

Payload Systems Data and Malfunction Procedures

STS-109

Mission Operations Directorate
Operations Division

Final, Rev A
November 28, 2001

National Aeronautics and
Space Administration

Lyndon B. Johnson Space Center
Houston, Texas



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PL SYS DATA & MAL PROC STS-109

FINAL, REV A (Nov 28, 2001)

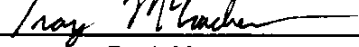
PCN-1 (Jan 11, 2002) Sheet 1 of 1

List of Implemented Change Requests (482s):

PL SYS-1320A
PL SYS-1331
PL SYS-1332 (incorporated in Rev A)
PL SYS-1333
MULTI-1583

Incorporate the following:

1. Replace iii & iv
2. Replace 1-7 thru 1-10, 1-23 thru 1-26, 1-31 & 1-32
3. Replace 3-5 & 3-6, 3-13 & 3-14
4. Replace 4-3 & 4-4
5. Replace 8-5 & 8-6
6. Replace 9-3 thru 9-6

Prepared by: 
Book Manager

Approved by: 
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Group


Chief, Cargo Integration and
Operations Branch

Encl: 24 pages

File this PCN immediately behind the front cover as a permanent record

MISSION OPERATIONS DIRECTORATE

**PAYLOAD SYSTEMS DATA AND MALFUNCTION PROCEDURES
STS-109**

FINAL, REVISION A
November 28, 2001

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Incorporates the following:				
482#:	PL SYS-1313A	PL SYS-1319	PL SYS-1323	PL SYS-1327
	PL SYS-1314A	PL SYS-1320	PL SYS-1324	PL SYS-1328
	PL SYS-1317	PL SYS-1321	PL SYS-1325	PL SYS-1329
	PL SYS-1318	PL SYS-1322	PL SYS-1326	PL SYS-1330

AREAS OF TECHNICAL RESPONSIBILITY

Book Manager	DO53/T. McCracken	281-244-0214
SSE	DO53/T. McCracken	281-244-0214
HST Systems	DO53/T. Arnold	281-483-7431
HST Command/Data	DO52/M. Halverson	281-483-1831

PAYLOAD SYSTEMS DATA AND MALFUNCTION PROCEDURES
STS-109

LIST OF EFFECTIVE PAGES

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REV A 11/28/01
PCN-1 01/11/02

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iii	* 109/FIN A,1	3-1	109/FIN A
iv	* 109/FIN A,1	3-2	109/FIN A
v	109/FIN A	3-3	109/FIN A
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* - Omit from flight book

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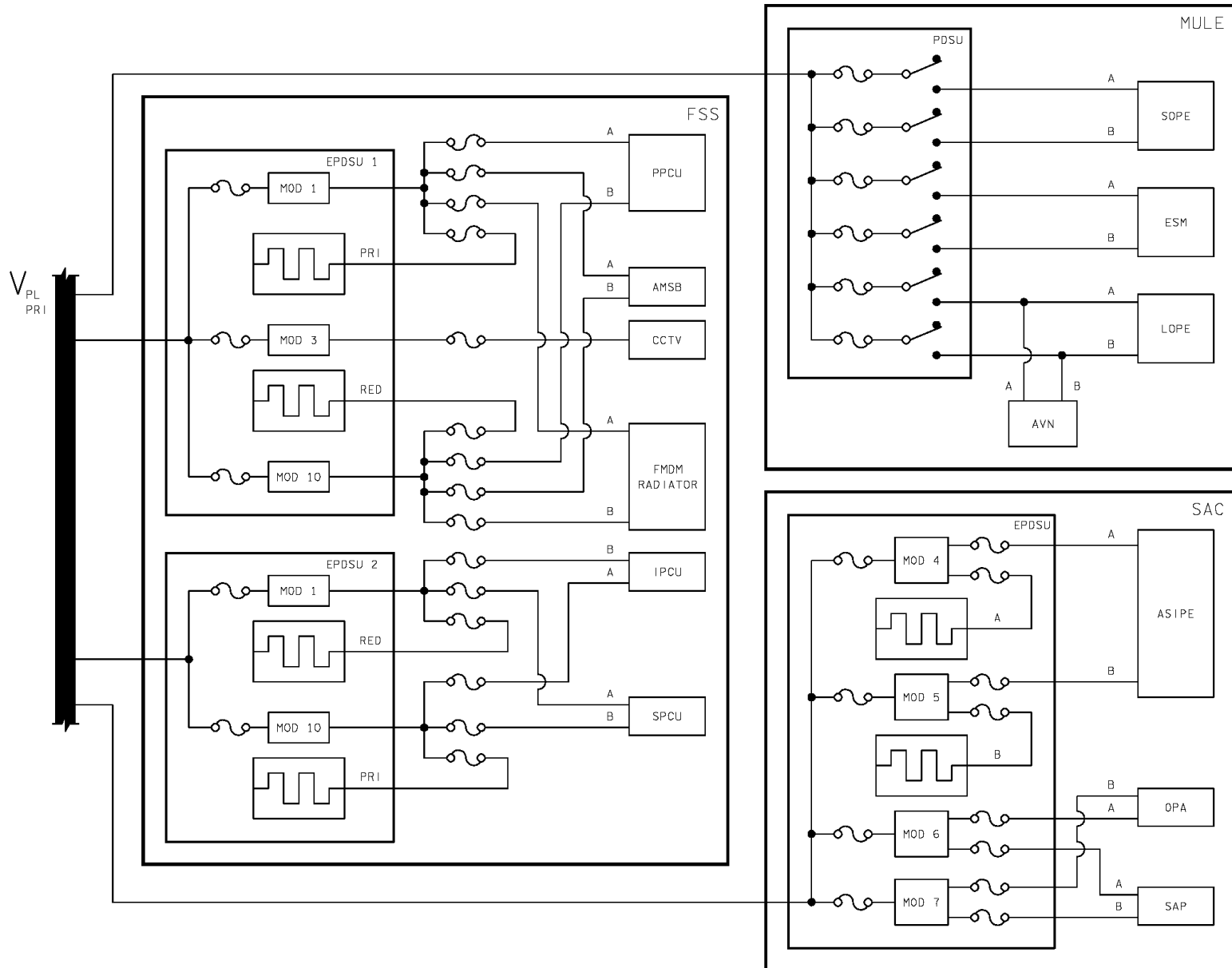
SSE

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SSE

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SSE THERMAL OVERVIEW



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SSE THERMAL
1.1

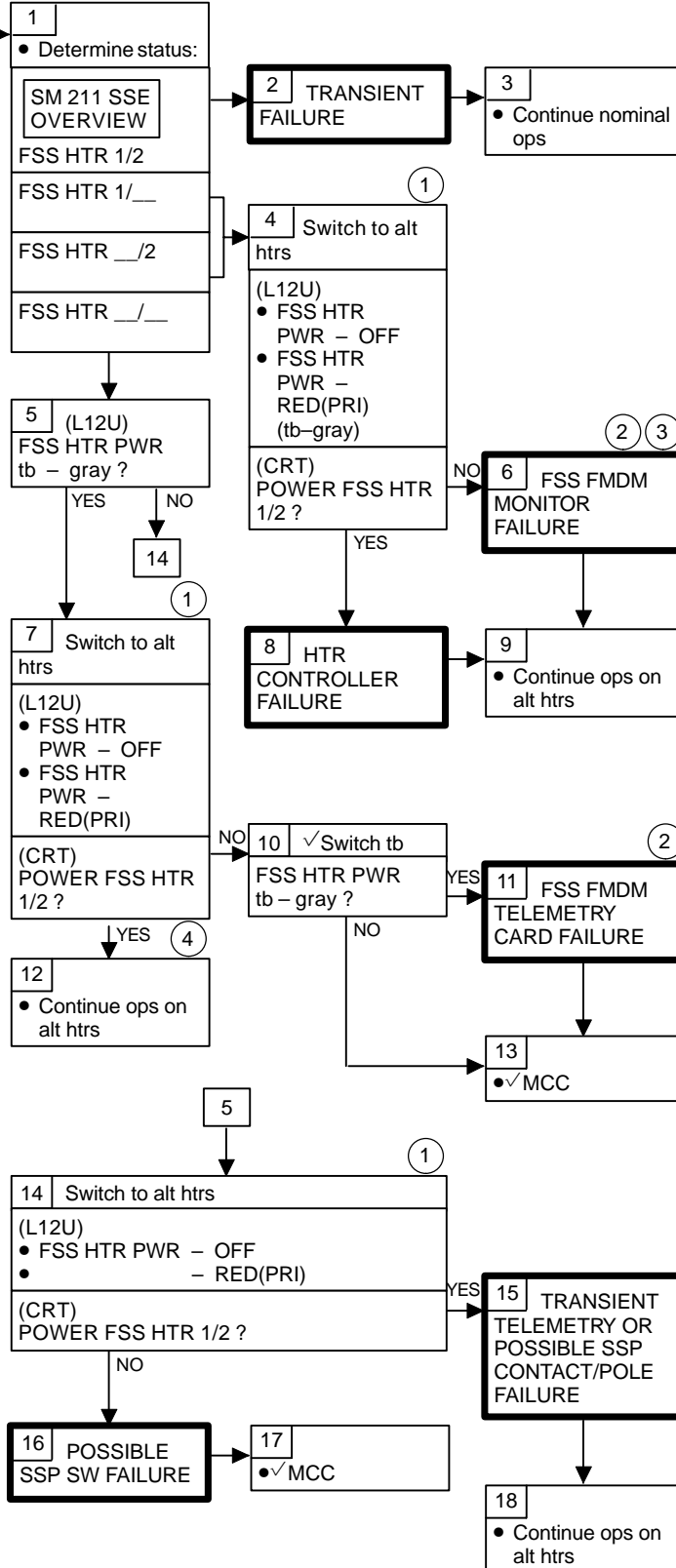
SSE THERMAL

1.1a POWER FSS HTR NOT 1/2 (S211)

