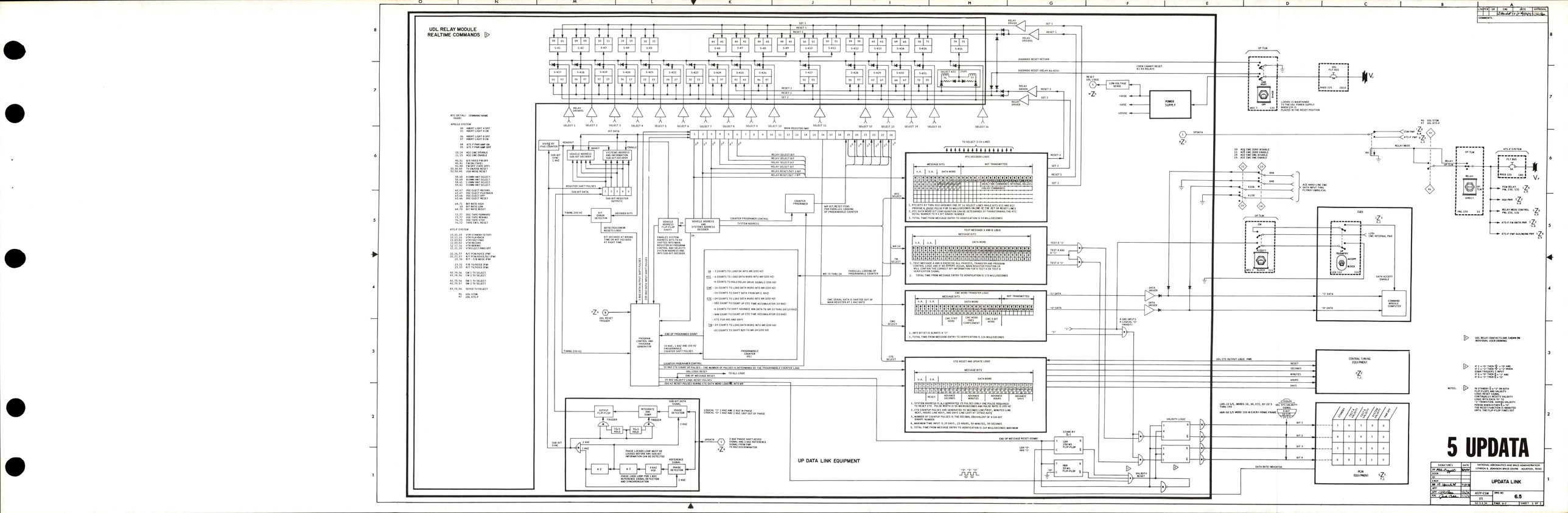
APRON ITEM 6,1




CM
S-BAND OMNI ANTENNAS
ATT HEAT SHIELD FLUSH MOUNTED
+ Z +
+ X 315°
+ X 225°
+ X 135°
+ X 45°
TEST
S-BAND ANTENNA SWITCH
K4
K5
K6
K1
K2
1A, 4B A OMNI ANT SELECT
1C, 4D B OMNI ANT SELECT
1E, 4F C OMNI ANT SELECT
1G, 4H D OMNI ANT SELECT
S-BAND ANTENNA DIPLEXER
K134
K135
K136
K137
S-BAND ANTENNA OMNI
OMNI
OFF
S-BAND ANTENNA
OMNI
OFF
TLM
S-BAND ANTENNA OMNI SELECT
OMNI A OR C SELECT
OMNI B OR D SELECT
OMNI SELECT
OFF
TLM
OMNI
PWR
1 = SELECT
2 = SELECT
3 = SELECT
4 = SELECT
TRIPLEXER
RCV + PM
XMIT - FM
BYPASS OUT
BYPASS IN
SECONDARY TWT
PRIMARY TWT
RF BYPASS
PM - PRIM TWT
PM - SEC TWT
6.35 WATTS
RF SWITCHING MODULE
SEC TWT PWR MODULE
PRIM TWT PWR MODULE
FILAMENT #A - #B
FILAMENT #C - #D
FILAMENT #E - #F
FILAMENT #G - #H
SEC TWT POWER SUPPLY
PRIM TWT POWER SUPPLY
ON (S1)
OFF (S2)
LOW (S3)
HIGH (S4)
OVERVOLT RESET
OVERVOLT LATCH
PULSER
90 SEC DELAY
WARMUP INHIBIT
TO SEC SECONDARY TWT FILAMENT WARMUP ELAPSED SIGNAL
TO SEC PRIM TWT FILAMENT WARMUP ELAPSED SIGNAL
SEC PWR SUPPLY HI FREQUENCY SIGNAL
PRIM PWR SUPPLY HI FREQUENCY SIGNAL
SEC PWR SUPPLY TWT FILAMENTS
PRIM PWR SUPPLY TWT FILAMENTS
SEC PWR SUPPLY
PRIM PWR SUPPLY
WARMUP SYSTEMS
TO SEC PRIM TWT ELAPSED TIMER START SIGNAL
SELECTS SEC TWT & SEC PWR
SELECTS PRIM TWT & PRIM PWR
SWITCHING LOGIC MODULE
S-BAND PWR AMPL EQUIPMENT
XMIT - FM
RCV - PM
S-BAND ANT COMMON USB ROUTE THROUGH CSM 2150
S-BAND PM DATA AND VOICE FROM CSM 2150
S-BAND PM DATA AND VOICE TO CSM 2150
S-BAND FM DATA AND VOICE FROM CSM 2150
S-BAND FM DATA AND VOICE TO CSM 2150
S-BAND ANT
OMNI
OFF
S-BAND SERIAL PWR AMPL
PRIM
OFF
SEC
S-BAND SERIAL PWR COMB
PRIM
SEC
LOW
INPUT METERING SWITCH
PWR
SEC PWR SUPPLY
PRIM PWR SUPPLY
FM DATA PWR SUPPLY
FM DATA PWR
FM DATA & RCVR PWR
SWITCHING NETWORKS CONTROL
SEC FM MOD
PRIM FM MOD
FM DATA & RCVR PWR SUPPLY
FM DATA & RCVR PWR
SWITCHING NETWORKS CONTROL
FM DATA PWR SUPPLY
FM DATA PWR
FLIP/FLOP RELAY CONTROL
FLIP/FLOP RELAY CONTROL
UNIFIED S-BAND EQUIPMENT
S-BAND NORMAL
RANGING
OFF
S-BAND PWR AMPL PHASE MOD SYNTH
S-BAND PRIM SYNTH
S-BAND PRIM PWR AMPL
S-BAND SEC PWR AMPL
S-BAND PM PATH
DATA SYNTHESIZER GROUP 1
S-BAND FM PATH
S-BAND PM DATA
S-BAND FM DATA
POWER TO SEC
POWER TO PRIM TLM CSE
POWER TO PCM TLM CSE
S-BAND SEC SYNTH
S-BAND SEC PWR AMPL
POWER TO HIGH GAIN SWITCHING
ATT-LF SYSTEM PWR
S-BAND PWR AMPL PHASE MOD SYNTH
DATA SYNTHESIZER GROUP 2
S-BAND FM DATA
DATA SYNTHESIZER GROUP 3
S-BAND AUX
TAPE
OFF
ON VOICE MI
PWR
PWR
S-BAND SERIAL SYNTH
S-BAND ANT SWITCH
S-BAND PWR AMPL
S-BAND PWR AMPL PHASE MOD SYNTH
PWR AMPL COMMON
PWR LOSMC
PWR REAL-TIME SCI DATA OFF
PWR PCM/PAM LOW/HI
VOICE - OFF - RELAY SWITCH CLOSY ENABLE
PWR BACKUP DOWN VOICE OFF/ NORMAL VOICE ON
PWR BACKUP DOWN VOICE ENABLE
S-BAND PWR AMPL PHASE MOD SYNTH
PCM DATA AND VOICE
BACKUP DOWN VOICE
FM DATA
SEC PWR SWS, 9
OPSTA AND VOICE SUBCARRIERS
TELEMETRY
GROUP 1
GROUP 2
GROUP 3
ANT 1
ANT 2
ANT 3
ANT 4
$V_{ANT 1}$
$V_{ANT 2}$
$V_{ANT 3}$
$V_{ANT 4}$
V_T
DATA CONSTANCY
OPSTA
ULTRA STABLE OSCILLATOR
S-BAND FM DATA
DATA SYNTHESIZER
S-BAND FM DATA
PLT BDS.
S-BAND 225 - 260 MHz
S-BAND 225 - 260 MHz
S-BAND 225 - 260 MHz


VHF AM TRANSCEIVER
VHF SCIMITAR ANTENNAS
VHF TRIPLEXER
VHF DIGITAL RANGING GENERATOR
AUDIO CENTER
CENTER COUCH AUDIO STATION (MDC 10)
RIGHT COUCH AUDIO STATION (MDC 6)
LEFT COUCH AUDIO STATION (MDC 9)
CCU
RIGHT CONTROL HEAD
RIGHT CREWMAN SUIT
CENTER CONTROL HEAD
CENTER CREWMAN SUIT
CSM SPEAKER BOX
3 VHF/AUDIO
CSM VHF AM TRANSCEIVERS AND AUDIO EQUIPMENT
6.3


CSM PREMODULATION PROCESSOR
DATA AND VOICE DETECTOR MODULE
FM MUXER/PCM LIMITER MODULE
AUXILIARY BI-PHASE MODULATOR MODULE
NORMAL BI-PHASE MODULATOR MODULE
PMP POWER SUPPLY
PM MUXER/EASY-TV MODULE
VOICE MODULATOR MODULE
VOICE RELAY MODULE
CM VOICE CLIPPER MODULE
S-BAND AUX
S-BAND NORMAL
S-BAND FM XMTR
PMP PWR
TAPE
VHF AM
DUPLEXER
DUPLEX A
CSM PREMODULATION PROCESSOR
4 PREMOD
6.4



5 UPDATA

SIGNATURES	DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
ORIG		LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
CHK		
ENGR		UPDATA LINK
APP		
APP		ASTP-CSM DWG NO 6.5
ENGR		

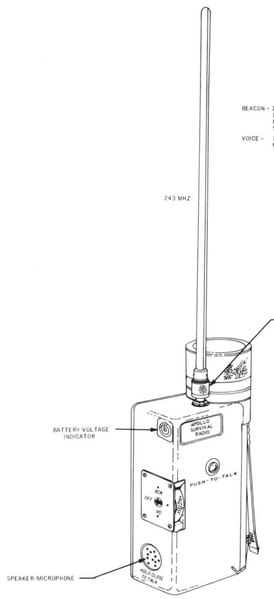
SCALE NONE SHEET 1 OF 1

CM

CM FORWARD COMPARTMENT

LTR	PCN	DR	ENGR	DATE	APPROVAL

COMMENTS:



VHF SURVIVAL BEACON/RADIO

BEACON - 1 1/2 WATTS PEAK WITH 50 PERCENT DUTY CYCLE. BEACON OUTPUT MODULATION IS 300 - 1000 HZ SWEEP 2 1/2 TIMES PER SECOND

VOICE - 1/2 WATT CW WITH 100 PERCENT MODULATION CAPACITY

CONNECT TO VHF RECOVERY ANTENNA NO 2 AT VHF RECOVERY BEACON INTERFACE OR VHF RECOVERY ANTENNA NO 1 AT VHF TRIPLEXER OUTPUT. UNIT HAS ITS OWN SEPARATELY STOWED ANTENNA WHICH MAY BE USED OUTSIDE THE SPACECRAFT

UNIT ALSO CONTAINS 2 SPARE BATTERY PACKS

VHF TRIPLEXER

TO VHF ANT SW P102 COAX

VHF RCVRY BEACON

TO RCVRY ANT NO 2 P112 COAX

ACCESSIBLE THRU PANEL DOOR

POST LANDING

BCN LT HI

BCN LT LO

MDC 15 S3

TO S6, MDC II FLOAT BAG FILL-OFF-VENT SWITCH

FLOAT BAG

FLT/PL

5A

MDC II CB8

POST LANDING

DYE MARKER

MDC 15 S2

TIED TO MAIN PARACHUTE RISERS

BEACON LIGHT DEPLOY INITIATE LINE

WHITE

8 SECOND DELAY PYRO ACTUATED DEPLOY MECHANISM

BEACON LIGHT POWER SUPPLY

BEACON LIGHT TRIGGER UNIT

	LO	HI
FLASH DURATION	10 μS	5 μS
FLASH RATE	15/MIN	120/MIN
INTENSITY	1.2 CANDLE SEC	1.0 CANDLE SEC

SWIMMER UMBILICAL DEPLOYS WITH DYE MARKER TO A LENGTH OF 8 FEET, DYE MARKER LIFE IS 12 HOURS NOMINAL

WATERPROOF CAP

SWIMMER UMBILICAL AND DYE MARKER ASSEMBLY

SWIMMER UMBILICAL (COILED)

YELLOW-GREEN DYE MARKER

INTERCOM BUS

FUSE LINK

ELECTRO MECHANICAL DEPLOY MECHANISM (10 TO 30 VDC OPERATING VOLTAGE)

LEFT COUCH AUDIO STATION
LEFT COUCH LEFT MIKE
CENTER COUCH RIGHT MIKE

VHF CREW STATION AUDIO

FLT POST LOG BUS

5A

RHEB 225 CB7

VHF BCN

ON

OFF

MDC 3 S45

VHF RECOVERY BEACON

POWER SUPPLY

FLIP FLOP

XMTR CONTROL
2 SEC ON - 3 SEC OFF

XMTR 243 MHZ

1 KHZ OSC

SQUARE WAVE MODULATION

J2

RCVRY ANT NO 2

ANT DEPLOY INITIATE LINE

TIED TO PARACHUTE RISERS

8 SEC DELAY PYRO ACTUATED DEPLOY MECHANISMS

TIED TO PARACHUTE RISERS

ANT DEPLOY INITIATE LINE

RCVRY ANT NO 1

FROM VHF ANT SWITCH

6 RCVRY

SIGNATURES	DATE
DR Robert J. Bryatt	5/14/74
DSGN	
QC	
ENGR	
NR Thomas H. Bonfield	7-22-74
APP	
APP Joseph P. Loftus	7/16/74
KHL Jack C. Sides	7/24/74

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS

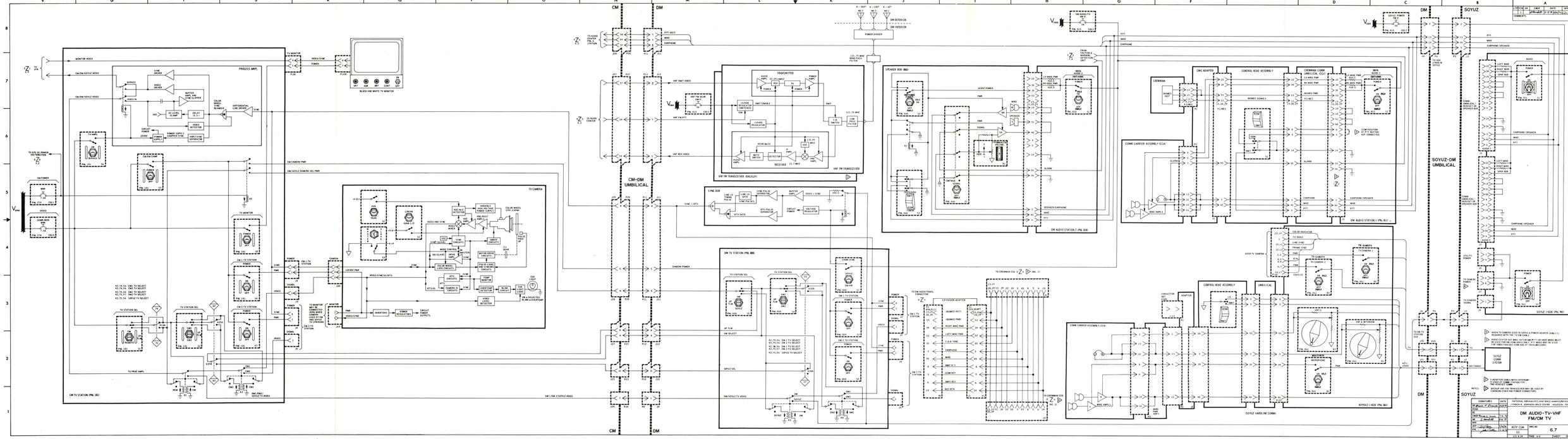
RECOVERY EQUIPMENT

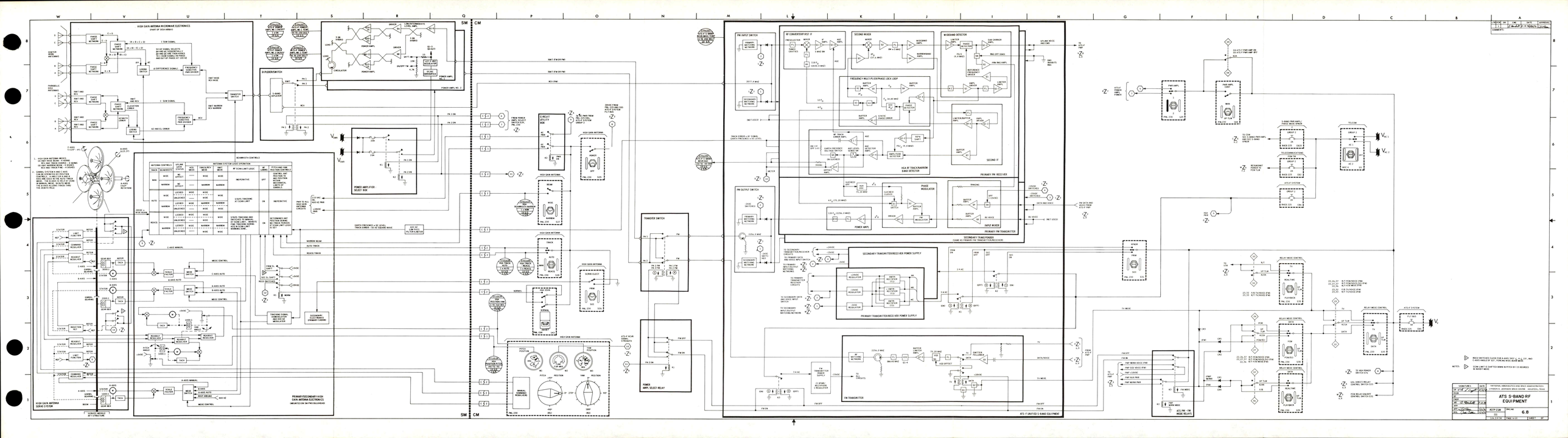
ASTP CSM 111

DWG NO 6.6

44 X 34

PAGE 6-8 SHEET OF


CM
DM
SOYUZ
CM-DM UMBILICAL
SOYUZ-DM UMBILICAL
DM TV STATION (PNL 180)
TV CAMERA
PROCESS AMPL
SYNC DRIVER
VIDEO DRIVER
BUFFER AMPL LINE CLAMPER
DELAY LINE
VIDEO DETECTOR
SYNC SEPARATOR
DIFFERENTIAL LINE DRIVER
COLOR BURST GATE & BLANKER
VERT SYNC SEPARATOR
POWER SUPPLY CHOPPER SYNC
CIRCUIT POWER
TV MONITOR
BLACK AND WHITE TV MONITOR
CAMERA
CAMERA POWER
CAMERA SEL PWR
CAMERA SYNC
CAMERA VIDEO
CAMERA SEL
CAMERA TO CIRCUITS
CAMERA TO CIRCUITS
CAMERA TO CIRCUITS


HIGH GAIN ANTENNA MICROWAVE ELECTRONICS
(PART OF SCIA ASSEMBLY)
SUM SIGNAL
Σ SUM SIGNAL
Δ DIFFERENCE SIGNAL
ΔAZ AND EL ERROR
XMIT AND RCV
XMIT WIDE RCV NARROW
XMIT NARROW RCV WIDE
XMIT
RCV
XMIT AND RCV
TRANSFER SWITCH
DIPLEXER SWITCH
DIPLEXER
HIGH GAIN ANTENNA SERVO SYSTEM
HIGH GAIN ANTENNA
PRIMARY/SECONDARY HIGH GAIN ANTENNA (MOUNTED ON SM TWO BULKHEAD)
POWER AMPL NO. 1
POWER AMPL NO. 2
POWER AMPLIFIER SELECT BOX
TRANSFER SWITCH
POWER AMPL SELECT RELAY
ATS-F UNIFIED S-BAND EQUIPMENT
SECONDARY TRANSMITTER/RECEIVER
PRIMARY TRANSMITTER/RECEIVER
PRIMARY FM TRANSMITTER
PRIMARY FM RECEIVER
SECONDARY FM TRANSMITTER
SECONDARY FM RECEIVER
FM TRANSMITTER
FM TRANSPONDER
S-BAND PWR AMPL
TELCOM
TELEMETRY SYSTEM
ATS-F SYSTEM
RELAY MDSC CONTROL
ANTENNA CONTROLS
UPLINK COMMAND MODE
MDS TRACKING MODE
TRACKING MODE
RF SCAN LIMIT LOGIC
RF LOCK
PITCH AND YAW POSITION CONTROL
INDICATIVE
OFF
INDICATIVE
ON
INDICATIVE
CONTROL NOT POSITION SIGNAL LIMITED BY COMMAND
NOTES:
1. HIGH GAIN ANTENNA MODES: (A) OMT WIDE BEAM = XSEMO; RCV AND TRACK SSAMCE = XEMW; (B) OMT NARROW BEAM = XSEMO; RCV AND TRACK PYMC = XEMW.
2. GIMBAL SYSTEM X AND Z AXES ARE DRIVEN BY SINGLE SPEED CONTROLS. IN AND OUT OF A HALO MODE, THE X AXIS IS HELD AT ZERO MODE. THE Z AXIS IS HELD AT ZERO MODE. THE Z AXIS IS HELD AT ZERO MODE. THE Z AXIS IS HELD AT ZERO MODE. THE Z AXIS IS HELD AT ZERO MODE.
3. THE Z AXIS ALLOWS TRACK THRU THE ZENITH POLE.
C-AXIS LIFT-OFF MOTOR
B-AXIS LIFT-OFF MOTOR
B-AXIS RETAINING
C-AXIS RETAINING
HIGH GAIN ANTENNA SERVO SYSTEM
C-AXIS MANUAL
C-AXIS AUTO
B-AXIS MANUAL
B-AXIS AUTO
MODE CONTROL
SCALE FACTOR
MODE SWITCH
TACH
RESOLVER
SERVO AMPL
SERVO MOTOR
GEAR BOX
GIMBAL BEARING
LIMIT FUNCTION
SYNCHRO
COMMAND RESOLVER
POWER
SERVO AMPLIFIER
TRACKING SIGNAL DEMODULATOR AND MODULATOR
SECONDARY ELECTRONICS (PRIMARY SYSTEM)
FROM SC RCVR
TO SC XMTR
SEQ SC TLM
MODE SWITCHING
NORM
ANTENNA CONTROLS
UPLINK COMMAND MODE
MDS TRACKING MODE
TRACKING MODE
RF SCAN LIMIT LOGIC
RF LOCK
PITCH AND YAW POSITION CONTROL
MANUAL COMMAND CONTROL LEVER
PITCH
YAW
POSITION
MC
MANUAL
AUTO
PRIMARY FM TRANSMITTER
PRIMARY FM RECEIVER
SECONDARY FM TRANSMITTER
SECONDARY FM RECEIVER
FM TRANSPONDER
S-BAND PWR AMPL
TELCOM
TELEMETRY SYSTEM
ATS-F SYSTEM
RELAY MDSC CONTROL
ANTENNA CONTROLS
UPLINK COMMAND MODE
MDS TRACKING MODE
TRACKING MODE
RF SCAN LIMIT LOGIC
RF LOCK
PITCH AND YAW POSITION CONTROL
INDICATIVE
OFF
INDICATIVE
ON
INDICATIVE
CONTROL NOT POSITION SIGNAL LIMITED BY COMMAND
NOTES:
1. HIGH GAIN ANTENNA MODES: (A) OMT WIDE BEAM = XSEMO; RCV AND TRACK SSAMCE = XEMW; (B) OMT NARROW BEAM = XSEMO; RCV AND TRACK PYMC = XEMW.
2. GIMBAL SYSTEM X AND Z AXES ARE DRIVEN BY SINGLE SPEED CONTROLS. IN AND OUT OF A HALO MODE, THE X AXIS IS HELD AT ZERO MODE. THE Z AXIS IS HELD AT ZERO MODE. THE Z AXIS IS HELD AT ZERO MODE. THE Z AXIS IS HELD AT ZERO MODE. THE Z AXIS IS HELD AT ZERO MODE.
3. THE Z AXIS ALLOWS TRACK THRU THE ZENITH POLE.
C-AXIS LIFT-OFF MOTOR
B-AXIS LIFT-OFF MOTOR
B-AXIS RETAINING
C-AXIS RETAINING
HIGH GAIN ANTENNA SERVO SYSTEM
C-AXIS MANUAL
C-AXIS AUTO
B-AXIS MANUAL
B-AXIS AUTO
MODE CONTROL
SCALE FACTOR
MODE SWITCH
TACH
RESOLVER
SERVO AMPL
SERVO MOTOR
GEAR BOX
GIMBAL BEARING
LIMIT FUNCTION
SYNCHRO
COMMAND RESOLVER
POWER
SERVO AMPLIFIER
TRACKING SIGNAL DEMODULATOR AND MODULATOR
SECONDARY ELECTRONICS (PRIMARY SYSTEM)
FROM SC RCVR
TO SC XMTR
SEQ SC TLM
MODE SWITCHING
NORM
ANTENNA CONTROLS
UPLINK COMMAND MODE
MDS TRACKING MODE
TRACKING MODE
RF SCAN LIMIT LOGIC
RF LOCK
PITCH AND YAW POSITION CONTROL
MANUAL COMMAND CONTROL LEVER
PITCH
YAW
POSITION
MC
MANUAL
AUTO
PRIMARY FM TRANSMITTER
PRIMARY FM RECEIVER
SECONDARY FM TRANSMITTER
SECONDARY FM RECEIVER
FM TRANSPONDER
S-BAND PWR AMPL
TELCOM
TELEMETRY SYSTEM
ATS-F SYSTEM
RELAY MDSC CONTROL
NOTES:
REED SWITCHES CLOSE FOR A AXIS, XXX° ± A-AXIS ANGLE OF XX°, YXXX MILS SEAM
TONES ARE SLIGHTLY DOWN IN PITCH BY 15 DECIBELS IN MAGNITUDE

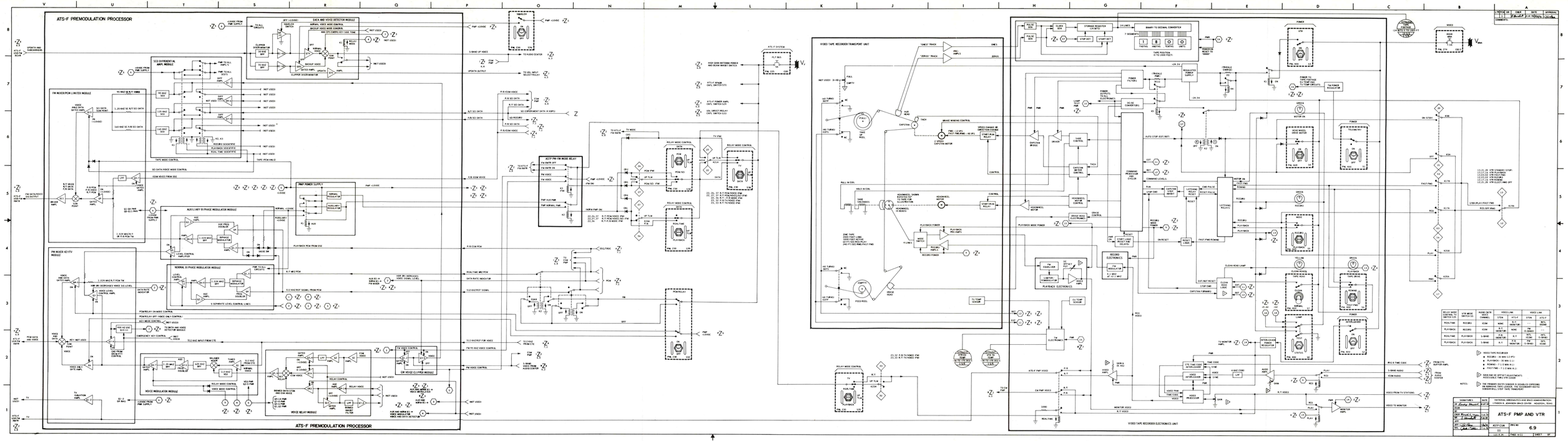

ATS-F PREMODULATION PROCESSOR
SCO DIFFERENTIAL AMPL MODULE
FM MIXER/PCM LIMITER MODULE
PM MIXER KEYTV MODULE
AUXILIARY BI-PHASE MODULATOR MODULE
NORMAL BI-PHASE MODULATOR MODULE
VOICE MODULATION MODULE
VOICE RELAY MODULE
DATA AND VOICE DETECTOR MODULE
PWR SUPPLY MODULE
ACCP PM-FM MODE RELAY
VOICE OR VOICE CLIPPER MODULE
ATS-F PREMODULATION PROCESSOR
VIDEO TAPE RECORDER/TRANSPORT UNIT
VIDEO TAPE RECORDER ELECTRONICS UNIT
RECORD ELECTRONICS
PLAYBACK ELECTRONICS
TM ELECTRONICS
RELAY MODE CONTROL
VOICE MODE CONTROL
TAPE MODE CONTROL
PWR SUPPLY
INTERLEAVER MODULATOR
VIDEO
AUDIO
TIME CODE
MONITOR VIDEO
R/F VIDEO
PLAY
RECORD
REPRODUCE
REWIND
FAST FWD
STOP
TAPE POSITION
0 TO 1200 FEET
TAPE MODE CONTROL
SCO DATA/VOICE MODE CONTROL
VOICE FROM DSC
PCM RELAY ON VOICE CONTROL
PCM RELAY OFF (VOICE ONLY) CONTROL
KEY MODE CONTROL
EMERGENCY KEY CONTROL
VOICE RELAY CONTROL
VOICE MODE CONTROL
RELAY MODE CONTROL
TAPE PCM ANLG
PCM VOICE
PCM DATA
PCM SCO
PCM VOICE
PCM SCO
PCM DATA
PCM VOICE
PCM SCO
PCM DATA
PCM VOICE
PCM SCO
PCM DATA

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

ITEM	FUNCTION AND/OR PARAMETERS
1. Weight	32 pounds
2. Cooling	
a. CSM	ECS Primary and/or Secondary Glycol loops
b. ATS-F	Crew suit $\frac{0}{2}$ Hoses
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 16.5 watts dc (Prim or Sec)
(2) FM Transmitter	1.5 watts dc 6.7 watts ac
4. Activation Time	1 minute maximum - PM Receiver, PM Transmitter, and FM Transmitter
5. PM Receiver (Prim/Sec)	
a. Type	Double conversion superheterodyne, phase lock loop
b. Frequency (Center)	
(1) Apollo	2106.40625 MHz
(2) ATS-F	2077.4 MHz

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

ITEM	FUNCTION AND/OR PARAMETERS
c. Phase Lock Tracking Loop	
(1) In-Lock Range	±90 kHz for RF INPUT >-114 dBm and STATIC PHASE ERROR <15 degrees peak.
(2) In-Lock Rate	Linear rate of 35 kHz/sec or less ±90 kHz for RF INPUT >-114 dBm
(3) Acquisition Probability	90 percent probability of acquisition on first sweep at above range and rates.
(4) Predetection Noise Bandwidth	16 kHz
(5) Loop Noise Bandwidth (Optimizing Point)	800 Hz (0 dB S/N at -134.5 dBm)
(6) Threshold	-125 dBm, defined as the level of unmodulated CW signal below which lock cannot be maintained for a period of at least one minute with 90 percent probability.
(7) Phase Error	24 degrees maximum (Offset + Rate Errors)
d. Dynamic Range	-51 dBm to -124 dBm (Normal) -35 dMb to -51 dBm (Must maintain lock and must not damage receiver)
e. Automatic Gain Control(AGC)	
(1) Attack Time	0.1 seconds
(2) Decay	3 seconds (-51 dBm to -127 dBm)

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

ITEM	FUNCTION AND/OR PARAMETERS
c. RF Output Power	301 to 374 milliwatts (Test Data)
d. Auto OSC Control	XMTR frequency is derived from XMTR Aux OSC prior to acquisition and RCVR VCO after acquisition. Switching is controlled using RCVR AGC signal.
(1) Aux OSC to RCVR VCO Switching Time	Less than 0.25 seconds
(2) RCVR VCO to Aux OSC Switching Time	Less than 6 seconds (3 Seconds Nominal at -51 dBm)
(3) Switching Threshold	-127 dBm
e. Inputs	(See Tables 6-IV and 6-V Modes)
7. FM Transmitter	
a. Type	FM, S-band
b. Frequency	
(1) Apollo	2272.5 MHz ± 445 kHz
(2) ATS-F	2256.0 MHz
c. Frequency Deviation	
(1) Apollo	(±3 MHz maximum)
(2) ATS-F	(±5 MHz maximum)
d. RF Output	111 to 138 milliwatts (Test Data)
e. Inputs (CSM)	(See Tables 6-IV and 6-V)

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

ITEM	FUNCTION AND/OR PARAMETERS
f. Ranging Channel	
(1) Modulation	PM on Carrier
(2) Bandwidth	10 kHz to 1.5 MHz (3 dB)
(3) PRN Bit Rate	992.834 kbs
(4) PRN Clock	992.834 kbs (496.417 kHz square wave)
(5) PRN Code Length	5,456,682 bits (lunar code)
g. High-Gain Antenna Track Channel	
(1) Pointing Error Signal	50 Hz amplitude modulated signal derived from the coherent AGC detector.
(2) Earth Presence Signal	DC signal superimpose on pointing error signal when RCVR is locked to incoming RF signal.
h. Outputs	(See Table 6-VI and Table 6-VII Modes)
6. PM Transmitter (Prim/Sec)	
a. Type	PM, S-band
b. Frequency	
(1) Apollo	2287.5 MHz (Aux OSC Mode)
(2) ATS-F	2256.0 MHz (Aux OSC Mode)
(3) Locked Mode	240/221 times RCVR frequency when RCVR is phase locked to uplink RF signal. (See Auto OSC Control.)

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

ITEM	FUNCTION AND/OR PARAMETERS
c. RF Output Power	301 to 374 milliwatts (Test Data)
d. Auto OSC Control	XMTR frequency is derived from XMTR Aux OSC prior to acquisition and RCVR VCO after acquisition. Switching is controlled using RCVR AGC signal.
(1) Aux OSC to RCVR VCO Switching Time	Less than 0.25 seconds
(2) RCVR VCO to Aux OSC Switching Time	Less than 6 seconds (3 Seconds Nominal at -51 dBm)
(3) Switching Threshold	-127 dBm
e. Inputs	(See Tables 6-IV and 6-V Modes)
7. FM Transmitter	
a. Type	FM, S-band
b. Frequency	
(1) Apollo	2272.5 MHz ± 445 kHz
(2) ATS-F	2256.0 MHz
c. Frequency Deviation	
(1) Apollo	(±3 MHz maximum)
(2) ATS-F	(±5 MHz maximum)
d. RF Output	111 to 138 milliwatts (Test Data)
e. Inputs (CSM)	(See Tables 6-IV and 6-V)

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

ITEM	FUNCTION AND/OR PARAMETERS
(1) TV (dc coupled)	f_o at +1.3 Vdc Input $\Delta f/V$ = 1 MHz/V Response dc to 500 kHz
(2) Wideband (ac coupled)	$\Delta f/V$ = 1 MHz/V Response 200 Hz to 300 kHz
f. Inputs (ATS-F)	(See Table 6-V)
(1) TV (dc coupled)	f_o at +1.3 Vdc Input $\Delta f/V$ = 2.5 MHz/V Response dc to 2.0 MHz
(2) Wideband (ac coupled)	$\Delta f/V$ = 1 MHz/V Response 200 Hz to 300 kHz
8. SPECIAL Operating Instructions	When switching between primary and secondary transponders, momentarily stop at the OFF (center) position to allow control relays to operate.

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

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

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

ITEM	FUNCTION AND/OR PARAMETERS
5. RF Output	
a. PM Output - Prim or Sec Power Amplifier	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)
7. Undervoltage Protection	Undervoltage protection circuit will remove ac pwr from power amplifier TWT if any phase of the ac input voltage falls below 95 Vac for 15 milliseconds or more. If this condition exists for 1 second or more, a 90 second filament warmup delay will occur when ac voltage is restored.
8. Special Operating Instructions	Dc power should be applied before ac power and removed after ac power removal to prevent possible damage.

