APOLLO 15	
CSM SYSTEMS DATA	
PART NO.	S/N
SKB32100115-340	1001

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MANEUVER	ENGINE LIMITS		RATES/ERRORS FOR		MANUAL START ACTION	OVERBURN SHUTDOWN CRITERIA	EARLY C/O RESTART CRITERIA	RCS TRIM GUIDELINES
	INHIBIT	TERMINATE	TAKEOVER	ACTION				
MODE III	NONE	ERRATIC ENG	5/5	COMPLETE	START	g	Hp > 40	N/A
MODE IV	NONE	ERRATIC ENG	5/5	COMPLETE	START	g	Hp < 95 IF G&N GO ΔVTG > 60 OR C/O > 6 SEC EARLY	N/A
APOGEE KICK	NONE	ERRATIC ENG	5/5	COMPLETE	START	g	Hp < 95 IF G&N GO ΔVTG > 60 OR C/O > 6 SEC EARLY	N/A
TLC MCC	TIGHT[i]	TIGHT[i]	10/10	TERMINATE	DELAY	1 SEC	NO	X = 0.2[b]
LOI	TIGHT[h]				START			NO
a. MODE I								
0 TO 1 + ~~34~~ 38		TIGHT	10/10	COMPLETE			YES	
1 + ~~34~~ TO 38 1 + ~~55~~ 58		LOOSE	10/10	COMPLETE			YES	
1 + ~~55~~ TO 58 ~~1 + 57~~ 2+12		LOOSE	10/10	COMPLETE			YES	
b. MODE II		LOOSE	10/10	COMPLETE			YES	
c. MODE III								
3 + ~~07~~ TO 11 3 + ~~50~~ 56		LOOSE	10/10	COMPLETE			YES	
3 + ~~50~~ 56 TO C/O		TIGHT[h]	10/10	COMPLETE		10 SEC	V_{GO} > 50 AND G&N GO	
DOI	TIGHT[i]	TIGHT[i]	10/10	TERMINATE	DELAY	BT	NO	j
DOI TRIM MANEUVER	TIGHT[i]	TIGHT[i]	10/10	TERMINATE	DELAY	BT	NO	K
CIRC	TIGHT[i]	TIGHT	10/10	TERMINATE	DELAY	1 SEC	NO	X = 0.2 Y = 0.2
RESCUE	LOOSE	LOOSE	10/10	COMPLETE	START	1 SEC	ΔV TOGO > 12	ALL = 0.2
LOPC	TIGHT[i]	TIGHT	10/10	TERMINATE	DELAY	1 SEC	NO	Y = 0.2
SHAPE	TIGHT	TIGHT	10/10	TERMINATE	DELAY	1 SEC	NO	ALL = 0.2
TEI (G&N)	NONE	NONE	10/10	COMPLETE	DELAY	2 SEC AND $\Delta V_C = -40$[c]	C/O > 3 SEC EARLY AND $\Delta V_C > 50$[c]	X AND Z = 0.2
TEI (SCS)	NONE	NONE	10/10	COMPLETE	START	2 SEC	ΔV_C > 50 OR C/O > 5 SEC EARLY	NO
TEC MCC								
a. CORRIDOR	LOOSE	LOOSE	10/10	COMPLETE	DELAY	1 SEC AND $\Delta V_C = 0$	NO	X = 0.2
b. IP CONTROL	TIGHT	TIGHT	10/10	TERMINATE	DELAY	1 SEC AND $\Delta V_C = 0$	NO	X AND Z = 0.2
TLC ABORT	TIGHT	LOOSE	10/10	COMPLETE	START	10 SEC AND $\Delta V_C = -70$	C/O > 10 SEC EARLY AND ΔV_C > 70	NO
EARTH DEORB	LOOSE[d]	LOOSE	10/10	COMPLETE	START	1 SEC AND $\Delta V_C = 0$	ΔV TO GO > 30 AND C/O > 3 SEC EARLY[e]	ALL = 0.2

TIGHT LIMITS: Fuel Ox ΔP > 20 and low P_c; either prop tank press < 160 psi and low P_c; P_c < 80 or decays 10 psi and V_M vs BT low; inhibit burn for any leak in He or prop tank. (Certain burns may be allowed with He tank leak if blowdown ΔV exceeds remaining mission requirements)[f]; GN_2 A or B < 400 psi (for LOI only, GN_2 A and B < 400 psi).

LOOSE LIMITS: P_c < 70 psi and other cues; either prop tank < 115 psi and low P_c; erratic engine (popping, vibration, etc.)[f].

NOTES:

a. Reserved

b. Trim all MCC (except MCC4) only if X ≤ 2 fps.

c. See Rule 5-131.

d. Both prop tank pressures ≥ 140; one GN_2 tank press ≥ 400 if SM-RCS deorbit is available.

e. See Rule 5-27.

f. Some limits may be downgraded if warranted by mission circumstance.

g. See Rule 5-3.

h. If indication of ball valve failure, start on good bank (with LM available). If thrusting, shut down good bank 10 sec prior to nominal cutoff to verify indication.

i. If indication of ball valve failure, start on suspect bank. If indication of ball valve failure while thrusting, shut down good bank to verify failure. If thrusting continues, reenable good bank. For DOI or DOI trim, apply only when bringing second bank on line.

j. See Rule 3-39.

k. See Rule 3-40.

EECOM CSM COMM/INSTR CB FUNCTION PNL 4 CB FUNCTION PNL 5 CB EFFECT PNL 5 CB FUNCTION PNL 8 CB EFFECT PNL 8

CSM EECOM GO CRITERIA

7/1/71

	EARTH ORBIT			TLC			CONT L.O./DOI	UNDOCK AND SEP	CIRC	POWERED DESCENT		LUNAR STAY		LUNAR ORBIT		TEC
	CONT BOOST	CONT E.O.	TLI	TD & E	CONT TLC	LOI				PDI	PDI TO T/D	PAST T_1	PAST T_3 & SUBS	POST RNDZ	LM JETT	CSM EVA
ECS																
CABIN INTEGRITY	← (7) CABIN INTEGRITY →				← CABIN INTEGRITY					(2) →			← CABIN INTEGRITY →			
NO FIRE OR SMOKE IN CABIN	← NO F OR S IN CABIN →				← NO FIRE OR SMOKE IN CABIN					(2) →			← NO F OR S IN CAB →			NO F OR S IN CAB
NO O_2 MANIFOLD LEAKS	← (7*) NO O_2 LEAKS →				← NO O_2 MANIFOLD LEAKS →									MANIF NO O_2 LEAK		NO LEAKS
MAIN O_2 REGULATORS	← (7*) 1 OF 2 →		1 OF 2		← 1 OF 2 →		(13) →							1 OF 2		BOTH (8)
ECS COOLANT LOOPS		1 OF 2 (5)	PRIMARY		← (1) PRIMARY (1) →		← (1)	(1) PRIMARY (1)		(1) →			PRIM (1)	PRIMARY (1)		PRIMARY
ECS RADIATORS		1 OF 2 (5)	PRIMARY		← (1) PRIMARY (1) →		← (1)	(1) PRIMARY (1)		(1) →			PRIM (1)	PRIMARY (1)		
ECS GLYCOL EVAPS																
SUIT INTEGRITY	SI (7*)							SI								SI
NO GLYCOL LEAK		← NO LEAK →			← NO GLYCOL LEAK →								← NO GLY LEAK →			NO LKS
NO EXCESS HUMIDITY		← NO HUMID →			← NO EXCESSIVE HUMIDITY →					(2) →			← NO HUMID →			NO HUMID
POTABLE & WASTE H_2O TK																
SURGE TK & REPRESS PKG																SURGE TK & REPRESS PKG (8)
SUIT COMPRESSORS	← (7*) 1 OF 2 (12) →		1 OF 2		← (12)	(12)	(12) 1 OF 2 →	(12)		(12) (2) →			← (12)	1 OF 2 (12)	(12) →	BOTH
SUIT CIRCUIT	← (7*) SUIT CIRCUIT →				← SUIT CIRCUIT →					(2) →			← SUIT CIRCUIT →			SUIT CIRCUIT
OVBD DUMPS		← 1 OF 3 →			← 1 OF 3 →									← 1 OF 3 →		
CRYO																
O_2 TANKS		1 OF 3	ALL (10)		← (10)	(10)	(10) ALL (10)		(10)	(10) →			← (10)	ALL (10) →	2 OF 3	ALL (3)
H_2 TANKS		1 OF 3	ALL (10)		← (10)	(10)	(10) ALL (10)		(10)	(10) →			← (10)	ALL (10) →	1 OF 3	1 OF 3
EPS																
FUEL CELLS	1 OR 1 + 1 / 0	2 OF 3	2 OF 3		← 2 OF 3 →								← 2 OF 3 →		2 OF 3 (11)	1 OF 3
AUX BATTERY	0															
ENTRY BATTERIES	3	2 OF 3	ALL (6)		← (6)	(6)	(6) ALL (6)		(6)	(6) →			← (6)	ALL (6) →		
MAIN BUSES	1 OF 2	← BOTH →			← BOTH					(2) →			← BOTH			BOTH
BATTERY BUSES	1 OF 2	← BOTH →			← BOTH					(2) →			← BOTH →			
AC BUSES	1 OF 2 (9)	← BOTH →			← BOTH					(2) →			← BOTH			BOTH
BAT RELAY BUS		BAT RELAY BUS			← BAT RELAY BUS →								← BAT RELAY BUS →			
INVERTERS	1 OF 3 (9)	← 2 OF 3 →			← 2 OF 3					(2) →			← 2 OF 3 →			2 OF 3
AC ⊕ A (1 AND 2)	1 OF 2	← BOTH →			← BOTH					(2) →			← BOTH →			
DOCKING																
DOCKING LATCHES						9 OF 12										
GN_2 BOTTLES																
SEQ																
SMJC		(4) SMJC NOT ACT (4) →			(4) SMJC NOT ACT (4)											
SEQUENTIAL SYSTEMS		← BOTH →			← BOTH											

(1) BASED ON AMOUNT OF WATER AVAILABLE, CONSIDERATION WILL BE GIVEN TO CONTINUING THE MISSION ON SECONDARY LOOP

(2) IF POSSIBLE LM DESCENT STAGE WILL BE RETAINED FOR TEI IF CONDITION NOT MET

(3) CONSIDERATION WILL BE GIVEN TO PERFORMING EVA IF TKS 1 & 2 OR 1 & 3 REMAIN AND QUANTITY IN 2 OR 3 IS LESS THAN 60%

(4) NO REQUIREMENT IF SOURCE OF ACTIVATION CAN BE ISOLATED

(5) MUST HAVE EITHER PRIMARY OR SECONDARY SYSTEM COMPOSED OF FUNCTIONING LOOP AND CORRESPONDING RADIATORS

(6) CONSIDERATION WILL BE GIVEN TO CONTINUING WITH TWO REMAINING

(7) MUST HAVE CABIN INTEGRITY OR SUIT LOOP CAPABLE OF SUPPORTING LIFE. ITEMS MARKED BY * ARE REQUIRED TO MAINTAIN SUIT LOOP

(8) 1 OF 2 REQUIRED IF OPS AVAILABLE FOR USE BY LMP OR CDR

(9) MODE I AND II REGIONS ONLY, 0 THEREAFTER

(10) CONSIDERATION WILL BE GIVEN TO CONTINUING AFTER LOSS OF A TANK

(11) BASED ON FAILURE MODE CONSIDERATION WILL BE GIVEN TO JETT LM WITH 1 REMAINING

(12) 1 OF 2 SUIT COMPRESSORS OR VACUUM CLEANER

(13) CONSIDERATION WILL BE GIVEN TO UNDOCKING IF MAIN REG. FAILED CLOSED

LEGEND: NO REQUIREMENTS

DATE 6/25/71

PAGE 1

CB EFFECT PNL 8 | CB FUNCTION PNL 8 | CB EFFECT PNL 5 | CB FUNCTION PNL 5 | CB FUNCTION PNL 4 | COMM/INSTR | CSM EECOM

CSM GNC GO CRITERIA

~~7/11/71~~ 7/7/71

GO / NO-GO ITEM	EARTH ORBIT			TLC			LUNAR ORBIT (BEFORE UNDOCKING)			UNDOCK	CIRC	POWERED DESCENT		LUNAR STAY		LUNAR ORBIT (P-RNDZ)	POST DOCK	TEC
	CONT BOOST	CONT EO	TLI	TD & E	CONT TLC	LOI	CONT LOI	CONT L.O.	DOI			PDI	PDI TO TD	PAST T_1	PAST T_3 & SUBS	CONT L.O.	LM JETT	CSM EVA
GNCS/SCS																		
DEORBIT CAPABILITY		SPS + B/U METHOD																
AUTO ATTITUDE CONTROL		3 AXIS		①	3 AXIS			2-AXIS							2 AXIS	2-AXIS	2-AXIS	③
RATE DAMPING		3 AXIS		①	3 AXIS			2-AXIS							2 AXIS	2-AXIS	2 AXIS	③
DIRECT RCS		3 AXIS		①	3 AXIS			3 AXIS							3-AXIS	3 AXIS	3-AXIS	③
BMAGS P, Y		1 OF 2				1 OF 2	1 OF 2 OR DPS	1 OF 2							1 OF 2			
BMAGS R			1 OF 2			1 OF 2										1 OF 2		
FDAI		1 OF 2				1 OF 2		1 OF 2								1 OF 2		
THC		THC							THC									
RHC		1 OF 2				1 OF 2		1 OF 2								1 OF 2		
EMS																		
CMC			CMC			CMC ⑦	CMC OR DPS	CMC							CMC		CMC	
ISS			ISS			ISS		ISS							ISS		ISS	
OSS									OSS OR VHF									
OPTICS DAC			O-DAC			O-DAC	O-DAC OR DPS	O-DAC							O-DAC			
NO SOLENOID DR GND																		
TVC SERVO LOOP		1 OF 2	BOTH			⑥	REFER TO MR 3-86	1 OF 2 AND DPS	BOTH						BOTH			
DSKY			1 OF 2			1 OF 2		1 OF 2 AND DPS	1 OF 2						1 OF 2		1 OF 2	
SPS																		
FU/OX TANK (W/O LEAK)		FU/OX				FU/OX		FU/OX TNK							FU/OX TANK			FU/OX TK
GN_2 TANK (W/O LEAK)		1 OF 2	BOTH			1 OF 2 AND DPS		1 OF 2 AND DPS	BOTH						BOTH			
BALL VALVE BANK		1 OF 2	BOTH			1 OF 2 AND DPS		1 OF 2 AND DPS	BOTH						BOTH			
FEEDLINE TEMP > 40°F		> 40°				> 40°		> 40°							> 40°			
FU/OX ΔP < 20 PSI		< 20						< 20							< 20			
PC > 70 PSI		> 70	N/A			> 70		> 70										
ULLAGE CAPABILITY			ULLAGE						ULLAGE									
HE TANK (W/O LEAK)		②	HE TNK			HE TNK	HE TNK OR DPS		HE TANK									
SM RCS																		
HE TANK (W/O LEAK)		3 OF 4	ALL			3 OF 4		3 OF 4							3 OF 4			
NO LEAK BELOW ISO VLV		3 OF 4	ALL			4 OF 4	3 OF 4		ALL						3 OF 4		4 OF 4	
PKG TEMP > 55°		3 OF 4	ALL			3 OF 4		3 OF 4							3 OF 4		3 OF 4	C + D
THRUSTERS		ALL ROT AXES, +X TRANS	3OF4 P,Y 6 OF 8R	①		3OF4 P,Y 6 OF 8R	6 OF 8	3 OF 4 P, Y 7 OF 8		6 OF 8R					3 OF 4 P,Y, 6 OF 8R	①	⑤	④
CM RCS																		
HE TANK (W/O LEAK)	1 OF 2 MODE 1			BOTH					BOTH						BOTH	BOTH	ONE	
MANIFOLD (W/O LEAK)	1 OF 2 MODE 1			BOTH					BOTH						BOTH	BOTH	ONE	BOTH
NOT ARMED				NOT ARMED														

① REQUIRES 3 AXIS ATTITUDE CONTROL AND TRANSLATION 3 AXIS (ONE LATERAL AXIS MAY BE DEGRADED)

② MUST HAVE SUFFICIENT ULLAGE FOR DEORBIT

③ AUTO OR MANUAL IN 3 AXIS

④ REQUIRES C2, C3, C4, D1, D3, D4 THRUSTERS

⑤ 3 AXIS ATT. CONTROL AND ± X TRANSLATION

⑥ 3 OF 4 TOTAL REQUIRED, CHANGE REFSMMAT IF NECESSARY TO KEEP REDUNDANCY IN YAW + DPS

⑦ GO FOR LOI WITH SCS TVC IF CMC FAILURE OCCURS BETWEEN MCC-H GO AND LOI

NOTE

1 T_2 NO STAY CONDITIONS: NONE

LEGEND: NO REQUIREMENT

DATE ~~6/25/71~~ 7/14/71

COMMUNICATIONS / INSTRUMENTATION GO CRITERIA

7/1/71

GO/NO-GO ITEM	EARTH ORBIT		TLC			LUNAR ORBIT (BEFORE UNDOCKING)			UNDOCKING	CIRC	POWERED DESCENT				LUNAR STAY			RENDEZVOUS LM ACTIVE	LUNAR ORBIT POST REND	POST DOCK	TEC
	CONT BOOST	CONT E.O.	TLI	TD&E	CONT TLC	LOI	CONT LOI	CONT L.O./DOI	NOMINAL MISSION		PDI	PDI TO PDI + 6:10	PDI + 6:10 TO HI GATE	HI GATE TO T/D	STAY W/O EVA	2-MAN EVA	1-MAN EVA		CONT L.O.	LM JETT	CSM EVA
USB 2-WAY VOICE COMM		①	CSM			CSM OR LM		CSM ⑤ OR LM	CSM & LM	CSM	CSM AND LM				CSM ③ & LM	CSM ③ & LM	CSM ③ & LM		CSM	CSM	
VHF COMM LM/CSM									SIMPLEX OR ←DUPLEX	→											
VHF COMM LM (LCRU)/EVA																SIMP ⑥	SIMP ⑥				
VHF COMM EVA/EVA																					
MSFN/EVA VOICE																⑧	⑧				
CRITICAL INSTRUMENTATION		← CSM →				CSM		CSM ⑦	LM & CSM	CSM AND LM	CSM AND LM	← ④ — LM — ④ —		④ →	← LM AND CSM →			← LM →	CSM		
LM TELEMETRY									LBR OR HBR	LBR OR HBR	LBR OR HBR				← LBR OR HBR →						
CSM TELEMETRY		← HBR OR LBR →																			
CSM SCE			SCE																		

① VHF IS ACCEPTABLE

② DELETED

③ LM RELAY TO CSM IS ACCEPTABLE

④ ADEQUATE DATA TO MAKE FINAL GO/NO GO TO CONTINUE POWERED DESCENT (TM OR ONBOARD DISPLAY)

⑤ CSM AND LM COMM REQUIRED FOR DOI

⑥ IF LM PROBLEM IS DEFINED CONTINUE EVA PREP AND ACTIVATE LCRU ASAP

⑦ CSM AND LM CRITICAL INSTR REQUIRED FOR DOI

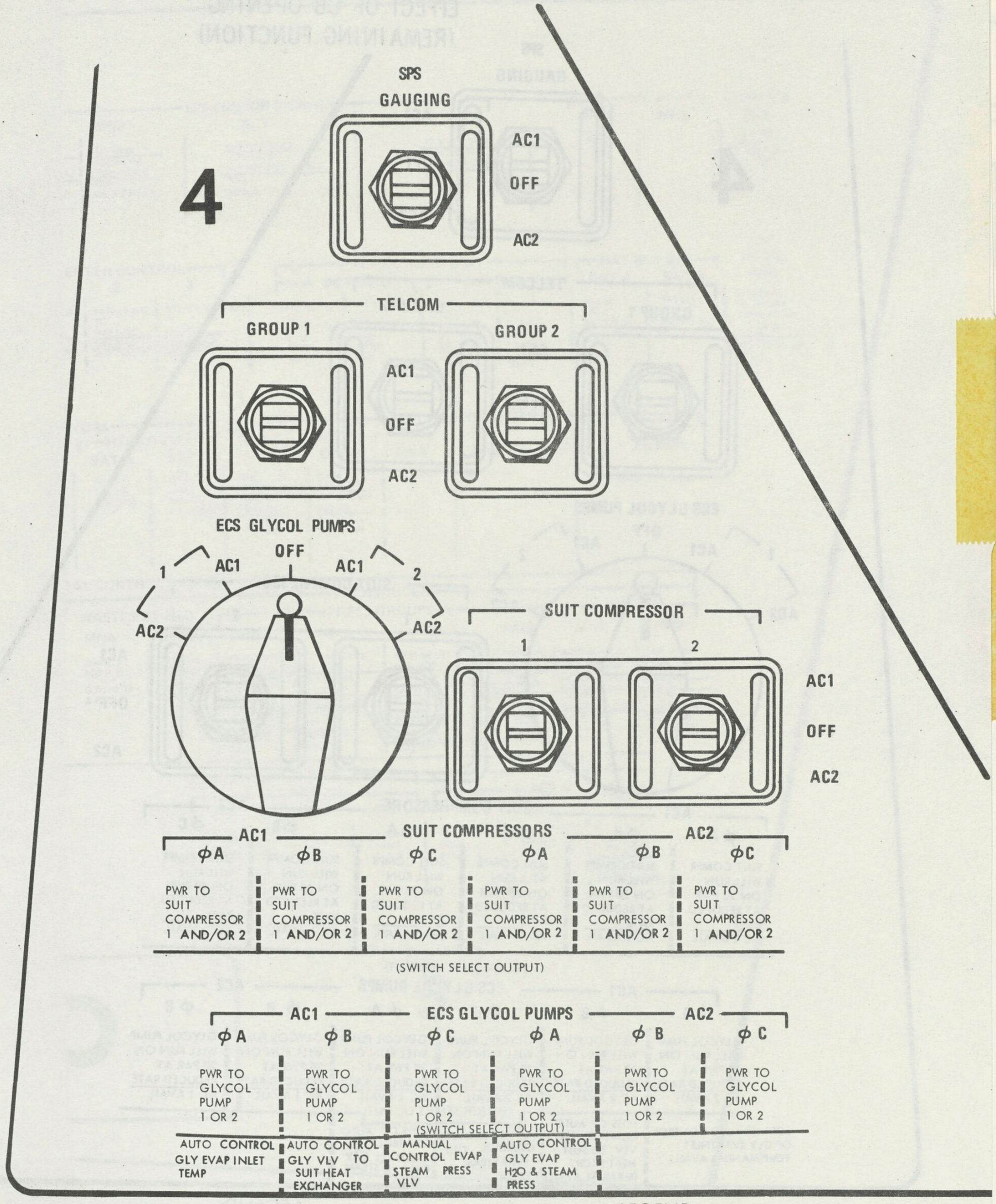
⑧ VOICE UPLINK TO EITHER CREWMAN, VOICE DOWNLINK FROM ONE CREWMAN OR TV

LEGEND: NO REQUIREMENT

CB EFFECT PNL 8
CB FUNCTION PNL 8
CB EFFECT PNL 5
CB FUNCTION PNL 5
CB FUNCTION PNL 4
COMM/INSTR
CB FUNCTIONS PNL 181

CSM GNC

FUNCTIONS POWERED THRU CB



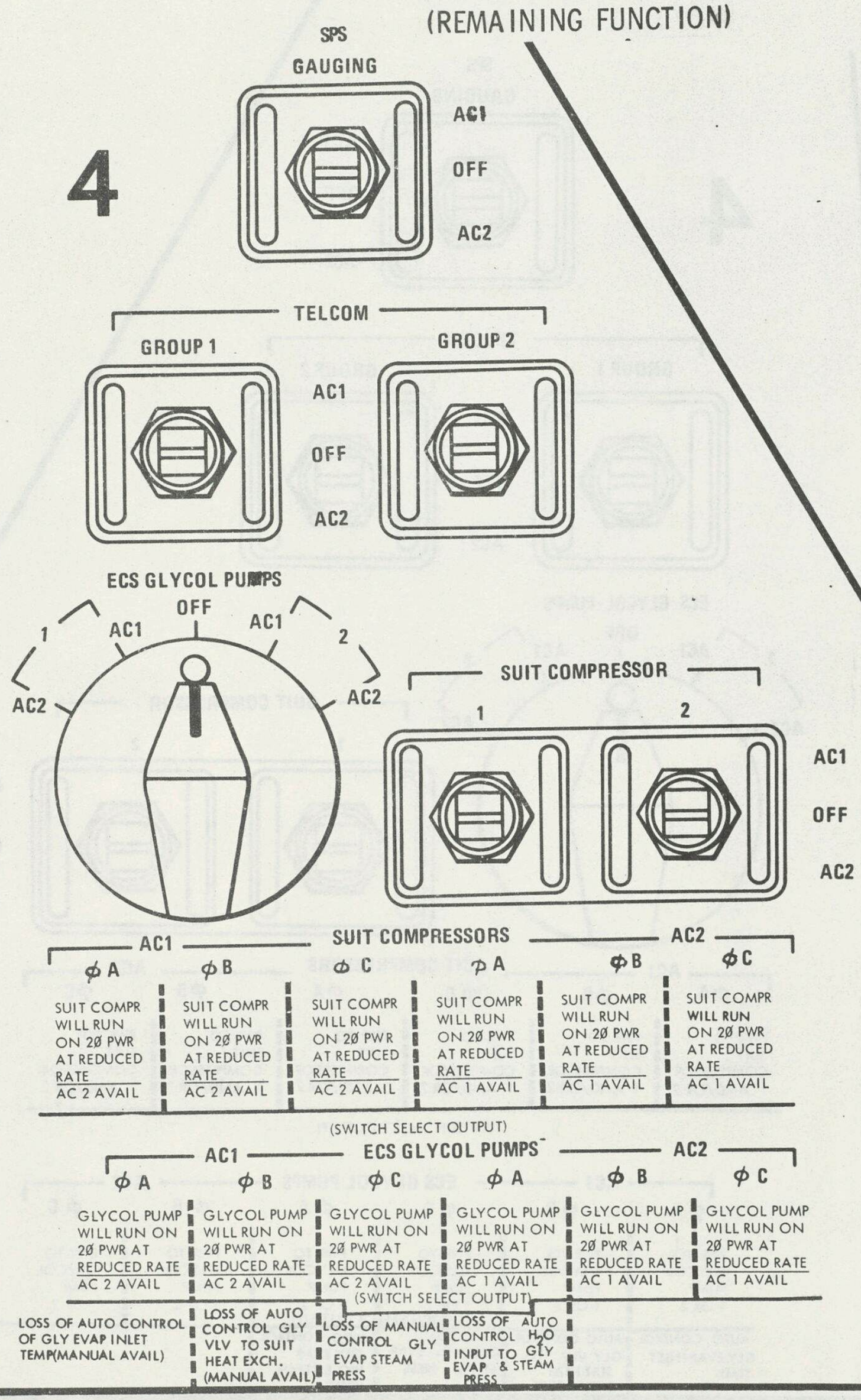
LEGEND:
LINE BETWEEN CIRCUIT BREAKERS
DESIGNATES DUAL POWER TO FUNCTION
DESIGNATES SIMILAR FUNCTIONS
DESIGNATES DIFFERENT FUNCTIONS

CSM GNC

CB EFFECT PNL 4

EFFECT OF CB OPENING (REMAINING FUNCTION)

4



LEGEND:

LINE BETWEEN CIRCUIT BREAKERS

DESIGNATES DUAL POWER TO FUNCTI

DESIGNATES SIMILAR FUNCTIONS

DESIGNATES DIFFERENT FUNCTIONS

EPS SENSOR SIGNAL

MNB	AC1	AC2
U/V SNSR VOLTMETER (MAIN BUS B) PCM MAIN B VOLTS	O/V-U/V SNSR VOLTMETER (AC BUS 1-ØA- ØB-ØC) PCM AC BUS 1 VOLTS (ØA)	O/V-U/V SNSR VOLTMETER (AC BUS 2-ØA- ØB-ØC) PCM AC BUS 2 VOLTS (ØA)

C/W

MNA	MNB
C/W	C/W

LM PWR-1

MNB
CONTROL OF TRNSFR & PWR TO LM (1 OF 2)

ERTER CONTROL

2	3
BAT RLY BUS TO INV 2-DC INV 2-AC 1 INV 1-AC 2	BAT RLY BUS TO INV 3-DC INV 3-AC 1 INV 2-AC 2

EPS SENSOR UNIT

A DC BUS B		1 AC BUS 2	
BAT RLY BUS TO MN A U/V SNSR (AFTER TRIP)	BAT RLY BUS TO MN B U/V SNSR (AFTER TRIP)	BAT RLY BUS TO AC 1 O/V-U/V SNSR &O/V DIS-CONNECT RELAY	BAT RLY BUS TO AC 2 O/V-U/V SNSR &O/V DIS-CONNECT RELAY

BAT RLY BUS

BAT A	BAT B
BAT BUS A TO BAT RLY BUS	BAT BUS B TO BAT RLY BUS

LM PWR-2

MNB
CONTROL OF TRNSFR & PWR TO LM (2 OF 2) CONTROL OF RESET

ATORS

HTRS OVLD

BAT A	BAT B
PRI 1 RAD HTR O/L SNSR	PRI 2 & SEC RAD HTR O/L SNSRS

BATTERY CHARGER

BAT A CHG	BAT B CHG	MNA	MNB	AC PWR
CHGR TO BAT BUS A BAT A/C MN BUS TIE BAT BUS A VM & PCM	CHGR TO BAT BUS B BAT B/C MN BUS TIE BAT BUS B VM & PCM	BAT CHGR	BAT CHGR	BAT CHGR (SWITCH SELECT INPUT)

TAL CONTROL SYSTEM

TRANSDUCER

WASTE/POT H_2O MNA	WASTE/POT H_2O MNB	PRESS GROUPS 1 MNA	PRESS GROUPS 1 MNB	PRESS GROUPS 2 MNA	PRESS GROUPS 2 MNB	TEMP MNA	TEMP MNB
WASTE & POT H_2O QTY METER & PCM	WASTE & POT H_2O QTY METER & PCM	PRESS METERS & PCM FOR - SUIT COMPR ΔP (C/W) SUIT PRESS ACCUM PRIM GLY QTY GLY DISCH PRIM	PRESS METERS & PCM FOR - SUIT COMPR ΔP (C/W) SUIT PRESS ACCUM PRIM GLY QTY GLY DISCH PRIM	PRESS METERS & PCM FOR - O_2 FLOW CABIN GLY EVAP PRIM STEAM O_2 REG OUT (PCM ONLY) CO_2 PART PRESS	PRESS METERS & PCM FOR - O_2 FLOW (& C&W) CABIN GLY EVAP PRIM STEAM O_2 REG OUT (PCM ONLY)	TEMP METERS & PCM FOR - SUIT CABIN RAD PRIM OUTLET (& C/W) GLY EVAP PRIM & SEC OUTLET	TEMP METERS & PCM FOR - SUIT CABIN RAD PRIM OUTLET (& C/W) GLY EVAP PRIM & SEC OUTLET

CABIN FANS

AC1 ϕA	AC1 ϕB	AC1 ϕC
CABIN FANS 1 & 2	CABIN FANS 1 & 2	CABIN FANS 1 & 2

AC UTIL

AC2 ϕA	AC2 ϕB	AC2 ϕC
AC UTILITY OUTLET ON PANEL 201	AC UTILITY OUTLET ON PANEL 201	AC UTILITY OUTLET ON PANEL 201 AUTO CABIN TEMP CONTROL

5

CB FUNCTIONS PNL 181

CB FUNCTION PNL 225

CB FUNCTION PNL 226

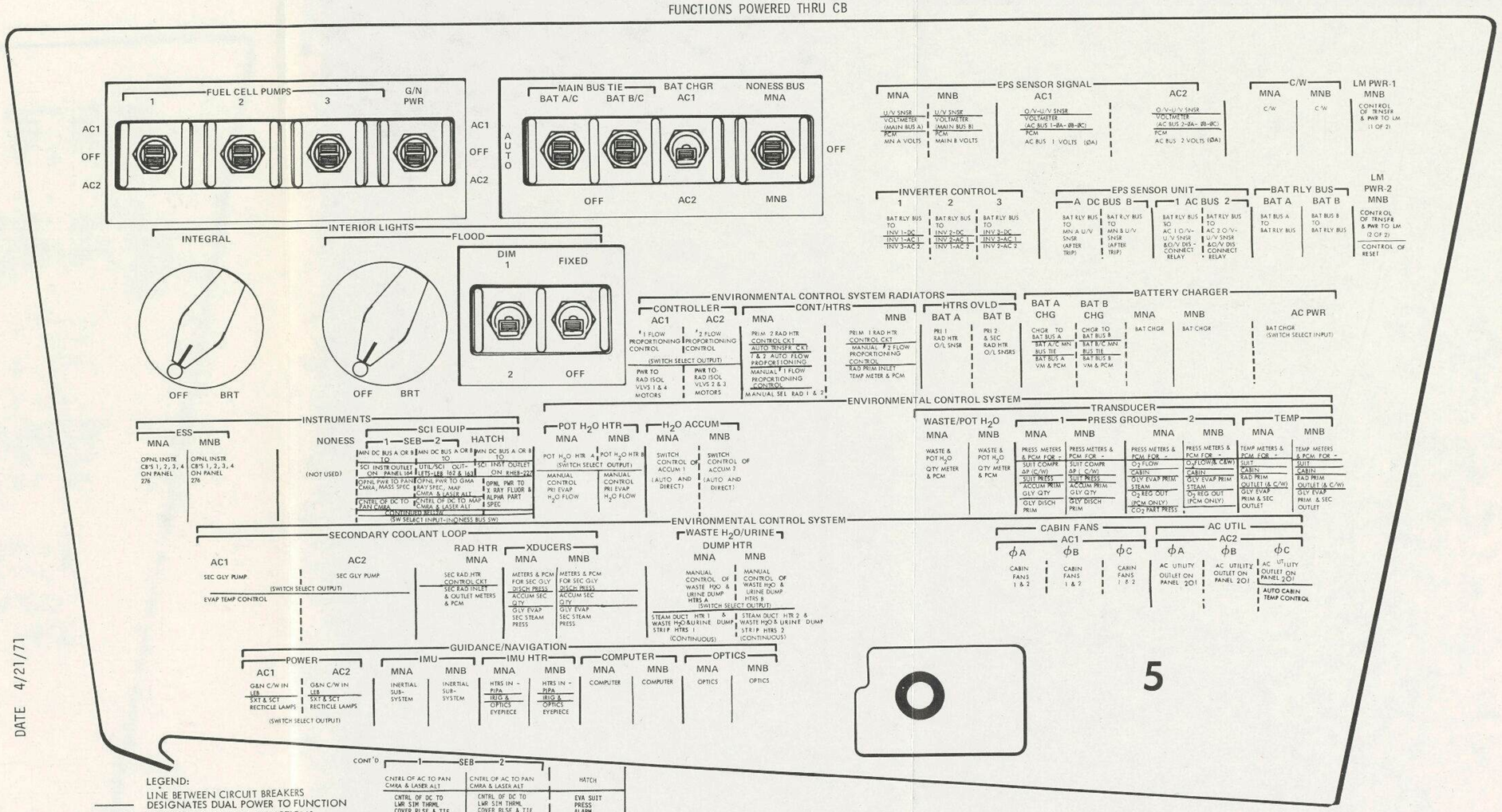
CB FUNCTION PNL 5

CB EFFECT PNL 5

CB FUNCTION PNL 8

CB EFFECT PNL 8

FUNCTIONS POWERED THRU CB



DATE 4/21/71

CB FUNCTION PNL 5

CSM GNC

CB EFFECT
PNL 4

EPS SENSOR SIGNAL

MNB	AC1	AC2
NO MN DC BUS B VOLT SENSING OR PCM	NO AC BUS 1 VOLTAGE SENSING OR PCM	NO AC BUS 2 VOLTAGE SENSING OR PCM
MN BUS B UNDERVOLT LITE ON (C/W)	AC BUS 1 LITE ON (C/W)	AC BUS 2 LITE ON (C/W)

C/W

MNA	MNB
MN B CB WILL PWR C/W	MN A CB WILL PWR C/W

LM PWR-1 MNB

LM PWR 2 CB WILL SUPPORT TRNSFR AND PWR TO LM

INVERTER CONTROL

2	3
CONTROL LEFT INV 1 - DC INV 1 - AC 1 INV 2 - AC 2 INV 3-DC INV 3 - AC 1 INV 3-AC 2	CONTROL LEFT INV 1 - DC INV 1 - AC 1 INV 2 - DC INV 2 - AC 1

EPS SENSOR UNIT

A DC BUS B		1 AC BUS 2	
IF CAUTION/WARNING-NORMAL-BOOST-ACK SW IN ACK - ONLY INITIAL U/V WILL BE INDICATED BY M/A UNLESS SW PLACED TO NORMAL. IF SW IN NORMAL-NO EFFECT ON MN A U/V CKT	IF CAUTION/WARNING-NORMAL-BOOST-ACK SW IN ACK - ONLY INITIAL U/V WILL BE INDICATED BY M/A UNLESS SW PLACED TO NORMAL. IF SW IN NORMAL-NO EFFECT ON MN B U/V CKT	NO AC BUS 1 VOLTAGE SENSING NO AC BUS 1 C/W LITE OR O/V DISCONNECT	NO AC BUS 2 VOLTAGE SENSING NO AC BUS 2 C/W LITE OR O/V DISCONNECT

BAT RLY BUS

BAT A	BAT B
BAT B CB WILL PWR BAT RLY BUS	BAT A CB WILL PWR BAT RLY BUS

LM PWR-2 MNB

LM PWR 1 CB WILL SUPPORT TRNSFR AND PWR TO LM

LOSS OF CM CONTROL OF RESET (LM CAN OVERRIDE)

DIATORS

B	HTRS OVLD BAT A	HTRS OVLD BAT B
OF ION-	PRI 2 & SEC RAD HTR O/L SENSING LEFT	PRI 1 RAD HTR O/L SENSING LEFT

BATTERY CHARGER

BAT A CHG	BAT B CHG	MNA	MNB	AC PWR
BAT B/C MN BUS TIE LEFT BAT A CHG THRU BAT C CKT BAT A VOLTS ON BAT C POS.	BAT A/C MN BUS TIE LEFT BAT B CHG THRU BAT C CKT BAT B VOLTS ON BAT C POS.	MN B CB WILL PWR CHGR	MN A CB WILL PWR CHGR	LOSS OF BAT CHGR

ENTAL CONTROL SYSTEM

TRANSDUCER

WASTE/POT H_2O MNA	WASTE/POT H_2O MNB	1 PRESS GROUPS MNA	1 PRESS GROUPS MNB	2 PRESS GROUPS MNA	2 PRESS GROUPS MNB	TEMP MNA	TEMP MNB
MN B CB WILL PWR WASTE & POT H_2O QTY METER & PCM	MN A CB WILL PWR WASTE & POT H_2O QTY METER & PCM	MN B CB WILL PWR ALL CKTS	MN A CB WILL PWR ALL CKTS	MN B CB WILL PWR CKTS LOSS OF CO_2 PART PRESS METER & PCM & C/W	MN A CB WILL PWR CKTS LOSS OF O_2 FLOW HI C&W & MASTER ALARM	MN B CB WILL PWR CKTS	MN A CB WILL PWR CKTS

CABIN FANS

AC1 ϕA	AC1 ϕB	AC1 ϕC
FANS 1 & 2 WILL OPERATE ON 2Ø PWR	FANS 1 & 2 WILL OPERATE ON 2Ø PWR	FANS 1 & 2 WILL OPERATE ON 2Ø PWR

AC UTIL

AC2 ϕA	AC2 ϕB	AC2 ϕC
LOSS OF ØA TO UTIL OUTLET PANEL 201	LOSS OF ØB TO UTIL OUTLET PANEL 201	LOSS OF ØC TO UTIL OUTLET PANEL 201 LOSS OF AUTO CABIN TEMP CONTROL

5

CB FUNCTIONS PNL 181

CB FUNCTION PNL 225

CB FUNCTION PNL 226

CB FUNCTION PNL 229, 250

CB EFFECT PNL 5

CB FUNCTION PNL 8

CB EFFECT PNL 8

EFFECT OF CB OPENING (REMAINING FUNCTION)

FUEL CELL PUMPS

1 | 2 | 3 | G/N PWR

AC1 / OFF / AC2

MAIN BUS TIE

BAT A/C | BAT B/C | BAT CHGR AC1 | NONESS BUS MNA

AUTO / OFF / AC2 / MNB

INTERIOR LIGHTS

INTEGRAL

OFF / BRT

FLOOD

DIM 1 | FIXED | 2 | OFF

OFF / BRT

EPS SENSOR SIGNAL

MNA	MNB	AC1	AC2
NO MN DC BUS A VOLT SENSING OR PCM MN BUS A UNDERVOLT LITE ON (C/W)	NO MN DC BUS B VOLT SENSING OR PCM MN BUS B UNDERVOLT LITE ON (C/W)	NO AC BUS 1 VOLTAGE SENSING OR PCM AC BUS 1 LITE ON (C/W)	NO AC BUS 2 VOLTAGE SENSING OR PCM AC BUS 2 LITE ON (C/W)

C/W

MNA	MNB	LM PWR-1 MNB
MN B CB WILL PWR C/W	MN A CB WILL PWR C/W	LM PWR 2 CB WILL SUPPORT TRNSFR AND PWR TO LM

INVERTER CONTROL

BASED ON INV 1 ON AC1 & INV 2 ON AC2

1	2	3
CONTROL LEFT INV 1-AC 2 INV 2-DC INV 2-AC 2	CONTROL LEFT INV 1 - DC INV 1 - AC 1 INV 2 - AC 2 INV 3-DC INV 3 - AC 1 INV 3-AC 2	CONTROL LEFT INV 1 - DC INV 1 - AC 1 INV 2 - DC INV 2 - AC 1

EPS SENSOR UNIT

A DC BUS B	1 AC BUS 2
IF CAUTION/WARNING-NORMAL-BOOST-ACK SW IN ACK - ONLY INITIAL U/V WILL BE INDICATED BY M/A UNLESS SW PLACED TO NORMAL. IF SW IN NORMAL-NO EFFECT ON MN A U/V CKT IF CAUTION/WARNING NORMAL-BOOST-ACK SW IN ACK - ONLY INITIAL U/V WILL BE INDICATED BY M/A UNLESS SW PLACED TO NORMAL. IF SW IN NORMAL-NO EFFECT ON MN B U/V CKT	NO AC BUS 1 VOLTAGE SENSING NO AC BUS 1 C/W LITE OR O/V DISCONNECT NO AC BUS 2 VOLTAGE SENSING NO AC BUS 2 C/W LITE OR O/V DISCONNECT

BAT RLY BUS

BAT A	BAT B	LM PWR-2 MNB
BAT B CB WILL PWR BAT RLY BUS	BAT A CB WILL PWR BAT RLY BUS	LM PWR 1 CB WILL SUPPORT TRNSFR AND PWR TO LM LOSS OF CM CONTROL OF RESET (LM CAN OVERRIDE)

ENVIRONMENTAL CONTROL SYSTEM RADIATORS

CONTROLLER

AC1	AC2
LIMITED FLOW PROPORTIONING LOSS OF PWR TO RAD ISOLATION VALVES 1 & 4 (VLVS REMAIN IN LAST POSITION)	1 FLOW PROPORTIONING CONTROL AVAIL (SW SELECT) LOSS OF PWR TO RAD ISOLATION VALVES 2 & 3 LOSS OF PRIM 2 (IF NOT IN USE)

CONT/HTRS

MNA	MNB
PRI 1 & SEC RAD HTR CONTROL LEFT MANUAL CONTROL OF 1 2 FLOW PROPORTIONING - LEFT LOSS OF MANUAL CONTROL OF ALL RAD ISOL VLVS	PRI 2 & SEC RAD HTR CONTROL LEFT AUTO 1 OR 2 FLOW PROPOR LEFT MANUAL CONTROL OF 1 FLOW PROPORTIONING LEFT LOSS OF PRIM 1 INLET METER & PCM

HTRS OVLD

BAT A	BAT B
PRI 2 & SEC RAD HTR O/L SENSING LEFT	PRI 1 RAD HTR O/L SENSING LEFT

BATTERY CHARGER

BAT A CHG	BAT B CHG	MNA	MNB	AC PWR
BAT B/C MN BUS TIE LEFT BAT A CHG THRU BAT C CKT BAT A VOLTS ON BAT C POS.	BAT A/C MN BUS TIE LEFT BAT B CHG THRU BAT C CKT BAT B VOLTS ON BAT C POS.	MN B CB WILL PWR CHGR	MN A CB WILL PWR CHGR	LOSS OF BAT CHGR

INSTRUMENTS

ESS

MNA	MNB
MN B CB WILL PWR OPN'L INSTR CB'S 1, 2, 3, 4 ON PANEL 276	MN A CB WILL PWR OPN'L INSTR CB'S 1, 2, 3, 4 ON PANEL 276

NONESS

(NOT USED)

SCI EQUIP

1 SEB 2		
LOSS OF PANEL 164 OUTLET LOSS OF FAN CMRA & MASS SPEC CB 2 WILL PWR CNTRL OF AC TO LASER ALT &	LOSS OF PANEL 162 & 163 OUTLETS LOSS OF GMA RAY SPEC, MAP CMRA & LASER ALT CB 1 WILL PWR CNTRL OF AC TO FAN CMRA &	LOSS OF PANEL 227 OUTLET LOSS OF 1 RAY FLUOR & ALPHA PART SPEC LOSS EVA SUIT PRESS ALARM

HATCH

CONTINUED BELOW

ENVIRONMENTAL CONTROL SYSTEM

POT H_2O HTR

MNA	MNB
MN B CB AVAIL TO POT H_2O HTR B	MN A CB AVAIL TO POT H_2O HTR A

(SWITCH SELECT OUTPUT)

MN B CB WILL PWR PRI EVAP H_2O FLOW	MN A CB WILL PWR PRI EVAP H_2O FLOW

H_2O ACCUM

MNA	MNB
SWITCH CONTROL OF ACCUM 2 LEFT MANUAL ACCUM 1 AVAIL	SWITCH CONTROL OF ACCUM 1 LEFT MANUAL ACCUM 2 AVAIL

TRANSDUCER

WASTE/POT H_2O MNA	WASTE/POT H_2O MNB	1 PRESS GROUPS MNA	1 PRESS GROUPS MNB	2 PRESS GROUPS MNA	2 PRESS GROUPS MNB	TEMP MNA	TEMP MNB
MN B CB WILL PWR WASTE & POT H_2O QTY METER & PCM	MN A CB WILL PWR WASTE & POT H_2O QTY METER & PCM	MN B CB WILL PWR ALL CKTS	MN A CB WILL PWR ALL CKTS	MN B CB WILL PWR CKTS LOSS OF CO_2 PART PRESS METER & PCM & C/W	MN A CB WILL PWR CKTS LOSS OF O_2 FLOW HI C&W & MASTER ALARM	MN B CB WILL PWR CKTS	MN A CB WILL PWR CKTS

SECONDARY COOLANT LOOP

AC1	AC2
AC 2 PWR AVAIL TO SEC GLY PUMP	AC 1 PWR AVAIL TO SEC GLY PUMP

(SWITCH SELECT OUTPUT)

LOSS OF SEC EVAP CONTROL

RAD HTR

MNA
PRI 1 & 2 RAD HTR CONTROL LEFT LOSS OF SEC RAD IN & OUT METERS & PCM

XDUCERS

MNA	MNB
MN B CB WILL PWR CKTS	MN A CB WILL PWR CKTS

ENVIRONMENTAL CONTROL SYSTEM

WASTE H_2O/URINE DUMP HTR

MNA	MNB
MN B CB AVAIL TO URINE & WASTE H_2O DUMP HTRS (SW SELECT B) MN B CB WILL PWR STEAM DUCT & STRIP HTRS 2	MN A CB AVAIL TO URINE & WASTE H_2O DUMP HTRS (SW SELECT A) MN A CB WILL PWR STEAM DUCT & STRIP HTRS 1

CABIN FANS

AC1 ϕA	AC1 ϕB	AC1 ϕC
FANS 1 & 2 WILL OPERATE ON 28 PWR	FANS 1 & 2 WILL OPERATE ON 28 PWR	FANS 1 & 2 WILL OPERATE ON 28 PWR

AC UTIL

AC2 ϕA	AC2 ϕB	AC2 ϕC
LOSS OF ϕA TO UTIL OUTLET PANEL 201	LOSS OF ϕB TO UTIL OUTLET PANEL 201	LOSS OF ϕC TO UTIL OUTLET PANEL 201 LOSS OF AUTO CABIN TEMP CONTROL

GUIDANCE/NAVIGATION

POWER

AC1	AC2
AC 2 PWR AVAILABLE	AC 1 PWR AVAILABLE

(SWITCH SELECT OUTPUT)

IMU

MNA	MNB
MN B CB WILL PWR IMU	MN A CB WILL PWR IMU

IMU HTR

MNA	MNB
MN B CB WILL PWR HTRS	MN A CB WILL PWR HTRS

COMPUTER

MNA	MNB
MN B CB WILL PWR COMPUTER	MN A CB WILL PWR COMPUTER

OPTICS

MNA	MNB
MN B CB WILL PWR OPTICS	MN A CB WILL PWR OPTICS

1 SEB 2

CONT'D

CNTRL OF DC TO LMR SIM THRM COVER RLSE, TIE OWN RLSES OF GMA RAY & MASS SPEC BOOMS & SAT CRGE LNCHR BASE	CNTRL OF DC TO LMR SIM THRM COVER RLSE, TIE OWN RLSES OF GMA RAY & MASS SPEC BOOMS & SAT CRGE LNCHR BASE

LEGEND:
- LINE BETWEEN CIRCUIT BREAKERS
- DESIGNATES DUAL POWER TO FUNCTION
- DESIGNATES SIMILAR FUNCTIONS
- DESIGNATES DIFFERENT FUNCTIONS

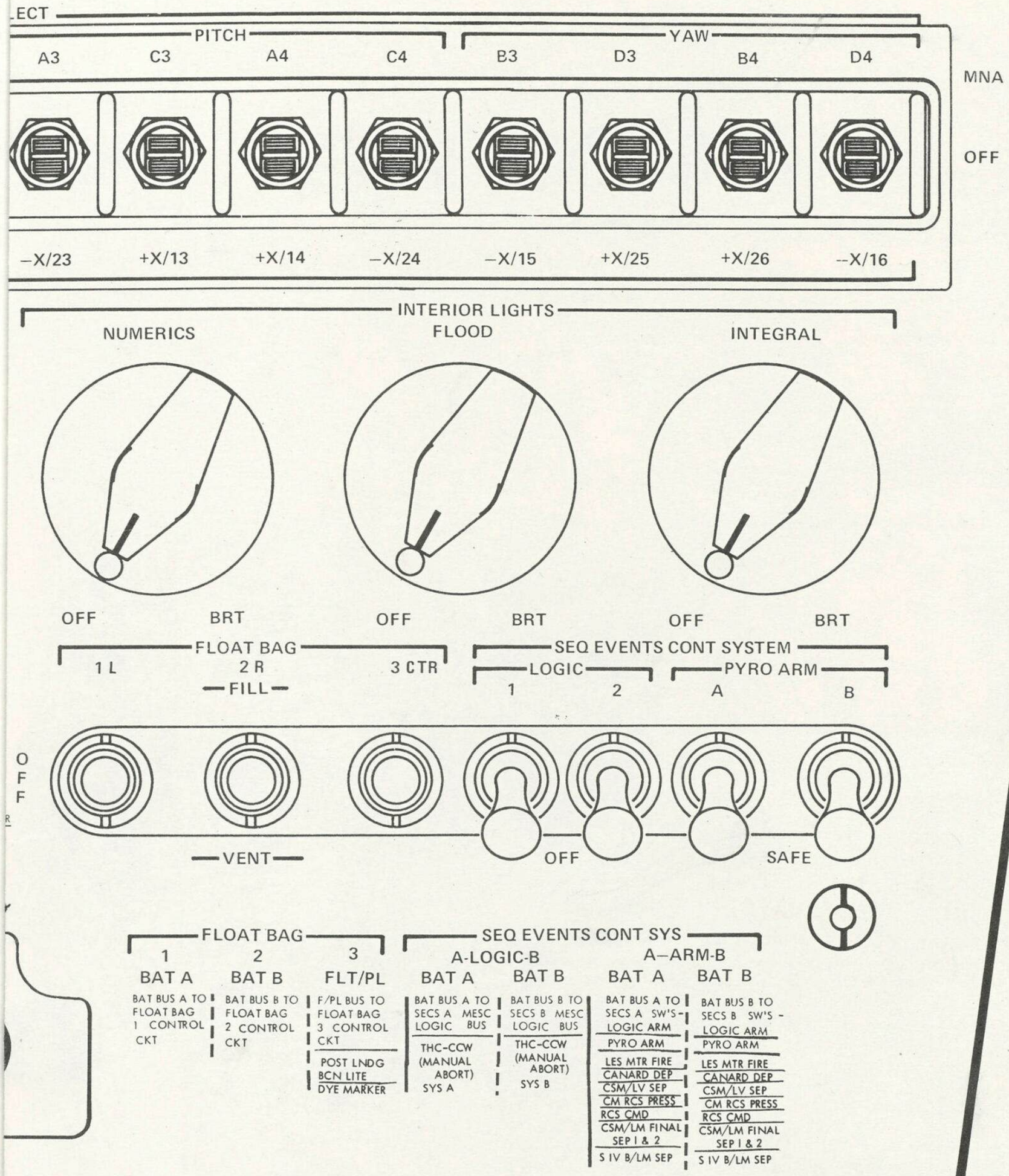
5

6/25/71
DATE 4/27/77

CB EFFECT PNL 5

CSM GNC

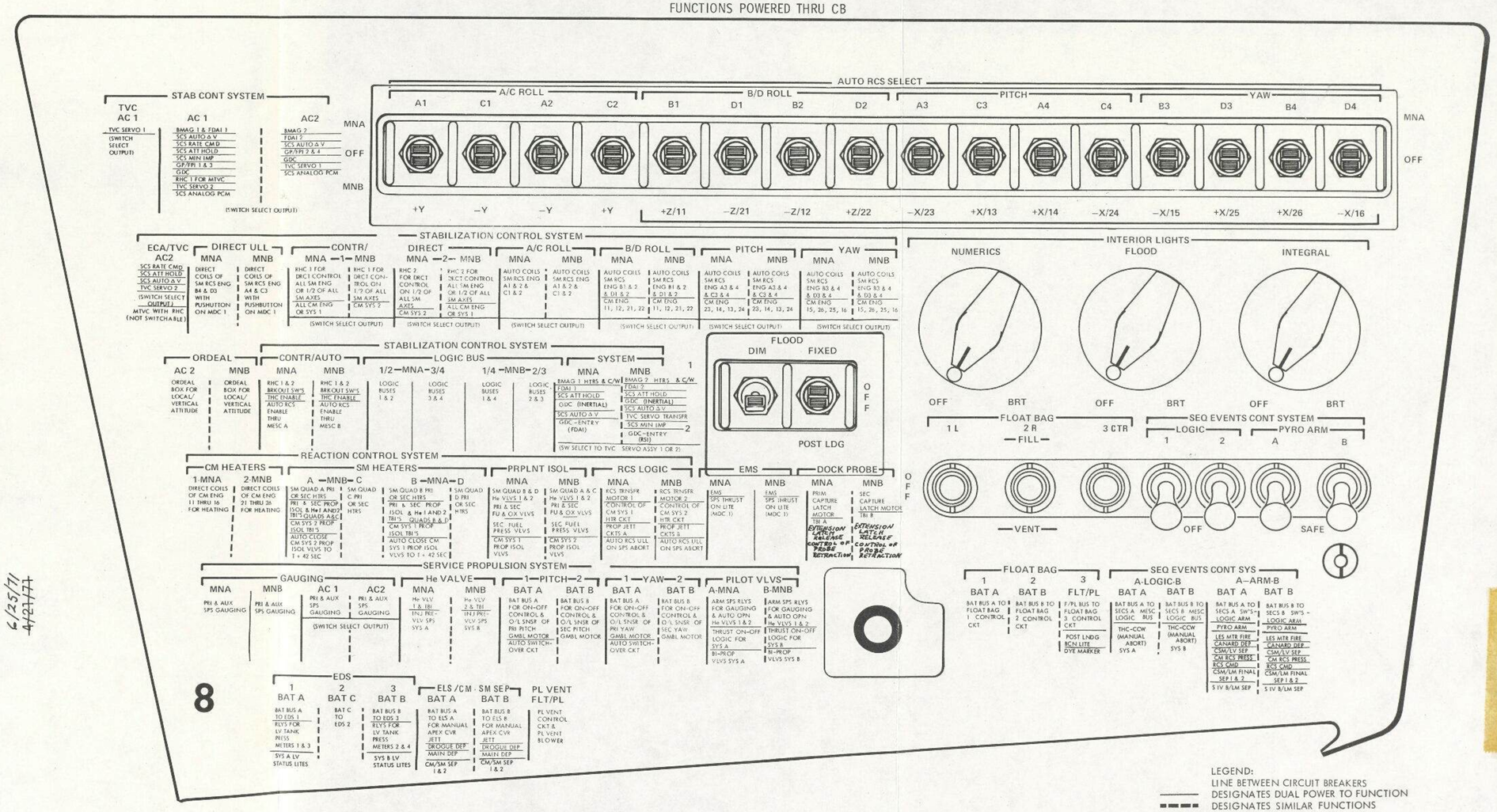
CB EFFECT
PNL 4



LEGEND:
LINE BETWEEN CIRCUIT BREAKERS
DESIGNATES DUAL POWER TO FUNCTION
DESIGNATES SIMILAR FUNCTIONS
DESIGNATES DIFFERENT FUNCTIONS

CB FUNCTIONS PNL 181
CB FUNCTION PNL 225
CB FUNCTION PNL 226
CB FUNCTION 229, 250
CB FUNCTION 275,276,278
CB FUNCTION PNL 8
CB EFFECT PNL 8

FUNCTIONS POWERED THRU CB



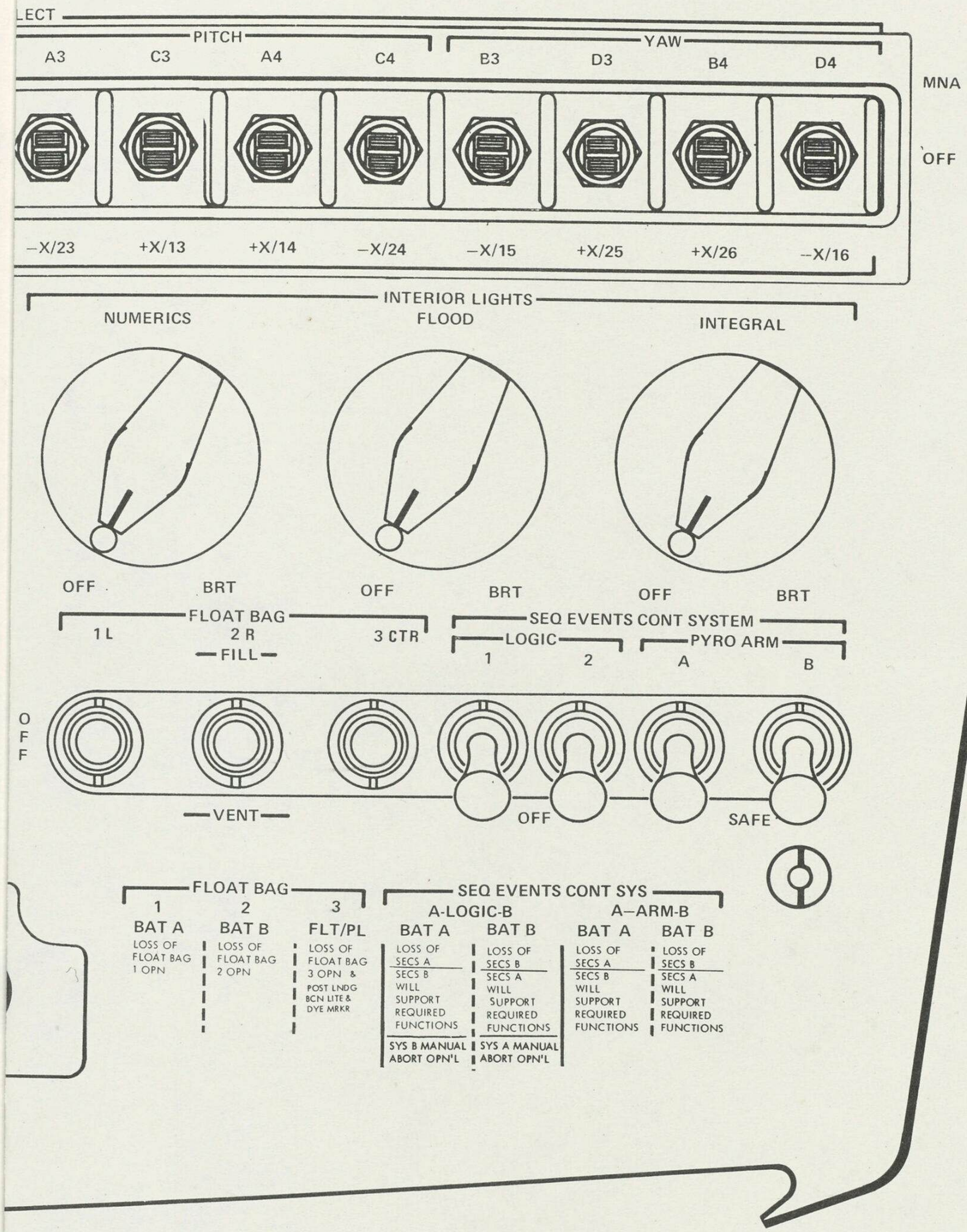
6/25/71
4/27/77

LEGEND:
LINE BETWEEN CIRCUIT BREAKERS
DESIGNATES DUAL POWER TO FUNCTION
DESIGNATES SIMILAR FUNCTIONS
DESIGNATES DIFFERENT FUNCTIONS