POWER FSS
HTR Not 1/2

Nominal Config:

(R1)
PL PRI MNC
tb – ON
PL CAB – MNA
(MNB)
(L12U)
cb FSS A SIDE
PWR – cl
FSS HTR PWR –
PRI(RED) (tb-gray)



① If all tlm shows off but FSS HTR drawing current, then HTR is ON. HTR may be ON but not drawing current based on temp

② Ref FMDM CHANNELIZATION CHART, CARD 04 CHANNEL 01

③ Single discrete input failure

④ Possible transient tlm failure or multiple failures

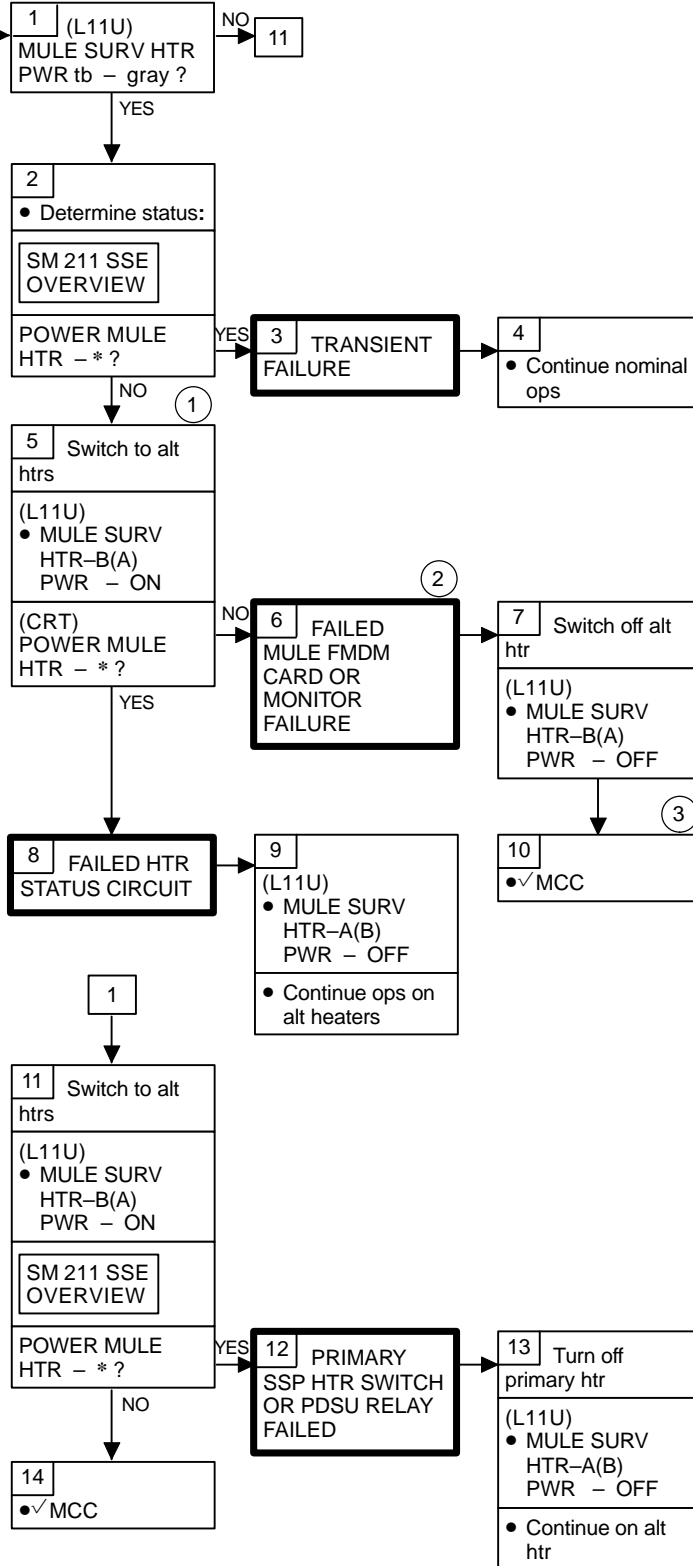
SSE THERMAL

1.1b POWER MULE HTR NOT * (S211)

POWER MULE HTR Not *

Nominal Config:

(R1)
 PL PRI MNC
 tb - ON
 PL CAB - MNA
 (MNB)
 (L11U)
 cb MULE SW
 PWR - cl
 MULE SURV HTR-A
 (B) PWR - ON



① If all tm shows off but MULE HTR drawing current, then HTR is ON. HTR may be ON but not drawing current based on temp

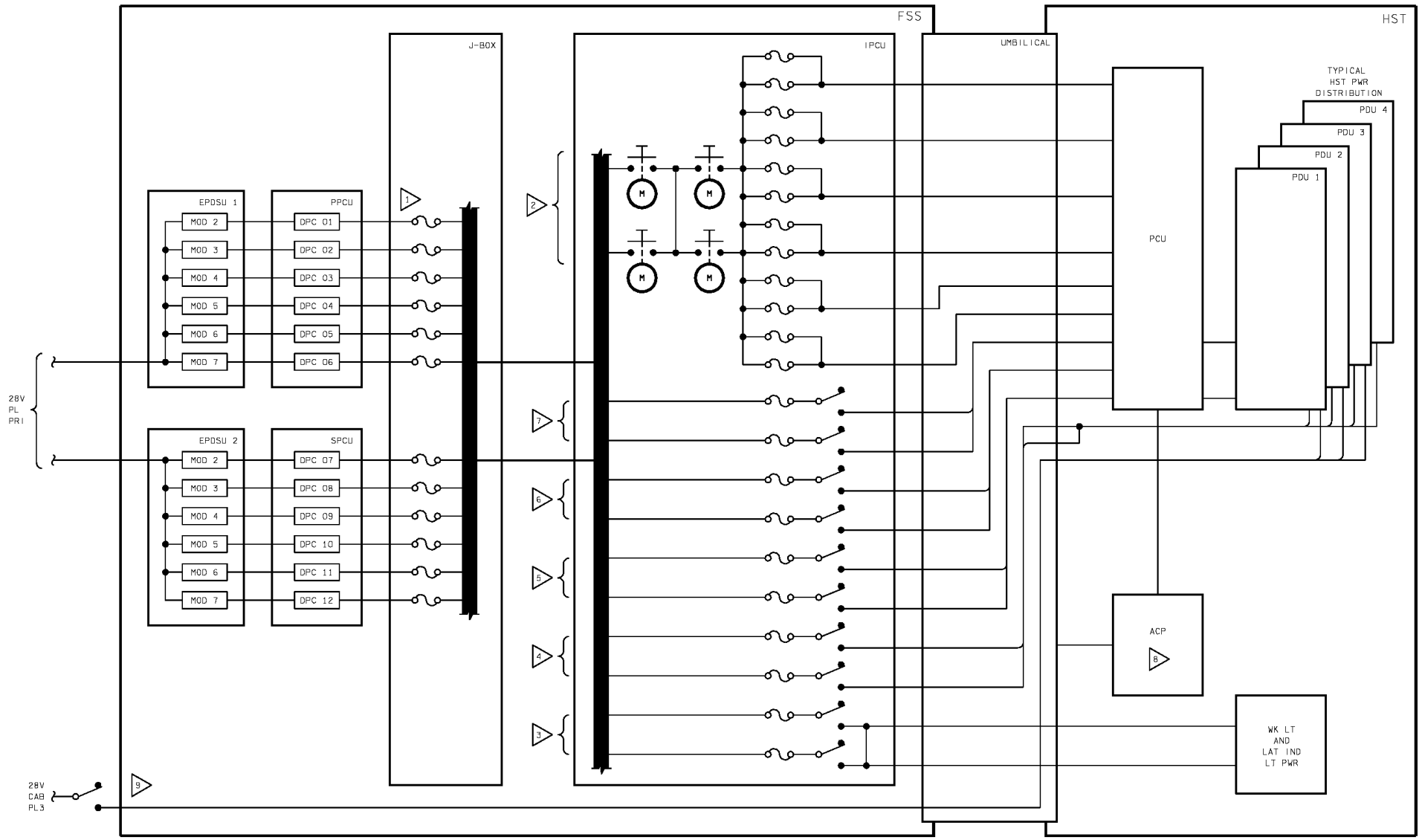
② Ref MULE FMDM CHANNELIZATION CHART, CARD 04 CHANNEL 01

③ Possible SSE SSR-1 FMDM SWAP reqd

SSE
EPS

1.2

SSE/HST POWER TRANSFER OVERVIEW



- NOTES:
- 1 ▽ INDIVIDUAL DPC OUTPUTS REDUNDANTLY FUSED
 - 2 ▽ EXT MAIN PWR
 - 3 ▽ WK LT PWR
 - 4 ▽ RSU HTR PWR/CNTRL
 - 5 ▽ EXT ESS PWR A, B
 - 6 ▽ INT ESS PWR CNTRL ON, OFF
 - 7 ▽ INT MAIN PWR CNTRL ON, OFF
 - 8 ▽ ACP ALLOWS REMOTE CONTROL OF IPCU RELAYS FOR MAIN AND ESS PWR BY EVA PERSONNEL
 - 9 ▽ FHST SHUTTER CLOSE PWR