TABLE 6-III.- ATS-F POWER AMPLIFIER

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

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

	MODE NUMBER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	0
PM DOWNLINK MODE AVAILABLE	Channels Included	Carrier Voice 51.2-kbps TM -- --	Carrier Voice 51.2-kbps TM PRN --	Carrier Voice 1.6-kbps TM PRN --	Carrier Voice 1.6-kbps TM -- --	Carrier -- 1.6-kbps TM -- --	Carrier -- -- -- KEY	Carrier -- -- PRN --	Carrier Backup Voice 1.6-kbps TM -- --	Carrier -- 1.6-kbps TM PRN --	Carrier Backup Voice(C) -- -- --	Carrier Voice -- PRN --	Carrier Voice -- -- --	Carrier -- 51.2-kbps TM -- --	Carrier Backup Voice(C) -- -- --	Carrier -- 51.2-kbps TM PRN --	Carrier Backup Voice 51.2-kbps TM -- --	No Carrier
PM DOWNLINK MODULATION PROCESS	Modulation Schemes; Sub-carrier Characteristics	PRN : PM directly on carrier (2287.5 MHz) Backup Voice: PM directly on carrier (2287.5 MHz) Normal Voice: FM/PM; 1.25 MHz subcarrier deviated ±7.5 kHz subcarrier TM : PCM/PSK/PM; 1.024 MHz subcarrier bi-phase modulated ±90 degrees Key : AM/PM; 512 kHz, 100 percent AM																
	Peak Carrier Deviation Radians (Δθ)	PRN : (A) Normal Voice: 0.7 for Modes 1, 2 1.2 for Modes 3, 4, 11, 12 Backup Voice: 0.7 for Modes 8, 14 1.2 for Modes 10, 16 TM (D) : 1.2 for Modes 1, 2, 16 (51.2-kbps) and Mode 8 (1.6-kbps) 0.7 for Modes 3,4 (1.6-kbps) 1.6 for Modes 5,9 (1.6-kbps) and Modes 13, 15 (51.2-kbps) Key : 1.0																

	MODE NUMBER	0	1	2	3	4	5	6	7	8	C
FM DOWNLINK MODES AVAILABLE	Channels Included	No Carrier	51.2-kbps TM and 4-kbps TM, Realtime, 4-kbps TM (E)	32:1 Playback Voice, 1.6-kbps TM	1:1 Playback TV, Interleaved Voice and CTE Time	Realtime TV	Realtime 4-kbps TM (E)	Realtime 51.2-kbps TM and 4-kbps TM, 1:1 Playback Voice and 4-kbps TM (E) (B)	Realtime 1.6-kbps TM and 4-kbps TM, 1:1 Playback Voice and 4-kbps TM (F) (B)	Realtime 51.2-kbps TM and 4-kbps TM (E) (B)	Realtime 1.60-kbps TM and 4-kbps TM (E) (B)
FM DOWNLINK MODULATION PROCESS	Modulation Sub-carrier Characteristics	TV : FM Directly on carrier (2272.5 MHz) Playback Voice : FM Directly on carrier (2272.5 MHz) Playback CSM TM (B): PCM/PSK/FM; 1.024 MHz subcarrier bi-phase modulated ±90 degrees Scientific Data: FM/FM 95 kHz (not used) PCM/FM 125 kHz R/T SCI (4-kbps BI-Φ PCM) PCM/FM 165 kHz P/B SCI (4-kbps BI-Φ PCM)									
	Peak Carrier Deviation (Δf)	Playback Voice : 100 kHz +20 percent -40 percent (Not used) 75 kHz ±15 percent (95 kHz SC) Playback CSM TM: 600 kHz ±15 percent Realtime 4-kbps TM: 180 kHz ±15 percent (125 kHz SC) TV (F) : 2.75 MHz ±10 percent, f_c at 1.3 Vdc Within 0 to +455 kHz Playback 4-kbps TM: 168 kHz ±15 percent (165 kHz SC)									

(A) Varies with the received uplink signal level.

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

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

(D) HBR Mod Index of 1.2 and 1.6 are actually 0.96 and 1.2 respectively due to HBR suppression of 1.024 MHz subcarrier.

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

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

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

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

	MODE NUMBER	R3	R4	R5	R6	
FM DOWNLINK MODES	Channels Included	Real-time TV, Voice, and CTE Time	Playback TV, Voice, and CTE Time	Real-time Voice and 4-kbps TM; Playback 51.2-kbps TM, Voice, and 4-kbps TM.	Real-time Voice 51.2/1.6-kbps TM, and 4-kbps TM.	
FM DOWNLINK MODULATION PROCESS	Modulation Schemes: Subcarrier Characteristics	TV Video: TV Voice and CTE Time: Playback Voice: Real-time Voice: Real-time 51.2/1.6-kbps TM: Playback 51.2/1.6 kbps TM: Real-time 4-kbps TM: Playback 4-kbps TM:		FM directly on carrier (2256.0 MHz) (A) PAM/FM (Voice) and BCD/FM (Time) interleaved with TV Video FM directly on carrier (2256.0 MHz) FM/FM on 95 kHz subcarrier PCM/PSK/FM; (1.024 MHz SC) Biphase modulated ±90 degrees (Same as Real-time) PCM,BI-$\emptyset$/FM/FM (125 kHz SC) PCM,BI-$\emptyset$/FM/FM (165 kHz SC)		
	Peak Carrier Deviation (Δf)	TV, INTL Voice & CTE Time: Real-time Voice: Playback Voice: Real-time 51.2/1.6-kbps TM: Playback 51.2/1.6-kbps TM: Real-time 4-kbps TM: Playback 4-kbps TM:		5 MHz peak (fc at 1.3 Vac within 0 to +455 kHz) (A) 75 kHz ±15% (95 kHz SC) 100 kHz + 20% - 40% (Baseband) 600 kHz ± 15% (1.024 kHz SC) 600 kHz ± 15% (1.024 kHz SC) 108 kHz ± 15% (125 kHz SC) 168 kHz ± 15% (165 kHz SC)		

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

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

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

*All phase deviations have ±10% tolerance

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

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

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

ITEM	FUNCTION AND/OR PARAMETERS
1. Weight	14.5 pounds
2. Cooling	
a. CSM	ECS Primary and/or Secondary Glycol Loops
b. ATS-F	Suit O_2 Hose
3. Electrical Power	
a. Input Voltage	28 ± 4 Vdc
b. Input Power	8.5 watts
4. CM Down Voice Channel (Normal)	
a. Subcarrier	1.25 MHz (± 500 Hz) derived from CTE 512 kHz
b. Response	300 to 3000 Hz flat within 6 dB.
5. CSM Down Voice Channel (Backup) or ATS-F 95 kHz SC Voice Channel	
a. Response	300 to 2300 Hz flat within 6 dB.
6. LM/EVA Voice and LM Biomed Relay Channel (not used)	
a. Subcarrier	1.25 MHz derived from CTE 512 kHz.
b. Subcarrier Deviation	LM Voice - 8 kHz EVA Voice and Biomed - 9 kHz
c. Response	300 to 13,300 Hz flat within 2 dB.
d. LM Input (not used)	Voice

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

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

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

ITEM	FUNCTION AND/OR PARAMETERS
10. Scientific Data Channel (Realtime)	
a. Response	Flat within 2 dB Channel 1 0 to 2850 Hz (95 kHz SC) 2 0 to 3750 Hz (125 kHz SC) 3 0 to 4950 Hz (165 kHz SC)
b. Frequency and Deviation	See Tables 6-IV & 6-V
11. Scientific Data Channel (Playback)	
a. Response	Flat within 2 dB Ch. 32:1 Playback 1:1 Playback 1 12.5 to 89 Hz 50 to 2850 Hz 2 12.5 to 117 Hz 50 to 3750 Hz 3 12.5 to 154 Hz 50 to 4950 Hz (Recorded data bandwidths)
12. Tape Recorder Input - LM PCM Channel (not used)	
a. Response	15 to 90 kHz flat within 1 dB.
13. Uplink Subcarrier Detectors	
a. Up Voice	30 kHz (normal) 70 kHz (backup) not used on ATS-F
b. Updata	70 kHz
c. Response	300 to 4,000 kHz flat within 3 dB.

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

ITEM	FUNCTION AND/OR PARAMETERS
14. Emergency Key Control (not used on ATS-F PMP)	512 kHz signal derived from CTE 512 kHz timing signal baseband modulates S-band PM carrier when key is depressed. A 400 Hz side-tone output to the audio center is provided when key is depressed.
15. Data Rate Indicator Control	Dc signal from PCM to control modulation levels to PM and FM Modulator modules. HBR = 5.3 Vdc LBR = 0 Vdc
16. Television Channel	
a. Direct Output	To S-band FM transmitter
b. Response	Direct wire through put.
c. Isolated Output	To GSE hardline
d. Response	10 to 500,000 Hz flat within 3 dB.
17. Uplink Voice Squelch (30 kHz Discriminator Output)	
a. Operation	Transistor switch actuated by voice subcarrier threshold detector. Switch grounds input to voice output amplifier.

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

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

TABLE 6-IX.- VHF AM TRANSCEIVER EQUIPMENT

ITEM	FUNCTION AND/OR PARAMETERS
1. Weight	13 pounds maximum
2. Cooling	ECS Primary and/or Secondary Glycol Loop
3. Electrical Power	
a. Input Voltage	28 ± 4 Vdc
b. Input Power	Duplex A (Key OFF) 4.2 watts Duplex A (Key ON) 28.8 watts Simplex A (Key OFF) 4.1 watts Simplex A (Key ON) 28.8 watts Duplex B (Key OFF) 3.8 watts Duplex B (Key ON) 27.6 watts Simplex B (Key OFF) 4.0 watts Simplex B (Key ON) 27.6 watts RCV A Only 1.2 watts RCV B Only 1.2 watts PTT (Key ON) 1.3 watts
4. Transmitter (A or B)	
a. Activation Time	250 milliseconds maximum to reach standby condition. 20 milliseconds maximum to reach full transmit power from PTT (Key ON)
b. RF Output	5 dBW (average) minimum
c. Transmitter Frequency	XMTR A 296.8 MHz ± 8.90 kHz XMTR B 259.7 MHz ± 7.79 kHz

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

ITEM	FUNCTION AND/OR PARAMETERS
d. Modulation	Modulated by clipped speech between 300 and 2000 Hz combined with a 30 kHz signal such that the ON-OFF duty cycle of the RF carrier (50 ± 5 percent) is speech signal dependent and the ON-OFF period is 30 kHz. When XMTR is keyed ON with no speech input the average RF Output is 5 dBW minimum.
5. Receiver (A or B)	
a. Activation Time	500 milliseconds maximum to reach full receive operation from turn-on. 100 milliseconds maximum to reach full receive operation from PTT release (Key OFF)
b. RCVR RF Input	2 to 625,000 microvolts
c. A&B Output Response	
(1) Output to Audio	300 to 3000 Hz, + 2 dB - 3 dB maximum variation, down 12 dB minimum at 5000 Hz.
(2) Output to PMP (Voice and Biomed Data)	300 to 13,000 (2 dB).
d. RCVR B LM PCM Output (not used)	300 to 13,000 Hz (2 dB).
e. RCVR Squelch	Adjustable by MDC 2 controls for between 0 and 10 to 25 microvolts. 9 on squelch control is maximum squelch (10 to 25 microvolt level)

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

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

TABLE 6-X.- VHF FM TRANSCEIVER

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

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TABLE 6-XI.- AUDIO CENTER EQUIPMENT

ITEM	FUNCTION AND/OR PARAMETERS
1. Weight	7.9 pounds
2. Cooling	ECS Primary and/or Secondary Glycol Loop
3. Electrical Power	
a. Input Voltage	28 ± Vdc
b. Input Power	14.2 watts (3 Stations ON)
4. Stations	Left Couch Station (Panel 9) Right Couch Station (Panel 6) Center Couch Station (Panel 10)
5. Microphone Amplifier	
(1 Each Station)	
a. Input	0 dBm sound pressure level (nominal)
b. Response	300 to 3000 Hz flat within 2 dB
c. Automatic Volume Control	
(1) Range	Less than 4 dB change for 20 dB input change
(2) Attack Time	50 milliseconds
(3) Release Time	1 to 6 seconds
(4) Threshold	13 ± dB (referred to input)
d. Output	0 dBm ± 3 dB at threshold
e. Isolation	30 dB or greater between modulation output channels

TABLE 6-XI.- AUDIO CENTER EQUIPMENT - Continued

ITEM	FUNCTION AND/OR PARAMETERS
6. Earphone Amplifier (1 Each Station)	
a. Input	Variable over 35 dB range of given input signal
b. Output	With 13 dB on input attenuator the output is 20 dBm ± 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 ± 0.7 seconds
8. Intercom Bus	
a. GSE Output	(Not Used)
b. Swimmer Output	For recovery voice to recovery swimmers
c. Tape Recorder	Output for voice recording on DSE
9. Spacecraft/GSE Facility Hardline Voice Interface	The Pad COMM Switch and Volume Control are used to operate each audio station's input/output voice links with the checkout and launch facilities.

TABLE 6-XI.- AUDIO CENTER EQUIPMENT - Concluded

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

TABLE 6-XII.- UPDATA LINK EQUIPMENT

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

TABLE 6-XII.- UPDATA LINK EQUIPMENT - Continued

ITEM	FUNCTION AND/OR PARAMETERS
b. Message Code	Each message contains up to 30 information bits which consist of a vehicle address, system address, and data word (see Drawing 6.5).
(1) Vehicle Address	Eight possible codes selectable by hard wire on an external connector.
(2) System Address	1. Command Module Computer 2. Real-Time Command (Internal relays) 3. Real-Time Command (External relays) (not used) 4. Central Timing Equipment 5. Salvo RTC reset 6. Test message A & B 7. Auxiliary decoder (not used)
(3) Data Word	(See Drawing 6.5.)
6. Sub-bit Detector	The 1 kHz and 2 kHz PSK signals are separated to provide synchronization and sub-bit data.
a. Sub-bit Sync	Recovered by phase lock techniques. Three 5 sub-bit sequences must precede a command message to synchronize the UDL.
b. Sub-bit Data	Detected at a 1 kHz rate.
7. Decoder Operation	The vehicle address decoded as ''access'' bits are decoded asynchronously (without sync). Message timing in the decoder is not established until after vehicle address is decoded.

TABLE 6-XII.- UPDATA LINK EQUIPMENT - Continued

ITEM	FUNCTION AND/OR PARAMETERS
	Vehicle address recognition disables access bit decoding and enables the decoding of the remaining message. The system address determines information for receiving the correct number of info bits and processing a particular data word. After the proper number of bits have been received and temporarily stored in the main register, the program control modifies the operation to enable processing or transfer of the data word.
8. Verification Signal	When a complete message is received, processed or transferred without the detection of sub-bit or bit errors and without the occurrence of a logic power deviation, the parallel 4-bit verification code to the PCM TM will be as follows: 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 *Verification signal is presented to the PCM as follows: PCM HBR 55 milliseconds PCM LBR 250 milliseconds

TABLE 6-XII.- UPDATA LINK EQUIPMENT - CONCLUDED

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

TABLE 6-XIII.- VHF RECOVERY BEACON

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

TABLE 6-XIV.- VHF SURVIVAL BEACON - TRANSCEIVER

ITEM	FUNCTION AND/OR PARAMETERS
1. Weight	5 pounds maximum including battery pack
2. Cooling	Not required
3. Electrical	
a. Dc Voltage	16.2 Vdc from self-contained battery
b. Power	Battery pack life 24 hours in 100% beacon operation
4. Activation Time	No appreciable warmup period
5. Receiver	
a. Type	Portable, VHF AM Beacon - xcvr with integral microphone, speaker, PTT pushbutton battery, antenna, and test meter
b. Frequency	234 MHz
Sensitivity ($\frac{S+N}{N}$ = 10 dB)	-97 dBm minimum
6. Transmitter	
a. Frequency	234 MHz
b. RF Output	
(1) Beacon	1.25 watts (peak)
(2) Voice	0.5 watts minimum (unmodulated)

TABLE 6-XIV.- VHF SURVIVAL BEACON-TRANSCEIVER - Conculded

ITEM	FUNCTION AND/OR PARAMETERS
c. Modulation	
(1) Beacon	ON-OFF key by a swept square wave, which varies in frequency from 1000 Hz to 300 Hz at a sweep rate of 2.5 Hz
(2) Voice	
7. Antenna	1/4 wavelength flexible whip

TABLE 6-XV.- CSM ANTENNA SWITCH, S-BAND

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

TABLE 6-XVI.- ANTENNA SWITCH, VHF

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

TABLE 6-XVII.- ANTENNA, CSM S-BAND OMNI

ITEM	FUNCTION AND/OR PARAMETERS
1. Type	Helix in loaded cavity
2. Frequency	2100 MHz to 2300 MHz
3. Gain	Greater than -3 dB relative to isotropic source between β >45 degrees and β $\geq$145 degrees (See Item 5 below)
4. Polarization	Right-hand circular
5. Coverage	The following coverage is applicable with sequential selection of the four antennas: *GAIN — SOLID ANGLE $\geq$ -3 dB between β = 45° and 145° $\geq$ -20 dB between β = 15° and 165° $\geq$ -24 dB between β = 10° and 170° GAIN WILL BE LESS THAN -24 dB for cones, with solid angles of 20 degrees at the spacecraft nose and SPS nozzle.
6. Power Rating	15 watts of CW RF

*Applicable for θ = 0° to 360°

TABLE 6-XVIII.- ANTENNA, VHF SCIMTAR

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

TABLE 6-XIX.- ANTENNA, VHF RECOVERY

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

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

ITEM	FUNCTION AND/OR PARAMETERS
1. Type	Multi-mode, variable gain, beamwidth, steerable antenna, consisting of four parabolas, a central horn, three-axis gimbal system and control logic.
2. Frequency	Transmit: 2256 ± 2.5 MHz Receive: 2077.4 ± 2 MHz
3. Gain (RF Axis) and Beamwidth (3 dB) for Antenna and Electronics Box	XMIT MODE — GAIN — BEAMWIDTH Wide — 8.0 dB — 40.0° Narrow — 25.7 dB — 3.9° RCV MODE — GAIN — BEAMWIDTH Wide — 3.1 dB — 40.0° Narrow — 23.0 dB — 4.5°
4. Polarization	Right-hand circular
5. Coverage	Spherical except for pointing angles where the STDN to the high gain antenna (HGA) line of sight is shadowed by the CSM. Shadow area covers approximately 40 percent of sphere.
6. RF Power Rating	40 watts continuous
7. Electrical	
a. Dc Voltage	28 (+2, -4) Vdc
b. Ac Voltage	115/200 Vac, 400 Hz, 3-phase

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

ITEM	FUNCTION AND/OR PARAMETERS
c. Dc Power (watts)	16.45 (Prim), 22.84 (Sec)
d. Ac Power (watts RMS)	34.5 (Prim), 34.5 (Sec)
8. Weight	94 pounds maximum
9. Acquisition Range	60 degrees or less from boresight axis when line of sight is outside RF Scan Limits.
10. Track Mode Transfer	wide track to narrow track switching occurs for tracking errors less than 1 degree. HGA will switch back to wide track if the tracking errors increase to greater than 3 degrees.
11. RF Scan Limit	Electronic limit set to correspond to CSM RF shadow profile.
12. Gimbal Limits.	
A-axis	360^{o} Rotation
B-axis	$\pm 23.5^{o}$
C-axis	$+125^{o}, -4^{o}$
	A-, B-, and C-axis are each at 0 degrees when B-axis is parallel to CSM X-axis and C-axis forms a right angle with A-axis.
	When onboard pitch and yaw indicators read 0 degrees, A-axis equals 0 degrees, B-axis equals 0 degrees, and C-axis equals +90 degrees.

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

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

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

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

TABLE 6-XXII.- RF TRANSFER SWITCH

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

TABLE 6-XXIII.- VHF DIGITAL RANGING GENERATOR

ITEM	FUNCTION AND/OR PARAMETERS
1. Weight	7 pounds maximum
2. Cooling	ECS Primary and/or Secondary Glycol Loop
3. Electrical Power	
a. Input Voltage	28 ± 4 Vdc
b. Input Power	10 watts maximum
4. Ranging Accuracy	±450 feet maximum error at 500 feet for ranging system: ±180 ft random ±270 ft bias
5. Range Tones	247 Hz (coarse), 3.9 kHz (medium), 31.6 kHz (fine)
6. EMS Interface	
a. Range Data Signal	Serial pulse train output to count up EMS range display to desired range in 0.01 n.mi. (60.761 feet) increments.
b. Maximum Unambiguous Range	327.68 n.mi. for initial range display.
C. Countdown Command Signal	When range is decreasing, a countdown command precedes each range data pulse.
d. Reset Pulse Signal	Resets EMS range display to zero when:

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

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

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

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

TABLE 6-XXIV.- BUFFER AMPLIFIER

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

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

ITEM	FUNCTION AND/OR PARAMETERS
1. Weight	42.5 pounds
2. Cooling	ECS Primary Glycol Loop
3. Electrical	
a. Dc Voltage	28 (+2, -3) Vdc
b. Ac Voltage	115/200 Vac, 400 Hz, 3-phase
c. Total Power Consumption	50 watts
4. Operational Stability	
a. Record Speed	3 seconds (max) from activation
b. Playback Speed	5 seconds (max) from activation
c. Tape Speed	The speeds will be within ±0.5% of specification with 400 Hz absolute power frequency
d. Flutter	
(1) 7.5 ips Record and Playback	3% peak-to-peak (max) with no vibration present; flutter bandwidth will be from 0.2 to 1250 Hz.
(2) 1.875 ips Record and 60 ips Playback	3% peak-to-peak (max) with no vibration present; flutter bandwidth will be from 0.2 to 2500 Hz.
5. CSM PCM Input	
a. Bit Rate	1.6 or 51.2 kbps
b. Level	"1" = 6 ±.8 Vdc

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

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

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

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

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

ITEM	FUNCTION AND/OR PARAMETERS
12. Analog Inputs	
a. Level	0 to 5 Vdc
b. Frequency	
(1) 1.875 ips	12.5 to 2500 Hz
(2) 7.5 ips	50 Hz to 10 kHz
c. Frequency Response	
(1) 7.5 ips Record and Playback	4 dB (max) between 50 and 5000 Hz 6 dB (max) between 50 and 10,000 Hz.
(2) 1.875 ips Record and 60 ips Playback	6 dB (max) between 12.5 and 2500 Hz.
d. Playback Voltage	Within 2 dB of the input at 1000 Hz
e. Distortion	2% (max)
f. Signal-to-Noise Ratio (SNR)	
(1) 1000 Hz output of 5 volts peak-to-peak	35 dB (min)
(2) 10,000 Hz output of 5 volts peak-to-peak	30 dB (min)
g. Output Voltage	5 Vdc ±5% peak-to-peak at 1000 Hz
13. Capabilities and Characteristics	
a. Tape Length	2262 ft (min)
b. Tape Width	1 inch

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

ITEM	FUNCTION AND/OR PARAMETERS
c. Record Times	4 hrs, at 1.875 ips 60 min, at 7.5 ips
d. Playback Times	7.5 min LBR at 60 ips 60 min HBR at 7.5 ips
e. Rewind Time	7.5 min (full tape) at 60 ips
f. Record/Playback Tracks	
(1) 6-Analog	3 active and 3 spare
(2) 1-CSM PCM	1.6 or 51.2 kbps, NRZ-L
(3) 1-SDS PCM (not used)	64 kbps, NRZ-L
(4) 1-LM PCM (not used)	1.6 kbps, Manchester split-phase
(5) 1-Voice	CSM/VHF
(6) 1-Timing	500 Hz in LBR No Timing in HBR

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

ITEM	FUNCTION AND/OR PARAMETERS

14. Tape Recorder Mode:

Data Source	Record			Playback		
	Speed	Control	Data	Speed	Control	Data
CSM	1.875 ips --- 7.5 ips	Bit Rate Select Switch	Voice 1.6 kbps --- Voice 51.2 kbps	60 ips (32:1) --- 7.5 ips (1:1)	Auto Speed Select (2)	Voice 51.2 kbps --- Voice 51.2 kbps
SDS (1) (3)	7.5 ips	Bit Rate Select Switch	64-kbps Analog	7.5 ips	Auto Speed Select (2)	64-kbps Analog
LM (3)	1.875 ips --- 7.5 ips	Bit Rate Select Switch	1.6 kbps	60 ips	Tape Recorder LM PCM Switch (s49)	51.2 kbps --- 12.8 kbps
4-kbps SCI Data (1)	7.5 ips	Bit Rate Select Switch	4-kbps SCI Data	7.5 ips (1:1)	Auto Speed Select (2)	4-kbps SCI Data

Notes: (1) Requires CSM HBR selection.

(2) Auto speed select circuitry is controlled by the presence (LBR) or absence (HBR) of a 500-Hz signal on track NBR. 1 of the tape.

(3) Not Used.

TABLE 6-XXVI.- DATA CONDITIONER (TRDC)

ITEM	FUNCTION AND/OR PARAMETERS
1. Weight	4 pounds maximum
2. Cooling	ECS Primary Glycol Loop (cooling not required)
3. Electrical Power	
a. Dc voltage	25 to 30 volts
b. Power consumption	5 watts maximum
4. 51.2 kbps PCM Inputs	
a. Bi-phase Space	51,200 ± 768 bits per second
b. NRZ-L	Synchronous with bi-phase input within ±5 microseconds.
c. Stability	Jitter is typically a frequency modulation of the input signal at a 10 Hz to 1250 Hz rate with maximum deviation of ±1% (10 Hz to 50 Hz) and ±2% (50 Hz to 1250 Hz).
5. 64 kbps PCM Inputs (not used)	
a. Bi-phase Space	64,000 ± 960 bits per second
b. NRZ-L	Synchronous with bi-phase input within ±5 microseconds.
c. Stability	Jitter is typically a frequency modulation of the input signal at a 10 Hz to 1250 Hz rate with maximum deviation of ±1% (10 Hz to 50 Hz) and ±2% (50 Hz to 1250 Hz).

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

ITEM	FUNCTION AND/OR PARAMETERS
6. 51.2 kbps PCM Output	Two buffered, time-stabilized NRZ-L signals
a. Bit Rate	51,200 ± 768 bits per second
b. Stability (maximum frequency modulation of output signal)	0 to 10 Hz (same as input) 10 Hz to 50 Hz (±1% to ±0.01%) 50 Hz and higher (±0.02%)
c. Bit Error Rate	Less than 10^{-8} due to data conditioner
d. Bit Time	15.6 microseconds nominal. Rise and fall time less than 2 microseconds between 10 and 90 percent points.
7. 64 kbps PCM Output (not used)	Time stabilized NRZ-L signal
a. Bit Rate	64,000 ± 960 bits per second
b. Stability (maximum frequency modulation of output signal)	0 to 10 Hz (same as input) 10 Hz to 50 Hz (±1% to 0.01%) 50 Hz and Higher (±0.02%)
c. Bit Error Rate	Bit Error Rate 10^{-8} due to data conditioner
d. Bit Time	15.6 microseconds nominal. Rise and fall time less than 2 microseconds between 10 and 90 percent points.

TABLE 6-XXVI.- DATA CONDITIONER (TRDC) - Concluded P-1

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

TABLE 6-XXVII.- COLOR TELEVISION CAMERA

ITEM	FUNCTION AND/OR PARAMETERS
1. Weight	Camera 16.0 pounds Lens (SKYLAB) 1.3 pounds Lens (zoom) 4.5 pounds
2. Cooling	Not required
3. Electrical Power	
a. Input Voltage	28 Vdc
b. Input Power	31 watts (camera) 2.5 watts (monitor)
4. Activation time	Instant on
5. Resolution	200 TV lines-per-picture height
6. Scanning rate	
a. Lines	525 scan lines per frame (2:1 interlace)
b. Frames	30 frames per second
7. Video Bandwidth	4.0 MHz with aperture correction ±3 bd response in 200 TV lines) limited to 2.0 MHz by CSM FM transmitter.
8. Illumination Levels	1 to 10,000 foot-candles at S/N of 35 dBm. (20 watt flourescent lamp ≈ 4870 foot-candles.)
9. Aspect Ratio	4:3

TABLE 6-XXVII.- COLOR TELEVISION CAMERA - Continued

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

TABLE 6-XXVII.- COLOR TELEVISION CAMERA - Continued

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

TABLE 6-XXVII.- COLOR TELEVISION CAMERA - Concluded

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

TABLE 6.-XXVIII.- TV MONITOR

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

TABLE 6-XXIX.- VIDEO TAPE RECORDER

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

TABLE 6-XXIX.- VIDEO TAPE RECORDER - Concluded

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

TABLE 6-XXX.- VIDEO SYNC BOX

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

TABLE 6-XXXI.- VIDEO PROCESSING AMPLIFIER

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

7 INSTRU-
MENTATION

SECTION 7

INSTRUMENTATION

7.1 GENERAL

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

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

MEAS ID	MEAS DESCRIPTION	MODULE TYPE	MODULE PLUG-CKT*	OUTPUT SIGNAL PCM	OUTPUT SIGNAL DISPLAY	DIST C&W
SC0039P	H2 TK 1 PRESS (5V BIAS)	--	--	--	--	C&W
SC0040P	H2 TK 2 PRESS (5V BIAS)	--	--	--	--	C&W
SR0307P	PSM FU TK PRESS (5V BIAS)	--	--	--	--	C&W
CC0175T	INVERTER 1 TEMP	DBA	35-1(2)	PCM	--	C&W
CC0176T	INVERTER 2 TEMP	DBA	35-2(2)	PCM	--	C&W
CC0177T	INVERTER 3 TEMP	DBA	36-1	PCM	--	C&W
CC0200V	AC BUS 1 PH A VOLTS	AC	24-1(2)	PCM	--	--
CC0203V	AC BUS 2 PH A VOLTS	AC	24-2(2)	PCM	--	--
CC0206V	MAIN BUS A VOLTS	AA	13-1(5)	PCM	--	--
CC0207V	MAIN BUS B VOLTS	AA	13-2(5)	PCM	--	--
CC0210V	BAT BUS A VOLTS	AA	13-3(5)	PCM	--	--
CC0211V	BAT BUS B VOLTS	AA	13-4(5)	PCM	--	--
CC0232V	BAT RELAY BUS VOLTS	AA	13-7(5)	PCM	SEL MTR	--
CC0215C	BAT CHGR CUR	DA	30-1(2)	PCM	--	--
CC0222C	BAT A CUR	DA	30-2(2)	PCM	--	--
CC0223C	BAT B CUR	DA	31-1(2)	PCM	--	--
CC0224C	BAT C CUR	DA	31-2(2)	PCM	--	--
SC2081T	FC 1 COND EXH TEMP	DBA	46-1(2)	PCM	SEL MTR	C&W
SC2082T	FC 2 COND EXH TEMP	DBA	46-2(2)	PCM	SEL MTR	C&W
SC2083T	FC 3 COND EXH TEMP	DBA	47-1	PCM	SEL MTR	C&W
SC2084T	FC 1 SKIN TEMP	DBA	41-1(2)	PCM	SEL MTR	C&W
SC2085T	FC 2 SKIN TEMP	DBA	41-2(2)	PCM	SEL MTR	C&W
SC2086T	FC 3 SKIN TEMP	DBA	42-1	PCM	SEL MTR	C&W
SC2113C	FC 1 CUR	DA	32-1(2)	PCM	--	--
SC2114C	FC 2 CUR	DA	32-2(2)	PCM	--	--
SC2115C	FC 3 CUR	DA	33-1	PCM	--	--
SF0266X	RAD FLOW CONT SYS 1 OR 2	AA	21-4(4)	PCM	--	--
CH3635X	BMAG MODE SW-ROLL ATT 1 RT 2	AA	19-1(6)	PCM	--	--
CH3636X	BMAG MODE SW-ROLL RATE 2	AA	19-2(6)	PCM	--	--
CH3638X	BMAG MODE SW-PITCH ATT 1 RT 2	AA	19-3(6)	PCM	--	--
CH3639X	BMAG MODE SW-PITCH RATE 2	AA	19-4(6)	PCM	--	--
CH3641X	BMAG MODE SW-YAW ATT 1 RT 2	AA	19-5(6)	PCM	--	--
CH3642X	BMAG MODE SW-YAW RATE 2	AA	19-6(6)	PCM	--	--
SP0062T	SPS INJECTOR FLANGE TEMP 2	DBA	43-2	PCM	--	--
BS0050P	SIVB OX TK PRESS A	DA	39-1(2)	--	SEL MTR	--
BS0051P	SIVB OX TK PRESS B	DA	40-1(2)	--	SEL MTR	--
BS0052P	SIVB FUEL PRESS A	DA	39-1(2)	--	SEL MTR	--
BS0053P	SIVB FUEL PRESS B	DA	40-2(2)	--	SEL MTR	--
BS0080X	EDS ABORT REQUEST A	AA	21-1(4)	PCM	--	--
BS0081X	EDS ABORT REQUEST B	AA	21-5(4)	PCM	--	--
CS0150X	MASTER CAUTION WARNING	AA	21-2(4)	PCM	--	--
CT0015V	SCE POS SUPPLY VOLTS	PS	--	PCM	--	--
CT0016V	SCE NEG SUPPLY VOLTS	PS	--	PCM	--	--
CT0017V	SENSOR EXCITATION 5 VOLTS	PS	--	PCM	--	--
CT0018V	SENSOR EXCITATION 10 VOLTS	PS	--	PCM	--	--

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

TABLE 7-2 INSTRUMENTATION - CM POWER DISTRIBUTION

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

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

MEAS ID	MEAS DESCRIPTION	FUSE NO.*	PCM	DISPLAY	C&W
CF0461T	H2O DUMP TEMP	5	PCM	--	--
CR0001P	CM He TK 1 PRESS	4	PCM	SEL MTR	--
CR0003T	CM He TK 1 TEMP	6	PCM	SEL MTR	--
CR0035P	CM He MANF 1 PRESS	9	PCM	--	C&W
CR0038P	CM He MANF 2 PRESS	2	--	SEL MTR	C&W
CR2103T	SYS 1 ENG 16 INJECT TEMP	8	--	SEL MTR	--
CR2114T	SYS 1 ENG 12 INJECT TEMP	7	--	SEL MTR	--

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

A. V2 - CURRENT LIMITER BOX C28A5 (FUSES 1 THRU 21).

MEAS ID	MEAS DESCRIPTION	FUSE NO.*	PCM	DISPLAY	C&W
CC0188P	BATT MANF PRESS	2	--	SEL MTR	--
CE0001X	DROGUE DEP RELAY A	7 (3)	PCM	--	--
CE0002X	DROGUE DEP RELAY B	19 (3)	PCM	--	--
CE0003X	MAIN DEPLOY RELAY A	7 (3)	PCM	--	--
CE0004X	MAIN DEPLOY RELAY B	19 (3)	PCM	--	--
CE0321X	MAIN CHUTE DISC RELAY A	7 (3)	PCM	--	--
CE0322X	MAIN CHUTE DISC RELAY B	19 (3)	PCM	--	--
CF0003P	SUIT-CABIN DELTA PRESS	18	PCM	MTR	--
CF0006P	SURGE TANK PRESS	3	PCM	SEL MTR	--
CF0120P	H2O TANK-GLY RES PRESS	20	PCM	--	--
CF0157R	PRI GLYCOL FLOW RATE	13	PCM	--	--
CF0181T	PRI EVAP INLET TEMP	1	PCM	--	--
CJ0060J	ASTRO 1 EKG AXIS 1	12 (2)	PCM	--	--
CJ0061J	ASTRO 2 EKG AXIS 1	10 (2)	PCM	--	--
CJ0062J	ASTRO 3 EKG AXIS 1	11 (2)	PCM	--	--
CJ0200R	ASTRO 1 RESPIR	12 (2)	PCM	--	--
CJ0201R	ASTRO 2 RESPIR	10 (2)	PCM	--	--
CJ0202R	ASTRO 3 RESPIR	11 (2)	PCM	--	--
CK0026A	CM X-AXIS ACCEL	9	PCM	--	--
CK0027A	CM Y-AXIS ACCEL	5	PCM	--	--
CK0028A	CM Z-AXIS ACCEL	6	PCM	--	--
CR2100T	SYS 1 ENG 14 INJECT TEMP	17	--	SEL MTR	--
CR2110T	SYS 2 ENG 24 INJECT TEMP	14	--	SEL MTR	--
CS0220T	DOCKING PROBE TEMP	8	PCM	--	--
	BUFFER AMPLIFIER (C28A33) (TIMING SIGNALS TO VTR, MA048, MA059, MA083 AND MA088)	16			

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

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

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

MEAS ID	MEAS DESCRIPTION	FUSE NO.*	PCM	DISPLAY	C&W
CA1820T	SIDE HS SURF LOC 1A TEMP	13 (4)	PCM	--	--
CA1821T	SIDE HS SURF LOC 4A TEMP	13 (4)	PCM	--	--
CA1822T	SIDE HS SURF LOC 7A TEMP	13 (4)	PCM	--	--
CA1823T	SIDE HS SURF LOC 10A TEMP	13 (4)	PCM	--	--
CF0460T	URINE DUMP NOZZLE TEMP	11	PCM	--	--
CR0002P	CM He TK 2 PRESS	20	PCM	SEL MTR	--
CR0004T	CM He TK 2 TEMP	19	PCM	SEL MTR	--
CR0036P	CM He MANF 2 PRESS	22	PCM	--	C&W
CR0037P	CM He MANF 1 PRESS	23	--	SEL MTR	C&W
CR2116T	SYS 2 ENG 25 INJECT TEMP	21	--	SEL MTR	--
CR2119T	SYS 2 ENG 21 INJECT TEMP	16	--	SEL MTR	--

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

TABLE 7-3 INSTRUMENTATION - SM POWER DISTRIBUTION

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

A. V3S - CURRENT LIMITER BOX S28A9.

MEAS ID	MEAS DESCRIPTION	FUSE NO.*	PCM	DISPLAY	C&W
SC0038P	O2 TK 2 PRESS	20	PCM	MTR	C&W
SC0040P	H2 TK 2 PRESS	21	PCM	MTR	C&W
SC2061P	FC 2 N2 PRESS (GSE ONLY)	1	--	--	--
SC2062P	FC 3 N2 PRESS (GSE ONLY)	8	--	--	--
SC2067P	FC 2 O2 PRESS	2	PCM	SEL MTR	--
SC2069P	FC 3 O2 PRESS	3	PCM	SEL MTR	--
SC2070P	FC 2 H2 PRESS	3	PCM	SEL MTR	--
SC2071P	FC 3 H2 PRESS	2	PCM	SEL MTR	--
SC2088T	FC 2 RAD OUT TEMP	11	PCM	SEL MTR	C&W
SC2089T	FC 3 RAD OUT TEMP	17	PCM	SEL MTR	C&W
SC2140R	FC 2 H2 FLOW	15	PCM	SEL MTR	C&W
SC2141R	FC 3 H2 FLOW	17	PCM	SEL MTR	C&W
SC2143R	FC 2 O2 FLOW	16	PCM	SEL MTR	C&W
SC2144R	FC 3 O2 FLOW	18	PCM	SEL MTR	C&W
SP0001P	He TK PRESS	4	PCM	--	--
SP0003P	OX TK PRESS	5	PCM	MTR	C&W
SP0022H	FU/OX VLV 1 POS	27 (4)	PCM	--	--
SP0024H	FU/OX VLV 3 POS	27 (4)	PCM	--	--
SP0027H	FU/OX VLV 2 POS	27 (4)	--	MTR	--
SP0029H	FU/OX VLV 4 POS	27 (4)	--	MTR	--
SP0048T	SPS FU FEED LINE TEMP	23	PCM	MTR	--
SP0054T	OX LINE 1 TEMP	24	PCM	--	--
SP0055T	OX SUMP TK SURF TEMP	19	PCM	--	--
SP0056T	FU SUMP TK SURF TEMP	13	PCM	--	--
SP0600P	SPS VLV ACT PRESS PRI	14	PCM	MTR	--
SP0661P	ENG CHAMBER PRESS	10	PCM	MTR	--
SP0930P	FU SM/ENG INTERFACE PRESS	6	PCM	--	--
	SM RCS QUAD A CURRENT LIMITER S28A10	28 (9)			
	SM RCS QUAD C CURRENT LIMITER S28A10	29 (9)			