CB FUNCTION PNL 8

CSM GNC

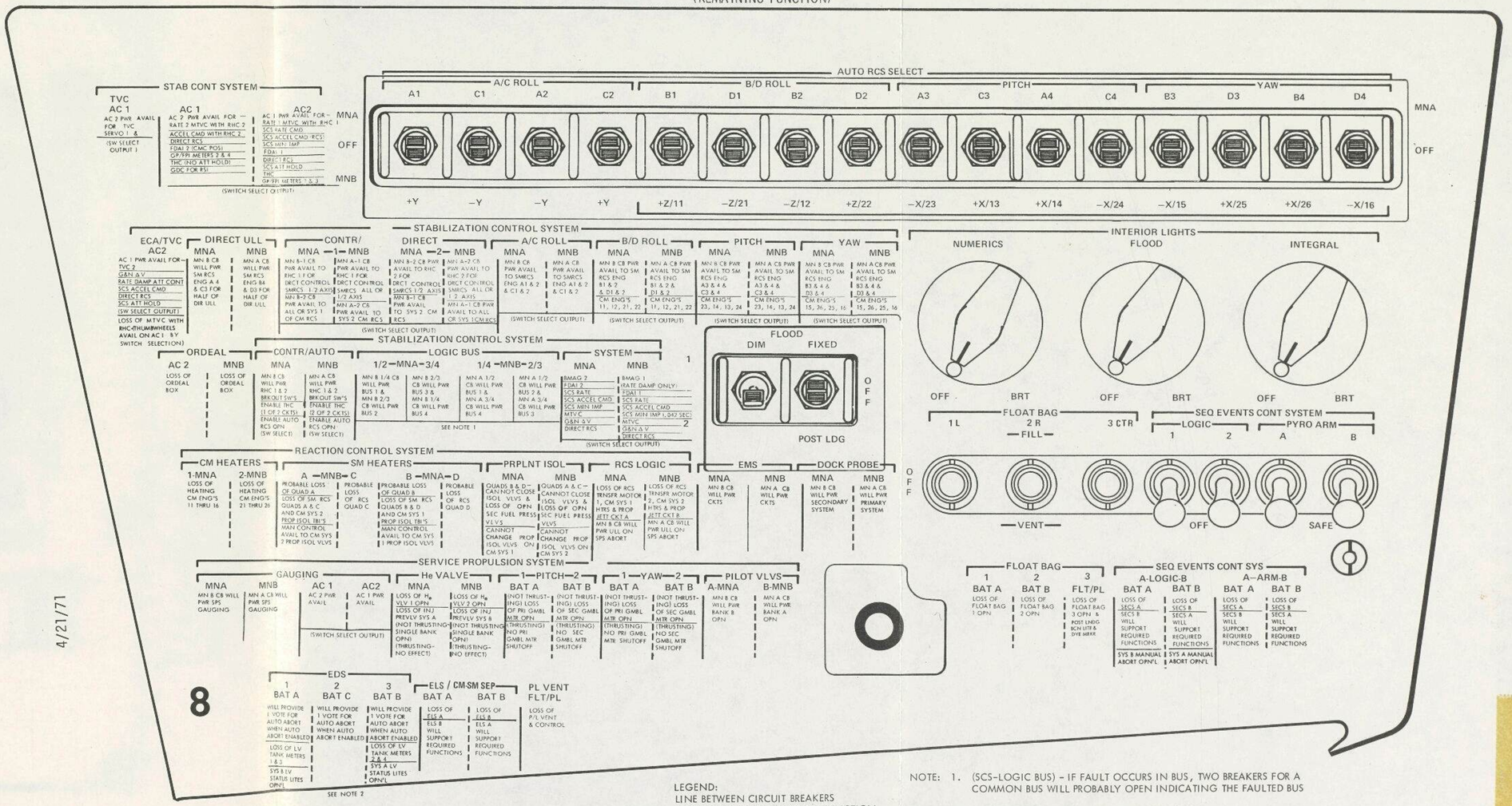
CB EFFECT
PNL 4



NOTE: 1. (SCS-LOGIC BUS) - IF FAULT OCCURS IN BUS, TWO BREAKERS FOR A COMMON BUS WILL PROBABLY OPEN INDICATING THE FAULTED BUS

2. TWO CB'S OPEN WILL INITIATE AN AUTO ABORT (WHEN EDS AUTO ENABLED)

EFFECT OF CB OPENING
(REMAINING FUNCTION)



4/21/71

LEGEND:
LINE BETWEEN CIRCUIT BREAKERS DESIGNATES DUAL POWER TO FUNCTION
DESIGNATES SIMILAR FUNCTIONS
DESIGNATES DIFFERENT FUNCTIONS

NOTE: 1. (SCS-LOGIC BUS) - IF FAULT OCCURS IN BUS, TWO BREAKERS FOR A COMMON BUS WILL PROBABLY OPEN INDICATING THE FAULTED BUS

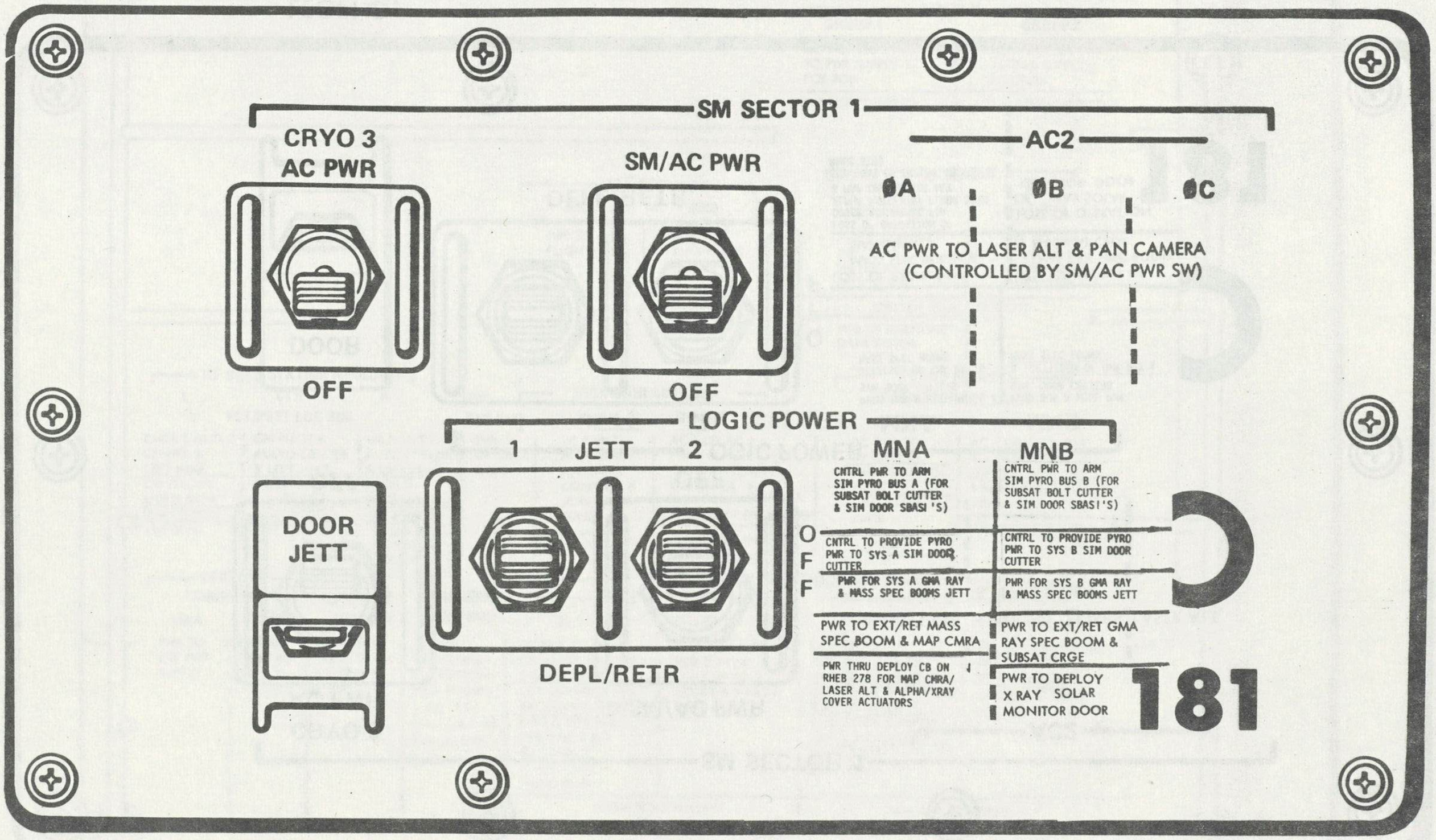
2. TWO CB'S OPEN WILL INITIATE AN AUTO ABORT (WHEN EDS AUTO ENABLED)

CB EFFECT PNL 8

CSM GNC

CB EFFECT
PNL 4

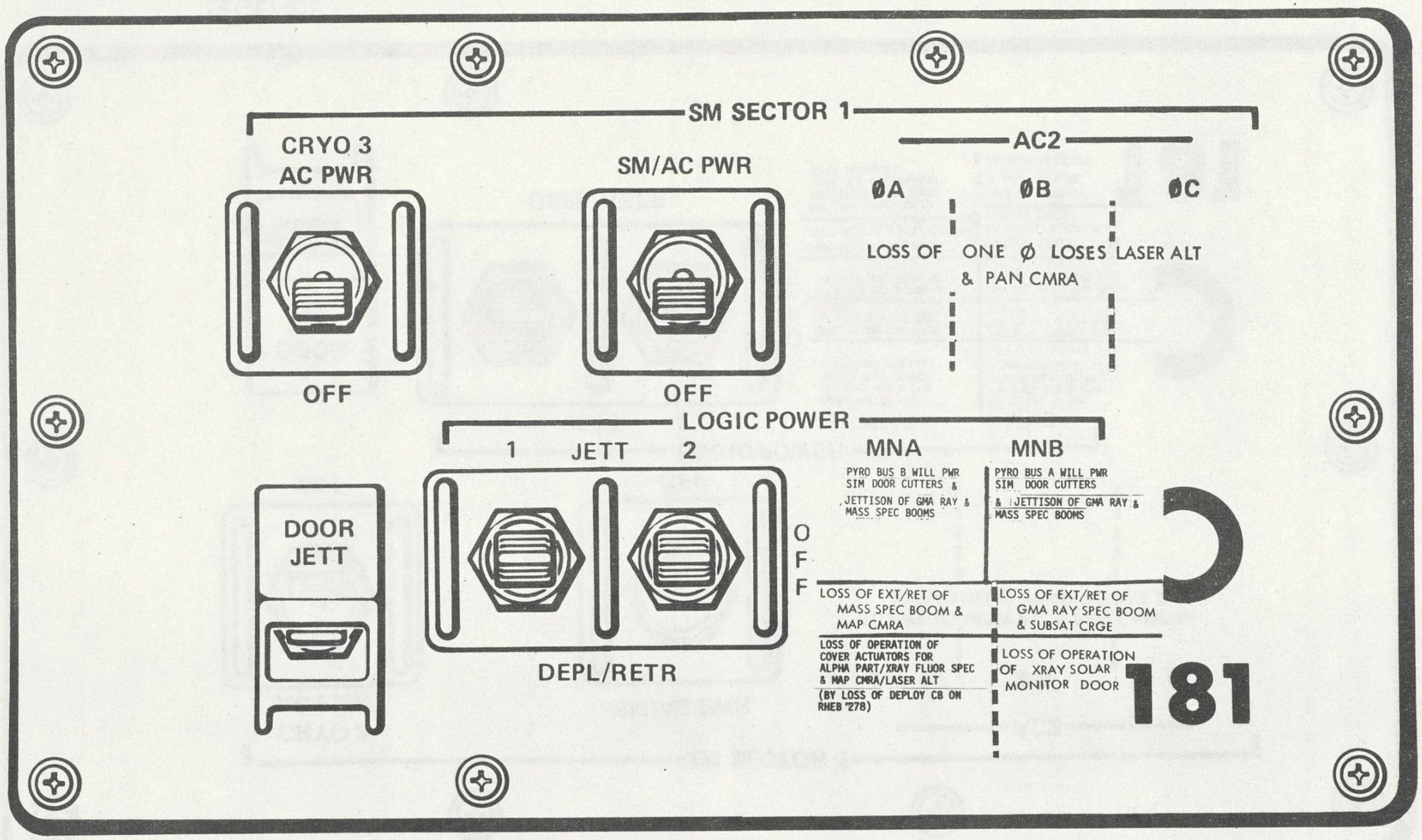
FUNCTIONS POWERED THRU CB



LEGEND:
LINE BETWEEN CIRCUIT BREAKERS
——— DESIGNATES DUAL POWER TO FUNCTION
- - - - - - DESIGNATES SIMILAR FUNCTIONS
——— DESIGNATES DIFFERENT FUNCTIONS

EASUREMENTS PNL 276
CB EFFECT 275,276,278
CB FUNCTION 275,276,278
CB FUNCTION 229, 250
CB FUNCTION PNL 226
CB FUNCTION PNL 225
CB FUNCTIONS PNL 181

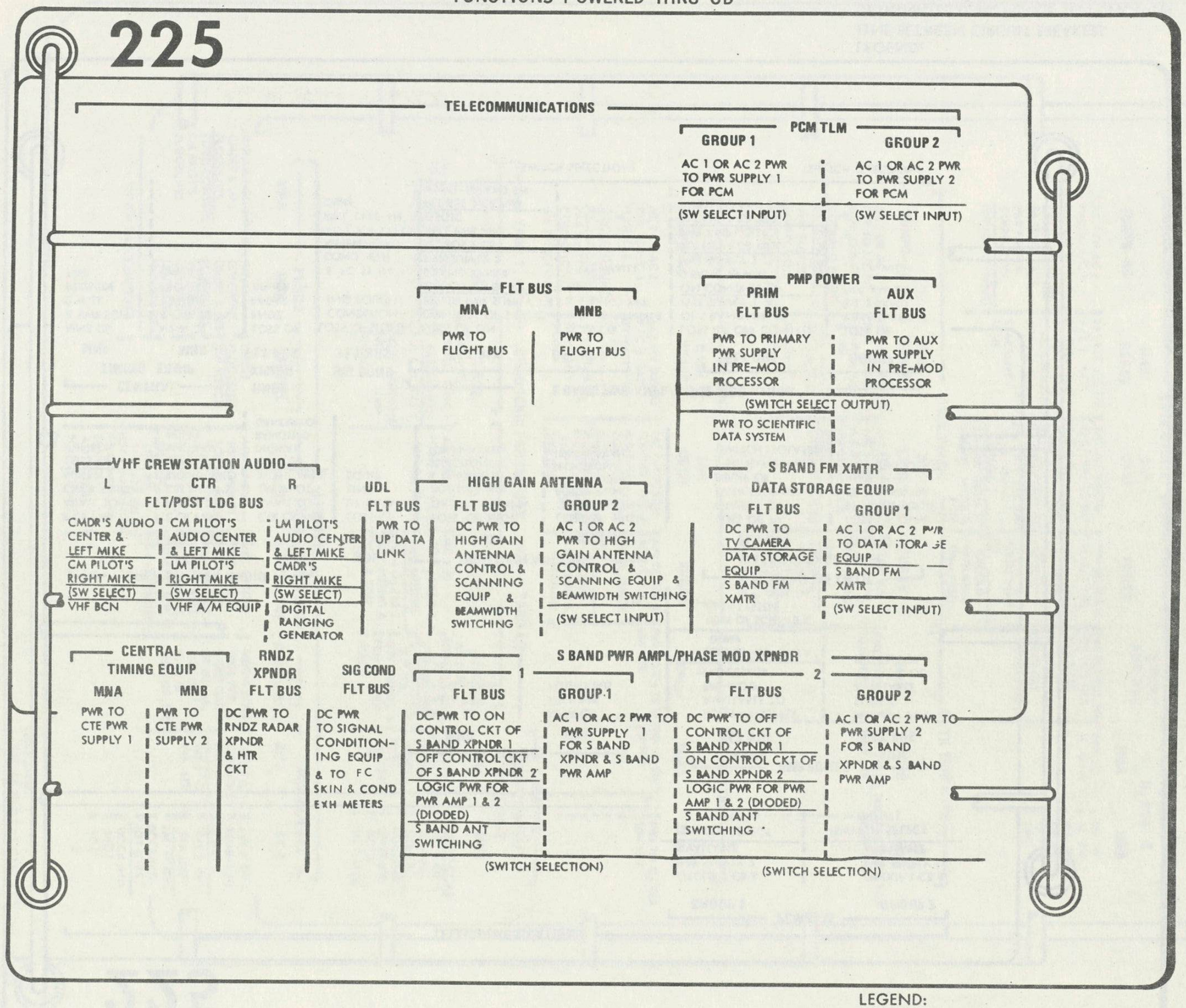
EFFECT OF CB OPENING
(REMAINING FUNCTION)



LEGEND:
LINE BETWEEN CIRCUIT BREAKERS
——— DESIGNATES DUAL POWER TO FUNCTION
- - - - - DESIGNATES SIMILAR FUNCTIONS
——— DESIGNATES DIFFERENT FUNCTIONS

FUNCTIONS POWERED THRU CB

225



LEGEND:
LINE BETWEEN CIRCUIT BREAKERS
DESIGNATES DUAL POWER TO FUNCTION
DESIGNATES SIMILAR FUNCTIONS
DESIGNATES DIFFERENT FUNCTIONS

EASUREMENTS PNL 276
CB EFFECT 275,276,278
CB FUNCTION 275,276,278
CB FUNCTION 229, 250
CB FUNCTION PNL 226
CB FUNCTION PNL 225
MEAS PNL 276

EFFECT OF CB OPENING
(REMAINING FUNCTION)

225

TELECOMMUNICATIONS

PCM TLM

GROUP 1	GROUP 2
GROUP 2 CB & PWR SUPPLY 2 AVAILABLE	GROUP 1 CB & PWR SUPPLY 1 AVAILABLE
(SWITCH SELECT INPUT)	(SWITCH SELECT INPUT)

FLT BUS

MNA	MNB
MNB CB WILL PWR FLIGHT BUS	MNA CB WILL PWR FLIGHT BUS

PMP POWER

PRIM FLT BUS	AUX FLT BUS
AUX PWR SUPPLY AVAILABLE TO PRE-MOD PROCESSOR	PRIMARY PWR SUPPLY AVAILABLE TO PRE-MOD PROCESSOR
LOSS OF CM DATA DUMP	
LOSS OF SCIENTIFIC DATA SYSTEM	

CREW STATION AUDIO

L	CTR	R
FLT/POST LDG BUS		
R CB PWR AVAIL TO CMDR'S RIGHT MIKE	L CB PWR AVAIL TO CM PILOT'S RIGHT MIKE	CTR CB PWR AVAIL TO LM PILOT'S RIGHT MIKE
LOSS OF VHF BCN	LOSS OF VHF A/M EQUIP	LOSS OF DIGITAL RANGING GENERATOR

UDL

FLT BUS
LOSS OF UP DATA LINK EQUIP

HIGH GAIN ANTENNA

FLT BUS	GROUP 2
LOSS OF HIGH GAIN ANTENNA POSITIONING & BEAMWIDTH SELECTION (OMNI AVAIL)	LOSS OF HIGH GAIN ANTENNA POSITIONING & BEAMWIDTH SELECTION (OMNI AVAIL)

S BAND FM XMTR

DATA STORAGE EQUIP

FLT BUS	GROUP 1
LOSS OF TV CAMERA OR DATA STORAGE EQUIP OR S BAND FM XMTR (SWITCH ISOLATE)	LOSS OF DATA STORAGE EQUIP OR S BAND FM XMTR (SWITCH ISOLATE)

CENTRAL TIMING EQUIP

MNA	MNB
MNB CB & PWR SUPPLY 2 WILL PROVIDE PWR	MNA CB & PWR SUPPLY 1 WILL PROVIDE PWR

RNDZ XPNDR

FLT BUS
LOSS OF RNDZ RADAR XPNDR

SIG COND

FLT BUS
LOSS OF SIGNAL CONDITIONING EQUIP & FC SK IN & COND EXH METERS (FC 1,2,3 LITES WILL LITE IN C&W)

S BAND PWR AMPL/PHASE MOD XPNDR

1		2	
FLT BUS	GROUP 1	FLT BUS	GROUP 2
LOSS OF ON CONTROL OF S BAND XPNDR PWR SUPPLY 1 & OFF CONTROL OF S BAND XPNDR PWR SUPPLY 2	LOSS OF S BAND XPNDR 1 & S BAND PWR AMP 1 (#2 AVAIL)	LOSS OF OFF CONTROL OF S BAND XPNDR PWR SUPPLY 1 & ON CONTROL OF S BAND XPNDR PWR SUPPLY 2	LOSS OF S BAND XPNDR 2 & S BAND PWR AMPL 2 (#1 AVAIL)
FLT BUS 2 CB WILL PWR AMP LOGIC		FLT BUS 1 CB WILL PWR AMP LOGIC	
FLT BUS 2 CB PWR AVAIL TO ANT SW		FLT BUS 1 CB PWR AVAIL TO ANT SW	
(SWITCH SELECTION)		(SWITCH SELECTION)	

LEGEND:
LINE BETWEEN CIRCUIT BREAKERS
DESIGNATES DUAL POWER TO FUNCTION
DESIGNATES SIMILAR FUNCTIONS
DESIGNATES DIFFERENT FUNCTIONS

FUNCTIONS POWERED THRU CB

226

FUEL CELL 1

PUMPS–AC	RAD/ REACS	BUS CONT	PURGE
AC 1 OR AC 2 PWR TO F/C 1 H_2/H_2O & COOLANT PUMPS ØA TO PH SNSR PWR FACTOR CORRECTION (SW SELECT INPUT)	BAT RLY BUS TO F/C 1 RAD BY-PASS VLV & TBI F/C 1 H_2 & O_2 REACTANT VLVS	BAT RLY BUS TO F/C 1 MN DC BUS A & B TIE CONTROL CKTS & TBI'S F/C-1 REACTANT TBI F/C 1 & 2 REACTANT VLVS HOLD VOLTAGE RLY BUS VOLTS TO SYS TEST METER & PCM	MN DC BUS A TO F/C 1 H_2 OR O_2 PURGE VLV & 1/2 OF H_2 PURGE VENT HT (DIODED WITH MN B THRU FUSE)

O_2 ISOL/ AUX BAT

BAT RLY BUS TO O_2 TK 3 ISOL VLV & TBI

SM PWR SOURCE SELECT CKT (BAT OR F/C 2)

CRYOGENIC 1 H_2 HTR 2

MNA	MNB
PWR TO H_2 TANK 1 HTR	PWR TO H_2 TANK 2 HTR, CNTRL PWR TO H_2 TANK 3 FANS

FUEL CELL 2

PUMPS–AC	RAD/ REACS	BUS CONT	PURGE
AC 1 OR AC 2 PWR TO F/C 2 H_2/H_2O & COOLANT PUMPS ØA TO PH SNSR PWR FACTOR CORRECTION (SW SELECT INPUT)	BAT RLY BUS TO F/C 2 RAD BY-PASS VLV & TBI F/C 2 H_2 & O_2 REACTANT VLVS	BAT RLY BUS TO F/C 2 MN DC BUS A & B TIE CONTROL CKTS & TBI'S F/C2 REACTANT TBI	MN DC BUS B TO F/C 2 H_2 OR O_2 PURGE VLV & 1/2 OF H_2 PURGE VENT HTR (DIODED WITH MN A THRU FUSE)

O_2 TK 100W HTRS

1 MNA	2 MNB	3 MNB
PWR TO O_2 TK 1 100W HTR	PWR TO O_2 TK2 100W HTR	PWR TO O_2 TK 3 100W HTR

FUEL CELL 3

PUMPS–AC	RAD/ REACS	BUS CONT	PURGE
AC 1 OR AC 2 PWR TO F/C 3 H_2/H_2O & COOLANT PUMPS ØA TO PH SNSR PWR FACTOR CORRECTION (SW SELECT INPUT)	BAT RLY BUS TO F/C 3 RAD BY-PASS VLV & TBI F/C 3 H_2 & O_2 REACTANT VLVS	BAT RLY BUS TO F/C 3 MN DC BUS A & B TIE CONTROL CKTS & TBI'S F/C 3 REACTANT TBI F/C 3 REACTANT VLV HOLD VOLTAGE	MN DC BUS B TO F/C 3 H_2 OR O_2 PURGE VLV (DIODED WITH MN A THRU FUSE)

O_2 TK 50W HTRS

1 MNB	2 MNA	3 MNA
PWR TO O_2 TK 1 50W HTR	PWR TO O_2 TK 2 50W HTR	PWR TO O_2 TK3 50W HTR

TANK 1 — CRYOGENIC FAN MOTORS — TANK 2/3

AC 1

ØA	ØB	ØC/SCE
AC 1 ØA TO H_2 TANK 1 FAN MOTORS	AC 1 ØB TO H_2 TANK 1 FAN MOTORS	AC 1 ØC TO H_2 TANK 1 FAN MOTORS H_2 & O_2 TKS 1 QTY MSRNG & PCM & TEMP PCM

AC2

ØA	ØB/SCE 3	ØC/SCE 2
AC 2 ØA TO H_2 TKS 2 & 3 FAN MOTORS	AC 2 ØB TO H_2 TKS 2 & 3 FAN MOTORS H_2 & O_2 TKS 3 QTY MSRNG & PCM & TEMP PCM	AC 2 ØC TO H_2 TKS 2 & 3 FAN MOTORS H_2 & O_2 TKS 2 QTY MSRNG & PCM & TEMP PCM

LIGHTING COAS/TUNNEL/ RNDZ/SPOT

MNA	MNB
LEFT COAS SYS A OF 6 TUNNEL LIGHTS RNDZ FLASHING LITE	RIGHT COAS SYS B OF 6 TUNNEL LIGHTS DOCKING SPOT LITE DOOR INITIATOR

LIGHTING

FLOOD

MNA	MNB	FLT/PL
VARIABLE CONTROL CMDRS & LEB FLOODLITES FIXED CONTROL LM PILOT'S FLOODLITES	FIXED CONTROL CMDRS & LEB FLOODLITES VARIABLE CONTROL LM PILOT'S FLOODLITES	CMDRS FLOODLITES (SW SELECT)

SWITCH SELECT OUTPUT

NUMERICS/INTEGRAL

LEB AC2	L MDC–AC1	R MDC–AC 1
LEB PANEL 100 CONTROL FOR LEB 100,101, 122 & DSKY STATUS & KEY LITES, MDC-10, LHEB 306, RHEB 225, 226 & MDC I FUNCTION SW CONTROL OF EMS ROLL ATTITUDE & SCROLL LIGHTS	MDC-8 CONTROL FOR MDC-1, LEFT HALF OF MDC-2 & DSKY STATUS & KEY LITES, MDC-7, 8, 9, 15 & EMS NOMEN	MDC-5 CONTROL FOR RIGHT HALF OF MDC-2, MDC-3, 4, 5, 6, 16 RHEB 229, 275

RUN/EVA/TRGT

AC 1	AC 2
SYS 1 OF 8 RUNNING LITES SYS 1 OF EVA LITE	SYS 2 OF 8 RUNNING LITES SYS 2 OF EVA LITE LM ACTIVE DOCKING TGT LITES DOCKING SPOT LITE

LEGEND:

LINE BETWEEN CIRCUIT BREAKERS

——— DESIGNATES DUAL POWER TO FUNCTION

▬▬▬ DESIGNATES SIMILAR FUNCTIONS

▬▬▬ DESIGNATES DIFFERENT FUNCTIONS

EFFECT OF CB OPENING
(REMAINING FUNCTION)

226

FUEL CELL 1

PUMPS–AC	RAD/ REACS	BUS CONT	PURGE
LOSS OF F/C 1 PUMPS & PH SNSR & PWR FACTOR CORR (F/C 2 PWR FACTOR CORR AVAIL)	LOSS OF F/C 1 REACTANT VLVS CONTROL & OF F/C 1 RAD BYPASS VLV CONTROL (TBI WILL NOT GO STRIPED)	LOSS OF F/C 1 MN A & B TIE CONTROL CKTS (TBI'S WILL NOT GO STRIPED) F/C 1 REACTANT TBI WILL NOT GO STRIPED LOSS OF REAC VLVS HOLD VOLTAGE TO F/C 1 & 2 RLY BUS VOLTS TO SYS TEST METER &PCM	PROBABLE LOSS OF CONTROL (MN B FUSE PROBABLY OPENED FIRST) F/C 2 PURGE CB WILL PWR 1/2 OF H_2 VENT HTR

O_2 ISOL/ AUX BAT

LOSS OF CONTROL OF O_2 TK 3 ISOL VLV
& OF SM PWR SOURCE SELECT CKT BAT OR F/C 2)

CRYOGENIC 1 H_2HTR 2

MNA	MNB
LOSS OF H_2 TANK 1 HTRS	LOSS OF H_2 TANK 2 HTRS H_2 TANK 3 FANS

FUEL CELL 2

PUMPS–AC	RAD/ REACS	BUS CONT	PURGE
LOSS OF F/C 2 PUMPS & PH SNSR & PWR FACTOR CORR (F/C 3 PWR FACTOR CORR AVAIL)	LOSS OF F/C 2 REACTANT VLVS CONTROL & OF F/C 2 RAD BYPASS VLV CONTROL (TBI WILL NOT GO STRIPED)	LOSS OF F/C 2 & AUX BAT MN A & B TIE CONTROL CKTS (TBI'S WILL NOT GO STRIPED) F/C 2 REACTANT TBI WILL NOT GO STRIPED	PROBABLE LOSS OF CONTROL (MN A FUSE PROBABLY OPENED FIRST) F/C 1 PURGE CB WILL PWR 1/2 OF H_2 VENT HTR

O_2 TK 100 W HTRS

1 MNA	2 MNB	3 MNB
LOSS OF O_2 TK 1 100W HTR	LOSS OF O_2 TANK 2 100W HTR	LOSS OF O_2 TANK 3 100W HTR

FUEL CELL 3

PUMPS–AC	RAD/ REACS	BUS CONT	PURGE
LOSS OF F/C 3 PUMPS & PH SNSR & PWR FACTOR CORR (F/C 2 PWR FACTOR CORR AVAIL)	LOSS OF F/C 3 REACTANT VLVS CONTROL & OF F/C 3 RAD BYPASS VLV CONTROL (TBI WILL NOT GO STRIPED)	LOSS OF F/C 3 MN A & B TIE CONTROL CKTS (TBI'S WILL NOT GO STRIPED) F/C 3 REACTANT TBI WILL NOT GO STRIPED LOSS OF F/C 3 REAC VLV HOLD VOLTAGE	PROBABLE LOSS OF CONTROL (MN A FUSE PROBABLY OPENED FIRST)

O_2 TK 50 W HTRS

1 MNB	2 MNA	3 MNA
LOSS OF O_2 TK 1 50W HTR	LOSS OF O_2 TANK 2 50W HTR	LOSS OF O_2 TANK 3 50W HTR

CRYOGENIC FAN MOTORS

TANK 1 — AC 1

ϕA	ϕB	ϕC/SCE
H_2 TANK 1 FAN MOTORS WILL RUN ON 2ϕ PWR AT REDUCED RATE	H_2 TANK 1 FAN MOTORS WILL RUN ON 2ϕ PWR AT REDUCED RATE	H_2 TANK 1 FAN MOTORS WILL RUN ON 2ϕ PWR AT REDUCED RATE LOSS OF H_2& O_2 TK 1 QTY METERS & PCM & TEMP PCM

TANK 2/3 — AC 2

ϕA	ϕB/SCE 3	ϕC/SCE 2
H_2 TKS 2 & 3 FAN MOTORS WILL RUN ON 2ϕ PWR AT REDUCED RATE	H_2 TKS 2 & 3 FAN MOTORS WILL RUN ON 2ϕ PWR AT REDUCED RATE LOSS OF H_2 & O_2 TKS 3 QTY METERS & PCM & TEMP PCM	H_2 TKS 2 & 3 FAN MOTORS WILL RUN ON 2ϕ PWR AT REDUCED RATE LOSS OF H_2& O_2 TKS 2 QTY METERS & PCM & TEMP PCM

LIGHTING

COAS/TUNNEL/ RNDZ/SPOT

MNA	MNB
LOSS OF LEFT COAS & RNDZ FLASHING LITE MN B CB WILL PWR SYS B OF 6 TUNNEL LITES	LOSS OF RIGHT COAS & DOCKING SPOT LITE & DOOR INITIATOR MN A CB WILL PWR SYS A OF 6 TUNNEL LITES

LIGHTING

FLOOD

MNA	MNB	FLT/PL
MN B CB PWR AVAIL TO FIXED CONTROL OF CMDR'S & LEB FLOODLITES FLT/PL CB PWR AVAIL TO CMDR'S FLOODLITES MN B CB PWR AVAIL TO VARIABLE CONTROL LM PILOT'S FLOODS	MN A CB PWR AVAIL TO VARIABLE CONTROL OF CMDR'S & LEB FLOODS MN A CB PWR AVAIL TO FIXED CONTROL OF LM PILOT'S FLOODLITES	LOSS OF FLT/PL PWR TO CMDR'S FLOODLITES

NUMERICS/INTEGRAL

LEB AC2	L MDC–AC1	R MDC – AC1
LOSS OF LIGHTING ON APPLICABLE PANELS & LEB DSKY STATUS & KEY LITES	LOSS OF LIGHTING ON APPLICABLE PANELS & MDC-I DSKY STATUS & KEY LITES	LOSS OF LIGHTING ON APPLICABLE PANELS

RUN/EVA/TRGT

AC 1	AC 2
AC 2 CB WILL PWR SYS 2 OF 8 RUNNING LITES & SYS 2 OF EVA LITE	AC 1 CB WILL PWR SYS 1 OF 8 RUNNING LITES & SYS 1 OF EVA LITE LOSS OF LM ACTIVE DOCKING TRGT LITES & SPOT LITE

LEGEND:
LINE BETWEEN CIRCUIT BREAKERS
DESIGNATES DUAL POWER TO FUNCTION
DESIGNATES SIMILAR FUNCTIONS
DESIGNATES DIFFERENT FUNCTIONS

FUNCTIONS POWERED THRU CB

EPS

GROUP 1

MNA	MNB
MDC-8 CB'S	MDC-8-CB'S
SCS-PITCH-MNA	SCS-PITCH-MNB
SCS-LOGIC BUS-3/4-MNA	SCS-LOGIC BUS 2/3-MNB
SCS-CONTR/AUTO-MNA	SCS CONTR/AUTO-MNB
RCS-SM HEATERS-D-MNA	RCS-SM HEATERS-C-MNB
RCS PRPLNT ISOL-MNA	RCS-PRPLNT ISOL-MNB

GROUP 2

MNA	MNB
MDC-8 CB'S	MDC-8 CB'S
SCS-A/C ROLL-MNA	SCS-A/C ROLL-MNB
SCS-SYSTEM-MNA	SCS-SYSTEM-MNB

GROUP 3

MNA	MNB
MDC-8 CB'S	MDC-8 CB'S
SCS-YAW-MNA	SCS-YAW-MNB
SCS-LOGIC BUS 1/2-MNA	SCS-LOGIC BUS 1/4-MNB
RCS-SM HEATERS, B-MNA	RCS-SM HEATERS A-MNB
	ORDEAL-MNB

GROUP 4

MNA	MNB
MDC-8 CB'S	MDC-8 CB'S
SCS-B/D ROLL-MNA	SCS-B/D ROLL-MNB
EMS-MNA	EMS-MNB
SPS-GAUGING-MNA	SPS-GAUGING-MNB
SPS-He VALVE-MNA	SPS He VALVE-MNB
DOCK PROBE-MNA	DOCK PROBE-MNB

GROUP 5

MNA	MNB
MDC-8 CB'S	MDC-8 CB'S
SCS-CONTR/DIRECT-MNA-1 & MNA-2	SCS-CONTR/DIRECT-MNB-1 & MNB-2
SCS-DIRECT ULL-MNA	SCS-DIRECT ULL-MNB
RCS LOGIC-MNA	RCS LOGIC-MNB
RCS-CM HEATERS-1-MNA	RCS-CM HEATERS-2-MNB
SPS-PILOT VLVS A-MNA	SPS-PILOT VLVS B-MNB

TIMERS

MNA	MNB
PWR TO EVENT TIMERS ON MDC-1 & LHEB 306	PWR TO EVENT TIMERS ON MDC-1 & LHEB 306
MSN TIMER ON MDC-2	MSN TIMER ON LHEB 306

SPS LINE HTRS

MN A	MN B
SPS SYS A HTRS	SPS SYS B HTRS

O_2 VAC-ION PUMPS

1-MN A	2/3-MN B
O_2 TANK 1 VAC ION PUMP	O_2 TANKS 2 & 3 VAC ION PUMPS

MAIN RELEASE

PYRO A	PYRO B
PYRO BUS A TO MAIN CHUTE RELEASE (NORMALLY OPEN-CLOSED AFTER SPLASHDOWN)	PYRO BUS B TO MAIN CHUTE RELEASE (NORMALLY OPEN-CLOSED AFTER SPLASHDOWN)

UTILITY

R/L STA	LEB
PWR TO UTILITY OUTLETS ON PANELS 15 & 16	PWR TO UTILITY OUTLET ON LEB PANEL 100

EPS BAT BUS

A	B
MDC-8 CB'S	MDC-8 CB'S
SECS-ARM A-BAT A	SECS-ARM B-BAT B
SECS-LOGIC A-BAT A	SECS-LOGIC B-BAT B
ELS/CM-SM SEP-BAT A	ELS/CM-SM SEP-BAT B
EDS-1-BAT A	EDS-3-BAT B
SPS-PITCH 1-BAT A	SPS-PITCH 2-BAT B
SPS-YAW 1-BAT A	SPS-YAW 2-BAT B
FLOAT BAG-1-BAT A	FLOAT BAG 2-BAT B

229

250

BAT BUS A TO PYRO BUS TIE

BAT BUS A BACK-UP TO PYRO A (NORMALLY OPEN-CLOSED IF PYRO BAT A FAILS)

PYRO A — **SEQ A**

PYRO BAT A TO PYRO BUS A & SIM PYRO BUS A (NORMALLY USED - OPEN IF PYRO BAT A FAILS)

BAT BUS B TO PYRO BUS TIE

BAT BUS B BACK-UP TO PYRO B (NORMALLY OPEN-CLOSED IF PYRO BAT B FAILS)

PYRO B — **SEQ B**

PYRO BAT B TO PYRO BUS B & SIM PYRO BUS B (NORMALLY USED - OPEN IF PYRO BAT B FAILS)

BAT A PWR ENTRY / POST LANDING

E/PL BAT A PWR TO BAT BUS A

BAT B PWR ENTRY / POST LANDING

E/PL BAT B PWR TO BAT BUS B

BAT C PWR ENTRY / POST LANDING

E/PL BAT C PWR TO ALL BAT C CKTS

BAT C TO BAT BUS A

BAT C BACKUP TO BAT BUS A (NORMALLY OPEN-CLOSED IF E/PL BAT A FAILS)

BAT C TO BAT BUS B

BAT C BACKUP TO BAT BUS B (NORMALLY OPEN-CLOSED IF E/PL BAT B FAILS)

BAT C BAT CHGR / EDS2

BAT CHGR TO BAT C
BAT C TO EDS 2

LEGEND:
LINE BETWEEN CIRCUIT BREAKERS
DESIGNATES DUAL POWER TO FUNCTION
DESIGNATES SIMILAR FUNCTIONS
DESIGNATES DIFFERENT FUNCTIONS

CB EFFECT PNL 181

CB EFFECT PNL 225

CB EFFECT PNL 226

CB EFFECT 229, 250

EFFECT OF CB OPENING (REMAINING FUNCTION)

229

EPS

GROUP 1

MNA	MNB
LOSS OF PWR TO LISTED CB'S ON MDC-8	LOSS OF PWR TO LISTED CB'S ON MDC-8

TIMERS

MNA	MNB
MN B CB WILL PWR EVENT TIMERS	MN A CB WILL PWR EVENT TIMERS
LOSS OF MSN TIMER ON MDC-2(LHEB 306 AVAIL)	LOSS OF MSN TIMER ON LHEB 306 (MDC-2 AVAIL)

GROUP 2

LOSS OF PWR TO LISTED CB'S ON MDC-8	LOSS OF PWR TO LISTED CB'S ON MDC-8

SPS LINE HTRS

MN A	MN B
LOSS OF SPS SYS A HTRS (SYS B AVAIL)	LOSS OF SPS SYS B HTRS (SYS A AVAIL)

GROUP 3

LOSS OF PWR TO LISTED CB'S ON MDC-8	LOSS OF PWR TO LISTED CB'S ON MDC-8

O_2 VAC-ION PUMPS

1-MN A	2/3-MN B
LOSS OF O_2 TANK 1 VAC ION PUMP	LOSS OF O_2 TKS 2 & 3 VAC ION PUMPS

GROUP 4

LOSS OF PWR TO LISTED CB'S ON MDC-8	LOSS OF PWR TO LISTED CB'S ON MDC-8

MAIN RELEASE

PYRO A	PYRO B
PYRO B CB WILL PWR REQUIRED FUNCTION	PYRO A CB WILL PWR REQUIRED FUNCTION

GROUP 5

LOSS OF PWR TO LISTED CB'S ON MDC-8	LOSS OF PWR TO LISTED CB'S ON MDC-8

UTILITY

R/L STA	LEB
LEB PANEL 100 UTILITY OUTLET AVAILABLE	MDC-15 & 16 UTILITY OUTLETS AVAILABLE

EPS BAT BUS

A	B
LOSS OF PWR TO LISTED CB'S ON MDC-8	LOSS OF PWR TO LISTED CB'S ON MDC-8

250

BAT BUS A TO PYRO BUS TIE

LOSS OF BACKUP TO PYRO A (SEQ B WILL PWR REQUIRED FUNCTIONS)

PYRO A **SEQ A**

(IF FAULT IN PYRO A SYSTEM) SEQ B CB WILL PWR REQUIRED FUNCTIONS

BAT BUS B TO PYRO BUS TIE

LOSS OF BACKUP TO PYRO B (SEQ A WILL PWR REQUIRED FUNCTIONS)

PYRO B **SEQ B**

(IF FAULT IN PYRO B SYSTEM) SEQ A CB WILL PWR REQUIRED FUNCTIONS

BAT A PWR ENTRY / POST LANDING

(IF FAULT ON BAT BUS A) LOSS OF BAT BUS A

BAT B PWR ENTRY / POST LANDING

(IF FAULT ON BAT BUS B) LOSS OF BAT BUS B

BAT C PWR ENTRY / POST LANDING

LOSS OF BAT C PWR TO CKTS

BAT C TO BAT BUS A

LOSS OF BACKUP TO BAT BUS A

BAT C TO BAT BUS B

LOSS OF BACKUP TO BAT BUS B

BAT C BAT CHGR / EDS2

BAT C CAN BE CHARGED THRU BAT A OR BAT B CKT

1 VOTE FOR EDS AUTO ABORT

LEGEND:

LINE BETWEEN CIRCUIT BREAKERS DESIGNATES DUAL POWER TO FUNCTION

DESIGNATES SIMILAR FUNCTIONS

DESIGNATES DIFFERENT FUNCTIONS

THRU CB

ST LANDING

MAIN A	MAIN B
MN DC BUS A TO F/PL BUS (NORMALLY CLOSED-OPEN BEFORE SPLASHDOWN)	MN DC BUS B TO F/PL BUS (NORMALLY CLOSED-OPEN BEFORE SPLASHDOWN)

INVERTER POWER

1 MAIN A	2 MAIN B	3 MAIN A	3 MAIN B
MN DC BUS A TO INV 1	MN DC BUS B TO INV 2	MN DC BUS A TO INV 3	MN DC BUS B TO INV 3

(SWITCH SELECT OUTPUT)

275

78

UPRIGHTING SYSTEM

COMPRESSOR

1	2
BAT BUS A TO COMPR 1	BAT BUS B TO COMPR 2

SIVB LM SEP

A	PYRO	B
PYRO BUS A FOR LM/ SIV B SEP		PYRO BUS B FOR LM/ SIV B SEP

DEPLOY

MN A

MN DC BUS A TO COVER ACTUATORS OF ALPHA PART/XRAY FLUOR SPEC & MAP CMRA/LASER ALT

LEGEND:

LINE BETWEEN CIRCUIT BREAKERS
DESIGNATES DUAL POWER TO FUNCTION
DESIGNATES SIMILAR FUNCTIONS
DESIGNATES DIFFERENT FUNCTIONS

FUNCTIONS POWERED THRU CB

275

MAIN A

BAT BUS A	BAT C
BAT BUS A TO MAIN DC BUS A	BAT C TO MAIN DC BUS A (NORMALLY OPEN-CLOSED BEFORE CSM SEP)

MAIN B

BAT C	BAT BUS B
BAT C TO MAIN DC BUS B (NORMALLY OPEN-CLOSED BEFORE CSM SEP)	BAT BUS B TO MAIN DC BUS B

FLIGHT / POST LANDING

BAT BUS A	BAT BUS B	BAT C	MAIN A	MAIN B
BAT BUS A TO F 'PL BUS (NORMALLY OPEN-CLOSED BEFORE SPLASHDOWN)	BAT BUS B TO F 'PL BUS (NORMALLY OPEN-CLOSED BEFORE SPLASHDOWN)	BAT C TO F PL BUS (NORMALLY OPEN-CLOSED BEFORE SPLASHDOWN)	MN DC BUS A TO F 'PL BUS (NORMALLY CLOSED-OPEN BEFORE SPLASHDOWN)	MN DC BUS B TO F 'PL BUS (NORMALLY CLOSED-OPEN BEFORE SPLASHDOWN)

INVERTER POWER

1 MAIN A	2 MAIN B	3 MAIN A	3 MAIN B
MN DC BUS A TO INV 1	MN DC BUS B TO INV 2	MN DC BUS A TO INV 3	MN DC BUS B TO INV 3

(SWITCH SELECT OUTPUT)

276

CB1	CB2
PWR TO MSRMNTS, METERS & PCM ON ATTACHED LIST	PWR TO MSRMNTS, METERS & PCM ON ATTACHED LIST

INSTRUMENTATION POWER CONTROL

CB3	CB4
PWR TO MSRMNTS, METERS & PCM ON ATTACHED LIST	PWR TO MSRMNTS, METERS & PCM ON ATTACHED LIST

OPERATIONAL

278

UPRIGHTING SYSTEM

COMPRESSOR

1	2
BAT BUS A TO COMPR 1	BAT BUS B TO COMPR 2

SIVB LM SEP

A	PYRO B
PYRO BUS A FOR LM/ SIV B SEP	PYRO BUS B FOR LM/ SIV B SEP

DEPLOY

MN A

MN DC BUS A TO COVER ACTUATORS OF ALPHA PART/XRAY FLUOR SPEC & MAP CMRA/LASER ALT

LEGEND:

LINE BETWEEN CIRCUIT BREAKERS

DESIGNATES DUAL POWER TO FUNCTION

DESIGNATES SIMILAR FUNCTIONS

DESIGNATES DIFFERENT FUNCTIONS

4/21/71

CB FUNCTION

CB EFFECT
PNL 181

CB EFFECT
PNL 225

CB EFFECT
PNL 324

CB EFFECT
PNL 350

NING
TION)

LANDING

MAIN A	MAIN B
MAIN B CB WILL PWR F/PL BUS	MAIN A CB WILL PWR F/PL BUS

INVERTER POWER

MAIN A	MAIN B	MAIN A	MAIN B
LOSS OF INV 1 / INVERTERS 2 & 3 AVAILABLE	LOSS OF INV 2 / INVERTERS 1 & 3 AVAILABLE	MAIN B CB PWR AVAIL TO INV 3	MAIN A CB PWR AVAIL TO INV 3

(SWITCH SELECT OUTPUT)

275

78

UPRIGHTING SYSTEM

COMPRESSOR

1	2
COMPR 2 WILL INFLATE (AT REDUCED RATE)	COMPR 1 WILL INFLATE (AT REDUCED RATE)

SIVB LM SEP

A	PYRO	B
PYRO B WILL PWR REQ'D FUNCTION		PYRO A WILL PWR REQ'D FUNCTION

DEPLOY

MN A

LOSS OF OPERATION OF COVER ACTUATORS FOR ALPHA PART/XRAY FLUOR SPEC & MAP CMRA/LASER ALT

EFFECT OF CB OPENING
(REMAINING FUNCTION)

275

MAIN A		MAIN B		FLIGHT / POST LANDING					INVERTER POWER			
BAT BUS A	BAT C	BAT C	BAT BUS B	BAT BUS A	BAT BUS B	BAT C	MAIN A	MAIN B	MAIN A	MAIN B	MAIN A	MAIN B
BAT C CB PWR AVAILABLE TO MN DC BUS A	BAT BUS A PWR AVAILABLE TO MN DC BUS A	BAT BUS B PWR AVAILABLE TO MN DC BUS B	BAT C CB PWR AVAILABLE TO MN DC BUS B	BAT BUS B CB & BAT C CB PWR AVAIL TO F/PL BUS	BAT BUS A CB & BAT C CB PWR AVAIL TO F/PL BUS	BAT BUS A CB & BAT BUS B CB PWR AVAIL TO F/PL BUS	MAIN B CB WILL PWR F/PL BUS	MAIN A CB WILL PWR F/PL BUS	LOSS OF INV 1 / INVERTERS 2 & 3 AVAILABLE	LOSS OF INV 2 / INVERTERS 1 & 3 AVAILABLE	MAIN B CB PWR AVAIL TO INV 3	MAIN A CB PWR AVAIL TO INV 3
											(SWITCH SELECT OUTPUT)	

276

CB1	CB2
LOSS OF MSRMNTS, METERS & PCM (C/W MAY ALARM)	LOSS OF MSRMNTS, METERS & PCM (C/W MAY ALARM)

INSTRUMENTATION POWER CONTROL

CB3	CB4
LOSS OF MSRMNTS, METERS & PCM (C/W MAY ALARM)	LOSS OF MSRMNTS, METERS & PCM (C/W MAY ALARM)

OPERATIONAL

278

UPRIGHTING SYSTEM

COMPRESSOR

1	2
COMPR 2 WILL INFLATE (AT REDUCED RATE)	COMPR 1 WILL INFLATE (AT REDUCED RATE)

SIVB LM SEP

A	PYRO B
PYRO B WILL PWR REQ'D FUNCTION	PYRO A WILL PWR REQ'D FUNCTION

DEPLOY MN A

LOSS OF OPERATION OF COVER ACTUATORS FOR ALPHA PART/XRAY FLUOR SPEC & MAP CMRA/LASER ALT

LEGEND:
LINE BETWEEN CIRCUIT BREAKERS
——— DESIGNATES DUAL POWER TO FUNCTION
- - - DESIGNATES SIMILAR FUNCTIONS
═══ DESIGNATES DIFFERENT FUNCTIONS

4/21/71

CB EFFECT 275,276,278

CB EFFECT 229 - 250

CB EFFECT PNL 226

CB EFFECT PNL 225

CB EFFECT PNL 181

RIGHT HAND EQUIPMENT BAY PANEL 276

Msrmnt Title	Msrmnt No.	O. B. Display
CB 1		
Main dc bus A&B power to following measurements:		
H_2O Dump Temp	CF 0461T	
CM He Tk 1 Press	CR 0001P	SM
CM He Tk 1 Temp	CR 0003T	SM
CM He Manif 1 Press	CR 0035P	*
CM He Manif 2 Press	CR 0038P	SM*
Temp 16 Eng Inj Sys 1	CR 2103T	SM
Temp 12 Eng Inj Sys 1	CR 2114T	SM
CB 2		
Main dc bus A&B power to following measurements:		
Temp Crew Ablator Surf Loc 1A	CA 1820T	
Temp Crew Ablator Surf Loc 4A	CA 1821T	
Temp Crew Ablator Surf Loc 7A	CA 1822T	
Temp Crew Ablator Surf Loc 10A	CA 1823T	
Press Batt Comprtmnt (Manif)	CC 0188P	SM
Drogue Dep Relay A	CE 0001X	
Drogue Dep Relay B	CE 0002X	
Main Dep Relay A	CE 0003X	
Main Dep Relay B	CE 0004X	
Main Chute Disc Relay A	CE 0321X	
Main Chute Disc Relay B	CE 0322X	
Suit Cabin Delta Press	CF 0003P	M
Surge Tank Press	CF 0006P	SM
H_2O Tank-Glycol Res Press	CF 0120P	
Pri Glycol Flow Rate	CF 0157R	
Pri Evap Inlet Temp	CF 0181T	
Urine Dump Nozzle Temp	CF 0460T	
Astro 1 EKG Axis 1	CJ 0060J	
Astro 2 EKG Axis 1	CJ 0061J	
Astro 3 EKG Axis 1	CJ 0062J	
Astro 1 Respir	CJ 0200R	
Astro 2 Respir	CJ 0201R	
Astro 3 Respir	CJ 0202R	
CM X Axis Accel	CK 0026A	
CM Y Axis Accel	CK 0027A	
CM Z Axis Accel	CK 0028A	
Dosimeter 1 Radiation	CK 1051K	
Dosimeter 2 Radiation	CK 1052K	
Dosimeter Rate	CK 1053R	

Msrmnt Title	Msrmnt No.	O. B. Display
CB 2 cont'd		
CM He Tk 2 Press	CR 0002P	SM
CM He Tk 2 Temp	CR 0004T	SM
CM He Manif 2 Press	CR 0036P	*
CM He Manif 1 Press	CR 0037P	SM*
Temp 14 Eng Inj Sys 1	CR 2100T	SM
Temp 24 Eng Inj Sys 2	CR 2110T	SM
Temp 25 Eng Inj Sys 2	CR 2116T	SM
Temp 21 Eng Inj Sys 2	CR 2119T	SM
Docking Probe Temp	CS 0220T	
CB 3		
Main dc bus A&B power to following measurements:		
O_2 Tk 2 Press	SC 0038P	SM
H_2 Tk 2 Press	SC 0040P	SM*
H_2 Tk 3 Press	SC 0052P	SM
O_2 Tk 3 Press	SC 0053P	SM
O_2 Tk 2&3 Manif Press	SC 0069P	*
O_2 Tk 1 Htr Temp	SC 0070T	SM
O_2 Tk 3 Htr Temp	SC 0072T	SM
FC 2 O_2 Press	SC 2067P	SM
FC 3 O_2 Press	SC 2068P	SM
FC 2 H_2 Press	SC 2070P	SM
FC 3 H_2 Press	SC 2071P	SM
FC 2 Rad Out Temp	SC 2088T	SMB*
FC 3 Rad Out Temp	SC 2089T	SMB*
FC 2 Rad In Temp	SC 2091T	
FC 3 Rad In Temp	SC 2092T	
FC 2 H_2 Flow	SC 2140R	SM*
FC 3 H_2 Flow	SC 2141R	SM*
FC 2 O_2 Flow	SC 2143R	SM*
FC 3 O_2 Flow	SC 2144R	SM*
He Tk Press	SP 0001P	
Ox Tks Press	SP 0003P	M*
Pos Fu/Ox Vlv 1 pot B	SP 0022H	
Pos Fu/Ox Vlv 3 pot B	SP 0024H	
Pos Fu/Ox Vlv 2 pot A	SP 0027H	M
Pos Fu/Ox Vlv 4 pot A	SP 0029H	M
Temp Fuel Eng Feed Line	SP 0048T	M
Temp Bay 2 Ox Sump Tk Surf	SP 0055T	
Temp Bay 5 Fuel Sump Tk Surf	SP 0056T	

CB EFFECT PNL 101

CB EFFECT PNL 225

CB EFFECT PNL 250

CB EFFECT 220

MEAS PNL 276

Msrmnt Title	Msrmnt No.	O. B. Display
CB 3 cont'd.		
SPS Prplnt Tks N_2A Press	SP 0600P	SM
Eng Chamber Press	SP 0661P	SM
Fuel SM/Eng Interface Press	SP 0930P	
SM He Tk A Press	SR 5001P	SM
SM He Tk C Press	SR 5003P	SM
SM He Tk A Temp	SR 5013T	SM
SM He Tk C Temp	SR 5015T	SM
Qty SM Propellant Sys A	SR 5025Q	SM
Qty SM Propellant Sys C	SR 5027Q	SM
SM Eng Package A Temp	SR 5065T	SM*
SM Eng Package C Temp	SR 5067T	SM*
SM Ox Feed Line A Temp	SR 5069T	
SM Ox Feed Line C Temp	SR 5071T	
SM Pri Fuel Tk A Temp	SR 5073T	
SM Pri Fuel Tk C Temp	SR 5075T	
SM He Manf Sys A Press	SR 5729P	
SM Ox Manf Sys A Press	SR 5733P	
SM Fuel Manf Sys A Press	SR 5737P	SM*
SM He Manf Sys C Press	SR 5817P	
SM Ox Manf Sys C Press	SR 5820P	
SM Fuel Manf Sys C Press	SR 5822P	SM*
Proton Ct Rate Chan 1	ST 0820K	
Proton Ct Rate Chan 2	ST 0821K	
Proton Ct Rate Chan 3	ST 0822K	
Proton Ct Rate Chan 4	ST 0823K	
Alpha Ct Rate Chan 1	ST 0830K	
Alpha Ct Rate Chan 2	ST 0831K	
Alpha Ct Rate Chan 3	ST 0832K	
Proton Integ Ct Rate	ST 0838K	
Pan Camera N_2 Tk Press	SL 1043P	
Subsatellite Launched	(64KBPS)	
Sim Therm Loc 1 Temp	SL 1201T	
Sim Thermal Loc 2 Temp	SL 1202T	
Sim Thermal Loc 4 Temp	SL 1204T	
Sim Thermal Loc 5 Temp	SL 1205T	
Sim Thermal Loc 6 Temp	SL 1206T	
Sim Thermal Loc 8 Temp	SL 1208T	
Sim Thermal Loc 11 Temp	SL 1211T	
Sim Thermal Loc 12 Temp	SL 1212T	
Sim Thermal Loc 15 Temp	SL 1215T	
Sim Thermal Loc 17 Temp	SL 1217T	
TLM 2 Master Unit Temp	ST 0562T	
TLM 2 Slave Unit Temp	ST 0563T	

Msrmt Title	Msrmt No.	O. B. Display
CB 4		
Main dc bus A&B power to following instrumentation:		
O_2 Tk 1 Press	SC 0037P	SM*
H_2 Tk 1 Press	SC 0039P	M*
O_2 Tk 2 Htr Temp	SC 0071T	SM
FC 1 O_2 Press	SC 2066P	SM
FC 1 H_2 Press	SC 2069P	SM
FC 1 Rad Out Temp	SC 2087T	SMB*
FC 1 Rad In Temp	SC 2090T	
FC 1 H_2 Flow	SC 2139R	SM*
FC 1 O_2 Flow	SC 2142R	SM*
Fu Tks Press	SP 0006P	M*
Upper He Tk Surf Temp	SP 0017T	
Position Fu/Ox Vlv 2 Pot B	SP 0023H	
Position Fu/Ox Vlv 4 Pot B	SP 0025H	
Position Fu/Ox Vlv 1 Pot A	SP 0026H	M
Position Fu/Ox Vlv 3 Pot A	SP 0028H	M
He Tk Press Display	SP 0035P	SM
Temp Eng Vlv Body	SP 0045T	
Temp Ox Eng Feed Line	SP 0049T	SM
Temp Bay 3 Ox St Tk Surf	SP 0058T	
Temp Bay 6 Fu St Tk Surf	SP 0059T	
SM He Tk B Press	SR 5002P	SM
SM He Tk D Press	SR 5004P	SM
SM He Tk B Temp	SR 5014T	SM
SM He Tk D Temp	SR 5016T	SM
Qty SM Propellant Sys B	SR 5026Q	SM
Qty SM Propellant Sys D	SR 5028Q	SM
SM Eng Package B Temp	SR 5066T	SM*
SM Eng Package D Temp	SR 5068T	SM*
SM Ox Feed Line B Temp	SR 5070T	
SM Ox Feed Line D Temp	SR 5072T	
SM Pri Fuel Tk B Temp	SR 5074T	
SM Pri Fuel Tk D Temp	SR 5076T	
SM He Manf Sys B Press	SR 5776P	
SM Ox Manf Sys B Press	SR 5780P	
SM Fuel Manf Sys B Press	SR 5784P	SM*
SM Ox Manf Sys D Press	SR 5821P	
SM Fuel Manf Sys D Press	SR 5823P	SM*
SM He Manf Sys D Press	SR 5830P	

(Cont'd on next page)

Msrmnt Title	Msrmnt No.	O. B. Display
CB4 CONT'D		
SPS Vlv Act Press Sec	SP 0601P	SM
Ox SM/Eng Interface Press	SP 0931P	

LEGEND:

O. B. Display	=	On Board Display
M	=	Meter
SM	=	Selectable Meter
B	=	Talk Back Indicator
*	=	Input to Caution/Warning

MEAS
PNL 276

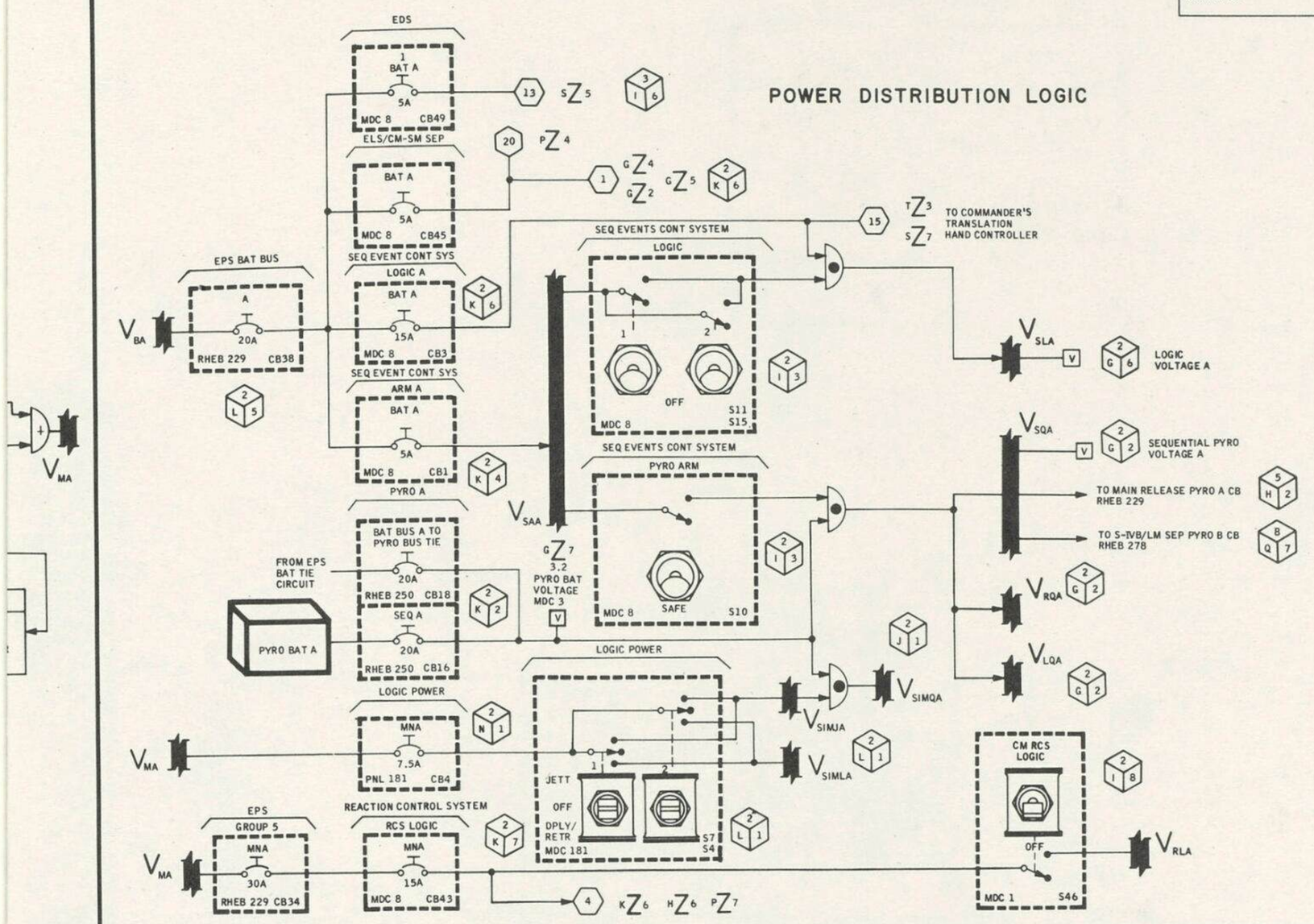
CB EFFECT
228 - 250

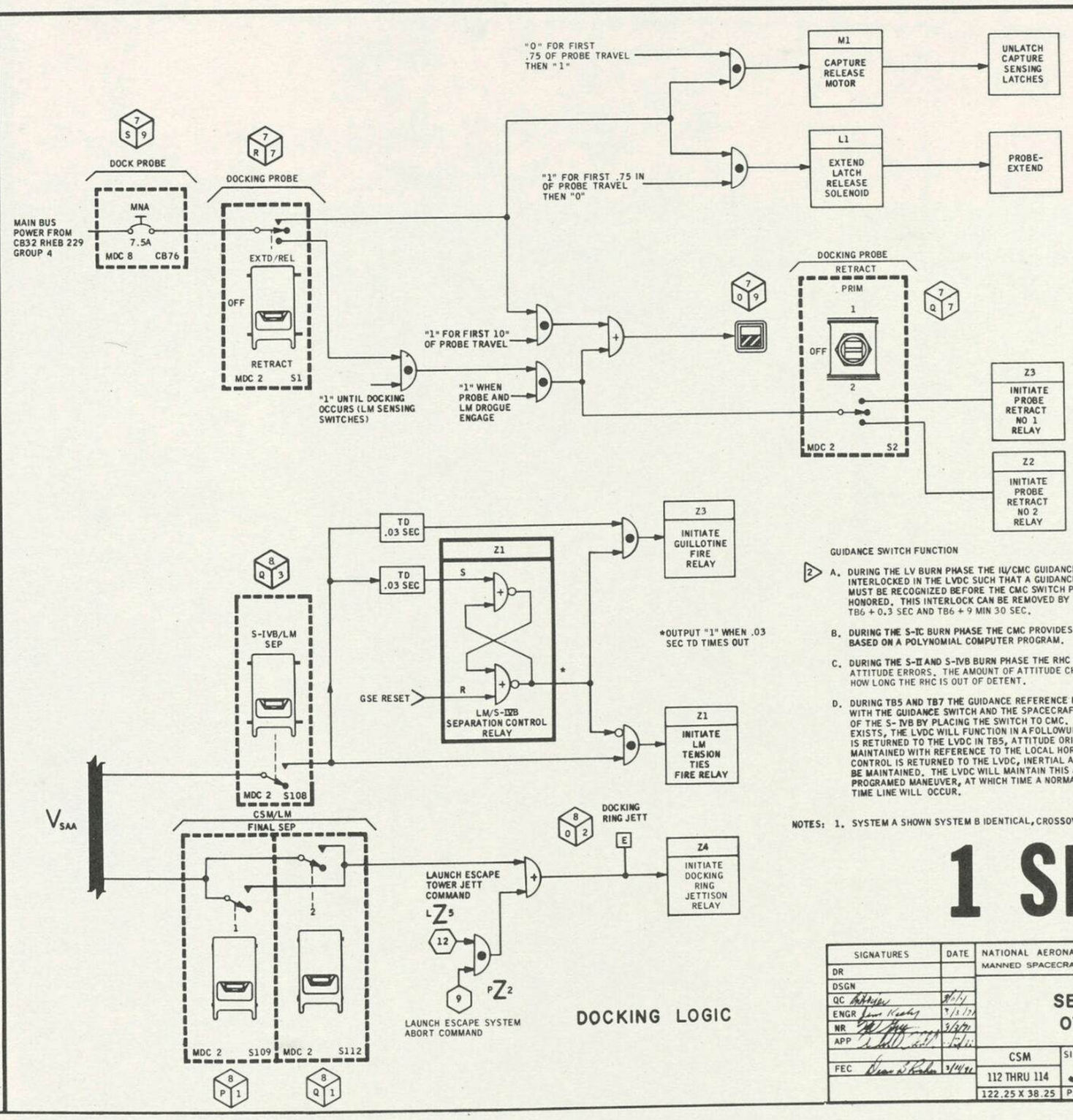
CB EFFECT
PNL 226

CB EFFECT
PNL 225

LTR	PCN	DR	ENGR	DATE	APPROVAL

COMMENTS:





GUIDANCE SWITCH FUNCTION

2 A. DURING THE LV BURN PHASE THE IU/CMC GUIDANCE SWITCH FUNCTION IS INTERLOCKED IN THE LVDC SUCH THAT A GUIDANCE REFERENCE FAILURE MUST BE RECOGNIZED BEFORE THE CMC SWITCH POSITION WILL BE HONORED. THIS INTERLOCK CAN BE REMOVED BY RTC'S BETWEEN TB6 + 0.3 SEC AND TB6 + 9 MIN 30 SEC.