48069002_109, ART 2

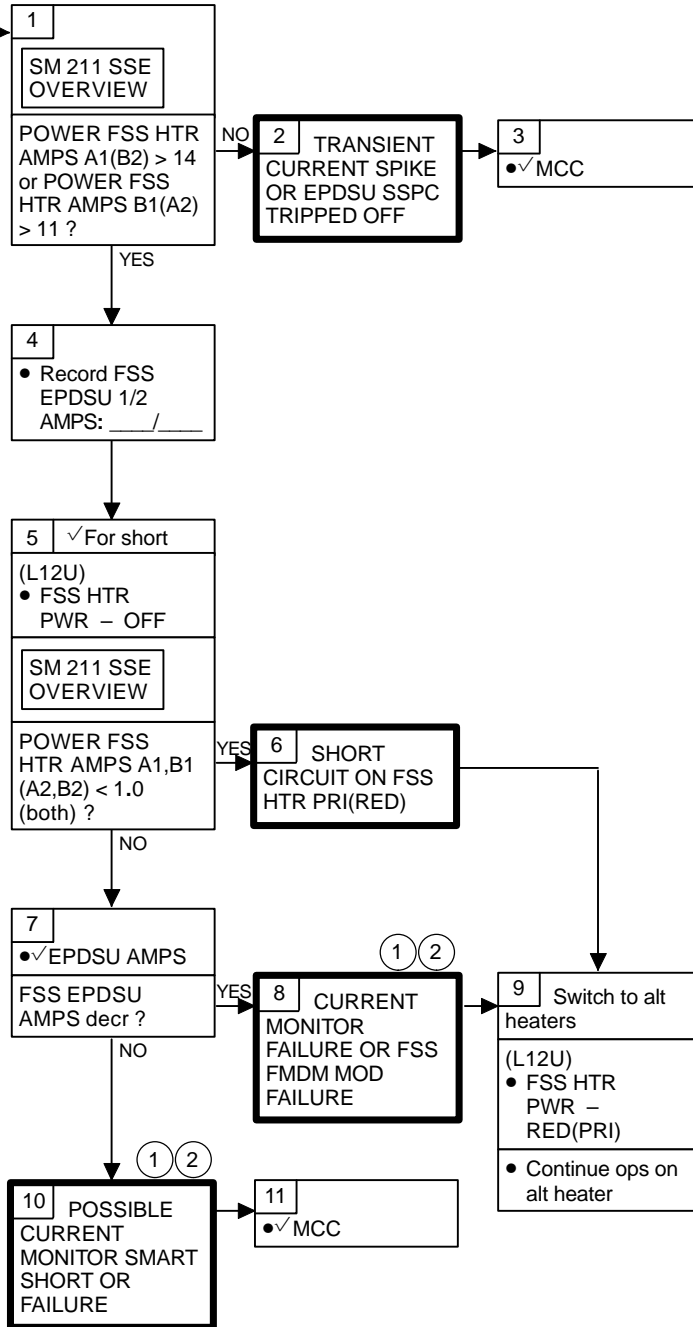
SSE EPS

1.2a POWER FSS HTR AMPS ↑ (S211)

POWER FSS HTR AMPS ↑

If:
 POWER FSS HTR A1(B2) AMPS > 14
 or
 POWER FSS HTR B1(A2) AMPS > 11

Nominal Config:
 (R1)
 PL PRI MNC
 tb - ON
 PL CAB - MNA
 (MNB)
 (L12U)
 cb FSS A
 SIDE PWR - cl
 FSS HTR PWR -
 PRI(RED)
 (tb-gray)



① Single analog input failure

② Ref FMDM CHANNELIZATION CHART MOD1 CH 8 - Htr 1A CH 21 - Htr 2B

MOD 0
 CH 13 - Htr 2A
 CH 15 - Htr 1B

SSE EPS

1.2b 'S212 AMSB DC AMPS'

SM ALERT

'S212 AMSB DC AMPS'

If:
AMSB DC AMPS > 0.09

Nominal Config:
(R1)
PL PRI MNC tb - ON
PL CAB - MNA (MNB) (L12U)
cb FSS A SIDE PWR - cl (A6U)
PL RETEN LAT 1(2) - OFF
PL RETEN PL SEL - 1 (R13L)
PL BAY MECH PWR SYS 1(2) - OFF

1 Verify inhibits
(A6U)
• ✓ PL RETEN LAT 1,2 (both) - OFF
(R13)
• ✓ PL BAY MECH PWR SYS 1,2 (both) - OFF
Msg accompanied by 'S212 MECH SEL' ?

1.2c 1
4
SM 212 SSE MECHANISMS
• Record selected Mech and corresponding status:

Item # Status
____ ____
____ ____
17

2
SM 212 SSE MECHANISMS
AMSB DC AMPS ↑ ?

3 TRANSIENT FAILURE

5
• Continue ops

6
• ✓ AMSB status
AMSB ON, ITEM 7 - blank ?

7 AMSB DC CURRENT SENSOR FAILURE

8
• Continue ops with caution using mech sel field to verify only one mechanism selected

9 Evaluate status
Any two MECH SEL - * or one MECH SEL - * and O/R ENA, ITEM 21 - * ?

13

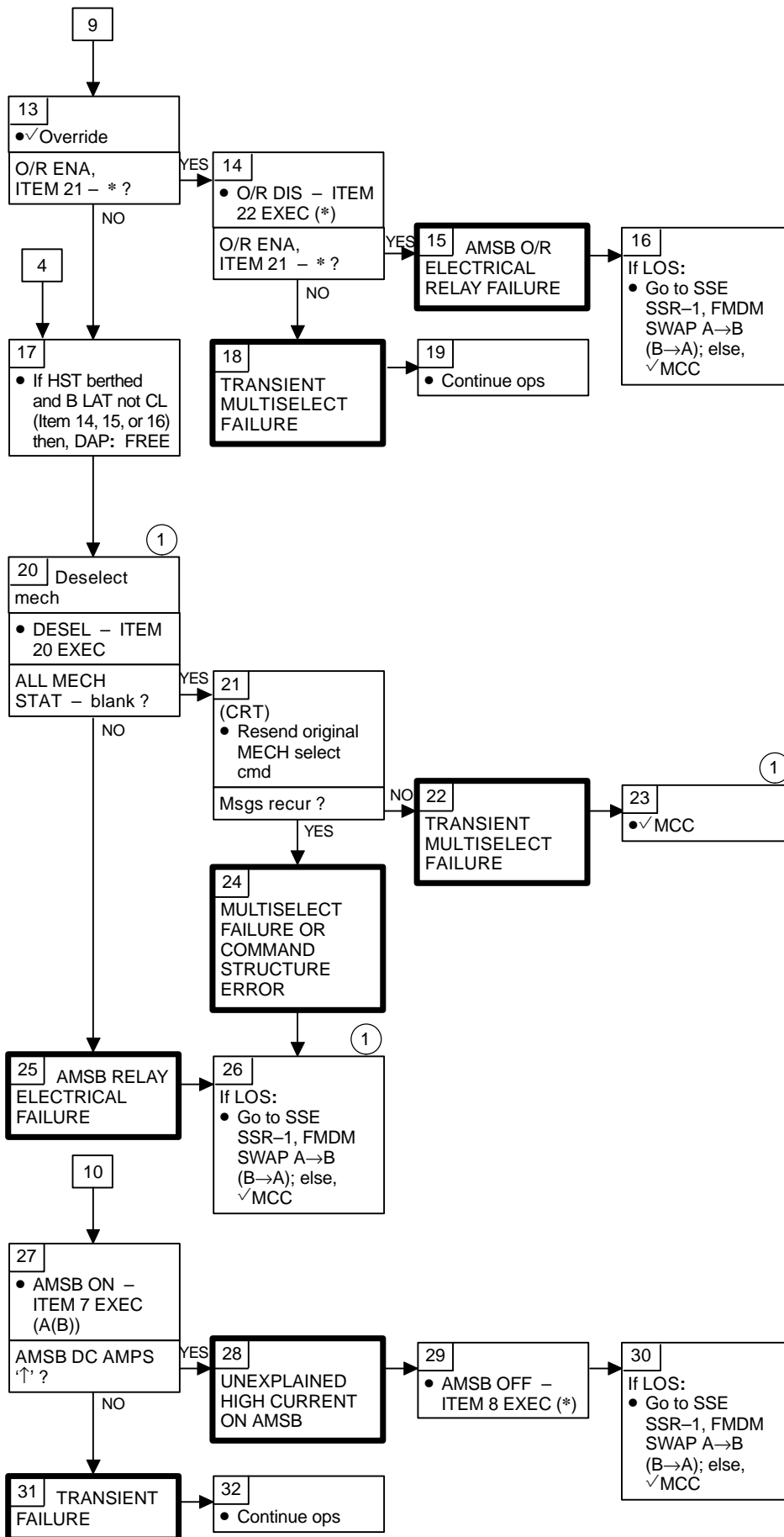
10 Test current sensor
• AMSB OFF - ITEM 8 EXEC (*)
AMSB DC AMPS ↑ ?