B. V3S - CURRENT LIMITER BOX S28A13.

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

P-1

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

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

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

MEAS ID	MEAS DESCRIPTION	FUSE NO.*	PCM	DISPLAY	C&W
SR5001P	SM He TK A PRESS	1	PCM	SEL MTR	--
SR5013T	SM He TK A TEMP	10	PCM	SEL MTR	--
SR5025Q	SM RCS A PROP QTY	7	PCM	SEL MTR	--
SR5065T	SM ENG PKG A TEMP	11	PCM	SEL MTR	C&W
SR5073T	SM PRI FU TK A OUT SURF TEMP	15	PCM	--	--
SR5729P	SM He MANF A PRESS	12	PCM	--	--
SR5733P	SM OX MANF A PRESS	17	PCM	--	--
SR5737P	SM FU MANF A PRESS	14	PCM	SEL MTR	C&W
SR9216T	PSM QD A FEED LINE BRKT TEMP	5	PCM	--	--

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

MEAS ID	MEAS DESCRIPTION	FUSE NO.*	PCM	DISPLAY	C&W
SR5003P	SM He TK C PRESS	1	PCM	SEL MTR	--
SR5015T	SM He TK C TEMP	10	PCM	SEL MTR	--
SR5027Q	SM RCS C PROP QTY	7	PCM	SEL MTR	--
SR5067T	SM ENG PKG C TEMP	11	PCM	SEL MTR	C&W
SR5075T	SM PRI FU TK C OUT SURF TEMP	15	PCM	--	--
SR5817P	SM He MANF C PRESS	12	PCM	--	--
SR5820P	SM OX MANF C PRESS	17	PCM	--	--
SR5822P	SM FU MANF C PRESS	14	PCM	SEL MTR	C&W
SR9416T	PSM QD C FEED LINE BRKT TEMP	5	PCM	--	--

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

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

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

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

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

A. V4S - CURRENT LIMITER BOX S28A7.

MEAS ID	MEAS DESCRIPTION	FUSE NO.*	PCM	DISPLAY	C&W
SC2090T	FC 1 RAD IN TEMP	13	PCM	--	--
SP0006P	FU TK PRESS	14	PCM	MTR	C&W
SP0023H	FU/OX VLV 2 POS	22 (4)	PCM	--	--
SP0025H	FU/OX VLV 4 POS	22 (4)	PCM	--	--
SP0026H	FU/OX VLV 1 POS	22 (4)	--	MTR	--
SP0028H	FU/OX VLV 3 POS	22 (4)	--	MTR	--
SP0035P	He TK PRESS	8	--	MTR	--
SP0049T	ENG OX FEED LINE TEMP	18	PCM	SEL MTR	--
SP0601P	ENG VLV ACT PRESS N2B	14	PCM	MTR	--
SP0931P	OX SM/ENG INTERFACE PRESS	3	PCM	--	--
SP9014T	OX SUMP TK AFT DOME TEMP	20	PCM	--	--
SP9017T	SPS He PRESS PANEL TEMP	11	PCM	SEL MTR	--
SP9027T	SPS He TK UPPER SURF TEMP	5	PCM	--	--
	SM RCS QUAD B CURRENT LIMITER S28A10	28 (9)			
	SM RCS QUAD D CURRENT LIMITER S28A10	29 (9)			

B. V4S - CURRENT LIMITER BOX S28A12.

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

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

MEAS ID	MEAS DESCRIPTION	FUSE NO.*	PCM	DISPLAY	C&W
SR5002P	SM He TK B PRESS	1	PCM	SEL MTR	--
SR5014T	SM He TK B TEMP	10	PCM	SEL MTR	--
SR5026Q	SM RCS B PROP QTY	7	PCM	SEL MTR	--
SR5066T	SM ENG PKG B TEMP	11	PCM	SEL MTR	C&W
SR5074T	SM PRI FU TK B OUT SURF TEMP	15	PCM	--	--
SR5776P	SM He MANF B PRESS	12	PCM	--	--
SR5780P	SM OX MANF B PRESS	17	PCM	--	--
SR5784P	SM FU MANF B PRESS	14	PCM	SEL MTR	C&W
SR9316T	PSM QD B FEED LINE BRKT TEMP	5	PCM	--	--

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

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

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

MEAS ID	MEAS DESCRIPTION	FUSE NO.*	PCM	DISPLAY	C&W
SR5004P	SM He TK D PRESS	1	PCM	SEL MTR	--
SR5016T	SM He TK D TEMP	10	PCM	SEL MTR	--
SR5028Q	SM RCS D PROP QTY	7	PCM	SEL MTR	--
SR5068T	SM ENG PKG D TEMP	11	PCM	SEL MTR	C&W
SR5076T	SM PRI FU TK D OUT SURF TEMP	15	PCM	--	--
SR5821P	SM OX MANF D PRESS	17	PCM	--	--
SR5823P	SM FU MANF D PRESS	14	PCM	SEL MTR	C&W
SR5830P	SM He MANF D PRESS	12	PCM	--	--
SR9516T	PSM QD D FEED LINE BRKT TEMP	5	PCM	--	--

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

TABLE 7-4 INSTRUMENTATION - DM POWER DISTRIBUTION

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

A. VIDMA - CURRENT LIMITER BOX D28A1.

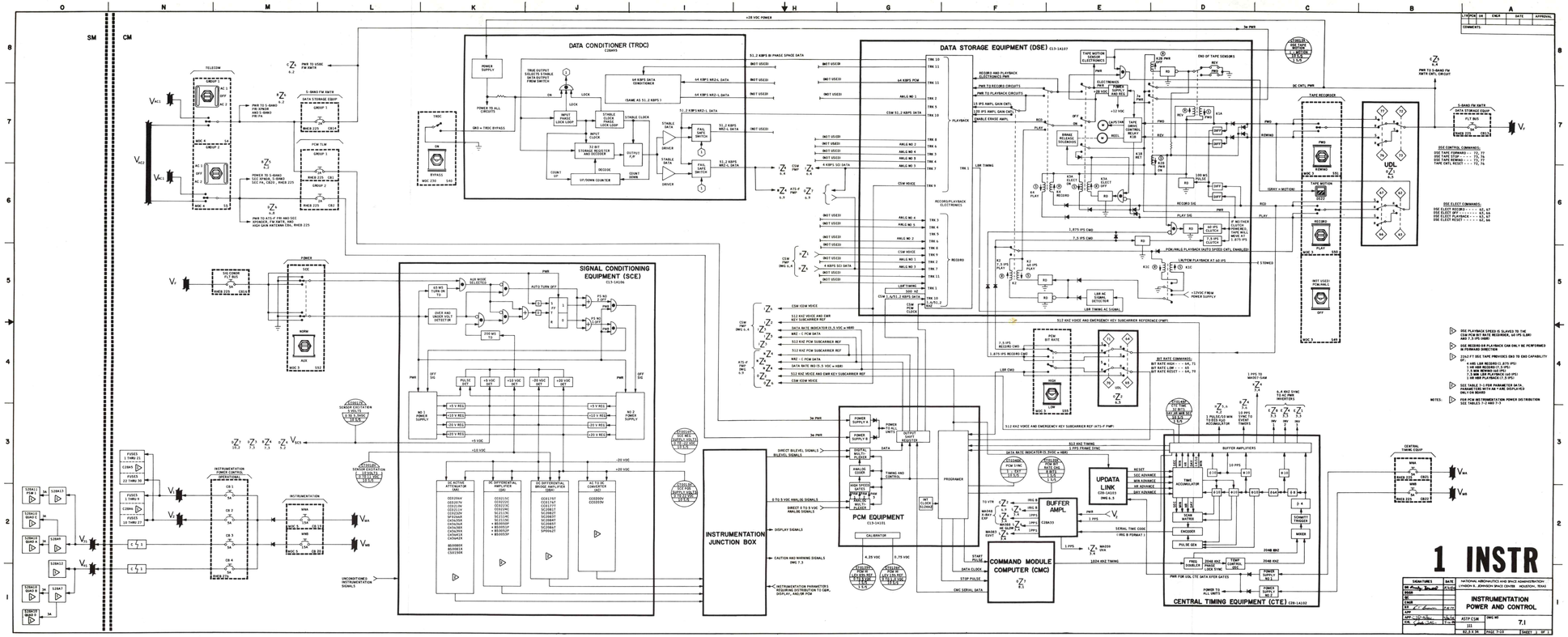
MEAS ID	MEAS DESCRIPTION	FUSE NO.*	CM DISPLAY	PCM	DM DISPLAY	DM C&W	
DF9601T	DM CABIN TEMP	1	--	--	MTR	--	
DF9602T	DM CABIN INNER WALL TEMP 1	9	--	PCM	--	--	P-1
DF9603T	DM CABIN INNER WALL TEMP 2	5	--	PCM	--	--	P-1
DF9605P	DM CABIN PRESS	7	SEL MTR	PCM	MTR	--	
DF9615P	DM SYS A O2 PP	4	SEL MTR	PCM	MTR	C&W	
DF9620P	DM CO2 PP	25	--	--	MTR	--	
DF9632Q	DM SYS A O2 TK 1 QTY	15	SEL MTR	PCM	--	--	
DF9637Q	DM SYS A O2 TK 2 QTY	17	SEL MTR	PCM	--	--	
DF9640X	DM O2 FLOW HIGH	19	--	--	--	C&W	
DF9652Q	DM SYS A N2 TK 1 QTY	12	SEL MTR	PCM	--	--	
DF9657Q	DM SYS A N2 TK 2 QTY	11	SEL MTR	PCM	--	--	
DL9609P	MA010 FURNACE VENT PRESS	18	--	--	SEL MTR	--	P-1
DS9635S	DS SYS A STRUCT LTCH 1 STRAIN	13(4)	--	--	SEL MTR	--	
DS9637S	DS SYS A STRUCT LTCH 3 STRAIN	13(4)	--	--	SEL MTR	--	
DS9639S	DS SYS A STRUCT LTCH 5 STRAIN	13(4)	--	--	SEL MTR	--	
DS9641S	DS SYS A STRUCT LTCH 7 STRAIN	13(4)	--	--	SEL MTR	--	

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

A. VIDMB - CURRENT LIMITER BOX D28A2.

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

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


SM
CM
DATA CONDITIONER (TRDC) CZ0495
SIGNAL CONDITIONING EQUIPMENT (SCE) CI3-16106
DATA STORAGE EQUIPMENT (DSE) CI3-14107
PCM EQUIPMENT CI3-14105
INSTRUMENTATION JUNCTION BOX
COMMAND MODULE COMPUTER (CMC)
CENTRAL TIMING EQUIPMENT (CTE) CZ8-14102
BUFFER AMPL CZ8A33
UPDATA LINK CZ8-14203
1 INSTR
INSTRUMENTATION POWER AND CONTROL
7.1
TELECOM GROUP 1
TELECOM GROUP 2
S-BAND FM DATA STORAGE EQUIP GROUP 1
S-BAND FM DATA STORAGE EQUIP GROUP 2
PCM TLM GROUP 1
PCM TLM GROUP 2
INSTRUMENTATION (OPERATIONAL)
INSTRUMENTATION (DEVELOPMENTAL)
+28 VDC POWER
51.2 KBPS BI PHASE SPACE DATA
64 KBPS PCM
64 KBPS NRZ-L DATA
51.2 KBPS NRZ-L DATA
51.2 KBPS NRZ-C DATA
4 KBPS SCI DATA
LBR TIMING
LBR TIMING AC SIGNAL
512 KHZ VOICE AND EMERGENCY KEY SUBCARRIER REFERENCE (PWP)
512 KHZ TIMING
1 PPS FRAME SYNC
DATA RATE INDICATOR (5.7VDC = HBR)
DIRECT BILEVEL SIGNALS
0 TO 5 VDC ANALOG SIGNALS
DIRECT 0 TO 5 VDC ANALOG SIGNALS
DISPLAY SIGNALS
CAUTION AND WARNING SIGNALS (IMG 7.3)
INSTRUMENTATION PARAMETERS REQUIRING DISTRIBUTION TO C&W, DISPLAY, AND/OR PCM
UNCONDITIONED INSTRUMENTATION SIGNALS
TAPE MOTION SENSOR ELECTRONICS
END OF TAPE SENSORS
TAPE RECORDER
TAPE MOTION
RECORD AND PLAYBACK ELECTRONICS PWR
PWR TO RECORD CIRCUITS
PWR TO PLAYBACK CIRCUITS
1.875 IPS AMPL GAIN CNTL
120 IPS AMPL GAIN CNTL
ENABLE ERASE AMPL
ERASE RELEASE SOLENOIDS
RECORD SIG
PLAY SIG
1.875 IPS CMD
7.5 IPS CMD
PCM/BILEVEL/PLAYBACK (WITH SPEED CNTL ENABLED)
1.875 IPS RECORD CMD
7.5 IPS RECORD CMD
LBR AC SIGNAL DETECTOR
PCM BIT RATE
BIT RATE COMMANDS:
BIT RATE HIGH - - - 64, 71
BIT RATE LOW - - - 8
BIT RATE RESET - - - 64, 70
DSE CONTROL COMMANDS:
DSE TAPE FORWARD - - - 72, 77
DSE TAPE REVERSE - - - 73, 76
DSE TAPE REWIND - - - 72, 73
TAPE CNTL RESET - - - 72, 76
DSE ELECT COMMANDS:
DSE ELECT RECORD - - - 62, 67
DSE ELECT PLAYBACK - - - 62, 66
DSE ELECT PLAYBACK - - - 62, 64
DSE ELECT RESET - - - 62, 64
DSE PLAYBACK SPEED IS SLAVED TO THE CSM PCM BIT RATE RECORDER, 60 IPS (LBR) AND 7.5 IPS (HBR)
DSE RECORD OR PLAYBACK CAN ONLY BE PERFORMED IN FORWARD DIRECTION
22ND PT DSE TAPE PROVIDES END TO END CAPABILITY FOR:
4 HBR LBR RECORD (1.875 IPS)
1 HR HBR RECORD (7.5 IPS)
1 HR HBR PLAYBACK
7.5 MIN LBR PLAYBACK (60 IPS)
1 HR HBR PLAYBACK (7.5 IPS)
SEE TABLE 7-I PCM PARAMETER DATA, PARAMETERS WITH AN F ARE DISPLAYED FROM DSE
SEE PCM INSTRUMENTATION POWER DISTRIBUTION SEE TABLES 7-J AND 7-T
NOTES:
SEQUENCE SUMMER SYSTEM
SEQUENCE SUMMER SYSTEM (OPERATIONAL)
SEQUENCE SUMMER SYSTEM (DEVELOPMENTAL)
SEQUENCE SUMMER SYSTEM
SEQUENCE SUMMER SYSTEM
SEQUENCE SUMMER SYSTEM

7.2 PCM EQUIPMENT (51.2 KBPS) SYSTEM NOTES.

7.2.1 General Description.

The PCM equipment consists of a programer, an analog multiplexer, an analog coder, a digital multiplexer, and an output shift register. The programer maintains primary control of all functioning units and may be commanded to operate in a high bit rate (51.2 KBPS) format or a low bit rate (1.6 KBPS) format.

7.2.2 Programer Timing.

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

7.2.3 Backup Circuits.

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

7.2.4 Formats.

The programer may be commanded to operate in a high bit rate (51.2 KBPS) format or a low bit rate (1.6 KBPS) format as shown on drawing 7.2. The format ID word will indicate a requested format change one subframe prior to the actual format change.

7.2.4.1 High bit rate format.

In HBR, all input parameter gates will be sampled at least once during a data cycle at sampling rates from 1 S/S to 200 S/S.

7.2.4.2 Low bit rate format.

In LBR, only selected input parameter gates will be sampled at 1 S/S with both the command module computer gate (51DS1) and UDL validity gate (51DP2) being sampled at 10 S/S.

7.2.5 Parameter Capabilities.

PCM equipment parameter capabilities, both HBR and LBR, are listed in Table 7-5.

7.2.6 Operating Characteristics.

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

TABLE 7-5 PCM EQUIPMENT PARAMETER CAPABILITIES

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

TABLE 7-6 PCM EQUIPMENT OPERATING CHARACTERISTICS

ITEM NO.	ITEM DESCRIPTION	FUNCTION OR VALUE
1.	WEIGHT	40 LBS MAX
2.	POWER	21 WATTS AC MAX
3.	INPUT VOLTAGE	115 VAC, 3-PHASE, 400 Hz
4.	OPERATING TEMP	32 TO 135 DEG F
5.	WARMUP TIME	10 SEC
6.	EXTERNAL CLOCK AND SUBFRAME SYNC	
	EXTERNAL CLOCK FREQ (FROM CTE)	512 KHz
	SUBFRAME SYNC PRR	1 PPS
	PULSE VOLTAGE	3 ± 0.5 VOLTS
	INTERPULSE VOLTAGE	0 TO 0.2 VOLTS
7.	GSE POWER INPUT (FOR PCM RZ OUTPUT)	
	VOLTAGE	11 ± 0.3 VOLTS
	CURRENT	400 MA MAX
8.	DATA INPUTS	
8.1	ANALOG	
	MAX VOLTAGE RANGE	-1 TO +16 VOLTS
	DATA VOLTAGE RANGE	0 TO 5 VOLTS
	SOURCE IMPEDANCE	5K OHMS MAX
	SAMPLING IMPEDANCE	1 MEGOHM MIN
	NON-SAMPLING IMPEDANCE	50 MEGOHM MIN
	UNUSED INPUTS	NORMALLY GROUNDED
8.2	ANALOG ENCODING (8-BITS)	
	ZERO OR LESS VOLTS	00000001
	5.00 OR GREATER VOLTS	11111110
	NO EXTERNAL CONNECTION	RANDOM OUTPUT
	ACCURACY	±2 COUNTS
	OUTPUT SEQUENCE	MSB FIRST
8.3	PARALLEL DIGITAL	
	MAX VOLTAGE RANGE	-2 TO +32 VOLTS
	LOGIC ONE	4.0 TO 10.0 VOLTS
	LOGIC ZERO	0 ± 0.5 VDC
	SOURCE IMPEDANCE	5K OHMS MAX
	NO CONNECTION	LOGIC ONE
	UNUSED INPUTS	NORMALLY OPEN

TABLE 7-6 PCM EQUIPMENT OPERATING CHARACTERISTICS - CONCLUDED

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

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

7.3.1 Column 1 - "MEAS ID/FTNOTE".

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

A. Module Code.

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

A - adapter

B - booster

C - command module

D - docking module

L - launch escape tower

S - service module.

B. Functional Subsystem Code.

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

A - structures

C - electrical power

D - master events sequence controller

E - earth landing sequence controller

F - environment control

G - guidance & navigation

H - stabilization control

J - crew equipment

K - flight technology

L - scientific equipment

P - service propulsion

R - reaction control

S - L/V emergency detection

T - communication and instrumentation

C. Discrete Number.

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

D. Measurement Classification.

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

A - acceleration

B - phase

C - current

D - vibration

E - power

F - frequency

G - force

H - position/attitude

J - biomedical

K - radiation

L - velocity

M - mass

N - camera/resistance

P - pressure

Q - Quantity

R - rate

S - strain

T - temperature

U - undefined

V - voltage

W - time

X - discrete event

Y - accoustical

Z - pH, acidity.

7.3.2 Column 2 - "MEAS DESCRIPTION".

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

7.3.3 Column 3 - "TM".

The telemetry column contains an alpha character and a numeral.

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

H - high level analog (0 to 5 VDC).

E - event (one bit).

D - digital word (more than one bit).

S - serial digital word (more than one bit).

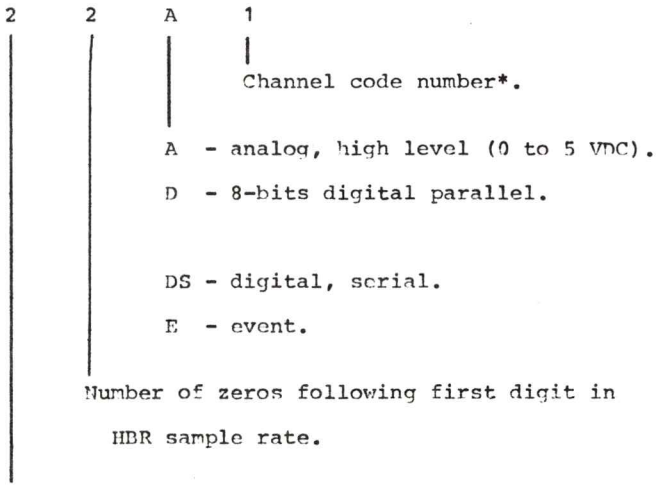
B. The numeric character indicates the telemetry format as follows:

1 - HBR format only.

2 - HBR and LBR formats.

7.3.4 Column 4 - "CHAN CODE".

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



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

7.3.5 Column 5 - "HBR FR-WD".

This column, consisting of a two digit number, a hyphen, and a three digit number, designates the high bit rate frame and word location of the first sample of the parameter.

7.3.6 Column 6 - "LBR WD".

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

7.3.7 Column 7 - "DATA RANGE".

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

7.3.8 Column 8 - "INST BUS".

A. The instrumentation bus column will indicate the power source for a parameter. Some measurements are sensed and/or signal conditioned within a particular system using that systems' power and will be indicated by "SYS".

B. The instrumentation system distributes +28 VDC power directly to certain sensors and signal conditioners. These instrumentation power buses are listed in paragraph 1.8.5.3 of this document and are designated as follows:

V1 - CM ESS INST BUS PWR FROM RHEB PNL 276, CB 1.
V2 - CM ESS INST BUS PWR FROM RHEB PNL 276, CB 2.
V3S - SM ESS INST BUS PWR FROM RHEB PNL 276, CB 3.
V4S - SM ESS INST BUS PWR FROM RHEB PNL 276, CB 4.
VSC - SCE PWR REQUIRED FOR SIGNAL CONDITIONING (+20, -20, and/or +10 VDC).
VIDMA - DM INST BUS PWR FROM DM PNL 815, CB INSTRUMENTATION DM A.
VIDMB - DM INST BUS PWR FROM DM PNL 815, CB INSTRUMENTATION DM B.

7.3.9 Column 9 - "O/B DISPL".

The following acronyms indicate the type of onboard display used for parameters that appear both onboard and in the PCM bit stream. Parameters displayed in the docking module will be listed in the DM column. Parameters displayed in the command module will be listed in the CM column.

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

M - displayed on meter.

SM - displayed on selectable meter.

L - displayed on lamp indicator.

TB - displayed on talk back (Flag).

STB - displayed on selectable talk back (Flag).

SMB - displayed on selectable meter and talk back.

7.3.10 Column 10 - "SIG DIST".

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

CS - common signal drives display and PCM.

SS - separate signal drives display and PCM.

TSC - common sensor, but PCM is signal conditioned.

7.3.11 Column 11 - "CSH DWG".

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

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

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

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

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

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

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

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

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

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

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

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

MEAS ID /FTNOTE	MEAS DESCRIPTION	T'M	CHAN CODE	HBR FR-WD	LBR WD	DATA RANGE LO	DATA RANGE HI	UNITS	INST BUS	C/B DM	DISPL CM	SIG DIST	CSH DWG
CF0001P	CABIN PRESS	H2	10A6	02-116	057	0	17	PSIA	SYS	--	M	CS	4.2
CF0002T	CABIN TEMP	H1	10A128	43-084	--	40	125	DEG F	SYS	--	M	CS	4.3
CF0003P	SUIT-CABIN DELTA PRESS	H1	11A37	02-009	--	-5	+5	IN H2O	V2	--	M	CS	4.2
CF0005P	CO2 PARTIAL PRESS	H1	11A15	01-057	--	0	30	MM HG	SYS	--	M*	SS	4.2
CF0006P	SURGE TANK PRESS	H2	11A4	01-012	008	50	1050	PSIA	V2	--	SM	CS	4.2
CF0008T	SUIT AIR HX OUT TEMP	H1	11A17	01-059	--	20	95	DEG F	SYS	--	M	CS	4.2
CF0009Q	WASTE H2O QTY	H2	10A9	03-116	097	0	100	PCT	SYS	--	SM	CS	4.5
CF0010Q	POTABLE H2O QTY	H1	10A103	35-053	--	0	100	PCT	SYS	--	SM	CS	4.5
CF0012P	SUIT MANF ABS PRESS	H2	11A1	01-009	005	0	17	PSIA	SYS	--	M	CS	4.2
CF0015P	SUIT COMP DELTA P	H2	11A2	01-010	006	0	1	PSID	SYS	--	M*	CS	4.2
CF0016P	GLY PUMP OUT PRESS	H2	11A3	01-011	007	0	60	PSIG	SYS	--	SM	CS	4.3
CF0017T	GLY EVAP OUT STEAM TEMP	H1	10A133	45-052	--	20	95	DEG F	SYS	--	--	--	4.3
CF0018T	GLY EVAP OUT TEMP	H2	10A12	04-116	137	25	75	DEG F	SYS	--	SM	CS	4.3
CF0019Q	GLY ACCUM QTY	H1	11A7	01-026	--	0	100	PCT	SYS	--	SM	CS	4.3
CF0020T	ECS RAD OUT TEMP	H2	10A15	05-116	177	-50	+100	DEG F	SYS	--	M*	CS	4.3
CF0034P	GLY EVAP BACK PRESS	H1	10A4	02-052	--	0.05	0.25	PSIA	SYS	--	SM	CS	4.3
CF0035R	ECS O2 FLOW O2 SUPPLY MANF	H2	10A114	38-116	120	0.2	1.0	LB/HR	SYS	--	M*	CS	4.2
CF0036P	O2 SUPPLY MANF PRESS	H2	11A55	02-073	145	0	150	PSIG	SYS	--	--	--	4.2
CF0070P	SEC GLY PUMP OUT PRESS	H2	11A157	05-044	128	0	60	PSIG	SYS	--	SM	CS	4.4
CF0071T	SEC EVAP OUT LIQ TEMP	H2	11A118	04-041	105	25	75	DEG F	SYS	--	SM	CS	4.4
CF0072Q	SEC GLY ACCUM QUANTITY	H1	11A44	02-027	--	0	100	PCT	SYS	--	SM	CS	4.4
CF0073P	SEC EVAP OUT STEAM PRESS	H1	10A8	03-084	--	0.05	0.25	PSIA	SYS	--	SM	CS	4.4
CF0120P	H2O TANK - GLY RES PRESS	H1	10A101	34-084	--	0	50	PSIA	V2	--	--	--	4.2
CF0157R	PRI GLYCOL FLOW RATE	H1	11A87	03-057	--	100	300	LB/HR	V2	--	--	--	4.3
CF0181T	PRI EVAP INLET TEMP	H1	10A100	34-052	--	35	100	DEG F	V2	--	--	--	4.3
SF0260T	PRI RAD IN TEMP	H2	10A48	16-116	020	55	120	DEG F	SYS	--	SM	CS	4.3
SF0262T	SEC RAD IN TEMP	H1	11A19	01-073	--	55	120	DEG F	SYS	--	SM	CS	4.4
SF0263T	SEC RAD OUT TEMP	H1	10A5	02-084	--	30	70	DEG F	SYS	--	M	CS	4.4
SF0266X	RAD FLOW CONT SYS 1 OR 2	E2	11E4-8	01-098	041	OFF/1	SYS 2	EVENT	VSC	--	TB	TSC	4.3
CF0460T	URINE DUMP NOZZLE TEMP	H1	11A14	01-049	--	0	100	DEG F	V2	--	--	--	4.5
CF0461T	H2O DUMP TEMP	H1	10A82	28-052	--	0	100	DEG F	V1	--	--	--	4.5
DF9602T	DM CABIN INNER WALL TEMP 1	H2	10A105	35-116	199	0	150	DEG F	VIDMA	--	--	--	4.6
DF9603T	DM CABIN INNER WALL TEMP 2	H2	10A54	18-116	100	0	150	DEG F	VIDMA	--	--	--	4.6
DF9605P	DM CABIN PRESS	H2	11A154	05-041	125	0	880	MM HG	VIDMA	M	SM	CS	4.6
DF9615P	DM SYS A O2 PARTIAL PRESS	H2	10A3	01-116	017	0	500	MM HG	VIDMA	M*	SM	CS	4.6
DF9616P	DM SYS B O2 PARTIAL PRESS	H2	10A60	20-116	180	0	500	MM HG	VIDMB	M*	SM	CS	4.6
DF9632Q	DM SYS A O2 TK 1 QTY	H2	10A45	15-116	179	0	100	PCT	VIDMA	--	SM	CS	4.6
DF9637Q	DM SYS A O2 TK 2 QTY	H2	11A119	04-042	106	0	100	PCT	VIDMA	--	SM	CS	4.6
DF9652Q	DM SYS A N2 TK 1 QTY	H2	10A87	29-116	158	0	100	PCT	VIDMA	--	SM	CS	4.6
DF9657Q	DM SYS A N2 TK 2 QTY	H2	11A148	05-012	064	0	100	PCT	VIDMA	--	SM	CS	4.6

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

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

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

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

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

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

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

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

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

MEAS ID /FTNOTE	MEAS DESCRIPTION	TM	CHAN CODE	HBR FR-WD	LBR WD	DATA RANGE LO	DATA RANGE HI	UNITS	INST BUS	O/B DM	DISPL CM	SIG DIST	CSH DWG	
CK0026A	CM X AXIS ACCEL	H1	12A9	01-045	--	-2	+10	G	V2	--	--	--		P-1
CK0027A	CM Y AXIS ACCEL	H1	12A11	01-047	--	-2	+2	G	V2	--	--	--		P-1
CK0028A	CM -Z AXIS ACCEL	H1	12A12	01-048	--	-2	+2	G	V2	--	--	--		P-1
CK1040X/1	16MM DAC SHUTTER OPEN	H1	51A3 AND 51A10	01-031 01-095	-- --		OPEN	EVENT	SYS	--	--	--		
CK1043X/1	70MM CAMERA SHUTTER OPEN	H1	51A3 AND 51A10	01-031 01-095	-- --		OPEN	EVENT	SYS	--	--	--		P-1

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

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

MEAS ID /FTNOTE	MEAS DESCRIPTION	TM	CHAN CODE	HBR FR-WD	LBR WD	DATA RANGE LO	DATA RANGE HI	UNITS	INST BUS	O/B DM	DISPL CM	SIG DIST	CSH DWG	
SL1003U	SCI EXP 3	H1	10A104	35-084	--	PROVISIONED FOR								
SL1004U	SCI EXP 4	H1	10A106	36-052	--	PROVISIONED FOR								
SL1005U	SCI EXP 5	H1	10A107	36-084	--	PROVISIONED FOR								
SL1006U	SCI EXP 6	H1	10A109	37-052	--	PROVISIONED FOR								
SL1007U	SCI EXP 7	H1	10A110	37-084	--	PROVISIONED FOR								
SL1008U	SCI EXP 8	H1	10A112	38-052	--	PROVISIONED FOR								
SL1009U	SCI EXP 9	H1	10A113	38-084	--	PROVISIONED FOR								
SL1010U	SCI EXP 10	H1	10A115	39-052	--	PROVISIONED FOR								
S11011U	SCI EXP 11	H1	10A116	39-084	--	PROVISIONED FOR								
SL1012U	SCI EXP 12	H1	10A118	40-052	--	PROVISIONED FOR								
SL1013U	SCI EXP 13	H1	10A119	40-084	--	PROVISIONED FOR								
SL1014U	SCI EXP 14	H1	10A121	41-052	--	PROVISIONED FOR								
SL1015U	SCI EXP 15	H1	10A122	41-084	--	PROVISIONED FOR								
SL1016U	SCI EXP 16	D2	11D16	03-068	142	PROVISIONED FOR								
SL1017U	SCI EXP 17	D2	11D3	01-097	035	PROVISIONED FOR								
SL1018U	SCI EXP 18	D2	11D5	01-099	042	PROVISIONED FOR								
SL1021U	SCI EXP 21	D2	11D10	02-097	082	PROVISIONED FOR								
SL1022U	SCI EXP 22	D2	11D11	02-098	083	PROVISIONED FOR								
SL1023U	SCI EXP 23	D2	11D12	02-099	084	PROVISIONED FOR								
DL9601T/1	MEFS HOT 1	H1	11A174	05-107	--	0	1200	DEG C	SYS	--	--	--		P-1
DL9602T/1	MEFS COLD 1	H1	11A175	05-108	--	0	200	DEG C	SYS	--	--	--		
SL9606V	EUVT DAC REGISTER	H1	11A99	03-092	--	0	5	VDC	SYS	--	--	--		
SL9607C	EUVT SYSTEM CURRENT	H1	11A100	03-105	--	0	1	AMP	SYS	--	--	--		
SL9608K	EUVT NO. 1 DETECTOR	H1	11A97	03-090	--	1	100K	C/SEC	SYS	--	--	--		
SL9609K	EUVT NO. 2 DETECTOR	H1	11A98	03-091	--	1	100K	C/SEC	SYS	--	--	--		
SL9610P	He GLOW DETECTOR TANK PRESS	H1	11A101	03-106	--	0	1200	PSIG	SYS	--	--	--		
SL9611T	He GLOW TEMP	H1	11A102	03-107	--	0	150	DEG F	SYS	--	--	--		
SL9612P	He GLOW FILTER CELL 1 PRESS	H1	11A103	03-108	--	.1	10	TORR	SYS	--	--	--		P-1
SL9613C	He GLOW SYSTEM CURRENT	H1	11A104	03-113	--	0	.18	AMP	SYS	--	--	--		
SL9614P	He GLOW FILTER CELL 2 PRESS	H1	11A113	04-017	--	.1	10	TORR	SYS	--	--	--		
SL9615K	He GLOW DETECTOR 1 RATE	H1	11A105	03-121	--	1	100K	C/SEC	SYS	--	--	--		
SL9616K	He GLOW DETECTOR 2 RATE	H1	11A106	03-122	--	1	100K	C/SEC	SYS	--	--	--		
SL9617K	He GLOW DETECTOR 3 RATE	H1	11A107	03-123	--	1	100K	C/SEC	SYS	--	--	--		
SL9618K	He GLOW DETECTOR 4 RATE	H1	11A108	03-124	--	1	100K	C/SEC	SYS	--	--	--		

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

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

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

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

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

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

TABLE 7-17 CSM PCM TELEMETRY (51.2 KBPS) - SERVICE PROPULSION.