B. DURING THE S-IC BURN PHASE THE CMC PROVIDES ATTITUDE ERROR SIGNALS BASED ON A POLYNOMIAL COMPUTER PROGRAM.

C. DURING THE S-II AND S-IVB BURN PHASE THE RHC IS USED TO GENERATE ATTITUDE ERRORS. THE AMOUNT OF ATTITUDE CHANGE IS A FUNCTION OF HOW LONG THE RHC IS OUT OF DETENT.

D. DURING TB5 AND TB7 THE GUIDANCE REFERENCE FAILURE IS NOT INTERLOCKED WITH THE GUIDANCE SWITCH AND THE SPACECRAFT CAN ASSUME CONTROL OF THE S-IVB BY PLACING THE SWITCH TO CMC. IF NO GUIDANCE FAILURE EXISTS, THE LVDC WILL FUNCTION IN A FOLLOWUP MODE. WHEN CONTROL IS RETURNED TO THE LVDC IN TB5, ATTITUDE ORIENTATION WILL BE MAINTAINED WITH REFERENCE TO THE LOCAL HORIZON. IN TB7, WHEN CONTROL IS RETURNED TO THE LVDC, INERTIAL ATTITUDE ORIENTATION WILL BE MAINTAINED. THE LVDC WILL MAINTAIN THIS ATTITUDE UNTIL THE NEXT PROGRAMED MANEUVER, AT WHICH TIME A NORMAL PROGRAM ATTITUDE TIME LINE WILL OCCUR.

NOTES: 1. SYSTEM A SHOWN SYSTEM B IDENTICAL, CROSSOVERS SHOWN ON DETAIL DRAWINGS.

1 SEQ

SIGNATURES	DATE
DR	
DSGN	
QC	8/6/71
ENGR	8/5/71
NR	8/4/71
APP	8/4/71
FEC	8/14/71

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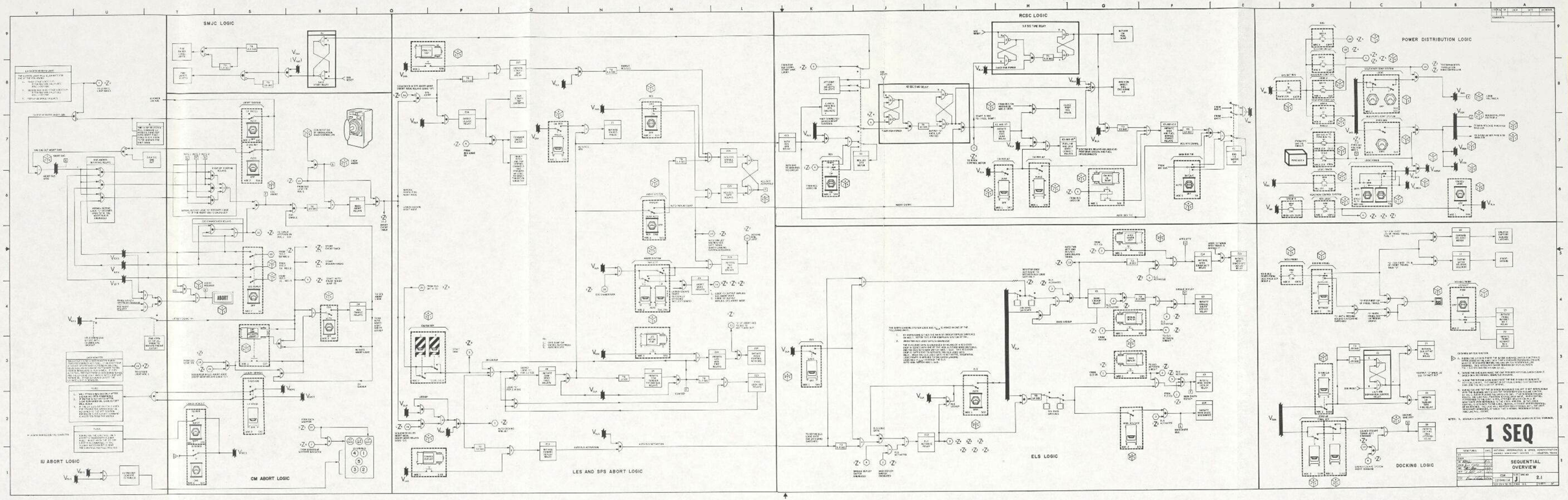
MANNED SPACECRAFT CENTER · HOUSTON, TEXAS

SEQUENTIAL OVERVIEW

CSM	SIZE	DWG NO
112 THRU 114	J	2.1
122.25 X 38.25	PAGE 2-1	SHEET OF



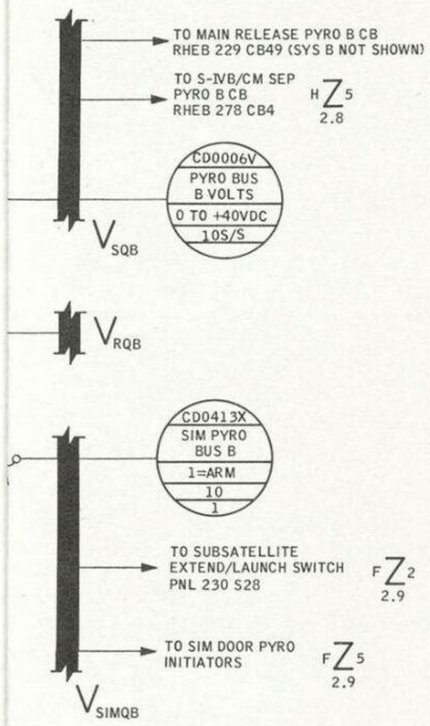
OVERVIEW SEQUENTIAL

MEAS

CB EFFECT

CB EFFECT

LTR	PCN	DR	ENGR	DATE		APPROVAL
COMMENTS:						



3. TIME-CURRENT OPERATING CHARACTERISTICS OF THE 1Ω FUSISTOR ARE:

AMP	SEC
20	0.03 TO 0.17
10	0.20 TO 1.20
8	0.30 TO 8.0
7	0.40 TO 20.0

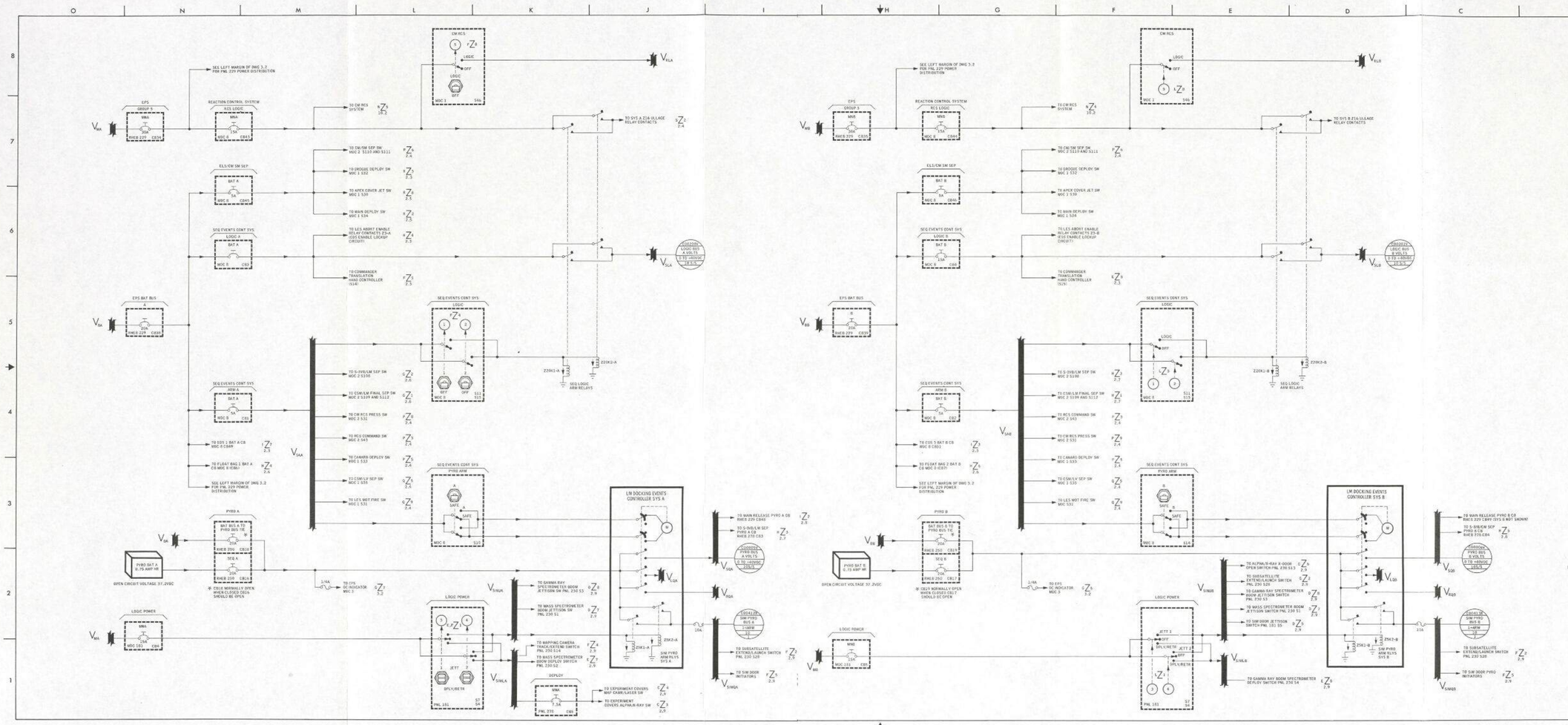
2. V_{ELA} EARTH LANDING BUS A
   V_{ELB} EARTH LANDING BUS B
   V_{RQA} REACTION CONTROL SYSTEM CONTROLLER PYRO BUS A
   V_{RQB} REACTION CONTROL SYSTEM CONTROLLER PYRO BUS B
   V_{RLA} REACTION CONTROL SYSTEM CONTROLLER LOGIC BUS A
   V_{RLB} REACTION CONTROL SYSTEM CONTROLLER LOGIC BUS B
   V_{LQA} LM DOCKING PYRO BUS A
   V_{LQB} LM DOCKING PYRO BUS B
   V_{SLA} SEQUENTIAL LOGIC BUS A
   V_{SLB} SEQUENTIAL LOGIC BUS B
   V_{SAA} SEQUENTIAL ARM BUS A
   V_{SAB} SEQUENTIAL ARM BUS B
   V_{SIMJA} SIM JETTISON BUS A
   V_{SIMJB} SIM JETTISON BUS B
   V_{SIMLA} SIM LOGIC BUS A
   V_{SIMLB} SIM LOGIC BUS B
   V_{SIMQA} SIM PYRO BUS A
   V_{SIMQB} SIM PYRO BUS B

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

2 SEQ PWR

SIGNATURES	DATE	NATIONAL AERONAUTICS & SPACE ADMINISTRATION MANNED SPACECRAFT CENTER · HOUSTON, TEXAS		
DR Linda J. Drautz	1-15-71	SEQUENTIAL POWER DISTRIBUTION		
DSGN				
QC	3/1/71			
ENGR	3/1/71			
NR	3/2/71			
APP				
FEC	3/11/71	CSM 112 ONLY	J_2	DWG NO 2.2
		82.5 X 34	PAGE 2-2	SHEET 1 OF 1

DISTR-CNTL AC
POWER DIST MAIN
PWR DIST SEQUENTIAL
DOCK PROBE
INTERFACE CSM-LM ELEC
INTERFACE CSM/EXPER
DISTR-CNTL DC



LTR	PCN	DR	ENGR	DATE	APPROVAL

COMMENTS:

PWR DIST SEQUENTIAL

3. TIME-CURRENT OPERATING CHARACTERISTICS OF THE 10 FUSISTOR ARE:

AMP	SEC
20	0.03 TO 0.12
15	0.04 TO 0.16
10	0.06 TO 0.20
7	0.40 TO 20.0

2. V_{ELA} EARTH LANDING BUS A
V_{ELB} EARTH LANDING BUS B
V_{RGA} REACTION CONTROL SYSTEM CONTROLLER PYRO BUS A
V_{RGB} REACTION CONTROL SYSTEM CONTROLLER PYRO BUS B
V_{RLA} REACTION CONTROL SYSTEM CONTROLLER LOGIC BUS A
V_{RLB} REACTION CONTROL SYSTEM CONTROLLER LOGIC BUS B
V_{LGA} LM DOCKING PYRO BUS A
V_{LGB} LM DOCKING PYRO BUS B
V_{SLA} SEQUENTIAL LOGIC BUS A
V_{SLB} SEQUENTIAL LOGIC BUS B
V_{SAA} SEQUENTIAL ARM BUS A
V_{SAB} SEQUENTIAL ARM BUS B
V_{SJRGA} S/W JETTISON BUS A
V_{SJRGB} S/W JETTISON BUS B
V_{SJRLA} S/W LOGIC BUS A
V_{SJRLB} S/W LOGIC BUS B
V_{SJRGA} S/W PYRO BUS A
V_{SJRGB} S/W PYRO BUS B

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

2 SEQ PWR

SIGNATURES		DATE
DR	Kenneth A. Brandt	1-17-70
DSGN		
DR		8-5
ENGR		8-5-70
MI		8-5-70
APP		8-5-70
FEC		8-5-70

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SEQUENTIAL POWER DISTRIBUTION

CSM 122 ONLY | J2 | DWG NO 2.2

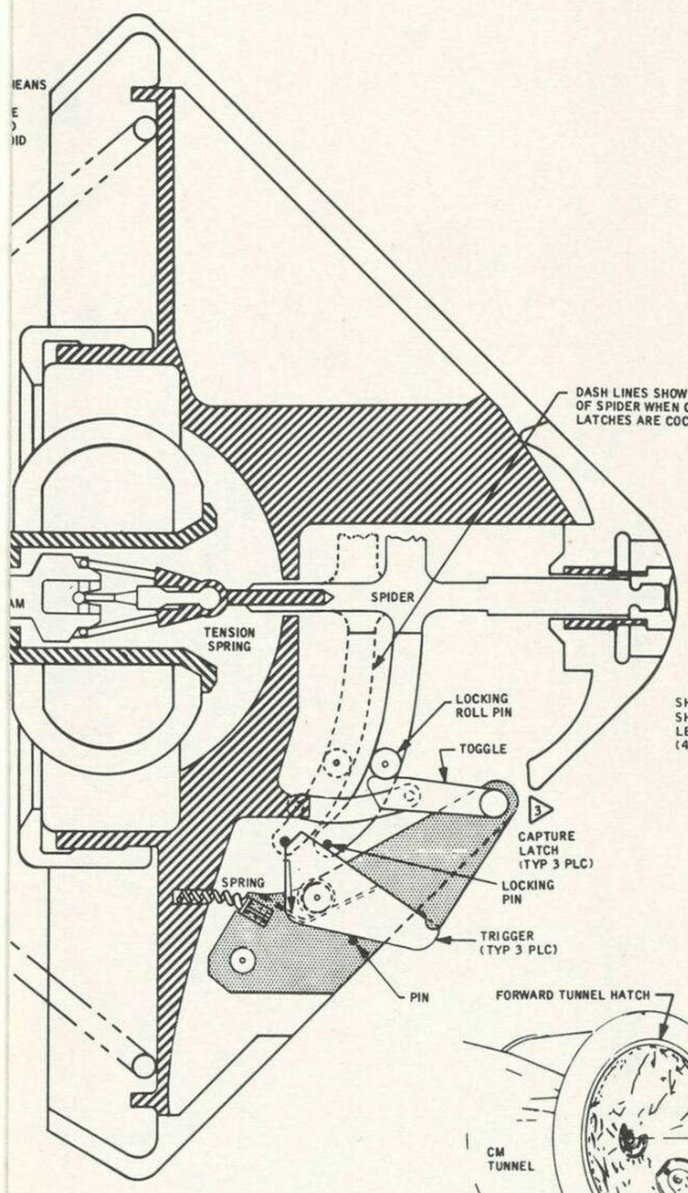
02.3.3.34 | PAGE 2-2 | SHEET 1 OF 1

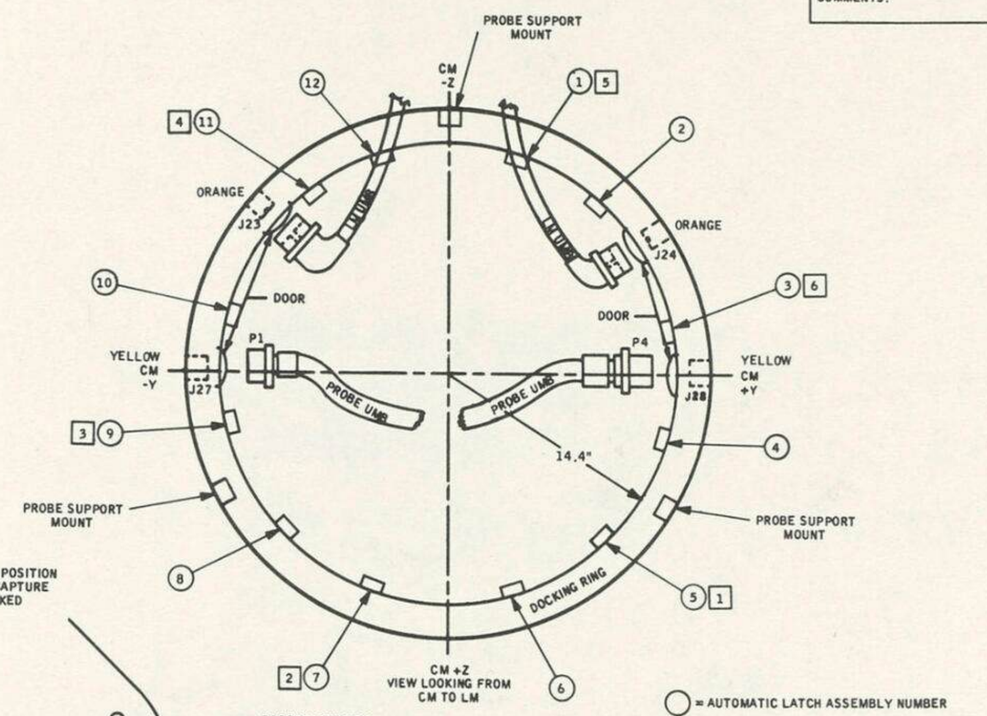
CB EFFECT

MEAS

LTR	PCN	DR	ENG	DATE	APPROVAL
	3	RB		6/15/71	6-15-71

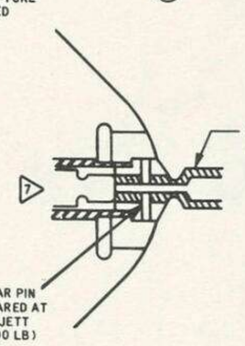
COMMENTS:



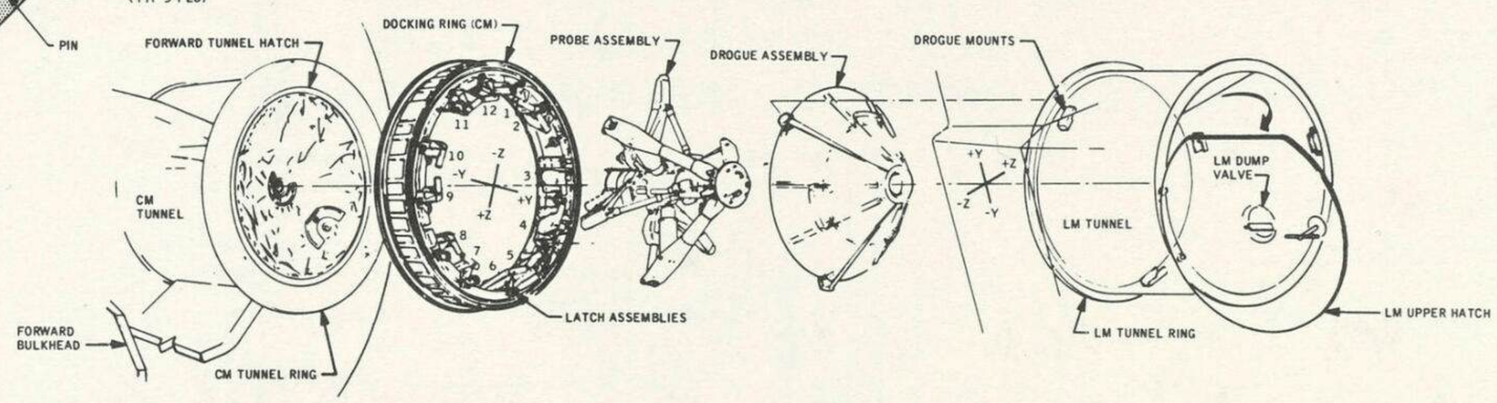


○ = AUTOMATIC LATCH ASSEMBLY NUMBER

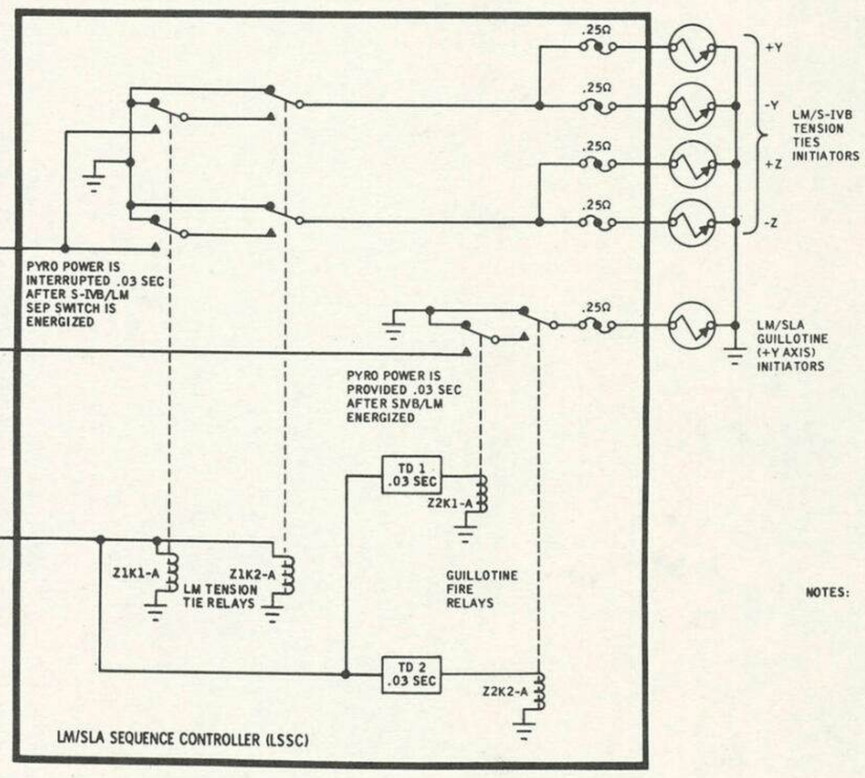
□ = FORWARD HATCH MOUNTINGS WITH NUMBER



AUTOMATIC SWITCH WILL ACTIVATE WHEN GAP IS <.1 INCHES BETWEEN DOCKING RINGS



LM | SLA



7 AT TD&E, THE CAPTURE LATCHES ARE COCKED PRIOR TO EXTENSION SINCE THE PASSIVE TENSION TIE HAS BEEN INSTALLED AT LIFTOFF.

6 FOR LOCATION AND ELECTRIC CONTROL OF LIGHT AND TARGET SEE LIGHTING DRAWING IN SECTION 11.

5 CSM/LM SEPARATION IS ACCOMPLISHED BY THE CREW APPLYING A PRELOAD ON THE EXTENSION SHAFT BY MEANS OF A PERMANENTLY INSTALLED TORQUE PRELOAD HANDLE. WHEN A PRELOAD HAS BEEN APPLIED AT THE INTERFACE, THE CREW WILL MANUALLY RELEASE AND COCK THE 12 AUTOMATIC DOCKING LATCHES. AFTER THE FORWARD PRESSURE HATCH HAS BEEN INSTALLED, THE CREW WILL PLACE THE EXTD/REL-RETRACT SWITCH (MDC 2) TO THE EXTD/REL POSITION TO EFFECT CM/LM UNDOCKING.

4 ORIFICE BYPASS VALVE :

DURING THE LAST ONE INCH OF THE RETRACT CYCLE, THE ORIFICE BYPASS VALVE WILL BE OPEN ALLOWING THE PRESSURE CHAMBER TO BUILD UP TO 250 PSIG.

3 CAPTURE LATCHES/MOTOR SHAFT:

A. THE CAPTURE LATCHES ARE UNLOCKED BY THE MOTOR ROTATING THE MOTOR SHAFT FROM 0° TO 180° CLOCKWISE WHEN THE EXTD/REL-RETRACT SWITCH (S1 MDC 2) IS PLACED IN THE EXTD/REL POSITION AND PROBE HAS TRAVELED 3/4 INCH.

(1) THE MOTOR SHAFT APPLIES A TORQUING MOMENT TO THE ROTATION-TO-TRANSLATION CAM. THE ROTATION-TO-TRANSLATION CAM IN TURN APPLIES A TENSION FORCE TO THE TENSION SPRING, PULLING THE SPIDER DOWN AND ALLOWING THE LOCKING PIN TO ENGAGE THE TRIGGER (COCKS THE CAPTURE LATCHES).

(2) THE MOTOR SHAFT IS KEPT IN A COCKED POSITION BY THE LOCKING PIN (PREVENTS THE TENSION SPRING FROM ROTATING THE SHAFT COUNTERCLOCKWISE) UNTIL THE PROBE HEAD AND LM DROGUE MAKE PHYSICAL CONTACT (CAPTURE).

(3) AN INDICATION THAT THIS HAS OCCURRED IS THAT THE PROBE EXTD/RET A AND B FLAGS ON MDC 2 WILL CHANGE FROM GRAY TO BARBER AND THEN BACK TO GRAY WHEN THE PROBE HAS EXTENDED TEN INCHES.

B WHEN THE PROBE HEAD AND LM DROGUE MAKE CONTACT, THE THREE CAPTURE LATCHES, THROUGH MECHANICAL ACTION, RELEASE THE LOCKING PIN WHICH IS HOLDING THE SPIDER DOWN, ALLOWING THE TENSION SPRING TO DRIVE THE SHAFT BACK TO 0°.

(1) AN INDICATION THAT THIS HAS OCCURRED IS THE PROBE EXTD/RET A AND B FLAGS ON MDC 2 CHANGE FROM GRAY TO BARBER POLE.

(2) IF THE EXTD/REL-RETRACT SWITCH (S1 MDC 2) HAS PREVIOUSLY BEEN PLACED IN THE RETRACT POSITION, AN AUTOMATIC GAS RETRACTION WILL OCCUR IF THE DOCKING PROBE - RETRACT PRIM OR SEC SWITCHES (MDC 2 S2 AND S3) HAVE BEEN PLACED TO AN UNUSED BOTTLE POSITION.

C. THE SHAFT RETURNS TO 180° FROM DETENT WHEN THE CREW ROTATES THE CAPTURE LATCH RELEASE HANDLE CLOCKWISE TO REMOVE THE PROBE (UNLOCKS THE CAPTURE LATCHES).

2 THE PROBE PISTON SPRING ACTS AS A PRELOAD TO EXTEND THE PROBE ONCE THE PROBE EXTEND LATCH RELEASE SOLENOID HAS BEEN ENERGIZED. THE PROBE EXTENTION LATCH IS ENERGIZED BY PLACING THE EXTD/REL-RETRACT SWITCH (MDC 2 S1) TO THE EXTD/REL POSITION. IN THE RETRACTED POSITION, THE PROBE PISTON EXERTS A FORCE OF 130 LBS ON THE PROBE ASSEMBLY AND 700 LBS WHEN EXTENDED TEN INCHES.

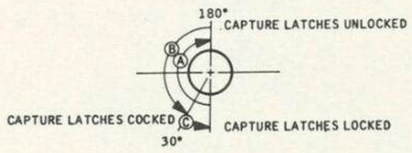
NOTES: 1 SYSTEM A AND B OF THE DOCKING PROBE AND RELATED ELECTRONIC COMPONENTS SHOWN.

8 TRANSLATION-TO-ROTATION CAM DESCRIPTION:

A. THE MOTOR SHAFT TURNS THE CAM 180° FROM 0° TO UNLOCK THE CAPTURE LATCHES, PULLING THE TENSION SPRING AFT.

B. WHEN POWER IS RELEASED FROM THE MOTORS, A TORSION SPRING PULLS THE CAM BACK TO 30° (FROM 0°), COCKING THE CAPTURE LATCHES.

C. WHEN THE THREE TRIGGERS ARE DEPRESSED (AT DROGUE CAPTURE), THE TORSION SPRING DRIVES THE CAM BACK TO 0°.



7 DOCKING

SIGNATURES	DATE
DR	5-13-70
DSGN	
QC	
ENGR	
NR	
APP	
FEC	

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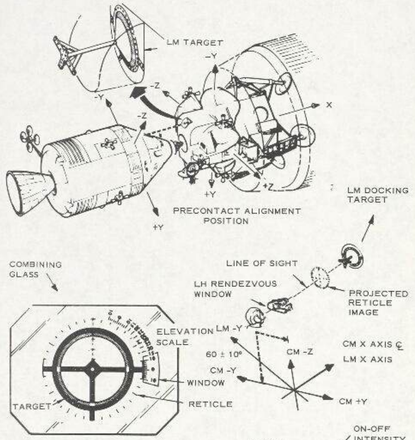
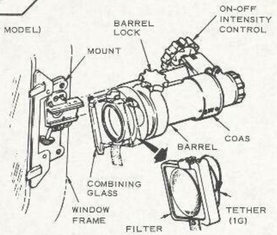
MANNED SPACECRAFT CENTER · HOUSTON, TEXAS

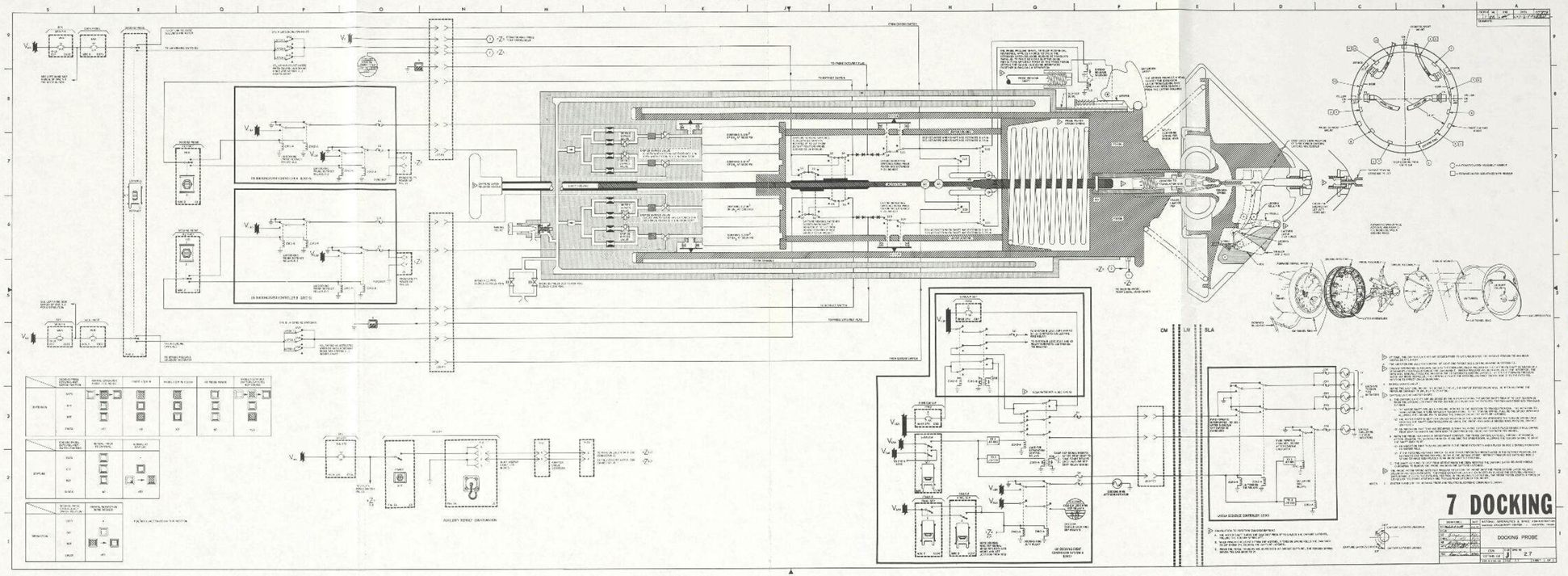
DOCKING PROBE

CSM	SIZE	DWG NO
112 THRU 114	J	2.7
104.5 X 38.25	PAGE 2-7	SHEET 1 OF 1





CREWMAN OPTICAL ALIGNMENT SIGHT SYSTEM
APRON ITEM DWG NO. 2,7

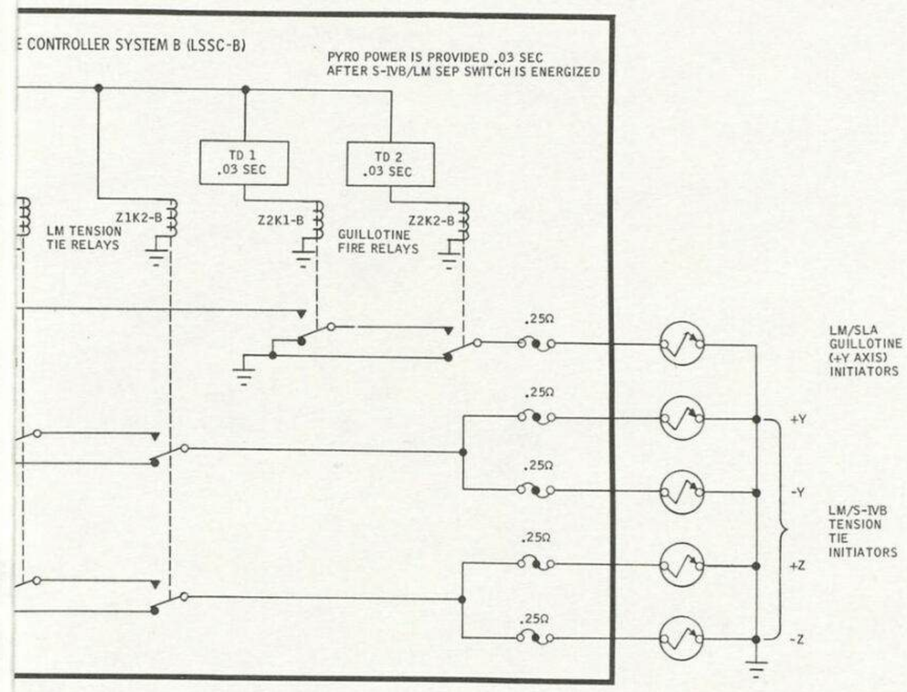


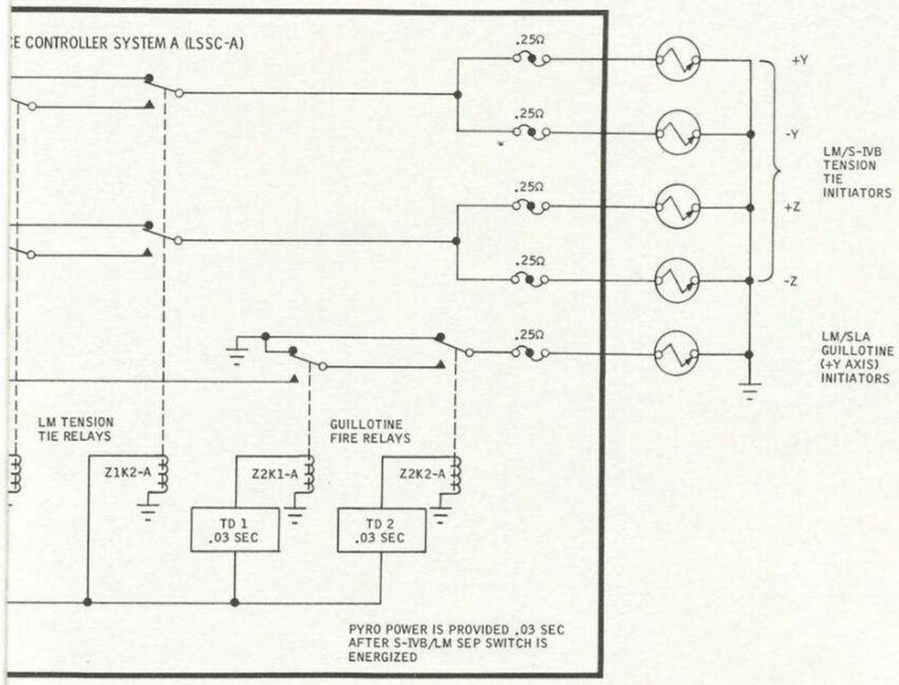
DOCK PROBE

MEAS

LTR	PCN	DR	ENGR	DATE	APPROVAL

COMMENTS:





NOTE:

2. THIS DRAWING SHOWS THE CM/LM ELECTRICAL INTERFACE AS A FUNCTIONAL REPRESENTATION. FOR COMPLETE ELECTRICAL INTERFACE, REFER TO LM DRAWING 5.2, LM SYSTEMS HANDBOOK

1. ALL UMB WIRES ARE 22GA. STRUCTURAL RESISTANCE WHEN HARD DOCKED IS 0.010Ω UMB RESISTANCE IS 0.240Ω

8 LM INTER

SIGNATURES	DATE
DR	
DSGN	
QC	
ENGR	
NR	2/26/71
APP	
FEC	3/14/71

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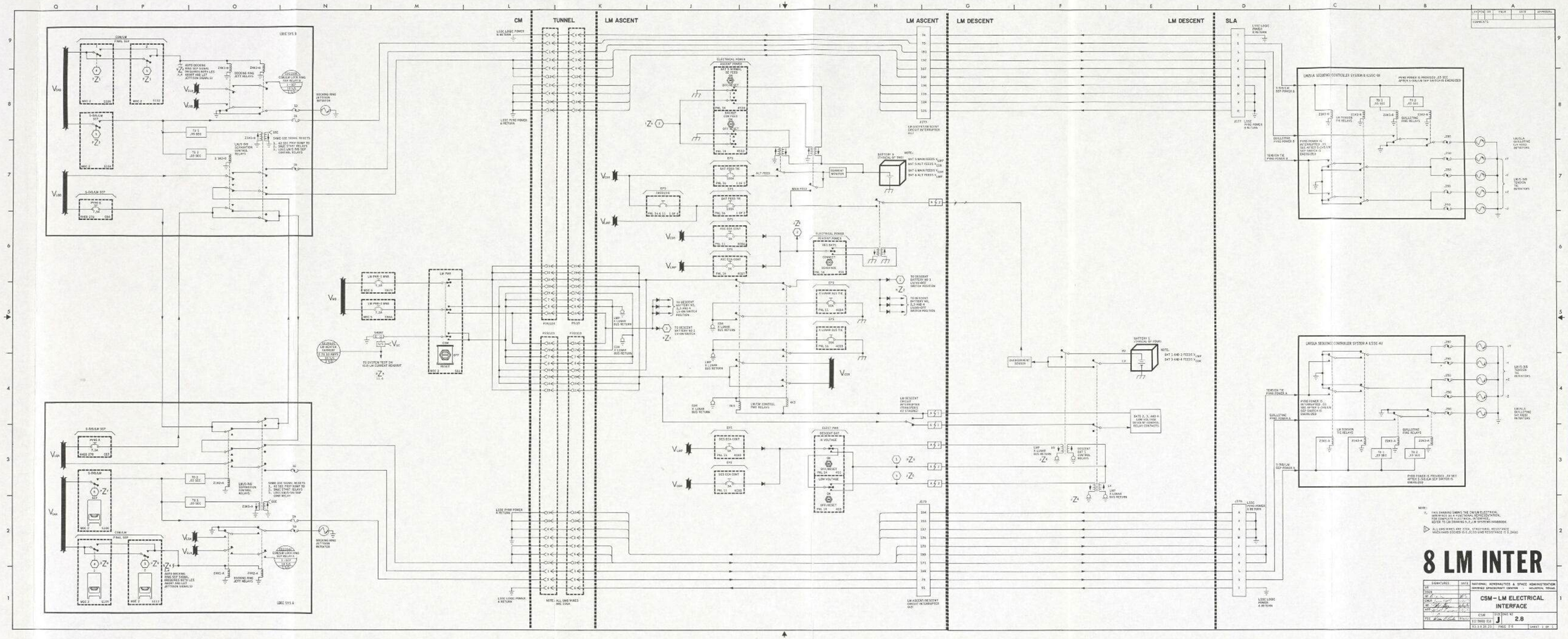
MANNED SPACECRAFT CENTER · HOUSTON, TEXAS

CSM – LM ELECTRICAL INTERFACE

CSM	SIZE	DWG NO
112 THRU 114	J	2.8
93.5 X 38.25	PAGE 2-8	SHEET 1 OF 1

DISTR-CNTL AC
POWER DIST MAIN
POWER DIST AC
INTERFACE CSM-LM ELEC
INTERFACE CSM/EXPER
DISTR-CNTL DC



8 LM INTER

SIGNATURES	DATE	NATIONAL AERONAUTICS & SPACE ADMINISTRATION MANNED SPACECRAFT CENTER - HOUSTON, TEXAS
		CSM – LM ELECTRICAL INTERFACE
		CODE IDENT NO. J — 2.8
		SCALE NONE — SHEET 1 OF 1

INTERFACE CSM-LM ELEC

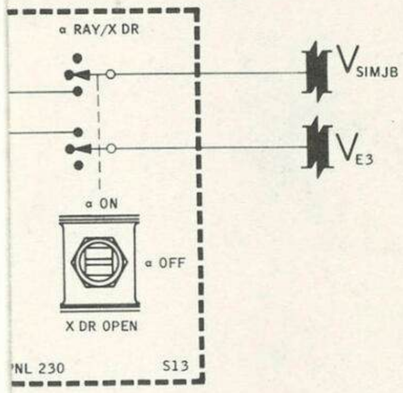
MEAS

LTR	PCN	DR	ENGR	DATE	APPROVAL
	3	RB			

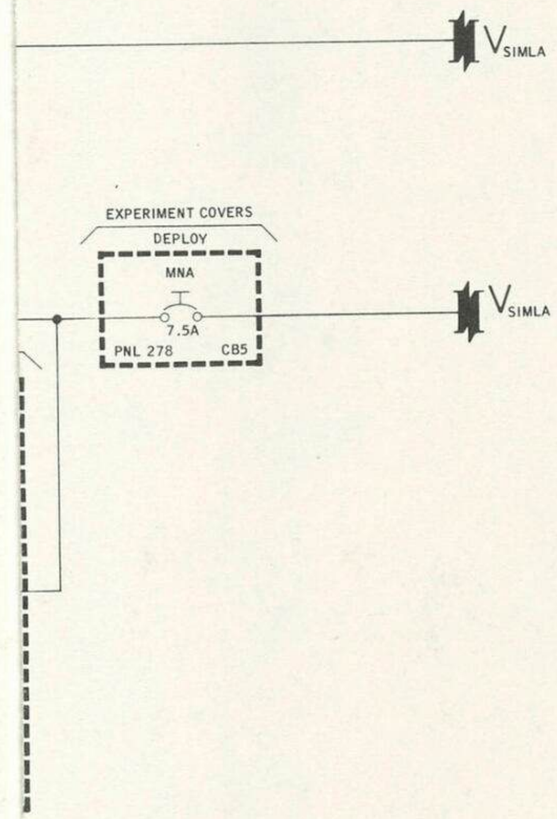
COMMENTS:

ES

GREY

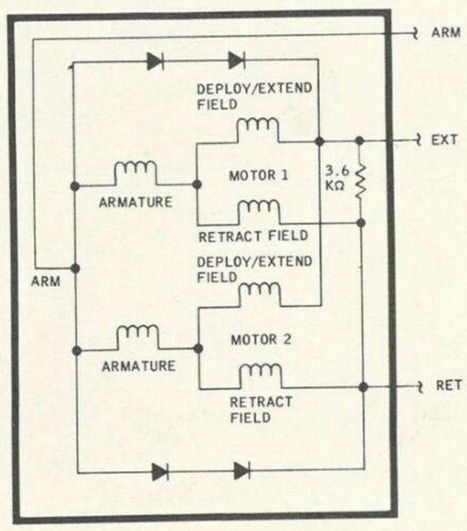


ROTECHNIC
TO 10.9
AT AN
90° FROM



4. FUSE LINK — FUSE LINK - OPERATING VOLTAGE 18 TO 30VDC WITH MAXIMUM CURRENT OF 5 AMPS.

3 DETAILED CIRCUIT FOR GAMMA RAY AND MASS SPECTROMETER DEPLOY/RETRACT MOTORS.



2. FOR BUS DEFINITION REFER TO DRAWING 2.2.

NOTES: 1. BOTH SYSTEMS A AND B OF THE SIM PYROTECHNIC AND DEPLOY/RETRACT SYSTEM ARE SHOWN.

9 EXPR INTER

SIGNATURES	DATE
DR Malcolm B. Smith	1-19-71
DSGN	
QC	3/17/71
ENGR	3/4/71
NR	3/8/71
APP	3/17/71
FEC	3/15/71

NATIONAL AERONAUTICS & SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER · HOUSTON, TEXAS

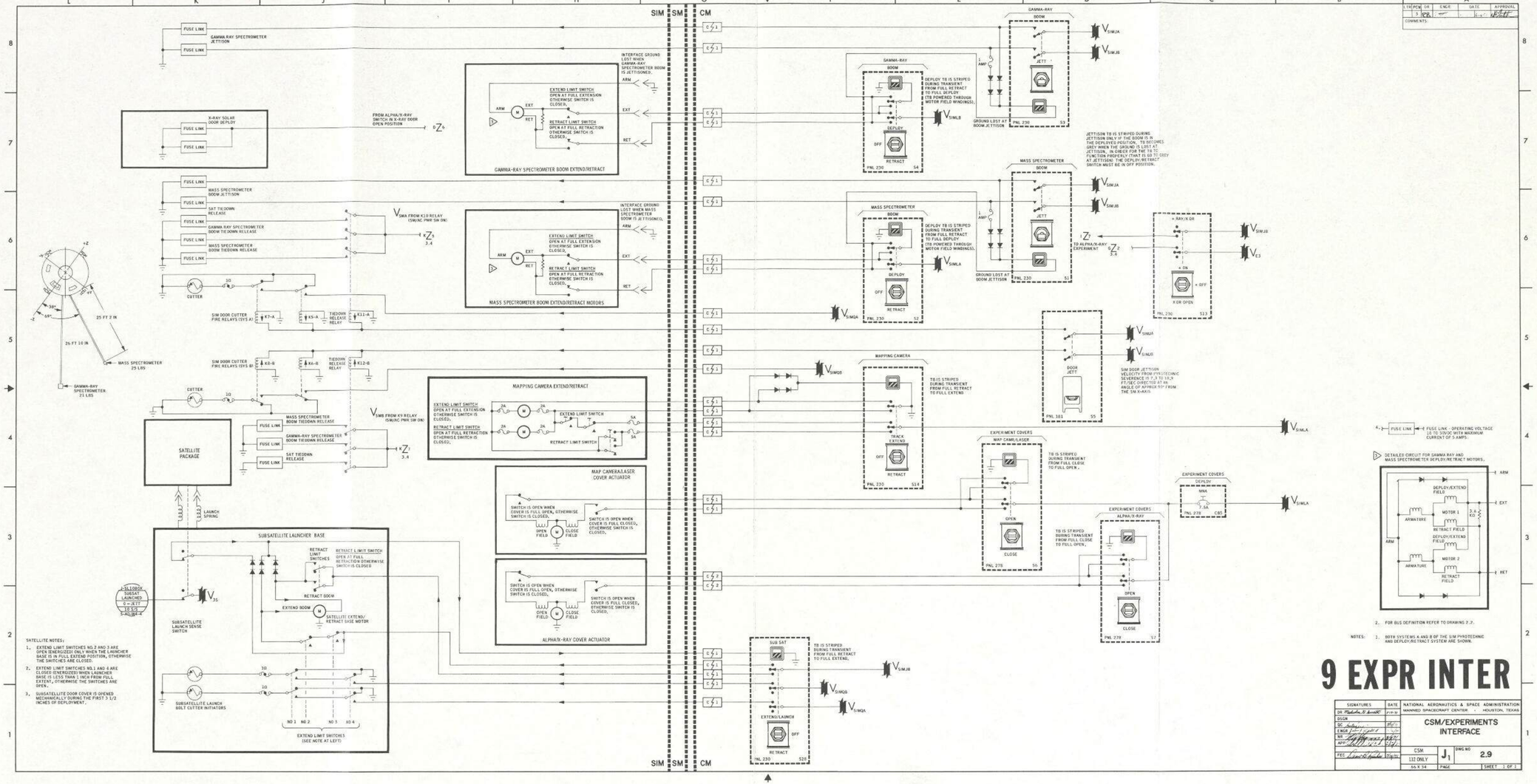
CSM/EXPERIMENTS INTERFACE

CSM	J1	DWG NO 2.9
112 ONLY		
66 X 34	PAGE	SHEET 1 OF 1

DISTR-CNTL AC
POWER DIST MAIN
POWER DIST AC
POWER DIST MISC
PWR DIST EXPERIMENTS
INTERFACE CSM/EXPER
DISTR-CNTL DC

LTR	PCN	DR	ENGR	DATE	APPROVAL
J	1				

COMMENTS:



SATELLITE NOTES:

1. EXTEND LIMIT SWITCHES NO.2 AND 3 ARE MECHANICALLY ENGAGED ONLY WHEN THE LAUNCHER BASE IS IN FULL EXTEND POSITION, OTHERWISE THE SWITCHES ARE CLOSED.
2. EXTEND LIMIT SWITCHES NO.1 AND 4 ARE ENGAGED ONLY WHEN LAUNCHER BASE IS LESS THAN ONE INCH FROM FULL EXTENT, OTHERWISE THE SWITCHES ARE OPEN.
3. SUBSATELLITE DOOR COVER IS OPENED MECHANICALLY DURING THE FIRST 3 1/2 INCHES OF DEPLOYMENT.