11 AMSB CURRENT SENSOR FAILURE OR EPDSU SHORT

27

12
If LOS:
• Go to SSE SSR-1, FMDM SWAP A→B (B→A); else, ✓ MCC

SSE EPS 1.2b (Cont)



① Multiple mechanisms may have driven and need to be reconfigured to a nominal state prior to continuing operations

SSE EPS

1.2c 'S212 MECH SEL'

SM
ALERT

'S212 MECH
SEL'

If any two of the mechanisms are selected:
Pivoter
Rotator
Translator
Downlock
B LATCHES 1,2,3
Main Umbilical

Nominal Config:

(R1)
PL PRI MNC tb - ON
PL CAB - MNA (MNB)
(L12U)
cb FSS A
SIDE PWR - cl
(A6U)
PL RETEN LAT 1(2) - OFF
(R13L)
PL BAY MECH PWR SYS 1(2) - OFF

1 Verify inhibits
(A6U)
• ✓ PL RETEN LAT 1,2 (both) - OFF
(R13)
• ✓ PL BAY MECH PWR SYS 1,2 (both) - OFF
Accompanied by 'S212 AMSB DC AMPS' ?

YES → 1.2b 4

NO

2
SM 212 SSE MECHANISMS
• ✓ MECH STAT - ITEMS 9-19
All but one STAT - blank ?

YES → 3 TRANSIENT AMSB RELAY STATUS FAILURE

4
• Continue ops

NO

5 Deselect mech
• DESEL - ITEM 20 EXEC
All MECH STAT - blank ?

NO → 6 AMSB RELAY PHYSICALLY FAILED CLOSED

YES

7 (CRT)
• Resend original MECH select cmd
Msg recurs ?

YES → 8 MULTISELECT FAILURE OR COMMAND STRUCTURE ERROR

9
• Go to SSE SSR-1, FMDM SWAP A→B (B→A)

NO

10 TRANSIENT MULTISELECT FAILURE

11
• Continue ops

SSE EPS

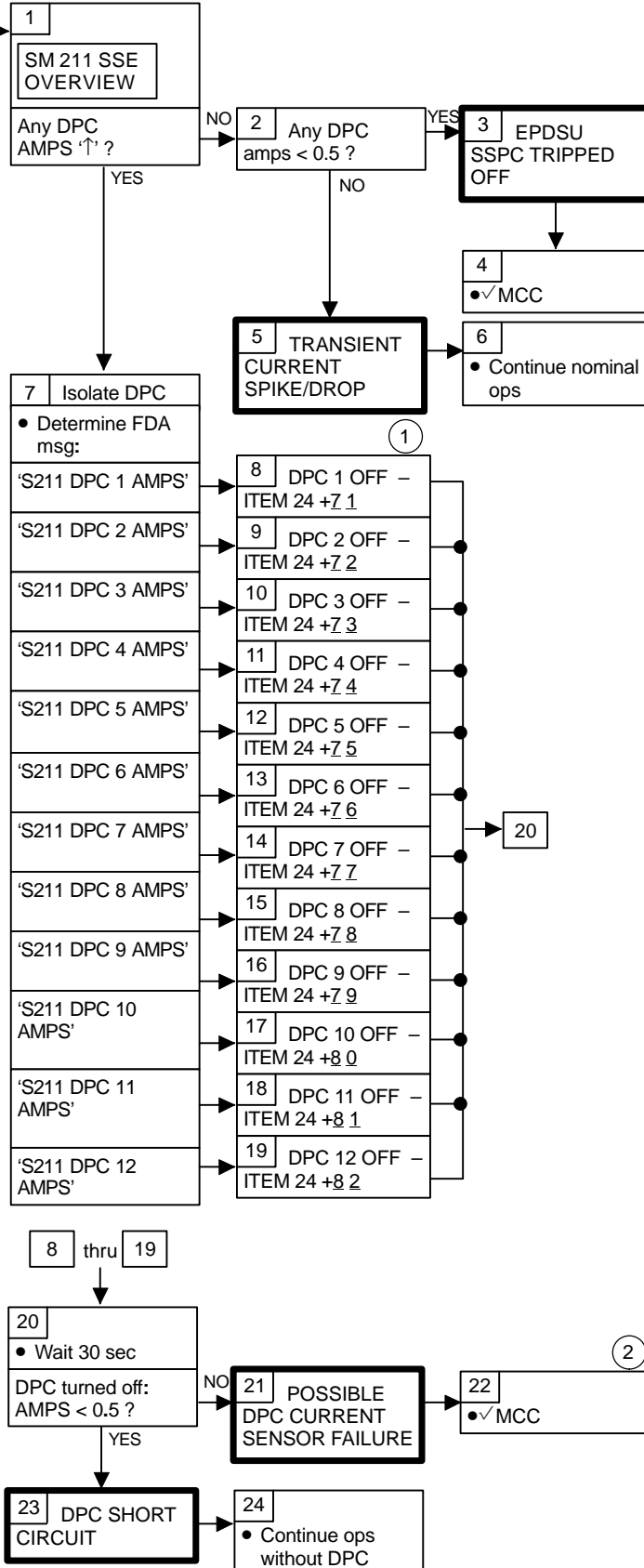
1.2d 'S211 DPC 1(2,3,4,...12) AMPS'

SM ALERT

'S211 DPC AMPS'

If any DPC 1-12 AMPS > 19.0

Nominal Config:
 (R1)
 PL PRI MNC tb - ON
 PL CAB - MNA (MNB)
 (L12U)
 cb FSS A
 SIDE PWR - cl
 FSS HTR PWR - PRI(RED) (tb-gray)



- ① Full HST load can be met by remaining DPCs
- ② Ground to evaluate whether to turn DPC back on