MEAS ID /FTNOTE	MEAS DESCRIPTION	TM	CHAN CODE	HBR FR-WD	LBR WD	DATA RANGE LO	DATA RANGE HI	UNITS	INST BUS	O/B DISPL DM	O/B DISPL CM	SIG DIST	CSH DWG
SP0001P	He TK PRESS	H2	11A10	01-041	065	0	5K	PSIA	V3S	--	M	SS	9.1
SP0003P	OX TK PRESS	H2	11A11	01-042	066	0	250	PSIA	V3S	--	M*	CS	9.1
SP0006P	FU TK PRESS	H2	11A12	01-043	067	0	250	PSIA	V4S	--	M*	CS	9.1
SP0022H	FU/OX VLV 1 POS	H1	11A31	01-108	--	0	90	DEG	V3S	--	M	SS	9.1
SP0023H	FU/OX VLV 2 POS	H1	11A32	01-113	--	0	90	DEG	V4S	--	M	SS	9.1
SP0024H	FU/OX VLV 3 POS	H1	11A33	01-121	--	0	90	DEG	V3S	--	M	SS	9.1
SP0025H	FU/OX VLV 4 POS	H1	11A34	01-122	--	0	90	DEG	V4S	--	M	SS	9.1
SP0045T	ENG VLV BODY TEMP	H1	10A37	13-052	--	0	200	DEG F	V4S	--	--	--	9.1
SP0048T	ENG FU FEED LINE TEMP	H2	10A117	39-116	160	0	200	DEG F	V3S	--	M	--	9.1
SP0049T	ENG OX FEED LINE TEMP	H2	10A120	40-116	200	0	200	DEG F	V4S	--	SM	CS	9.1
SP0054T	OX LINE 1 TEMP	H1	10A44	15-084	--	0	200	DEG F	V3S	--	--	--	9.1
SP0055T	OX SUMP TK SURF TEMP	H1	10A61	21-052	--	0	150	DEG F	V3S	--	--	--	9.1
SP0056T	FU SUMP TK SURF TEMP	H1	10A60	23-084	--	0	150	DEG F	V3S	--	--	--	9.1
SP0057T	FU LINE 1 TEMP	H1	10A59	20-084	--	0	200	DEG F	V4S	--	--	--	9.1
SP0062T	ENG INJECTOR FLANGE TEMP 2	H1	10A49	17-052	--	0	600	DEG F	VSC	--	--	--	9.1
SP0600P	ENG VLV ACT PRESS N2A	H1	10A10	04-052	--	0	5K	PSIA	V3S	--	M	CS	9.1
SP0601P	ENG VLV ACT PRESS N2B	H1	10A11	04-084	--	0	5K	PSIA	V4S	--	M	CS	9.1
SP0661P	ENG CHAMBER PRESS	H1	12A14	01-054	--	0	150	PSIA	V3S	--	M	CS	9.1
SP0930P	FU SM/ENG INTERFACE PRESS	H1	11A152	05-027	--	0	300	PSIA	V3S	--	--	--	9.1
SP0931P	OX SM/ENG INTERFACE PRESS	H1	11A161	05-059	--	0	300	PSIA	V4S	--	--	--	9.1
SP9007Q/1	OX SUMP TANK QTY - AUX	H1	10A26	09-084	--	0	100	PCT	SYS	--	--	--	
SP9008Q/1	OX SUMP TANK QTY - PRI	H1	10A28	10-052	--	0	60	PCT	SYS	--	--	--	
SP9009Q/1	FU SUMP TANK QTY - AUX	H1	10A29	10-084	--	0	100	PCT	SYS	--	--	--	
SP9010Q/1	FU SUMP TANK QTY - PRI	H1	10A31	11-052	--	0	60	PCT	SYS	--	--	--	
SP9014T	OX SUMP TK OUTBOARD TEMP	H1	10A137	46-084	--	0	150	DEG F	V4S	--	--	--	9.1
SP9017T	SPS He PRESS PANEL TEMP	H2	10A93	31-116	039	0	200	DEG F	V4S	--	SM	CS	9.1
SP9027T	SPS He TK UPPER SURF TEMP	H1	10A92	31-084	--	-100	+200	DEG F	V4S	--	--	--	9.1

P-1

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

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

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

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

MEAS ID /FTIOTP	MEAS DESCRIPTION	T'M	CHAN CODE	HBR FR-WD	LBR WD	DATA RANGE LO	DATA RANGE HI	UNITS	INST BUS	O/B DISPL DM	O/B DISPL CM	SIG DIST	CSM DWG
SR5822P	SM FU MANF C PRESS	H2	11A111	04-011	047	0	400	PSIA	V3S	--	SM*	CS	10.1
SR5823P	SM FU MANF D PRESS	H2	11A112	04-012	048	0	400	PSIA	V4S	--	SM*	CS	10.1
SR5830P	SM He MANF D PRESS	H1	11A28	01-105	--	0	400	PSIA	V4S	--	--	--	10.1
SR9216T	PSM QD A FEED LINE BRKT TEMP	H2	10A84	28-116	118	0	150	DEG F	V3S	--	--	--	10.1
SR9316T	PSM QD B FEED LINE BRKT TEMP	H2	10A99	33-116	119	0	150	DEG F	V4S	--	--	--	10.1
SR9416T	PSM QD C FEED LINE BRKT TEMP	H2	10A102	34-116	159	0	150	DEG F	V3S	--	--	--	10.1
SR9516T	PSM QD D FEED LINE BRKT TEMP	H2	10A135	45-116	175	0	150	DEG F	V4S	--	--	--	10.1
SR9801Q	PSM 1 PROP QTY	H1	10A23	08-084	--	0	100	PCT	V3S	--	SM	CS	10.2
SR9802T	PSM 1 He TK TEMP	H1	10A25	09-052	--	-50	+150	DEG F	V3S	--	SM	CS	10.2
SR9804P	PSM 1 He TK PRESS	H2	11A47	02-042	086	0	5K	PSIA	V3S	--	SM	CS	10.2
SR9806P	PSM 1 OX TK PRESS	H2	11A49	02-044	088	0	400	PSIA	V3S	--	--	--	10.2
SR9807P	PSM 1 FU TK PRESS	H2	11A120	04-043	107	0	400	PSIA	V3S	--	SM*	CS	10.2
SR9808T	PSM 1 OX TK TEMP	H1	10A34	12-052	--	0	150	DEG F	V3S	--	--	--	10.2
SR9809T	PSM 1 FU TK TEMP	H1	10A35	12-094	--	0	150	DEG F	V3S	--	--	--	10.2

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

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

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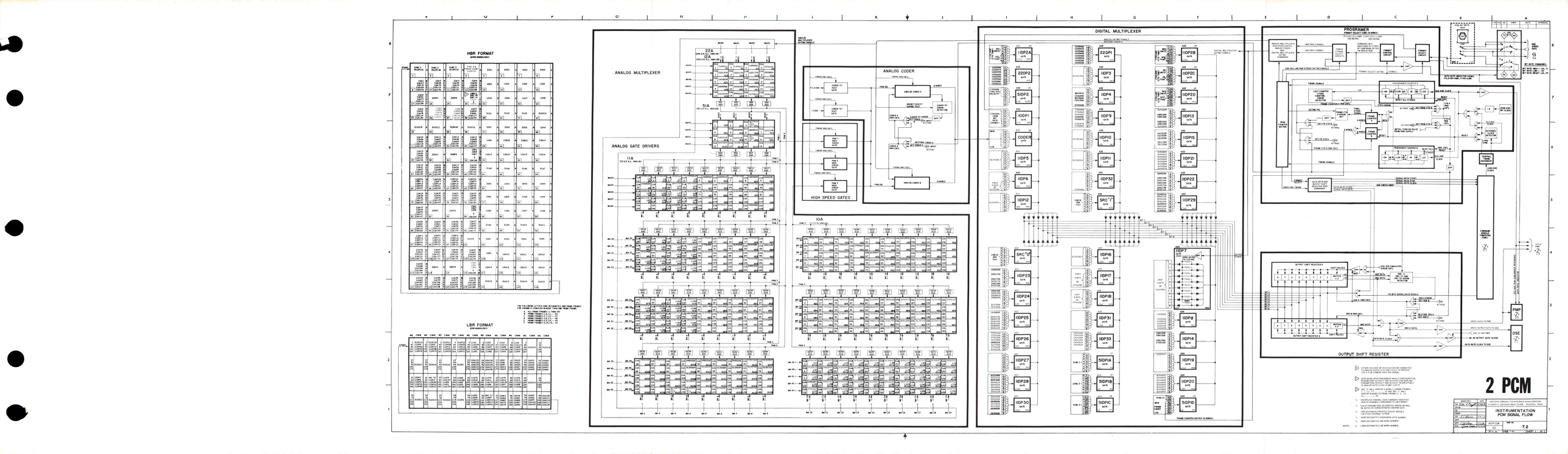
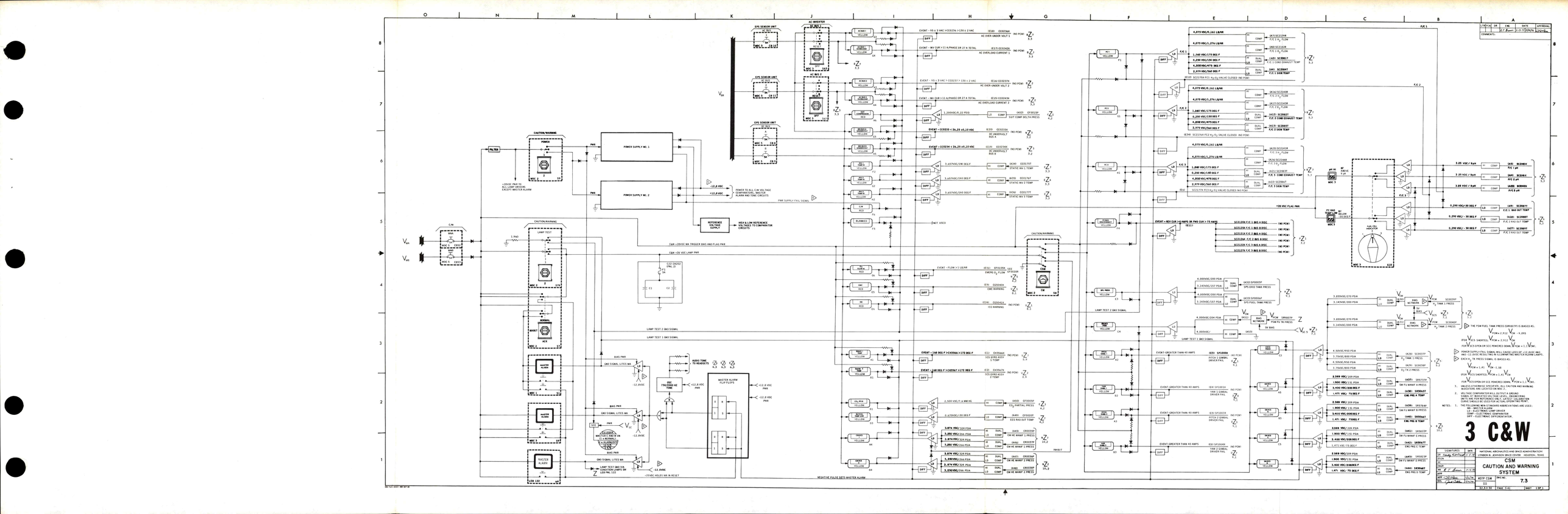
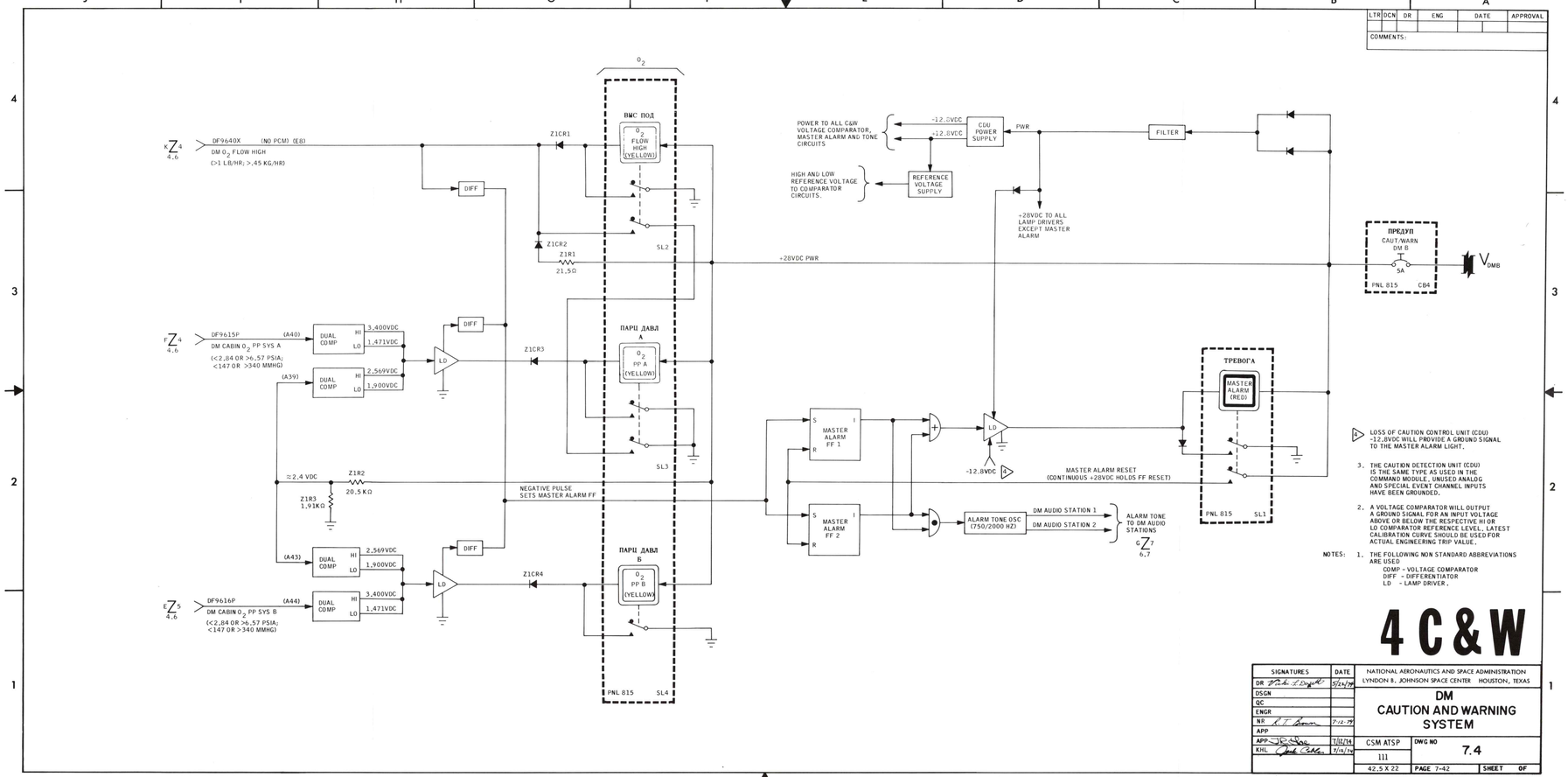
TABLE 7-20 CSM PCM TELEMETRY (51.2 KBPS) - COMMUNICATION AND INSTRUMENTATION.

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

P-1


HBR FORMAT
LBR FORMAT
ANALOG MULTIPLEXER
ANALOG GATE DRIVERS
ANALOG CODER
HIGH SPEED GATES
DIGITAL MULTIPLEXER
PROGRAMER
OUTPUT SHIFT REGISTER
2 PCM
INSTRUMENTATION
PCM SIGNAL FLOW


3 C&W
CSM CAUTION AND WARNING SYSTEM
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
ASTP CSM
7.3
CAUTION/WARNING POWER
POWER SUPPLY NO. 1
POWER SUPPLY NO. 2
LAMP TEST
MASTER ALARM
MASTER ALARM
MASTER ALARM
AUDIO TONE TO HEADSETS
MASTER ALARM FLIP FLOPS
REFERENCE VOLTAGE SUPPLY
C/W
CAUTION/WARNING
EPS SENSOR UNIT NO. 1
EPS SENSOR UNIT NO. 2
EPS SENSOR UNIT NO. 3
AC INVERTER NO. 1
AC INVERTER NO. 2
EVENT - 5% ± 3 VAC > CCO2376 >130 ± 2 VAC
EVENT - INV CUR >11 A/PHASE OR 27 A TOTAL
EVENT = CCO2370 < 26.25 ±0.10 VDC
EVENT = CCO2374 < 26.25 ±0.10 VDC
EVENT - FLOW >1 LB/HR
EVENT = 148 DEG F >CH3968.3 <172 DEG F
EVENT = 148 DEG F >CH3967 >172 DEG F
2,500 VDC/7.4 MM HG
0.670VDC/50 DEG F
3,874 VDC/324 PSIA
3,350VDC/324 PSIA
LAMP TEST 1 GKO SIGNAL
LAMP TEST 2 GKO SIGNAL
C/W +28VDC MN TRIGGER BIAS AND FLAG PWR
C/W +28 VDC LAMP PWR
NEGATIVE PULSE SETS MASTER ALARM
+28VDC PWR TO ALL LAMP DRIVERS, EXCEPT MASTER ALARM
POWER TO ALL C/W VOLTAGE DISCRIMINATORS, MASTER ALARM AND TONE CIRCUITS
PWR SUPPLY FAIL SIGNAL
HIGH & LOW REFERENCE VOLTAGES TO COMPARATOR CIRCUITS
+28 VDC FLAG PWR
FC RAD BY FLAG YELLOW
SM RCS HELIUM TANK PRESS
SM RCS FUEL TANK PRESS
SPS FUEL TANK PRESS
SPS HELIUM TANK PRESS
SM RCS HELIUM TANK PRESS
SM RCS PROPELLANT TANK PRESS
SM RCS OXIDIZER TANK PRESS
SM RCS FUEL


LTR DCN DR ENG DATE APPROVAL
COMMENTS:
O_2
ВИС ПОД
O_2 FLOW HIGH (YELLOW))
ПАРЦ ДАВЛ A
O_2 PP A (YELLOW)
ПАРЦ ДАВЛ B
O_2 PP B (YELLOW)
PNL 815 SL4
DF9640X (NO PCM) (E8)
DM O_2 FLOW HIGH (>1 LB/HR; >.45 KG/HR)
DF9615P (A40)
DM CABIN O_2 PP SYS A (<2,84 OR >6,57 PSIA; <147 OR >340 MMHG)
DF9616P (A44)
DM CABIN O_2 PP SYS B (<2,84 OR >6,57 PSIA; <147 OR >340 MMHG)
DUAL COMP
HI
LO
3,400VDC
1,471VDC
2,569VDC
1,900VDC
DIFF
LD
Z1CR1
Z1CR2
Z1CR3
Z1CR4
Z1R1 21,5Ω
Z1R2 20,5 KΩ
Z1R3 1,91KΩ
≈2,4 VDC
SL2
SL3
NEGATIVE PULSE SETS MASTER ALARM FF
+28VDC PWR
POWER TO ALL C&W VOLTAGE COMPARATOR, MASTER ALARM AND TONE CIRCUITS
-12.0VDC
+12.0VDC
CDU POWER SUPPLY
PWR
FILTER
HIGH AND LOW REFERENCE VOLTAGE TO COMPARATOR CIRCUITS.
REFERENCE VOLTAGE SUPPLY
+28VDC TO ALL LAMP DRIVERS EXCEPT MASTER ALARM
ПРЕДУП
CAUT/WARN DM B
5A
PNL 815 CB4
V_{DMB}
MASTER ALARM FF 1
MASTER ALARM FF 2
-12.8VDC
MASTER ALARM RESET (CONTINUOUS +28VDC HOLDS FF RESET)
ТРЕВОГА
MASTER ALARM (RED)
PNL 815 SL1
ALARM TONE OSC (750/2000 HZ)
DM AUDIO STATION 1
DM AUDIO STATION 2
ALARM TONE TO DM AUDIO STATIONS
LOSS OF CAUTION CONTROL UNIT (CDU) -12,8VDC WILL PROVIDE A GROUND SIGNAL TO THE MASTER ALARM LIGHT.
3. THE CAUTION DETECTION UNIT (CDU) IS THE SAME TYPE AS USED IN THE COMMAND MODULE, UNUSED ANALOG AND SPECIAL EVENT CHANNEL INPUTS HAVE BEEN GROUNDED.
2. A VOLTAGE COMPARATOR WILL OUTPUT A GROUND SIGNAL FOR AN INPUT VOLTAGE ABOVE OR BELOW THE RESPECTIVE HI OR LO COMPARATOR REFERENCE LEVEL. LATEST CALIBRATION CURVE SHOULD BE USED FOR ACTUAL ENGINEERING TRIP VALUE.
NOTES: 1. THE FOLLOWING NON STANDARD ABBREVIATIONS ARE USED
COMP - VOLTAGE COMPARATOR
DIFF - DIFFERENTIATOR
LD - LAMP DRIVER.
4 C&W
SIGNATURES
DR Mark T. Dwight 5/29/70
DSGN
QC
ENGR
NR R. T. Brown 7-12-70
APP
APP J. Hodge 7/31/74
KHL Clyde Chitty 7/1/74
DATE
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
DM
CAUTION AND WARNING SYSTEM
CSM ATSP
111
DWG NO 7.4
42.5 X 22
PAGE 7-42
SHEET OF

8 GUIDANCE
AND CONTROL
SYSTEM

MISCELLANEOUS G & C INFORMATION

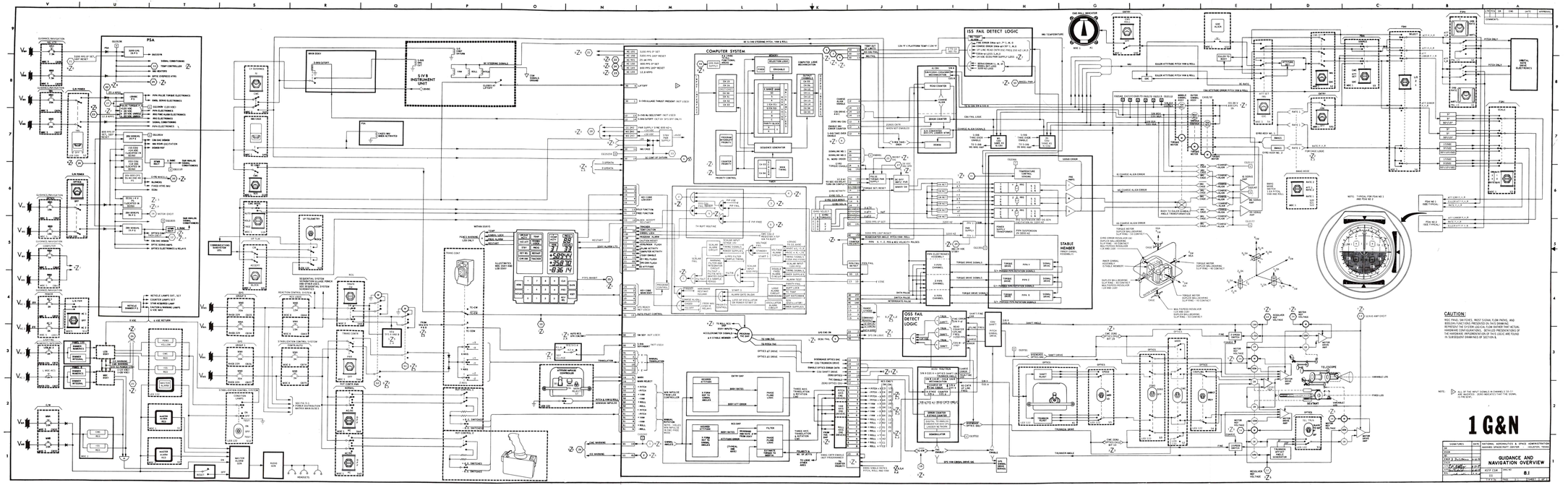
S/C MOTION DESIRED BY THE CREW	GIMBAL THUMB WHEEL POSITION	ENGINE NOZZLE MOVES TOWARDS THE:	THE TRUST VECTOR OF THE ENGINE MOVES TOWARD THE:	GIMBAL POSITION INDICATOR MOVES TO:	ACTUATOR TRAVEL
S/C NOSE DOWN (PITCH) S/C NOSE UP (PITCH) S/C RIGHT (YAW) S/C LEFT (YAW)	+ NUMERAL (UP) - NUMERAL (DOWN) + NUMERAL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

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

ERROR & RATE DEADBAND CONTROL S11 & S12 SCS MODES					
ATT DBND	RATE SW	ATTITUDE DEADBAND	RATE DEADBAND	ROT CONT PROPORTIONAL
S11 MAX	S12	LOW	±5.0°	10.25°/S	±0.65°/S,P,Y,R
		HIGH	±8.0°	±2.0°/S	±20.0°/S ROLL ± 7.5°/S,P,Y
S11 MAX	S12	LOW	±0.5°	10.25°/S	±0.65°/S,P,Y,R
		HIGH	±4.0°	±2.0°/S	±20.0°/S ROLL ± 7.5°/S,P,Y

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

APRON DWG 8.1



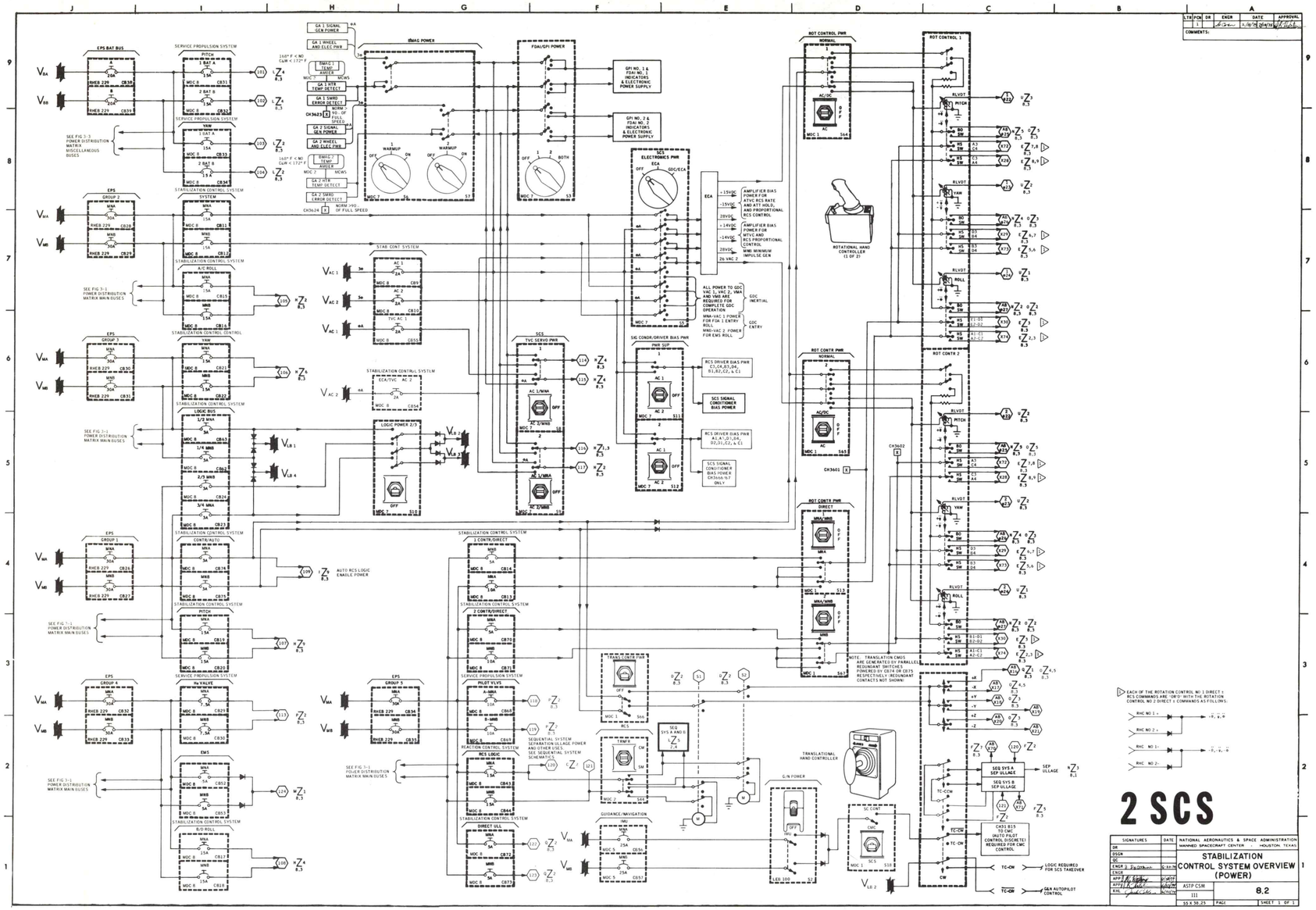
SCS SIGNAL AND POWER CODE

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

CODE	TYPE OF POWER
40	GA2 ac RATE
41	dc RATE
42	ENGINE ON WITH 1 SECOND DELAYED OFF
43	ENGINE ON/OFF 1 SECOND DELAY
44	MODE SELECTED SCS
45	PITCH GYRO UNCAGE
46	YAW GYRO UNCAGE
47	ROLL GYRO UNCAGE
48	SIG COND POWER ±15.0, -2.5 AND -10 Vdc
49	115 V 400 Hz PHASE A
50	MODE SELECTED CMC
51	PITCH AUTO CNTL DISABLE
52	YAW AUTO CNTL DISABLE
53	ROLL AUTO CNTL DISABLE
54	PITCH ACCEL CMD ENABLE
55	YAW ACCEL CMD ENABLE
56	ROLL ACCEL CMD ENABLE
57	DIRECT ULLAGE PITCH JETS
58	DIRECT ULLAGE YAW JETS
59	.05g OFF
60	GDC EULER
61	.05g ON
R	400/800 CPS OUT PHASE FDAI ≈1 RESOLVER SIG DEMOD
S	400/800 CPS OUT PHASE FDAI ≈2 RESOLVER SIG DEMOD
T	FDAI 1 AND 2 PYR RATE DEMOD REF VOLTAGE
62	115 V 400 Hz
63	26 Vac <90°, 400 Hz REACTION
64	A/C ROLL ENGINE POWER CB15 AND CB16, MDC 8
65	B/D ROLL REACTION ENGINE POWER CB17 AND CB18, MDC 8
66	PITCH REACTION ENGINE POWER CB19 AND CB20, MDC 8
67	YAW REACTION ENGINE POWER CB 21 AND CB22, MDC 8
68	REACTION ENGINE SOLENOID DRIVER ENABLE POWER CB74 AND CB75, MDC 8 (AUTO RCS)
69	RCS LOGIC POWER FROM CB34 AND CB35, PNL 229
70	SEQ A SPS THRUST ON LOGIC ENABLE AND SEP ULLAGE
71	SEQ B SPS THRUST ON LOGIC ENABLE AND SEP ULLAGE
72	PITCH DIRECT (A3-C4)
73	YAW DIRECT (B3-D4)
74	ROLL DIRECT (A1-C1, A2-C2)
75	**SIG COND POWER ±15, -2.5 AND -10 Vdc**

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

APRON DWG 8.2



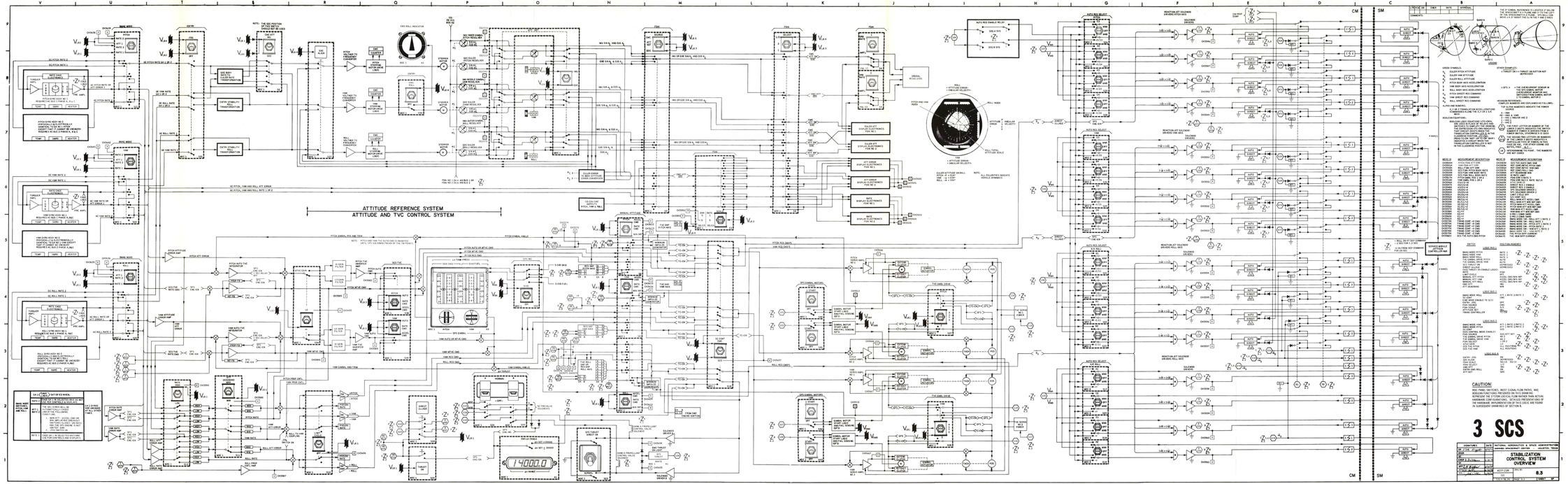

ATTITUDE REFERENCE SYSTEM
ATTITUDE AND TVC CONTROL SYSTEM
3 SCS
STABILIZATION CONTROL SYSTEM OVERVIEW
NATIONAL AERONAUTICS & SPACE ADMINISTRATION
GEORGE C. MARSHALL SPACE FLIGHT CENTER
ASTP-CSM
8.3
CAUTION:
THE INFORMATION PRESENTED ON THIS DRAWING REFLECTS THE LOGIC AS IT EXISTS IN THE ACTIVE HARDWARE CSM CONFIGURING. DETAILED PRESERVATION OF THE HARDWARE IMPLEMENTATION OF THIS LOGIC ARE FOUND IN SUPERSEDED DRAWING LIST SECTION 6.

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

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

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

TABLE 8-II.- CSM ALARM CODES

ALARM CODE (OCTAL)	ACTION	TITLE-DESCRIPTION
00107	RECYCLE PROGRAM AND SELECT A NEW CELESTIAL BODY TO BE ACQUIRED.	STAR TRACKER GIMBAL ANGLES OUT OF LIMITS - IF THE SELECTED CELESTIAL BODY TO BE ACQUIRED BY THE STAR TRACKER RESULTS IN STAR TRACKER GIMBAL ANGLES BEYOND THE LIMITS OF $-87° < \text{OUTER} < +87°$ $-40° < \text{INNER} < +40°$, PROGRAM ALARM WILL BE DISPLAYED.
00110	NONE	NO MARK SINCE LAST MK REJ - THE PROCESS OF MARKING SETS BIT 10 OF MARKSTAT TO ENABLE A MARK REJECT. IF MARKING IS BEING ACCEPTED BY PROGRAM WHEN MARK REJECT IS ACTIVATED, BIT 10 IF MARKSTAT IS FOUND TO BE ZERO. THIS INDICATES NO MARK HAS BEEN MADE WHICH CAN BE REJECTED. PROGRAM ALARM WILL BE DISPLAYED.
00113	DETERMINE IF AN INPUT CHANNEL BIT(S) FAILURE HAS OCCURRED. USE MAIN DSKY IF FAILURE VERIFIED.	NO INBITS - IF A MARKRUPT OR KEYRUPT 2 (SAME RUPT) OCCURS AND THE RUPT ROUTINE DETECTS, BITS 1 THROUGH 7 ARE RESET (I.E., NO KEYCODE, MARK OR MARK REJECT IS PRESENT). PROGRAM ALARM WILL BE DISPLAYED.
00114	SELECT THE DESIRED PROGRAM BEFORE TAKING MARKS, OR TOO MANY MARKS HAVE BEEN MADE. NO OTHER ACTION REQUIRED.	MARK MADE BUT NOT DESIRED - THE PROGRAM USING THE MARK ROUTINE STORES THE NUMBER OF MARKS DESIRED IN BITS 12 THROUGH 14 OF MARKSTAT. IF A MARK IS MADE WITH NO MARKS DESIRED AS INDICATED BY BITS 12 THROUGH 14 = 0, PROGRAM ALARM IS DISPLAYED.
00115	PLACE OPTICS SWITCH TO CMC.	OPTICS TORQUE REQUEST WITH SWITCH NOT AT CMC - OCCURS WHEN AN EXTENDED VERB 41 NOUN 91 IS REQUESTED FOR A COARSE ALIGN OF THE OCDU'S WITH THE OPTICS MODE SWITCH NOT IN THE CMC POSITION. THIS WILL RESULT IN A PROGRAM ALARM DISPLAY.
00116	REZERO THE OPTICS.	OPTICS SWITCH ALTERED BEFORE 15 SEC ZERO TIME ELAPSED - POSITIONING OF THE OPTICS ZERO SWITCH TO THE ZERO POSITION INITIATES A COMPUTER ROUTINE, WHICH HAS A 15 SECOND TIME DELAY TO ALLOW THE OPTICS TO ZERO BEFORE RESET OF THE SHAFT AND TRUNNION COUNTERS. ALTERING OF THE ZERO SWITCH TO THE OFF POSITION PRIOR TO COMPLETION OF THE TIME DELAY RESULTS IN A PROGRAM ALARM DISPLAY.

TABLE 8-II.- CSM ALARM CODES - CONTINUED

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

TABLE 8-II.- CSM ALARM CODES - CONTINUED

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

TABLE 8-II.- CSM ALARM CODES - CONTINUED

ALARM CODE (OCTAL)	ACTION	TITLE-DESCRIPTION
00213	REF MALF. PROCEDURES.	IMU NOT OPERATING WITH TURNON REQUEST - UPON RECEIPT OF A TURNON REQUEST, THE CMC WILL CHECK THE OPERATE BIT (BIT 9 IMODES 30). IF THE OPERATE BIT INDICATES THE IMU IS NOT POWERED UP, A PROGRAM ALARM WILL BE DISPLAYED.
00214	REACTIVATE IMU IF PROGRAM USING IMU IS CRITICAL - OTHERWISE TERMINATE PROGRAM.	PROGRAM USING IMU WHEN TURNED OFF - WHEN THE IMU IS TURNED OFF, AS INDICATED BY BIT 9 IMODES 30, THE CMC CHECKS THE STATUS OF BIT 8 FLAGWORD 0 (IMU IN USE FLAG). IF A PROGRAM HAD BEEN USING THE IMU AND HAD SET THIS BIT, A PROGRAM ALARM WILL BE DISPLAYED.
00217	REF MALF. PROCEDURES.	BAD RETURN FROM STALL ROUTINES - DETECTION BY THE MODE SWITCHING LOGIC OF THE IMU INITIALIZATION BIT (BIT 6 OF IMODES 30) PROVIDES A FLAG FOR THE IMU STALL ROUTINE TO PERFORM AN ERROR RETURN TO THE SLEEPING PROGRAM (PRIMARILY P51 OR P53). THE ERROR RETURN IS TO ROUTINE CURTAINS WHICH CAUSES A PROGRAM ALARM DISPLAY.
00220	REALIGN IMU OR SET REFSMMAT FLAG IF ALIGNMENT IS OK.	IMU NOT ALIGNED (BAD REFSMMAT) - ANY MAJOR PROGRAM WHICH USES THE IMU ATTITUDE INFORMATION AND THE REFSMMAT WILL PERFORM A CHECK WITH ROUTINE R02 BOTH, ON THE REFSMMAT FLAG (BIT 13 OF FLAGWORD 3) AND THE IMU OPERATE BIT (BIT 9 OF IMODES 30), TO INSURE THE IMU IS OPERATING AND THE REFSMMAT IS VALID. THE THRUSTING, ALIGNMENT, AND NAVIGATION PROGRAMS ALL USE THIS INFORMATION; AND, IF THE REFSMMAT IS FOUND INVALID WHILE THE IMU IS OPERATING, A PROGRAM ALARM WILL BE DISPLAYED.
00401	MANEUVER AND REINITIATE PROGRAM TO AVOID GIMBAL LOCK.	DESIRED ANGLES YIELD GIMBAL LOCK - CALCGA COMPUTES DESIRED IMU GIMBAL ANGLES FROM A SET OF N.B. VECTORS AND DESIRED S.M. VECTORS FOR PRELAUNCH AND INFLIGHT ALIGNMENT PROGRAMS. IF THE DESIRED IMU ATTITUDE WILL RESULT IN A MIDDLE GIMBAL ANGLE OF GREATER THAN 60°, GLOK FAIL (BIT 14 OF FLAGWORD 3) IS SET AND PROGRAM ALARM IS DISPLAYED.