9 EXPR INTER

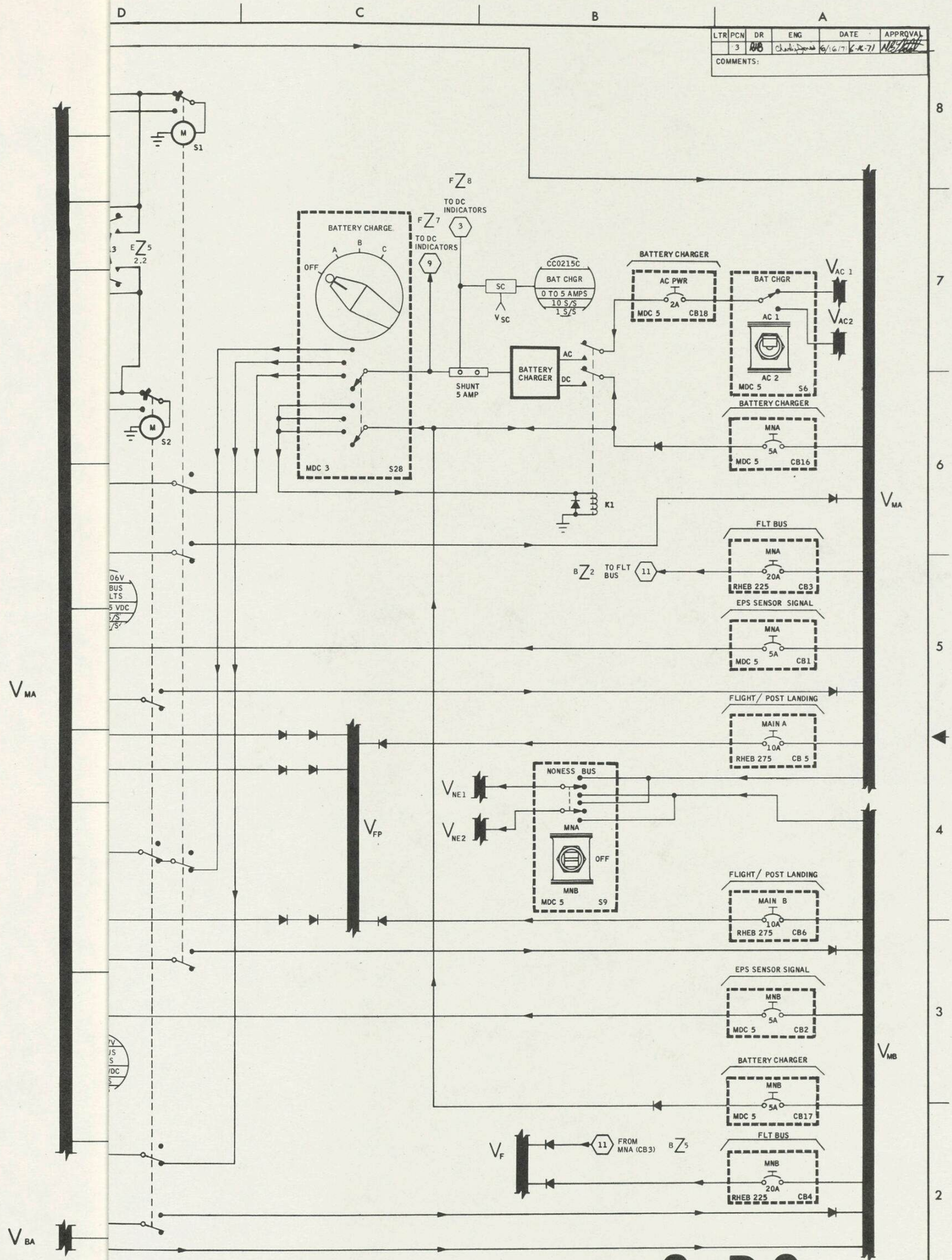
SIGNATURES	DATE	NATIONAL AERONAUTICS & SPACE ADMINISTRATION MANNED SPACECRAFT CENTER - HOUSTON, TEXAS
DR		CSM/EXPERIMENTS INTERFACE
DSGN		
SC		
ENGR		
NR		
APP		
FEC		CSM 110 ONLY — J1 — DWG NO 2.9 — 66 X 34 — PAGE — SHEET 1 OF 1

INTERFACE CSM/EXPER

MEAS

LTR	PCN	DR	ENG	DATE		APPROVAL
	3	RJB	Charles Jones	6/16/71	6-16-71	NB/[illegible]

COMMENTS:



PEN UNTIL ENTRY

NOTES:

7. NORMALLY OPEN UNLESS BATTERY MALFUNCTION
6. STRIPED INDICATES FUEL CELL OFF BUS
   WHITE (GRAY) INDICATES FUEL CELL ON BUS
5. RELAYS K13 AND K14 CLOSE AT CSM SEP. SEE L Z5 2.4
4. FUEL CELL DISCONNECT FOR:
   A. OVERLOAD ≥ 75 AMPS
   B. REVERSE CURRENT > 4 AMPS
3. FOR DETAILS OF FUEL CELL SEE DWG 5.3
2. CB41, CB42 AND CB43 ARE INACCESSIBLE
1. BATTERY VENT PRESS ONBOARD READOUT SHOWN ON 4.5

2 DC

SIGNATURES	DATE
DR	
DSGN	
QC	8/1/71
ENGR	2/23/71
NR	2/23/71
APP	
FEC	3/11/71

NATIONAL AERONAUTICS & SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER • HOUSTON, TEXAS

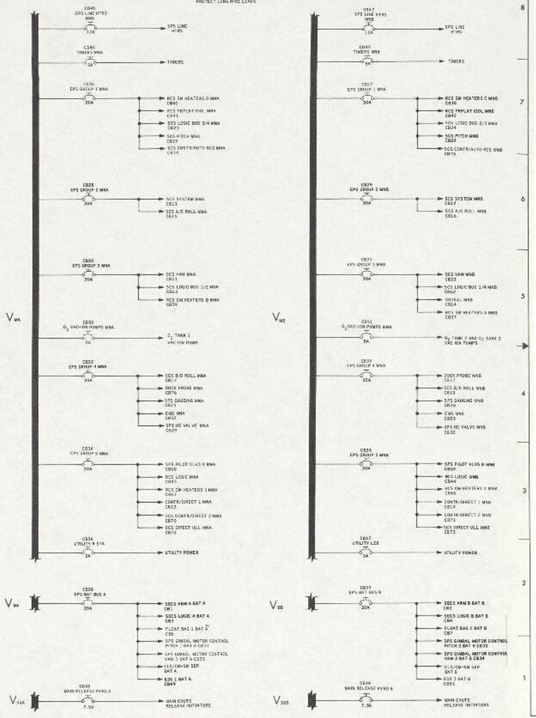
ELECTRICAL
DIRECT CURRENT
DISTRIBUTION & CONTROL SYS

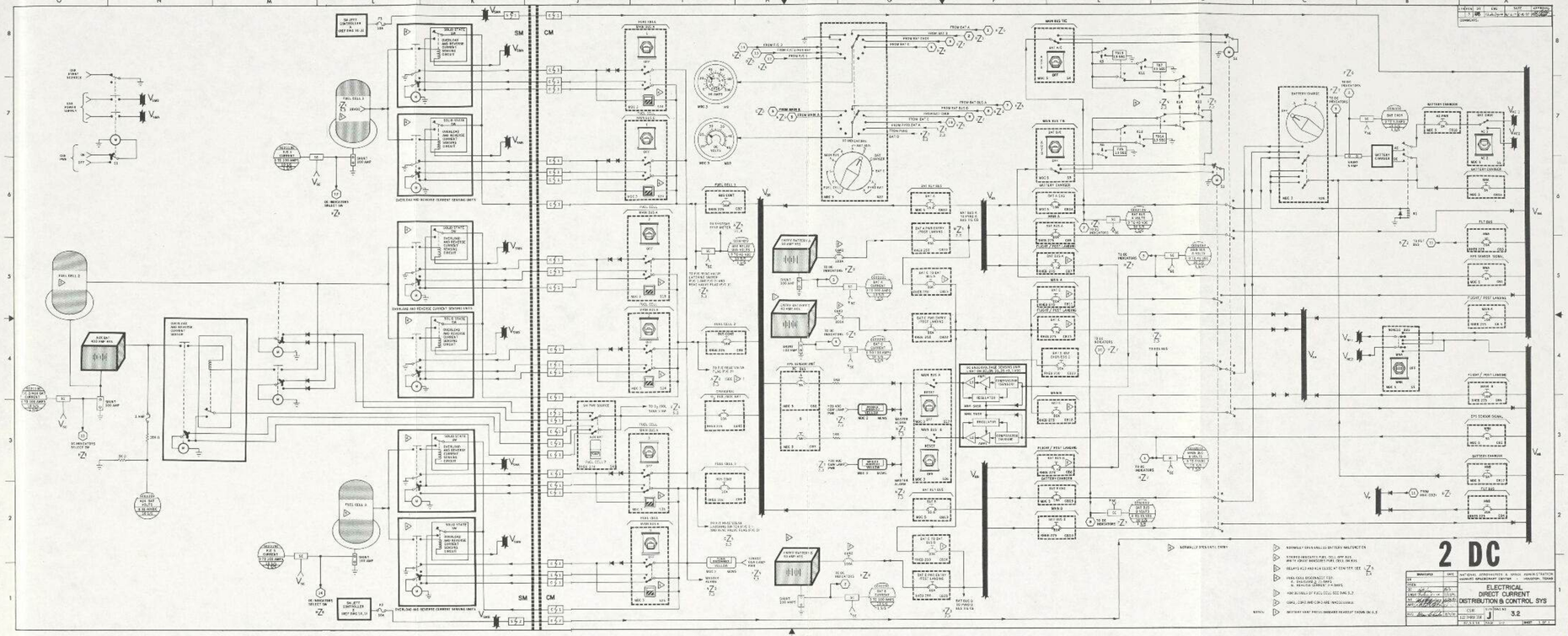
CSM	SIZE	DWG NO
112 THRU 114	J	3.2
82.5 X 34	PAGE 3-2	SHEET 1 OF 1

DISTR-CNTL AC
POWER DIST MAIN
POWER DIST AC
POWER DIST MISC
PWR DIST EXPERIMENTS
SUIT/CABIN PRESS
DISTR-CNTL DC

RHEB-229 POWER DISTRIBUTION

NOTE: THRUSTER CIRCUIT BREAKERS ARE INSTALLED TO PROTECT LONG WIRE LOADS





2 DC

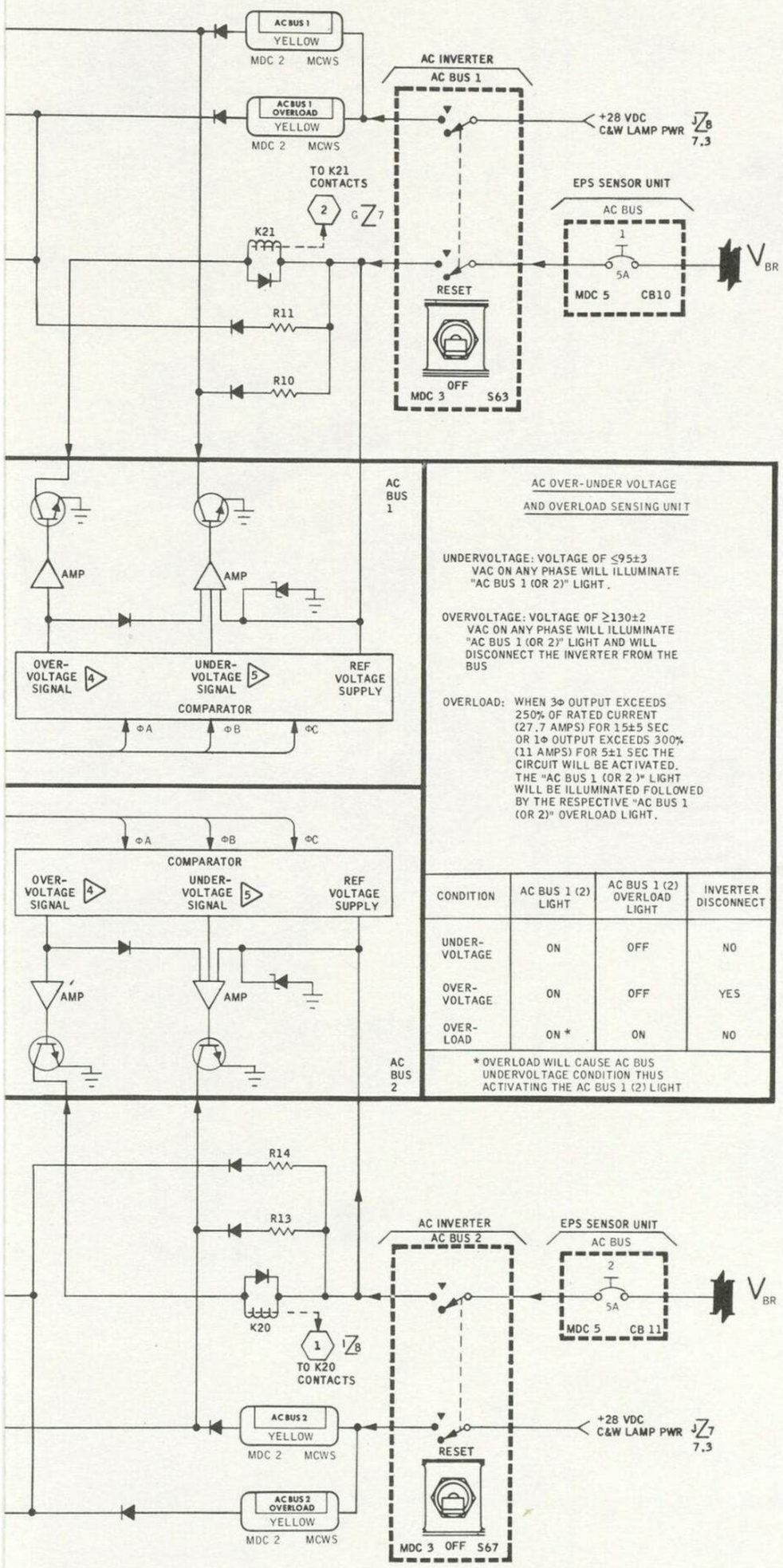
DRAWN/DATE		NATIONAL AERONAUTICS & SPACE ADMINISTRATION MANNED SPACECRAFT CENTER, HOUSTON, TEXAS	
CK		ELECTRICAL DIRECT CURRENT DISTRIBUTION & CONTROL SYS	
		CODE	DRAWING NO.
		12	3.2
SCALE NONE		SHEET 1 OF 1	

DISTR_CNTL DC

MEAS

LTR	PCN	DR	ENGR	DATE	APPROVAL

COMMENTS: PCN-3 P&I



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

3 AC

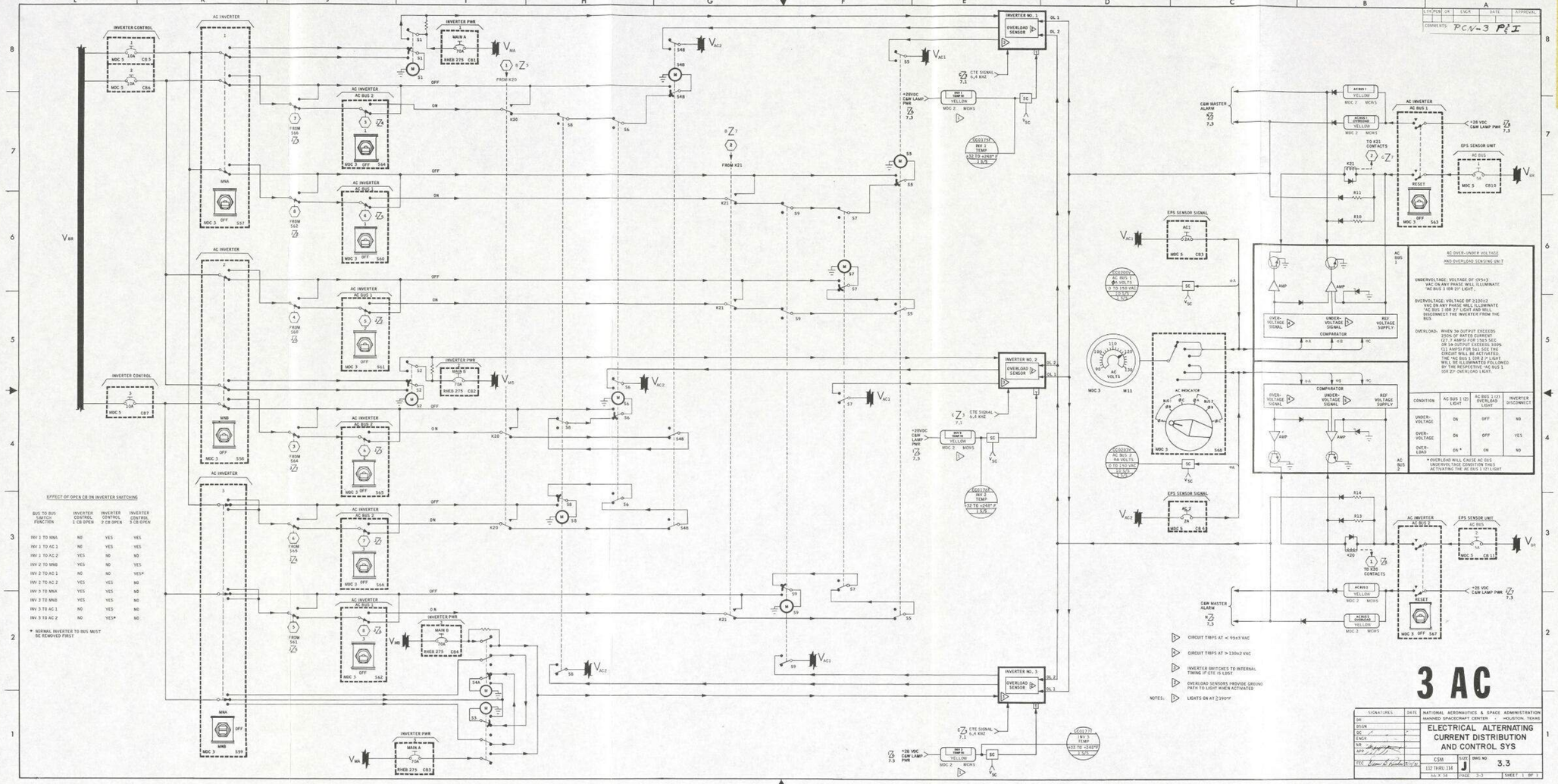
SIGNATURES	DATE
DR	
DSGN	
QC	
ENGR	
NR	
APP	
FEC Elson D. Rucker	3/11/71

NATIONAL AERONAUTICS & SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER · HOUSTON, TEXAS

ELECTRICAL ALTERNATING CURRENT DISTRIBUTION AND CONTROL SYS

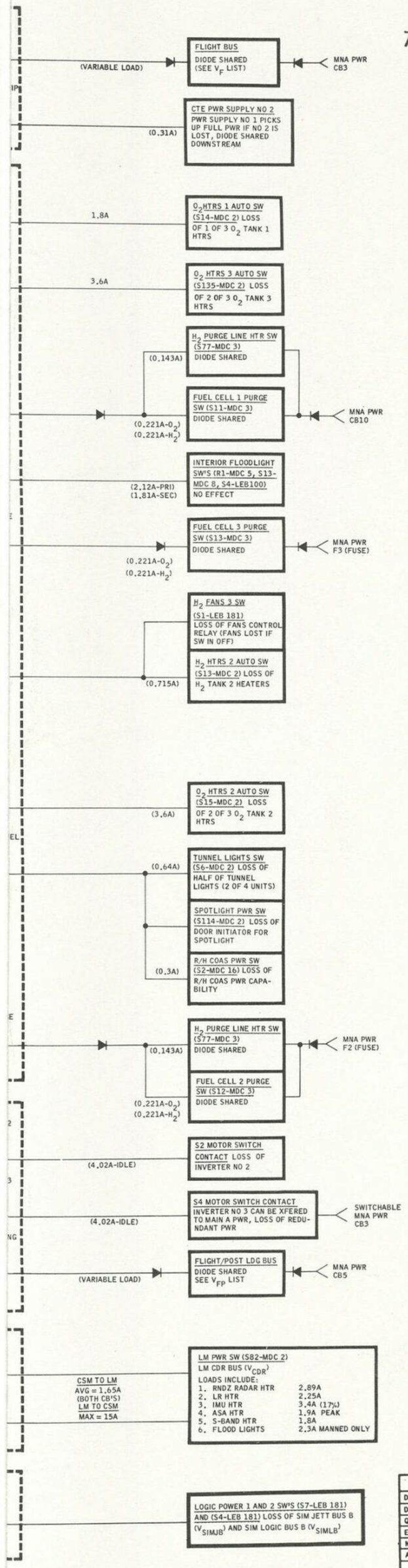
CSM	SIZE	DWG NO
112 THRU 114	J	3.3
66 X 34	PAGE 3-3	SHEET 1 OF 1

DISTR-CNTL AC
POWER DIST MAIN
POWER DIST AC
PWR DIST EXPERIMENTS
SUIT/CABIN PRESS
GLYCOL


INVERTER CONTROL
AC INVERTER
INVERTER PWR
MAIN A
RHEB 275 CB3
MAIN B
RHEB 275 CB4
INVERTER NO. 1
INVERTER NO. 2
INVERTER NO. 3
OVERLOAD SENSOR
CTE SIGNAL 5.4 KHZ
+28VDC C&W LAMP PWR
INV 1 TEMP
INV 2 TEMP
INV 3 TEMP
YELLOW
EPS SENSOR SIGNAL
EPS SENSOR UNIT
AC BUS 1
AC BUS 2
AC BUS 3
C&W MASTER ALARM
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 132±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 1 SEC OR 1φ OUTPUT EXCEEDS 200% OF RATED CURRENT (20 AMPS) FOR 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
CIRCUIT TRIPS AT < 95±3 VAC
CIRCUIT TRIPS AT > 130±2 VAC
INVERTER SWITCHES TO INTERNAL TIMING IF CTE IS LOST
OVERLOAD SENSORS PROVIDE GROUND PATH TO LIGHT WHEN ACTIVATED
NOTES: LIGHTS ON AT ≥190°F
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
3 AC
NATIONAL AERONAUTICS & SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER - HOUSTON, TEXAS
ELECTRICAL ALTERNATING CURRENT DISTRIBUTION AND CONTROL SYS
CSM
DWG NO 3.3
SHEET 1 OF 1
DISTR-CNTL AC

MFAS

PCN-3 PEI



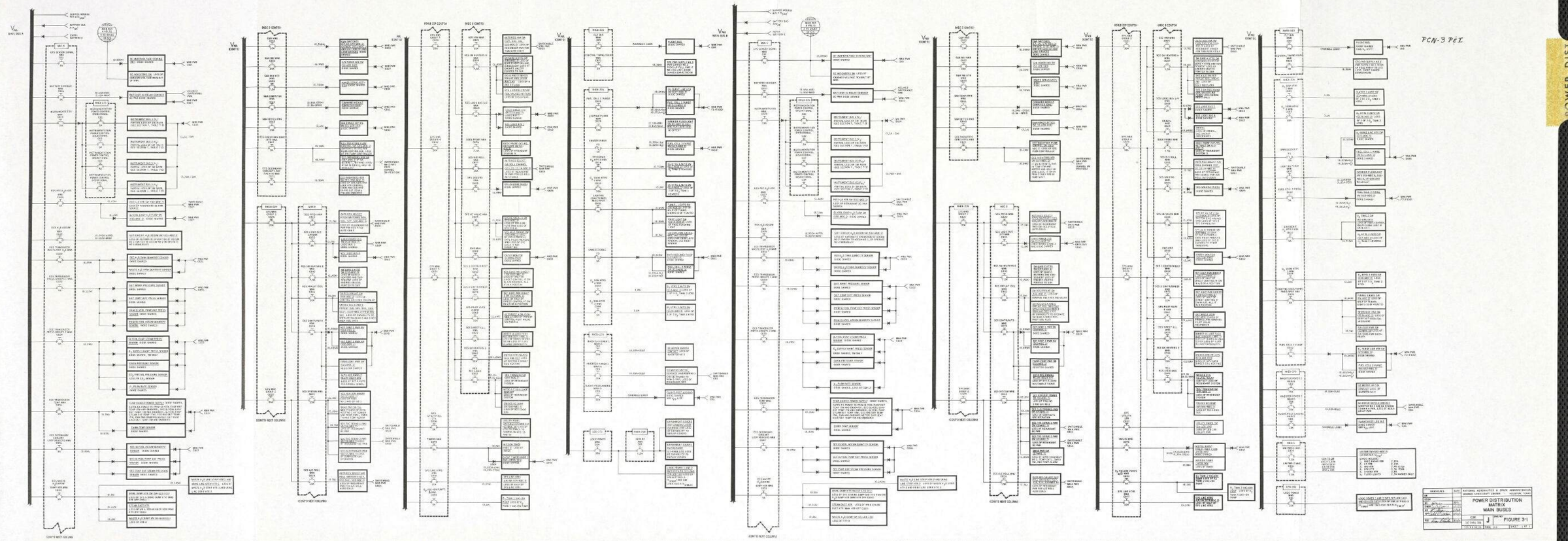
SIGNATURES	DATE
DR	
DSGN	
QC	2/1/71
ENGR	2/23/71
NR	2/23/71
APP	2/23/71
FEC	3/11/71

NATIONAL AERONAUTICS & SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER · HOUSTON, TEXAS

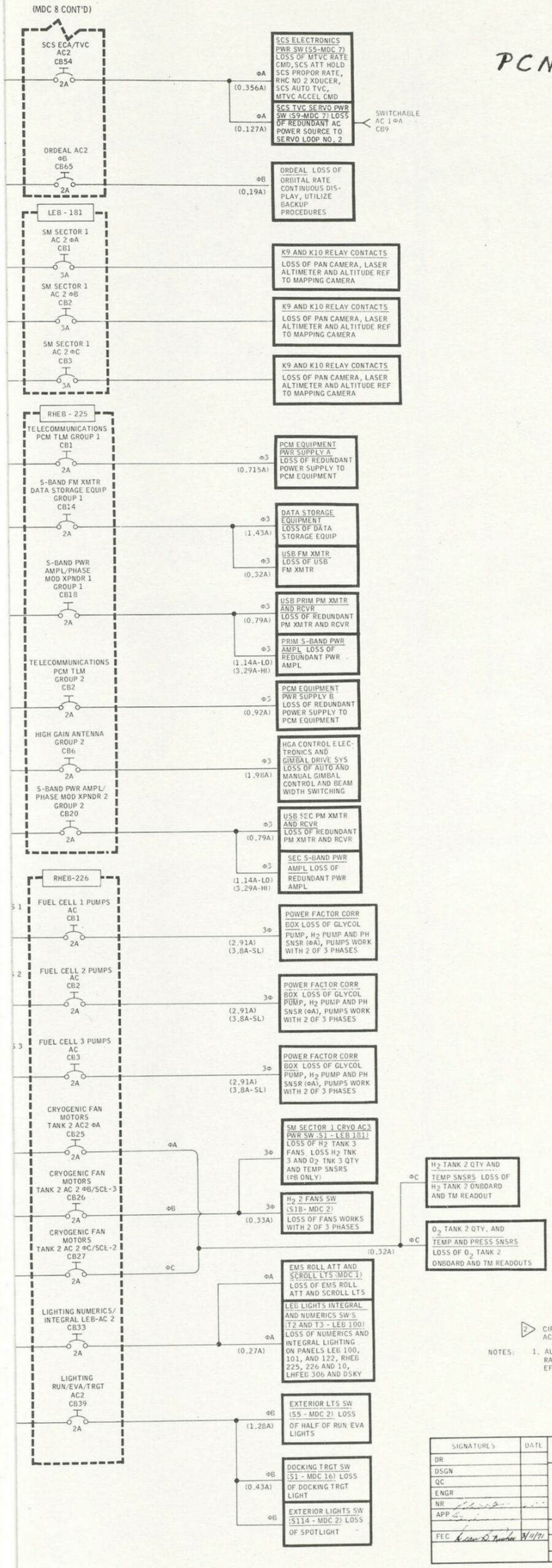
POWER DISTRIBUTION MATRIX MAIN BUSES

CSM	DWG NO	
112 THRU 114	J	FIGURE 3-1
113.5 X 38.25	PAGE 3-5	SHEET 1 OF 1

SECONDARY
POWER DIST MAIN
POWER DIST AC
POWER DIST MISC
PWR DIST EXPERIMENTS
SUIT/CABIN PRESS
GLYCOL


POWER DISTRIBUTION MATRIX
MAIN BUSES
FIGURE 3-1
J
NATIONAL AERONAUTICS & SPACE ADMINISTRATION
MARSHALL SPACE FLIGHT CENTER, HUNTSVILLE, ALABAMA
POWER DIST MAIN
FCN-3 PEI

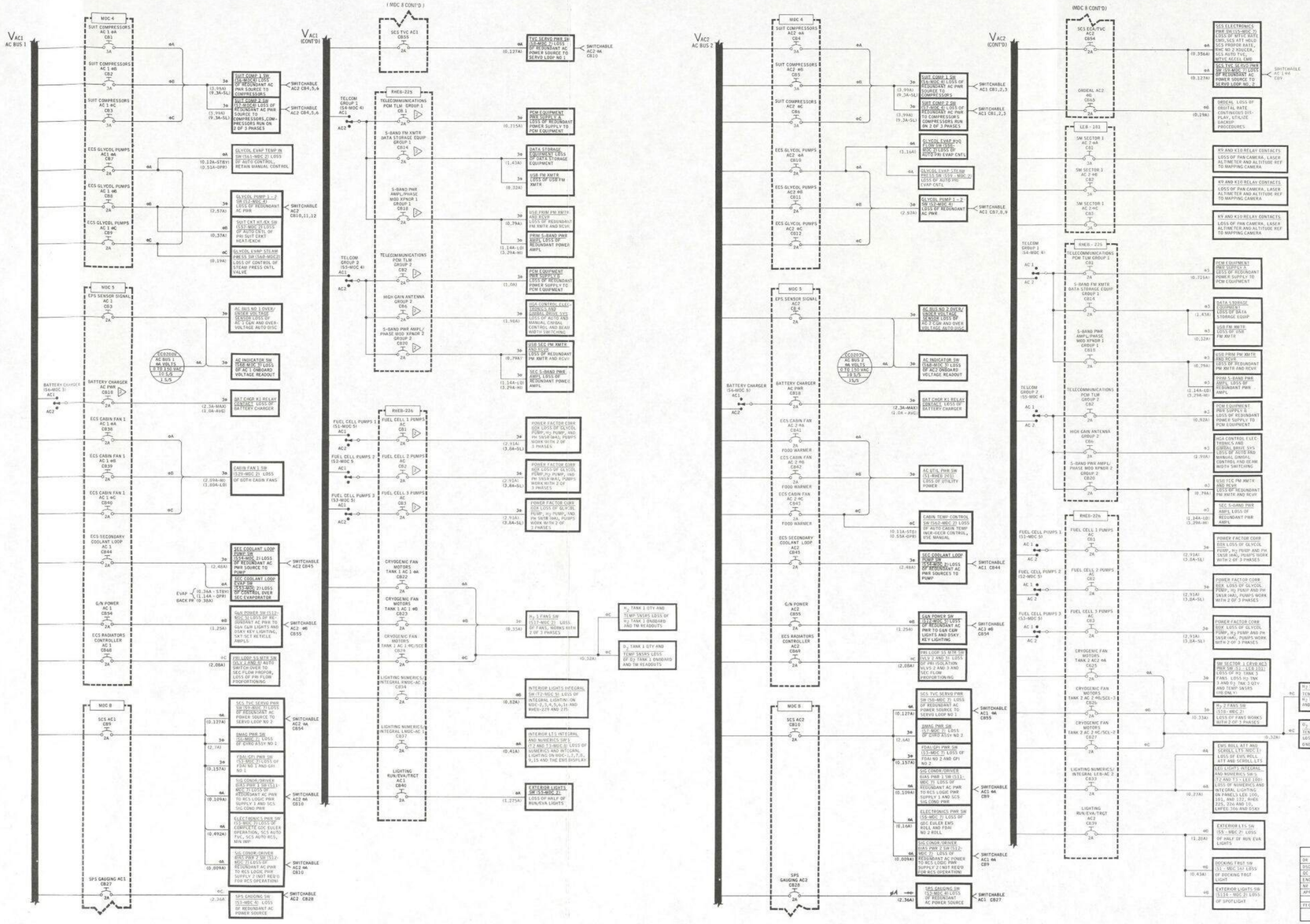
PCN-3 PEI

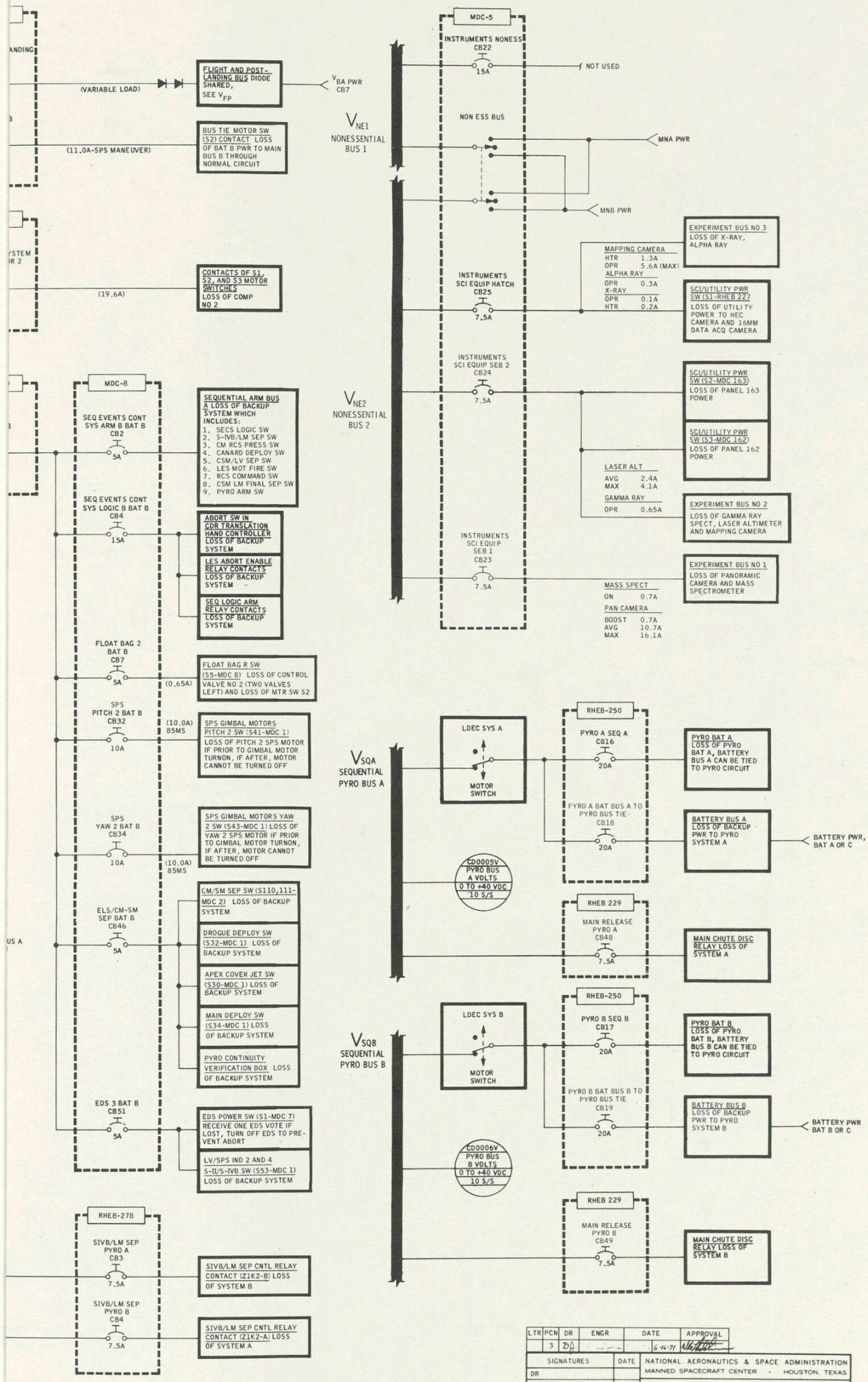


2 CIRCUIT BREAKER SHOWN UNDER AC 2 ALSO

NOTES: 1. ALL CURRENT RATINGS ARE DC EQUIVALENT RATED AT 28.0 VDC AND INVERTER EFF. = 75

SIGNATURES	DATE	NATIONAL AERONAUTICS & SPACE ADMINISTRATION MANNED SPACECRAFT CENTER · HOUSTON, TEXAS
DR		POWER DISTRIBUTION MATRIX AC BUSES
DSGN		
QC		
ENGR		
NR		
APP		
FEC	8/11/71	CSM 112 THRU 114 · SIZE J · FIGURE 3-2
		66 X 38.25 · PAGE 3-6 · SHEET OF 1


PCN-3 PEI
POWER DIST
AC
VAC1 AC BUS 1
VAC1 (CONT'D)
VAC2 AC BUS 2
VAC2 (CONT'D)
(MDC 8 CONT'D)
MDC 4
MDC 5
MDC 8
SUIT COMPRESSORS AC 1 #A CB1
SUIT COMPRESSORS AC 1 #B CB2
SUIT COMPRESSORS AC 1 #C CB3
ECS GLYCOL PUMPS AC 1 #A CB7
ECS GLYCOL PUMPS AC 1 #B CB8
ECS GLYCOL PUMPS AC 1 #C CB9
EPS SENSOR SIGNAL AC 1 CB3
BATTERY CHARGER AC PWR CB18
ECS CABIN FAN 1 AC 1 #A CB38
ECS CABIN FAN 1 AC 1 #B CB39
ECS CABIN FAN 1 AC 1 #C CB40
ECS SECONDARY COOLANT LOOP AC 1 CB44
G/N POWER AC 1 CB54
ECS RADIATORS CONTROLLER AC 1 CB48
SCS AC1 CB9
SPS GAUGING AC1 CB27
SUIT COMP 1 SW (53-MDC 2) LOSS OF REDUNDANT AC PWR SOURCE TO COMPRESSOR 1
SUIT COMP 2 SW (53-MDC 2) LOSS OF REDUNDANT AC PWR SOURCE TO COMPRESSOR 2 (COMPRESSORS RUN ON 2 OF 3 PHASES)
GLYCOL EVAP TEMP IN (51-MDC 2) LOSS OF AUTO CONTROL, RETAIN MANUAL CONTROL
GLYCOL PUMP 1-3 SW (53-MDC 4) LOSS OF REDUNDANT AC PWR
SUIT CIRT HEAT SW (53-MDC 2) LOSS OF AUTO CNTL OF PRI SUIT CIRCT HEAT/EACH
GLYCOL EVAP STEAM PRESS SW (54B-MDC 2) LOSS OF CONTROL OR STEAM PRESS CNTL VALVE
AC BUS NO 1 OVER/UNDER VOLTAGE SENSOR LOSS OF AC 1 CBR AND OVER-VOLTAGE AUTO DISC
AC INDICATOR SW (54B-MDC 3) LOSS OF AC 1 ONBOARD VOLTAGE READOUT
BATTERY CHARGER (54-MDC 5)
BAT CHGR #1 RELAY (54-MDC 5) LOSS OF BATTERY CHARGER
CABIN FAN 1 SW (53-MDC 2) LOSS OF BOTH CABIN FANS
SEC COOLANT LOOP PUMP SW (53-MDC 2) LOSS OF REDUNDANT AC PWR SOURCE TO PUMP
SEC COOLANT LOOP EVAP SW (53-MDC 2) LOSS OF CONTROL OVER SEC EVAPORATOR
EVAP (0.34A - STBY) (1.14A - OPR) BACK PR (0.38A)
G/N POWER SW (53-MDC 2) LOSS OF REDUNDANT AC PWR TO G/N FAIR LIGHTS AND OSKY KEY LIGHTING, SKY SCE RETICLE AMPLS
CBL LOOP 1,5 MTR SW (53-MDC 2) ONLY IF NOT SWITCH OVER SEC FLOW PROPOR, LOSS OF PRI FLOW PROPORTIONING
SCS TVC SERVO PWR SW (53-MDC 2) LOSS OF REDUNDANT AC POWER SOURCE TO SERVO LOOP NO 2
IMAG PWR SW (53-MDC 2) LOSS OF GYRO ASSY NO 1
FDAI GPI PWR SW (53-MDC 2) LOSS OF FDAI NO 2 AND GPI NO 1
SIG CONDR DRIVER BUS PWR 1 SW (53-MDC 2) LOSS OF REDUNDANT AC PWR TO RCS LOGIC PWR SUPPLY 1 AND SCS SIG CONDR PWR
ELECTRONICS PWR SW (53-MDC 2) LOSS OF CORRECT COS ENGER OPERATION, SCS AUTO TVC, SCS AUTO RCS, MIN IMP
SIG CONDR DRIVER BUS PWR 2 SW (53-MDC 2) LOSS OF REDUNDANT AC PWR TO RCS LOGIC PWR SUPPLY 2 (NOT REQ'D FOR RCS OPERATION)
SPS GAUGING SW (53-MDC 4) LOSS OF REDUNDANT AC POWER SOURCE
SCS TVC SERVO PWR SW (54-MDC 2) LOSS OF REDUNDANT AC POWER SOURCE TO SERVO LOOP NO 1
TELECOMMUNICATIONS PCM TLM GROUP 1 CB1
S-BAND FM XMTR DATA STORAGE EQUIP GROUP 1 CB14
S-BAND PWR AMPL/PHASE MOD XPNDR 1 GROUP 1 CB18
TELECOMMUNICATIONS PCM TLM GROUP 2 CB2
HIGH GAIN ANTENNA GROUP 2 CB6
S-BAND PWR AMPL/PHASE MOD XPNDR 2 GROUP 2 CB20
FUEL CELL 1 PUMPS AC CB1
FUEL CELL 2 PUMPS AC CB2
FUEL CELL 3 PUMPS AC CB3
CRYOGENIC FAN MOTORS TANK 1 AC 1 #A CB22
CRYOGENIC FAN MOTORS TANK 1 AC 1 #B CB23
CRYOGENIC FAN MOTORS TANK 1 AC 1 #C/SCE CB24
LIGHTING NUMERICS INTEGRAL (MDC-AC CB34
LIGHTING NUMERICS INTEGRAL LMDC-AC CB37
LIGHTING RUN/EVA/TRGT AC1 CB40
PCM EQUIPMENT PWR SUPPLY 1 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 AND RCVR LOSS OF REDUNDANT FM XMTR AND RCVR
FRM S-BAND PWR AMPL LOSS OF REDUNDANT POWER AMPL
PCM EQUIPMENT PWR SUPPLY 2 LOSS OF REDUNDANT POWER SUPPLY TO PCM EQUIPMENT
GCS CONTROL ELECTRONICS AND GIMBAL DRIVE SYS LOSS OF AUTO AND MANUAL GIMBAL CONTROL AND BEAM WIDTH SWITCHING
USB SEC FM XMTR AND RCVR LOSS OF REDUNDANT FM XMTR AND RCVR
SEC S-BAND PWR AMPL LOSS OF REDUNDANT POWER AMPL
POWER FACTOR CORR BDA LOSS OF GLYCOL PUMP, H_2 PUMP, AND FM SKSR (4A), PUMPS WORK WITH 2 OF 3 PHASES
POWER FACTOR CORR BDA LOSS OF GLYCOL PUMP, H_2 PUMP, AND FM SKSR (4A), PUMPS WORK WITH 2 OF 3 PHASES
POWER FACTOR CORR BDA LOSS OF GLYCOL PUMP, H_2 PUMP, AND FM SKSR (4A), PUMPS WORK WITH 2 OF 3 PHASES
H_2 FANS SW (53-MDC 2) LOSS OF FANS, NORMG WITH 2 OF 3 PHASES
H_2 TANK 1 QTY AND TEMP SNSRS LOSS OF H_2 TANK 1 ONBOARD AND TM READOUTS
O_2 TANK 1 QTY AND TEMP SNSRS LOSS OF O_2 TANK 1 ONBOARD AND TM READOUTS
INTERIOR LIGHTS INTEGRAL SW (53-MDC 5) LOSS OF INTEGRAL LIGHTING ON MDC-2,3,4,5,6,11 AND RHEB-229 AND 225
INTERIOR LTS INTEGRAL AND NUMERICS SW (53-MDC 5) LOSS OF NUMERICS AND INTEGRAL LIGHTING ON MDC-1,2,7,8,9,15 AND THE EMS DISPLAY
EXTERIOR LIGHTS SW (53-MDC 2) LOSS OF HALF OF RUN/EVA LIGHTS
SUIT COMP 1 SW (54-MDC 4) LOSS OF REDUNDANT AC PWR SOURCE TO COMPRESSORS
SUIT COMP 2 SW (54-MDC 4) LOSS OF REDUNDANT AC PWR TO COMPRESSORS (COMPRESSORS RUN ON 2 OF 3 PHASES)
GLYCOL EVAP PRS SW (53B-MDC 4) LOSS OF AUTO CNTL
GLYCOL EVAP STEAM PRESS SW (53B-MDC 4) LOSS OF AUTO PRI EVAP CNTL
GLYCOL PUMP 1-2 SW (53-MDC 4) LOSS OF REDUNDANT AC PWR
AC BUS NO 2 OVER/UNDER VOLTAGE SENSOR LOSS OF AC 2 CBR AND OVER-VOLTAGE AUTO DISC
AC INDICATOR SW (54B-MDC 3) LOSS OF AC 2 ONBOARD VOLTAGE READOUT
BAT CHGR #2 RELAY (54-MDC 5) LOSS OF BATTERY CHARGER
AC UTIL PWR SW (53-RHEB 203) LOSS OF UTILITY POWER
CABIN TEMP CONTROL SW (54-MDC 2) LOSS OF AUTO CABIN TEMP INCR-DECR CONTROL, USE MANUAL
SEC COOLANT LOOP PUMP SW (53-MDC 2) LOSS OF REDUNDANT AC PWR SOURCES TO PUMP
G/N POWER SW (53-MDC 2) LOSS OF REDUNDANT AC PWR TO G/N CBR AND OSKY KEY LIGHTING
CBL LOOP 1,5 MTR SW (53-MDC 2) LOSS OF PRI ISOLATION VALVE CLOSURE AND SEC FLOW PROPORTIONING
SCS TVC SERVO PWR SW (53-MDC 2) LOSS OF REDUNDANT AC POWER SOURCE TO SERVO LOOP NO 1
IMAG PWR SW (53-MDC 2) LOSS OF GYRO ASSY NO 2
FDAI GPI PWR SW (53-MDC 2) LOSS OF FDAI NO 2 AND GPI NO 2
SIG CONDR DRIVER BUS PWR 1 SW (53-MDC 2) LOSS OF REDUNDANT AC PWR TO RCS LOGIC PWR SUPPLY 1 AND SCS SIG CONDR PWR
ELECTRONICS PWR SW (53-MDC 2) LOSS OF GDC ROLLER EMS ROLL AND EBAI NO 2 ROLL
SIG CONDR DRIVER BUS PWR 2 SW (53-MDC 2) LOSS OF REDUNDANT AC POWER TO RCS LOGIC PWR SUPPLY 2 (NOT REQ'D FOR RCS OPERATION)
SPS GAUGING SW (53-MDC 4) LOSS OF REDUNDANT AC POWER SOURCE
SCS ELECTRONICS PWR SW (53-MDC 2) LOSS OF BITUC BITS, SCS AUTO TVC, SCS PROPOR RATE, RHC NO 2 XDUCER, SCS AUTO TVC, MTVC ACCEL CMD
SCS TVC SLOSS PWR SW (54-MDC 2) LOSS OF REDUNDANT AC POWER SOURCE TO SERVO LOOP NO 2
ORDEAL LOSS OF DIGITAL RATE, CONTINUOUS DIS-PLAY OF ATTITUDE, BACKUP PROCEDURES
K9 AND K10 RELAY CONTACTS LOSS OF PAN CAMERA, LASER ALTIMETER AND ALTITUDE REF TO MAPPING CAMERA
K9 AND K10 RELAY CONTACTS LOSS OF PAN CAMERA, LASER ALTIMETER AND ALTITUDE REF TO MAPPING CAMERA
K9 AND K10 RELAY CONTACTS LOSS OF PAN CAMERA, LASER ALTIMETER AND ALTITUDE REF TO MAPPING CAMERA
FRM EQUIPMENT PWR SUPPLY 1 LOSS OF REDUNDANT POWER SUPPLY TO PCM EQUIPMENT
DATA STORAGE EQUIPMENT LOSS OF DATA STORAGE EQUIP
USB FM XMTR LOSS OF USB FM XMTR
FRM FRM FM XMTR AND RCVR LOSS OF REDUNDANT FM XMTR AND RCVR
FRM S-BAND PWR AMPL LOSS OF REDUNDANT PWR AMPL
FRM EQUIPMENT PWR SUPPLY 1 LOSS OF REDUNDANT POWER SUPPLY TO PCM EQUIPMENT
HGA CONTROL ELECTRONICS AND GIMBAL DRIVE SYS LOSS OF AUTO AND MANUAL GIMBAL CONTROL AND BEAM WIDTH SWITCHING
USB FSC FM XMTR AND RCVR LOSS OF REDUNDANT FM XMTR AND RCVR
SEC S-BAND PWR AMPL LOSS OF REDUNDANT PWR AMPL
POWER FACTOR CORR BDA LOSS OF GLYCOL PUMP, H_2 PUMP AND FM SKSR (4A), PUMPS WORK WITH 2 OF 3 PHASES
POWER FACTOR CORR BDA LOSS OF GLYCOL PUMP, H_2 PUMP AND FM SKSR (4A), PUMPS WORK WITH 2 OF 3 PHASES
POWER FACTOR CORR BDA LOSS OF GLYCOL PUMP, H_2 PUMP AND FM SKSR (4A), PUMPS WORK WITH 2 OF 3 PHASES
SW SECTOR 1 CRYO AC1 (53-MDC 2) LOSS OF H_2 TANK FANS, LOSS H_2 TNK 1 AND O_2 TNK 2 QTY AND TEMP SNSRS (RE ONLY)
H_2 FANS SW (53B-MDC 2) LOSS OF FANS NORMG WITH 2 OF 3 PHASES
EMS ROLL ATT AND SCROLL LTS (53-MDC 2) LOSS OF EMS ROLL ATT AND SCROLL LTS
LED LIGHTS INTEGRAL AND NUMERICS SW (53 AND 53-LED (DS) LOSS OF NUMERICS AND INTEGRAL LIGHTING ON PANEL 1,2,3,4,5,6,9,10,11,14,15,16,17,18,22A AND 1,2, LMFEC 20A AND DS4)
EXTERIOR LTS SW (53-MDC 2) LOSS OF HALF OF RUN EVA LIGHTS
DOCKING TRGT SW (53-MDC 5) LOSS OF DOCKING TRGT LIGHT
EXTERIOR LIGHTS SW (53B-MDC 2) LOSS OF SPOTLIGHT
H_2 TANK 2 QTY AND TEMP SNSRS LOSS OF H_2 TANK 2 ONBOARD AND TM READOUT
O_2 TANK 2 QTY AND TEMP AND PRESS SNSRS LOSS OF O_2 TANK 2 ONBOARD AND TM READOUTS
CIRCUIT BREAKER SHOWN UNDER AC 3 AL50
NOTES: 1. ALL CURRENT RATINGS ARE DC EQUIVALENT RATED AT 20.5 VDC AND INVERTER EFF. = .75
SWITCHABLE AC 1 #A CB9
SWITCHABLE AC 1 #B CB10
SWITCHABLE AC 2 #A CB9
SWITCHABLE AC 2 #B CB10
SIGNATURES
DH
DSGN
QC
ENGR
NF
APP
FTC
NATIONAL AERONAUTICS & SPACE ADMINISTRATION
MARSHALL SPACE FLIGHT CENTER, HUNTSVILLE, ALABAMA
POWER DISTRIBUTION MATRIX AC BUSES
C186
SIZE J
FIGURE 3-2
117 (REV) 114
PAGE 3-4
SHEET 6F



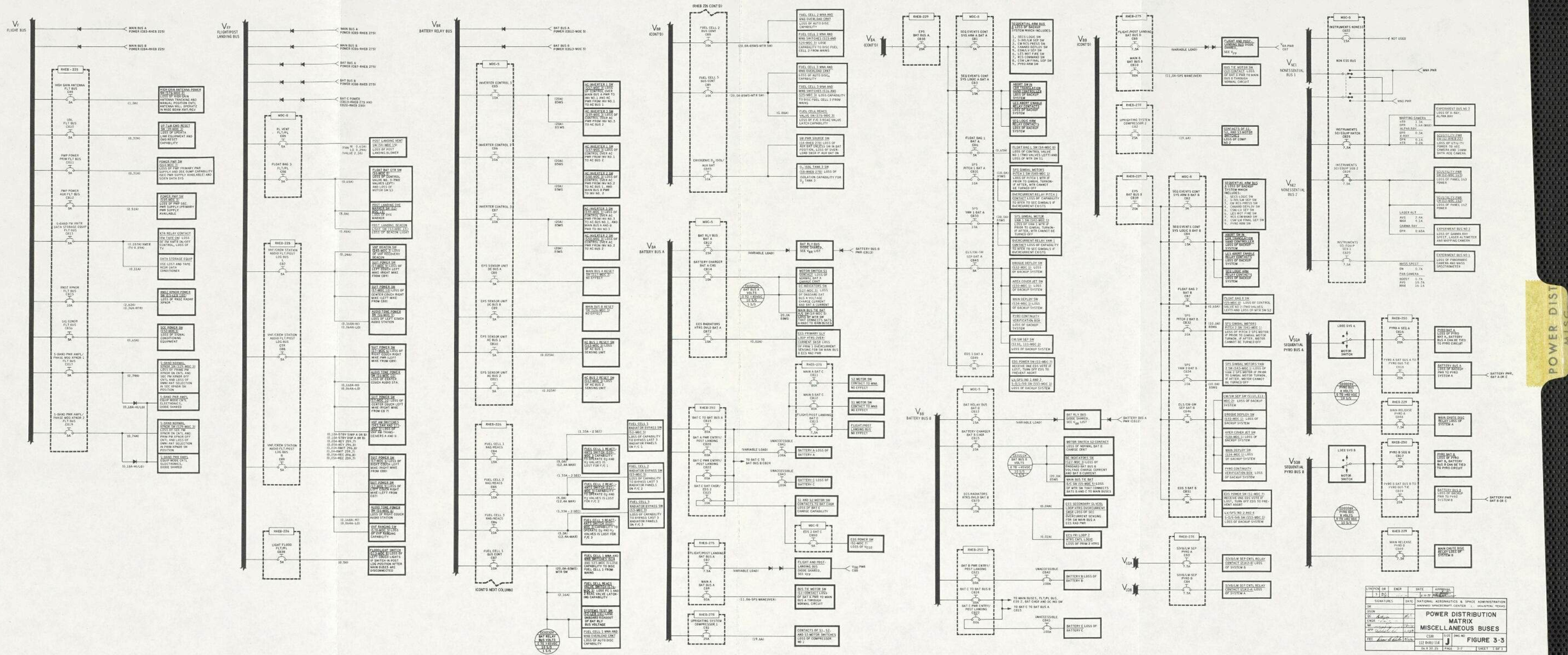
LTR	PCN	DR	ENGR	DATE	APPROVAL
	3	DJ		6-16-71	

SIGNATURES	DATE
DR	
DSGN	
QC	
ENGR	
NR	1-6-71
APP	
FEC	3/11/71

NATIONAL AERONAUTICS & SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER · HOUSTON, TEXAS

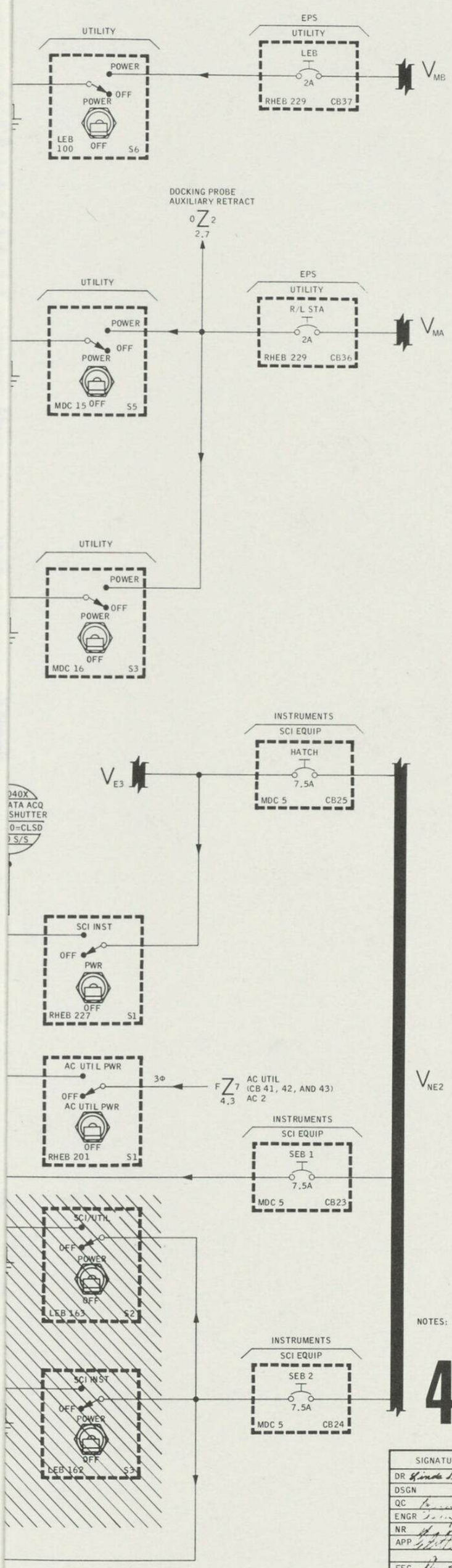
POWER DISTRIBUTION MATRIX MISCELLANEOUS BUSES

CSM	SIZE	DWG NO
112 THRU 114	J	FIGURE 3-3
86 X 38.25	PAGE 3-7	SHEET 1 OF 1


V1 FLIGHT BUS
VFP FLIGHT/POST LANDING BUS
VBR BATTERY RELAY BUS
VBR (CONT'D)
VBA BATTERY BUS A
VBA (CONT'D)
VBB BATTERY BUS B
VBB (CONT'D)
VNE1 NONESSENTIAL BUS 1
VNE2 NONESSENTIAL BUS 2
VSQA SEQUENTIAL PYRO BUS A
VSQB SEQUENTIAL PYRO BUS B
(CONT'D NEXT COLUMN)
POWER DISTRIBUTION MATRIX MISCELLANEOUS BUSES
NATIONAL AERONAUTICS & SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER, HOUSTON, TEXAS
FIGURE 3-3

LTR	PCN	DR	ENG	DATE	APPROVAL
	3	RR			

COMMENTS:



EXPERIMENT MATRIX

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

* NOT SHOWN ON THIS DRAWING

NOTES:

1. SHADED AREA COVERED BY CLOSEOUT PANEL
2. ACOUSTIC TONE BOOSTER CAN BE USED ON MDC 15 OR MDC 16
3. AUX DUMP HTR USED ONLY ON MDC 16
4. DATA ACQ CAMERA CAN BE USED ON LEB 100, MDC 15, MDC 16, AND RHEB 227 (RHEB 227 ONLY HAS TM CAPABILITY)
5. BARBERPOLE-CAMERA OUT OF TEMP LIMITS OR MECH FAILURE
   GRAY- CAMERA OFF OR NORMAL
6. BARBERPOLE-CAMERA OUT OF TEMP LIMITS (STBY OR ON) OR MECH FAILURE (ON)
   GRAY- CAMERA OFF OR GO
7. TM INTERFACES NOT SHOWN ON THIS DWG

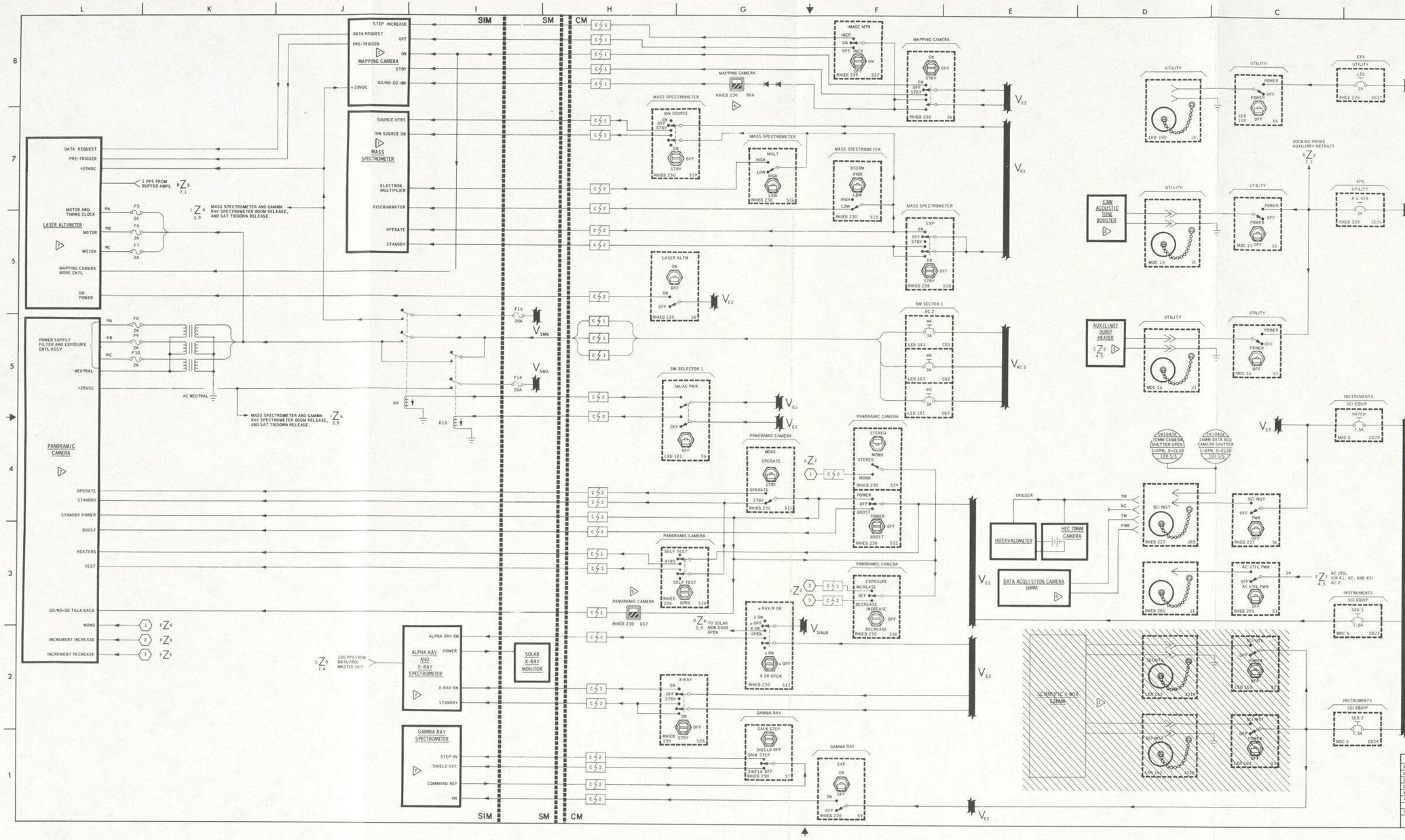
4 SCI PWR

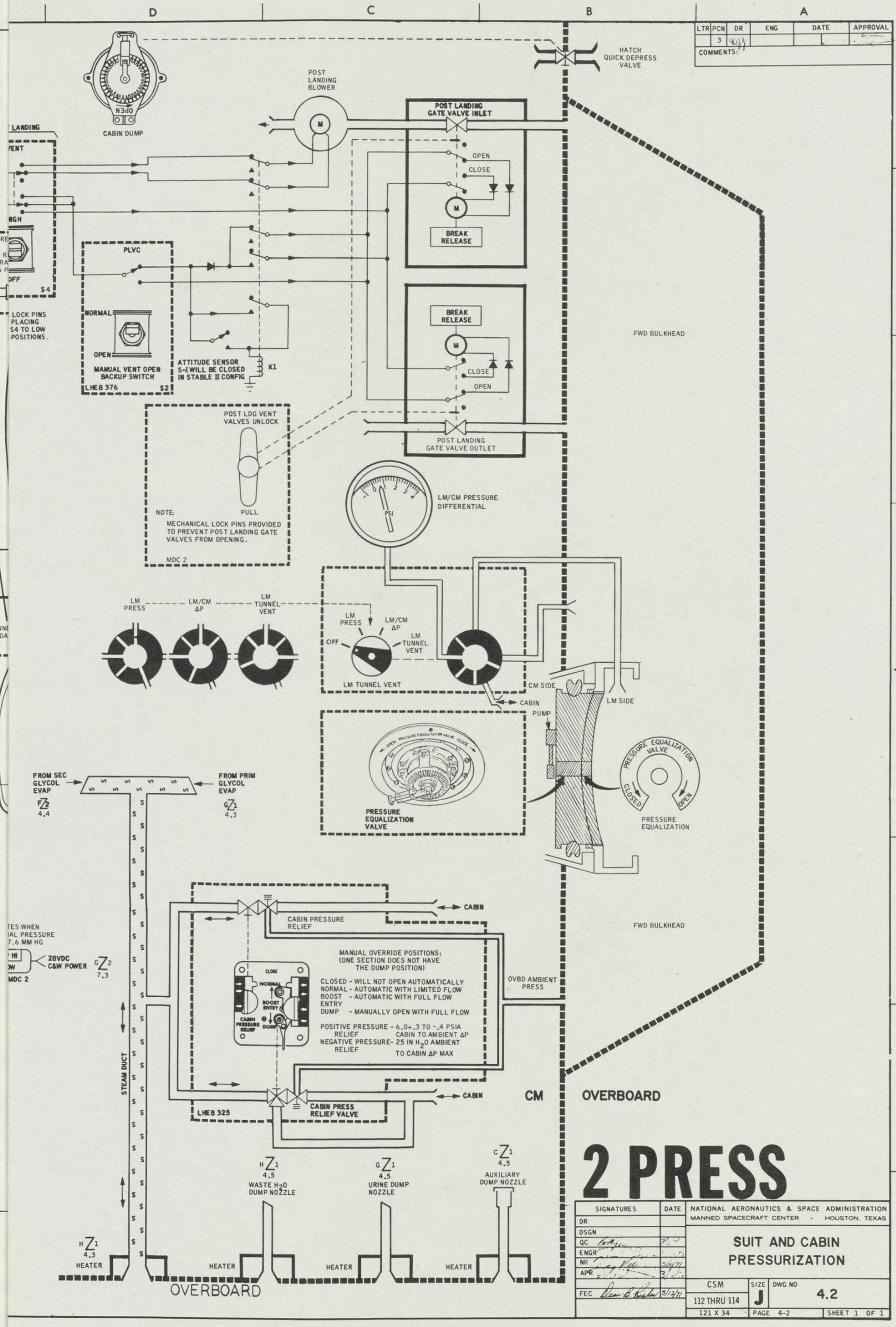
SIGNATURES	DATE
DR Linda J. Drouin	6-29-70
DSGN	
QC	
ENGR	
NR	
APP	
FEC Ben D. Fisher	3/11/71

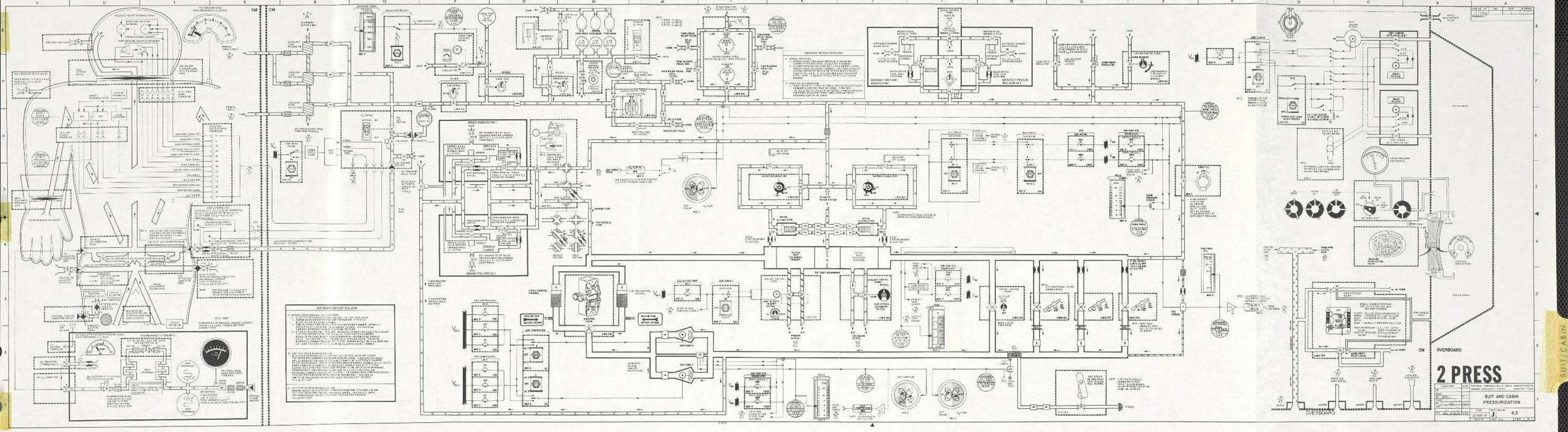
NATIONAL AERONAUTICS & SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER · HOUSTON, TEXAS

SCIENTIFIC EXPERIMENTS AND UTILITY POWER DISTRIBUTION

CSM	SIZE	DWG NO
112 THRU 114	J	3.4
66 X 34	PAGE 3-4	SHEET 1 OF 1

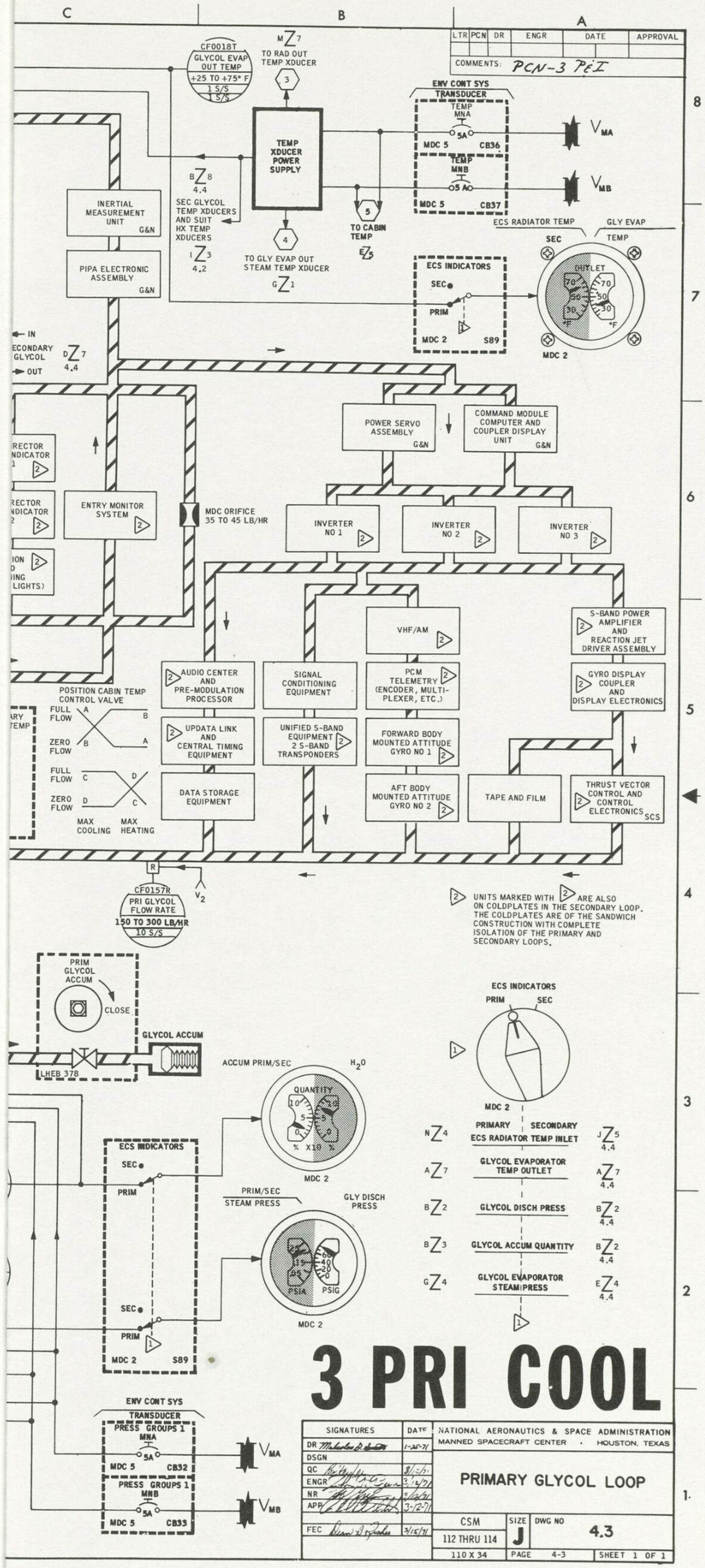

SIM
SM
CM
MAPPING CAMERA
MASS SPECTROMETER
LASER ALTIMETER
POWER SUPPLY FILTER AND EXPOSURE CNTL ASSY
PANORAMIC CAMERA
ALPHA RAY AND X-RAY SPECTROMETER
GAMMA RAY SPECTROMETER
SOLAR X-RAY MONITOR
SM SELECTOR 1
SM SECTOR 1
UTILITY
EPS
INSTRUMENTS
SCI EQUIP
INTERVALOMETER
HEC 70MM CAMERA
DATA ACQUISITION CAMERA 16MM
SCIENTIFIC 1 BOP
C&W ACOUSTIC TONE BOOSTER
AUXILIARY DUMP HEATER
DOCKING PROBE AUXILIARY RETRACT
EXPERIMENT MATRIX
MISSION
VEHICLE
EXPERIMENT
ALPHA RAY
X-RAY
PANORAMIC CAMERA
MAPPING CAMERA
MASS SPECT
GAMMA RAY
LASER ALTIMETER
FAR U.V. SPEC.
I.R. SCANNING RADAR
SUBSATELLITE
NOTES:
SHADED AREA COVERED BY CLOSEOUT PANEL
4 SCI PWR
SCIENTIFIC AND UTILITY POWER DISTRIBUTION
NATIONAL AERONAUTICS & SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER - HOUSTON, TEXAS
DWG NO 3.4
PWR DIST EXPERIMENTS