SSE EPS

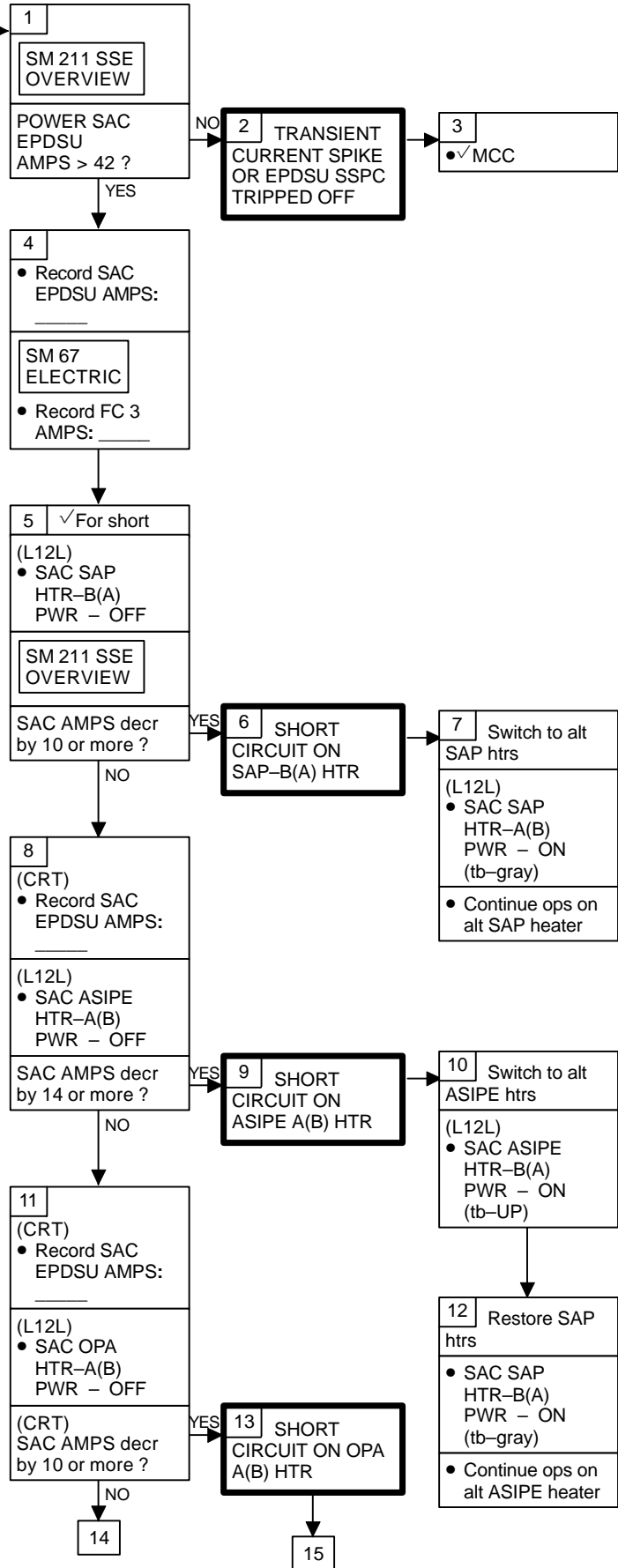
1.2e RESERVED

SSE EPS

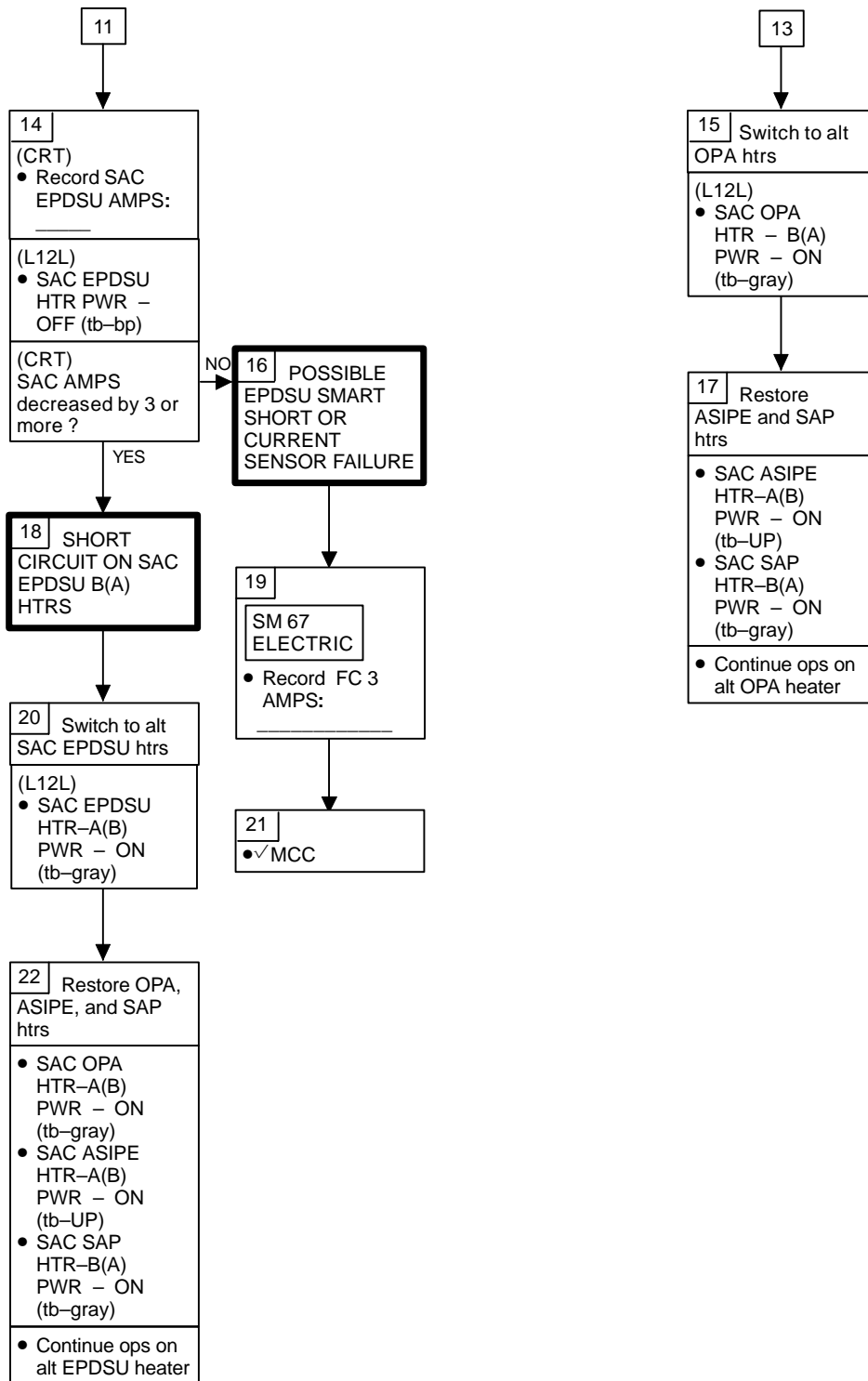
1.2f POWER SAC EPDSU AMPS ↑ (S211)

POWER SAC EPDSU AMPS ↑
If: SAC AMPS > 42

Nominal Config:
(R1)
PL PRI MNC – ON
PL CAB – MNA (MNB)
(L12U)
cb SAC A–SIDE PWR ENA – cl
SAC B–SIDE PWR ENA – ON
SAC EPDSU HTR PWR–B – ON (tb–gray)
SAC ASIPE HTR–A PWR – ON (tb–UP)
SAC OPA HTR–A PWR – ON
SAC SAP HTR–B PWR – ON (tb–gray)



SSE EPS 1.2f (Cont)



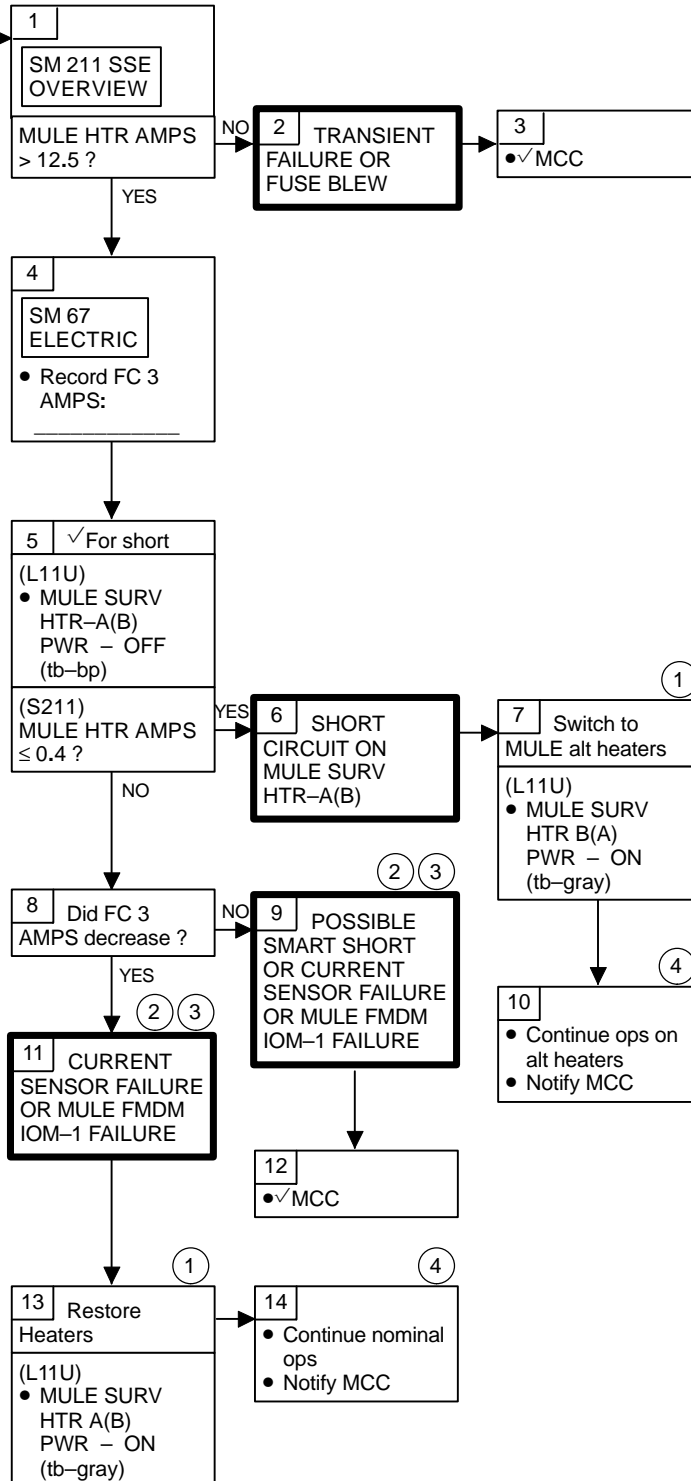
SSE EPS

1.2g POWER MULE HTR AMPS ↑ (S211)

POWER MULE
HTR AMPS ↑

If MULE HTR AMPS
> 12.5

Nominal Config:
(R1)
PL PRI MNC
tb – ON
PL CAB – MNA
(MNB)
(L11U)
cb MULE SW
PWR – cl
MULE SURV
HTR-A(B)
PWR – ON
MULE SURV HTR
PWR tb – gray



- ① MULE HTR AMPS Invalid
- ② Single analog input failure
- ③ Ref FMDM CHANNELIZATION CHART MOD 1 CH 26-MULE SURV HTR CURRENT
- ④ Possible SSE SSR-1 FMDM SWAP reqd