TABLE 8-II.- CSM ALARM CODES - CONTINUED

ALARM CODE (OCTAL)	ACTION	TITLE-DESCRIPTION
00402	CREW MUST TORQUE PLATFORM BACK TO PRE-PLANE CHANGE ALIGNMENT.	CREW MUST HONOR 2ND MINKEY TORQUE REQUEST - SET IN P52 DURING RENDEZVOUS SEQUENCE WHEN CREW HAS TORQUED PLATFORM FOR PLANE CHANGE BUT FAILED TO TORQUE BACK TO PRE-PLANE CHANGE ALIGNMENT.
00404	1. TERMINATE, REINITIATE PROGRAM, AND RESELECT A NEW PAIR OF STARS. 2. MANEUVER AND PROCEED WITH RECOMPUTATION OF DESIRED OPTICS ANGLES.	TARGET OUT OF VIEW (A_t > 90 DEG) - IF A SELECTED STAR IS OCCULTED BY EARTH, SUN, MOON OR IF COMPUTATION OF DESIRED TRUNNION ANGLE IS GREATER THEN 90°, THE CULTFLAG (BIT 7 OF FLAGWORD 3) WILL BE SET. PROVIDING THE TARGET BEING SIGHTED IS NOT THE LM, THE OPTICS AUTO-POSITION ROUTINE WILL DISPLAY PROGRAM ALARM AND ERROR CODE 404 WITH AN OPTIONAL CREW RESPONSE REQUIRED.
00405	1. PROCEED WITH SIGHTINGS USING MANUALLY SELECTED STARS. 2. MANEUVER AND RECYCLE THROUGH THE STAR SELECTION ROUTINE.	TWO STARS NOT AVAILABLE - IF THE STAR SELECTION ROUTINE CANNOT FIND TWO STARS WHICH ARE NOT OCCULTED BY THE SUN, EARTH, OR MOON, AND DO NOT HAVE SATISFACTORY ANGLE SEPARATION, TRUNNION DRIVE IS INHIBITED AND PROGRAM ALARM AND ERROR CODE 405 WILL BE DISPLAYED WITH AN OPTIONAL CREW RESPONSE REQUIRED.
00406	ACTIVATE P20 BEFORE REQUESTING SIGHTINGS.	RENDEZVOUS NAVIGATION NOT OPERATING - REQUESTS FOR RENDEZVOUS SIGHTING MARKS (V57, V54) ARE REJECTED IF THE RENDEZVOUS NAVIGATION PROGRAM (P20) IS NOT RUNNING AS INDICATED BY THE RNDVZFLG (FWI BIT 7) AND THE TRACKFLG (FWI BIT 5). IF THE REQUEST IS MADE, A PROGRAM ALARM WILL BE DISPLAYED AND THE REQUEST IS TERMINATED.
00421	1. GROUND UPDATE S.V. 2. PERFORM SUFFICIENT NUMBER OF NAVIGATION MARKS TO REINITIALIZE W-MATRIX AND ELIMINATE S.V. ERROR.	W-MATRIX OVERFLOW - IF, DURING STATE VECTOR UPDATE, THE ORBITAL INTEGRATION PACKAGE DETECTS AN OVERFLOW IN ANY W-MATRIX ELEMENT, AN ERRONEOUS STATE VECTOR WILL RESULT AND A PROGRAM ALARM WILL BE DISPLAYED.

TABLE 8-II.- CSM ALARM CODES - CONTINUED

ALARM CODE (OCTAL)	ACTION	TITLE-DESCRIPTION
00500	PERFORM DOCKED DAP DATA LOAD (R04) ROUTINE TO UNINHIBIT JET REQUIRED TO RESTORE VEHICLE ATTITUDE CONTROL.	NOT ENOUGH JETS IN DOCKED DAP FOR P/Y MANEUVER - THE DOCKED DAP WILL MAINTAIN P/Y ROTATION CONTROL WITH THE JETS AVAILABLE (FORCE OR COUPLE). IF ONE TORQUE COUPLE JET AND BOTH FORCE CONTROL JETS ARE INHIBITED FOR A P/Y COMMAND (REGARDLESS OF WHETHER ROTATION CONTROL PREFERENCE IS TORQUE COUPLE OR FORCE CONTROL), PROGRAM ALARM WILL BE DISPLAYED.
00501	PERFORM DOCKED DAP DATA LOAD (R04) ROUTINE TO UNINHIBIT ROLL JET REQUIRED TO RESTORE VEHICLE ATTITUDE CONTROL.	NOT ENOUGH JETS IN DOCKED DAP FOR ROLL MANEUVER - DOCKED DAP ROLL CONTROL IS ACCOMPLISHED BY UNBALANCING COMMANDED P/Y FORCE JET FIRINGS FOR ROLL COMPENSATION AND BY ROLL TORQUE COUPLES WHEN ROLL COMPENSATION CANNOT BE ACCOMPLISHED. IF ROLL JET INHIBITIONS PRECLUDE ROLL TORQUE COUPLES (REGARDLESS OF ROLL CONTROL PREFERENCE - A/C OR B/D) AND IF ROLL COMPENSATION CANNOT BE ACCOMPLISHED, PROGRAM ALARM WILL BE DISPLAYED.
00600	RECYCLE TO START OF PROGRAM AND ADJUST INPUT PARAMETERS.	FAILURE IN PHASE MATCH ITERATION - IF THE PHASE MATCHING OF THE VEHICLE STATE VECTORS DOES NOT CONVERGE TO A PRESET VALUE (POSSIBLY DUE TO STATE VECTOR ERRORS), PROGRAM ALARM WILL BE DISPLAYED WITH ERROR CODE 600.
00601	RECYCLE AND ADJUST INPUT PARAMETERS FOR NEW SOLUTION.	FAILURE IN HEIGHT MANEUVER ITERATION - IF THE FIRST (NC2) OR SECOND (NCC) HEIGHT MANEUVER SOLUTIONS FAIL TO CONVERGE FOR THE ALTITUDE CONSTRAINTS SPECIFIED AT NCC OR TPI TIMES RESPECTIVELY, PROGRAM ALARM WILL BE DISPLAYED WITH ERROR CODE 601.
00602	RECYCLE AND ADJUST INPUT PARAMETERS FOR NEW SOLUTION.	FAILURE IN OUTER LOOP ITERATION - A PHASING CONSTRAINT AT TPI REQUIRES THE CSM STATE VECTOR SOLUTION TO BE COLINEAR WITH THE DESIRED STATE VECTOR AT TPI BASED ON THE DESIRED Δ HEIGHT AND ELEVATION ANGLE AT TPI. IF NO NCC SOLUTION IS ARRIVED AT WHICH SATISFIES THE CONSTRAINT LIMITS, PROGRAM ALARM WILL BE DISPLAYED WITH ERROR CODE 602.

TABLE 8-II.- CSM ALARM CODES - CONTINUED

ALARM CODE (OCTAL)	ACTION	TITLE-DESCRIPTION
00603	RECYCLE AND ADJUST INPUT PARAMETERS FOR NEW SOLUTION.	FAILURE TO QRDTPI ITERATION - IF THE DIFFERENCE BETWEEN THE PREDICTED CENTRAL ANGLE OF THE CSM AND OWS AT TPI AND THE DESIRED CENTRAL ANGLE (BASED ON THE Δ HEIGHT AND ELEVATION ANGLE AT TPI) DOES NOT CONVERGE WITHIN SPECIFIED LIMITS, PROGRAM ALARM WILL BE DISPLAYED WITH ERROR CODE 603.
00611	PROCEED WITH DISPLAYS OR RECYCLE PROGRAM WITH NEW INPUT PARAMETERS.	NO TIG FOR ELEVATION ANGLE - IF NO TIG (TPI) SOLUTION EXISTS FOR THE SPECIFIED ELEVATION ANGLE, PROGRAM ALARM WILL BE DISPLAYED WITH ERROR CODE 611.
00777	REF MALF. PROCEDURE G&N 6.	PIPA FAIL CAUSED THE ISS WARNING - WHEN AN ISS FAIL INPUT (IMU, CDU, PIPA) IS DETECTED BY T4RUPT, THE INPUT WHICH CAUSES THE ALARM IS COMMUNICATED TO THE "VARALARM" ROUTINE WHICH PROVIDES FOR AN ERROR CODED DISPLAY OF THE FAIL INPUT. THOSE FAIL BITS OF IMODES 30 (BITS 13, 12, AND 10) WHICH ARE NOT INHIBITED (BITS 4, 3, AND 1) WILL CAUSE ISS WARNING AND THE SUM OF THESE FAIL BITS MINUS 1 WILL YIELD THE ERROR CODE (BIT 10 - 1 = 01000_8 - 1 = 0777_8), AND A PROGRAM ALARM IS DISPLAYED.
01102	REF MALF. PROCEDURES G&N SSR-1.	CMC SELF TEST ERROR - IF AN ERROR IS DETECTED DURING THE CMC SELF TEST, REGARDLESS OF OPTION, A PROGRAM ALARM WILL BE DISPLAYED.
01105	REF MALF. PROCEDURES.	DOWNLINK TOO FAST - TRANSMISSION OF THE CMC DOWNLINK DATA TO THE PCM IS INITIATED BY A DOWNLINK START PULSE FOLLOWED BY SYNC PULSES WHICH SERIALLY GATE THE DOWNLINK WORDS TO THE PCM. FOLLOWING THE TRANSMISSION OF THE WORDS FROM THE OUTCOUNTERS, A DOWNLINK END PULSE IS SENT TO THE COMPUTER WHICH INITIATES RELOADING OF THE OUTCOUNTERS WITH THE NEXT TWO WORDS OF THE DOWNLIST. RECEIPT OF THE DOWNLINK END PULSE IS ENABLED AT A RATE OF 100 PPS. IF TWO END PULSES ARE RECEIVED WITHIN A 10 MSEC PERIOD, THE DOWNLINK TOO-FAST BIT (CH33 BIT 12) IS RESET AND WHEN DETECTED BY THE T4RUPT ROUTINE, A PROGRAM ALARM IS DISPLAYED.

TABLE 8-II.- CSM ALARM CODES - CONTINUED

ALARM CODE (OCTAL)	ACTION	TITLE-DESCRIPTION
01106	REF MALF. PROCEDURES.	UPLINK TOO FAST - TRANSMISSION OF EACH SERIAL UPLINK BIT IS ENABLED AT A 6400 PPS RATE. IF TWO UPLINK BITS (EITHER 1'S OR 0'S) ARE RECEIVED WITHIN A 156 MSEC PERIOD, THE UPLINK TOO-FAST BIT (CH 33 BIT 11) IS RESET AND WHEN DETECTED BY THE T4RUPT ROUTINE, A PROGRAM ALARM IS DISPLAYED.
01107	REF MALF. PROCEDURES. IMU REALIGN MAY BE NECESSARY.	PHASE TABLE FAILURE - ASSUMING ERASABLE MEMORY IS DESTROYED - AT VARIOUS POINTS IN A PROGRAM, THE PHASE TABLE IS SET UP TO ESTABLISH A RESTART POINT IN THE PROGRAM SHOULD A RESTART OCCUR. ESSENTIALLY, TWO TABLES ARE SET UP, ONE BEING THE INVERSE OF THE OTHER. THESE TABLES ARE CHECKED FOR AGREEMENT DURING A RESTART. IF PHASE TABLE DISAGREEMENT OCCURS, IT IS ASSUMED THAT ERASABLE MEMORY HAS BEEN ALTERED AND A FRESH START IS PERFORMED. E MEMORY MUST THEN BE REESTABLISHED. DETECTION OF THE ABOVE RESULTS IN A PROGRAM ALARM DISPLAY.
01301	RECYCLE PROGRAM WHICH UTILIZING COMPUTATIONS.	ARCSIN - ARCCOS INPUT ANGLE TOO LARGE - IF THE ARCSIN OR ARCCOS IS GREATER THAN 1, THE COMPLEMENT ROUTINE WILL DISPLAY A PROGRAM ALARM.
01407	REF MALF. PROCEDURES.	Vg INCREASING - A CHECK IS MADE IN P40, WHICH ESSENTIALLY CHECKS THAT THE DIRECTION OF THE MEASURED DV ACCUMULATED IS THE SAME AS THAT OF Vg. IF THRUST IS IN THE WRONG DIRECTION, A PROGRAM ALARM IS DISPLAYED.
1426	REALIGN OR USE EMS FOR ENTRY.	IMU UNSATISFACTORY - A CHECK IS MADE ON THE IMU ORIENTATION TO INSURE THAT THE +Y SM VECTOR IS WITHIN 30 DEGREES OF THE (V X R) VECTOR. IF NOT, A CHECK IS MADE TO INSURE THE -Y SM VECTOR IS WITHIN -30 DEGREES OF THE (V X R) VECTOR. (SEE ALARM CODE 1427.) IF NEITHER OF THESE CONDITIONS EXIST, A PROGRAM ALARM AND ERROR CODE 1426 ARE DISPLAYED.
1427	FDAI DISPLAY IS REVERSED.	IMU REVERSED - IF THE -Y SM VECTOR IS WITHIN -30° OF THE (V X R) VECTOR (SEE ALARM CODE 1426), A PROGRAM ALARM WITH ERROR CODE 1427 IS DISPLAYED.

TABLE 8-II.- CSM ALARM CODES - CONTINUED

ALARM CODE (OCTAL)	ACTION	TITLE-DESCRIPTION
1520	WAIT UNTIL COMP ACTY LIGHT IS OUT OR CALL POO BEFORE CALLING DESIRED PROGRAM.	V37 REQUEST NOT PERMITTED AT THIS TIME - IF A MAJOR MODE CHANGE REQUEST IS MADE DURING IMU INITIALIZATION (IMODES 30 BIT 6) OR IF OTHER THAN A POO REQUEST IS INHIBITED BY ANOTHER PROGRAM, A PROGRAM ALARM WILL BE DISPLAYED.
01600	REPEAT TEST PROGRAM FOR VALID DATA.	OVERFLOW IN DRIFT TEST - THIS ALARM IS PECULIAR TO PRELAUNCH TESTING ONLY AND IS MECHANIZED FOR A COMPUTATIONAL OVERFLOW IN THE PRELAUNCH GYRO DRIFT TEST. THIS OVERFLOW WILL RESULT IN A PROGRAM ALARM DISPLAY.
01601	REPEAT TEST PROGRAM AS TEST RESULTS MAY BE INVALID.	BAD IMU TORQUE - THIS ALARM IS THE RESULT OF A BAD RETURN FROM THE IMU STALL ROUTINE IN THE PRELAUNCH ALIGNMENT PROGRAM. IT IS INDICATIVE OF A BAD COARSE ALIGN OR IMU TORQUE AND WILL RESULT IN A PROGRAM ALARM DISPLAY.
01703	PROCEED. TIG WILL SLIP BY AN AMOUNT NECESSARY TO ALLOW FOR INTEGRATION.	INSUFFICIENT TIME FOR INTEGRATION - TIG WAS SLIPPED - IN THE BURN PROGRAM, THE STATE VECTOR IS INTEGRATED TO TIG - 30 AND IS INPUT TO THE SERVICER. IF THERE IS INSUFFICIENT TIME (12.5 SECONDS) PRIOR TO TIG -30 TO ALLOW FOR THIS INTEGRATION, A PROGRAM ALARM WILL BE DISPLAYED.
03777	REFER TO MALF. PROCEDURE G&N 6.	ICDU FAIL CAUSED THE ISS WARNING - WHEN AN ICDU FAIL (IMODES 30 BIT 12) IS DETECTED BY T4RUPT ROUTINE WITH NO FAIL INHIBIT PRESENT, ISS WARNING IS DISPLAYED AND THE ROUTINE VARALARM.WILL GENERATE AN ERROR CODE OF THE FAIL BIT VALUE MINUS 1 (0400 - 1 = 03777) AND WILL DISPLAY A PROGRAM ALARM.
04777	REFER TO MALF. PROCEDURE G&N 6.	ICDU, PIPA FAILS CAUSED ISS WARNING - WHEN BOTH ICDU (IMODES 30 BIT 12) AND PIPA (IMODES 30 BIT 10) UNINHIBITED FAILS ARE DETECTED BY THE T4RUPT ROUTINE, ISS WARNING IS DISPLAYED, AN ERROR CODE OF THE FAIL BIT VALUES MINUS 1 (05000 - 1 = 4777) IS GENERATED AND A PROGRAM ALARM IS DISPLAYED.

TABLE 8-II.- CSM ALARM CODES - CONTINUED

ALARM CODE (OCTAL)	ACTION	TITLE-DESCRIPTION
07777	REFER TO MALF. PROCEDURE G&N 6.	IMU FAIL CAUSED THE ISS WARNING - WHEN AN UNINHIBITED IMU FAIL (IMODES 30 BIT 13) IS DETECTED BY THE T4RUPT ROUTINE, ISS WARNING DISPLAYED, AN ERROR CODE OF THE FAIL BIT VALUE MINUS 1 (10000 - 1 = 07777) IS GENERATED, AND A PROGRAM ALARM IS DISPLAYED.
10777	REFER TO MALF. PROCEDURE G&N 6.	IMU, PIPA FAILS CAUSED THE ISS WARNING - WHEN BOTH UNINHIBITED IMU FAIL (IMODES 30 BIT 13) AND PIPA FAIL (IMODES 30 BIT 10) ARE DETECTED BY T4RUPT ROUTINE, ISS WARNING IS DISPLAYED, AN ERROR CODE OF THE FAIL BIT VALUES MINUS 1 (11000 - 1 = 10777) IS GENERATED, AND A PROGRAM ALARM IS DISPLAYED.
13777	REFER TO MALF. PROCEDURE G&N 6.	IMU, ICDU FAILS CAUSED THE ISS WARNING - WHEN BOTH UNINHIBITED IMU FAIL (IMODES 30 BIT 13) AND ICDU FAIL (IMODES 30 BIT 12) ARE DETECTED BY THE T4RUPT ROUTINE, ISS WARNING IS DISPLAYED, AN ERROR CODE OF THE FAIL BIT VALUES MINUS 1 (14000 - 1 = 13777) IS GENERATED, AND A PROGRAM ALARM IS DISPLAYED.
14777	REFER TO MALF. PROCEDURE G&N 6.	IMU, ICDU, PIPA FAILS CAUSED ISS WARNING - WHEN UNINHIBITED IMU FAIL (IMODES 30 BIT 13), PIPA FAIL (IMODES 30 BIT 10), AND ICDU FAIL (IMODES 30 BIT 12) ARE DETECTED BY T4RUPT ROUTINE, ISS WARNING IS DISPLAYED, AN ERROR CODE OF THE FAIL BIT VALUES MINUS 1 (15000 - 1 = 14777) IS GENERATED, AND A PROGRAM ALARM IS DISPLAYED.
24030	UPLINK NEW S.V.	INTEGRATION ABORT DUE TO SUBSURFACE S.V. - IF STATE VECTOR POSITION MAGNITUDE BECOMES TOO LOW DUE TO A "BAD" S.V. CAUSING OVER-FLOW IN THE INTEGRATION ROUTINE WHICH RECTIFICATION CANNOT ELIMINATE, A SOFT-WARE RESTART IS GENERATED, AND (PROVIDING AVERAGE-G IS NOT RUNNING) ALL RESTART GROUPS ARE RESET. PROGRAM ALARM WILL BE DISPLAYED, AND PROGRAM FLOW WILL ENTER GOTOPOOH.

TABLE 8-II.- CSM ALARM CODES - CONTINUED

ALARM CODE (OCTAL)	ACTION	TITLE-DESCRIPTION
20607	RECYCLE PROGRAM WITH ADJUSTED INPUT PARAMETERS.	NO SOLUTION FROM TIME THETA OR TIME RADIUS ROUTINE - THESE ROUTINES PROVIDE TRANSFER TIME SOLUTIONS FOR TWO BODIES WITH INPUTS OF POSITION AND VELOCITY VECTORS AND THE TRANSFER ANGLE TO THE TERMINAL POSITION OR THE RADIUS MAGNITUDE. IF THE CONIC TRAJECTORY IS PARABOLIC OR HYPERBOLIC AND THE DESIRED TRANSFER ANGLE LIES BEYOND THE ASYMPTOTE TO THE TRAJECTORY OR THE ECCENTRICITY OF ORBIT IS LESS THAN 2-18, NO SOLUTION IS AVAILABLE FOR THE ROUTINE AND A POODOO ALARM WILL OCCUR. A SOFTWARE RESTART WILL BE GENERATED, AND PROGRAM ALARM WILL BE DISPLAYED WITH AN ENTRANCE TO GOTOPOOH.
20610	RECYCLE PROGRAM AND ADJUSTING.	LAMBDA LESS THAN UNITY - IF THE POSITION VECTOR IS LESS THAN 400,000 FT ABOVE THE PAD RADIUS AT TIG FOR THE RTE MANEUVER, THIS SIGNIFIES THE POSITION VECTOR IS TOO SMALL FOR THE MANEUVER. PROGRAM ALARM WILL BE DISPLAYED, AND PROGRAM WILL PROCEED TO GOTOPOOH.
21204	RESELECT PROGRAM UNLESS AVG G IS RUNNING.	NEGATIVE OR ZERO WAITLIST CALL - A FINITE POSITIVE DELAY IS REQUIRED TO SCHEDULE A WAITLIST TASK FOR THE T3RUPT ROUTINE TO EXECUTE. A TIME DELAY OF ZERO OR NEGATIVE FOR AN INSERTED TASK IS ILLEGAL AND WILL RESULT IN ABORTING THE TASK.
21206	RESELECT PROGRAM UNLESS AVG G IS RUNNING.	SECOND JOB ATTEMPTS TO GO TO SLEEP VIA KEYBOARD AND DISPLAY PROGRAM - WHEN JOB IS PUT TO SLEEP WITH A DSKY DISPLAY WHILE WAITING FOR A CREW RESPONSE OR DSKY RELEASE, THE RETURN ADDRESS OF THE SLEEPING JOB IS STORED IN CADRSTOR OR DSPLIST. IF ANOTHER ATTEMPT IS MADE BY PROGRAM TO PUT A JOB TO SLEEP USING THESE LOCATIONS, A PROGRAM ALARM IS DISPLAYED, A SOFTWARE RESTART IS EXECUTED, AND THE PROGRAM WILL PROCEED TO GOTOPOOH.

TABLE 8-II.- CSM ALARM CODES - CONTINUED

ALARM CODE (OCTAL)	ACTION	TITLE-DESCRIPTION
21210	RESELECT PROGRAM. DO NOT USE IMU WHILE CMC IS USING IT.	TWO PROGRAMS USING SAME DEVICE AT SAME TIME - IF TWO JOBS TRY TO UTILIZE ANY OF THE STALL ROUTINES OR THE AUTO MANEUVER ROUTINE (ALL OF WHICH CONTAIN RETURN ADDRESS INFORMATION TO THE PROGRAM USING THESE DEVICES), A PROGRAM ALARM WILL BE DISPLAYED, A SOFTWARE RESTART I IS EXECUTED, AND THE PROCESSING WILL PROCEED TO GOTOPOOH.
21302	RESELECT PROGRAM UNLESS AVG G IS RUNNING.	SQRT CALLED WITH NEGATIVE ARGUMENT - IF A SQUARE ROOT IS ATTEMPTED WITH A NEGATIVE NUMBER WHICH IS LESS NEGATIVE THAN -2^{-14}, THE SQUARE ROOT IS 0. IF THE ARGUMENT IS MORE NEGATIVE THAN -2^{-14}, A PROGRAM ALARM IS DISPLAYED, A SOFTWARE RESTART IS EXECUTED, AND PROCESSING PROCEEDS TO GOTOPOOH.
21501	RESELECT PROGRAM UNLESS AVG G IS RUNNING.	KEYBOARD AND DISPLAY ALARM DURING INTERNAL USE (NVSUB) - IF AN INTERNAL USER OF THE DISPLAY SYSTEM FAILS TO COMMUNICATE A VERB NOUN PATTERN OR AN ILLEGAL PATTERN, A PROGRAM ALARM WILL BE DISPLAYED, A SOFTWARE RESTART IS EXECUTED, AND PROCESSING WILL PROCEED TO GOTOPOOH. AN ERROR FOR AN EXTERNAL USER OF THE DSKY WILL RESULT IN AN OPERATE ERROR LIGHT.
21502	RESELECT PROGRAM UNLESS AVG G IS RUNNING.	ILLEGAL FLASHING DISPLAY - IF A REQUEST FOR A FLASHING DISPLAY IS MADE WITH ONE ALREADY ACTIVATED IN THE DISPLAY SYSTEM, A PROGRAM ALARM WILL BE DISPLAYED AND PROCESSING WILL PROCEED TO GOTOPOOH.
21521	DO NOT REQUEST P01, P07 AFTER LIFTOFF.	P01, P07 ILLEGALLY SELECTED - AT LIFTOFF WHEN P11 IS STARTED, THE NODOP01 FLAG (FWI BIT 12) IS SET AND REMAINS SET THEREAFTER. IF P01, P07 ARE ATTEMPTED AFTER LIFTOFF, THE STATE OF THE FLAG BIT WILL CAUSE A PROGRAM ALARM DISPLAY, A SOFTWARE RESTART, AND PROCESSING WILL PROCEED TO GOTOPOOH.

TABLE 8-II.- CSM ALARM CODES - CONTINUED

ALARM CODE (OCTAL)	ACTION	TITLE-DESCRIPTION
31104	RESELECT EXTENDED VERB OR CONTINUE.	DELAY ROUTINE BUSY - THE ROUTINE DELAY JOB CAN HANDLE FOUR DELAY REQUESTS. IF MORE THAN FOUR JOBS ATTEMPT TO USE THE ROUTINE, A BAILOUT ABORT IS GENERATED WHICH PERFORMS A SOFTWARE RESTART FOR A RESTARTABLE PROGRAM. PROGRAM ALARM IS DISPLAYED.
31201	RESELECT EXTENDED VERB OR CONTINUE.	EXECUTIVE OVERFLOW - NO VAC AREAS - THE PROCESS OF JOB SCHEDULING BY THE EXECUTIVE ROUTINE RESERVES VAC AREAS OR INTERPRETER WORK AREAS FOR THE JOBS ON THE EXECUTIVE CORE SET LIST. IF A JOB IS REQUESTED AND NO VAC AREAS EXIST, A BAILOUT ABORT IS GENERATED WHICH PERFORMS A SOFTWARE RESTART AND DISPLAYS PROGRAM ALARM.
31202	RESELECT EXTENDED VERB OR CONTINUE.	EXECUTIVE OVERFLOW - NO CORE SETS - WHEN A JOB IS REQUESTED, THE EXECUTIVE ROUTINE PLACES THE JOB ON THE CORE SET LIST AND RESERVES A CORESET AREA FOR USE BY THE JOB. IF NO CORE SETS ARE AVAILABLE TO SCHEDULE A REQUESTED JOB, A BAILOUT ABORT IS GENERATED WHICH PERFORMS A SOFTWARE RESTART AND DISPLAYS PROGRAM ALARM.
31203	RESELECT EXTENDED VERB OR CONTINUE.	WAITLIST OVERFLOW - TOO MANY TASKS - THE WAITLIST ROUTINE HAS CAPABILITY OF SCHEDULING NINE TIME-DEPENDENT TASKS. IF A TASK IS REQUESTED AND NO VACANT ENTRIES EXIST ON THE LIST, A BAILOUT ABORT IS GENERATED WHICH PERFORMS A SOFTWARE RESTART AND DISPLAYS PROGRAM ALARM.
31211	RESELECT EXTENDED VERB AFTER OPTICS MARKING IS COMPLETED	ILLEGAL INTERRUPT OF EXTENDED VERB - THE MARKING SYSTEM PERFORMS A CHECK OF THE EXTENDED VERB ACTIVITY BITS (EXTVBACT BITS 2, 3) BEFORE THE MARK SYSTEM IS ACTIVATED. IF THE MARK SYSTEM INTERRUPTS AN EXTENDED VERB IN PROCESS, A BAILOUT ABORT IS GENERATED WHICH PERFORMS A SOFTWARE RESTART AND A PROGRAM ALARM IS DISPLAYED.

TABLE 8-II.- CSM ALARM CODES - CONCLUDED

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

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

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

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

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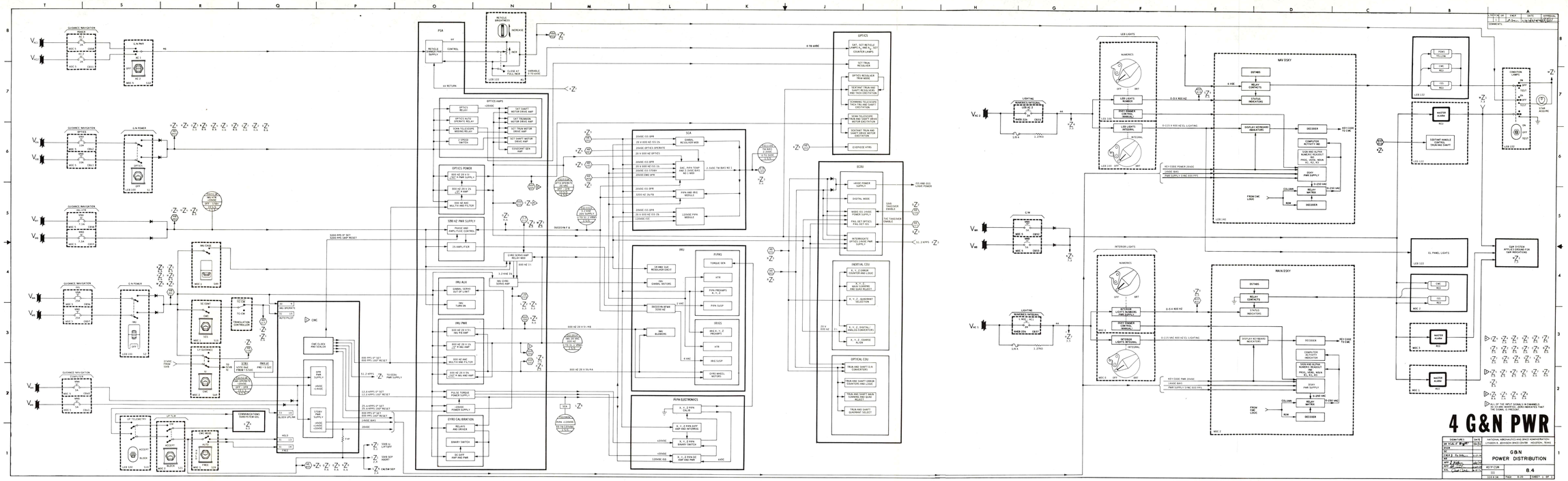
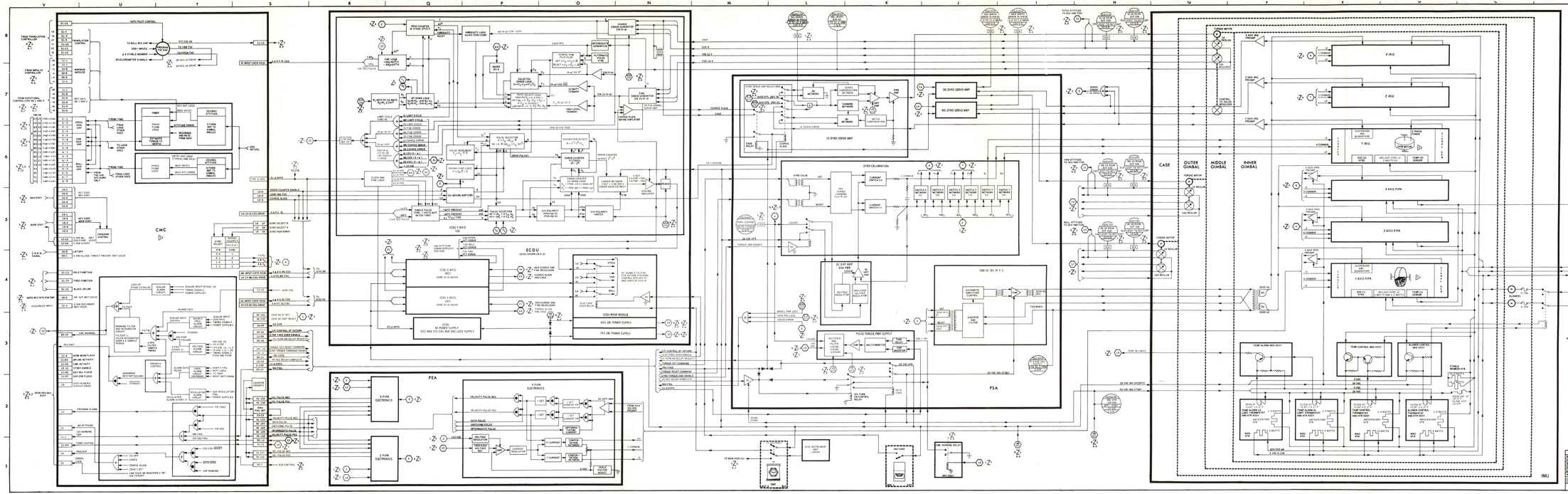
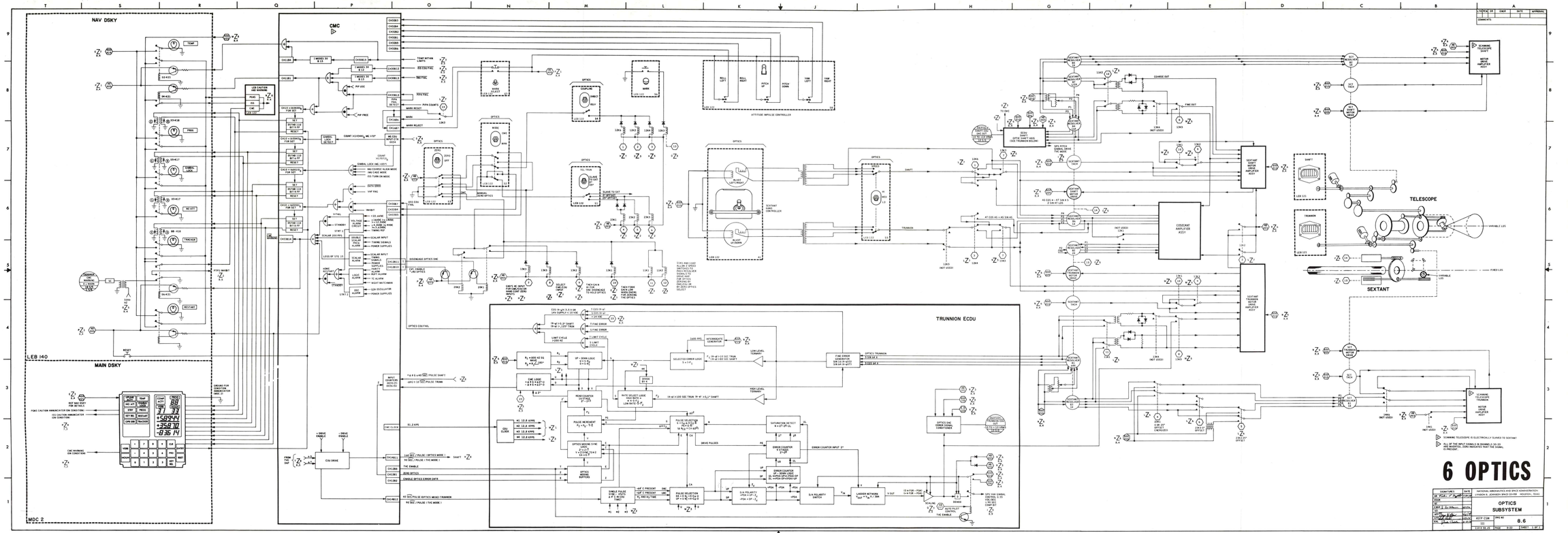
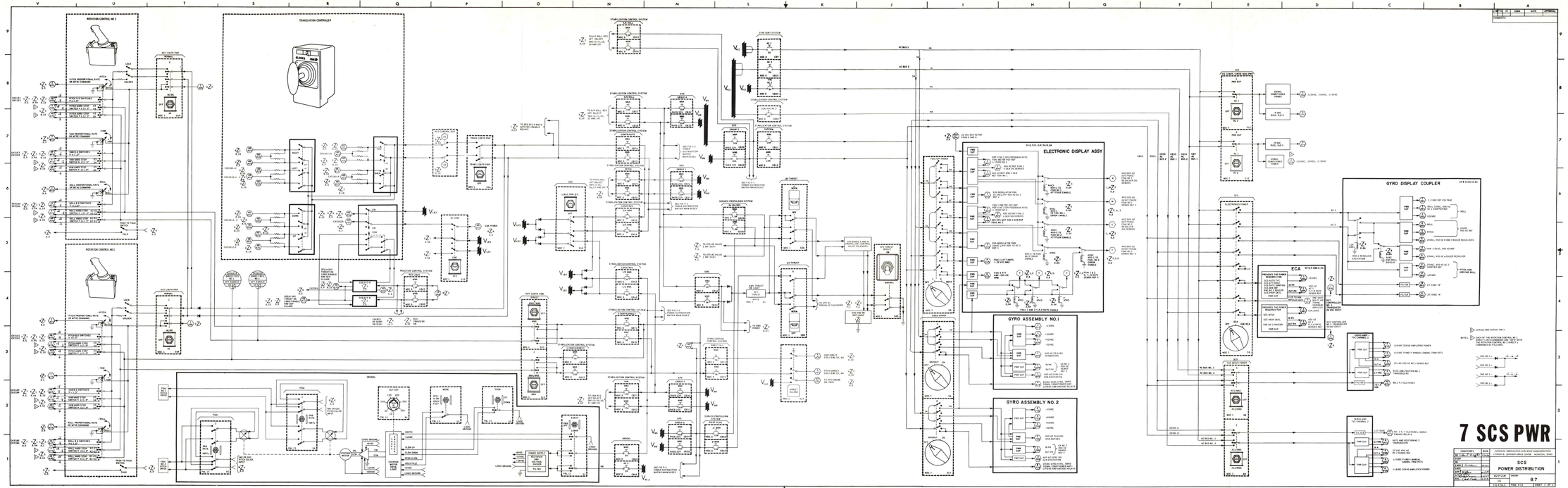

4 G&N PWR
G&N POWER DISTRIBUTION
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
8.4
SHEET 1 OF 2
GUIDANCE NAVIGATION
C/W POWER
OPTICS POWER
SCA
IMU
PIPA ELECTRONICS
OPTICS
ECSV
INERTIAL CDU
OPTICAL CDU
LEB LIGHTS
INTERIOR LIGHTS
NUMERICS
INTEGRAL
LIGHTING
NAV DSKY
MAIN DSKY
EL PANEL LIGHTS
CONSOLE LAMPS
TEST
MASTER ALARM
RESET
CWC CLOCK AND SCALER
COMMUNICATIONS SUBSYSTEM (CSS)
UP TELEMETRY
UP CLR
CWC MUX
IMU MUX
SCA MUX
OPTICS MUX
ECSV MUX
MDC 1
MDC 2
MDC 3
MDC 4
LEB 120
LEB 121
LEB 122
LEB 123
LEB 130
LEB 131
LEB 132
LEB 133
LEB 140
LEB 141
LEB 142
LEB 143
CSM SYSTEM APPLICATIONS (SEE INDICATIONS)
ALL OF THE INPUT SIGNALS IN CHANNELS 1 AND 2 ARE MARKED (ZERO) INDICATING THAT THE SIGNAL IS TRISTATE.