D
C
B
A
LTR PCN DR ENG DATE APPROVAL
3
COMMENTS:
HATCH QUICK DEPRESS VALVE
POST LANDING BLOWER
CABIN DUMP
OPEN
POST LANDING GATE VALVE INLET
OPEN
CLOSE
BREAK RELEASE
PLVC
NORMAL
OPEN
MANUAL VENT OPEN BACKUP SWITCH
LHEB 376
S2
ATTITUDE SENSOR S-I WILL BE CLOSED IN STABLE II CONFIG
K1
S4
LOCK PINS PLACING S4 TO LOW POSITIONS.
BREAK RELEASE
CLOSE
OPEN
POST LANDING GATE VALVE OUTLET
FWD BULKHEAD
POST LDG VENT VALVES UNLOCK
PULL
NOTE:
MECHANICAL LOCK PINS PROVIDED TO PREVENT POST LANDING GATE VALVES FROM OPENING.
MDC 2
LM/CM PRESSURE DIFFERENTIAL
PSI
LM PRESS
LM/CM ΔP
LM TUNNEL VENT
OFF
LM TUNNEL VENT
CM SIDE
CABIN
PUMP
LM SIDE
PRESSURE EQUALIZATION VALVE
PRESSURE EQUALIZATION VALVE
CLOSED
OPEN
PRESSURE EQUALIZATION
FROM SEC GLYCOL EVAP
FZ2 4.4
FROM PRIM GLYCOL EVAP
GZ1 4.3
28VDC C&W POWER
GZ2 7.3
MDC 2
CABIN
CABIN PRESSURE RELIEF
MANUAL OVERRIDE POSITIONS: (ONE SECTION DOES NOT HAVE THE DUMP POSITION)
CLOSED - WILL NOT OPEN AUTOMATICALLY
NORMAL - AUTOMATIC WITH LIMITED FLOW
BOOST ENTRY - AUTOMATIC WITH FULL FLOW
DUMP - MANUALLY OPEN WITH FULL FLOW
POSITIVE PRESSURE RELIEF - 6.0+.3 TO -.4 PSIA CABIN TO AMBIENT ΔP
NEGATIVE PRESSURE RELIEF - 25 IN H2O AMBIENT TO CABIN ΔP MAX
OVBD AMBIENT PRESS
FWD BULKHEAD
STEAM DUCT
LHEB 325
CABIN PRESS RELIEF VALVE
CABIN
CM
OVERBOARD
HZ1 4.3
HEATER
WASTE H2O DUMP NOZZLE
HZ1 4.5
URINE DUMP NOZZLE
GZ1 4.5
AUXILIARY DUMP NOZZLE
CZ1 4.5
HEATER
HEATER
HEATER
OVERBOARD
2 PRESS
SIGNATURES
DATE
DR
DSGN
QC
ENGR
NR
APR
FEC
NATIONAL AERONAUTICS & SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER · HOUSTON, TEXAS
SUIT AND CABIN PRESSURIZATION
CSM
112 THRU 114
SIZE J
DWG NO 4.2
121 X 34
PAGE 4-2
SHEET 1 OF 1


2 PRESS
SUIT AND CABIN PRESSURIZATION
4.2
OVERBOARD
SUIT/CABIN

LTR	PCN	DR	ENGR	DATE	APPROVAL

COMMENTS: PCN-3 PEI



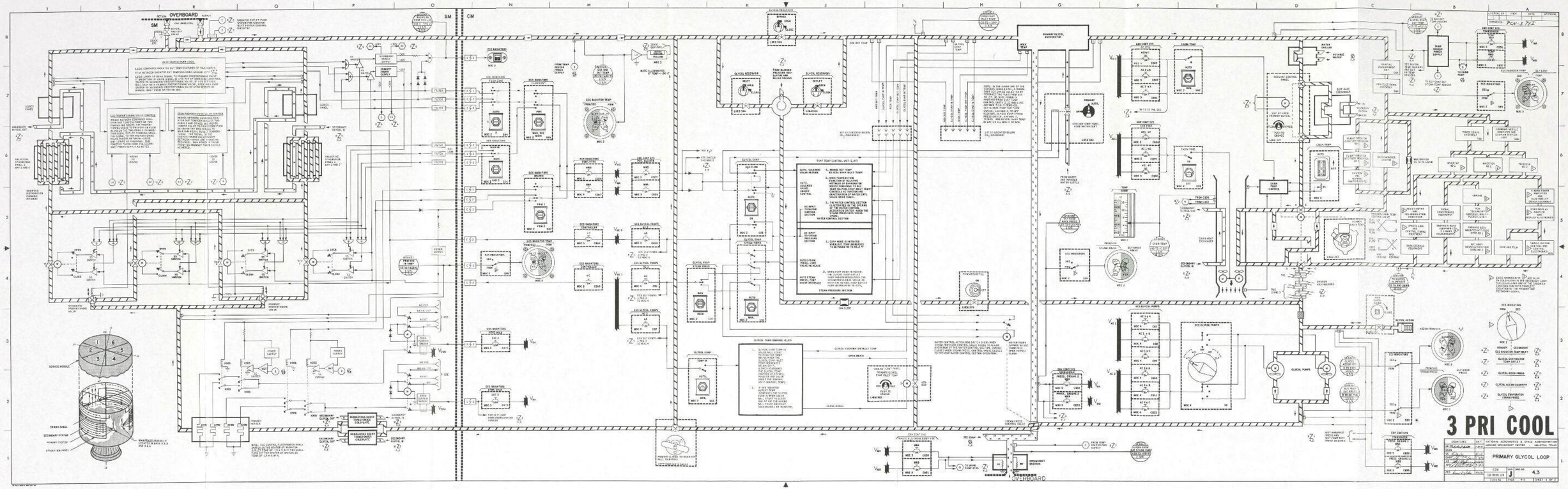
3 PRI COOL

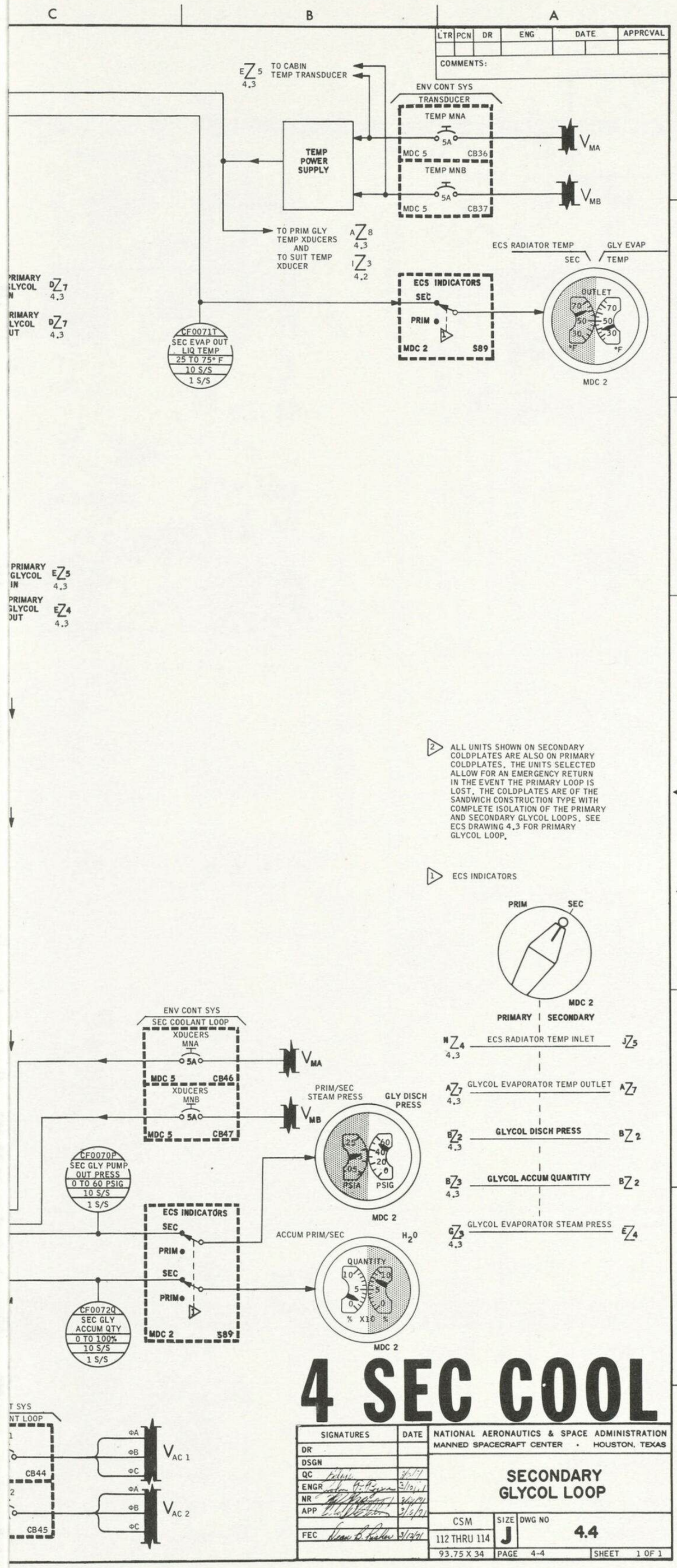
SIGNATURES	DATE
DR	1-25-71
DSGN	
QC	3/12/71
ENGR	3/12/71
NR	3/12/71
APP	3-12-71
FEC	3/15/71

NATIONAL AERONAUTICS & SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER · HOUSTON, TEXAS

PRIMARY GLYCOL LOOP

CSM	SIZE	DWG NO
112 THRU 114	J	4.3
110 X 34	PAGE 4-3	SHEET 1 OF 1


3 PRI COOL
PRIMARY GLYCOL LOOP
OVERBOARD
SM
CM
PCN-3-712
PRIMARY GLYCOL



4 SEC COOL

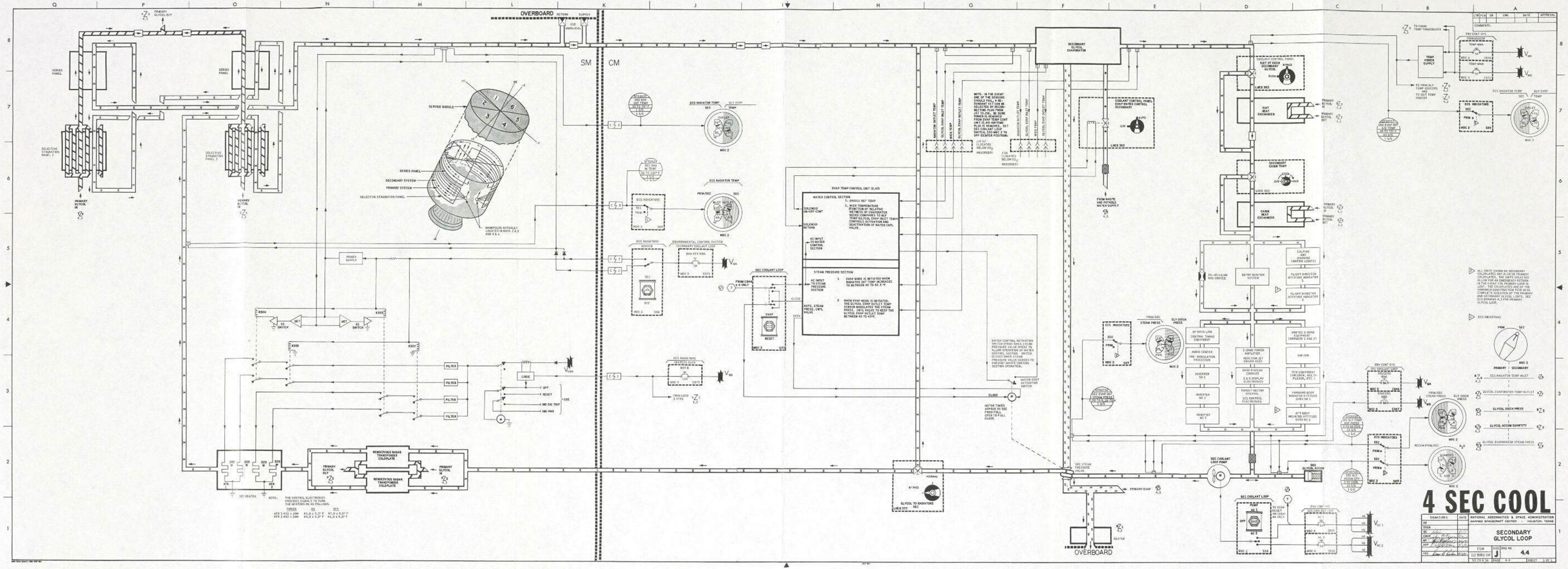
SIGNATURES	DATE
DR	
DSGN	
QC	3/1/71
ENGR	3/10/71
NR	3/6/71
APP	3/6/71
FEC	3/12/71

NATIONAL AERONAUTICS & SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER · HOUSTON, TEXAS

SECONDARY GLYCOL LOOP

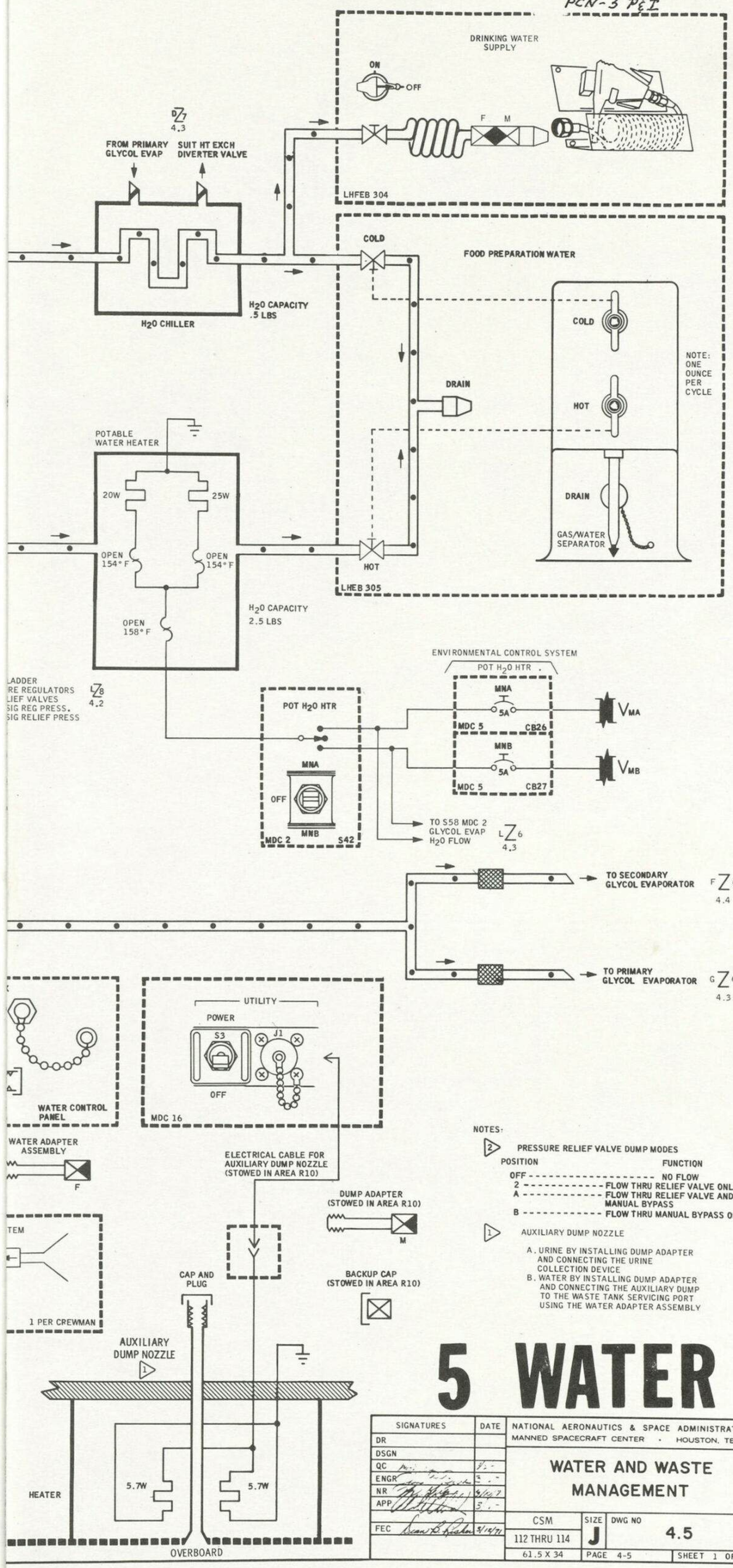
CSM	SIZE	DWG NO
112 THRU 114	J	4.4
93.75 X 34	PAGE 4-4	SHEET 1 OF 1

SECONDARY GLYCOL
WATER WASTE
FUEL CELL CRYO
COMM
S-BAND RF
PROCESS


4 SEC COOL
SECONDARY GLYCOL LOOP
NATIONAL AERONAUTICS & SPACE ADMINISTRATION
LYNDON B JOHNSON SPACE CENTER HOUSTON, TEXAS
SIGNATURES
DATE
CSM
SIZE J
DWG NO 4.4
SCALE NONE
SHEET 1 OF 1
OVERBOARD
SM
CM
SERVICE MODULE
SERIES PANEL
SELECTIVE STAGNATION PANEL
SECONDARY SYSTEM
PRIMARY SYSTEM
MARYGOLDS ACTUALLY ARE SHOWN IN SECS 2 & 3 AND 5 & 6
POWER SUPPLY
FILTER
LOGIC
REMOVEABLE RADIAN HEAT REJECTION COLDPLATE
PRIMARY GLYCOL
SECONDARY GLYCOL EVAPORATOR
SEC COOLANT LOOP PUMP
SEC GLYCOL ACCUM
SUIT AT EACH SECONDARY GLYCOL
SUIT HEAT EXCHANGER
COOLANT CONTROL PANEL
CABIN HEAT EXCHANGER
TEMP POWER SUPPLY
ENTRY MONITOR SYSTEM
FLIGHT DIRECTOR ATTITUDE INDICATOR
SEC COOLANT LOOP
OVERBOARD

LTR	PCN	DR	ENGR	DATE	APPROVAL

PCN-3 P&I



NOTES:

2 PRESSURE RELIEF VALVE DUMP MODES

POSITION	FUNCTION
OFF	NO FLOW
2	FLOW THRU RELIEF VALVE ONLY
A	FLOW THRU RELIEF VALVE AND MANUAL BYPASS
B	FLOW THRU MANUAL BYPASS ONLY

1 AUXILIARY DUMP NOZZLE

A. URINE BY INSTALLING DUMP ADAPTER AND CONNECTING THE URINE COLLECTION DEVICE
B. WATER BY INSTALLING DUMP ADAPTER AND CONNECTING THE AUXILIARY DUMP TO THE WASTE TANK SERVICING PORT USING THE WATER ADAPTER ASSEMBLY

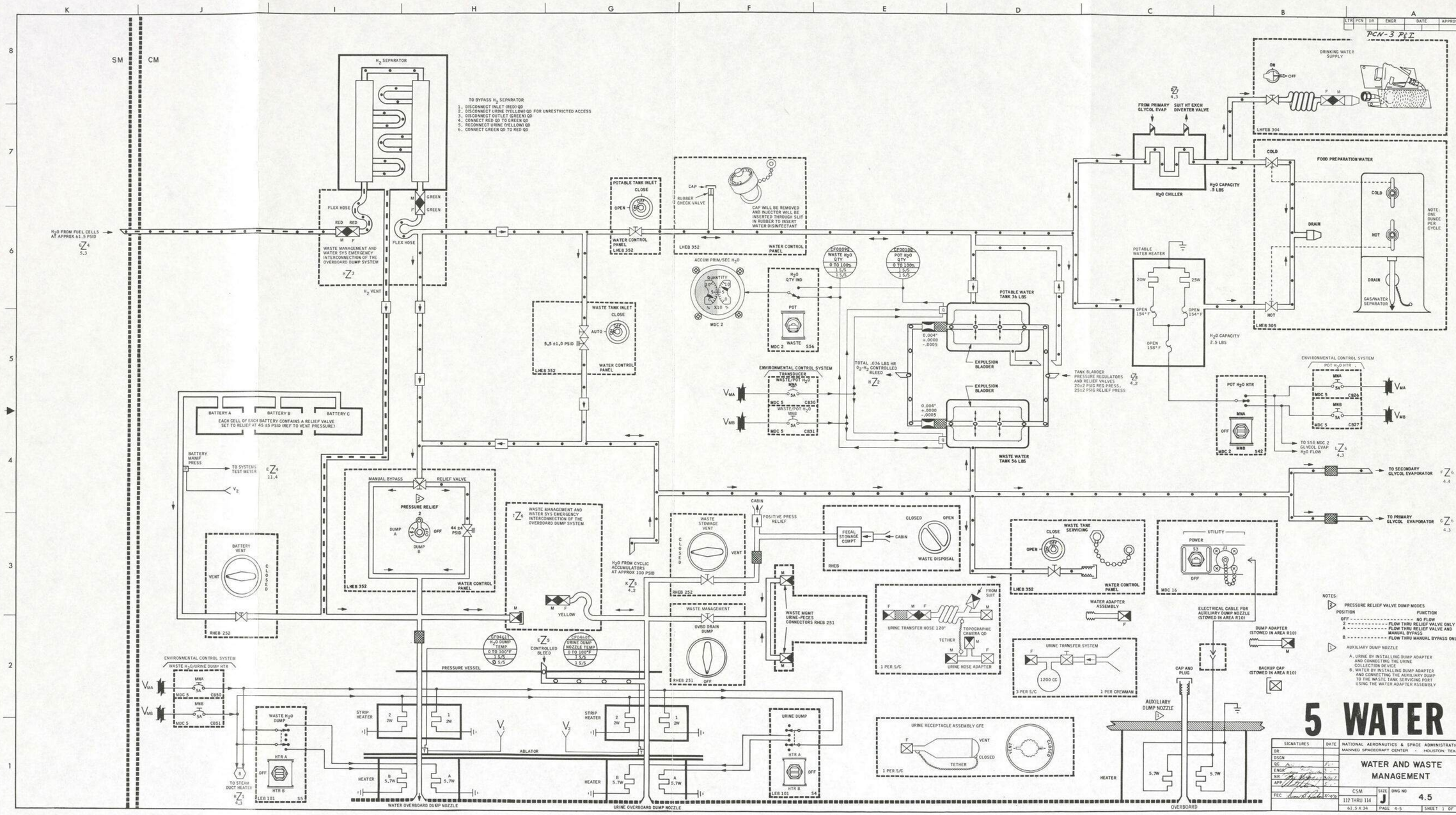
5 WATER

SIGNATURES	DATE
DR	
DSGN	
QC	
ENGR	
NR	4/14/71
APP	
FEC	5/14/71

NATIONAL AERONAUTICS & SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER · HOUSTON, TEXAS

WATER AND WASTE MANAGEMENT

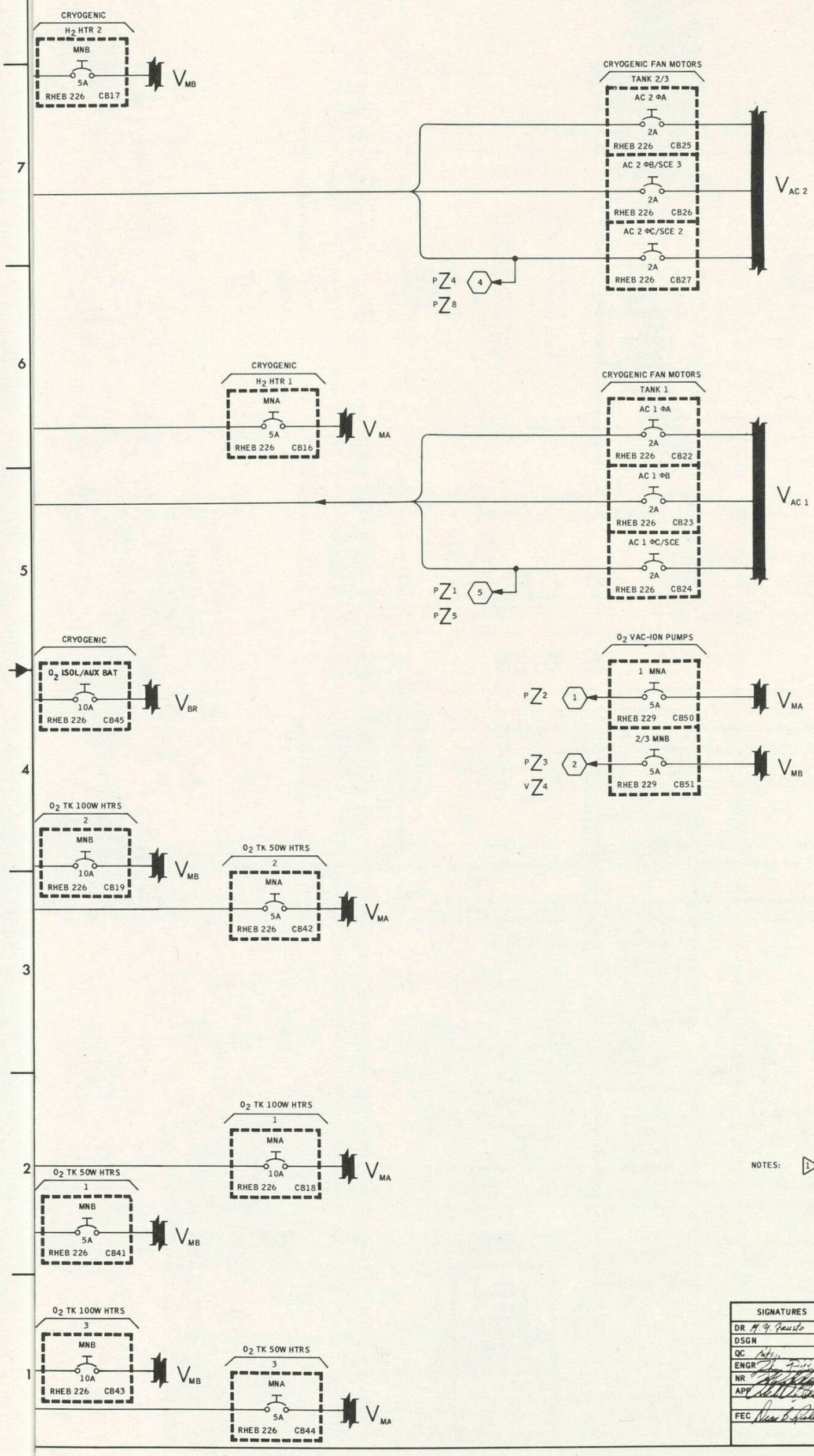
CSM	SIZE	DWG NO
112 THRU 114	J	4.5
61.5 X 34	PAGE 4-5	SHEET 1 OF 1


PCN-3 Pt I
SM
CM
H_2 SEPARATOR
TO BYPASS H_2 SEPARATOR
1. DISCONNECT INLET (RED) QD
2. DISCONNECT URINE (YELLOW) QD FOR UNRESTRICTED ACCESS
3. DISCONNECT OUTLET (GREEN) QD
4. CONNECT RED QD TO GREEN QD
5. RECONNECT URINE (YELLOW) QD
6. CONNECT GREEN QD TO RED QD
H_2O FROM FUEL CELLS AT APPROX 61.5 PSID
FLEX HOSE
WASTE MANAGEMENT AND WATER SYS EMERGENCY INTERCONNECTION OF THE OVERBOARD DUMP SYSTEM
H_2 VENT
POTABLE TANK INLET
CLOSE
OPEN
WATER CONTROL PANEL
LHEB 352
CAP
RUBBER CHECK VALVE
CAP WILL BE REMOVED AND INJECTOR WILL BE INSERTED THROUGH SLIT IN RUBBER TO INSERT WATER DISINFECTANT
ACCUM PRIM/SEC H_2O
QUANTITY
MDC 2
H_2O QTY IND
POT
WASTE
MDC 2 S56
WASTE TANK INLET
AUTO
5.5 ±1.0 PSID
ENVIRONMENTAL CONTROL SYSTEM
TRANSDUCER
WASTE/POT H_2O
MNA
MNB
MDC 5
CB30
CB31
V_{MA}
V_{MB}
TOTAL .036 LBS HR O_2-H_2 CONTROLLED BLEED
EXPULSION BLADDER
POTABLE WATER TANK 36 LBS
WASTE WATER TANK 36 LBS
TANK BLADDER PRESSURE REGULATORS AND RELIEF VALVES 20±2 PSIG REG PRESS., 25±2 PSIG RELIEF PRESS
FROM PRIMARY GLYCOL EVAP
SUIT HT EXCH DIVERTER VALVE
H_2O CHILLER
H_2O CAPACITY .5 LBS
H_2O CAPACITY 2.5 LBS
POTABLE WATER HEATER
20W
25W
OPEN 154°F
OPEN 158°F
DRINKING WATER SUPPLY
ON
OFF
LNFEB 304
FOOD PREPARATION WATER
COLD
HOT
DRAIN
GAS/WATER SEPARATOR
NOTE: ONE OUNCE PER CYCLE
LHEB 305
POT H_2O HTR
MNA
MNB
OFF
MDC 2 S42
TO SSB MDC 2 GLYCOL EVAP H_2O FLOW
TO SECONDARY GLYCOL EVAPORATOR
TO PRIMARY GLYCOL EVAPORATOR
BATTERY A
BATTERY B
BATTERY C
EACH CELL OF EACH BATTERY CONTAINS A RELIEF VALVE SET TO RELIEF AT 45 ±5 PSID (REF TO VENT PRESSURE)
BATTERY MANIF PRESS
TO SYSTEMS TEST METER
BATTERY VENT
VENT
CLOSED
RHEB 252
MANUAL BYPASS
RELIEF VALVE
PRESSURE RELIEF
DUMP A
DUMP B
OFF
44 ±4 PSID
WATER CONTROL PANEL
WASTE MANAGEMENT AND WATER SYS EMERGENCY INTERCONNECTION OF THE OVERBOARD DUMP SYSTEM
H_2O FROM CYCLIC ACCUMULATORS AT APPROX 100 PSID
YELLOW
WASTE STOWAGE VENT
CABIN
POSITIVE PRESS RELIEF
FECAL STOWAGE COMPT
WASTE DISPOSAL
WASTE MANAGEMENT
OVBD DRAIN DUMP
RHEB 251
WASTE MGMT URINE-FECES CONNECTORS RHEB 251
WASTE TANK SERVICING
WATER ADAPTER ASSEMBLY
UTILITY
POWER
MDC 16
URINE TRANSFER HOSE 120"
FROM SUIT
TOPOGRAPHIC CAMERA QD
TETHER
URINE HOSE ADAPTER
1 PER S/C
URINE TRANSFER SYSTEM
1200 CC
3 PER S/C
1 PER CREWMAN
ELECTRICAL CABLE FOR AUXILIARY DUMP NOZZLE (STOWED IN AREA R10)
DUMP ADAPTER (STOWED IN AREA R10)
BACKUP CAP (STOWED IN AREA R10)
CAP AND PLUG
AUXILIARY DUMP NOZZLE
CFD4617 H_2O DUMP TEMP 0 TO 100°F
CFD4607 URINE DUMP NOZZLE TEMP 0 TO 180°F
CONTROLLED BLEED
PRESSURE VESSEL
ENVIRONMENTAL CONTROL SYSTEM
WASTE H_2O/URINE DUMP HTR
WASTE H_2O DUMP
HTR A
HTR B
LEB 101 S5
TO STEAM DUCT HEATER
STRIP HEATER
ABLATOR
HEATER
WATER OVERBOARD DUMP NOZZLE
URINE DUMP
LEB 101 S4
URINE OVERBOARD DUMP NOZZLE
URINE RECEPTACLE ASSEMBLY GFE
VENT
CLOSED
TETHER
1 PER S/C
OVERBOARD
NOTES:
PRESSURE RELIEF VALVE DUMP MODES
POSITION — FUNCTION
OFF — NO FLOW
Z — FLOW THRU RELIEF VALVE ONLY
A — FLOW THRU RELIEF VALVE AND MANUAL BYPASS
B — FLOW THRU MANUAL BYPASS ONLY
AUXILIARY DUMP NOZZLE
A. URINE BY INSTALLING DUMP ADAPTER AND CONNECTING THE URINE COLLECTION DEVICE
B. WATER BY INSTALLING DUMP ADAPTER AND CONNECTING THE AUXILIARY DUMP TO THE WASTE TANK SERVICING PORT USING THE WATER ADAPTER ASSEMBLY
5 WATER
SIGNATURES
DATE
DR
DSGN
QC
ENGR
S/R
APP
FEC
NATIONAL AERONAUTICS & SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER - HOUSTON, TEXAS
WATER AND WASTE MANAGEMENT
CSM
112 THRU 114
SIZE J
DWG NO 4.5
61.5 X 34
PAGE 4-5
SHEET 1 OF 1

MEAS

LTR	PCN	DR	ENGR	DATE	APPROVAL
	3				

COMMENTS:



NOTES: 1 CLOSED - BARBERPOLE
OPEN - GRAY

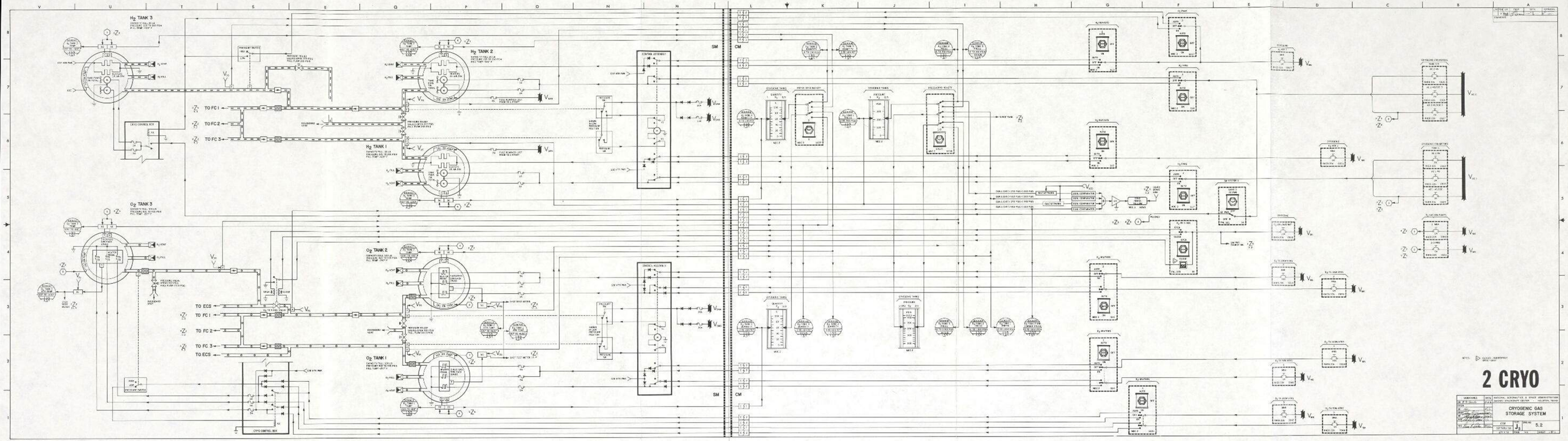
2 CRYO

SIGNATURES	DATE
DR M. Y. Fausto	12-18-70
DSGN	
QC	3/1/71
ENGR	3/10/71
NR	3/10/71
APP	3/10/71
FEC	3/12/71

NATIONAL AERONAUTICS & SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER · HOUSTON, TEXAS

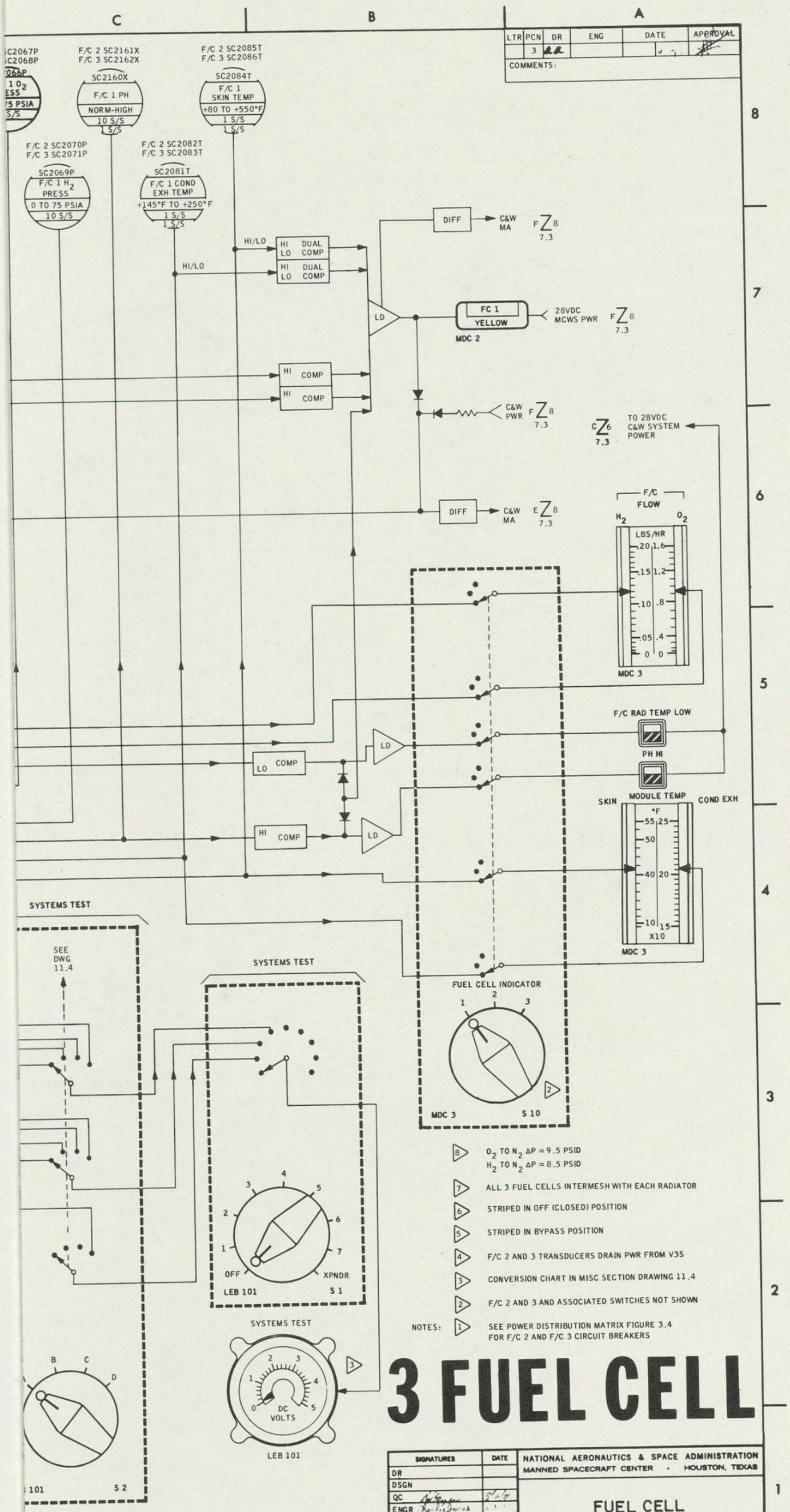
CRYOGENIC GAS STORAGE SYSTEM

CSM	SIZE	DWG NO
112 THRU 114	J_5	5.2
21 X 34	PAGE 5-2	SHEET 1 OF 1


H_2 TANK 3
H_2 TANK 2
H_2 TANK 1
O_2 TANK 3
O_2 TANK 2
O_2 TANK 1
TO FC 1
TO FC 2
TO FC 3
TO ECS
CRYO CONTROL BOX
CONTROL ASSEMBLY
SM
CM
2 CRYO
CRYOGENIC GAS
STORAGE SYSTEM
NATIONAL AERONAUTICS & SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER
HOUSTON, TEXAS
5.2

LTR	PCN	DR	ENG	DATE	APPROVAL
	3				

COMMENTS:



NOTES:

1. SEE POWER DISTRIBUTION MATRIX FIGURE 3.4 FOR F/C 2 AND F/C 3 CIRCUIT BREAKERS
2. F/C 2 AND 3 AND ASSOCIATED SWITCHES NOT SHOWN
3. CONVERSION CHART IN MISC SECTION DRAWING 11.4
4. F/C 2 AND 3 TRANSDUCERS DRAIN PWR FROM V3S
5. STRIPED IN BYPASS POSITION
6. STRIPED IN OFF (CLOSED) POSITION
7. ALL 3 FUEL CELLS INTERMESH WITH EACH RADIATOR
8. O_2 TO N_2 $\Delta P = 9.5$ PSID; H_2 TO N_2 $\Delta P = 8.5$ PSID

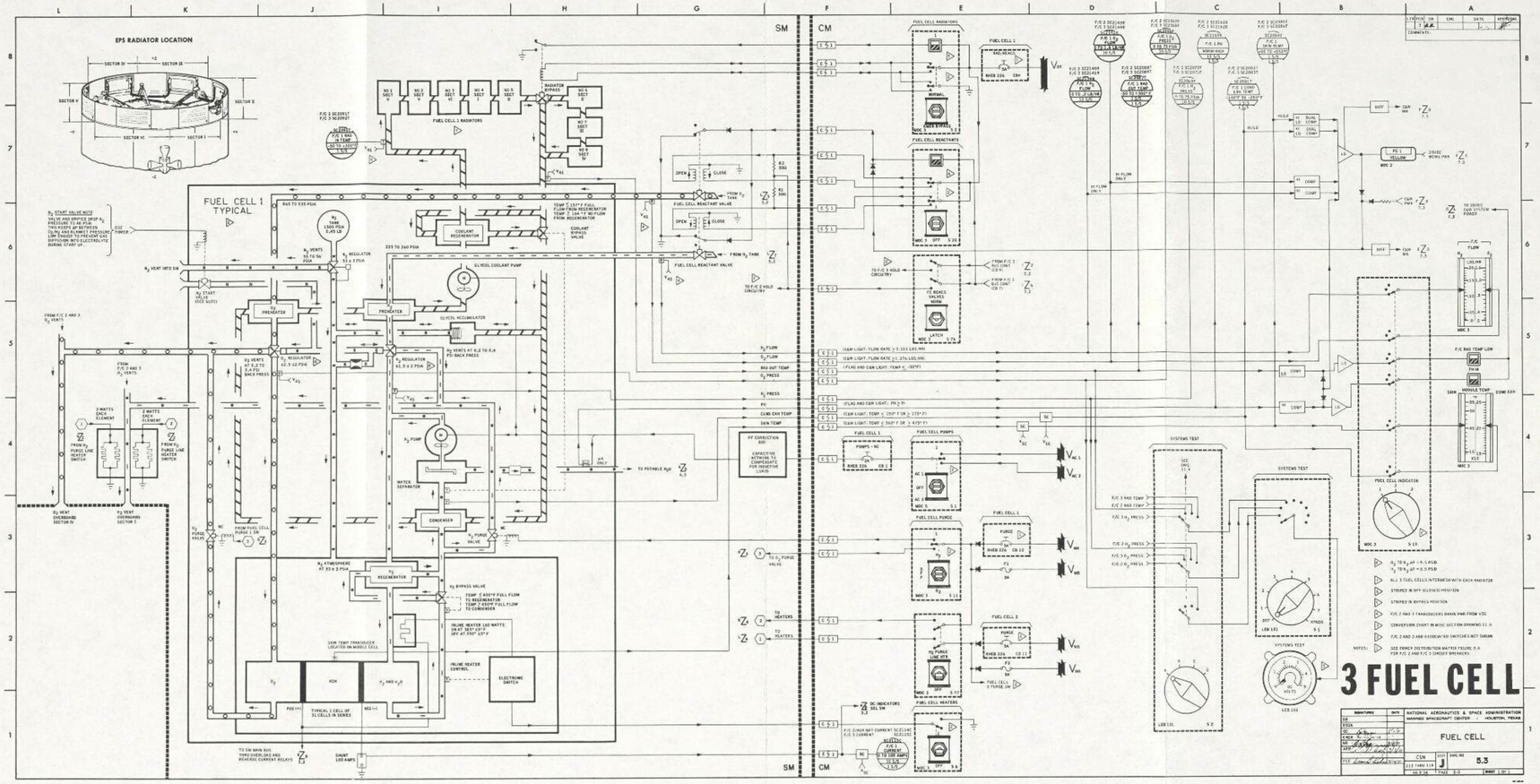
3 FUEL CELL

SIGNATURES	DATE
DR	
DSGN	
QC	
ENGR	
NR	3/4/71
APP	3/7/71
FEC	3/14/71

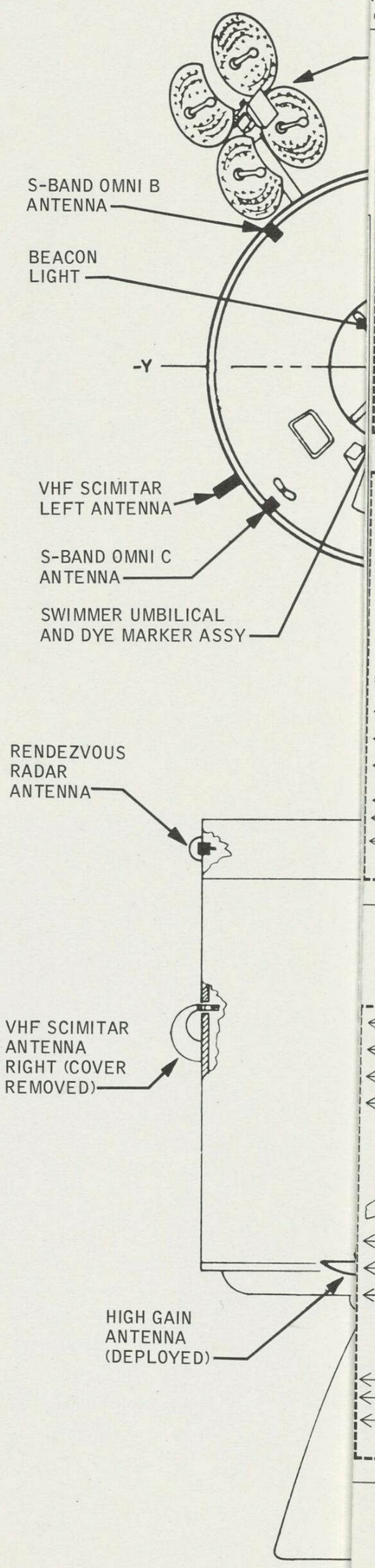
NATIONAL AERONAUTICS & SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER · HOUSTON, TEXAS

FUEL CELL

CSM	SIZE	DWG NO
112 THRU 114	J	5.3
66 X 34	PAGE 5-3	SHEET 1 OF 1


EPS RADIATOR LOCATION
FUEL CELL 1 TYPICAL
FUEL CELL 3 RADIATORS
FUEL CELL RADIATORS
FUEL CELL REACTANTS
FUEL CELL PUMPS
FUEL CELL PURGE
FUEL CELL HEATERS
SYSTEMS TEST
3 FUEL CELL
FUEL CELL
NATIONAL AERONAUTICS & SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER HOUSTON, TEXAS
5.3

MEAS



LTR	PCN	DR	ENGR	DATE	APPROVAL
	3				

COMMENTS

BIOMED INST SIGNALS
BIOMED INST PWR
RIGHT MIKE PWR
LEFT MIKE PWR
C&W TONE
VOICE
EARPHONES
MIKES
RIGHT COUCH SPACESUIT
SUIT PRESSURE ALARM, EVA
EVA UMBILICAL
PNL 603
LEFT CREW STATION AUDIO (CB7)
CENTER ICOM/XMIT CONTROL HEAD
CENTER COUCH SPACESUIT
SUIT CABLE
PTT
SCS ROTATION CONTROL NO 1
LEFT ICOM/XMIT CONTROL HEAD
LEFT COUCH SPACESUIT
SCS ROTATION CONTROL NO 2

POST LANDING
BCN LT HI
BCN LT LO
MDC 15 S3
VHF BCN
ON
OFF
MDC 3 S45
VHF RECOVERY BEACON
J2/P112 243 MHZ
FROM VHF ANT SWITCH
TO S6, MDC 8 FLOAT BAG FILL - OFF - VENT SWITCH
AUDIO CENTER
DYE MARKER
MDC 15 S2
FLOAT BAG
FLT/PL
MDC 8 CB8
V_{FP}

TIED TO MAIN PARACHUTE RISERS
WHITE
BEACON LIGHT
BEACON LIGHT DEPLOY INITIATE LINE
8 SECOND DELAY PYRO ACTUATED DEPLOY MECHANISM
BEACON LIGHT
BEACON LIGHT POWER SUPPLY
BEACON LIGHT TRIGGER UNIT
LO HI
FLASH DURATION 10 μS 5μS
FLASH RATE 15/MIN 120/MIN
INTENSITY 1.2 CANDLE SEC 1.0 CANDLE SEC
TIED TO PARACHUTE RISERS
VHF RECOVERY ANT NO 2
243.0 MAX XMIT
ANT DEPLOY INITIATE LINE ACTUATED BY MAIN PARACHUTE DEPLOYMENT
RCVRY ANT NO 1
ANT DEPLOY INITIATE LINE
TIED TO PARACHUTE RISERS
SWIMMER UMBILICAL AND DYE MARKER ASSY
YELLOW GREEN DYE MARKER
ELECTRO MECHANICAL DEPLOY MECHANISM
SWIMMER UMBILICAL DEPLOYS WITH DYE MARKER TO A LENGTH OF 8 FEET, DYE MARKER LIFE IS 12 HOURS NOMINAL
CM
CM FORWARD COMPARTMENT

2 FOR EVA, SUIT UMBILICAL IS DISCONNECTED AT CONTROL HEAD AND CONNECTED TO PNL 603. THE EVA UMBILICAL IS CONNECTED BETWEEN PNL 603 AND SUIT CABLE. NORMAL COMM CONFIGURATION IS SAME AS SHOWN FOR LEFT COUCH

1 COMM CARRIER HEADSET SHOWN. LIGHTWEIGHT HEADSET HAS ONLY THE RIGHT MIKE AND ONE EARPHONE. POWER TO THE LWHS MIKE IS SUPPLIED THRU THE BACKUP CREW STATION AUDIO CIRCUIT BREAKER. NORMALLY THE CREW AUDIO STATION ASSIGNMENT IS LMP-RIGHT, CMP-CENTER AND CDR-LEFT.

1 COMM

SIGNATURES	DATE
DR	
DSGN	
QC	8/5/71
ENGR	
NR	
APP	
FEC	8/5/71

NATIONAL AERONAUTICS & SPACE ADMINISTRATION
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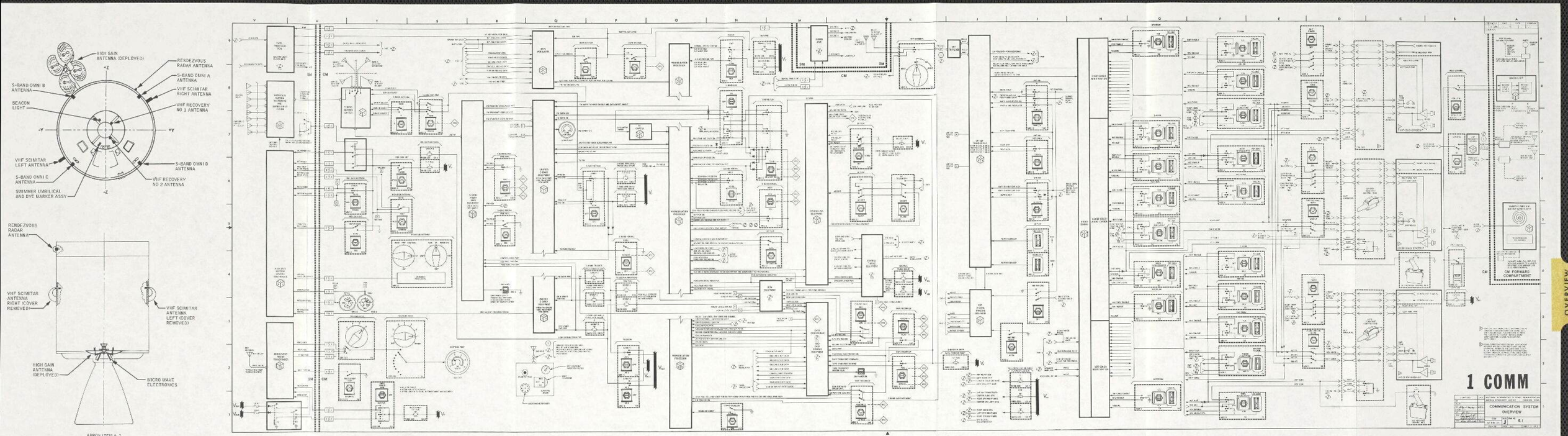
COMMUNICATION SYSTEM OVERVIEW

CSM	SIZE	DWG NO
112 THRU 114	J	6.1
121 X 38	PAGE 6-1	SHEET 1 OF 1

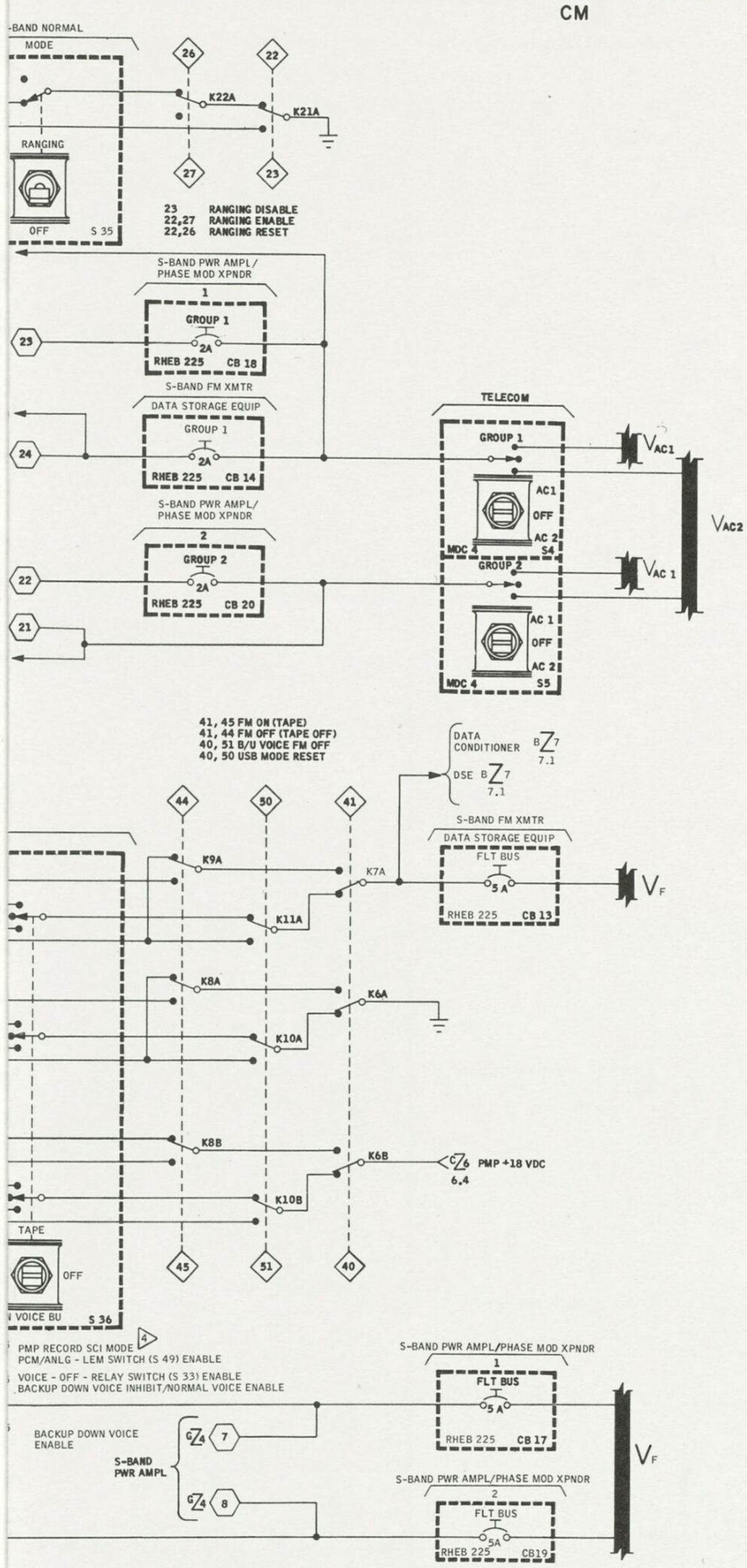
PWR/CNTL
C&W
SCS PWR
SCS
OVERVIEW
COMM
UNIFIED S-BAND RF
PREMOD PROCESS


HIGH GAIN ANTENNA (DEPLOYED)
RENDEZVOUS RADAR ANTENNA
S-BAND OMNI A ANTENNA
VHF SCIMITAR RIGHT ANTENNA
VHF RECOVERY NO 1 ANTENNA
S-BAND OMNI B ANTENNA
BEACON LIGHT
VHF SCIMITAR LEFT ANTENNA
S-BAND OMNI C ANTENNA
SWIMMER UMBILICAL AND DYE MARKER ASSY
S-BAND OMNI D ANTENNA
VHF RECOVERY NO 2 ANTENNA
RENDEZVOUS RADAR ANTENNA
VHF SCIMITAR ANTENNA RIGHT (COVER REMOVED)
VHF SCIMITAR ANTENNA LEFT (COVER REMOVED)
HIGH GAIN ANTENNA (DEPLOYED)
MICRO WAVE ELECTRONICS
APRON ITEM 6.1
CM FORWARD COMPARTMENT
1 COMM
COMMUNICATION SYSTEM OVERVIEW
OVERVIEW

LTR	PCN	DR	ENG	DATE	APPROVAL

COMMENTS: PCN-3 PEI

CM



TA TO PMP

TCHING RELAY K6 SET
CT OUTPUTS

QUENCY IS TRANSFERRED FROM
NCY TO RCVR VCO DEPENDENCY
SE LOCK IS ACHIEVED

BETWEEN PRIM - SEC MODES,
OP AT CENTER POSITION TO
USB TO SWITCH

2 S-BAND

SIGNATURES	DATE
DR	
DSGN	
QC	3/5/71
ENGR	
NR	
APP	
	2/23/71
FEC	3/16/71

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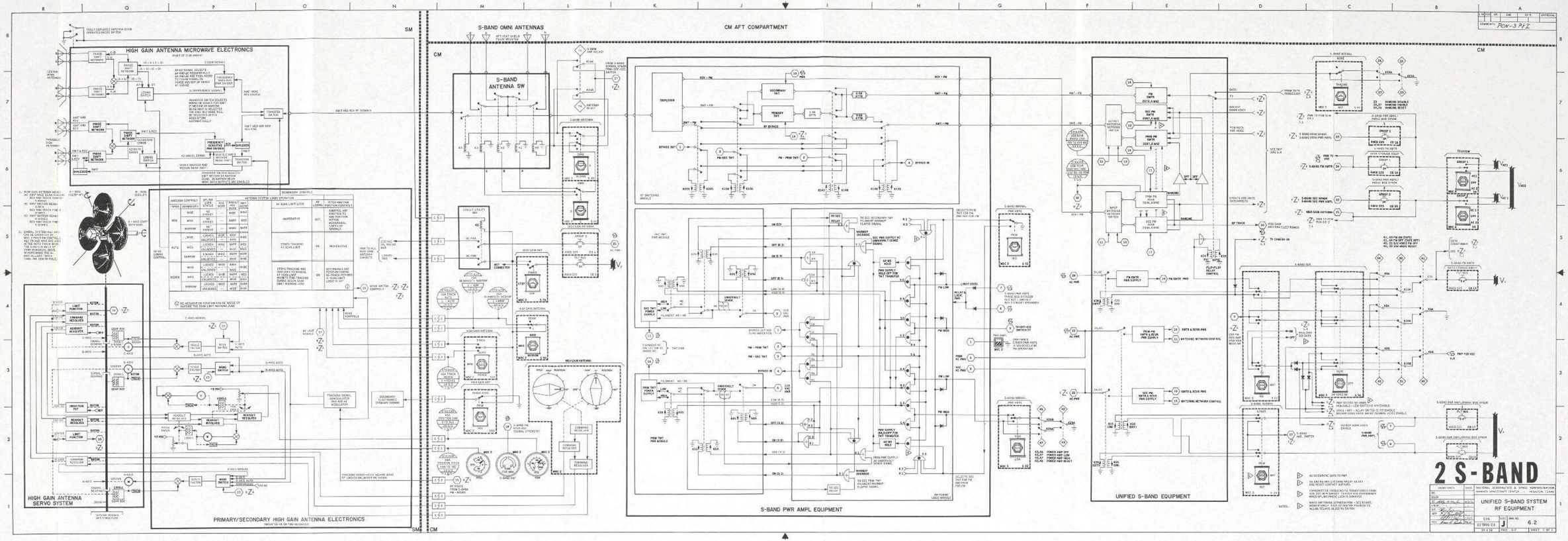
UNIFIED S-BAND SYSTEM
RF EQUIPMENT