SSE EPS

1.2h POWER MULE ESM AMPS ↑ (S211)

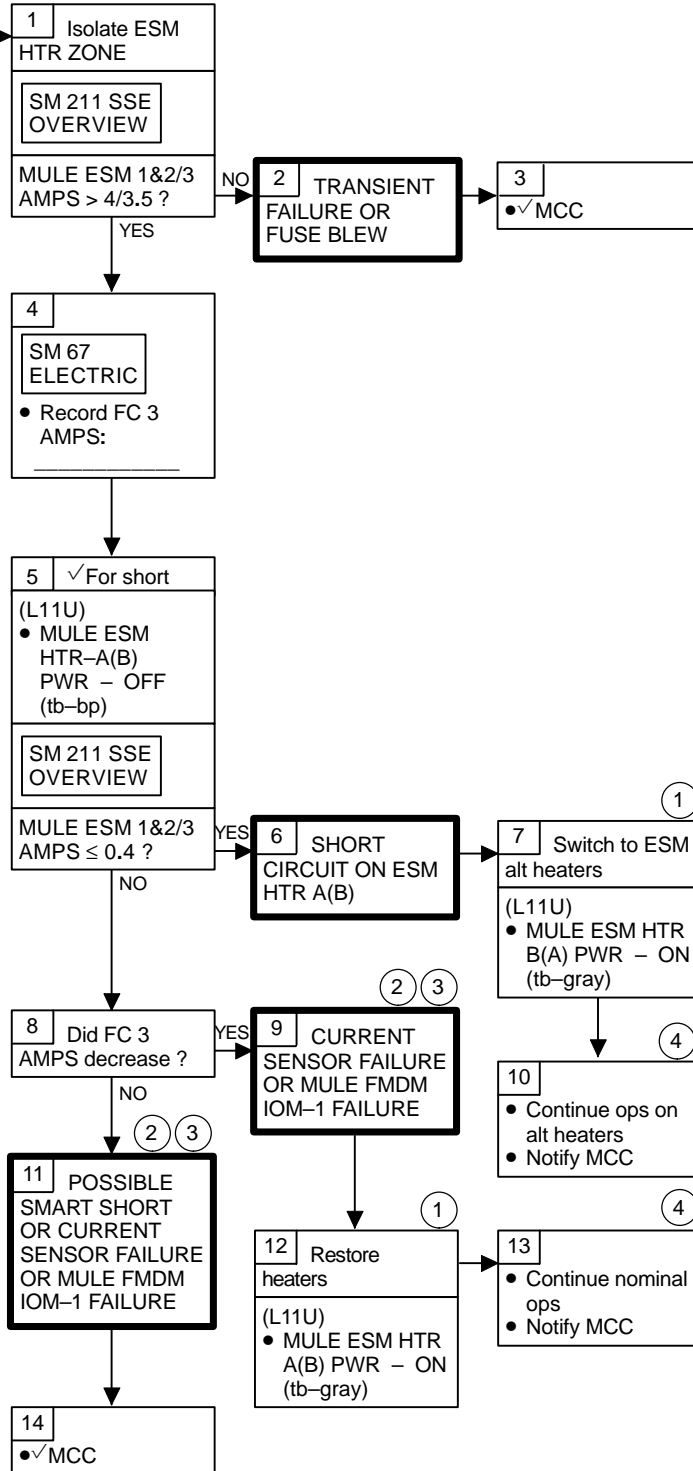
POWER MULE ESM AMPS ↑

If MULE ESM 1&2 AMPS > 4.0

If MULE ESM 3 AMPS > 3.5

Nominal Config:

(R1)
 PL PRI MNC
 tb – ON
 PL CAB – MNA (MNB)
 (L11U)
 cb MULE SW
 PWR – cl
 MULE ESM HTR A(B) PWR – ON
 (tb–gray)



- ① MULE ESM HTR AMPS Invalid
- ② Single analog input failure
- ③ Ref FMDM CHANNELIZATION CHART MOD 1 CH 11–MULE ESM ZONE 1&2 HTR CURRENT
- CH 12–MULE ESM ZONE 3 HTR CURRENT
- ④ Possible SSE SSR–1 FMDM SWAP reqd

SSE EPS

1.2i POWER MULE SOPE AMPS ↑ (S211)

POWER MULE SOPE AMPS ↑

If MULE SOPE 1A AMPS > 3.5

If MULE SOPE 2A AMPS > 3.5

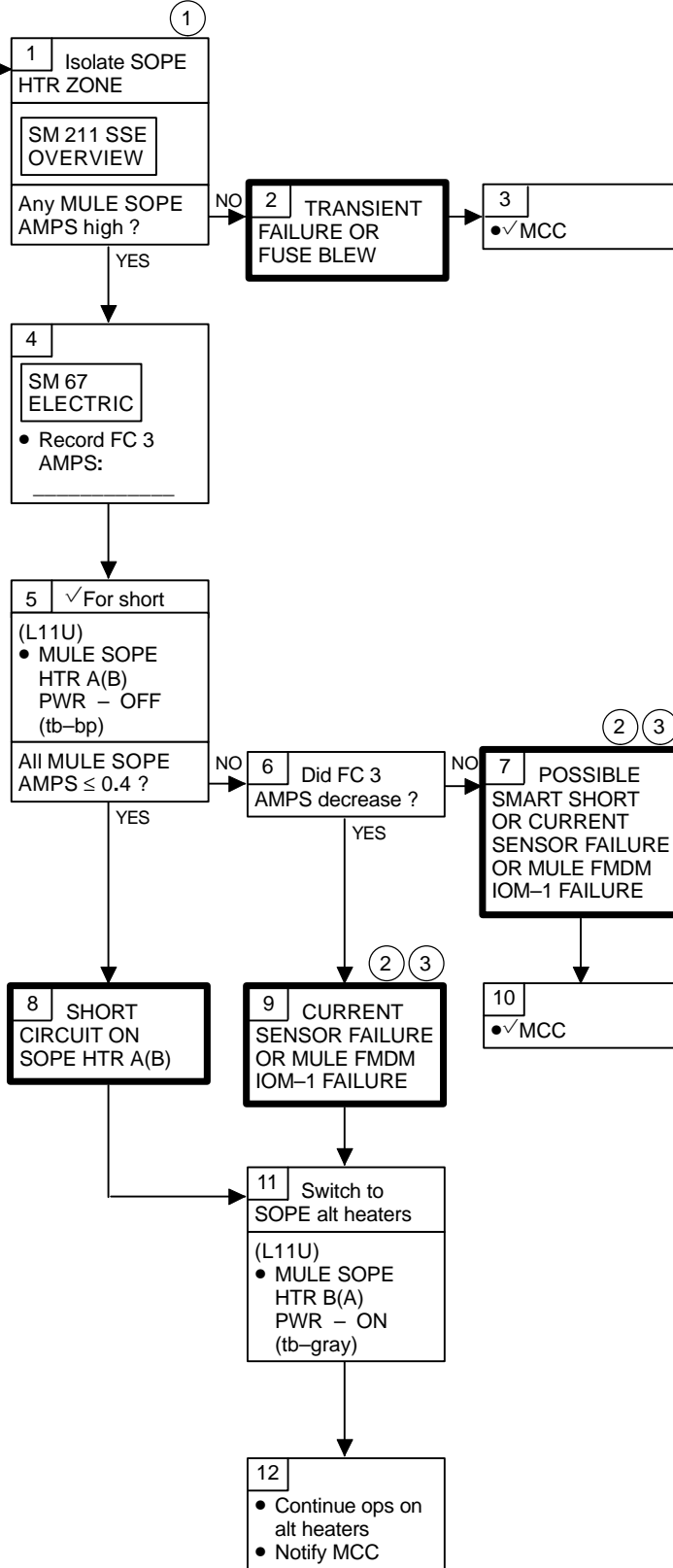
If MULE SOPE 3A AMPS > 3.5

If MULE SOPE 1B&2B AMPS > 6

If MULE SOPE 3B AMPS > 3.5

Nominal Config:

- (R1)
- PL PRI MNC
tb – ON
- PL CAB – MNA
(MNB)
- (L11U)
- cb MULE SW
PWR – cl
- MULE SOPE HTR
A(B) PWR – ON
(tb-gray)