AUTO PILOT CONTROL
CMC
PEA
ECDU
IMU
CASE
OUTER GIMBAL
MIDDLE GIMBAL
INNER GIMBAL
PSA
TORQUE MOTOR
X IRIG
Y IRIG
Z IRIG
X AXIS PWA
Y AXIS PWA
Z AXIS PWA
5 ISS
INERTIAL SUBSYSTEM
8.5


NAV DSKY
MAIN DSKY
CMC
LEB 140
MDC 2
TRUNNION ECDU
OPTICS
SEXTANT
TELESCOPE
6 OPTICS
OPTICS SUBSYSTEM
8.6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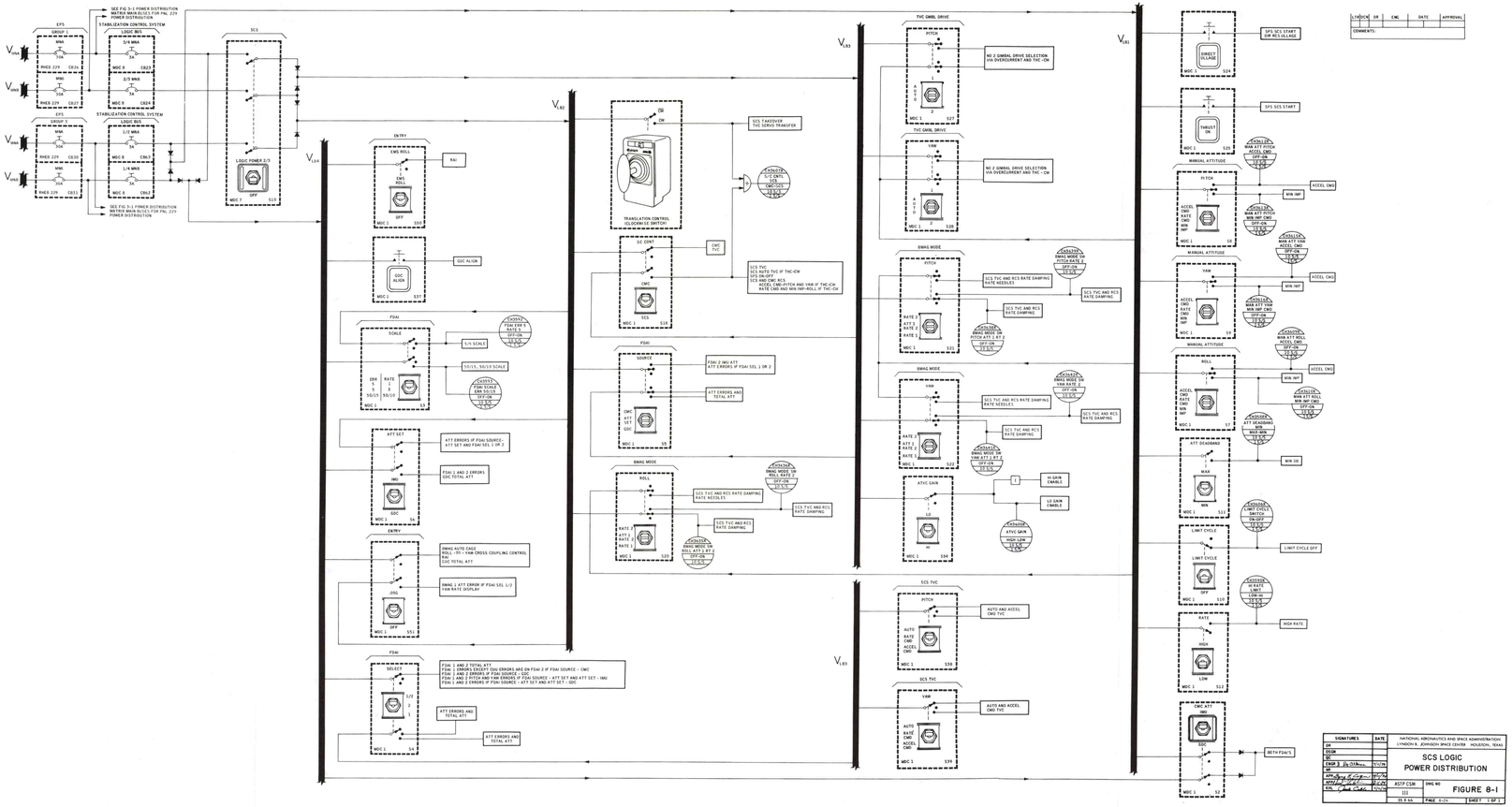
ROTATION CONTROL NO 1
TRANSLATION CONTROLLER
ELECTRONIC DISPLAY ASSY
GYRO ASSEMBLY NO.1
GYRO ASSEMBLY NO.2
GYRO DISPLAY COUPLER
ECA
7 SCS PWR
SCS
POWER DISTRIBUTION
87



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COMMENTS:				

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DR	
DSUN	
ENG	
ENG Jim Nixon	7/1/71
ENG Ray King	7/1/71
ENG Richard Colton	7/1/71
ENG Carl Carter	7/1/71

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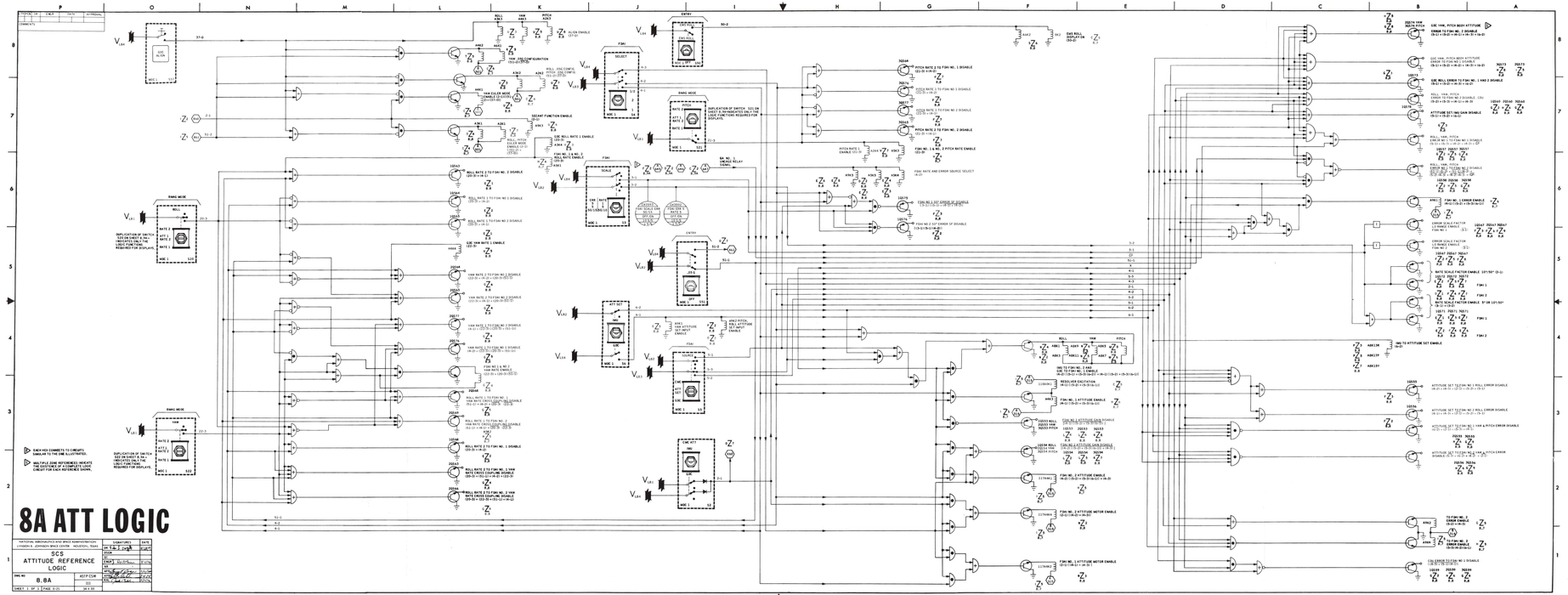
LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS

SCS LOGIC POWER DISTRIBUTION

ASTP CSM	DRG NO
111	FIGURE 8-1
35 X 46	PAGE 8-229 SHEET 1 OF 1


8A ATT LOGIC
SCS ATTITUDE REFERENCE LOGIC
8.8A
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
SIZE B
SHEET 1 OF 2 PAGE 0.01
DRAWN
CHECKED
DESIGN
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MGR
ASTP CSM
DSKY
ENGR MODE
ROLL
YAW
PITCH
SELECT
RATE 2
RATE 1
ATT SET
OFF
SCALE
ON
SEC 1
SEC 2
SEC 3
SEC 4
MDC 1
MDC 2
MDC 3
MDC 4
ENTRY
CMC ATT
GDC ALIGN
GDC ATT
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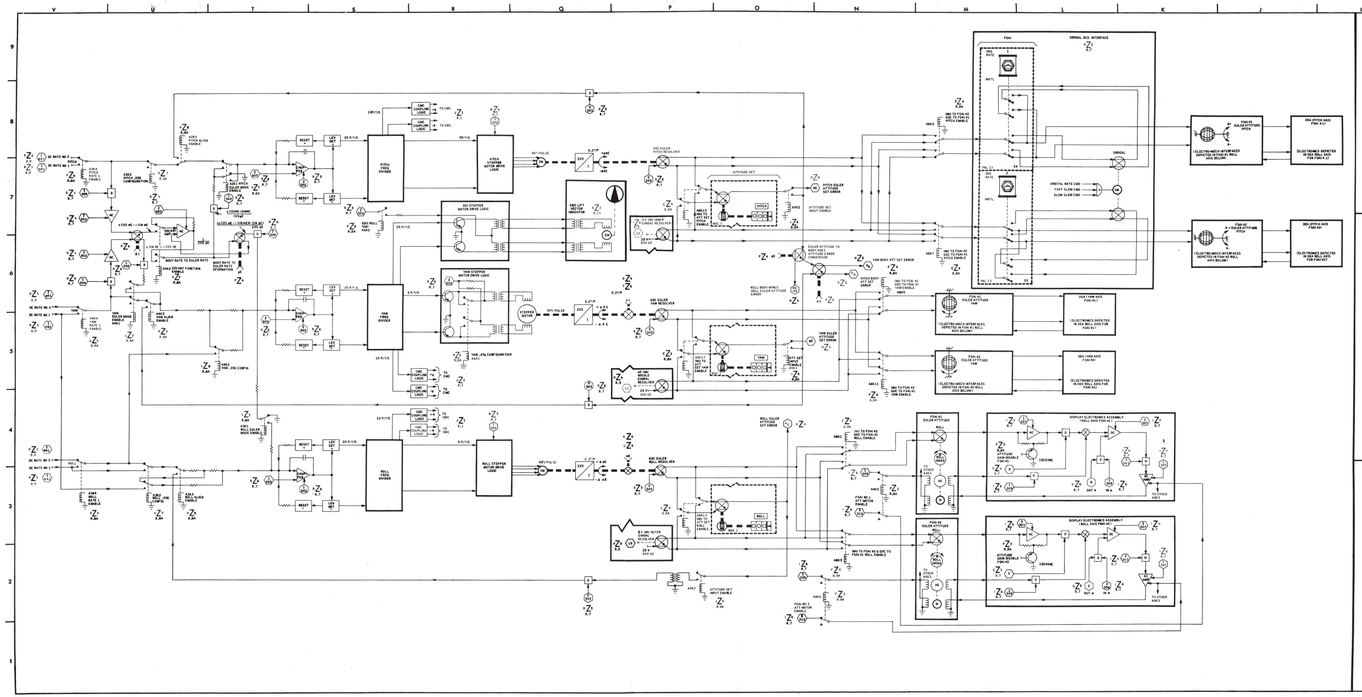
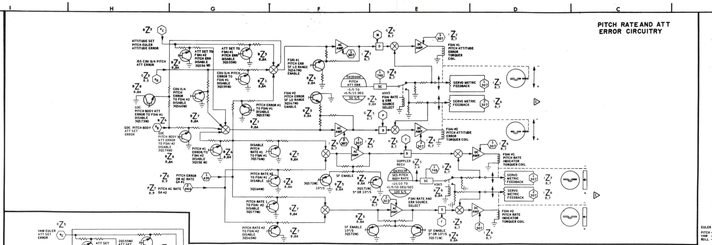
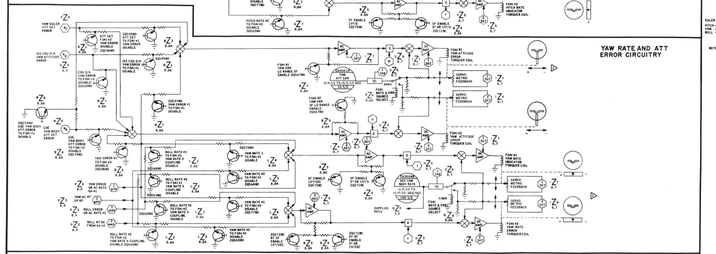
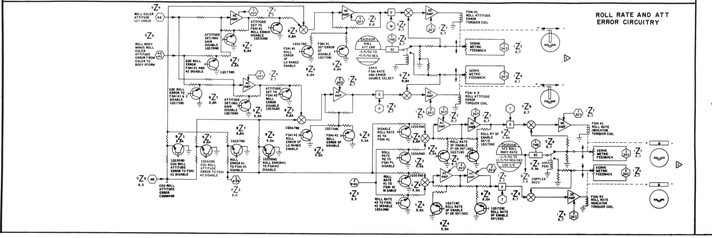
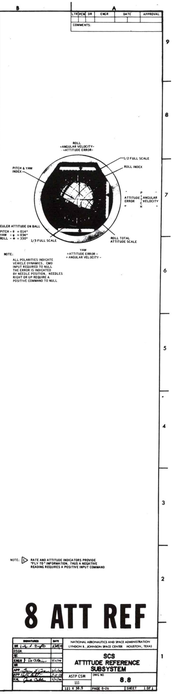
ACCEL
ENABLE
DISABLE
ATTITUDE ERROR
ATTITUDE RATE
ATTITUDE SET





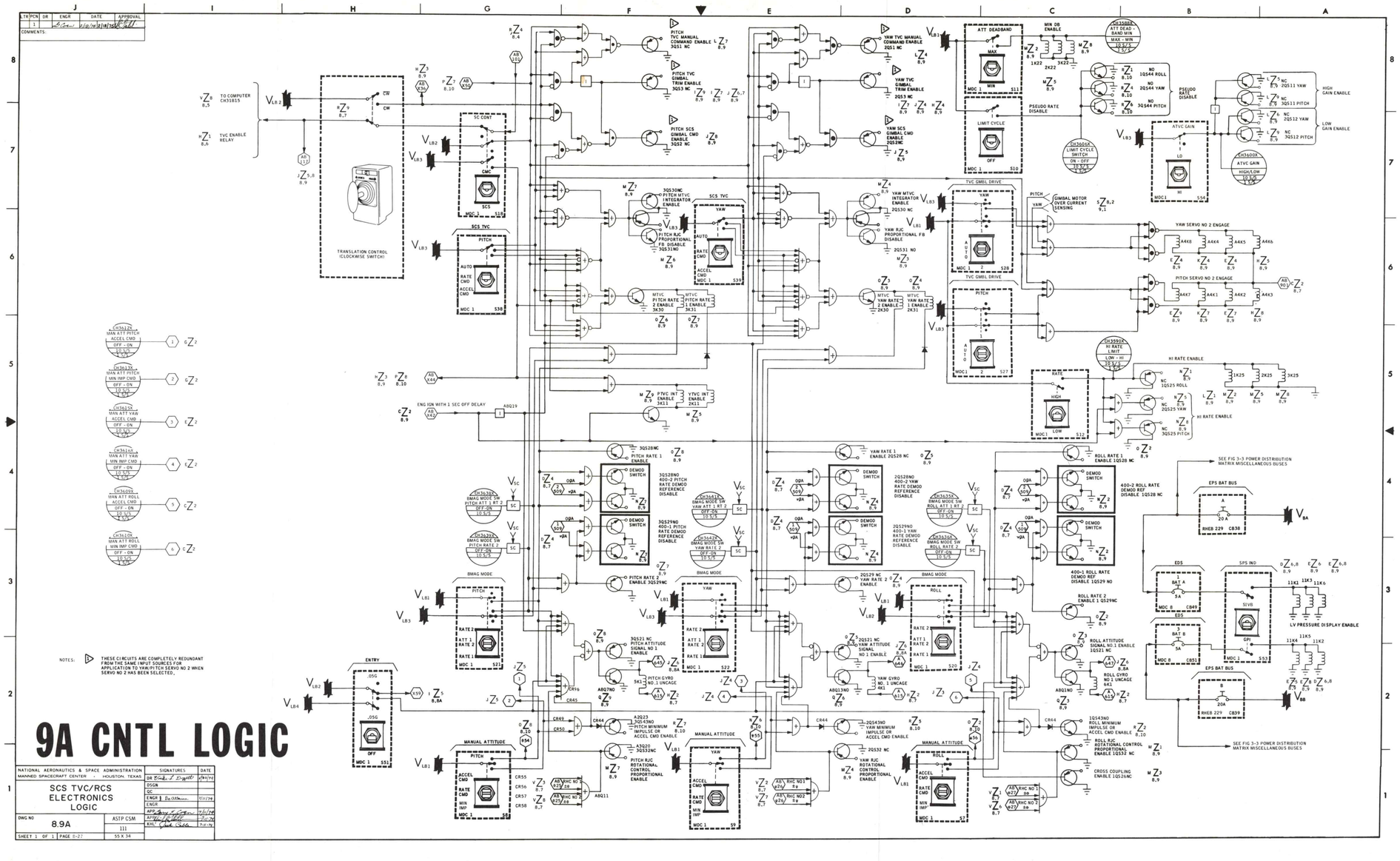






8 ATT REF

DESIGNED	DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION	
CHECKED	DATE	LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS	
APPROVED	DATE	SCS ATTITUDE REFERENCE SUBSYSTEM	
APPROVED	DATE	ASTP CSM	DRAWING NO. 8.0
		SIZE E	SCALE NONE SHEET 1 OF 1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1 1 2 Sep 9/10/70
COMMENTS:
9A CNTL LOGIC
NOTES: THESE CIRCUITS ARE COMPLETELY REDUNDANT FROM THE SAME INPUT SOURCES FOR APPLICATION TO YAW/PITCH SERVO NO 2 WHEN SERVO NO 2 HAS BEEN SELECTED.
NATIONAL AERONAUTICS & SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER - HOUSTON, TEXAS
SCS TVC/RCS ELECTRONICS LOGIC
DWG NO 8.9A
ASTP CSM 111
SHEET 1 OF 1 PAGE 8-22
55 X 34
SIGNATURES DATE
DR Bob F Dysett 9/11/70
DSGN
QC
ENGR J Bowman 9/11/70
ENGR
APP Jerry L Gibson 9/11/70
APP Wm H Tobler 9/11/70
KHC Clark Cole 9-11-70
TRANSLATION CONTROL (CLOCKWISE SWITCH)
SC CONT
SCS
CMC
SCS TVC
AUTO
RATE CMD
ACCEL CMD
PITCH
YAW
ROLL
MDC 1 510
MDC 1 530
MDC 1 539
MDC 1 520
MDC 1 527
MDC 1 512
MDC 1 521
MDC 1 522
MDC 1 520
MDC 1 551
MDC 1 518
MDC 1 519
MDC 1 532
ENTRY
OFF
.05G
ATT DEADBAND
MAX
MIN
LIMIT CYCLE
ON-OFF
ATVC GAIN
HI
LO
HIGH
LOW
RATE
TVC GMBL DRIVE
MIN DB ENABLE
ATT DEAD-BAND MIN
MAX - MIN 10 K/5
PSEUDO RATE DISABLE
NO 1QS44 ROLL
NO 2QS44 YAW
NO 3QS44 PITCH
HIGH GAIN ENABLE
LOW GAIN ENABLE
NC 2QS11 YAW
NC 2QS11 PITCH
NC 2QS12 YAW
NC 3QS12 PITCH
LIMIT CYCLE SWITCH ON-OFF 10 K/5
ATVC GAIN HIGH/LOW 10 K/5
HI RATE LIMIT LOW-HI 10 K/5
HI RATE ENABLE
YAW SERVO NO 2 ENGAGE
PITCH SERVO NO 2 ENGAGE
GIMBAL MOTOR OVER CURRENT SENSING
PITCH TVC MANUAL COMMAND ENABLE 3QS1 NC
PITCH TVC GIMBAL TRIM ENABLE 3QS3 NC
PITCH SCS GIMBAL CMD ENABLE 3QS2 NC
YAW TVC MANUAL COMMAND ENABLE 2QS1 NC
YAW TVC GIMBAL TRIM ENABLE 2QS3 NC
YAW SCS GIMBAL CMD ENABLE 2QS2NC
3QS30NC PITCH MTVC INTEGRATOR ENABLE
PITCH RJC PROPORTIONAL FB DISABLE 3QS31NO
YAW MTVC INTEGRATOR ENABLE 2QS30 NC
YAW RJC PROPORTIONAL FB DISABLE 2QS31 NO
MTVC PITCH RATE 2 ENABLE 3K30
MTVC PITCH RATE 1 ENABLE 3K31
MTVC YAW RATE 2 ENABLE 2K30
MTVC YAW RATE 1 ENABLE 2K31
PTVC INT ENABLE 5K11
YTVC INT ENABLE 2K11
ENG IGN WITH 1 SEC OFF DELAY
ABQ19
3QS28NC PITCH RATE 1 ENABLE
3QS28NO 400-2 PITCH RATE DEMOD REFERENCE DISABLE
3QS29NO 400-1 PITCH RATE DEMOD REFERENCE DISABLE
PITCH RATE 2 ENABLE 3QS29NC
YAW RATE 1 ENABLE 2QS28 NC
2QS28NO 400-2 YAW RATE DEMOD REFERENCE DISABLE
2QS29NO 400-1 YAW RATE DEMOD REFERENCE DISABLE
YAW RATE 2 ENABLE 2QS29 NC
ROLL RATE 1 ENABLE 1QS28 NC
400-2 ROLL RATE DEMOD REF DISABLE 1QS28 NC
400-1 ROLL RATE DEMOD REF DISABLE 1QS29 NO
ROLL RATE 2 ENABLE 1QS29NC
BMAG MODE SW PITCH ATT 1 RT 2 OFF-ON 10 K/5
BMAG MODE SW PITCH RATE 2 OFF-ON 10 K/5
BMAG MODE SW YAW ATT 1 RT 2 OFF-ON 10 K/5
BMAG MODE SW YAW RATE 2 OFF-ON 10 K/5
BMAG MODE SW ROLL ATT 1 RT 2 OFF-ON 10 K/5
BMAG MODE SW ROLL RATE 2 OFF-ON 10 K/5
MAN ATT PITCH ACCEL CMD OFF-ON 10 K/5
MAN ATT PITCH MIN IMP CMD OFF-ON 10 K/5
MAN ATT YAW ACCEL CMD OFF-ON 10 K/5
MAN ATT YAW MIN IMP CMD OFF-ON 10 K/5
MAN ATT ROLL ACCEL CMD OFF-ON 10 K/5
MAN ATT ROLL MIN IMP CMD OFF-ON 10 K/5
PITCH ATTITUDE SIGNAL NO 1 ENABLE 3QS21 NC
PITCH GYRO NO 1 UNCAGE
YAW ATTITUDE SIGNAL NO 1 ENABLE 2QS21 NC
YAW GYRO NO 1 UNCAGE
ROLL ATTITUDE SIGNAL NO 1 ENABLE 1QS21 NC
ROLL GYRO NO 1 UNCAGE
A2023 3QS43NO PITCH MINIMUM IMPULSE OR ACCEL CMD ENABLE
A3020 3QS32NC PITCH RJC ROTATIONAL CONTROL PROPORTIONAL ENABLE
2QS43NO YAW MINIMUM IMPULSE OR ACCEL CMD ENABLE
2QS32 NC YAW RJC ROTATIONAL CONTROL PROPORTIONAL ENABLE
1QS43NO ROLL MINIMUM IMPULSE OR ACCEL CMD ENABLE
ROLL RJC ROTATIONAL CONTROL PROPORTIONAL ENABLE 1QS32 NC
CROSS COUPLING ENABLE 1QS26NC
RHC NO 1
RHC NO 2
SEE FIG 3-3 POWER DISTRIBUTION MATRIX MISCELLANEOUS BUSES
EPS BAT BUS
RHEB 229 CB38
RHEB 229 CB39
EDS
SPS IND
SVIS
GPI
LV PRESSURE DISPLAY ENABLE
BAT A 5A
BAT B 5A
MDC 8 CB49
MDC 8 CB51
MDC 1 3S13
MDC 1 2S13
MDC 1 1S13
MDC 1 3S14
MDC 1 2S14
MDC 1 1S14
MDC 1 3S15
MDC 1 2S15
MDC 1 1S15
MDC 1 3S16
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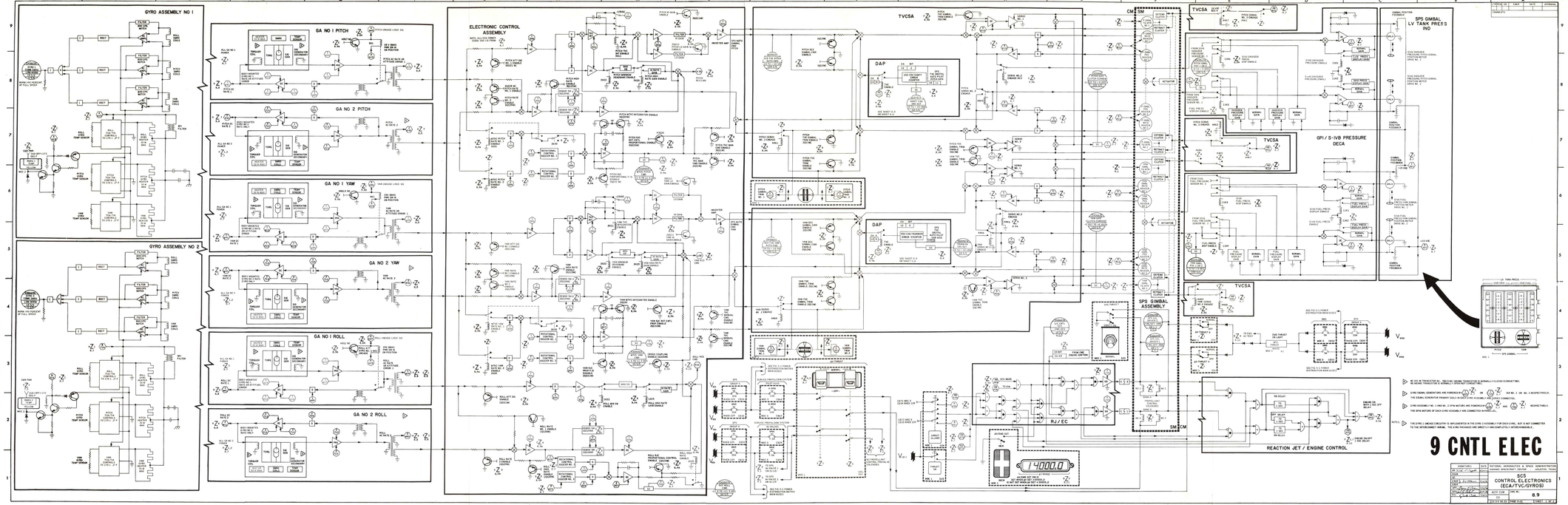
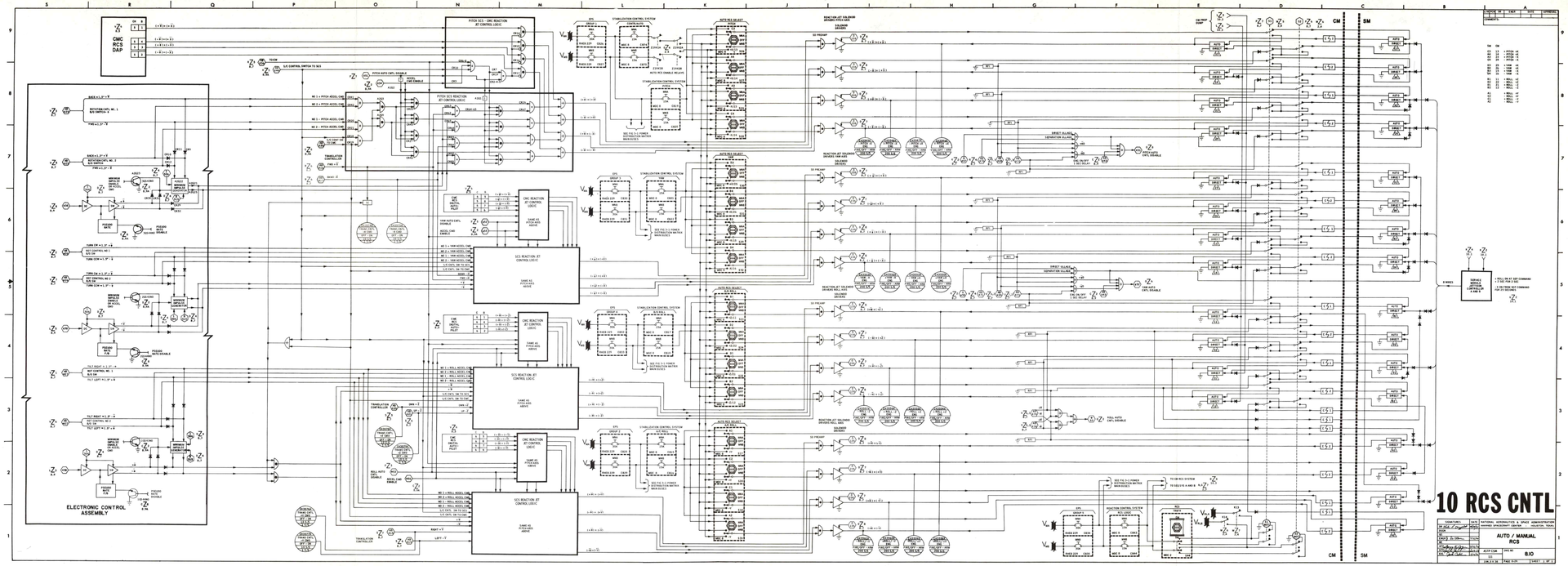
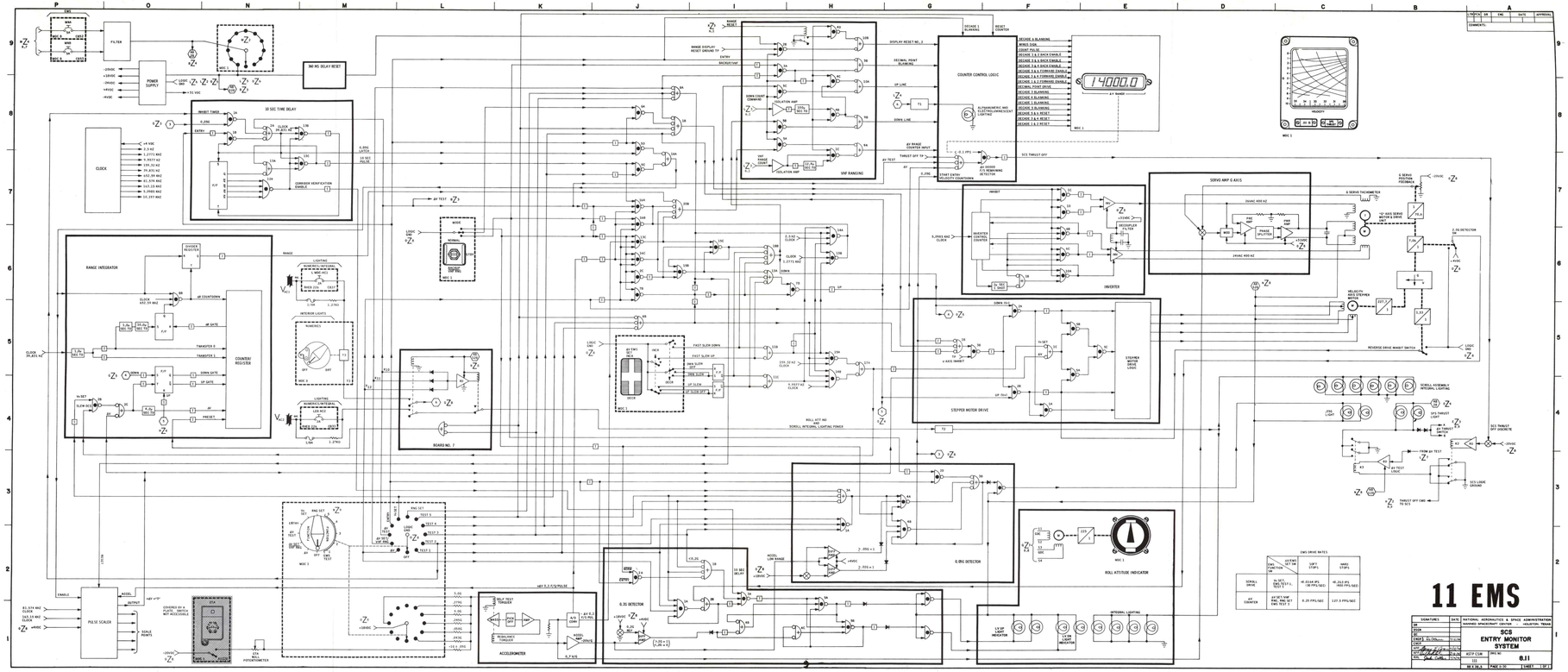
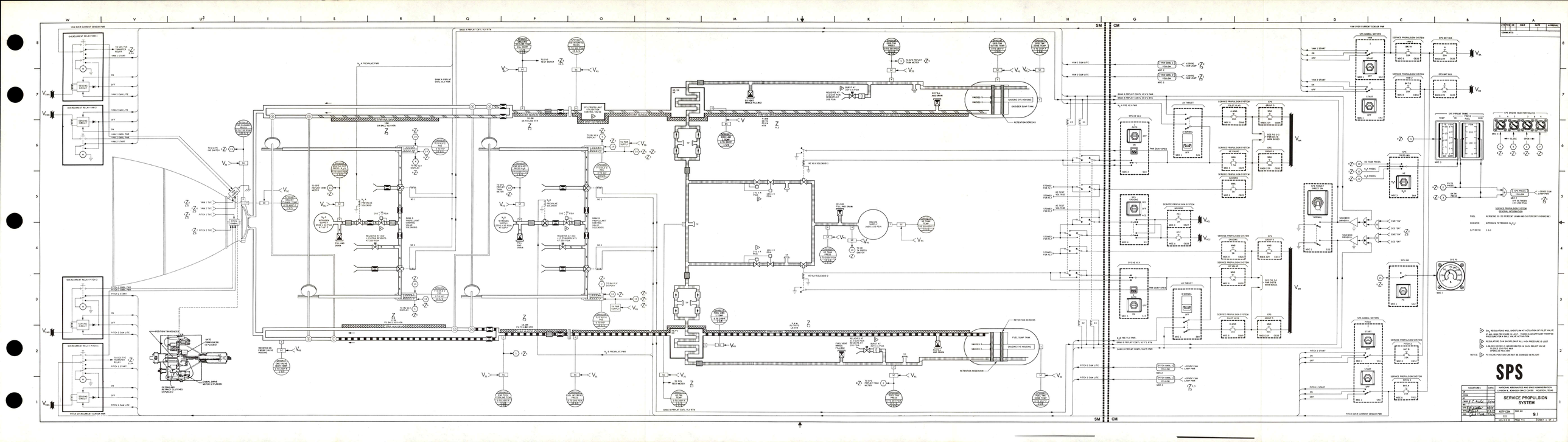
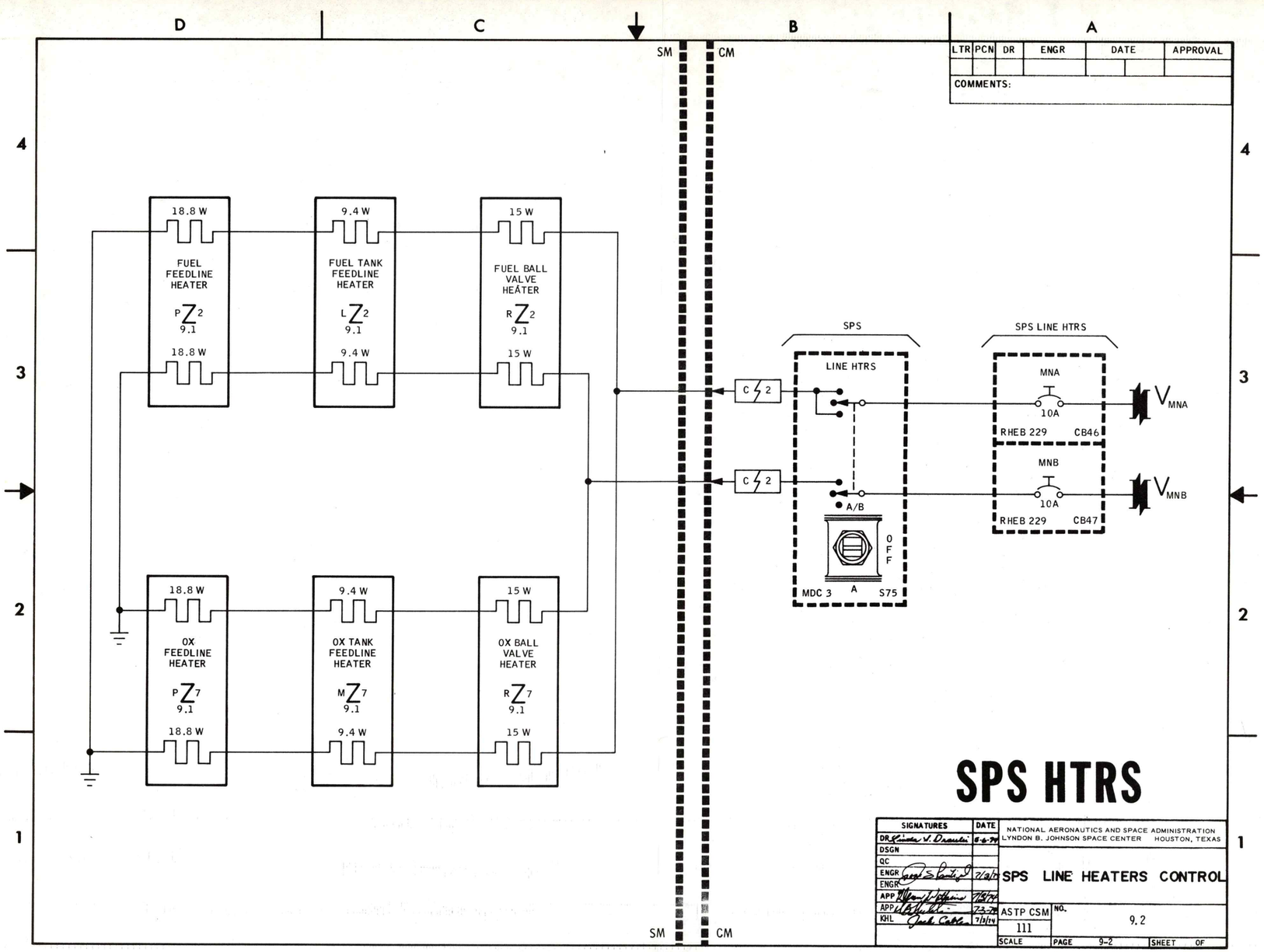