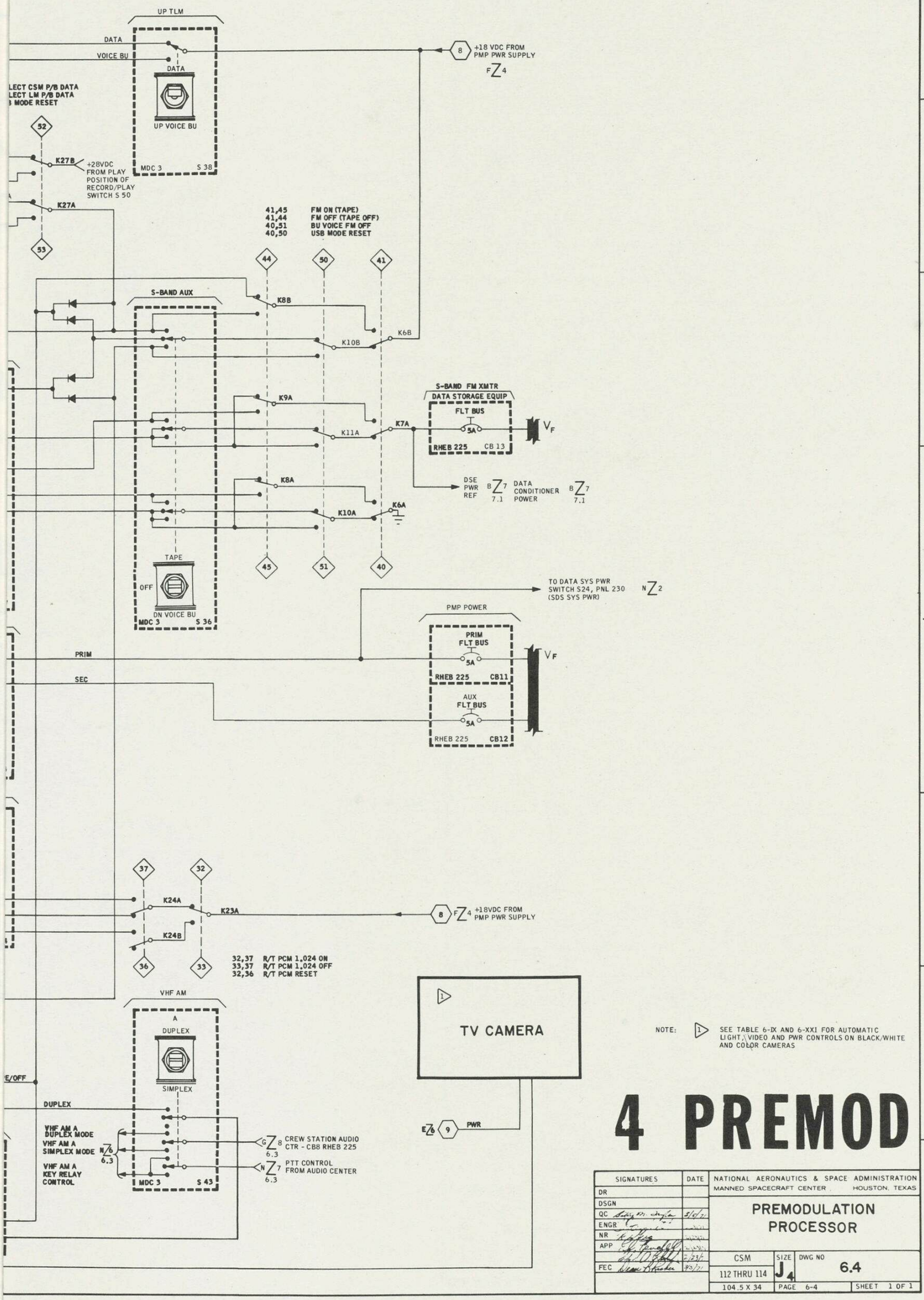
CSM	SIZE	DWG NO
112 THRU 114	J	6.2
99 X 34	PAGE 6-2	SHEET 1 OF 1

PWR/CNTL
C&W
SCS PWR
SCS
DISTR G&N PWR
UNIFIED S-BAND RF
PREMOD PROCESS


HIGH GAIN ANTENNA MICROWAVE ELECTRONICS
HIGH GAIN ANTENNA SERVO SYSTEM
PRIMARY/SECONDARY HIGH GAIN ANTENNA ELECTRONICS
S-BAND OMNI ANTENNAS
CM AFT COMPARTMENT
S-BAND ANTENNA SW
S-BAND PWR AMPL EQUIPMENT
UNIFIED S-BAND EQUIPMENT
2 S-BAND
UNIFIED S-BAND SYSTEM
RF EQUIPMENT
NATIONAL AERONAUTICS & SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER - HOUSTON, TEXAS
J
6.2
SM
CM

LTR	PCN	DR	ENG	DATE	APPROVAL
	3				

COMMENTS:



NOTE: 1 SEE TABLE 6-IX AND 6-XXI FOR AUTOMATIC LIGHT, VIDEO AND PWR CONTROLS ON BLACK/WHITE AND COLOR CAMERAS

4 PREMOD

SIGNATURES	DATE
DR	
DSGN	
QC	5/5/71
ENGR	
NR	
APP	
	5/23/71
FEC	5/5/71

NATIONAL AERONAUTICS & SPACE ADMINISTRATION
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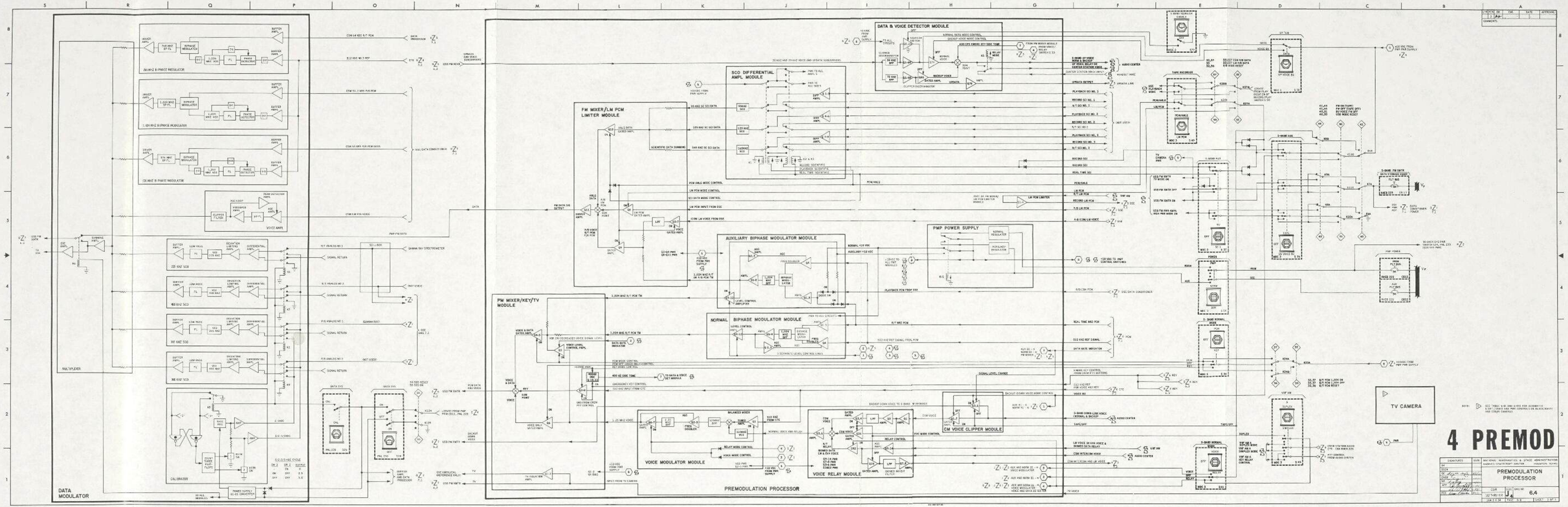
PREMODULATION PROCESSOR

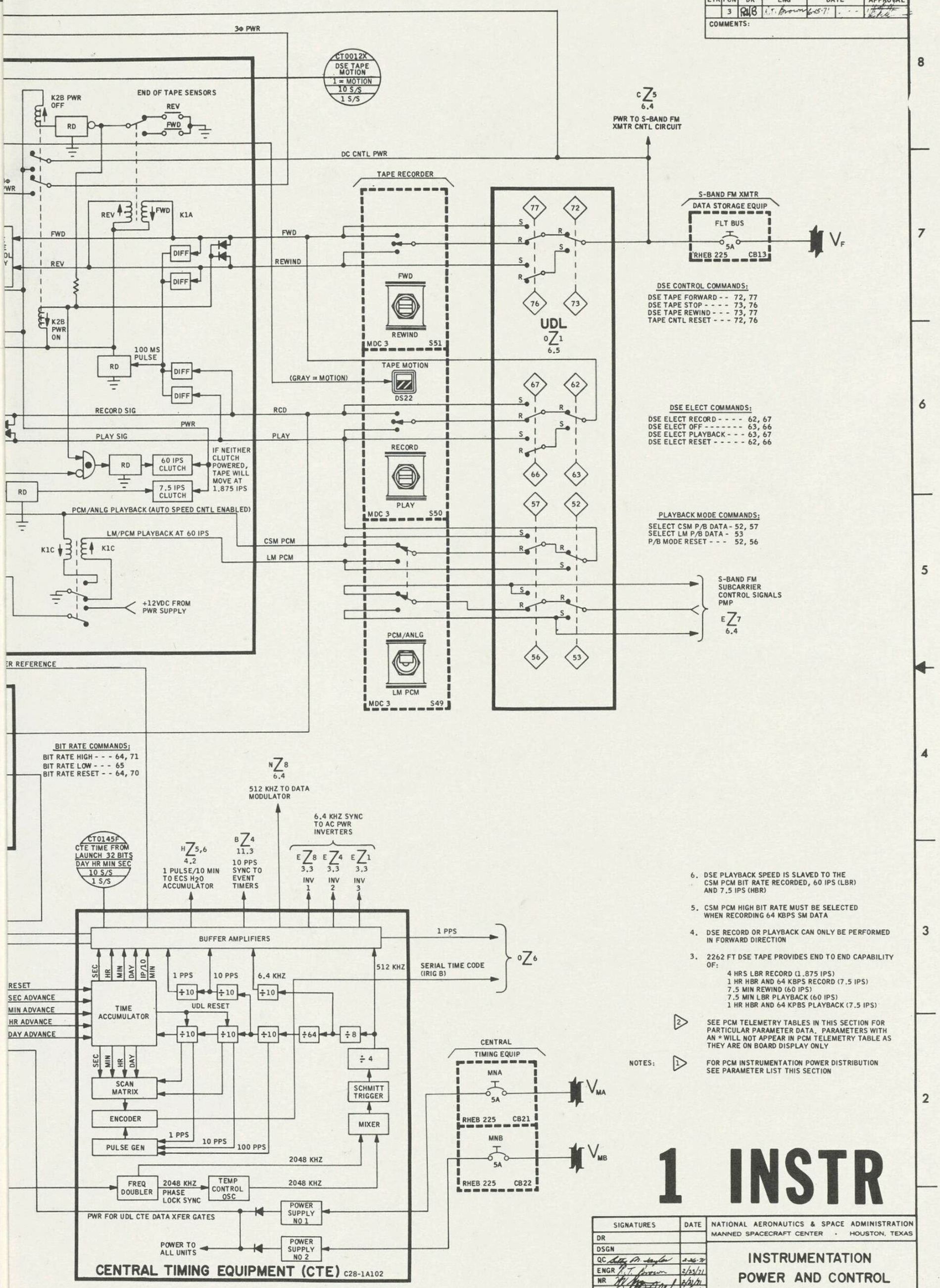
CSM	SIZE	DWG NO
112 THRU 114	J4	6.4
104.5 X 34	PAGE 6-4	SHEET 1 OF 1

PWR/CNTL
C&W
SCS PWR
SCS
DISK C&N PWR
INERTIAL SUBSYSTEM
PREMOD PROCESS


DATA MODULATOR
PREMODULATION PROCESSOR
FM MIXER/LM PCM LIMITER MODULE
SCO DIFFERENTIAL AMPL MODULE
DATA & VOICE DETECTOR MODULE
AUXILIARY BIPHASE MODULATOR MODULE
NORMAL BIPHASE MODULATOR MODULE
PMP POWER SUPPLY
PM MIXER/KEY/TV MODULE
VOICE MODULATOR MODULE
VOICE RELAY MODULE
CM VOICE CLIPPER MODULE
TV CAMERA
4 PREMOD
PREMODULATION PROCESSOR
PREMOD PROCESS

LTR	PCN	DR	ENG	DATE	APPROVAL
	3	RJB	L.T. Brown	6-5-71	

COMMENTS:



6. DSE PLAYBACK SPEED IS SLAVED TO THE CSM PCM BIT RATE RECORDED, 60 IPS (LBR) AND 7.5 IPS (HBR)

5. CSM PCM HIGH BIT RATE MUST BE SELECTED WHEN RECORDING 64 KBPS SM DATA

4. DSE RECORD OR PLAYBACK CAN ONLY BE PERFORMED IN FORWARD DIRECTION

3. 2262 FT DSE TAPE PROVIDES END TO END CAPABILITY OF:
   - 4 HRS LBR RECORD (1.875 IPS)
   - 1 HR HBR AND 64 KBPS RECORD (7.5 IPS)
   - 7.5 MIN REWIND (60 IPS)
   - 7.5 MIN LBR PLAYBACK (60 IPS)
   - 1 HR HBR AND 64 KPBS PLAYBACK (7.5 IPS)

NOTES:

2 SEE PCM TELEMETRY TABLES IN THIS SECTION FOR PARTICULAR PARAMETER DATA. PARAMETERS WITH AN * WILL NOT APPEAR IN PCM TELEMETRY TABLE AS THEY ARE ON BOARD DISPLAY ONLY

1 FOR PCM INSTRUMENTATION POWER DISTRIBUTION SEE PARAMETER LIST THIS SECTION

1 INSTR

SIGNATURES	DATE
DR	
DSGN	
QC	2-26-71
ENGR	2/25/71
NR	2/25/71
APP	2/25/71
FEC	2-26-71

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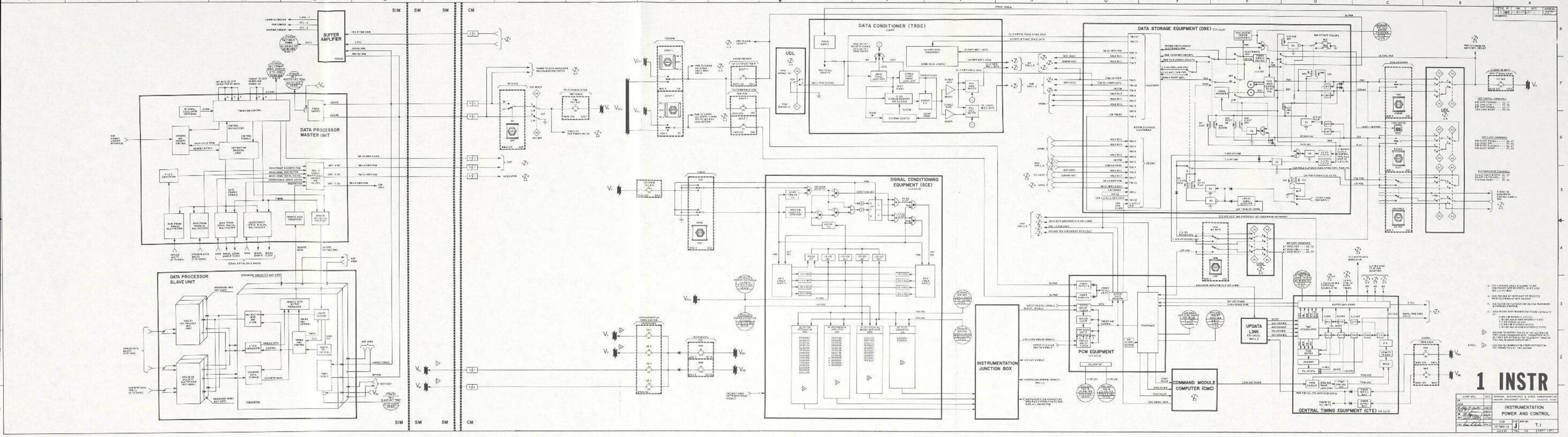
INSTRUMENTATION POWER AND CONTROL

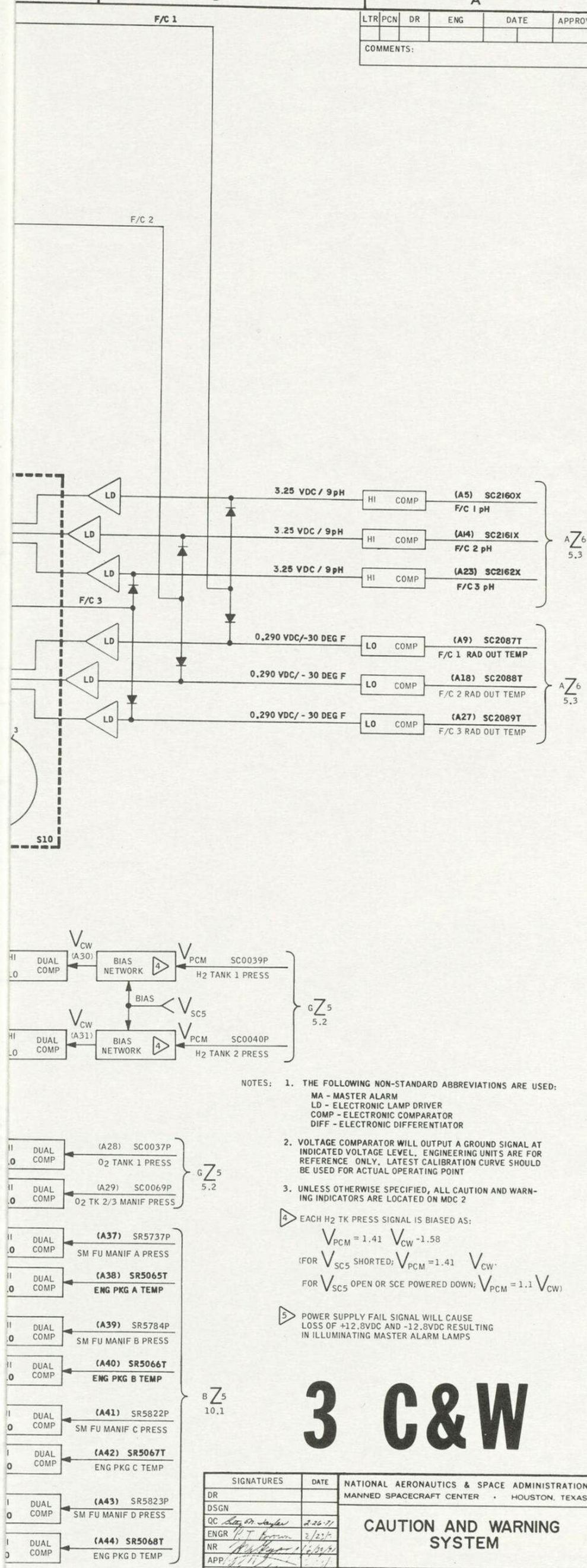
CSM	SIZE	DWG NO
112 THRU 114	J	7.1
121 X 34	PAGE 7-9	SHEET 1 OF 1

INSTR PWR/CNTL
C&W
DISTR SCS PWR
SCS
DISTR G&N PWR
INERTIAL SUBSYSTEM
OPTICS


BUFFER AMPLIFIER
DATA PROCESSOR MASTER UNIT
DATA PROCESSOR SLAVE UNIT
DATA CONDITIONER (TRDC)
UDL
SIGNAL CONDITIONING EQUIPMENT (SCE)
DATA STORAGE EQUIPMENT (DSE)
PCM EQUIPMENT
INSTRUMENTATION JUNCTION BOX
COMMAND MODULE COMPUTER (CMC)
UPDATA LINK
CENTRAL TIMING EQUIPMENT (CTE)
SIM
SM
CM
1 INSTR
INSTRUMENTATION POWER AND CONTROL
7.1

LTR	PCN	DR	ENG	DATE		APPROVAL

COMMENTS:



NOTES:

1. THE FOLLOWING NON-STANDARD ABBREVIATIONS ARE USED:
   MA - MASTER ALARM
   LD - ELECTRONIC LAMP DRIVER
   COMP - ELECTRONIC COMPARATOR
   DIFF - ELECTRONIC DIFFERENTIATOR
2. VOLTAGE COMPARATOR WILL OUTPUT A GROUND SIGNAL AT INDICATED VOLTAGE LEVEL. ENGINEERING UNITS ARE FOR REFERENCE ONLY. LATEST CALIBRATION CURVE SHOULD BE USED FOR ACTUAL OPERATING POINT
3. UNLESS OTHERWISE SPECIFIED, ALL CAUTION AND WARNING INDICATORS ARE LOCATED ON MDC 2

4 EACH H_2 TK PRESS SIGNAL IS BIASED AS:

$V_{PCM} = 1.41\ V_{CW} - 1.58$

(FOR V_{SC5} SHORTED; $V_{PCM} = 1.41\ V_{CW}$.

FOR V_{SC5} OPEN OR SCE POWERED DOWN; $V_{PCM} = 1.1\ V_{CW}$)

5 POWER SUPPLY FAIL SIGNAL WILL CAUSE LOSS OF +12.8VDC AND -12.8VDC RESULTING IN ILLUMINATING MASTER ALARM LAMPS

3 C&W

SIGNATURES	DATE
DR	
DSGN	
QC	2-26-71
ENGR	2/22/71
NR	2/22/71
APP	
FEC	2-26-71

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CAUTION AND WARNING SYSTEM

CSM	SIZE	DWG NO
112 THRU 114	J	7.3
82.5 X 34	PAGE 7-39	SHEET 1 OF 1

3 C&W

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CAUTION AND WARNING SYSTEM

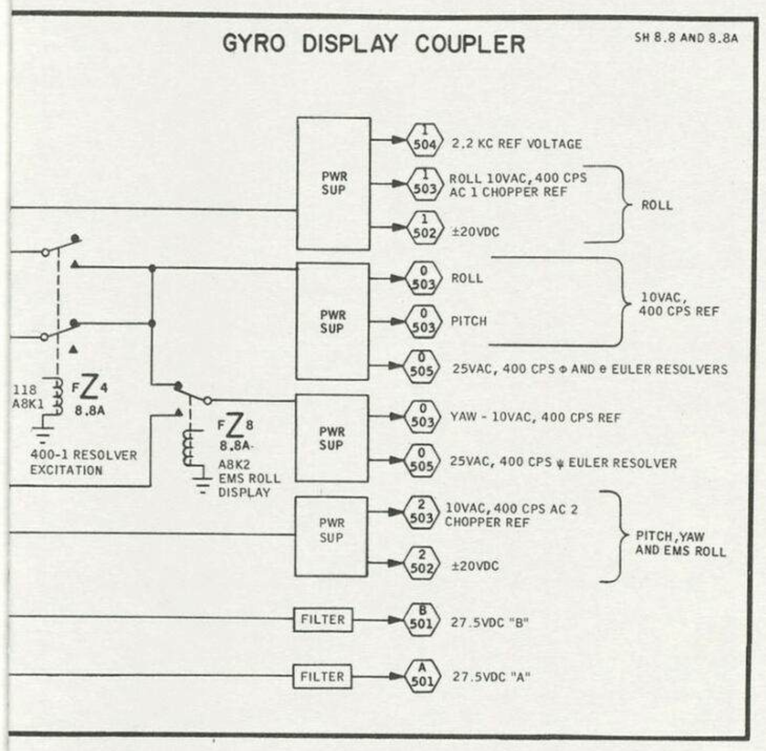
CODE IDENT NO. J — DWG NO. 7.3

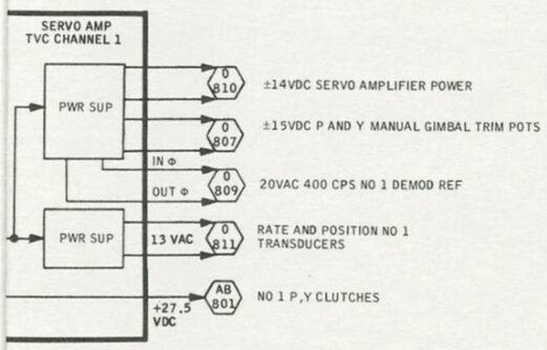
122 DWG 114 — 32.3.9.14 — PAGE 7-34 — SHEET 1 OF 1

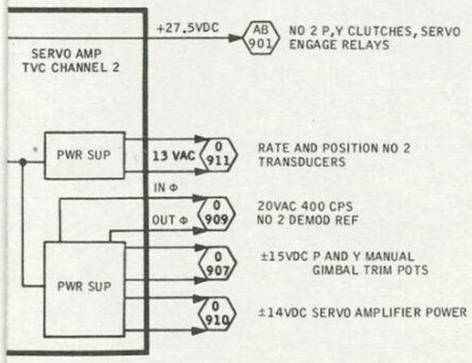
SIGNATURES: DR, CHKD, ENGR, REV, REV, REV

LTR	PCN	DR	ENGR	DATE	APPROVAL

COMMENTS:







7 SCS PWR

SIGNATURES	DATE
DR	
DSGN	
QC	
ENGR	3/12/71
NR	
APP	3/12/71
	3/15/71
FEC	3/15/71

NATIONAL AERONAUTICS & SPACE ADMINISTRATION
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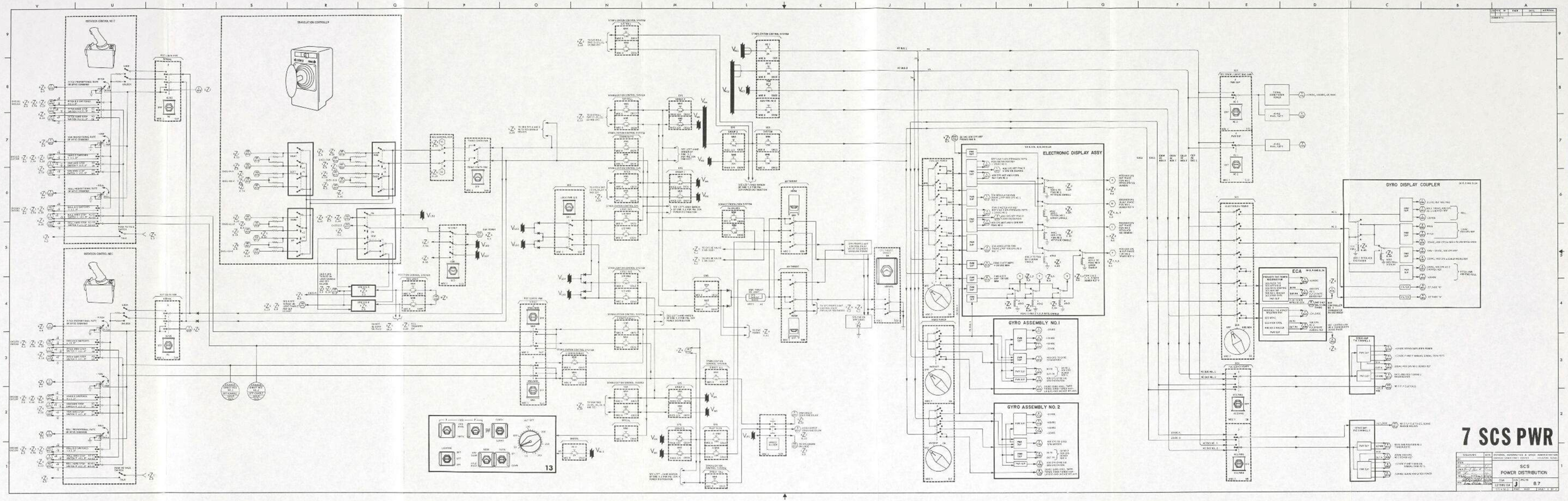
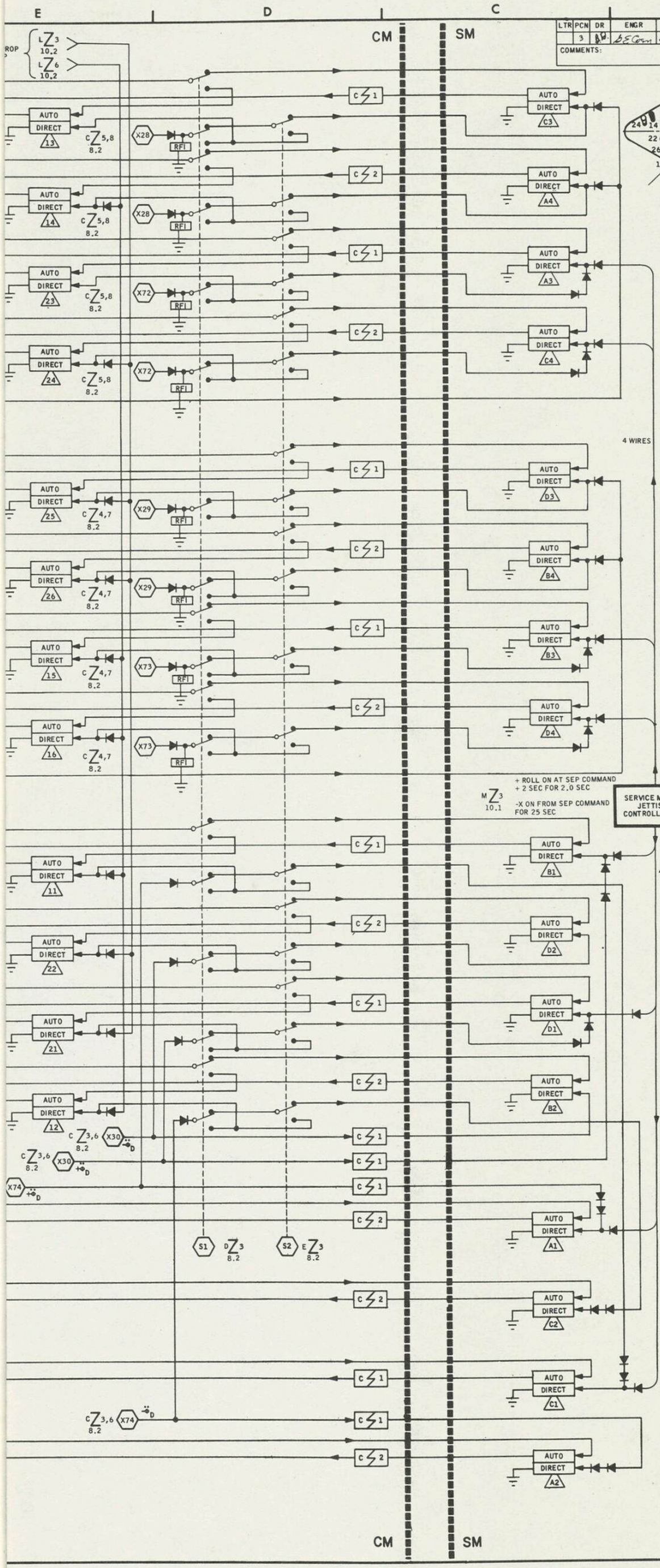
SCS
POWER DISTRIBUTION

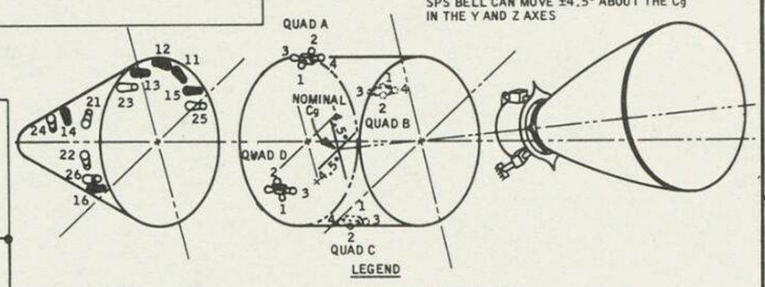
CSM	SIZE	DWG NO
112 THRU 114	J	8.7
121 X 38.5	PAGE 8-23	SHEET 1 OF 1


7 SCS PWR
SCS
POWER DISTRIBUTION
8.7
ELECTRONIC DISPLAY ASSY
GYRO ASSEMBLY NO. 1
GYRO ASSEMBLY NO. 2
GYRO DISPLAY COUPLER
ECA
TRANSLATION CONTROLLER
13
DISTR
SCS PWR

LTR	PCN	DR	ENGR	DATE	APPROVAL
	3			6/14	

COMMENTS:





THE NOMINAL Cg IS LOCATED 2" BELOW THE SPACECRAFT X-Y PLANE AND 1" TO THE LEFT OF THE SPACECRAFT X-Z PLANE. SPS BELL CAN MOVE ±4.5" ABOUT THE Cg IN THE Y AND Z AXES

LEGEND

GREEK SYMBOLS:

- θ_ξ EULER PITCH ATTITUDE
- ψ_ξ EULER YAW ATTITUDE
- ϕ_ξ EULER ROLL ATTITUDE
- θ PITCH BODY AXIS ACCELERATION
- ψ YAW BODY AXIS ACCELERATION
- ϕ ROLL BODY AXIS ACCELERATION
- θ_D PITCH DIRECT RCS COMMAND
- ψ_D YAW DIRECT RCS COMMAND
- ϕ_D ROLL DIRECT RCS COMMAND

ALPHA AND NUMERIC:

X,Y OR Z TRANSLATION ACCELLERATIONS (COMMANDED ALONG THE X,Y OR Z S/C AXIS)

BOOLEAN EQUATIONS:

BOOLEAN LOGIC EQUATIONS (<TC-CW>), ARE USED IN PLACE OF RELAYS AND SWITCHES TO SIMPLIFY THE DRAWING. THE EXPRESSION <TC-CW> INDICATES THAT CIRCUIT EXISTS WHEN THE TRANSLATION CONTROLLER IS IN THE CLOCKWISE POSITION. <TC-CW> (READ TC-CW "NOT" OR TC-CW "BAR") INDICATES A CIRCUIT WHEN THE TRANSLATION CONTROLLER IS NOT IN THE CLOCKWISE POSITION.

OTHER EXAMPLES:

<THRUST ON> = THRUST ON BUTTON NOT DEPRESSED

<GFS> = THE OVERCURRENT SENSOR IN THE SPS GIMBAL MOTOR OVERCURRENT MONITOR HAS SWITCHED FROM GIMBAL MOTOR 1 TO GIMBAL MOTOR 2

HEXAGON REFERENCE:
COMPLEX NUMBERS ARE EXPLAINED AS FOLLOWS:

TOP ALPHA NUMERICS INDICATE THE POWER SOURCE

A - VMA
AB - VMA & VMB
0 - VAC 1 AND/OR VAC 2
1 - VAC 1
2 - VAC 2

(A 2XX) THE FIRST LETTER OR NUMBER OF THE LOWER 3 DIGITS INDICATES THE SWITCH NUMBER IF POWER IS DERIVED FROM A POWER SWITCH, OTHERWISE X IS USED

(A 215) THE SECOND TWO LETTERS OR NUMBERS OF THE LOWER 3 DIGITS INDICATES A PARTICULAR TYPE OF POWER; IN THIS CASE 28 VDC. FOR OTHER CODING SEE NOTES, PAGE 8.7

(18) INTERDRAWING TIE POINT. THE NUMBERS ARE NOT CODED

MEAS ID	MEASUREMENT DESCRIPTION	MEAS ID	MEASUREMENT DESCRIPTION
CH3500H	PITCH FDAI ATT ERR	CH3583V	SCS TVC AUTO CMD YAW
CH3501H	YAW FDAI ATT ERR	CH3585H	ROT CONT/MTVC PITCH CMD
CH3502H	ROLL FDAI ATT ERR	CH3586H	ROT CONT/MTVC YAW CMD
CH3503R	SCS FDAI PITCH BODY RATE	CH3587H	ROT CONT/ROLL CMD
CH3504R	SCS FDAI YAW BODY RATE	CH3588X	ATT DEADBAND MIN
CH3505R	SCS FDAI ROLL BODY RATE	CH3590X	HI RATE LIMIT
CH3517H	PITCH GMBL POS 1 OR 2	CH3592X	FDAI ERR 5 RATE 5
CH3518H	YAW GMBL POS 1 OR 2	CH3593X	FDAI ERR 50/15 RATE 50/10
CH3546X	C3/13/+X	CH3600X	ΔV CG LM/CSM
CH3547X	A4/14/+X	CH3601X	DIRECT RCS 1 ENABLE
CH3548X	A3/23/-X	CH3602X	DIRECT RCS 2 ENABLE
CH3549X	C4/24/-X	CH3604X	SPS SOLENOID DRIVER 1
CH3550X	D3/25/+X	CH3605X	SPS SOLENOID DRIVER 2
CH3551X	B4/26/+X	CH3606X	LIMIT CYCLE OFF
CH3552X	B3/15/-X	CH3607X	S/C CONT SCS
CH3553X	D4/16/-X	CH3609X	ROLL MAN ATT ACCEL CMD
CH3554X	B1/11/+Z	CH3610X	ROLL MAN ATT MIN IMP CMD
CH3555X	D2/22/+Z	CH3612X	PITCH MAN ATT ACCEL CMD
CH3556X	D1/21/-Z	CH3613X	PITCH MAN ATT MIN IMP CMD
CH3557X	B2/12/-Z	CH3615X	YAW MAN ATT ACCEL CMD
CH3558X	A1/+Y	CH3616X	YAW MAN ATT MIN IMP CMD
CH3559X	C2/+Y	CH3623X	GYRO 1 COMB SMRD
CH3560X	C1/-Y	CH3624X	GYRO 2 COMB SMRD
CH3561X	A2/-Y	CH3635X	BMAG MODE SW - ROLL ATT 1 RATE 2
CH3574X	TRANS CONT +X CMD	CH3636X	BMAG MODE SW - ROLL RATE 2
CH3575X	TRANS CONT -X CMD	CH3638X	BMAG MODE SW - PITCH ATT 1 RATE 2
CH3576X	TRANS CONT +Y CMD	CH3639X	BMAG MODE SW - PITCH RATE 2
CH3577X	TRANS CONT -Y CMD	CH3641X	BMAG MODE SW - YAW ATT 1 RATE 2
CH3578X	TRANS CONT +Z CMD	CH3642X	BMAG MODE SW - YAW RATE 2
CH3579X	TRANS CONT -Z CMD	CH3666C	TVC PITCH DIFF CURRENT
CH3582V	SCS TVC AUTO CMD PITCH	CH3667C	TVC YAW DIFF CURRENT

SWITCH	POSITION POWERED	
LOGIC BUS 1		
BMAG MODE PITCH	RATE 1	U Z 9
BMAG MODE YAW	RATE 1	U Z 6
BMAG MODE ROLL	RATE 1	U Z 4
TVC GIMBAL DRIVE PITCH	AUTO	I Z 4
TVC GIMBAL DRIVE YAW	AUTO	I Z 1
SCS THRUST ON	DEPRESSED	Q Z 1
DIRECT ULLAGE (SCS THRUST ON ENABLE LOGIC)	DEPRESSED	P Z 2
RATE	HIGH	T Z 2
LIMIT CYCLE	OFF	R Z 1
MANUAL ATT PITCH	ACCEL CMD/MIN IMP	N Z 5
MANUAL ATT YAW	ACCEL CMD/MIN IMP	N Z 4
MANUAL ATT ROLL	ACCEL CMD/MIN IMP	N Z 2
CMC ATT	IMU	S Z 9
ATT DEADBAND	MIN	S Z 2
LOGIC BUS 2		
BMAG MODE ROLL	ATT 1 RATE 2/RATE 2	U Z 4
SC CONT (CMC MODE ENABLE TO SCS)	CMC	L Z 3
ENTRY .05G	OFF	T Z 8
FDAI SOURCE	CMC	M Z 9
FDAI SCALE	5/5	L Z 6
ATTITUDE SET	IMU	O Z 8
TRANS CONTROLLER	TC-CW	D Z 1 8.2
LOGIC BUS 3		
BMAG MODE YAW	ATT 1 RATE 2/RATE 2	U Z 6
BMAG MODE PITCH	ATT 1 RATE 2/RATE 2	U Z 8
SC CONT (SCS CONTROL MODE ENABLE)	SCS	L Z 3
FDAI SOURCE	GDC/ATT SET	M Z 8
TVC GIMBAL DRIVE PITCH	NO 2	I Z 4
TVC GIMBAL DRIVE YAW	NO 2	I Z 2
FDAI SELECT	1 OR 2	K Z 9
ΔV CG	LM/CSM	R Z 4
SCS TVC PITCH	ALL POSITIONS	Q Z 4
SCS TVC YAW	ALL POSITIONS	Q Z 3
LOGIC BUS 4		
ENTRY .05G	ON	T Z 9
GDC ALIGN	DEPRESSED	R Z 8
FDAI SCALE	50/15 50/10	L Z 6
FDAI SELECT	1/2	K Z 9
CMC ATT	IMU	S Z 8
ENTRY EMS ROLL	ON	Q Z 8
ATT SET	GDC	O Z 8

CAUTION:

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

3 SCS

SIGNATURES	DATE
DR	
DSGN	
QC	7/8/71
ENGR	7/12/71
NR	7/12/71
APR	8/12/71
	9/14/71
FEC	9/15/71

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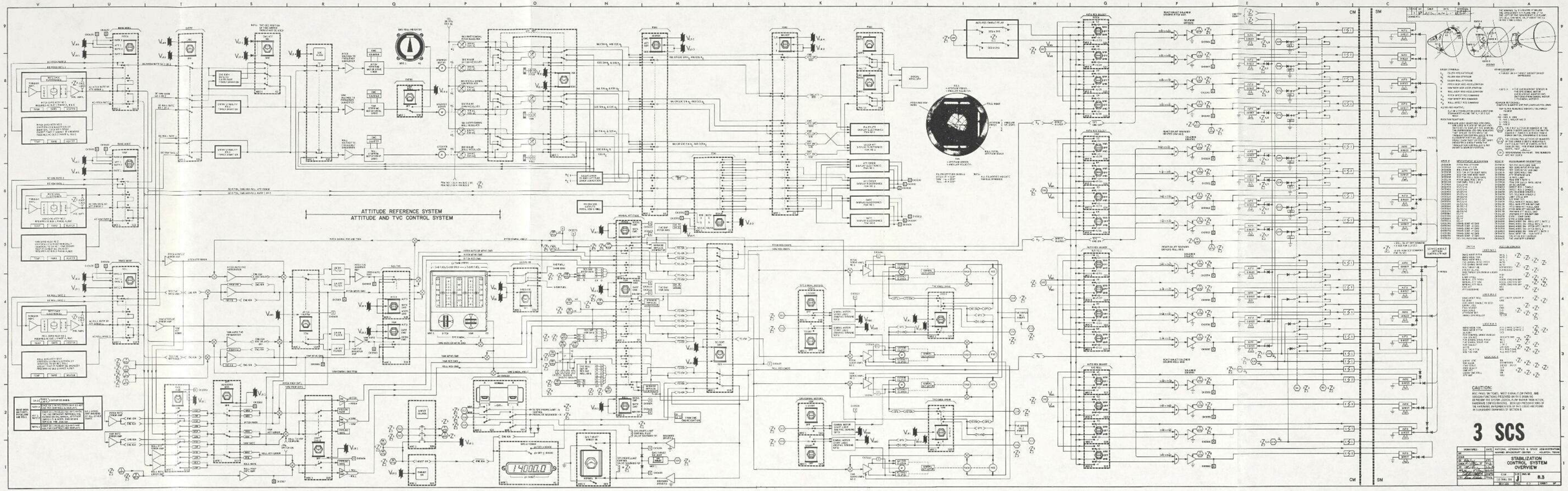
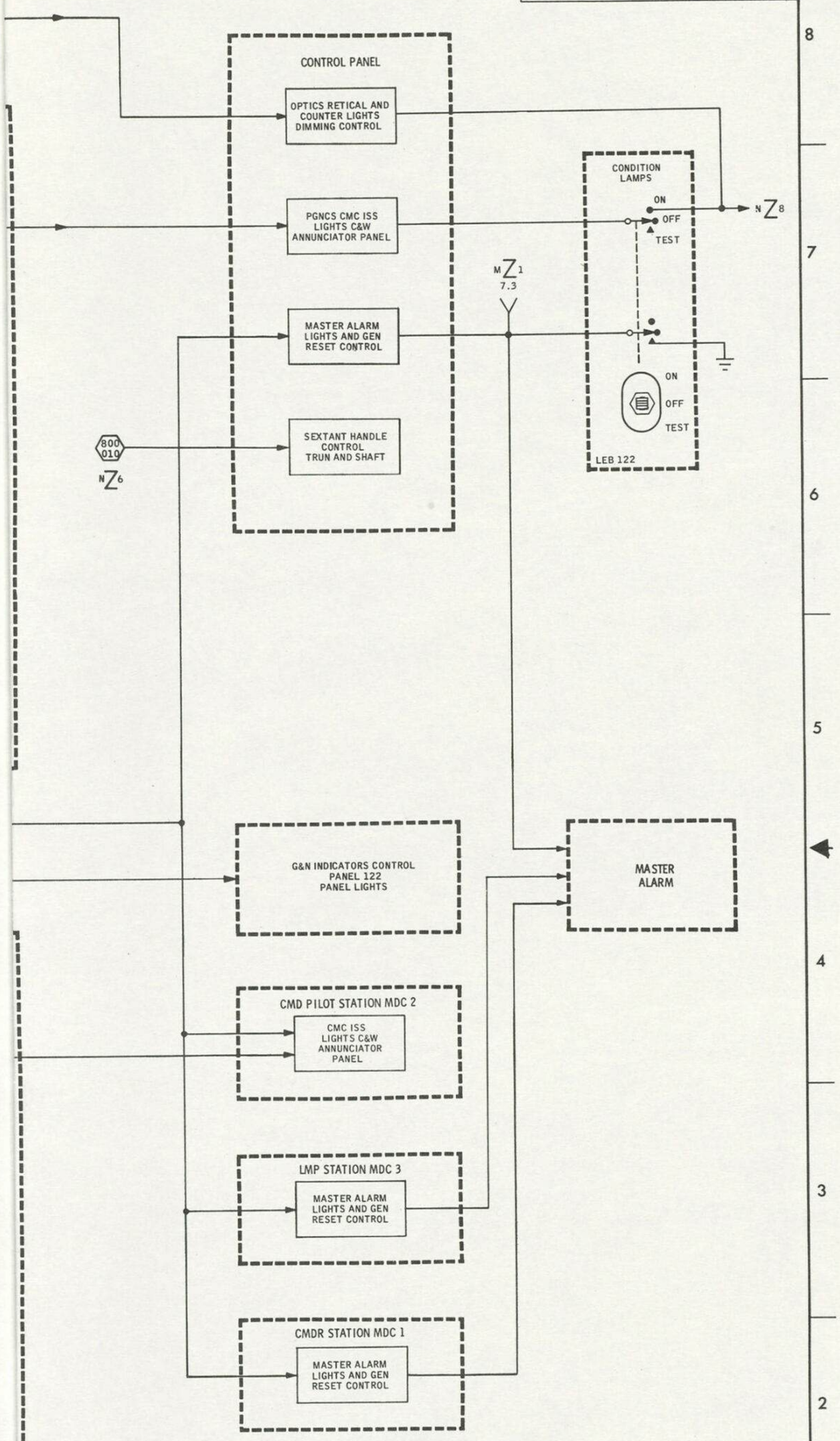
STABILIZATION CONTROL SYSTEM OVERVIEW

CSM	SIZE	DWG NO
112 THRU 114	J	8.3
38 X 121	PAGE 8-3	SHEET OF


ATTITUDE REFERENCE SYSTEM
ATTITUDE AND TVC CONTROL SYSTEM
CAUTION:
3 SCS
STABILIZATION CONTROL SYSTEM OVERVIEW
OVERVIEW SCS

LTR	PCN	DR	ENG	DATE	APPROVAL

COMMENTS:



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

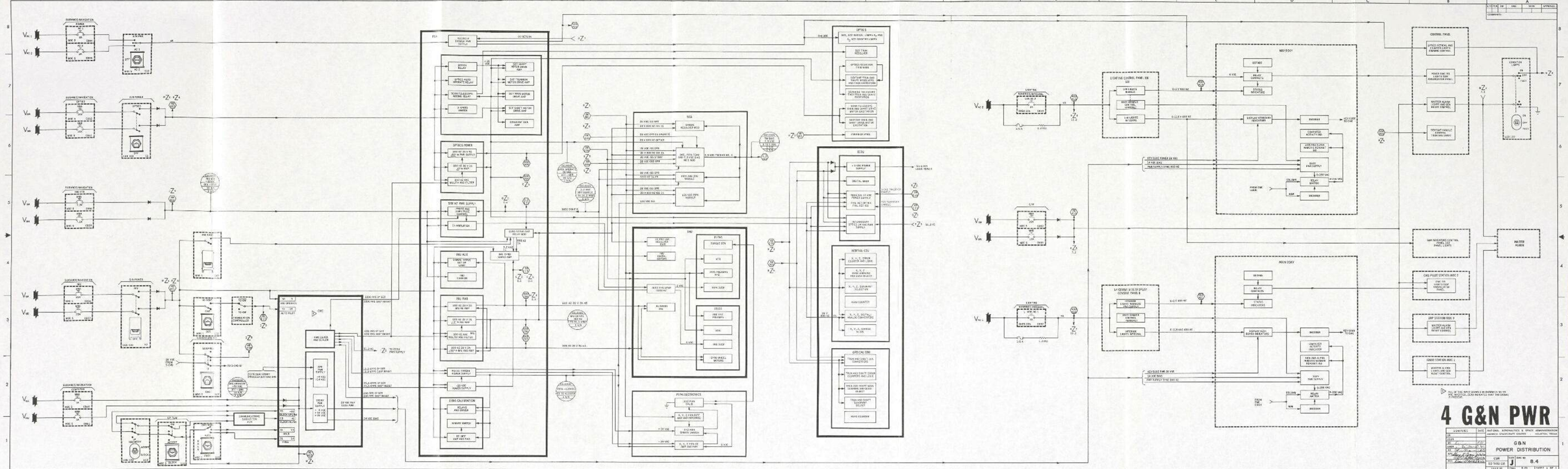
4 G&N PWR

SIGNATURES	DATE
DR	
DSGN	
QC	3/1/71
ENGR	3/9/71
NR	3/9/71
APP	3/9/71
	3/15/71
FEC	3/15/71

NATIONAL AERONAUTICS & SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER · HOUSTON, TEXAS

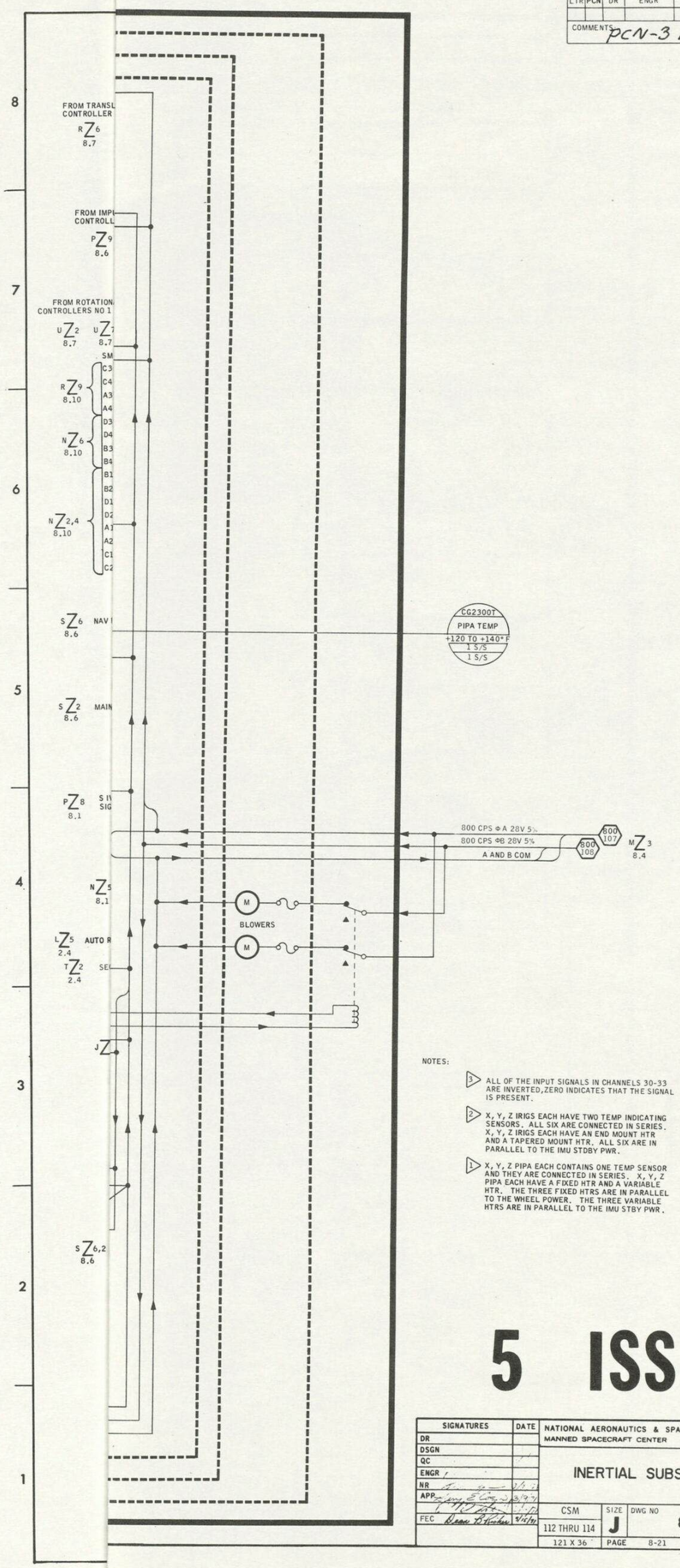
G&N
POWER DISTRIBUTION

CSM	SIZE	DWG NO
112 THRU 114	J	8.4
110 X 34	PAGE 8-20	SHEET 1 OF 1


4 G&N PWR
G&N
POWER DISTRIBUTION
8.4
DISTR. G&N PWR

LTR	PCN	DR	ENGR	DATE	APPROVAL

COMMENTS PCN-3 P&I



NOTES:

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

2. X, Y, Z IRIGS EACH HAVE TWO TEMP INDICATING SENSORS. ALL SIX ARE CONNECTED IN SERIES. X, Y, Z IRIGS EACH HAVE AN END MOUNT HTR AND A TAPERED MOUNT HTR. ALL SIX ARE IN PARALLEL TO THE IMU STDBY PWR.

1. X, Y, Z PIPA EACH CONTAINS ONE TEMP SENSOR AND THEY ARE CONNECTED IN SERIES. X, Y, Z PIPA EACH HAVE A FIXED HTR AND A VARIABLE HTR. THE THREE FIXED HTRS ARE IN PARALLEL TO THE WHEEL POWER. THE THREE VARIABLE HTRS ARE IN PARALLEL TO THE IMU STBY PWR.

5 ISS

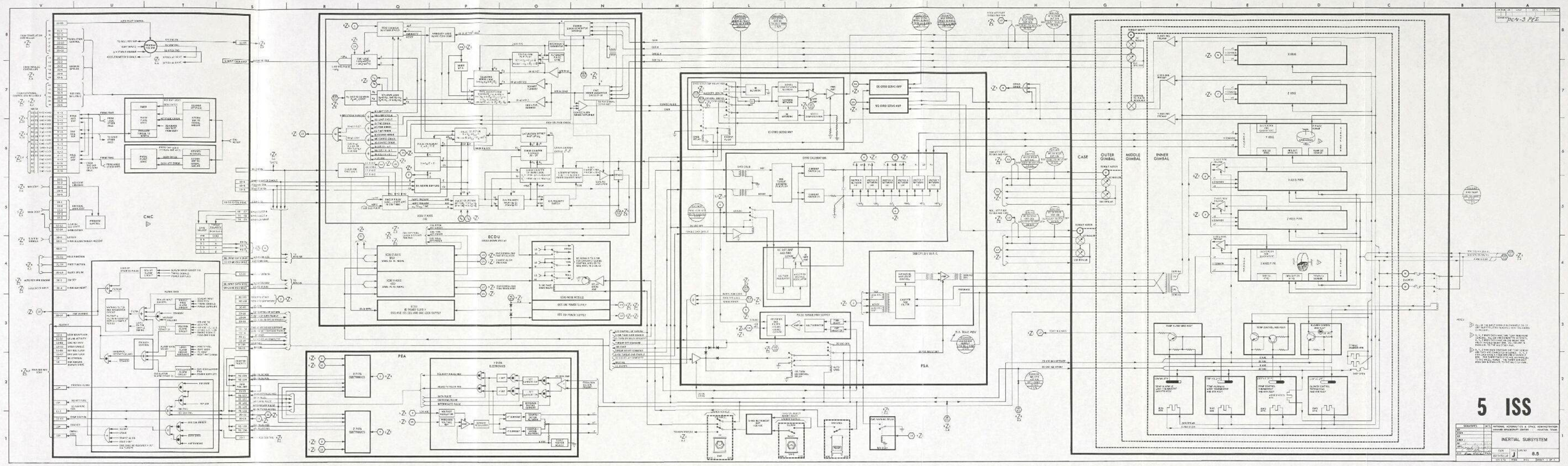
SIGNATURES	DATE
DR	
DSGN	
QC	
ENGR	
NR	
APP	
FEC	

NATIONAL AERONAUTICS & SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER · HOUSTON, TEXAS

INERTIAL SUBSYSTEM

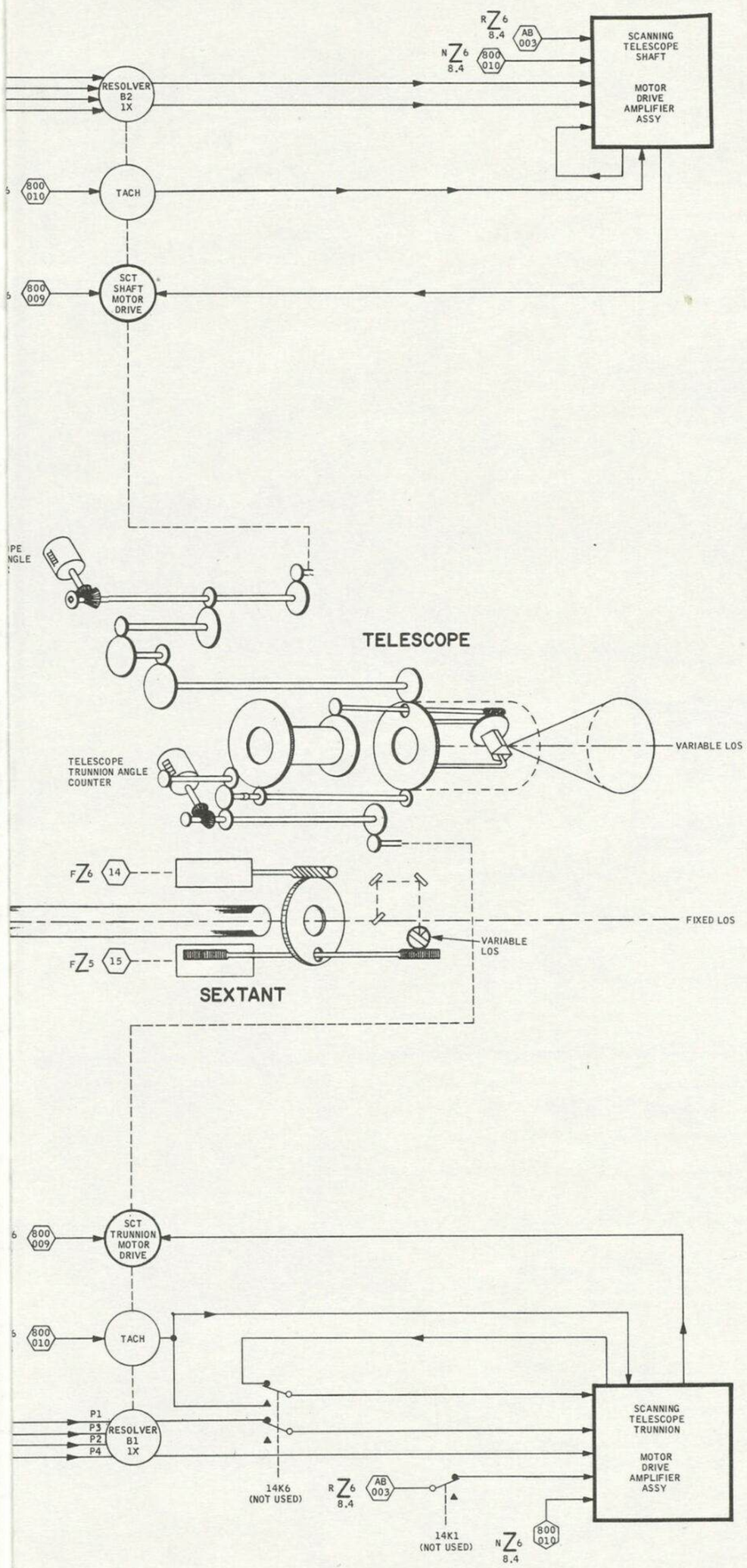
CSM	SIZE	DWG NO
112 THRU 114	J	8.5
121 X 36	PAGE 8-21	SHEET 1 OF 1

ELECTRICS
MA
AUTO/MANUAL RCS
SPS
SM-RCS
CM-RCS
INERTIAL SUBSYSTEM
OPTICS


CMC
ECDU
PEA
PSA
CASE
OUTER GIMBAL
MIDDLE GIMBAL
INNER GIMBAL
5 ISS
INERTIAL SUBSYSTEM
NATIONAL AERONAUTICS & SPACE ADMINISTRATION
GODDARD SPACE FLIGHT CENTER
GREENBELT, MARYLAND
8.5

LTR	PCN	DR	ENGR	DATE		APPROVAL

COMMENTS:



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

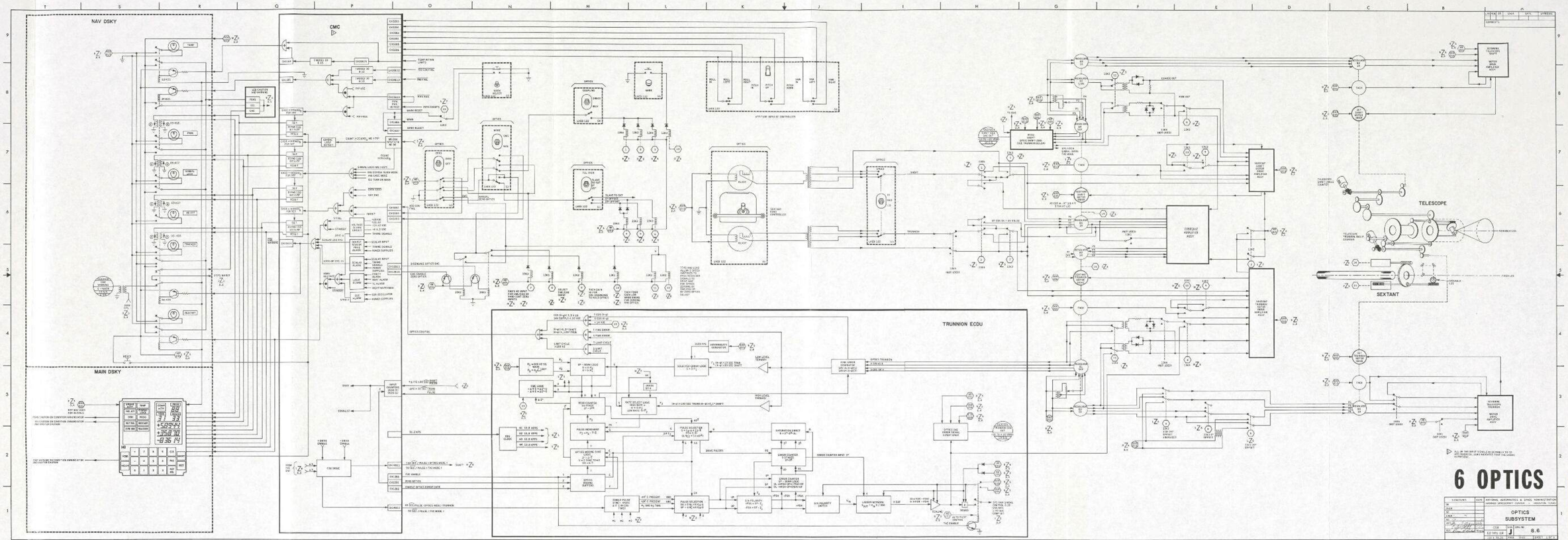
6 OPTICS

SIGNATURES	DATE
DR	
DSGN	
QC	
ENGR	
NR	
APP	3/1/7
FEC	3/13/7

NATIONAL AERONAUTICS & SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER · HOUSTON, TEXAS

OPTICS SUBSYSTEM

CSM	SIZE	DWG NO
112 THRU 114	J	8.6
110 X 38,25	PAGE 8-22	SHEET 1 OF 1



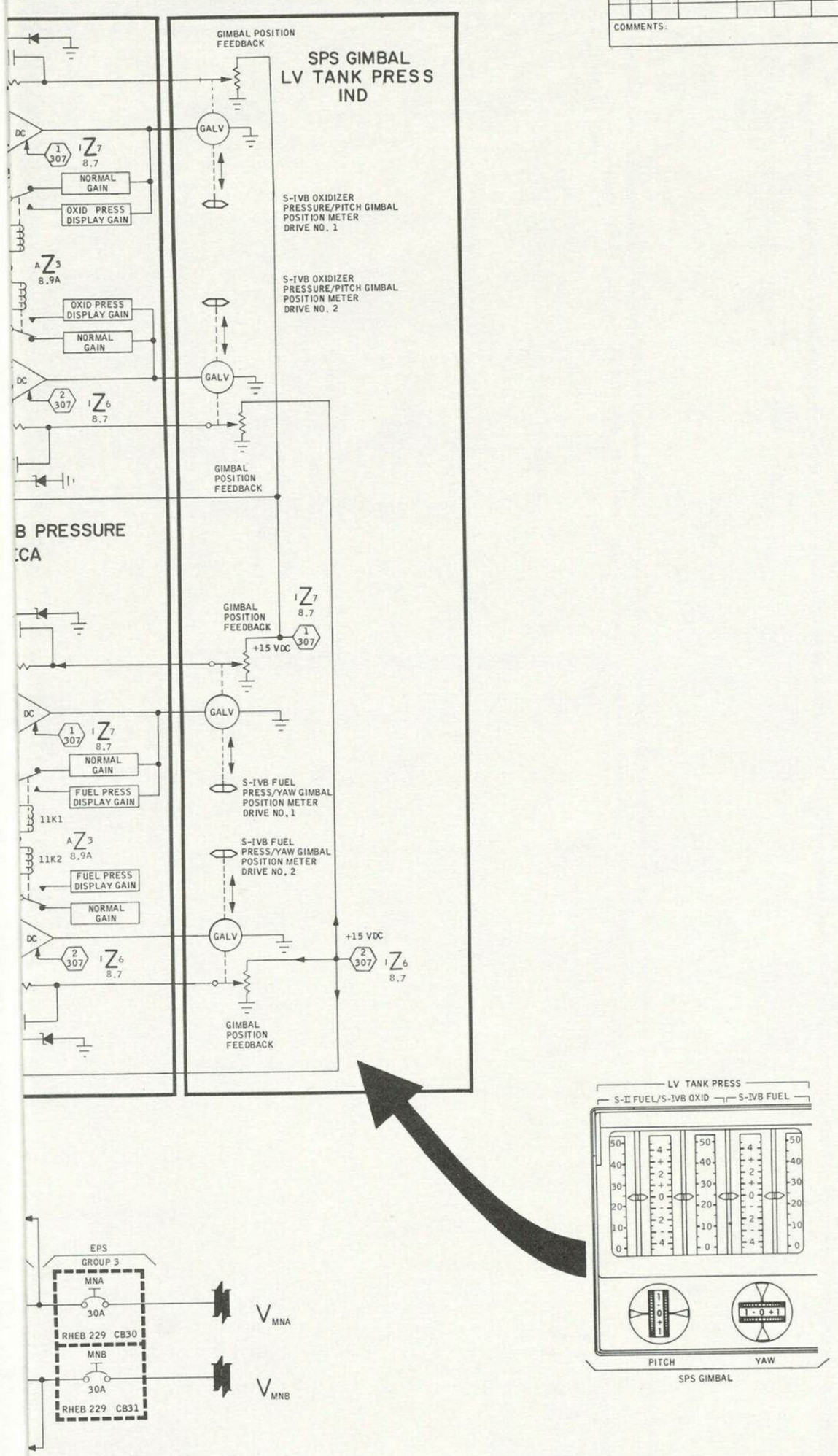
6 OPTICS

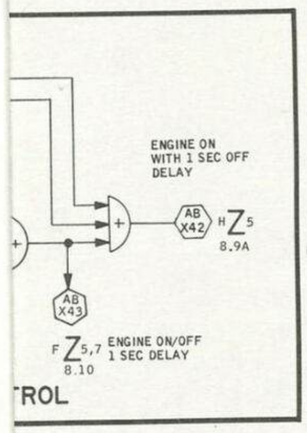
SIGNATURES	DATE	NATIONAL AERONAUTICS & SPACE ADMINISTRATION GRUMMAN AEROSPACE CORPORATION BETHPAGE, NEW YORK	
DRAWN		OPTICS SUBSYSTEM	
CHECK			
ENG			
PROJ			
		CODE IDENT NO. 81349	DRAWING NO. 8.6
		SCALE NONE	SHEET 1 OF 1

OPTICS

LTR	PCN	DR	ENGR	DATE	APPROVAL

COMMENTS:





NOTES:

1. THE GYRO 1 UNCAGE CIRCUITRY IS IMPLEMENTED IN THE GYRO 2 ASSEMBLY FOR EACH GYRO, BUT IS NOT CONNECTED TO THE INTERCONNECT WIRING. THE GYRO PACKAGES ARE DIRECTLY AND COMPLETELY INTERCHANGEABLE.
2. GYRO ASSEMBLY NO. 1 AND NO. 2 SPIN MOTORS ARE POWERED BY 608/1 HZ3 8.7 AND 708/2 HZ1 8.7 RESPECTIVELY. THE SPIN MOTORS OF EACH GYRO ASSEMBLY ARE CONNECTED IN PARALLEL.
3. GYRO SIGNAL GENERATORS ARE POWERED BY 609/1 HZ3 8.7 OR 709/2 HZ1 8.7 (GA NO. 1 OR NO. 2 RESPECTIVELY). THE SIGNAL GENERATOR PRIMARY COILS IN EACH GYRO ASSEMBLY ARE SERIES CONNECTED.
4. NC (AS IN TRANSISTOR NO. 3QS31NC) MEANS TRANSISTOR IS NORMALLY CLOSED (CONDUCTING). NO MEANS TRANSISTOR IS NORMALLY OPEN (NOT CONDUCTING).