① SOPE HTR HIGH AMP indications:
1A > 3.5
2A > 3.5
3A > 3.5
1B&2B > 6
3B > 3.5

② Single analog input failure

③ Ref FMDM CHANNELIZATION CHART MOD 1 CH 8–MULE SOPE ZONE 2 PRI HTR CURRENT

CH 13–MULE SOPE ZONE 1 PRI HTR CURRENT

CH 14–MULE SOPE ZONE 3 PRI HTR CURRENT

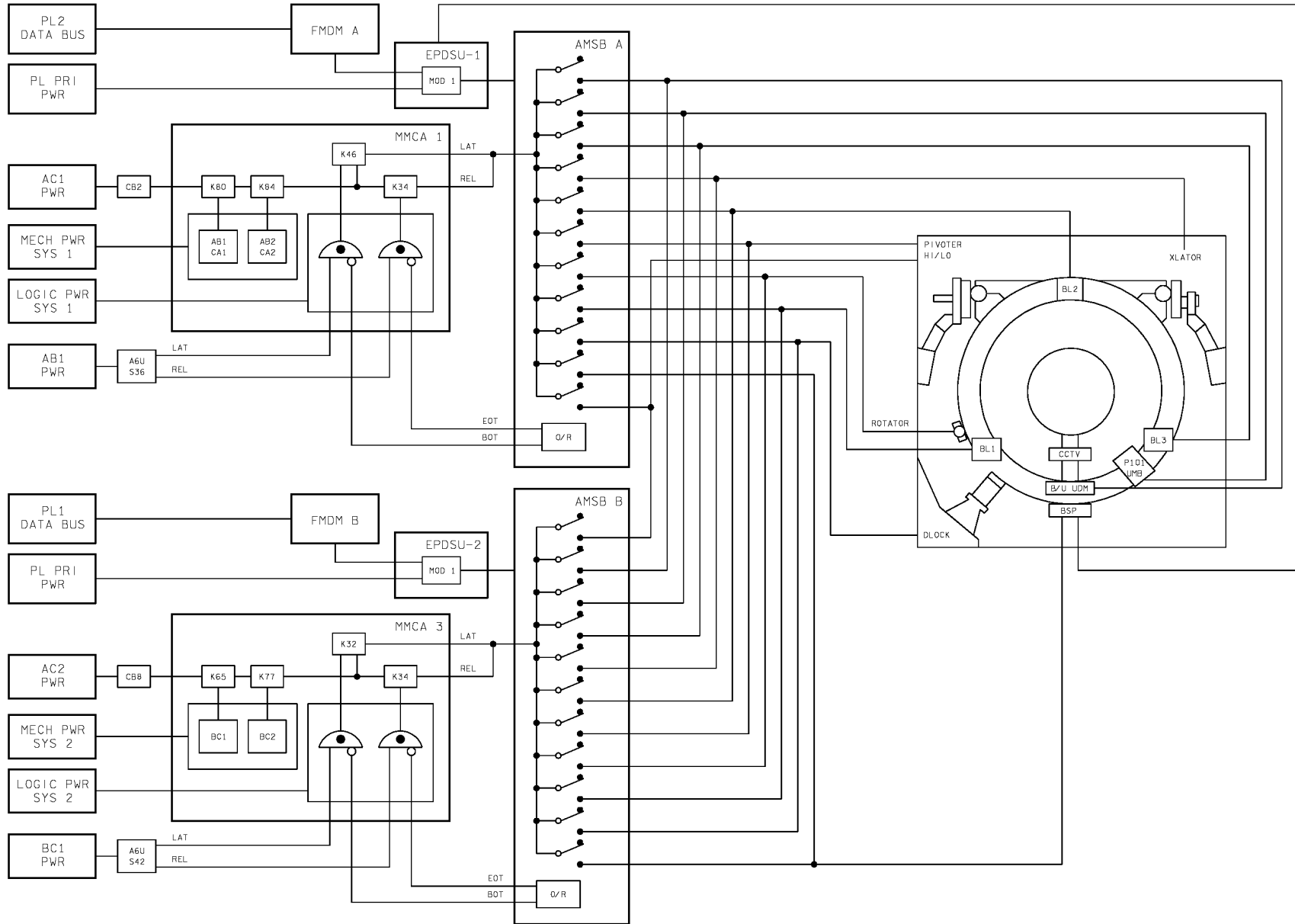
CH 24–SOPE ZONE 1&2 RED HTR CURRENT

CH 25–SOPE ZONE 3 RED HTR CURRENT

SSE MECH

1.3

SSE MECHANISMS

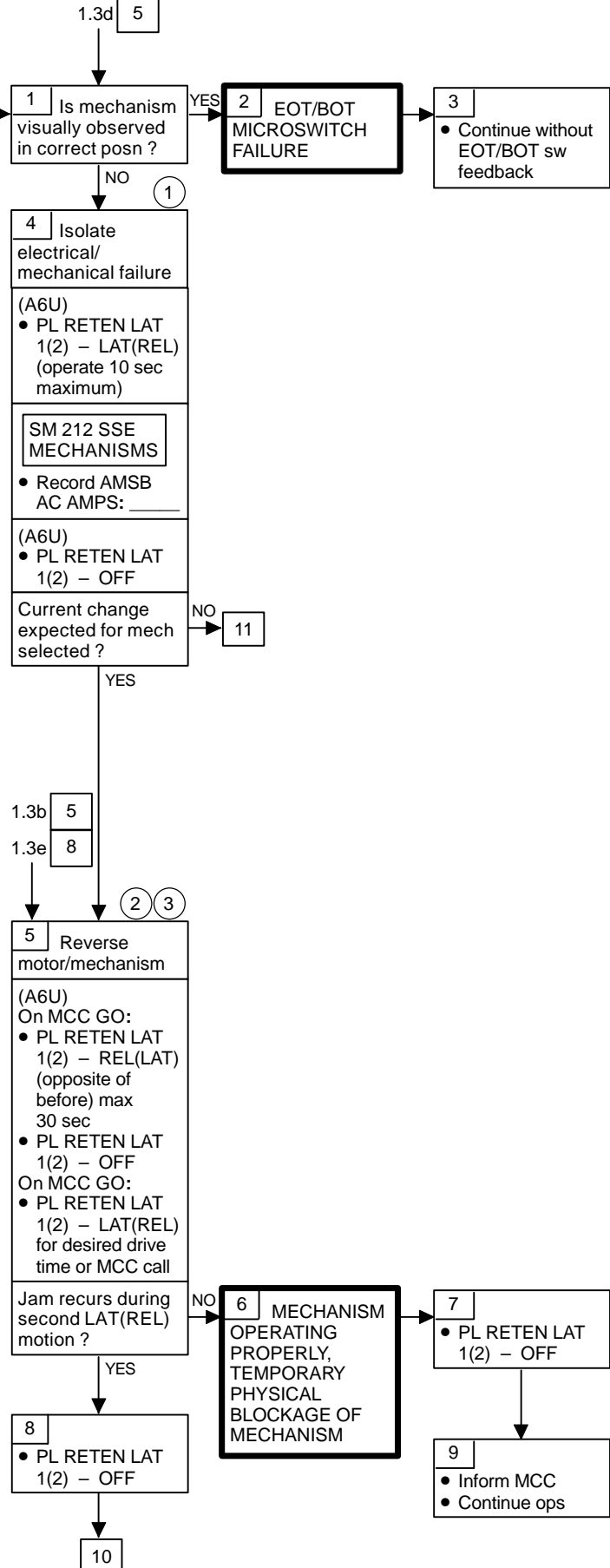


SSE MECH

1.3a PRIMARY MOTOR FAILS TO DRIVE MECHANISM

Mechanism Fails to Operate

Nominal Config:
 (R1)
 PL PRI MNC
 tb - ON
 PL CAB - MNA
 (MNB)
 (A6U)
 PL RETEN
 LAT 1(2) - OFF
 PL RETEN LOGIC
 PWR SYS
 1(2) - ON
 PL RETEN PL
 SEL - 1
 PL BAY MECH PWR
 1(2) - ON
 (MA73C)
 cb MCA PWR
 AC1(2) 3φ
 MID 1(3) - cl
 (S212)
 AMSB ON,
 ITEM 7 - A(B)



① Mechanism total currents:
 DLOCK 2-3.75A
 BLAT 1,2,3 2-3.75A
 UMB MAT 0.6-1.0A
 UMB B/U 0.6-1.0A
 PIVOT LO 0.3-0.5A
 ROTATOR 0.3-0.5A
 BSP MECH 0.3-0.5A
 For BSP and UMB B/U, current may not be observed due to short duration of mechanism run time