GYRO ASSEMBLY NO 1
GYRO ASSEMBLY NO 2
ELECTRONIC CONTROL ASSEMBLY
GA NO 1 PITCH
GA NO 2 PITCH
GA NO 1 YAW
GA NO 2 YAW
GA NO 1 ROLL
GA NO 2 ROLL
DAP
TVCSA
CM/SM
SPS GIMBAL ASSEMBLY
SPS GIMBAL LV TANK PRES'S IND
GPI / S-IVB PRESSURE DECA
REACTION JET / ENGINE CONTROL
RJ/EC
SM/COM
14000.0
9 CNTL ELEC


CMC RCS DAP
ELECTRONIC CONTROL ASSEMBLY
PITCH SCS - CMC REACTION JET CONTROL LOGIC
SCS REACTION JET CONTROL LOGIC
CMC REACTION JET CONTROL LOGIC
STABILIZATION CONTROL SYSTEM
REACTION JET SOLENOID DRIVERS
AUTO RCS SELECT
DIRECT RCS
AUTO RCS
10 RCS CNTL
AUTO / MANUAL RCS
SM
CM

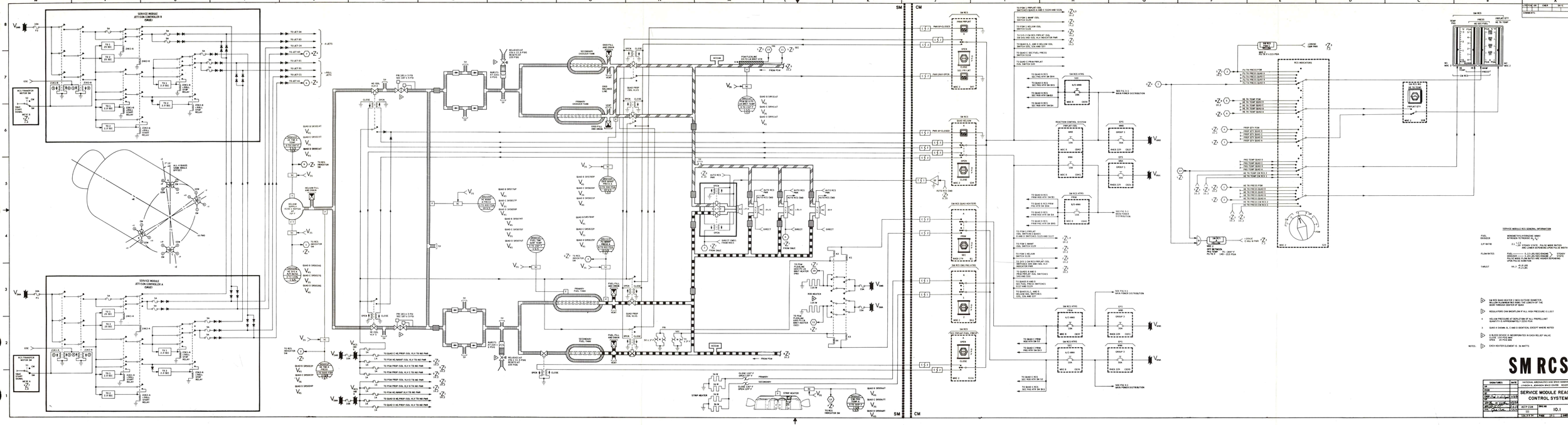

11 EMS
SCS ENTRY MONITOR SYSTEM
NATIONAL AERONAUTICS & SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER
HOUSTON, TEXAS
8.11
14000.0
4-7 RANGE
VELOCITY
ROLL ATTITUDE INDICATOR
ACCELEROMETER
0.05G DETECTOR
SERVO AMP 0 AXIS
INVERTER
STEPPER MOTOR DRIVE
VHF RANGING
RANGE INTEGRATOR
COUNTER CONTROL LOGIC
10 SEC TIME DELAY
360 MS DELAY RESET
POWER SUPPLY
CLOCK
PULSE SCALER
BOARD NO. 7
SCROLL ASSEMBLY INTEGRAL LIGHTING
SCS THRUST OFF DISCRETE
SCS LOGIC GROUND
THRUST OFF CMD TO SCS
FROM AV TEST
AV TEST LOGIC
EMS DRIVE RATES
SCROLL DRIVE
AV COUNTER
HI RATE (1 PPS)
HI 2124 PPS
HI 24.3 PPS (1022 PPS/SEC)
LO RATE (1 PPS)
LO 21.24 PPS
LO 127.5 PPS/SEC
SIGNATURES
DATE
APPROVAL
DESIGN
DRAWN
CHECK
APPROVED
ASTP CSM
DWG NO.
SIZE
SCALE
SHEET 1 OF 1

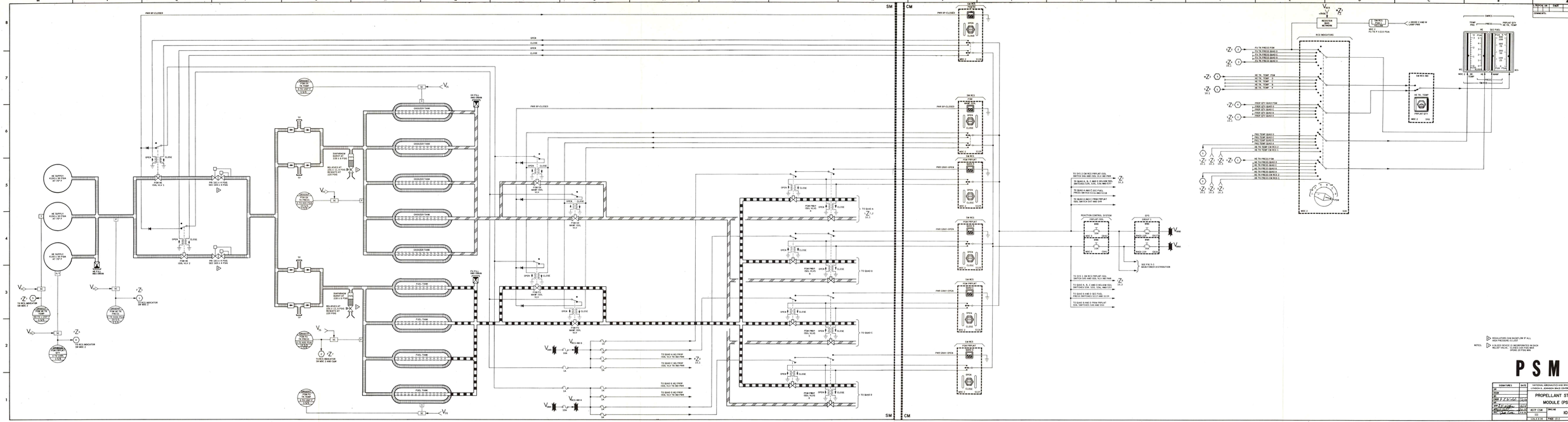
9 SERVICE
PROPULSION
SYSTEM

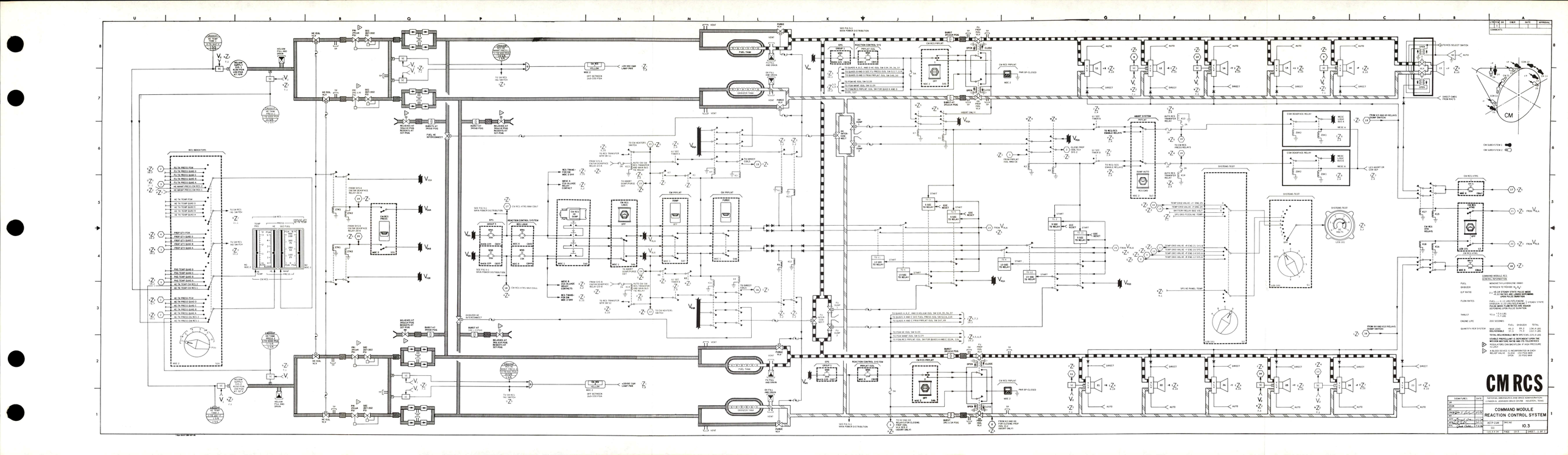

SPS
SERVICE PROPULSION SYSTEM
SPS GIMBAL MOTORS
SPS ENGINE INJECTOR VALVES
SPS PROPLANT TANKS
SPS HE VLV
SPS HE REG
SPS PC
SPS BAT BUS
SERVICE PROPULSION SYSTEM GENERAL INFORMATION
FUEL HYDRAZINE 50-50 PERCENT UDMH AND 50 PERCENT HYDRAZINE
OXIDIZER NITROGEN TETROXIDE (N_2O_4)
O/F RATIO 1.6:1
SPS PROPELLANT SYSTEM
SPS PROPELLANT SYSTEM SCHEMATIC
SPS PROPELLANT SYSTEM SCHEMATIC
SPS PROPELLANT SYSTEM SCHEMATIC


D
C
B
A
SM
CM
4
3
2
1
18.8 W
FUEL FEEDLINE HEATER
P Z 2 9.1
18.8 W
9.4 W
FUEL TANK FEEDLINE HEATER
L Z 2 9.1
9.4 W
15 W
FUEL BALL VALVE HEATER
R Z 2 9.1
15 W
18.8 W
OX FEEDLINE HEATER
P Z 7 9.1
18.8 W
9.4 W
OX TANK FEEDLINE HEATER
M Z 7 9.1
9.4 W
15 W
OX BALL VALVE HEATER
R Z 7 9.1
15 W
C 2
C 2
SPS
LINE HTRS
A/B
OFF
MDC 3 A S75
SPS LINE HTRS
MNA
10A
RHEB 229 CB46
MNB
10A
RHEB 229 CB47
V MNA
V MNB
LTR PCN DR ENGR DATE APPROVAL
COMMENTS:
SPS HTRS
SIGNATURES
DR
DSGN
QC
ENGR
ENGR
APP
APP
KHL
DATE
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
SPS LINE HEATERS CONTROL
ASTP CSM 111
NO. 9.2
SCALE
PAGE 9-2
SHEET OF

10 REACTION CONTROL SYSTEM


SERVICE MODULE ATTITUDE CONTROLLER B (SMAC)
SERVICE MODULE ATTITUDE CONTROLLER A (SMAC)
SM
CM
SM RCS
SM RCS QUAD HEATER
SM RCS HTRS
CM RCS
CM RCS HTRS
SERVICE MODULE RCS GENERAL INFORMATION
FUEL
OXIDIZER
MONOMETHYL HYDRAZINE (MMH)
NITROGEN TETROXIDE (N_2O_4)
O/F RATIO
2.1 ± 0.3 STEADY STATE ; PULSE MODE RATIOS ARE LOWER DEPENDING UPON PULSE WIDTH
FLOW RATES
FUEL ——— 0.124 LBS/SEC/ENGINE STEADY STATE
OXIDIZER —— 0.261 LBS/SEC/ENGINE PULSE MODE FLOW RATES ARE HIGHER DEPENDING UPON PULSE DURATION
THRUST
100 ± 4.5 LBS
VACUUM
SM RCS
SM RCS HTRS
CM RCS
CM RCS HTRS
SM RCS QUAD HEATERS
SM RCS QUAD HEATER
SM RCS HTR
SM RCS HTRS
CM RCS HTR
CM RCS HTRS
SM RCS HTR
SM RCS HTRS
SM RCS QUAD HEATER
SM RCS HTR
SM RCS HTRS
CM RCS HTR
CM RCS HTRS
SM RCS
SM RCS HTRS
CM RCS


SM
CM
PSM
PROPELLANT STORAGE MODULE (PSM)
IO.2
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LYNDON B. JOHNSON SPACE CENTER - HOUSTON, TEXAS
NOTES:
1. REGULATORS CAN BACKFLOW IF ALL MAIN PRESSURE IS LOST.
2. A GLASS DEVICE IS INCORPORATED IN EACH RELIEF VALVE TO INDICATE RUPTURE OF THE DISC.


CM RCS
COMMAND MODULE
REACTION CONTROL SYSTEM
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
APPROVED
DRG NO
10.3
SIZE
E
SCALE NONE
SHEET 1 OF 1
CM
RCS INDICATORS
REACTION CONTROL SYS
PROPULSION
CM RCS PREFLIGHT
SYSTEMS TEST
ABORT SYSTEM
ESM DEADFACE RELAY
CM RCS HTRS
COMMAND MODULE RCS
GENERAL INFORMATION
FUEL
DIVIDER
OXIDIZER
MONOMETHYLHYDRAZINE (MMH)
N2TO4 OR N2TO10(N) (N2O4/NO)
O/F RATIO
2.1 +0.14 STEADY STATE VALVE MIXT
+0.3 -0.14 PULSE MODE AVG MIXT
WITH PULSE MODE TRN
FLOW RATES
FUEL ---- 5 @ 1.5 PULSE/ENGINE
OXIDIZER ---- 5 @ 2.4 PULSE/ENGINE
PULSE MODE FLOW RATES ARE HIGHER
DEPENDING UPON PULSE DURATION
THRUST
100 SECONDS
ENGINE LIFE
FUEL DIVIDER TOTAL
QUANTITY PER SYSTEM
MAX USABLE 77.0 LBS 154.0 LBS
DELIVERABLE 75.0 LBS 150.0 LBS
TOTAL DELIVERABLE BETW SYS (150.0 LBS)
DOUBLE PROPELLANT IS DEPENDENT UPON THE
MISSION MIXTURE RATIO AND ITS TOLERANCES
ENGINE MUST FIRE DWN BATT FOR 1ST PRESS PERIOD
AFTER LOSS
ALL RCS SERVICE IS INCORPORATED IN EACH
VALVE VALVE OPERATING TIME 20 MSEC MIN
25 MSEC MAX
SIGNATURES
DATE
DR
DSN
CM RCS
COMMAND MODULE
REACTION CONTROL SYSTEM
ASTP CSM
DRG NO
10.3
SIZE
E
SCALE NONE
SHEET 1 OF 1
ENGINEER
PRESS
HE REG
HE REG
HE REG

11 CM AND DM EXPERIMENTS

5 UV SPECTRUM COUNT FORMAT, DL9642X THRU DL9657X

WORD	FUNCTION		COMMENTS
1	SYNC WORD 1	1 1 1 1 1 1 1 1 1 1 1 1 0 1 0 1 0	WORD 1-5 ARE GENERATED UPON DETECTION OF THE FIDUCIAL MARK AT THE END OF THE SPECTRUM SCAN
2	SYNC WORD 2	0 0 0 0 0 0 0 0 0 0 0 1 0 1 0 1	
3	SCAN PERIOD WORD	0 0 X X X X X X X X X X X X X X	"X" DENOTES BINARY BITS INDICATING THE BINARY NUMBER OF 400 HZ PULSES OCCURING BETWEEN SUCCESSIVE FIDUCIAL MARKS (~4800 COUNTS)
4	SYNC WORD 2	0 0 0 0 0 0 0 0 0 0 0 1 0 1 0 1	
5	SYNC WORD 1 (MSB … LSB)	1 1 1 1 1 1 1 1 1 1 1 1 0 1 0 1 0	
6 1 1 1 120	DATA WORDS	Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y	"Y" REPRESENTS BITS INDICATING THE BINARY NUMBER OF PHOTOELECTRONS DETECTED IN THE 0.1 SECOND WORD PERIOD

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

3 THE MUX LOGIC FOR BITS 12-1 IS IDENTICAL TO THE MUX LOGIC FOR BITS 16-13. ONLY THE WIRING TO FORMAT THE SYNC PATTERN DIFFERS. SEE NOTE

2 HARDWIRED "1'S" AND "0'S" TO PROVIDE SYNC PATTERNS FOR WORDS 1, 2, 4 AND 5

NOTES:
1 TWO DRIVERS ARE REQUIRED TO HANDLE THE LOADS IMPOSED BY 16 GATES

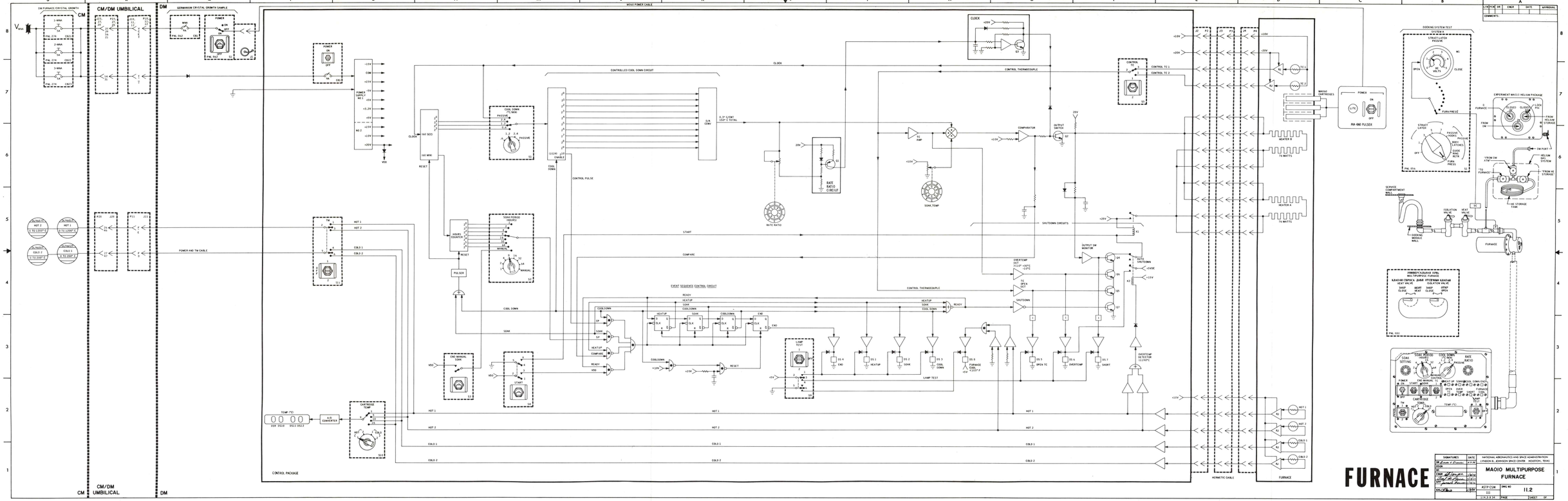
UVA

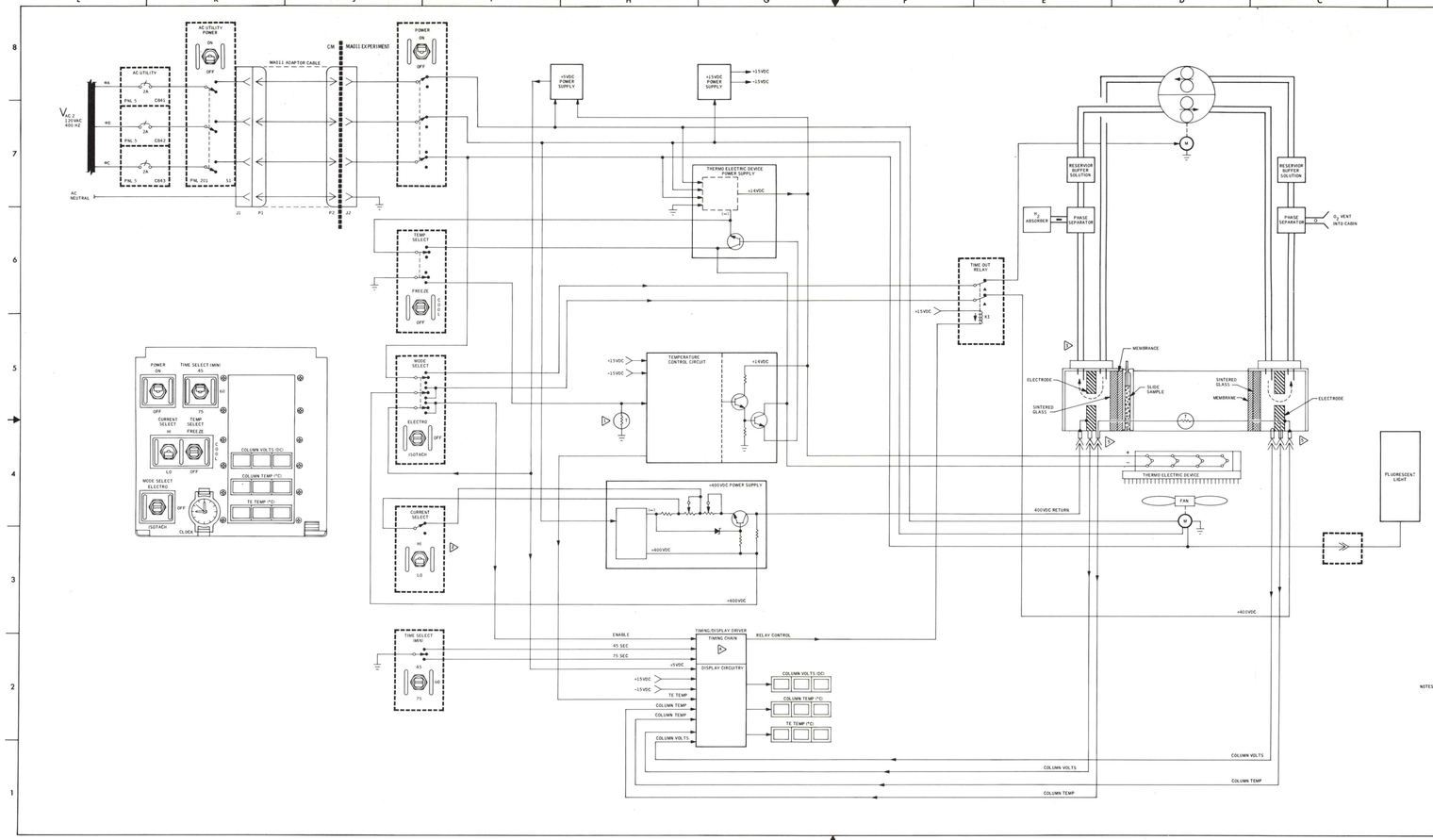
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS

ULTRAVIOLET ABSORPTION EXPERIMENT

SIGNATURES	DATE
DR [signature]	10-31-74
DSGN	
QC	
ENGR [signature]	1/8/75
[signature]	1/13/75
APP [signature]	1/13/75
KHL [signature]	1/8/75

ASTP CSM 111 — DWG NO 11.1 — 126.5 X 34 — PAGE — SHEET OF


CM/DM UMBILICAL
CM
DM
CM/DM UMBILICAL
GERMANIUM CRYSTAL GROWTH SAMPLE
POWER AND TM CABLE
MONO POWER CABLE
CONTROL PACKAGE
CONTROL THERMOCOUPLE
CLOCK
START
COMPARE
CONTROL PULSE
EVENT SEQUENCE CONTROL CIRCUIT
LAMP TEST
SHUTDOWN CIRCUITS
HEATER A
HEATER B
74 WATTS
HERMETIC CABLE
FURNACE
MAGNO CARTRIDGES
MA-080 PULSER
DOCKING SYSTEM TEST
EXPERIMENT MA-011 HELIUM PACKAGE
MULTIPURPOSE FURNACE
ИЗОЛЯЦИЯ СКЛЯНКА ДАВЯ ОТСЕЧНОЙ КЛАПАН
ISOLATION VALVE
FURNACE
MAOIO MULTIPURPOSE FURNACE
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
ASTP CSM
DRG NO 11.2
SIZE D
SCALE NONE
PAGE
SHEET OF



ACTUAL TERMINAL ASSIGNMENTS ARE AS LISTED BELOW, BEGINNING WITH THE OUTSIDE TERMINAL ON THE SAMPLE END OF THE COLUMN.

1. COLUMN VOLTS RETURN
2. + 400 VOLTS IN
3. COLUMN VOLTS
4. COLUMN TEMP. RETURN
5. 400 VOLTS RETURN
6. COLUMN TEMP.

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

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

NOTES:

H3 POSITION 20 MA
1/2-POSITION 2 MA

PHYSICAL LOCATION OF THERMISTOR IS INSIDE THE THERMOELECTRIC DEVICE

ETE

SIGNATURES	DATE
DR of Control	7/7/71
DESIGN	
QC	
ENGR Paul Hoffman	7/7/71
Chief of Engr.	7/7/71
APPROVAL Samuel Pearson	7/8/71
CHG Office	7/8/71

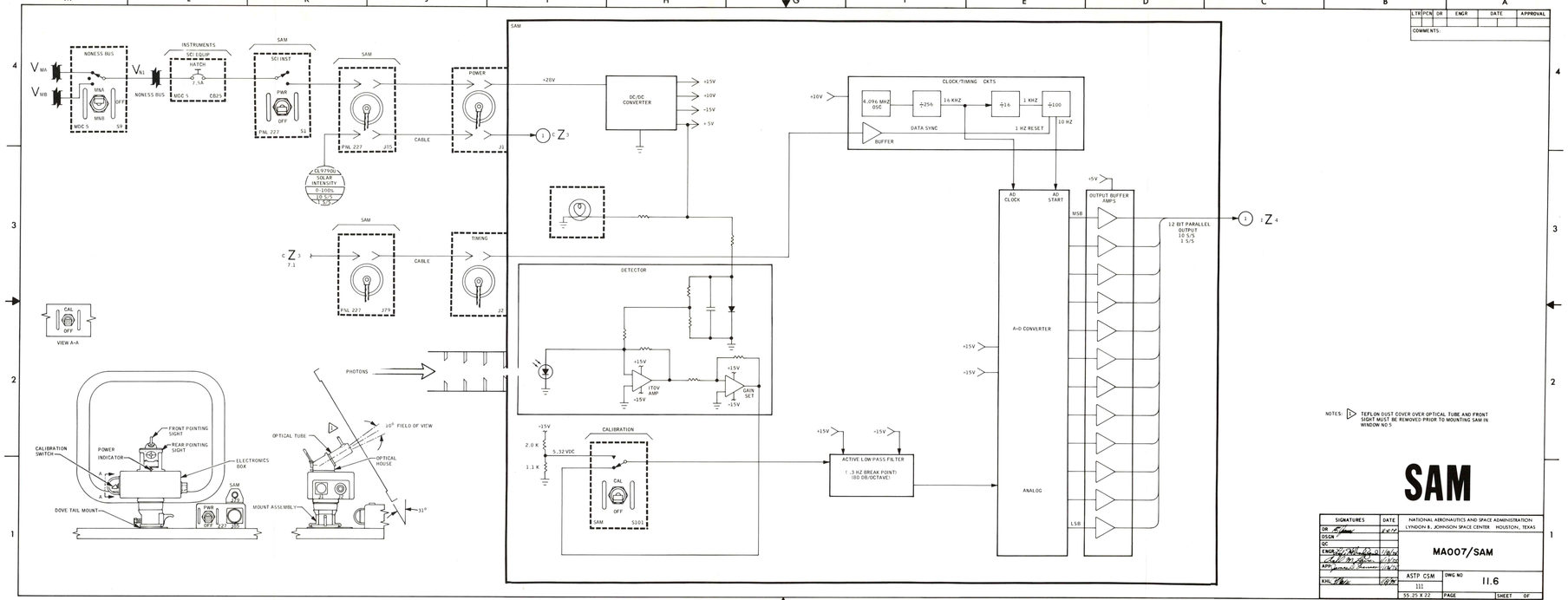
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS

ELECTROPHORESIS TECHNOLOGY (MSFC) MA-011

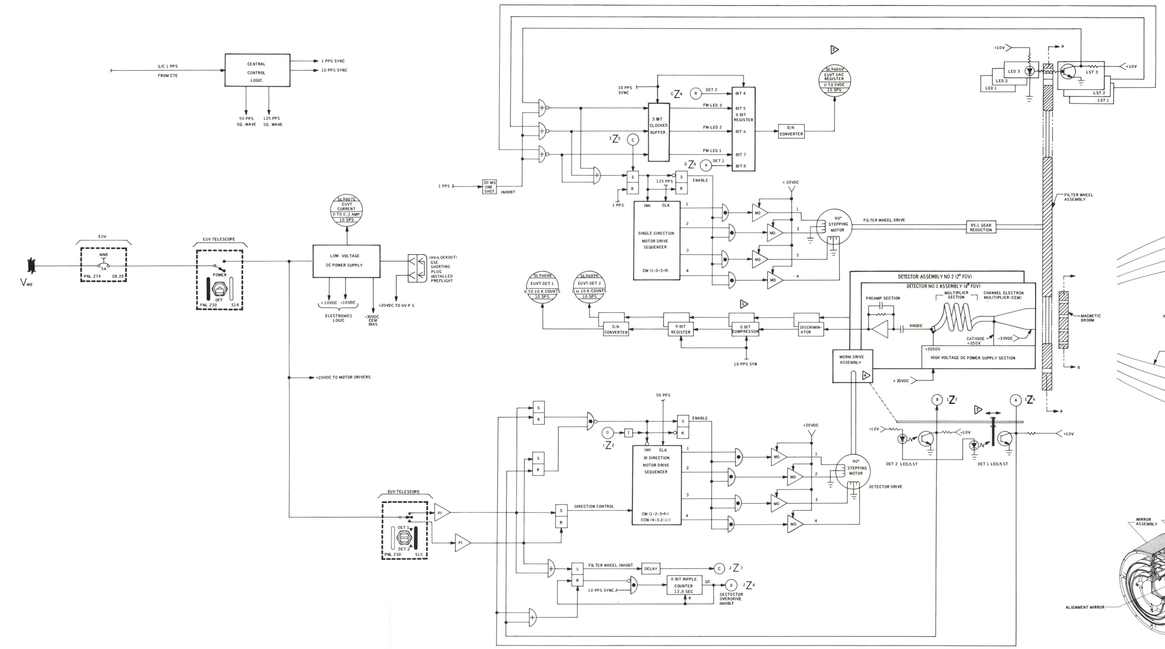
ASTP CSM	DWG NO	11.4
111		
12 X 24	PAGE	SHEET OF

TYPICAL DR	ENGR	DATE	APPROVAL

COMMENTS:


M
L
K
J
I
H
G
F
E
D
C
B
A
4
3
2
1
LTR PCN DR ENGR DATE APPROVAL
COMMENTS:
SAM
NONESS BUS
INSTRUMENTS
SEQ EQUIP HATCH
SAM SEQINST
PWR OFF SL
FNL 227 J75
FNL 227 J76
CABLE
POWER
J1
J2
+20V
DC/DC CONVERTER
+15V
+10V
-15V
+5V
CLOCK/TIMING CKTS
4.096 MHZ OSC
÷256
16 KHZ
÷16
1 KHZ
÷100
10 HZ
DATA SYNC
1 HZ RESET
BUFFER
SOLAR INTENSITY 0-100% 10 S/S 1 S/S
DETECTOR
TIMING
+15V
ITOV AMP
GAIN SET
-15V
A/D CLOCK
A/D START
A-D CONVERTER
OUTPUT BUFFER AMPS
MSB
LSB
12 BIT PARALLEL OUTPUT 10 S/S 1 S/S
CAL
OFF
VIEW A-A
PHOTONS
FRONT POINTING SIGHT
REAR POINTING SIGHT
POWER INDICATOR
CALIBRATION SWITCH
ELECTRONICS BOX
DOVE TAIL MOUNT
OPTICAL TUBE
10° FIELD OF VIEW
OPTICAL HOUSE
MOUNT ASSEMBLY
31°
2.0 K
5.32 VDC
1.1 K
CALIBRATION
5101
ACTIVE LOW PASS FILTER
(.3 HZ BREAK POINT) (80 DB/OCTAVE)
ANALOG
NOTES: TEFLON DUST COVER OVER OPTICAL TUBE AND FRONT SIGHT MUST BE REMOVED PRIOR TO MOUNTING SAM IN WINDOW NO 5
SAM
SIGNATURES
DATE
DR
DSGN
QC
ENGR
APP
KHL
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
MA007/SAM
ASTP CSM
111
DWG NO
11.6
55.25 X 22
PAGE
SHEET OF

12 SM
EXPERIMENTS



5. MANUFACTURERS REFERENCE

FILTER WHEEL POSITION	FILTER MATERIAL	FILTER WHEEL POSITION
1	BE/PA COMPOSITE	X-4
2	AL 1U +C	X-3
3	PARYLENE-N	X-6
4	SPHASE	X-1
5	BAF 2	X-2
6	SN 60	X-5

OUTPUT WITH FILTER AT THE FOCAL PLANE

4. SEE SECTION A-A WHEEL IS IN SET 2 POSITION THE 3RD FW (SET 2) WHOLE BE BEHIND FILTER 1 (LOCATION 1) AND THE 4TH FW (SET 2) WHOLE BE BEHIND FILTER 2 (LOCATION 6). BOTH (SET 1 SET 2) FILTERS IN WHEEL ARE ROTATED TO THE 45° POSITION SO THAT THEY ARE NORMAL TO THE FOCAL PLANE. THE OPTICAL AXIS OF THE TELESCOPE IS ALIGNED WITH THE AXIS OF THE CALIBRATION SOURCE. AT THE FILTERS ARE ROTATED TO THE 45° POSITION, COUNT RATES ABOVE BACKGROUND WILL BE DETECTED.