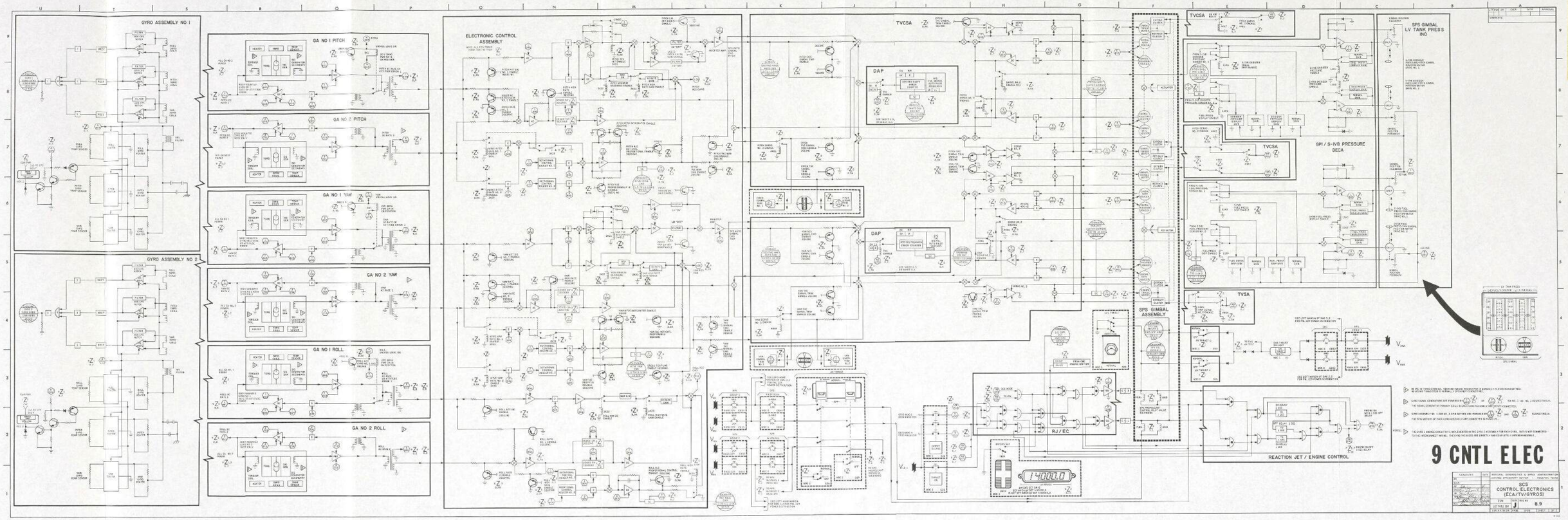
9 CNTL ELEC

SIGNATURES	DATE
DR	
DSGN	
QC	3/1/71
ENGR	3/1/71
NR	3/1/71
APP	3/10/71
	3/15/71
FEC	3/16/71

NATIONAL AERONAUTICS & SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER · HOUSTON, TEXAS

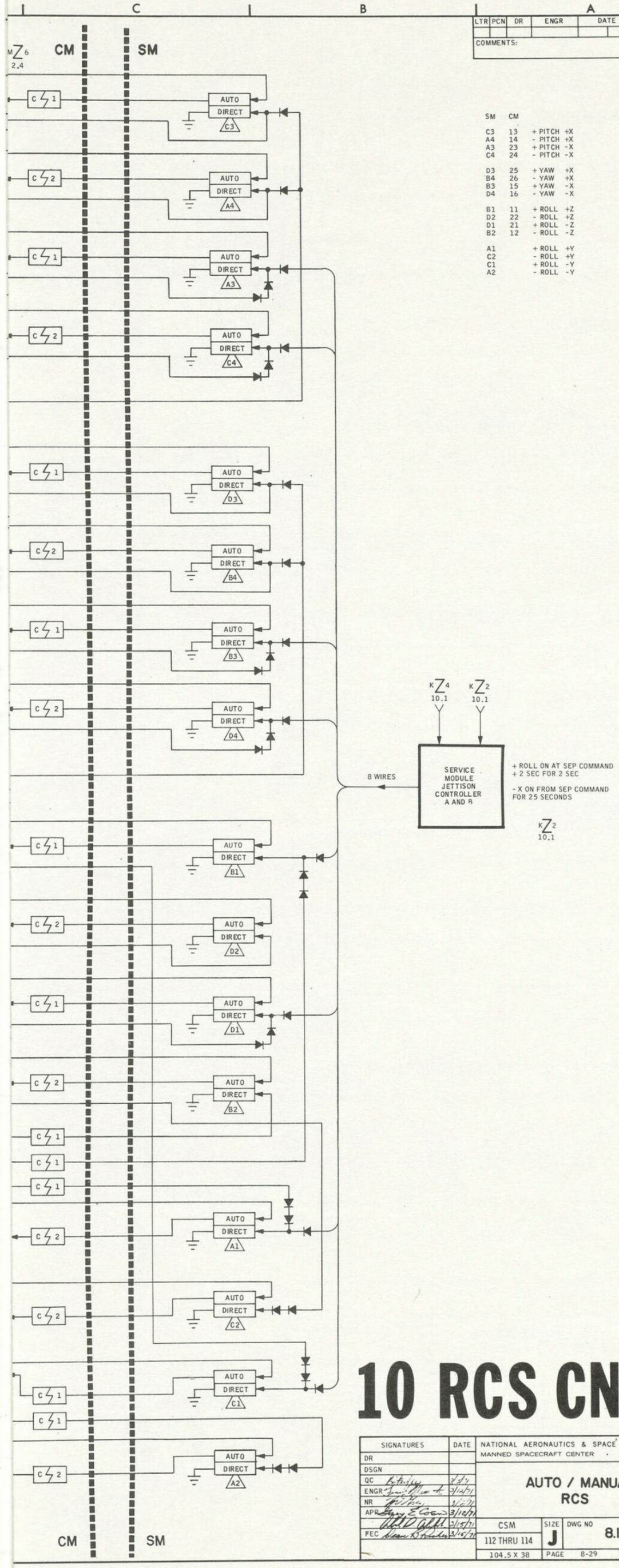
SCS
CONTROL ELECTRONICS
(ECA/TV/GYROS)

CSM	SIZE	DWG NO
112 THRU 114	J	8.9
115.5 X 38.25	PAGE 8-28	SHEET 1 OF 1


GYRO ASSEMBLY NO 1
GYRO ASSEMBLY NO 2
GA NO 1 PITCH
GA NO 2 PITCH
GA NO 1 YAW
GA NO 2 YAW
GA NO 1 ROLL
GA NO 2 ROLL
ELECTRONIC CONTROL ASSEMBLY
TVCSA
DAP
SPS GIMBAL ASSEMBLY
RJ/EC
GPI / S-IVB PRESSURE DECA
SPS GIMBAL LV TANK PRESS IND
REACTION JET / ENGINE CONTROL
9 CNTL ELEC
SCS CONTROL ELECTRONICS (ECA/TV/GYROS)
8.9

LTR	PCN	DR	ENGR	DATE	APPROVAL

COMMENTS:



SM	CM		
C3	13	+ PITCH	+X
A4	14	- PITCH	+X
A3	23	+ PITCH	-X
C4	24	- PITCH	-X
D3	25	+ YAW	+X
B4	26	- YAW	+X
B3	15	+ YAW	-X
D4	16	- YAW	-X
B1	11	+ ROLL	+Z
D2	22	- ROLL	+Z
D1	21	+ ROLL	-Z
B2	12	- ROLL	-Z
A1		+ ROLL	+Y
C2		- ROLL	+Y
C1		+ ROLL	-Y
A2		- ROLL	-Y

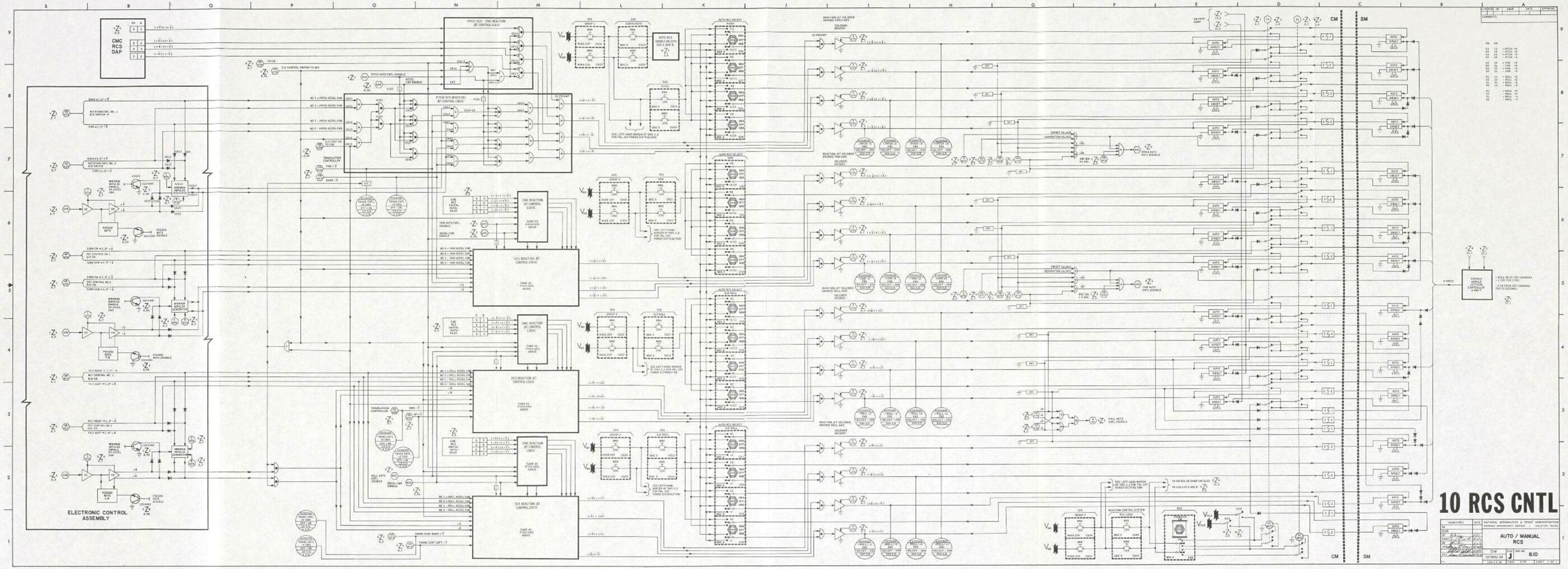
10 RCS CNTL

SIGNATURES	DATE
DR	
DSGN	
QC	3/2/71
ENGR	3/12/71
NR	3/12/71
APR	3/12/71
	3/15/71
FEC	3/16/71

NATIONAL AERONAUTICS & SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER · HOUSTON, TEXAS

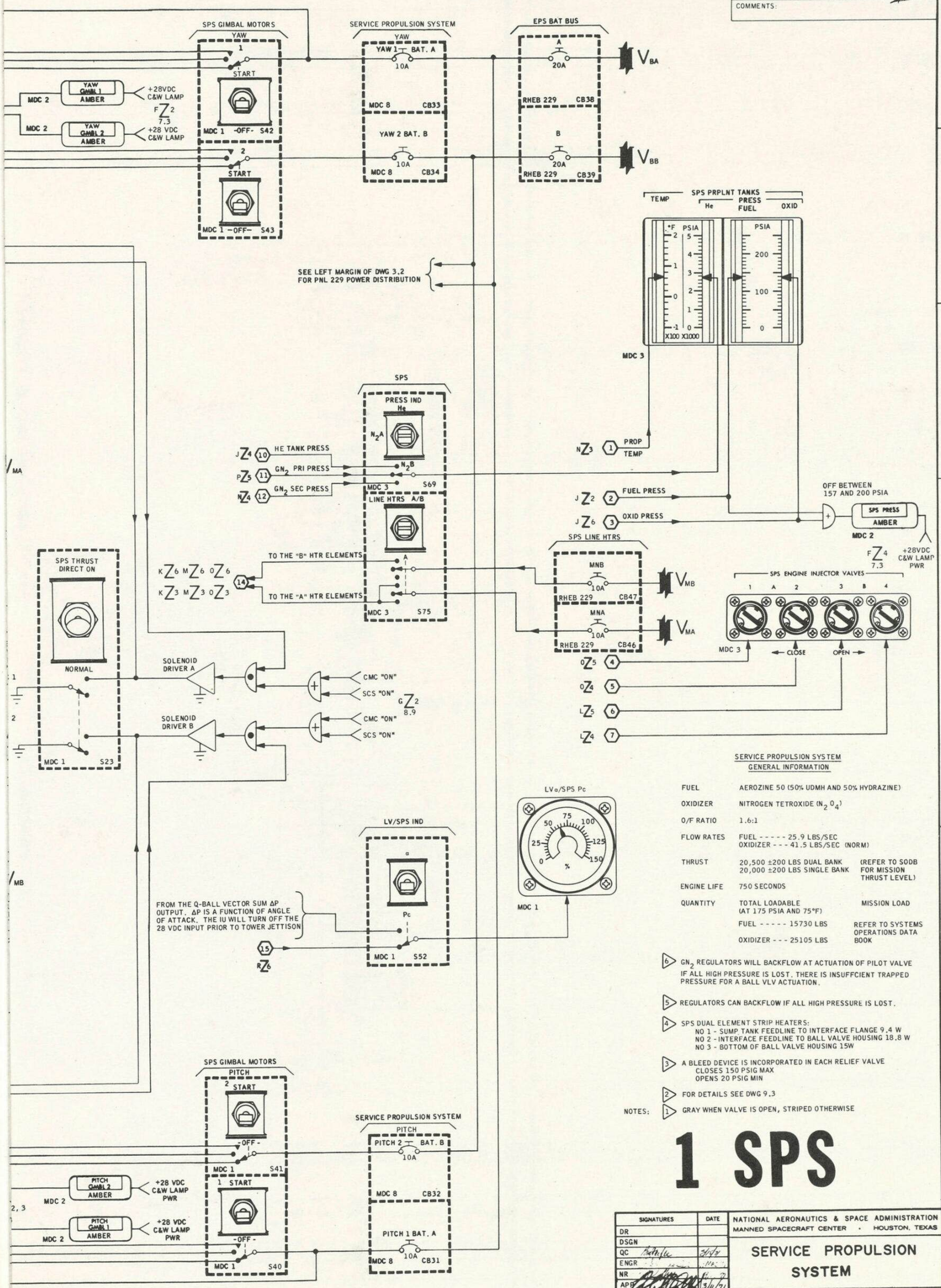
AUTO / MANUAL RCS

CSM	SIZE	DWG NO
112 THRU 114	J	8.10
104.5 X 38	PAGE 8-29	SHEET 1 OF 1


CMC RCS DAP
ELECTRONIC CONTROL ASSEMBLY
PITCH SCS - CMC REACTION JET CONTROL LOGIC
PITCH SCS REACTION JET CONTROL LOGIC
CMC REACTION JET CONTROL LOGIC
SCS REACTION JET CONTROL LOGIC
SCS REACTION JET CONTROL LOGIC
CMC REACTION JET CONTROL LOGIC
SCS REACTION JET CONTROL LOGIC
AUTO RCS SELECT
CM
SM
10 RCS CNTL
AUTO / MANUAL RCS
NATIONAL AERONAUTICS & SPACE ADMINISTRATION
Bellcomm/GRUMMAN/CSC/IBM
MANUAL
AUTO
DIRECT
AUTO/MANUAL RCS

LTR	PCN	DR	ENGR	DATE	APPROVAL
	3				

COMMENTS:



SERVICE PROPULSION SYSTEM
GENERAL INFORMATION

FUEL	AEROZINE 50 (50% UDMH AND 50% HYDRAZINE)	
OXIDIZER	NITROGEN TETROXIDE (N_2O_4)	
O/F RATIO	1.6:1	
FLOW RATES	FUEL - - - - - 25.9 LBS/SEC OXIDIZER - - - 41.5 LBS/SEC (NORM)	
THRUST	20,500 ±200 LBS DUAL BANK 20,000 ±200 LBS SINGLE BANK	(REFER TO SODB FOR MISSION THRUST LEVEL)
ENGINE LIFE	750 SECONDS	
QUANTITY	TOTAL LOADABLE (AT 175 PSIA AND 75°F)	MISSION LOAD
	FUEL - - - - - 15730 LBS	REFER TO SYSTEMS OPERATIONS DATA BOOK
	OXIDIZER - - - 25105 LBS	

NOTES:

1. GRAY WHEN VALVE IS OPEN, STRIPED OTHERWISE
2. FOR DETAILS SEE DWG 9.3
3. A BLEED DEVICE IS INCORPORATED IN EACH RELIEF VALVE
   CLOSES 150 PSIG MAX
   OPENS 20 PSIG MIN
4. SPS DUAL ELEMENT STRIP HEATERS:
   NO 1 - SUMP TANK FEEDLINE TO INTERFACE FLANGE 9.4 W
   NO 2 - INTERFACE FEEDLINE TO BALL VALVE HOUSING 18.8 W
   NO 3 - BOTTOM OF BALL VALVE HOUSING 15W
5. REGULATORS CAN BACKFLOW IF ALL HIGH PRESSURE IS LOST.
6. GN_2 REGULATORS WILL BACKFLOW AT ACTUATION OF PILOT VALVE IF ALL HIGH PRESSURE IS LOST. THERE IS INSUFFCIENT TRAPPED PRESSURE FOR A BALL VLV ACTUATION.

1 SPS

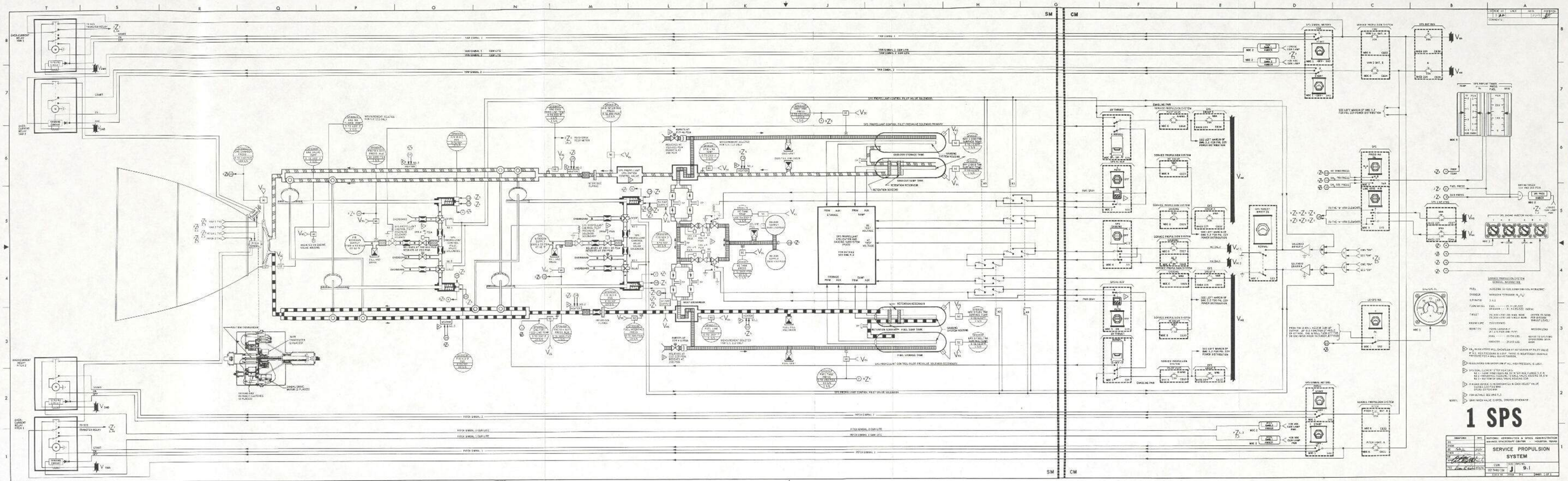
SIGNATURES	DATE
DR	
DSGN	
QC	3/1/71
ENGR	
NR	
APP	3/11/71
FEC	3/12/71

NATIONAL AERONAUTICS & SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER · HOUSTON, TEXAS

SERVICE PROPULSION SYSTEM

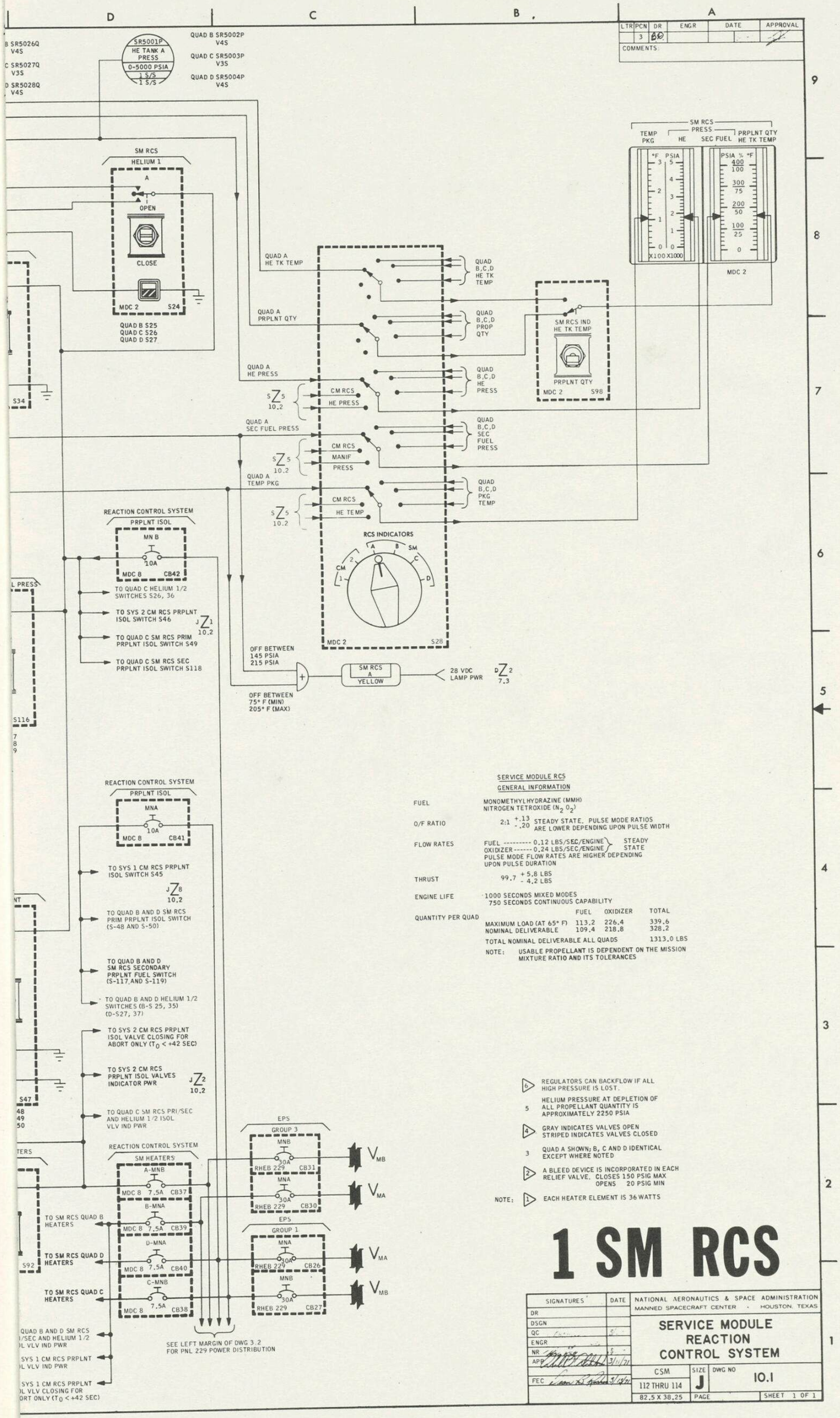
CSM	SIZE	DWG NO.
112 THRU 114	J	9.1
110 X 34	PAGE 9-1	SHEET 1 OF 1

GAMMA RAY
MAP CAMERA
SPS
SM-RCS
CM-RCS
LIGHTING
PAN CAMERA


SM
CM
1 SPS
SERVICE PROPULSION SYSTEM
NATIONAL AERONAUTICS & SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER — HOUSTON, TEXAS
CODE IDENT NO. 9-1
SERVICE PROPULSION SYSTEM
GENERAL INFORMATION
FUEL
OXIDIZER
MIXTURE RATIO
FUEL CONTENTS
OXIDIZER CONTENTS
MISSION LOAD
NOTES:
SPS
SPS

LTR	PCN	DR	ENGR	DATE	APPROVAL
	3	BD			

COMMENTS:



SERVICE MODULE RCS
GENERAL INFORMATION

FUEL	MONOMETHYLHYDRAZINE (MMH) NITROGEN TETROXIDE (N_2O_2)
O/F RATIO	2:1 $^{+.13}_{-.20}$ STEADY STATE. PULSE MODE RATIOS ARE LOWER DEPENDING UPON PULSE WIDTH
FLOW RATES	FUEL --------- 0.12 LBS/SEC/ENGINE OXIDIZER ------ 0.24 LBS/SEC/ENGINE } STEADY STATE PULSE MODE FLOW RATES ARE HIGHER DEPENDING UPON PULSE DURATION
THRUST	99.7 $^{+5.8}_{-4.2}$ LBS
ENGINE LIFE	1000 SECONDS MIXED MODES 750 SECONDS CONTINUOUS CAPABILITY

QUANTITY PER QUAD

	FUEL	OXIDIZER	TOTAL
MAXIMUM LOAD (AT 65° F)	113.2	226.4	339.6
NOMINAL DELIVERABLE	109.4	218.8	328.2

TOTAL NOMINAL DELIVERABLE ALL QUADS 1313.0 LBS

NOTE: USABLE PROPELLANT IS DEPENDENT ON THE MISSION MIXTURE RATIO AND ITS TOLERANCES

6 REGULATORS CAN BACKFLOW IF ALL HIGH PRESSURE IS LOST.

5 HELIUM PRESSURE AT DEPLETION OF ALL PROPELLANT QUANTITY IS APPROXIMATELY 2250 PSIA

4 GRAY INDICATES VALVES OPEN STRIPED INDICATES VALVES CLOSED

3 QUAD A SHOWN; B, C AND D IDENTICAL EXCEPT WHERE NOTED

2 A BLEED DEVICE IS INCORPORATED IN EACH RELIEF VALVE. CLOSES 150 PSIG MAX OPENS 20 PSIG MIN

NOTE: 1 EACH HEATER ELEMENT IS 36 WATTS

1 SM RCS

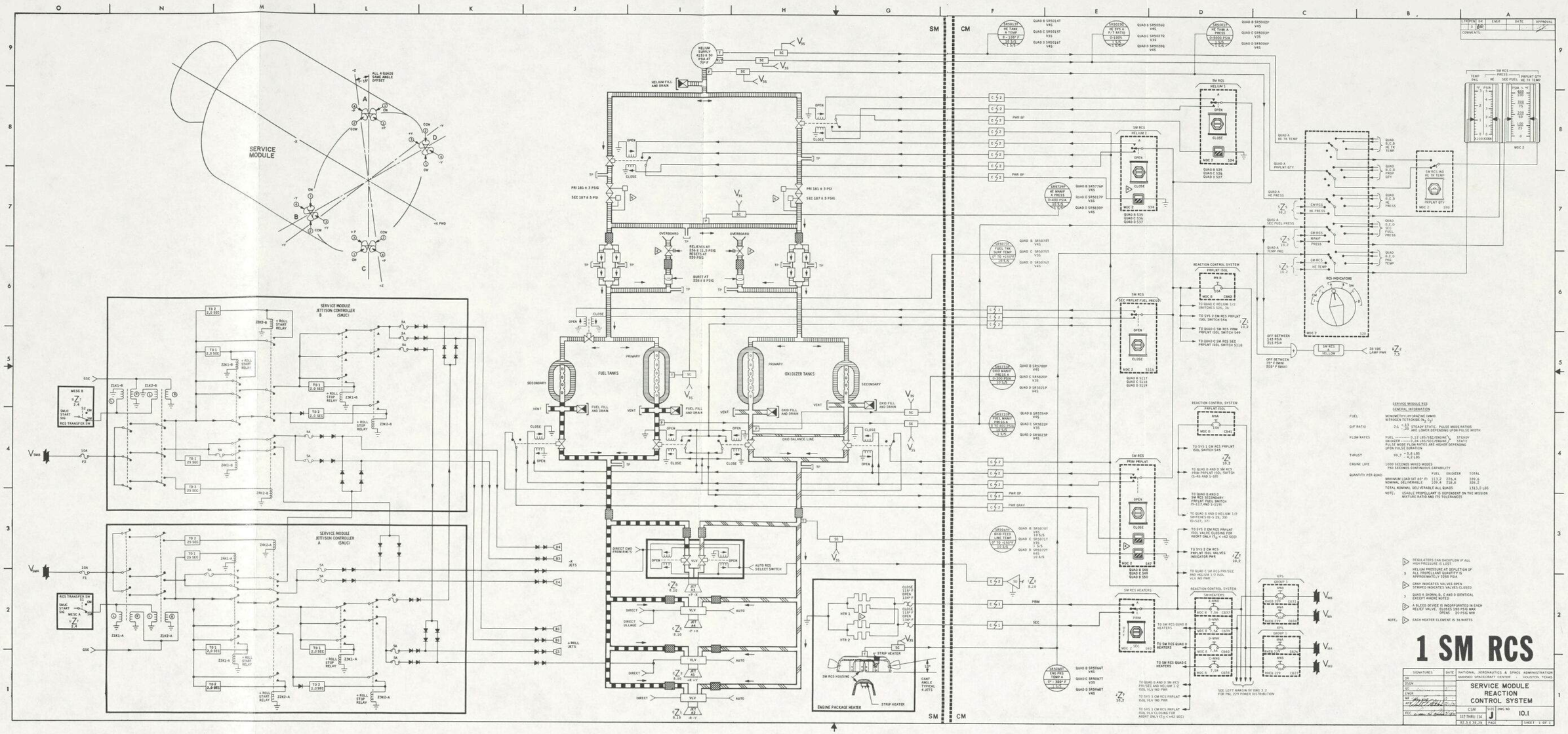
SIGNATURES	DATE
DR	
DSGN	
QC	
ENGR	
NR	
APP	3/11/71
FEC	3/12/71

NATIONAL AERONAUTICS & SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER · HOUSTON, TEXAS

SERVICE MODULE REACTION CONTROL SYSTEM

CSM	SIZE	DWG NO
112 THRU 114	J	10.1
82.5 X 38.25	PAGE	SHEET 1 OF 1

GAMMA RAY
MAP CAMERA
MASS SPEC
SM-RCS
CM-RCS
LIGHTING
PAN CAMERA

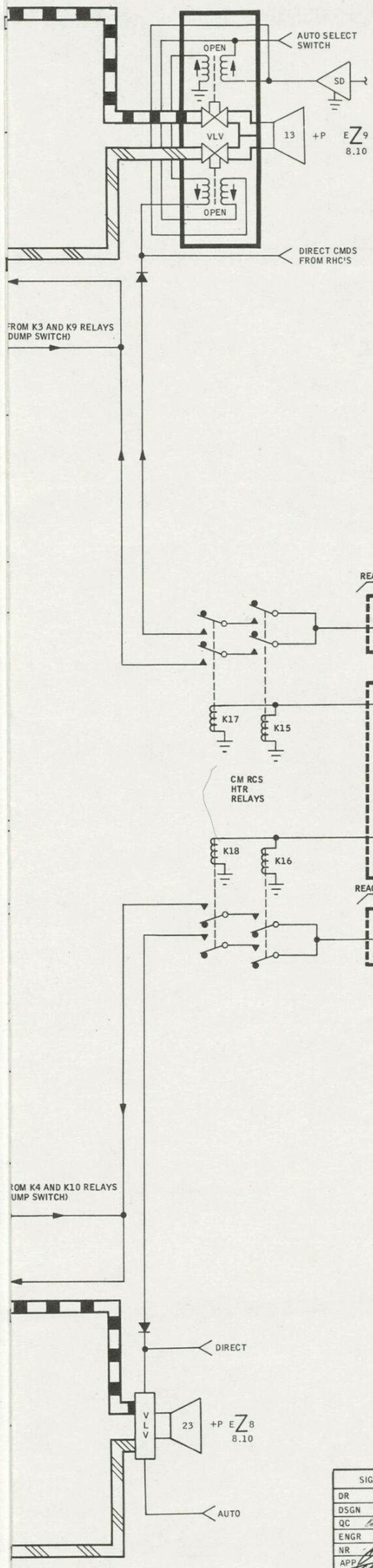

SERVICE MODULE
ALL 4 QUADS SAME ANGLE OFFSET
+X FWD
SERVICE MODULE JETTISON CONTROLLER B (SMJC)
SERVICE MODULE JETTISON CONTROLLER A (SMJC)
MESC B
SMJC START SW
RCS TRANSFER SW
MESC A
RCS TRANSFER SW
+ ROLL START RELAY
+ ROLL STOP RELAY
+X JETS
+Z JETS
HELIUM SUPPLY 4259 ± 50 PSIA AT 70° F
HELIUM FILL AND DRAIN
PRI 181 ± 3 PSIG
SEC 187 ± 5 PSIG
OVERBOARD
RELIEVES AT 250 ± 50 PSIG RESETS AT 220 PSIG
BURST AT 220 ± 0 PSIG
FUEL TANKS
OXIDIZER TANKS
PRIMARY
SECONDARY
FUEL FILL AND DRAIN
OXID FILL AND DRAIN
OXID BALANCE LINE
DIRECT CMD FROM RHCS
AUTO RCS SELECT SWITCH
DIRECT
DIRECT ULLAGE
AUTO
STRIP HEATER
SM RCS HOUSING
ENGINE PACKAGE HEATER
CANT ANGLE TYPICAL 4 JETS
SM
CM
HE TANK A TEMP
HE SYS A P/T RATIO
HE TANK A PRESS
HE MANIF PRESS
FUEL TNK SURF TEMP
OXID MANIF PRESS A
FUEL MANIF PRESS A
OXID FEED LINE TEMP
ENG PKG TEMP
SM RCS HELIUM 1
SM RCS HELIUM 2
SM RCS SEC PRPLNT/FUEL PRESS
SM RCS PRIM PRPLNT
SM RCS HEATERS
REACTION CONTROL SYSTEM
PRPLNT ISOL
SM RCS HEATER
SM RCS NO HE TK TEMP
SM RCS PRESS
PRPLNT QTY
RCS INDICATORS
SM RCS HELIUM
28 VDC LAMP PWR
SEE LEFT MARGIN OF DWG 3.2 FOR PNL 22V POWER DISTRIBUTION
SERVICE MODULE RCS GENERAL INFORMATION
FUEL: MONOMETHYLHYDRAZINE (MMH)
OXIDIZER: NITROGEN TETROXIDE (N_2O_4)
O/F RATIO: 2.4 +.13 -.13 STEADY STATE, PULSE MODE RATIOS ARE LOWER DEPENDING UPON PULSE WIDTH
FLOW RATES: FUEL — 0.22 LBS/SEC/ENGINE, OXIDIZER — 0.34 LBS/SEC/ENGINE; STEADY STATE. PULSE MODE FLOW RATES ARE HIGHER DEPENDING UPON PULSE DURATION
THRUST: N_2O_4 - 5.0 LBS; MMH - 4.2 LBS
ENGINE LIFE: 1000 SECONDS MIXED MODES; 750 SECONDS CONTINUOUS CAPABILITY
QUANTITY PER QUAD:

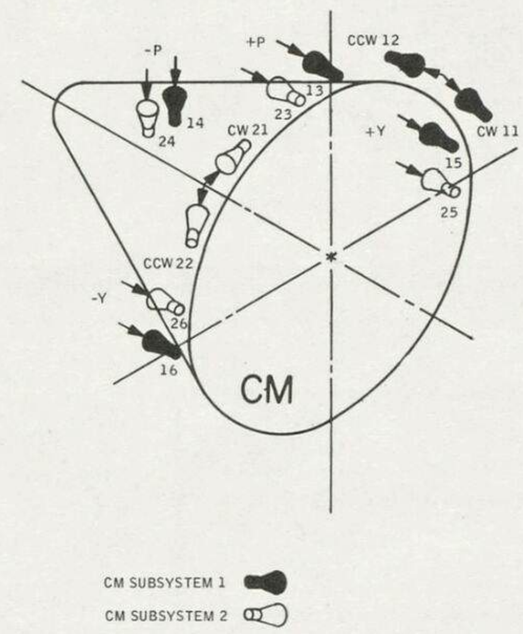
	FUEL	OXIDIZER	TOTAL
MAXIMUM LOAD (AT 65° F)	113.2	226.4	339.6
NOMINAL DELIVERABLE	109.4	218.8	328.2

TOTAL NOMINAL DELIVERABLE ALL QUADS: 1313.0 LBS
NOTE: USABLE PROPELLANT IS DEPENDENT ON THE MISSION MIXTURE RATIO AND ITS TOLERANCES
REGULATORS CAN BACKFLOW IF ALL HIGH PRESSURE IS LOST
HELIUM PRESSURE AT DEPLETION OF ALL PROPELLANT QUANTITY IS APPROXIMATELY 2250 PSIA
GRAY INDICATES VALVES OPEN STRIPED INDICATES VALVES CLOSED
QUAD A SHOWN, B, C AND D IDENTICAL EXCEPT WHERE NOTED
A BLEED DEVICE IS INCORPORATED IN EACH RELIEF VALVE. 0.0055 150 PSIG MAX OPEND 20 PSIG MIN
NOTE: EACH HEATER ELEMENT IS 36 WATTS
1 SM RCS
SIGNATURES
DR
DSGN
SC
ENGR
NE
REC
NATIONAL AERONAUTICS & SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER HOUSTON, TEXAS
SERVICE MODULE REACTION CONTROL SYSTEM
CSM 112 THRU 114
SIZE J
DWG NO 10.1
SHEET 1 OF 1
SM RCS

LTR	PCN	DR	ENGR	DATE	APPROVAL

COMMENTS: PCN-3 P&I





COMMAND MODULE RCS
GENERAL INFORMATION

FUEL	MONOMETHYLHYDRAZINE (MMH)
OXIDIZER	NITROGEN TETROXIDE (N_2O_4)
O/F RATIO	2:1 +0.14 -0.12 STEADY STATE PULSE MODE RATIOS ARE LOWER DEPENDING UPON PULSE DURATION
FLOW RATES	FUEL---- 0.11 LBS/SEC/ENGINE, OXIDIZER- 0.23 LBS/SEC/ENGINE } STEADY STATE; PULSE MODE FLOW RATES ARE HIGHER DEPENDING UPON PULSE DURATION
THRUST	93.6 +3.6 -3.7 LBS
ENGINE LIFE	200 SECONDS

QUANTITY PER SYSTEM	FUEL	OXIDIZER	TOTAL
MAX LOAD	45.2	89.2	134.4 LBS
DELIVERABLE	37.5	75.0	112.5 LBS

TOTAL DELIVERABLE BOTH SYTEMS 225.0 LBS

USABLE PROPELLANT IS DEPENDENT UPON THE MISSION MIXTURE RATIO AND ITS TOLERANCES

NOTES:
3. REGULATORS CAN BACKFLOW
2. A BLEED DEVICE IS INCORPORATED IN EACH RELIEF VALVE — CLOSES 150 PSIG MAX; OPEN 20 PSIG MAX
1. GRAY INDICATES VALVES OPEN; STRIPED INDICATES VALVE CLOSED

2 CM RCS

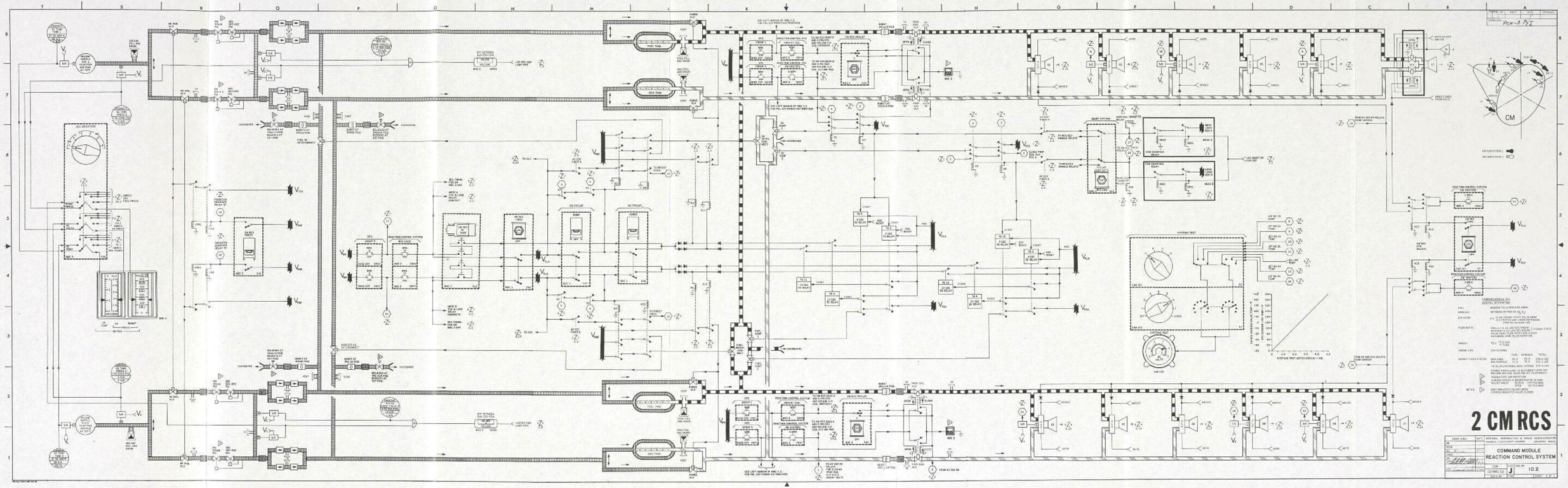
SIGNATURES	DATE
DR	
DSGN	
QC	
ENGR	
NR	
APP	3/11/71
FEC	3/13/71

NATIONAL AERONAUTICS & SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER · HOUSTON, TEXAS

COMMAND MODULE
REACTION CONTROL SYSTEM

CSM	SIZE	DWG NO
112 THRU 114	J	10.2
110 X 34	PAGE	SHEET 1 OF 1

GAMMA RAY
MAP CAMERA
MASS SPEC
F C PERFORM
CM-RCS
LIGHTING
PAN CAMERA


2 CM RCS
COMMAND MODULE
REACTION CONTROL SYSTEM
10.2
CM
C.M.RCS

LTR	PCN	DR	ENG	DATE		APPROVAL

COMMENTS:

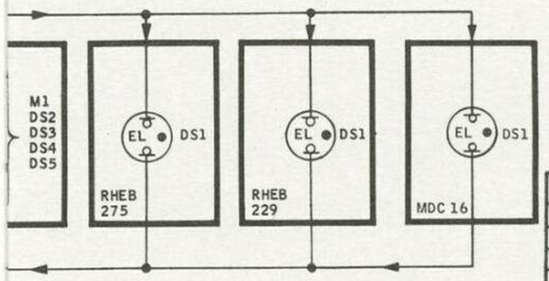
5 PREVENTS CURRENT SURGE - WHICH IN TURN PREVENTS SPURIOUS RCS JET FIRINGS

4 CONTROL KNOB IS MECHANICALLY INHIBITED FROM COMPLETE CCW ROTATION TO OFF

3. RECOVERY BEACON LIGHT SHOWN ON DWG 6.6

2 INCANDESCENT LIGHTS

NOTES: 1 FLUORESCENT LIGHT - CONVERTER IN EACH LIGHT FIXTURE CONVERTS +28 VDC TO AC



2 LIGHTING

SIGNATURES	DATE
DR	
DSGN	
QC	3/-/
ENGR	2/27
NR	3/28/71
APP	3/29/71
FEC	3/1/71

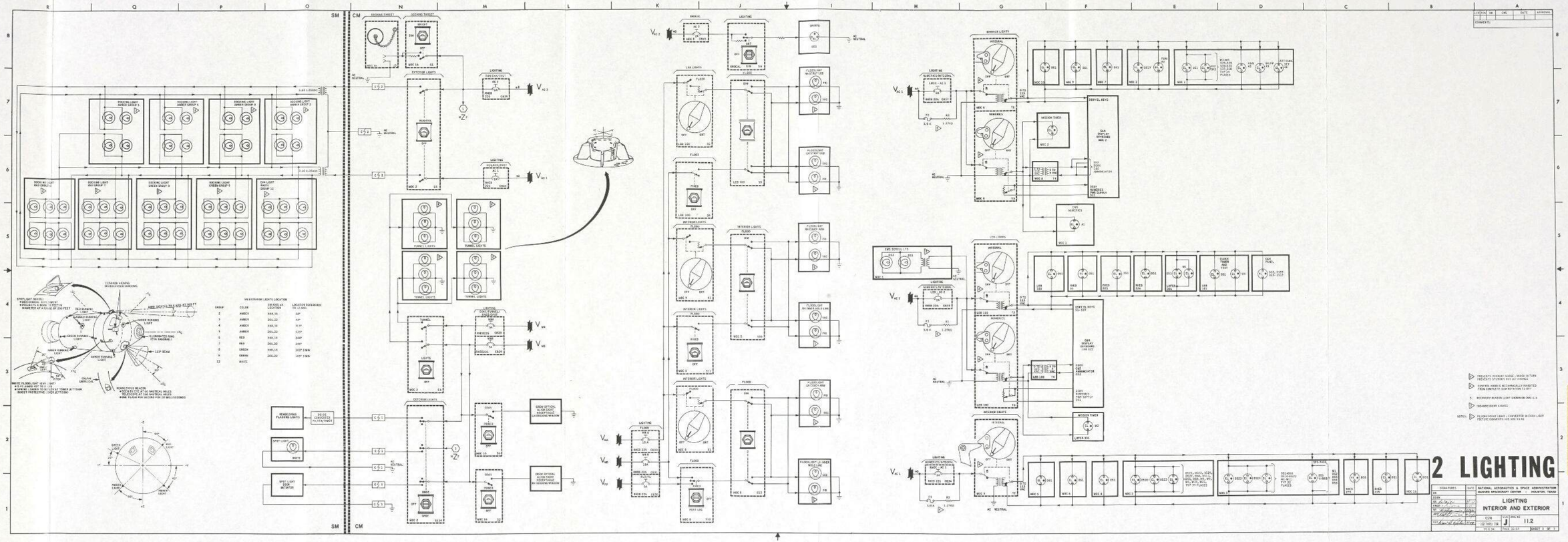
NATIONAL AERONAUTICS & SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER · HOUSTON, TEXAS

LIGHTING
INTERIOR AND EXTERIOR

CSM	SIZE	DWG NO
112 THRU 114	J	11.2
99 X 34	PAGE 11-14	SHEET 1 OF 1

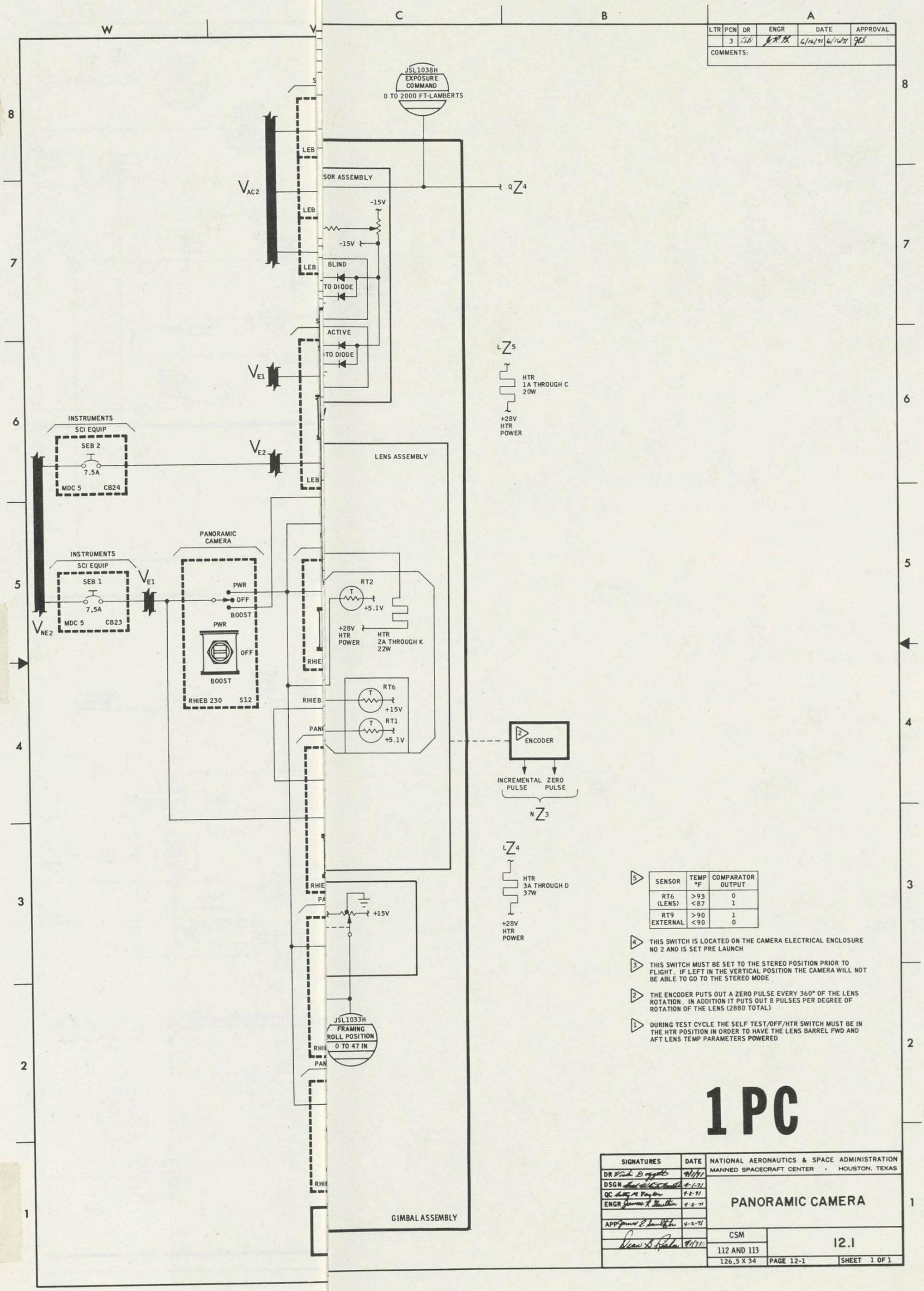
8 7 6 5 4 3 2 1

MAP CAMERA
GAMMA RAY
MASS SPEC
F C PERFORM
SM RCS PROPELLANT
LIGHTING
PAN CAMERA


2 LIGHTING
LIGHTING
INTERIOR AND EXTERIOR
NATIONAL AERONAUTICS & SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER — HOUSTON, TEXAS
J
11.2
SHEET 1 OF 1
SM
CM
DOCKING TARGET
EXTERIOR LIGHTS
INTERIOR LIGHTS
TUNNEL LIGHTS
FLOOD
LEK LIGHTS
WINDOW LIGHTS
MARKERS
SERVICE KEYS
Q&A DISPLAY KEYBOARD
DOCKING LIGHT AMBER GROUP 1
DOCKING LIGHT AMBER GROUP 2
DOCKING LIGHT AMBER GROUP 3
DOCKING LIGHT AMBER GROUP 4
DOCKING LIGHT RED GROUP 7
DOCKING LIGHT RED GROUP 8
DOCKING LIGHT GREEN GROUP 9
DOCKING LIGHT GREEN GROUP 5
CSM LIGHT WHITE GROUP 12
SPOTLIGHT (WHITE)
SPOTLIGHT (COLOR MONITOR)
DOCKING LIGHTS (COLOR)
DOCKING LIGHT (WHITE)
DOCKING LIGHT (RED)
DOCKING LIGHT (GREEN)
CSM LIGHT (WHITE)
SM EXTERIOR LIGHTS LOCATION
GROUP
COLOR
SM EXTERIOR LIGHTS LOCATION
LOCATION REFERENCE (FR +Z AXIS)
2 AMBER 356.10 60°
3 AMBER 206.22 60°
4 AMBER 356.10 30.5°
5 AMBER 206.22 30.5°
6 RED 356.10 240°
7 RED 206.22 240°
8 GREEN 356.10 120° 3 MN
9 GREEN 206.22 120° 3 MN
12 WHITE
SPOTLIGHT (WHITE)
SPOTLIGHT (COLOR MONITOR)
DOCKING FLASHING LIGHTS
DC-DC CONVERTER
GREEN OPTICAL ALIGN SIGHT (OPTICAL ALIGNMENT ON DOCKING WINDOW)
GROW OPTICAL ALIGN SIGHT (ADJUSTABLE ON DOCKING WINDOW)
SPOTLIGHT (WHITE)
SPOTLIGHT (COLOR MONITOR)
DOCKING LIGHT (WHITE)
DOCKING LIGHT (RED)
DOCKING LIGHT (GREEN)
CSM LIGHT (WHITE

LTR	PCN	DR	ENGR	DATE		APPROVAL
	3			6/16/71	6/16/71	

COMMENTS:



SENSOR	TEMP °F	COMPARATOR OUTPUT
RT6 (LENS)	>93	0
	<87	1
RT9 EXTERNAL	>90	1
	<90	0

4. THIS SWITCH IS LOCATED ON THE CAMERA ELECTRICAL ENCLOSURE NO 2 AND IS SET PRE LAUNCH

3. THIS SWITCH MUST BE SET TO THE STEREO POSITION PRIOR TO FLIGHT. IF LEFT IN THE VERTICAL POSITION THE CAMERA WILL NOT BE ABLE TO GO TO THE STEREO MODE

2. THE ENCODER PUTS OUT A ZERO PULSE EVERY 360° OF THE LENS ROTATION. IN ADDITION IT PUTS OUT 8 PULSES PER DEGREE OF ROTATION OF THE LENS (2880 TOTAL)

1. DURING TEST CYCLE THE SELF TEST/OFF/HTR SWITCH MUST BE IN THE HTR POSITION IN ORDER TO HAVE THE LENS BARREL FWD AND AFT LENS TEMP PARAMETERS POWERED

1 PC

SIGNATURES	DATE
DR	4/1/71
DSGN	4-1-71
QC	4-2-71
ENGR	4-2-71
APP	4-2-71
	4/1/71

NATIONAL AERONAUTICS & SPACE ADMINISTRATION
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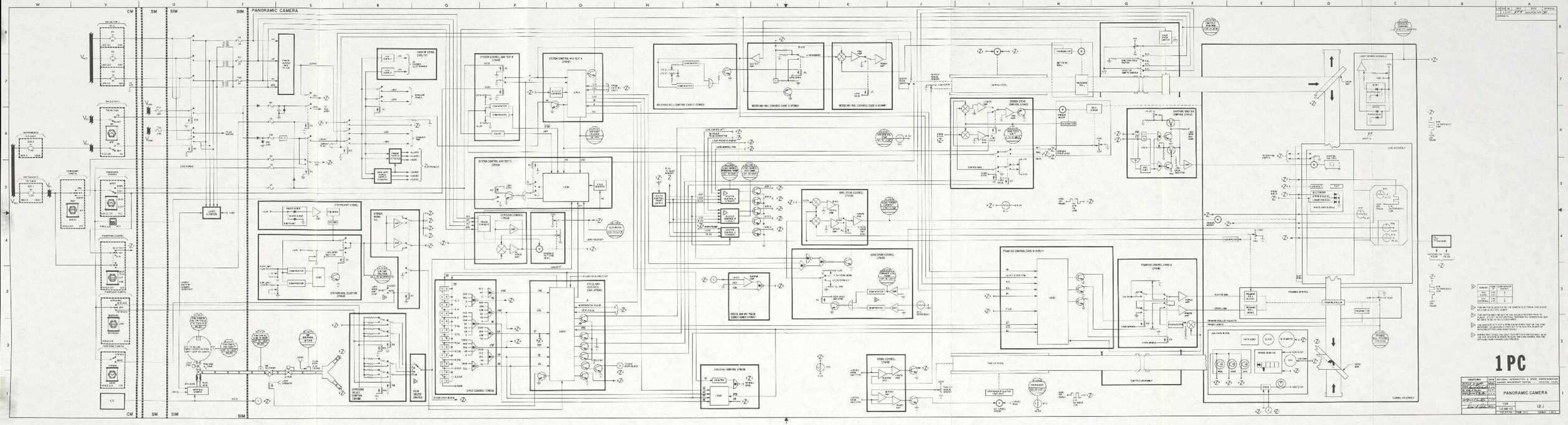
PANORAMIC CAMERA

CSM 112 AND 113

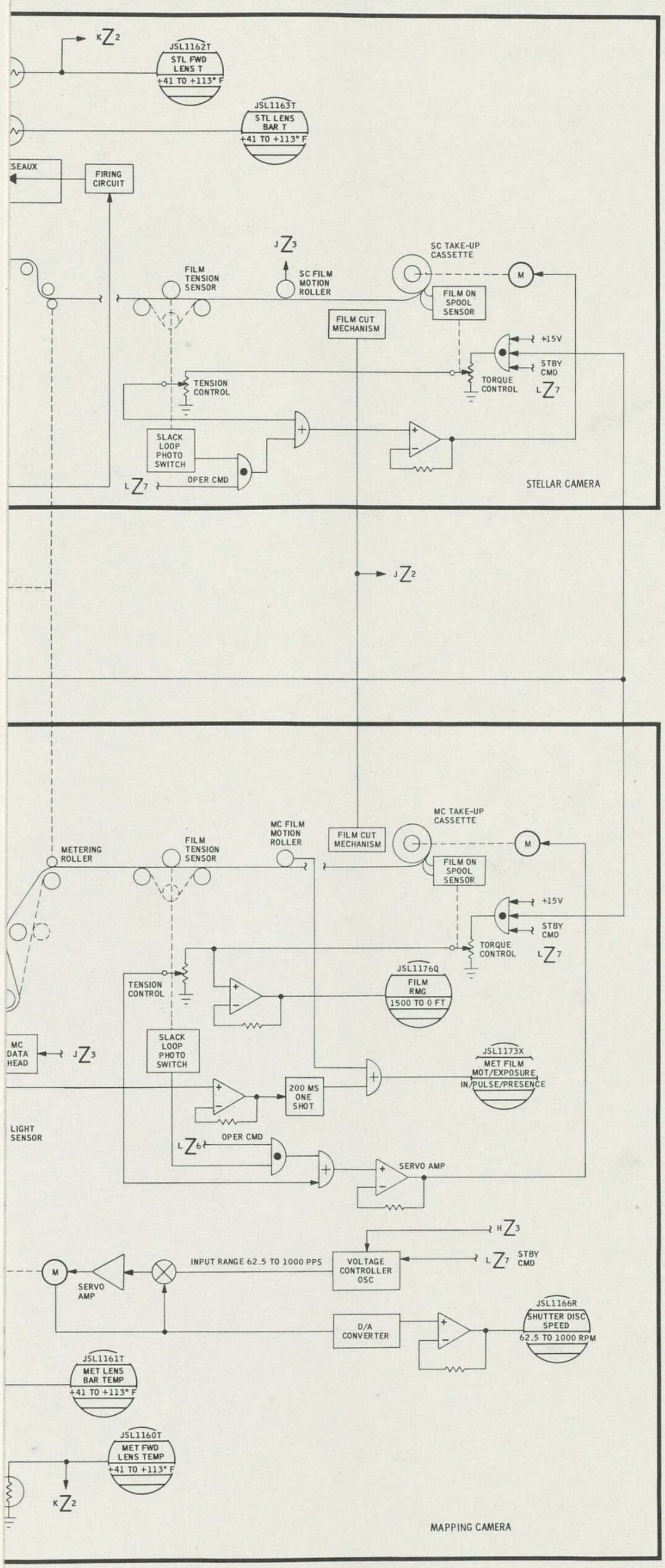
12.1

126.5 X 34 | PAGE 12-1 | SHEET 1 OF 1


PANORAMIC CAMERA
CM
SM
SIM
1PC
PAN CAMERA

LTR	PCN	DR	ENGR	DATA	APPROVAL
	3				

COMMENTS:



NOTES:

2. REFER TO DWG NO 2.9 FOR MC AND LA INSTRUMENT COVER ACTUATOR CIRCUIT

1. EXTEND LIMIT SWITCH
   OPEN AT FULL EXTENSION OTHERWISE SWITCH IS CLOSED
   RETRACT LIMIT SWITCH
   OPEN AT FULL RETRACTION OTHERWISE SWITCH IS CLOSED

2 MC

SIGNATURES	DATE
DR Beverly Roberts	3-31-71
DSGN	
QC Betty M. Taylor	4-1-71
ENGR James R. Griffin	4-1-71
NR	
APP James R. Sandy Jr.	4-1-71
FEC Dean B. Rooks	4/1/71

NATIONAL AERONAUTICS & SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER · HOUSTON, TEXAS

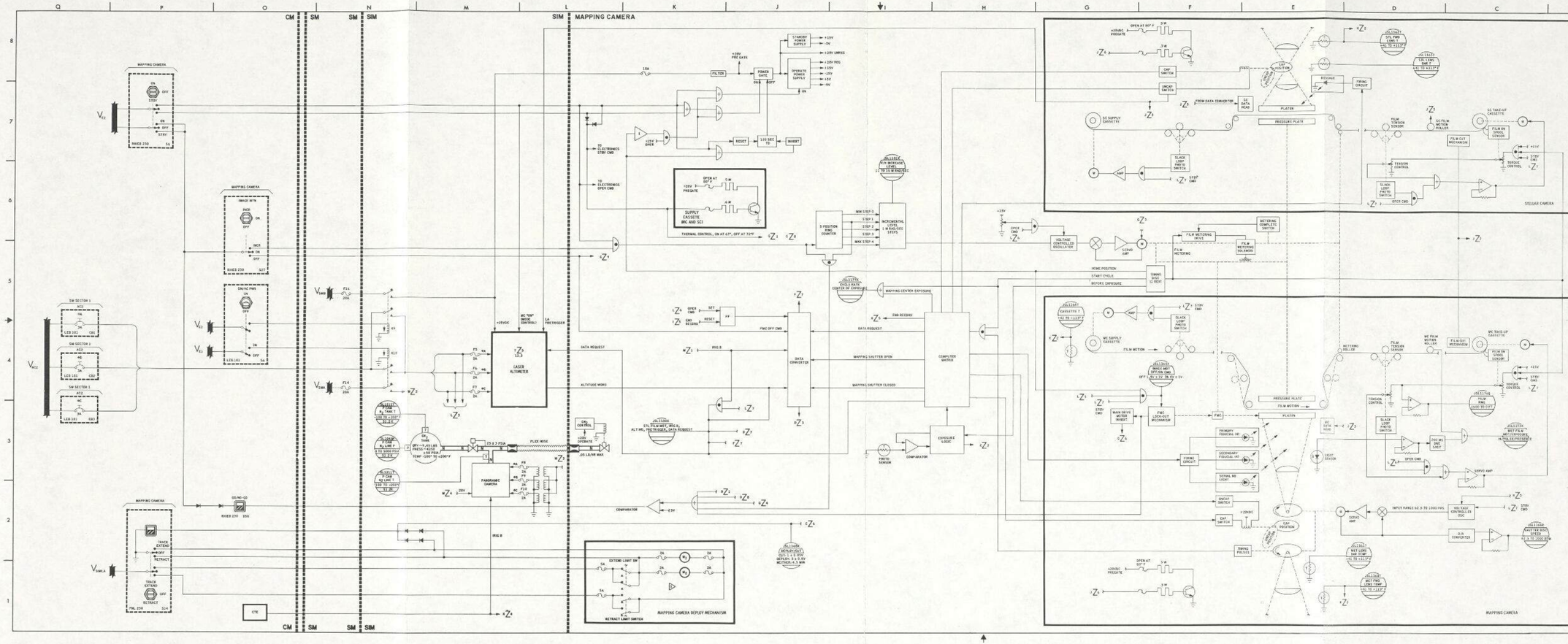
MAPPING CAMERA

CSM 112 AND 113

DWG NO 12.2

93.5 X 34 | PAGE 12-2 | SHEET 1 OF 1

MAP CAMERA
GAMMA RAY
MASS SPEC
F C PERFORM
SM RCS PROPELLANT
CSM H_2
SIM BAY SECRD/OPEN



NOTES:

2. HOPER TO IMU NO 2.9 FOR MC AND LA INITIALIZE & COVER ACTIVATION CIRCUIT

3. STOW LIMIT SWITCH OPEN AT FULL EXTENSION, OPEN AT RETRACT, CLOSED RETRACT LIMIT SWITCH

4. MAPPING FILM ACTUATION OTHERWISE SWITCH IS CLOSED

2 MC

SIGNATURES:	DATE	NATIONAL AERONAUTICS & SPACE ADMINISTRATION
DR Bernard Dobrski	12-30-65	MANNED SPACECRAFT CENTER - HOUSTON, TEXAS
EDA		
DC Gary M. Crowder	12-30	MAPPING CAMERA
CHIEF James F. Buchli	12-30	
MO		
MD Donald E. Hyatt	12-30	
FEC Kenneth D. Bailey	12-30	CSM / IMU NO / 12.2
		101 AND 103
		2.9 & 3.4 / PAGE 32-2 / SHEET 1 OF 1

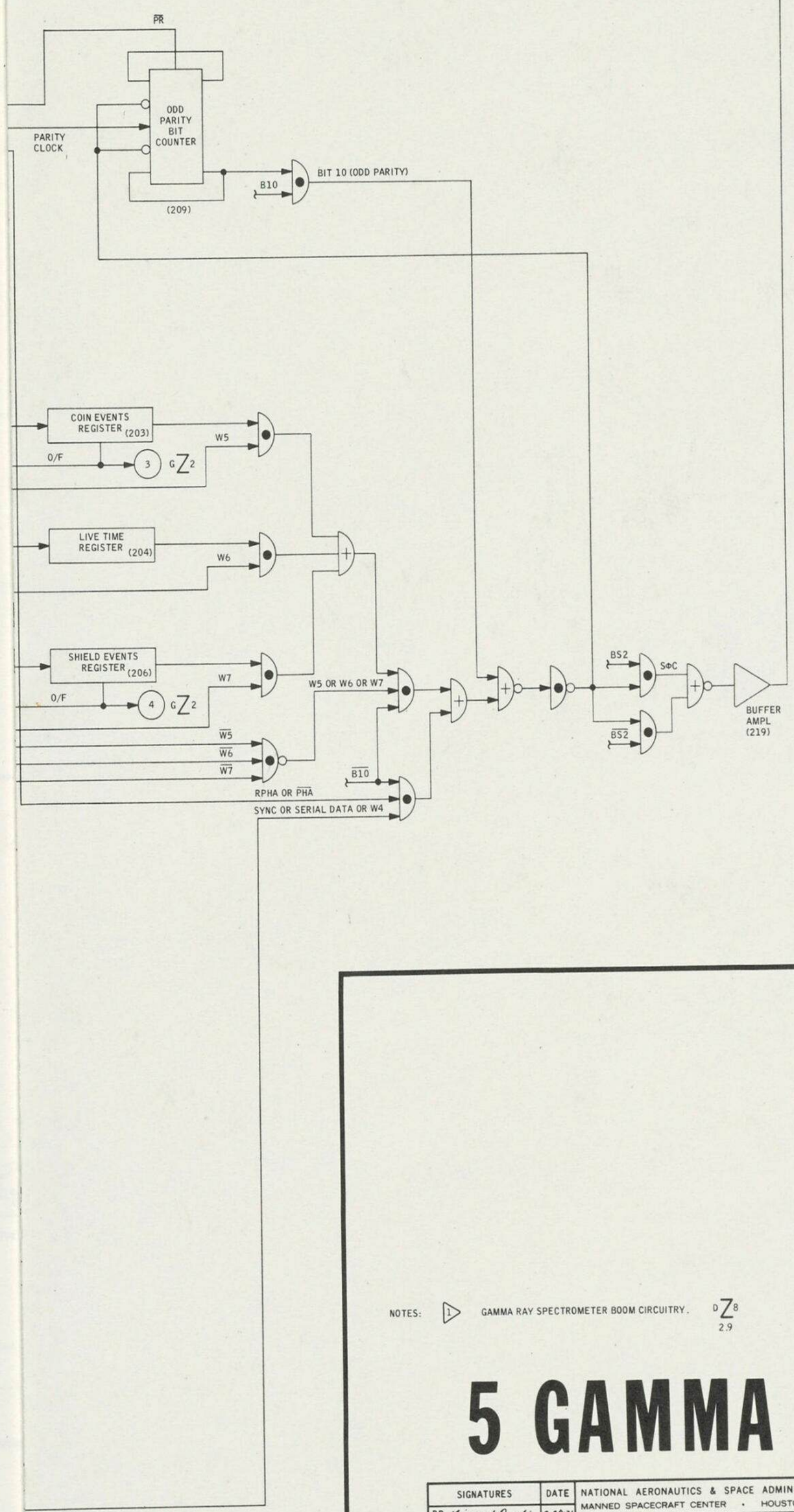
SYM	FCN	DR	CHGR	DATA	APPROVAL
3	3P-1	gdd		6/3/66	6/13/66

COMMENTS:

MAP CAMERA

LTR	PCN	DR	ENGR	DATE	APPROVAL
	3			6/16/71	6/16/71

COMMENTS:



NOTES: 1 GAMMA RAY SPECTROMETER BOOM CIRCUITRY. D Z8 2.9

5 GAMMA

SIGNATURES	DATE
DR Konda J. Drambi	8-20-71
DSGN	
QC Betty M. Taylor	4-1-71
ENGR Lyle M. Vandegrift	4-1-71
NR	
APP James R. Scally Jr.	4-1-71
FEC Dean B. Reeder	4/1/71

NATIONAL AERONAUTICS & SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER · HOUSTON, TEXAS

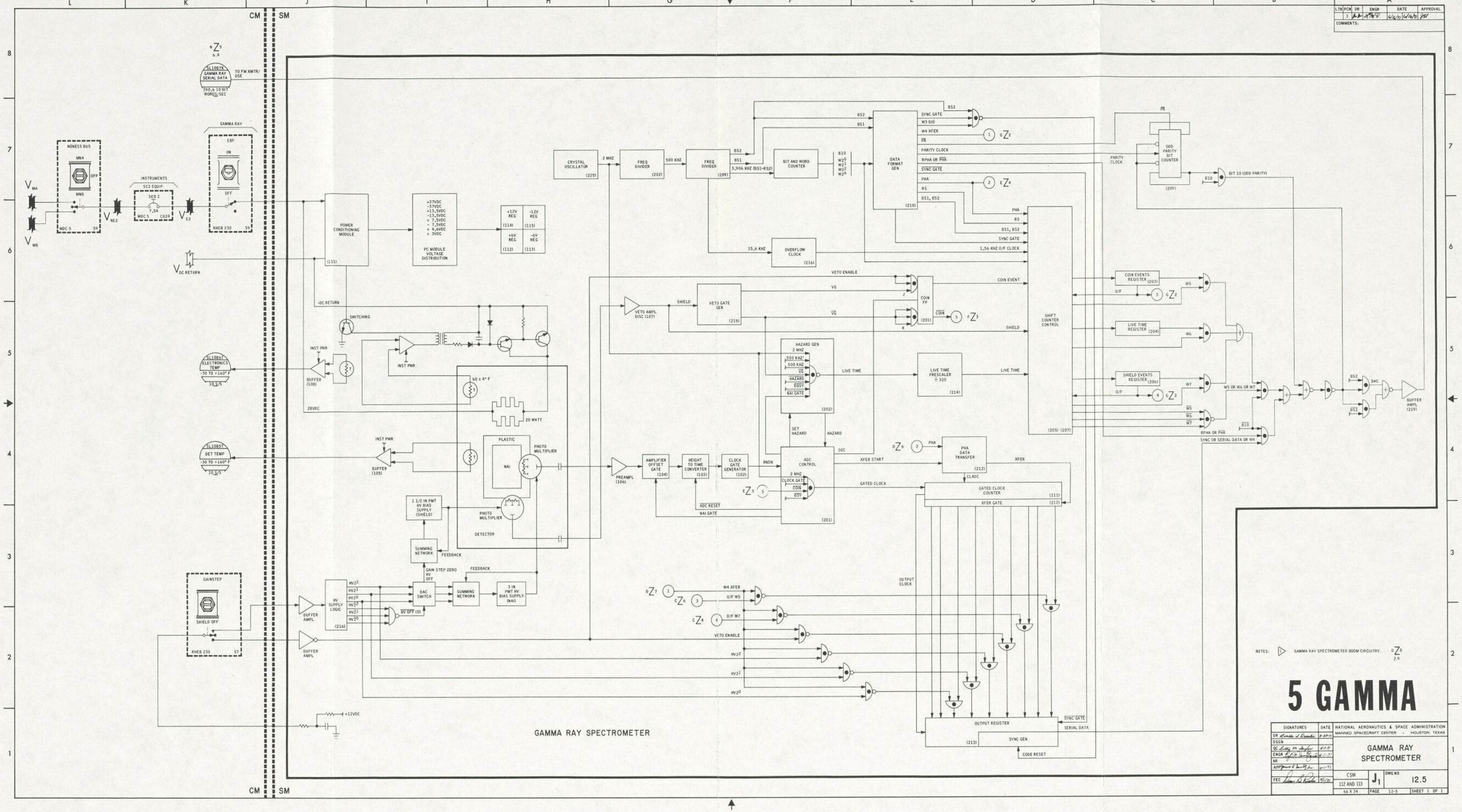
GAMMA RAY SPECTROMETER

CSM	J1	DWG NO 12.5
112 AND 113		
66 X 34	PAGE 12-5	SHEET 1 OF 1

GAMMA RAY
MASS SPEC
F C PERFORM
SM RCS PROPELLANT
CSM H_2
SIM BAY SECRD/OPEN

LTR	PCN	DR	ENGR	DATE	APPROVAL
J				4/26/71	4/26/71

COMMENTS:



5 GAMMA

SIGNATURES	DATE
DR	4-26-71
DSGN	
DC	4-27-71
ENGR	4-27-71
NB	
APP	4-27-71
FEC	4/27/71

NATIONAL AERONAUTICS & SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER · HOUSTON, TEXAS

GAMMA RAY SPECTROMETER

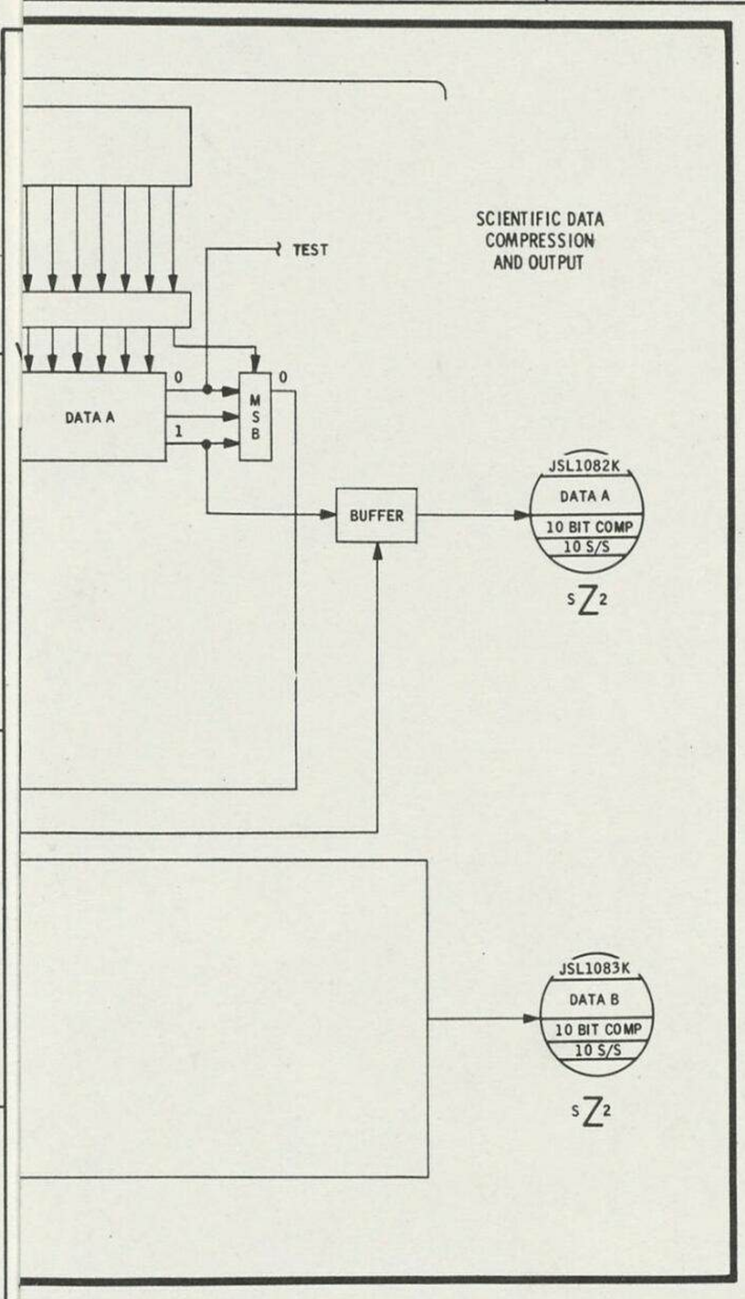
CSM 112 AND 113 | J1 | DWG NO 12.5

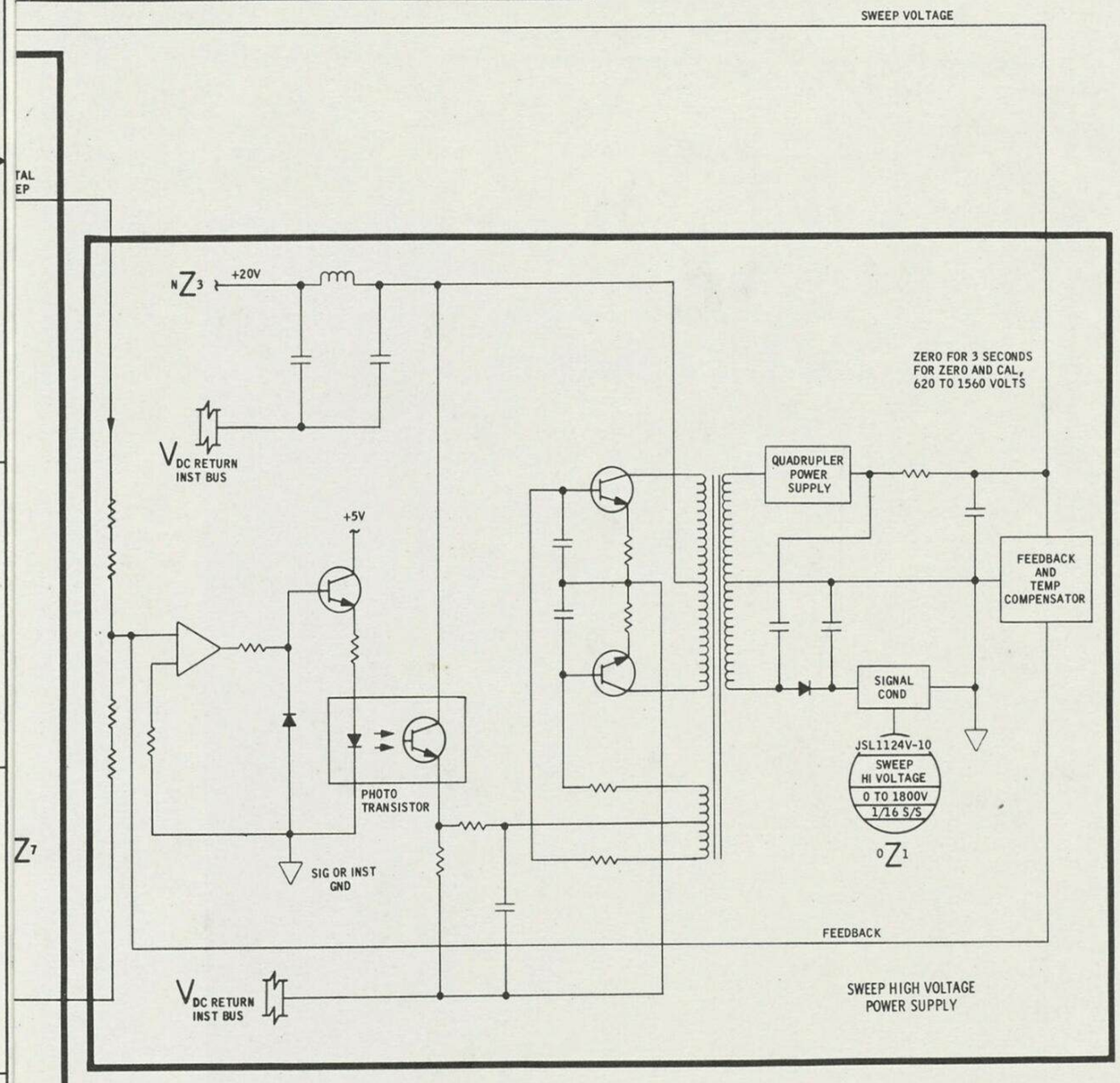
66 X 34 | PAGE 12-5 | SHEET 1 OF 1

GAMMA RAY

LTR	PCN	DR	ENGR	DATE	APPROVAL
	3			6/16/71	6/16/71

COMMENTS:





NOTES: 1 MASS SPECTROMETER BOOM CIRCUITRY.
D Z6
2.9

6 MASS

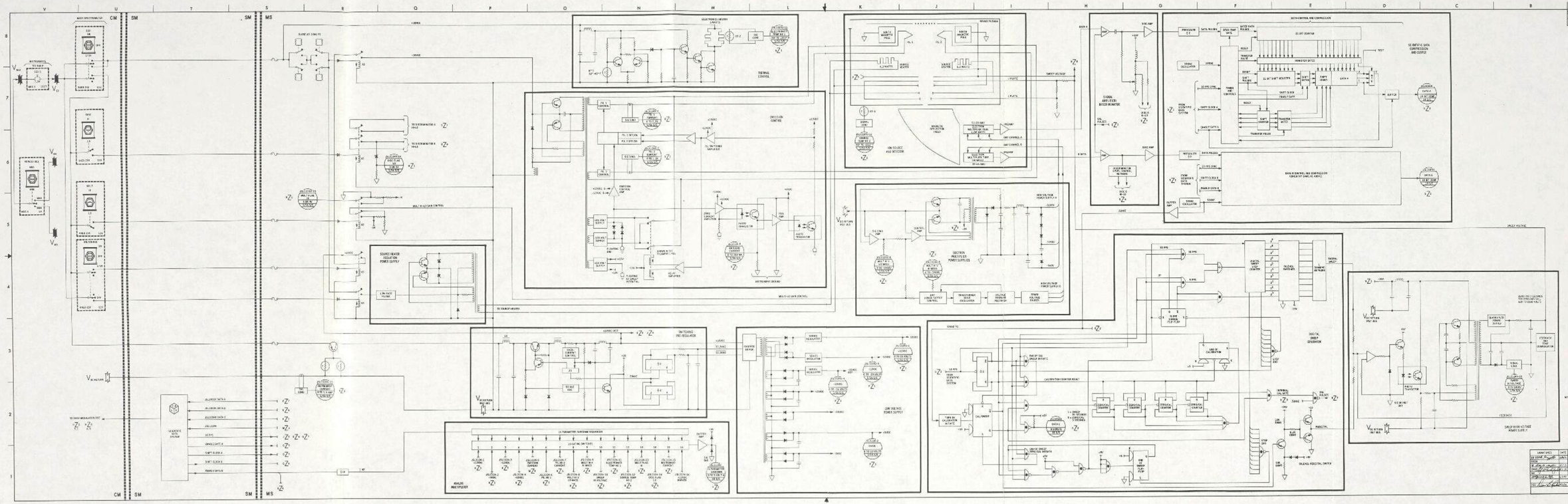
SIGNATURES	DATE
DR	3/24/71
DSGN	
QC	4-1-71
ENGR	4-1-71
NR	
APP	4-1-71
FEC	4/1/71

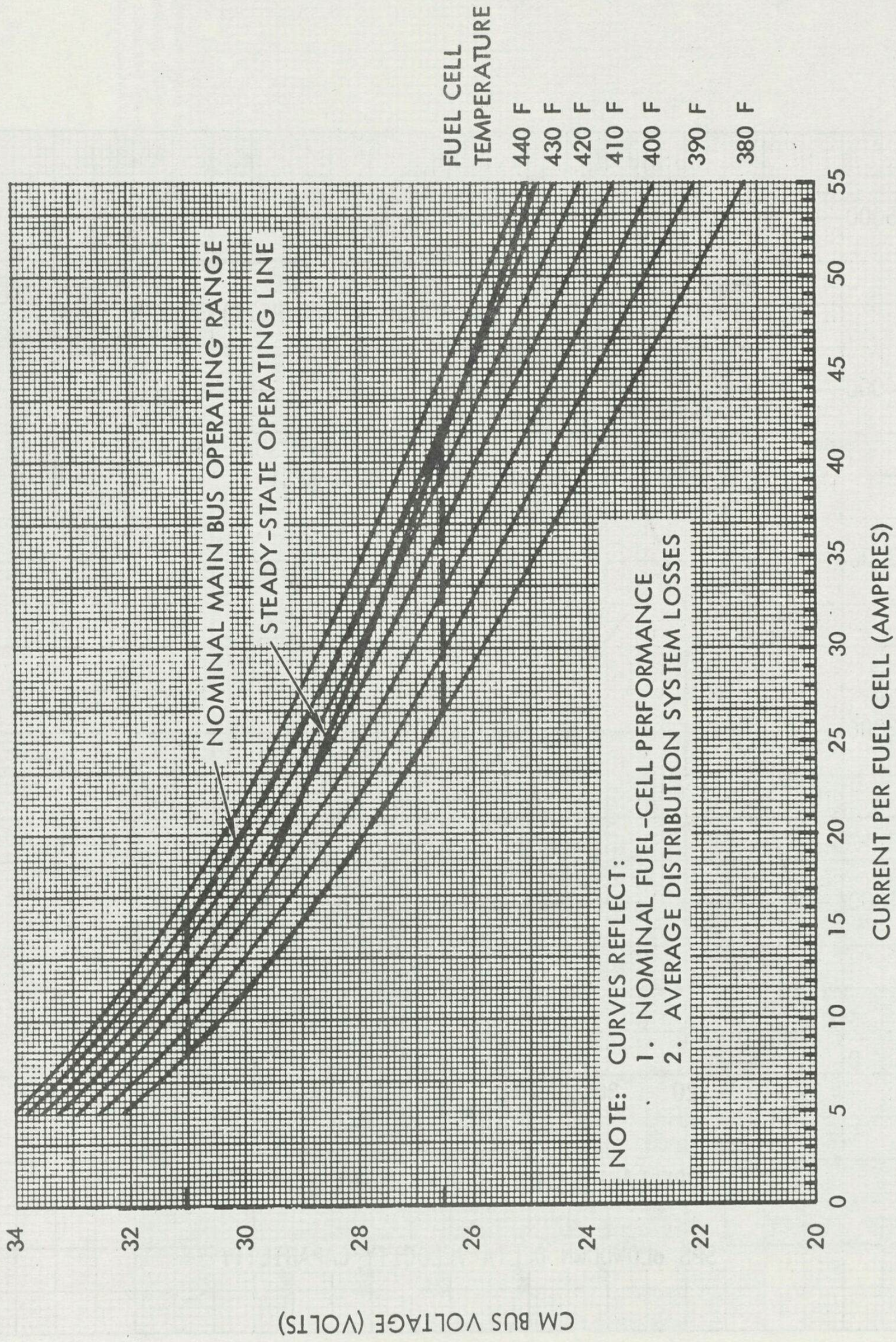
NATIONAL AERONAUTICS & SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER · HOUSTON, TEXAS

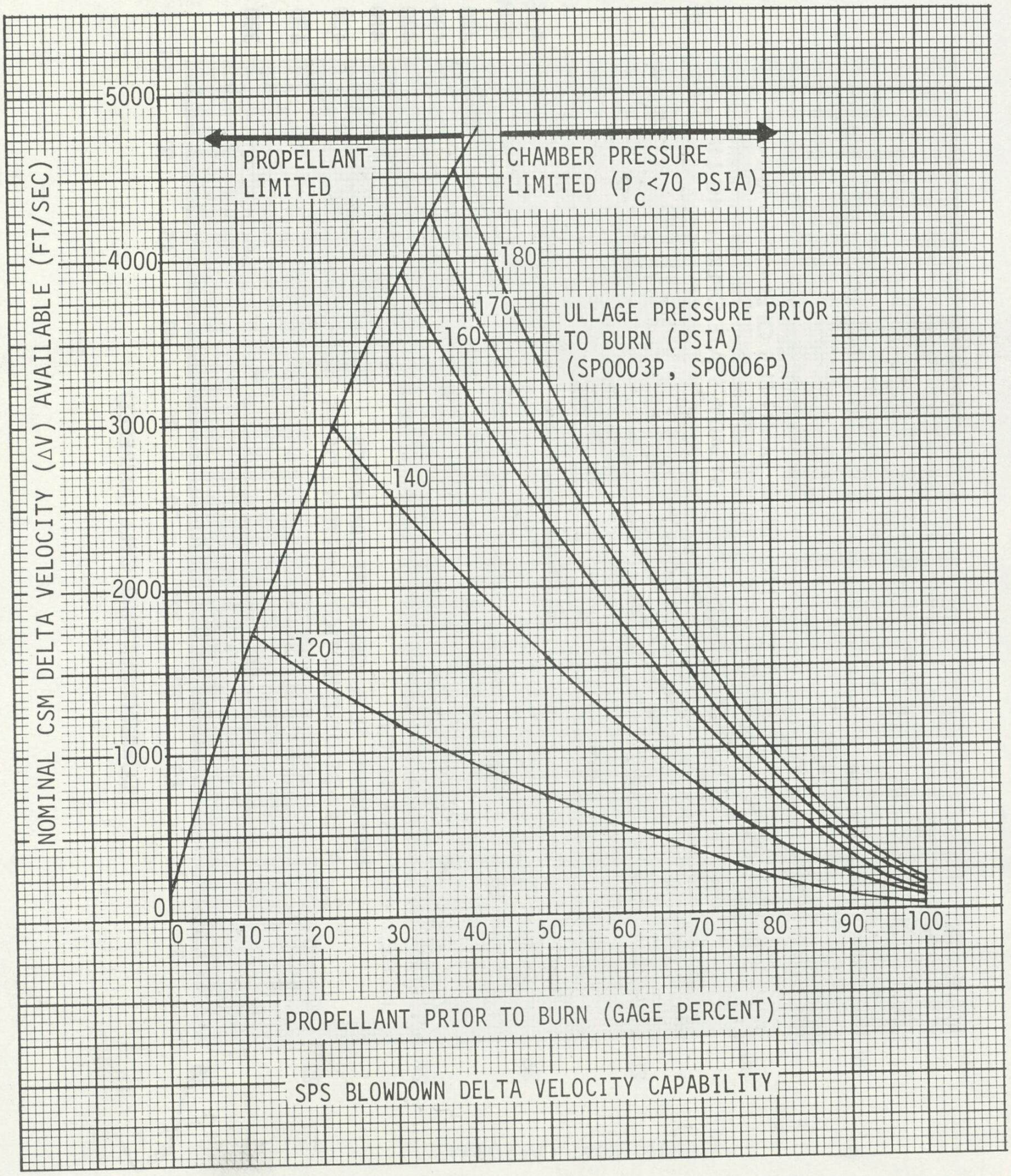
MASS SPECTROMETER

CSM		DWG NO
112 THRU 113	J_5	12.6
121 X 34	PAGE 12-6	SHEET 1 OF 1

SIM BAY SECRD/OPEN
CSM H_2
SM RCS PROPELLANT
F C PERFORM
MASS SPEC

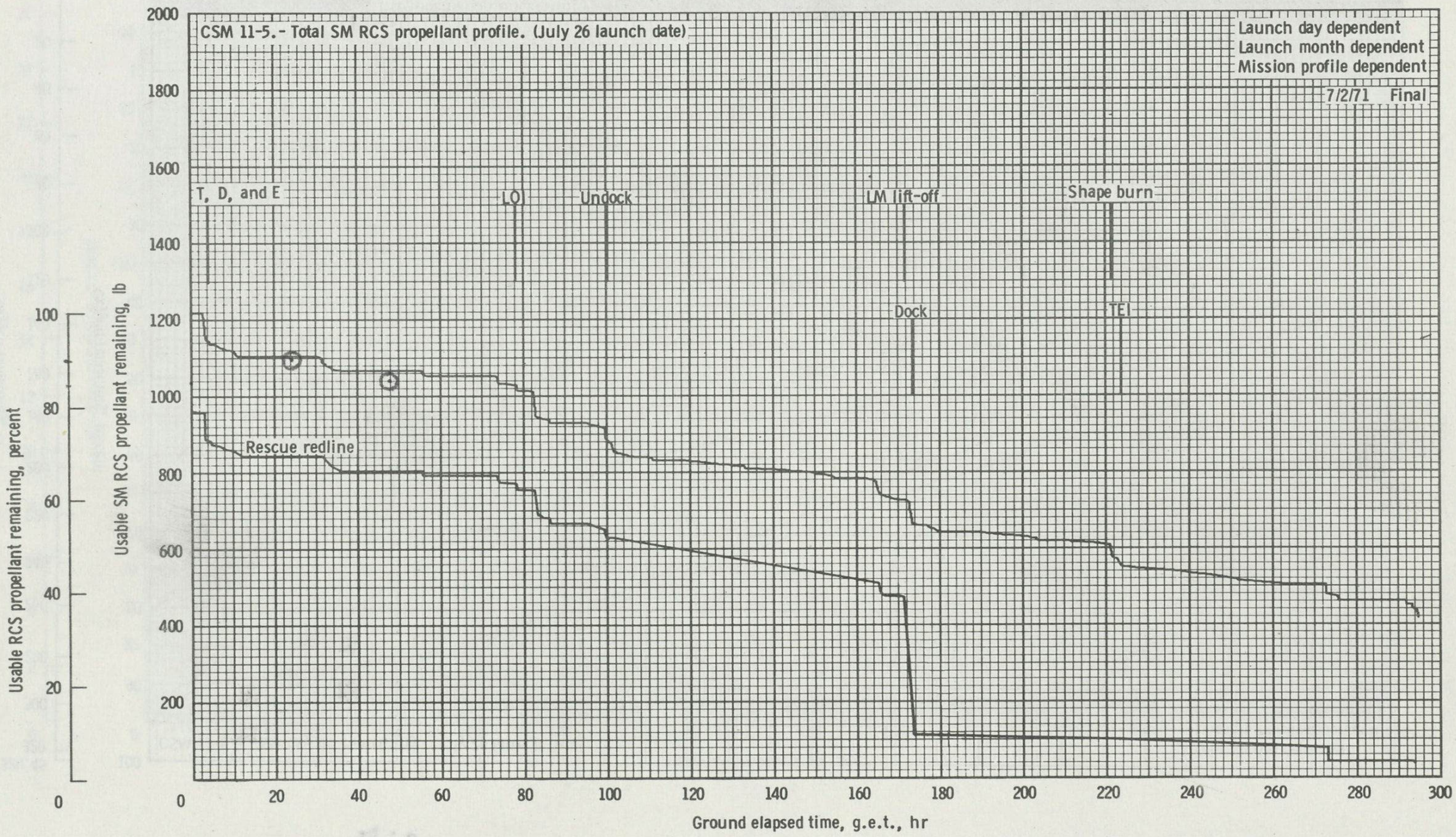

6 MASS
MASS SPECTROMETER
MASS SPEC
CM
SM
MS
THERMAL CONTROL
EMISSION CONTROL
ION SOURCE AND DETECTOR
ANALOG AMPLIFICATION HEAD
SIGNAL AMPLIFIERS BITSER MONITOR
DATA CONTROL AND COMPRESSION
SCIENTIFIC DATA COMPRESSION AND OUTPUT
DATA CONTROL AND COMPRESSION CIRCUITRY (MASS AS ASSY)
ELECTRON MULTIPLIER POWER SUPPLIES
HIGH VOLTAGE POWER SUPPLY
SOURCE HEATER ISOLATION POWER SUPPLY
SWITCHING PRE-REGULATOR
LOW VOLTAGE POWER SUPPLY
ANALOG MULTIPLEXER
DIGITAL SWEEP GENERATOR
CALIBRATION COUNTER HEAT
DRIVE SWEEP VOLTAGE GENERATOR
DRIVE SWEEP VOLTAGE POWER SUPPLY
MASS SPECTROMETER
NASA
GSFC
12.6


FUEL CELL TEMPERATURE
440 F
430 F
420 F
410 F
400 F
390 F
380 F
NOMINAL MAIN BUS OPERATING RANGE
STEADY-STATE OPERATING LINE
NOTE: CURVES REFLECT:
1. NOMINAL FUEL-CELL PERFORMANCE
2. AVERAGE DISTRIBUTION SYSTEM LOSSES
CM BUS VOLTAGE (VOLTS)
34
32
30
28
26
24
22
20
0
5
10
15
20
25
30
35
40
45
50
55
CURRENT PER FUEL CELL (AMPERES)



SPS BLOWDOWN DELTA VELOCITY CAPABILITY

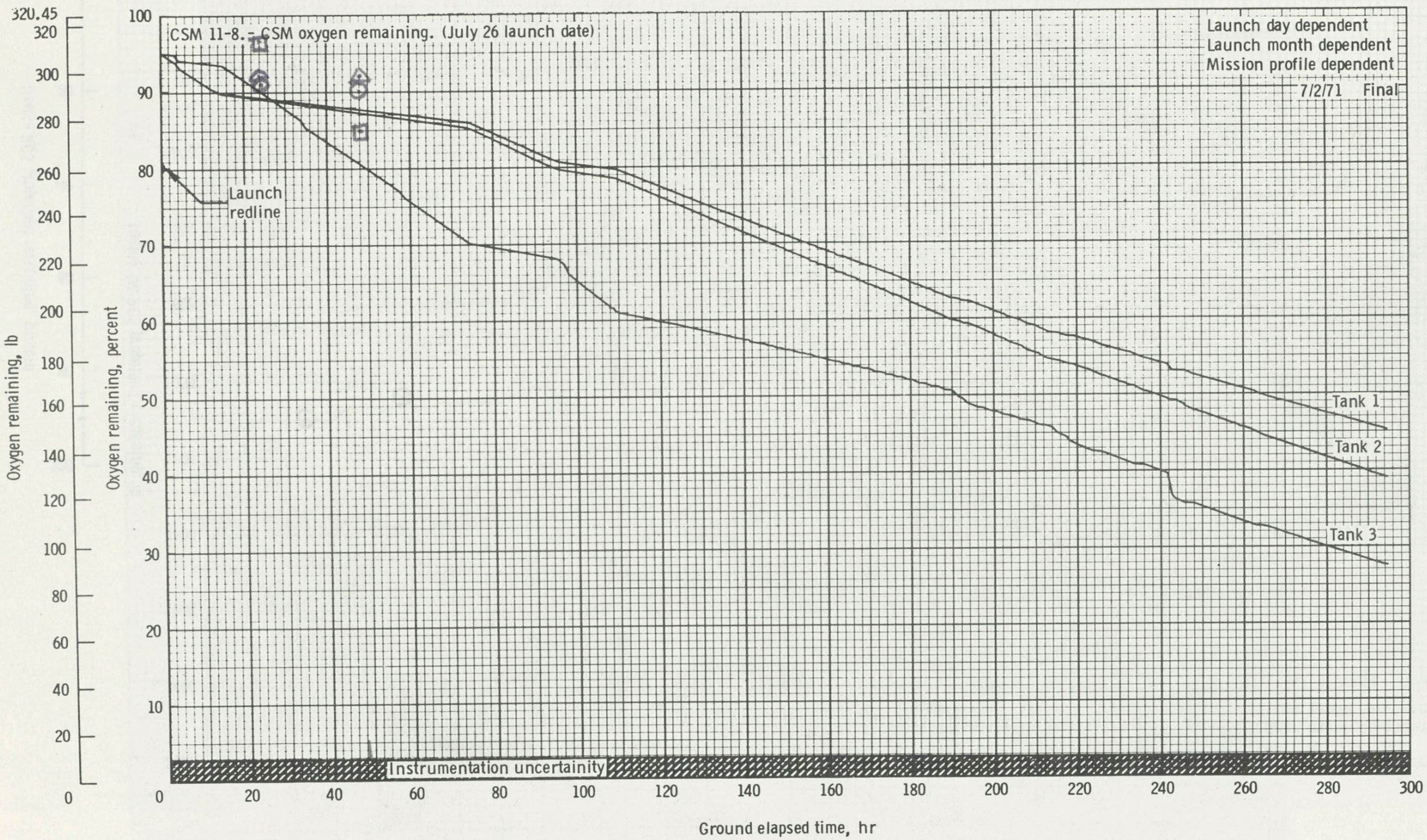
SPS BLWDN ΔV



SIM BAY SECRD/OPEN

CSM H_2

SM RCS PROPELLANT


⊙ : 1
△ : 2
□ : 3
CSM 11-8. - CSM oxygen remaining. (July 26 launch date)
Launch day dependent
Launch month dependent
Mission profile dependent
7/2/71 Final
Launch redline
Tank 1
Tank 2
Tank 3
Instrumentation uncertainity
Oxygen remaining, lb
Oxygen remaining, percent
Ground elapsed time, hr
320.45
320
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
100
90
80
70
60
50
40
30
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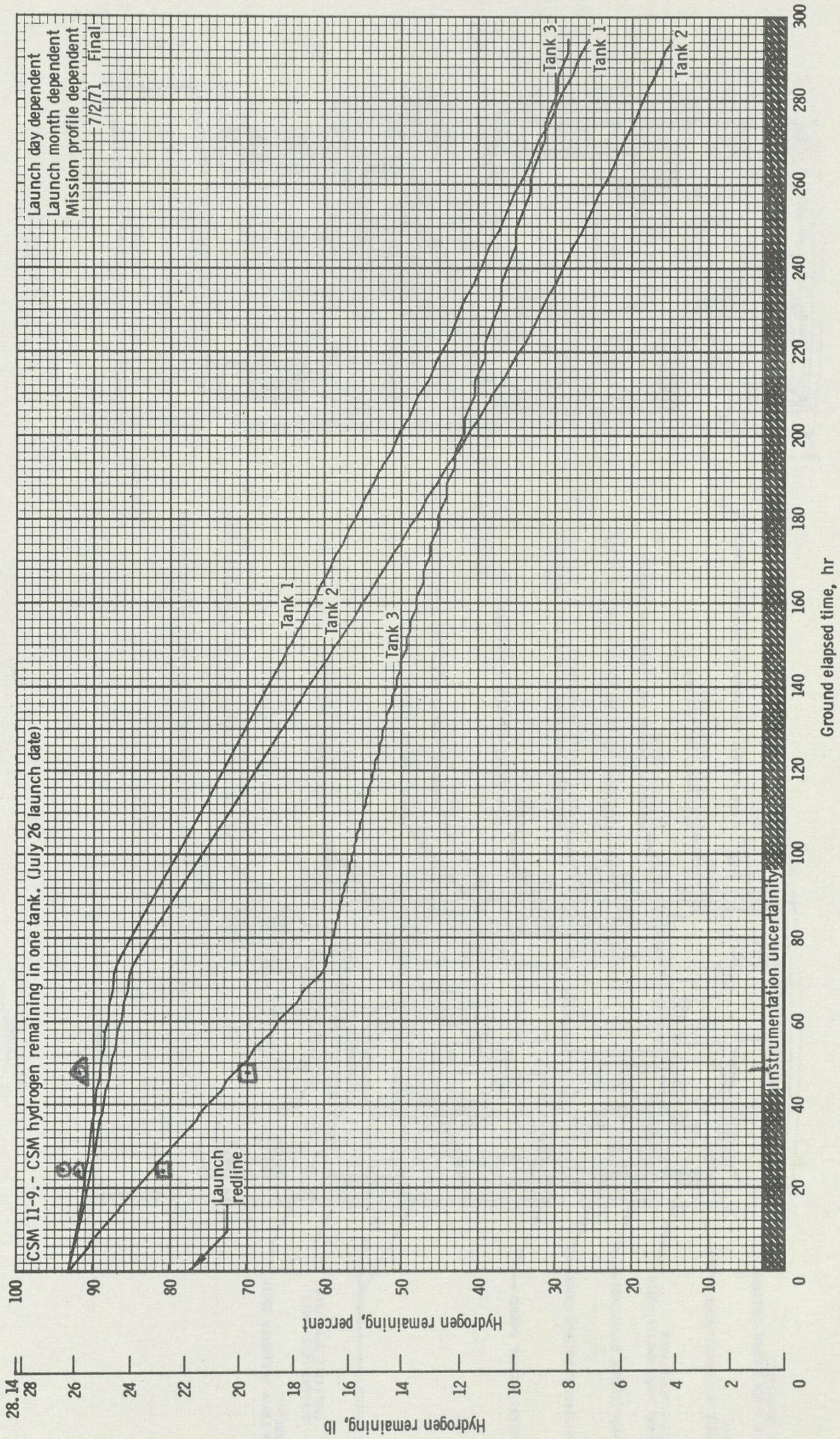
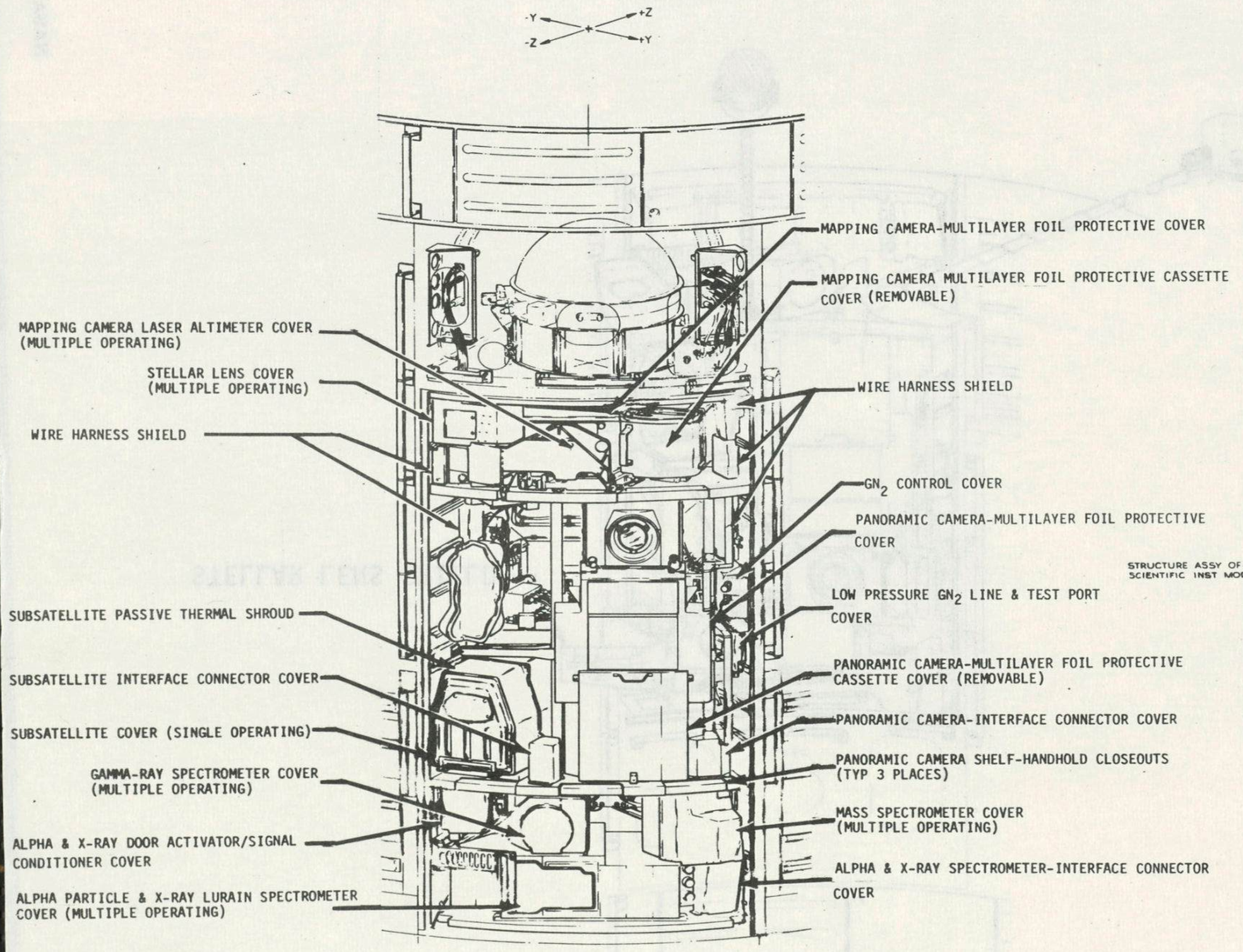
160
180
200
220
240
260
280
300



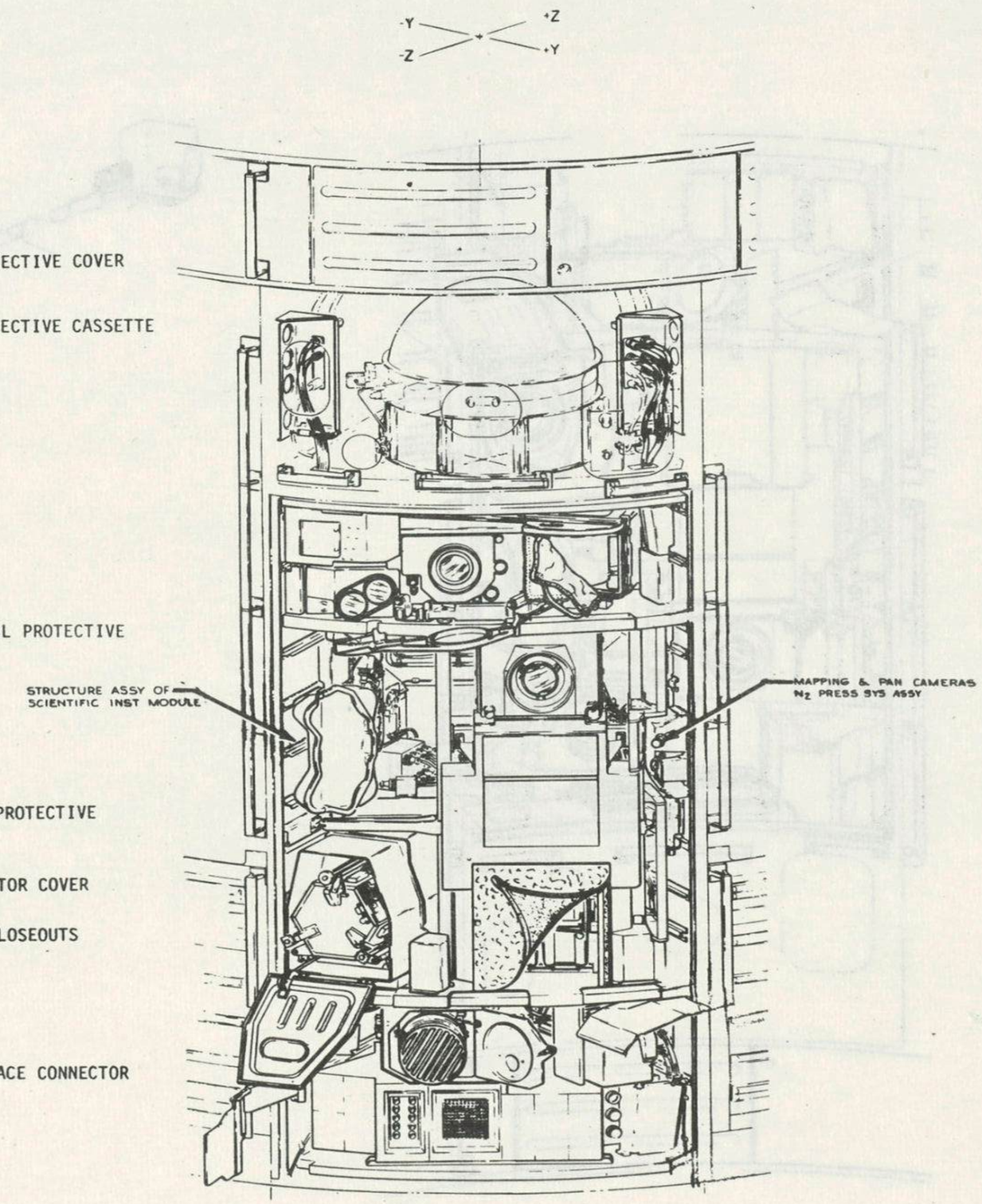
SIM BAY
SECRD/OPEN
CSM H_2

CSM O_2

SPS BLWDN ΔV

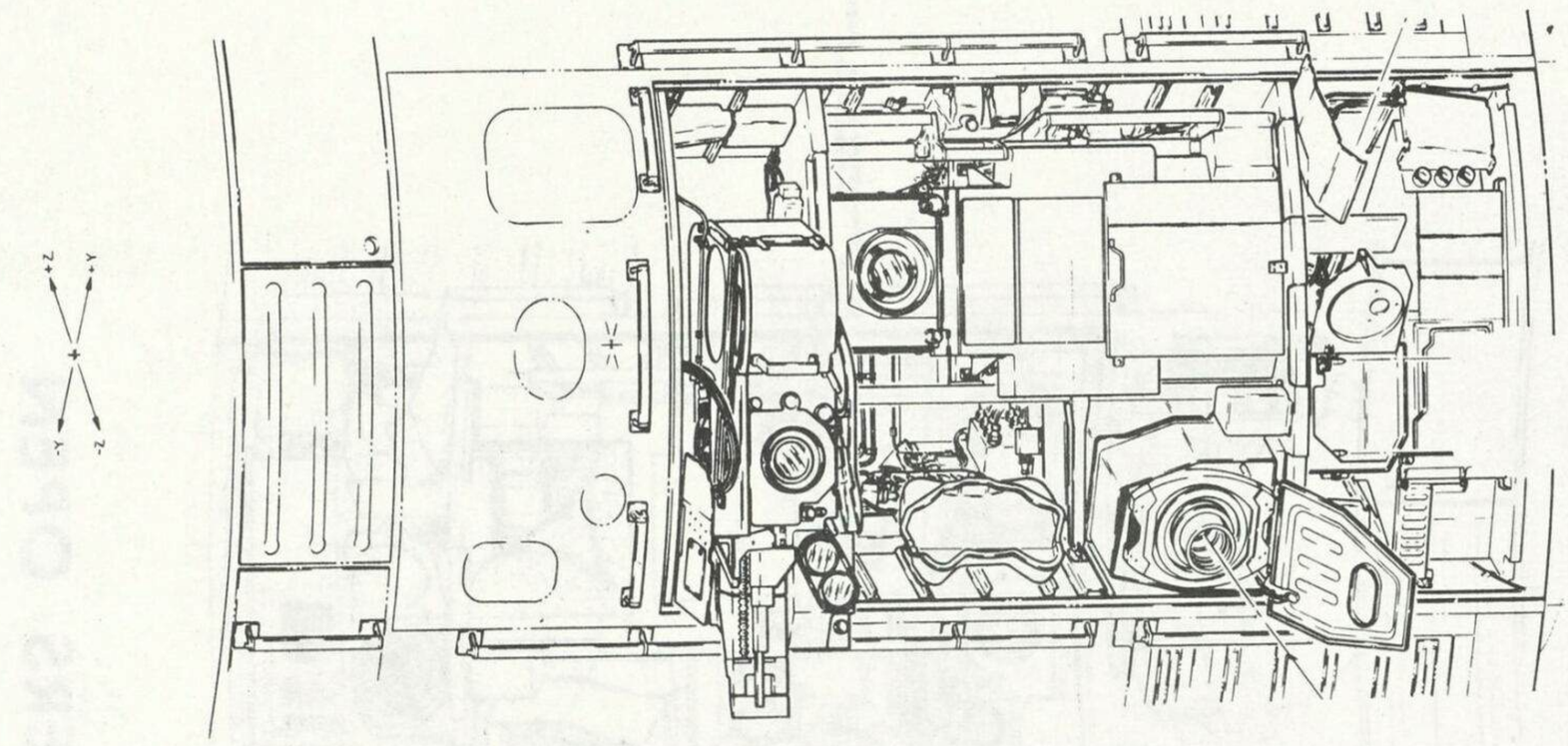


SECURED

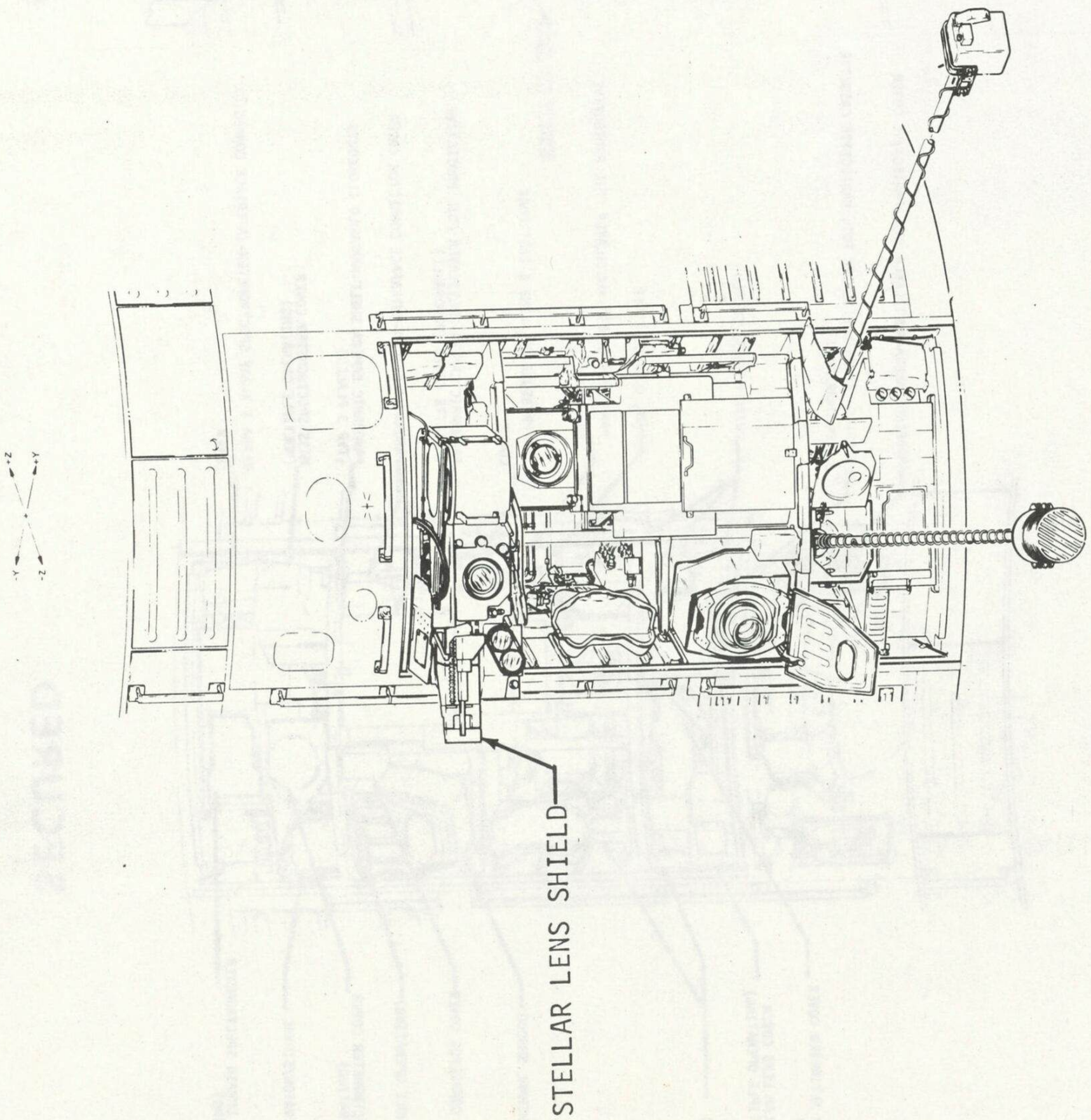


COVERS OPEN

SIM BAY
SECRD/OPEN



JETTISONED



DEPLOYED

STELLAR LENS SHIELD—D