3. AS WORM GEAR DRIVES TO MOVE DETECTOR TO THE FOCAL PLANE, A RAY MOVES DOWN A SLOWER FROM ONE END TO THE OTHER. A SET OF LIMIT SWITCH PAIR INDICATING THE DETECTOR IN THE FOCAL PLANE

2. DAC REGISTER OUTPUT

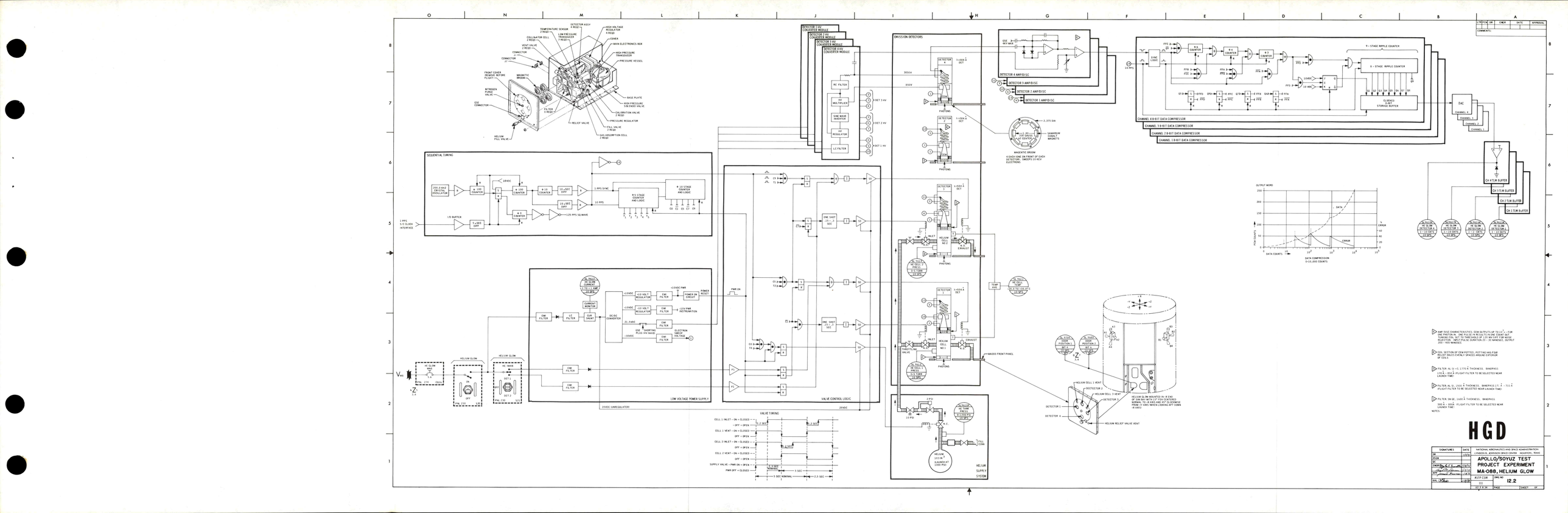
INPUT (SET-1)	VOLTAGE
4	0.1372
5	0.3145
6	0.629
7	1.259
8	2.519

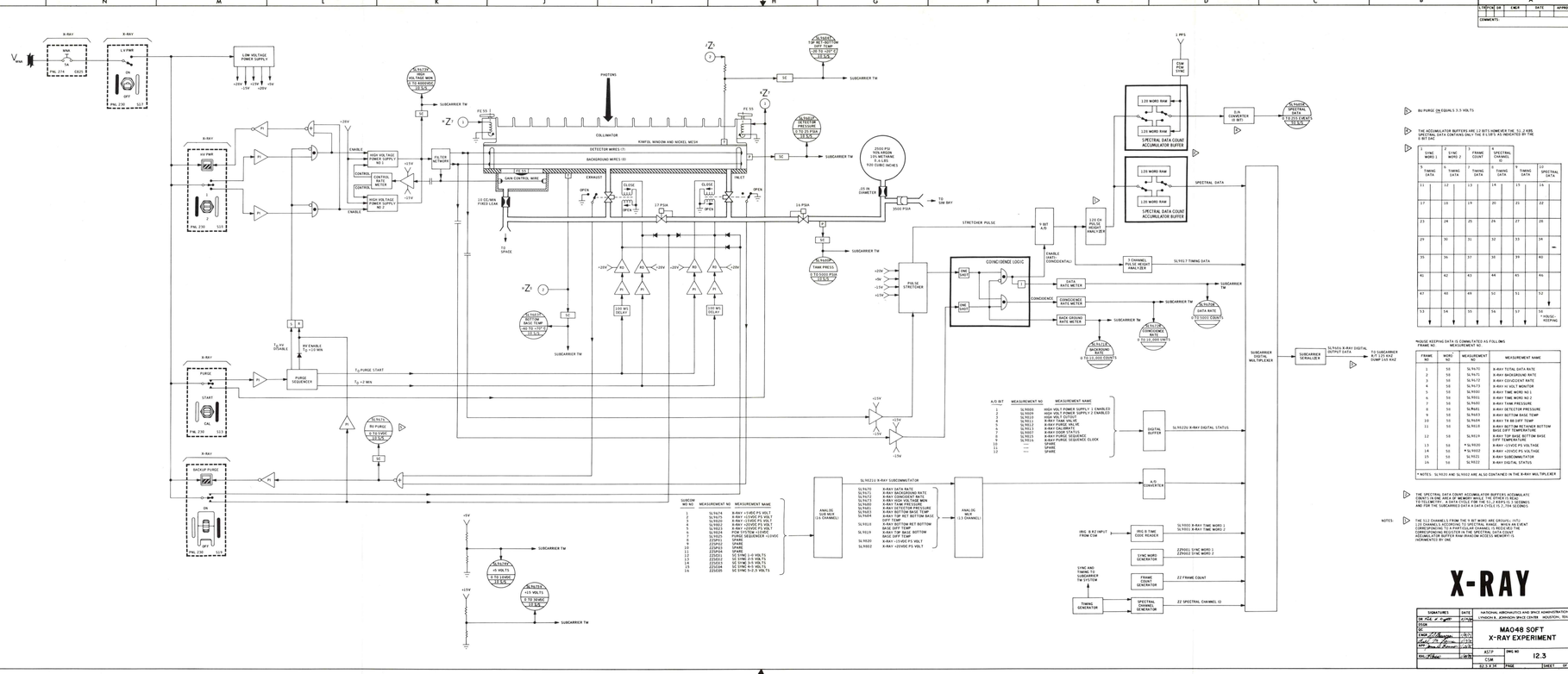
FOR INPUT TO PCM SYSTEM AFTER D/A CONVERSION. ADD THE VOLTAGES FOR SET BITS

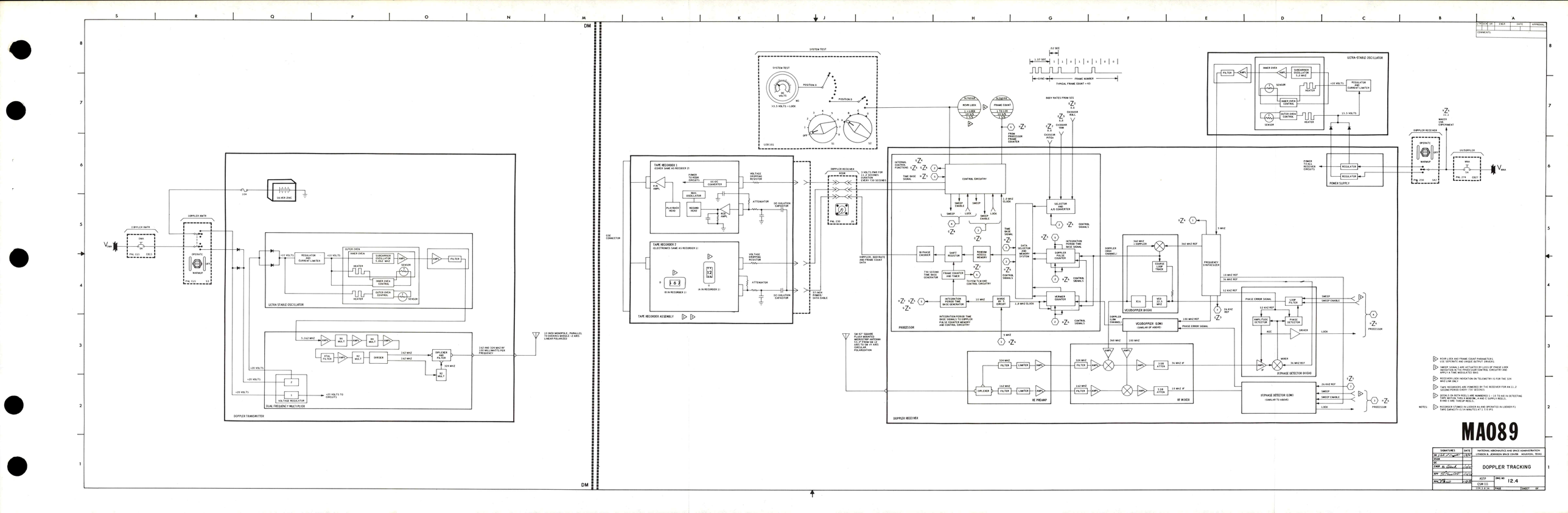
1. DATA COMPRESSION

EUVT

SIGNATURES	DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
DR		LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
DSR		
ENGR		MA083 EXTREME UV TELESCOPE
APPROVED		CSM 111 DWG NO 12.1
		SIZE B X 34 PAGE SHEET 1 OF 1


HELIUM GLOW
HELIUM GLOW
HELIUM GLOW
VALVE TIMING
LOW VOLTAGE POWER SUPPLY
VALVE CONTROL LOGIC
EMISSION DETECTORS
SEQUENTIAL TIMING
HELIUM SUPPLY SYSTEM
APOLLO/SOYUZ TEST PROJECT EXPERIMENT MA-088, HELIUM GLOW
HGD


X-RAY
MAN
ON
OFF
PNL 274
OS25
X-RAY
L4 PWR
ON
OFF
PNL 230
S17
LOW VOLTAGE POWER SUPPLY
+20V
+15V
-15V
-20V
+5V
SL9120 FACE MON DEL TEMP MONITOR 0 TO 400 DEGREES ±0.5%
SUBCARRIER TM
SC
+Z
FE 55 SOURCE
PHOTONS
COLLIMATOR
KAPTON WINDOW AND NICKEL MESH
DETECTOR WIRES (7)
BACKGROUND WIRES (8)
SL9121 DETECTOR TEMPERATURE OFF TEMP -30 TO +30° C ±0.5%
SUBCARRIER TW
2500 PSI 50% ARGON 5% METHANE 95% CO2 900 CUBIC INCHES
.05 IN DIAMETER
3500 PSIA
TO SIM BAY
1 PPS
SOM SYNC
SPECTRAL DATA COUNT ACCUMULATOR BUFFER
SPECTRAL DATA
A/D CONVERTER (8 BIT)
SL9120 SPECTRAL DATA (12 BIT) ±0.5%
SL9117 TIMING DATA
SL9118 DATA RATE 0 TO 5000 EVENTS
SL9119 BACKGROUND RATE 0 TO 12,000 EVENTS
SL9116 COINCIDENCE RATE 0 TO 20,000 EVENTS
SUBCARRIER TW
SUBCARRIER TM
SUBCARRIER DIGITAL MULTIPLEXER
SUBCARRIER DEMULTIPLEXER
SL9165 X-RAY DIGITAL OUTPUT DATA
TO SUBCARRIER DIGITAL DUMP 250 KBZ
STRETCHER PULSE
PULSE STRETCHER
CONCIDENCE LOGIC
ENABLE COINCIDENCE
DISC UNIT
DATA RATE METER
CONCIDENCE RATE METER
BACK GROUND RATE METER
A/D BIT
MEASUREMENT NO
MEASUREMENT NAME
SL9005 +HIGH VOLT POWER SUPPLY 1 ENABLED
SL9009 +HIGH VOLT POWER SUPPLY 2 ENABLED
SL9010 X-RAY TEMP HI/LO
SL9011 X-RAY TEMP VALVE
SL9012 X-RAY PURGE VALVE
SL9013 X-RAY PURGE
SL9007 X-RAY DOOR STATUS
SL9015 X-RAY PURGE SEQUENCE
SL9016 X-RAY PURGE SEQUENCE CLOCK
SPARE
SPARE
SPARE
DIGITAL BUFFER
SL9022U X-RAY DIGITAL STATUS
A/D CONVERTER
SL9002 X-RAY TIME WORD 1
SL9003 X-RAY TIME WORD 2
SYNC WORD GENERATOR
FRAME COUNT GENERATOR
22 FRAME COUNT
SPECTRAL CHANNEL GENERATOR
22 SPECTRAL CHANNEL ID
IRIG B RZ INPUT FROM CSM
IRIG B TIME CODE READER
SYNC AND TIMING FROM SUBCARRIER TM SYSTEM
TIMING GENERATOR
SUBCOM WD NO
MEASUREMENT NO
MEASUREMENT NAME
SL9674 X-RAY +15VDC PS VOLT
SL9675 X-RAY +10VDC PS VOLT
SL9020 X-RAY +25VDC PS VOLT
SL9021 X-RAY +20VDC PS VOLT
SL9023 X-RAY +5VDC PS VOLT
SL9024 PDM SYSTEM +10VDC
SL9025 X-RAY SEQUENCER +10VDC
SPARE
SPARE
SPARE
SPARE
SC SYNC 1-0 VOLTS
SC SYNC 2-0 VOLTS
SC SYNC 3-0 VOLTS
SC SYNC 4-0 VOLTS
SC SYNC 5-0 VOLTS
ANALOG 1OF8 MUX (16 CHANNEL)
SL9022U X-RAY SUBCOMMUTATOR
SL9670 X-RAY DATA RATE
SL9671 X-RAY BACKGROUND RATE
SL9672 X-RAY COINCIDENT RATE
SL9673 X-RAY +5 VOLT MONITOR
SL9680 X-RAY TANK PRESSURE
SL9681 X-RAY DETECTOR PRESSURE
SL9682 X-RAY TANK TEMPERATURE
SL9689 X-RAY TIP SET BOTTOM BASE OFFT TEMP
SL9018 X-RAY TIP SET BOTTOM RET BASE OFFT TEMP
SL9019 X-RAY TIP BASE BOTTOM RET BASE OFFT TEMP
SL9020 X-RAY +25VDC PS VOLT
SL9002 X-RAY +20VDC PS VOLT
ANALOG MUX (15 CHANNEL)
+5 VOLTS
SL9677 ±5 VOLTS ±0.5%
+15 VOLTS
SL9678 ±15 VOLTS ±0.5%
SUBCARRIER TW
SUBCARRIER TM
V_{MA}
T_0 5V ENABLE
5V ENABLE T_0 +10 MIN
T_0 PURGE START
T_0 +2 MIN
PURGE SEQUENCER
PURGE
START
CAL
BACK PURGE
ON
OFF
PNL 230
S13
SL9121 RV PURGE ± 10 VOLTS ±0.5%
SL9122 FACE MON BASE TEMP 440 TO +70° C ±0.5%
SL9124 TANK PRESS 0 TO 5000 PSIA ±0.5%
ENABLE
CONTROL
CONTROL RATE SELECTOR
HIGH VOLTAGE POWER SUPPLY NO 1
HIGH VOLTAGE POWER SUPPLY NO 2
FILTER NETWORK
10 CC/MIN FIXED LEAK
TO SPACE
SIM CONTROL MEM
OPEN
CLOSE
INLET
17 PSIA
14 PSIA
TO SIM BAY
100 MS DELAY
X-RAY
SYNC WORD 1
SYNC WORD 2
FRAME COUNT
SPECTRAL CHANNEL ID
TIMING DATA
SPECTRAL DATA
HOUSE KEEPING
BU PURGE IN EQUALS 5.3.5 VOLTS
THE ACCUMULATOR BUFFERS ARE 12 BITS WIDE PER THE 32.2 KBS SPECTRAL DATA CONTAINS ONLY THE 8 LSB'S AS INDICATED BY THE 8 BIT DAC
HOUSE KEEPING DATA IS COMMUTATED AS FOLLOWS
FRAME NO.
WORD NO.
MEASUREMENT NO.
MEASUREMENT NAME
X-RAY TOTAL DATA RATE
X-RAY BACKGROUND RATE
X-RAY COUICIDENT RATE
X-RAY +5 VOLT MONITOR
X-RAY TIME WORD NO 1
X-RAY TIME WORD NO 2
X-RAY TANK PRESSURE
X-RAY DETECTOR PRESSURE
X-RAY TANK TEMPERATURE
X-RAY TIP BOTTOM BASE OFFT TEMPERATURE
X-RAY TIP BASE BOTTOM RET BASE OFFT TEMP
X-RAY +25VDC PS VOLTAGE
X-RAY +20VDC PS VOLTAGE
X-RAY SUBCOMMUTATOR
X-RAY DIGITAL STATUS
* NOTES: SL9020 AND SL9002 ARE ALSO CONTAINED IN THE X-RAY MULTIPLEXER
THE SPECTRAL DATA COUNT ACCUMULATOR BUFFERS ACCUMULATE 12 BIT DATA WORDS FOR 1.4 SECONDS AND THEN DUMP THE DATA TO TELEMETRY. A DATA CYCLE FOR THE 32.2 KBPS IS 1.4 SECONDS AND FOR THE SUBCARRIED DATA A DATA CYCLE IS 2.704 SECONDS
NOTES:
THE 512 CHANNELS FROM THE 9 BIT WORD ARE ERRIVED, INTO THE SPECTRAL DATA COUNT BUFFER BY THE 9 BIT SPECTRAL CHANNEL ID WORD CORRESPONDING TO A PARTICULAR CHANNEL IS RECEIVED BY THE CORRESPONDING REGISTER IN THE SPECTRAL DATA COUNT ACCUMULATOR BUFFER. THE RANDOM ACCESS MEMORY IS INCREMENTED BY ONE
X-RAY
SIGNATURES
DR
DESIGN
CHIEF
PROJ. ENGR.
MGR. PROJECT OFFICE
DATE
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
MA048 SOFT X-RAY EXPERIMENT
ASTP
CSM
DWG NO
12.3
SIZE B
PAGE
SHEET
ITEM
DR OR ENGR
DATE
APPROVAL
COMMENTS



SUBSYSTEM OR ENGR	ENGR	DATE	APPROVAL
COMMENTS			

RCVR LOCK AND FRAME COUNT PARAMETERS, SEE SUBSYSTEMS AND UNDISC OUTPUT, DP0003.

SWEEP SIGNALS ARE ACTUATED BY S1/23 OF PHASE LOCK LOOP SWITCH ASSEMBLY IN RECEIVER CONTROL CIRCUITRY AND APPLY A TIME MODULATED BIAS.

RECEIVER LOCK INDICATION ON TELEMETRY IS FOR THE 324 MHZ LINK ONLY.

TAPE RECORDERS ARE POWERED BY THE RECEIVER FOR AN 11.2 SECOND PERIOD EVERY 730 SECONDS.

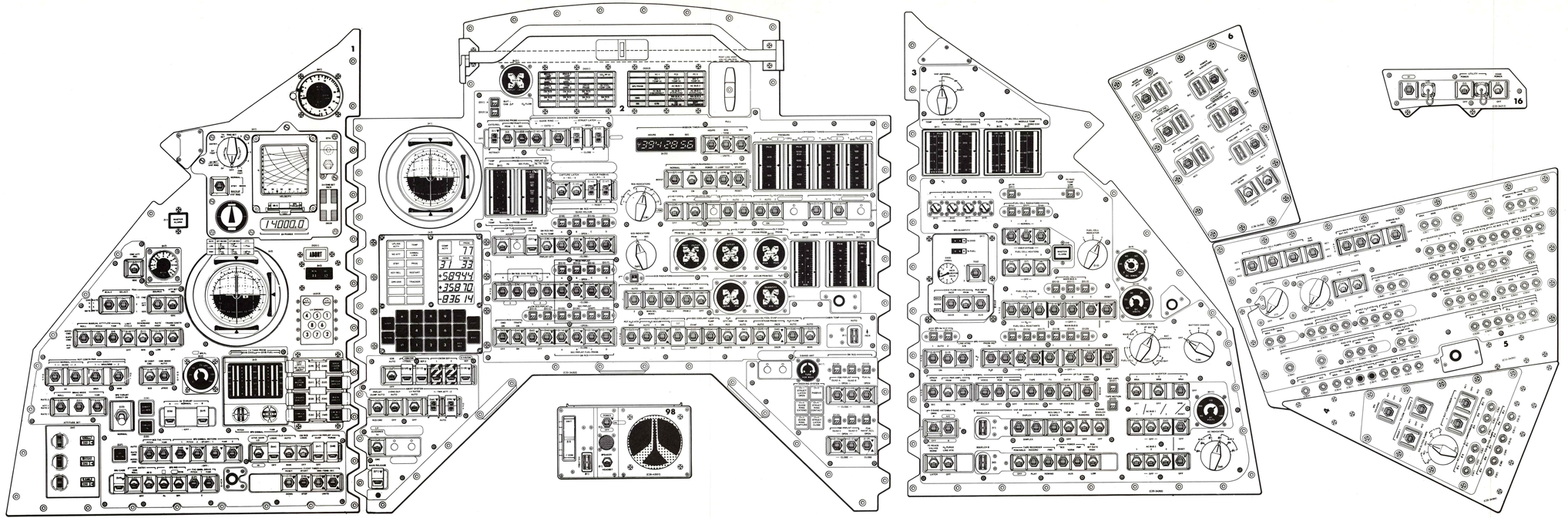
SIGNALS ON BOTH RDDR'S ARE NUMBERED 1 - 24 TO AID IN DETECTING TAPE MOTION THRU A WINDOW, A AND C SUPPLY REELS, B AND D ARE TAKEUP REELS.

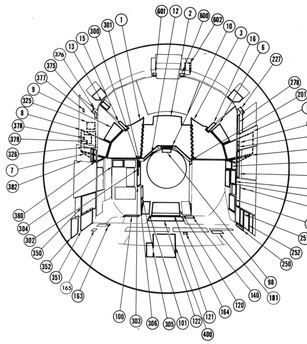
NOTES:
1. RECORDER STORES IN LOCKER #4 AND OPERATED IN LOCKER #1. TAPE CAPACITY IS 54 MINUTES AT 1 7/8 IPS

MA089

SIGNATURES	DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
DR [illegible]	12/67	LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
DSVR		
QE		
ENGR In Charge	12/67	DOPPLER TRACKING
APR [illegible]	12/67	
		ASTP DWG NO 12.4
[illegible]	12/67	CSM 111
		154 X 84 PAGE SHEET OF

13 MISCELLANEOUS





1. ALL NUMBERS AND LETTERS ENCLOSED WITH PARENTHESIS DO NOT APPEAR ON PANELS.

2. ■ SYMBOL DENOTES MOMENTARY SWITCH POSITION AND DOES NOT APPEAR ON PANELS.

3. SWITCH POSITIONS ARE SHOWN FOR CONVENIENCE ONLY AND DO NOT NECESSARILY REFLECT OPERATING MODES OR CONDITIONS. ALL MOMENTARY SWITCH POSITIONS ARE SHOWN IN THE DOWN POSITION. SOME ROTATION SWITCHES ARE SHOWN IN CENTER POSITION.

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

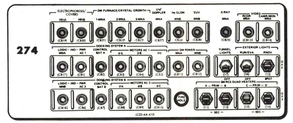
5. THIS DWG REFLECTS A CONFIGURATION AS DEFINED BY APPLICABLE ECP'S, ASSEMBLY DWGS AND MARKING DWGS AT THE TIME OF RELEASE WITH RESPECT TO THE AFFECTED VEHICLE(S).

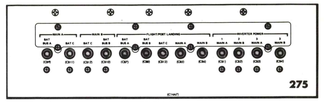
NOTES:

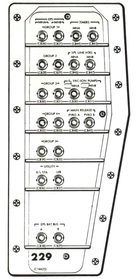
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LYNDON B. JOHNSON SPACE CENTER, HOUSTON, TEXAS

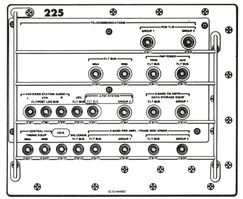
DESIGN LAYOUT
MAIN DISPLAY CONSOLE
COMMAND MODULE ASTP 111/
DOCKING MODULE 2

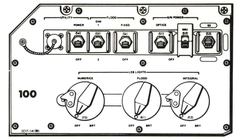
ASTP-CSM | DWG NO
111 | FIGURE 13-1
SCALE 3/8 | SHEET 1 OF 1

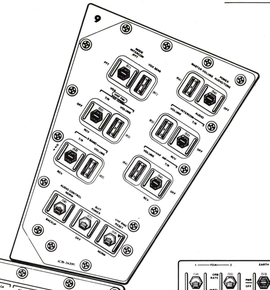


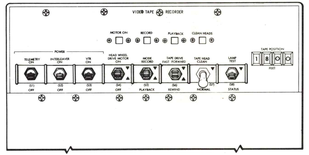


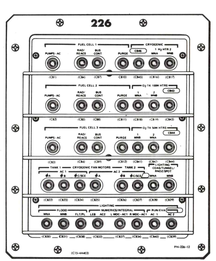


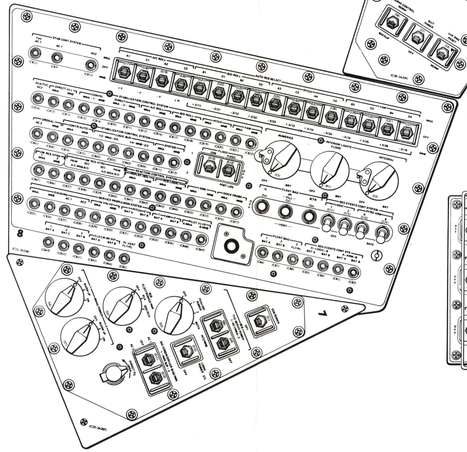


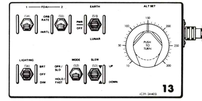


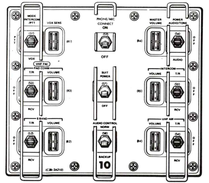


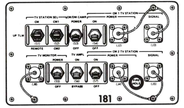


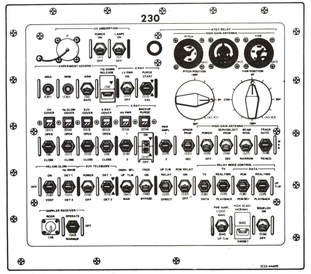


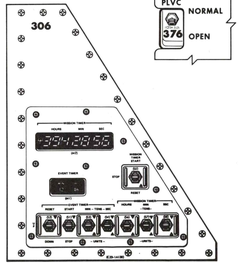


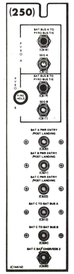


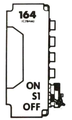








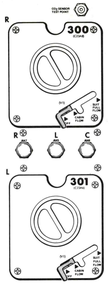


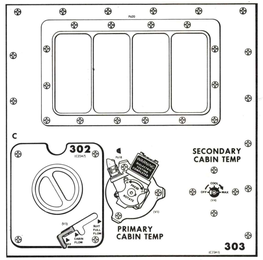


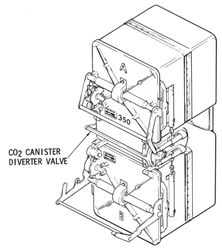
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS

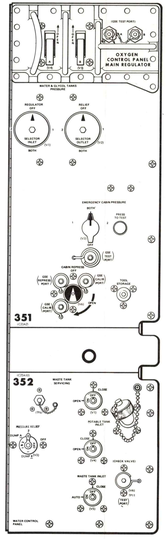
DESIGN LAYOUT
MAIN DISPLAY CONSOLE
COMMAND MODULE ASTP 111/
DOCKING MODULE 2

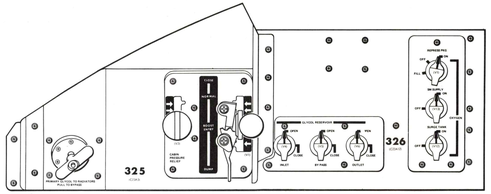
SCALE	DWG NO
1/2	FIGURE 13-1
1 in = 0.5 in	FREE 1.1.7 SHEET 7 OF 14

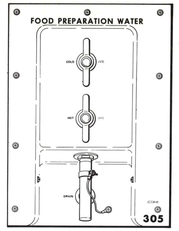


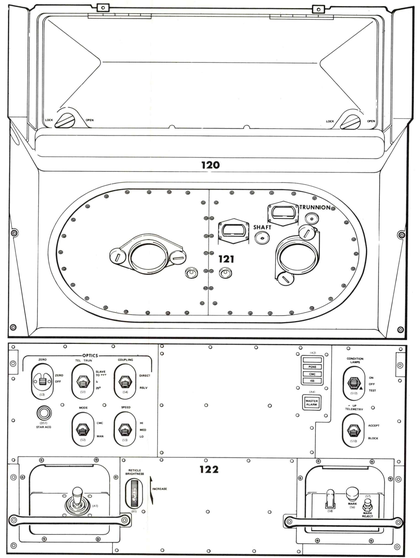


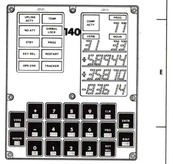


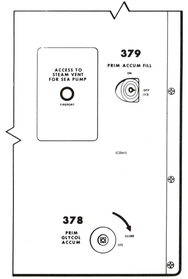


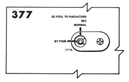


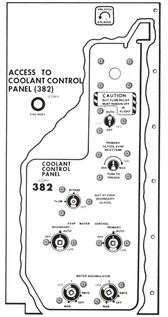


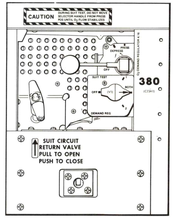


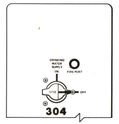


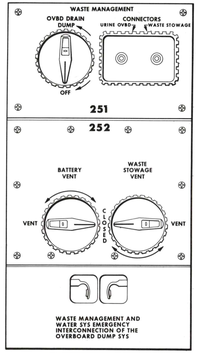


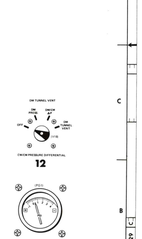












REVISIONS		
LTR	DESCRIPTION	DATE (YR/MO/DA)

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LYNDON B. JOHNSON SPACE CENTER, HOUSTON, TEXAS

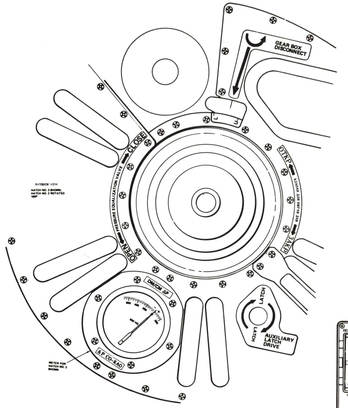
DESIGN LAYOUT
MAIN DISPLAY CONSOLE
COMMAND MODULE ASTP III/
DOCKING MODULE 2

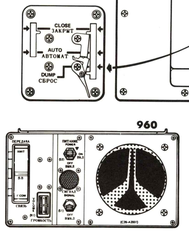
ASTP CUM	SPEC NO	
101		FIGURE 13-1
LEAD	PAGE 13-2	SHEET 1 OF 4

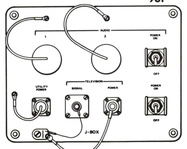
CONTRACT NO. 1

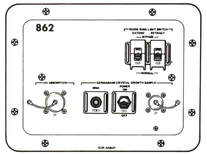
SD 67-629-4

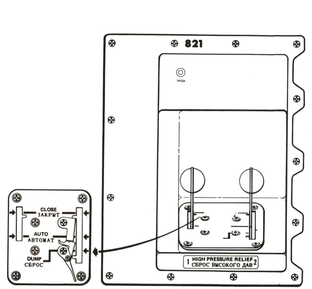
DOCKING MODULE

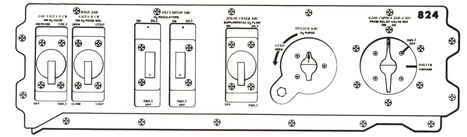


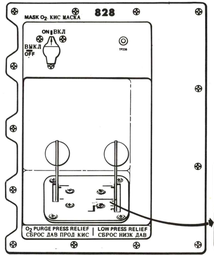


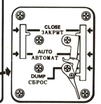


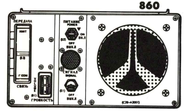


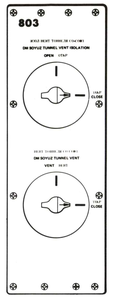


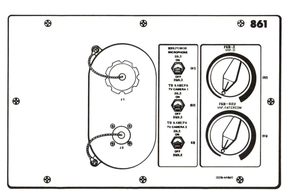


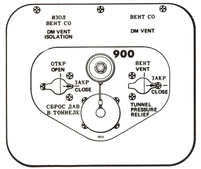


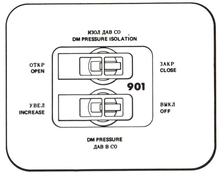


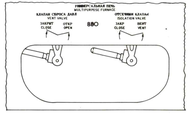


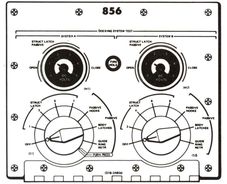


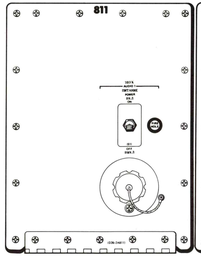


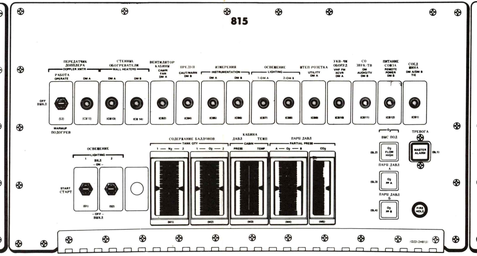


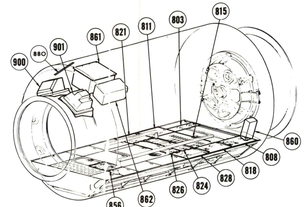


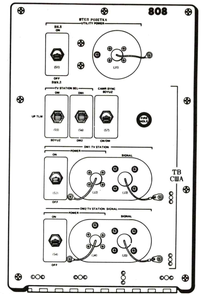


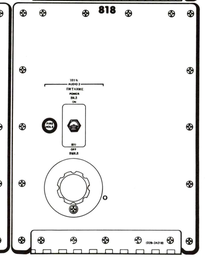




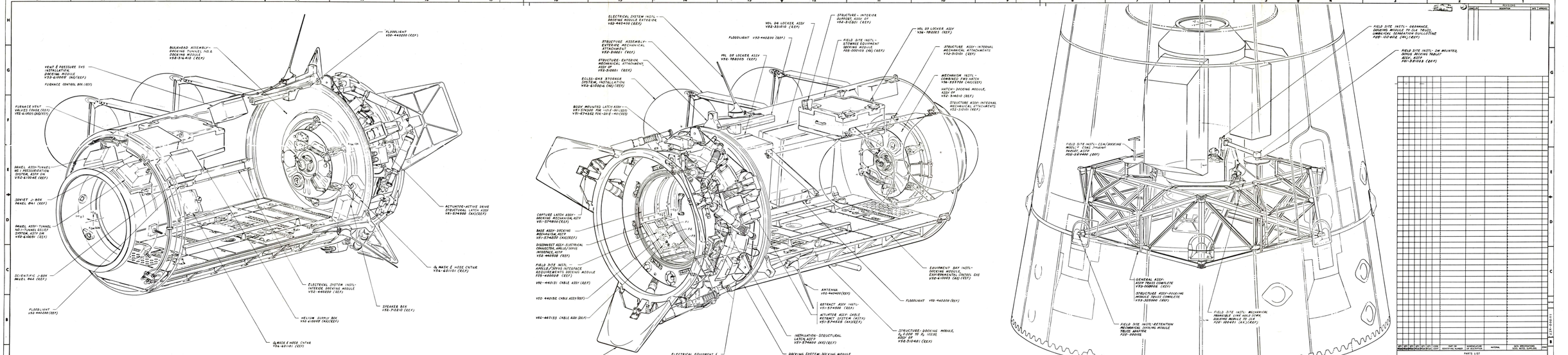








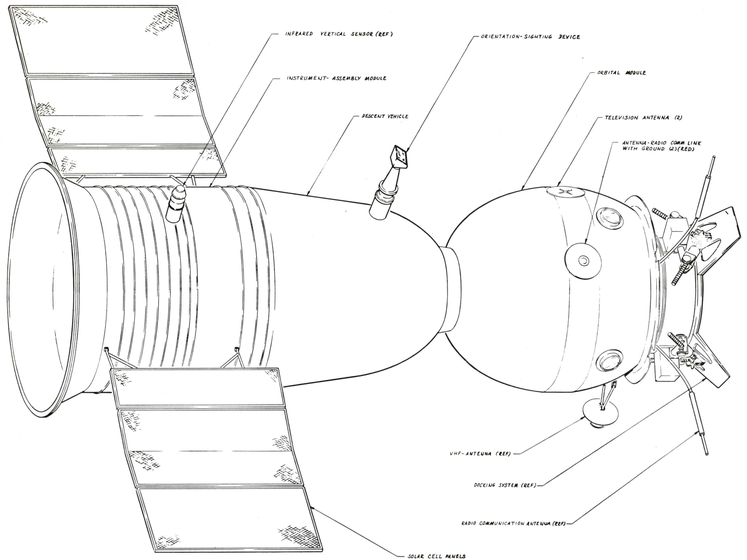
SIGNATURES	DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
		LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
DESIGN LAYOUT MAIN DISPLAY CONSOLE COMMAND MODULE ASTP III / DOCKING MODULE 2		
ASTP-CUM		DRG NO. FIGURE 13-1
SIZE B	SCALE 1:1.4	SHEET 1 OF 2

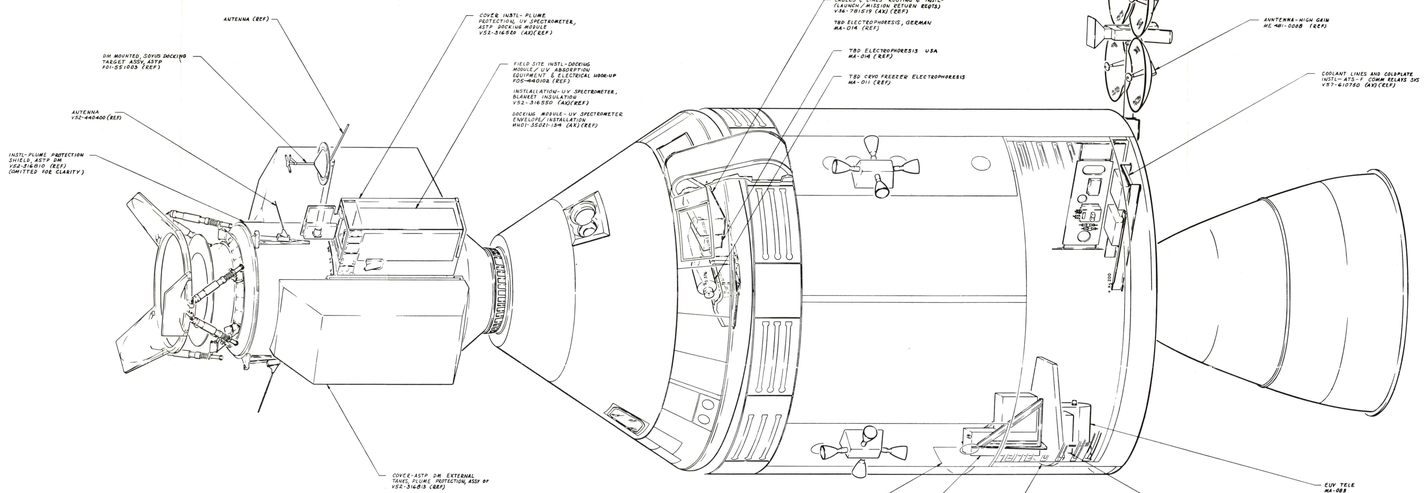


REVISIONS		
LTR	DESCRIPTION	DATE & APPROVED

PARTS LIST

ITEM QTY	NEXT HIGH ASSY	PART OR IDENTIFYING NUMBER	NOMENCLATURE OR DESCRIPTION	MATERIAL	DATA SPECIFICATION SIZE, NOTES, SUPPLIER	ZONE





REVISIONS		
LTR	DESCRIPTION	DATE | APPROVED

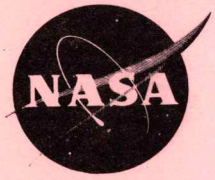
ASTP

CSH

COMMAND/ SERVICE MODULE AND DOCKING MODULE SYSTEMS HANDBOOK

CSM 111

AUGUST 1, 1974



FOD
JSC
NASA