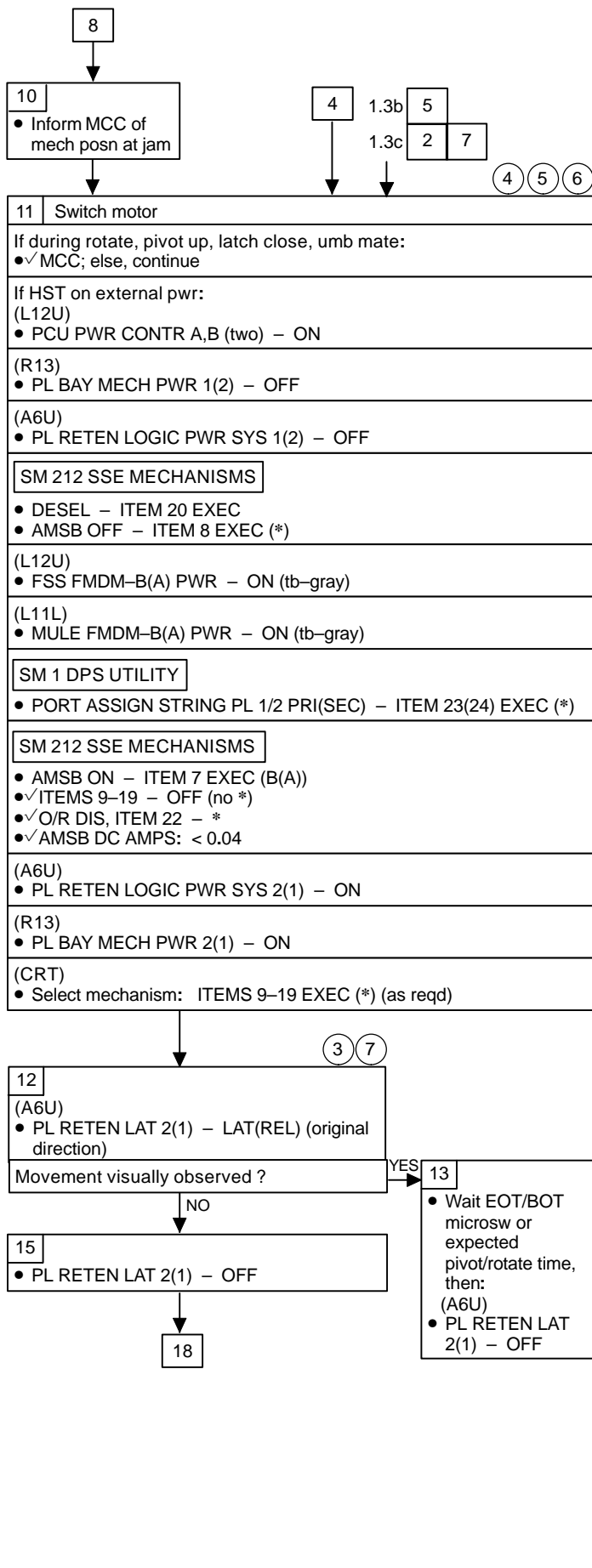
② MCC GO reqd to prevent possible mech drive to/failure in undesirable posn

③ MOTION CUE:
 For Pivoter and Rotator use Tach:
 Pivoter > 2.5 deg/min
 Rotator > 10 deg/min

For BSP:
 EOT/BOT microsw and BSP microsws as expected

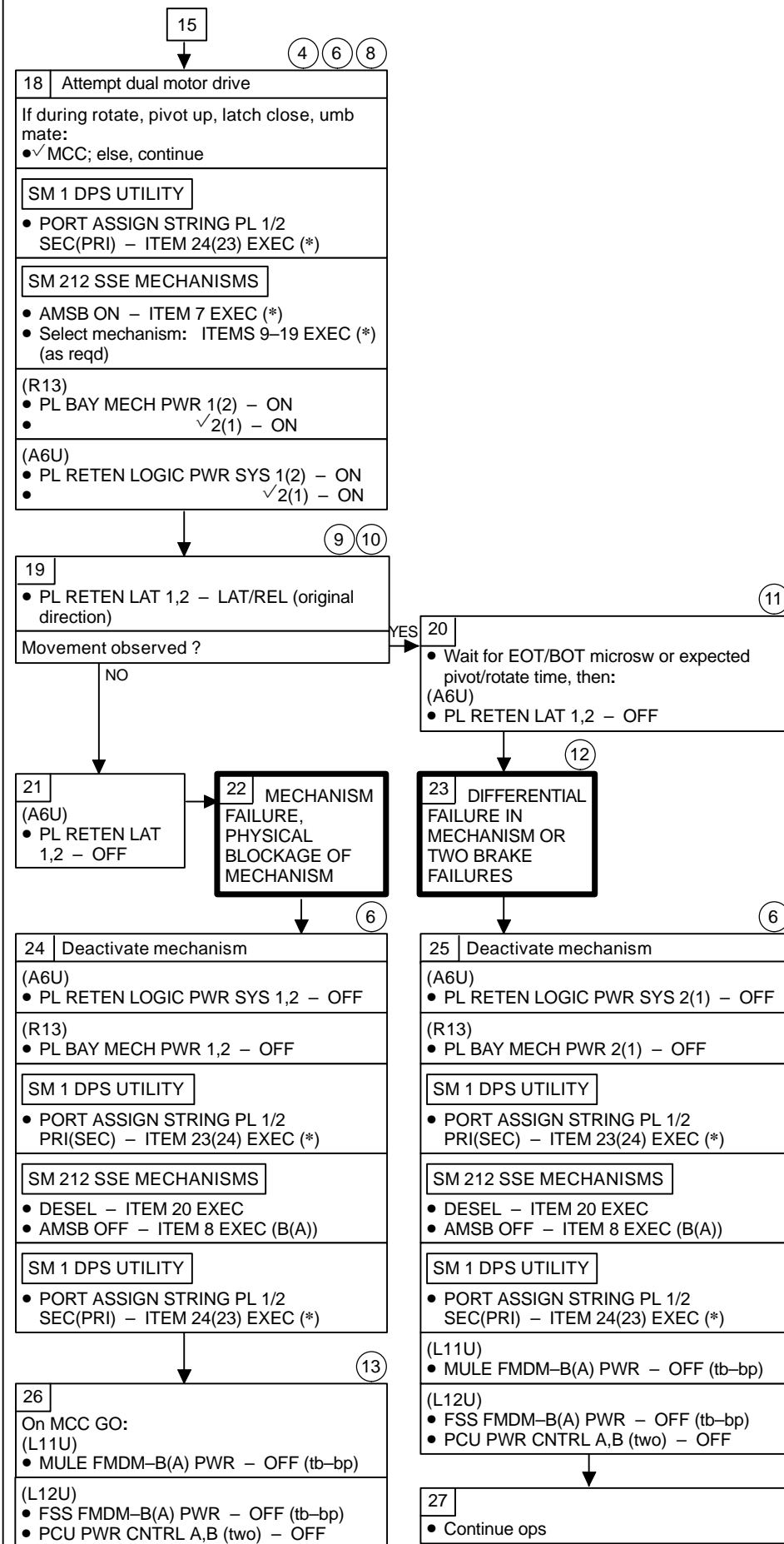
For ALL others:
 Visual cues

SSE MECH 1.3a (Cont)



- ③ MOTION CUE:
 For Pivoter and Rotator use Tach:
 Pivoter > 2.5 deg/min
 Rotator > 10 deg/min
- For BSP:
 EOT/BOT microsw and BSP microsws as expected
- For ALL others:
 Visual cues
- ④ AMSB B side does not drive tb on A6U
- ⑤ For MECH OPS (umbilical, latches, pivot, rotate) which may prevent PLBD closure, alt motor ops might not be performed
- ⑥ Port moding causes fault msgs to occur for all previously bypassed units and processes
- ⑦ Maximum operation of Berthing Latches or Down Lock is limited to 30 sec

SSE MECH 1.3a (Cont)



④ AMSB B side does not drive tb on A6U

⑥ Port moding causes fault msgs to occur for all previously bypassed units and processes

⑧ For MECH OPS (umbilical, latches, pivot, rotate) which may prevent PLBD closure, dual motor ops might not be performed

⑨ Limit maximum continuous operation of stalled mechanisms to 30 sec

⑩ MOTION CUE:
For Pivoter and Rotator dual ops use Tach:
Pivoter > 2.5 deg/min
Rotator > 10 deg/min

For BSP:
EOT/BOT microsw and BSP microsws as expected

For ALL others:
Visual cues

⑪ Mechanism operation times will be one-half expected time with dual motor operations

⑫ Dual motor drive reqd for failed mechanism for remainder of mission

⑬ MCC will provide additional troubleshooting steps as reqd

SSE MECH

1.3b BSP FAILS TO DISENGAGE

BSP DIS Blank
 BSP DIS A(B) and BSP STAT Not REL

Nominal Config:
 (R1)
 PL PRI MNC tb - ON
 PL CAB - MNA (MNB)
 (A6U)
 PL RETEN PL SEL - 1
 PL RETEN LOGIC PWR SYS 1(2) - ON
 (R13)
 PL BAY MECH PWR 1(2) - ON
 (L12U)
 cb FSS A SIDE PWR - cl
 FSS FMDM A(B) PWR - ON (tb-gray)
 (S212)
 AMSB ON, ITEM 7 - A(B)

1 Pivot BAPS down to relieve latch interference

SM 212 SSE MECHANISMS

- PIVOT LO SEL - ITEM 11 EXEC (*)

(A6U)

- PL RETEN LAT 1(2) - REL

(CRT)
 When PIVOT TACH: < 0.25 deg/min

(A6U)

- PL RETEN LAT 1(2) - OFF

2 Reattempt BSP release

(CRT)

- BSP SEL - ITEM 19 EXEC (*)

(A6U)

- PL RETEN LAT 1(2) - REL
- Wait 4 sec
- PL RETEN LAT 1(2) - OFF

- ✓BSP DIS, BSP STAT

(CRT)
 BSP DIS *(BSP STAT REL and BSP DIS A(DIS B)) ?

3 TRANSIENT LATCH INTERFERENCE RELIEVED

4

- Continue with nominal pivot ops

5 ✓BSP engage status

BSP ENG - blank ?

1.3a 5

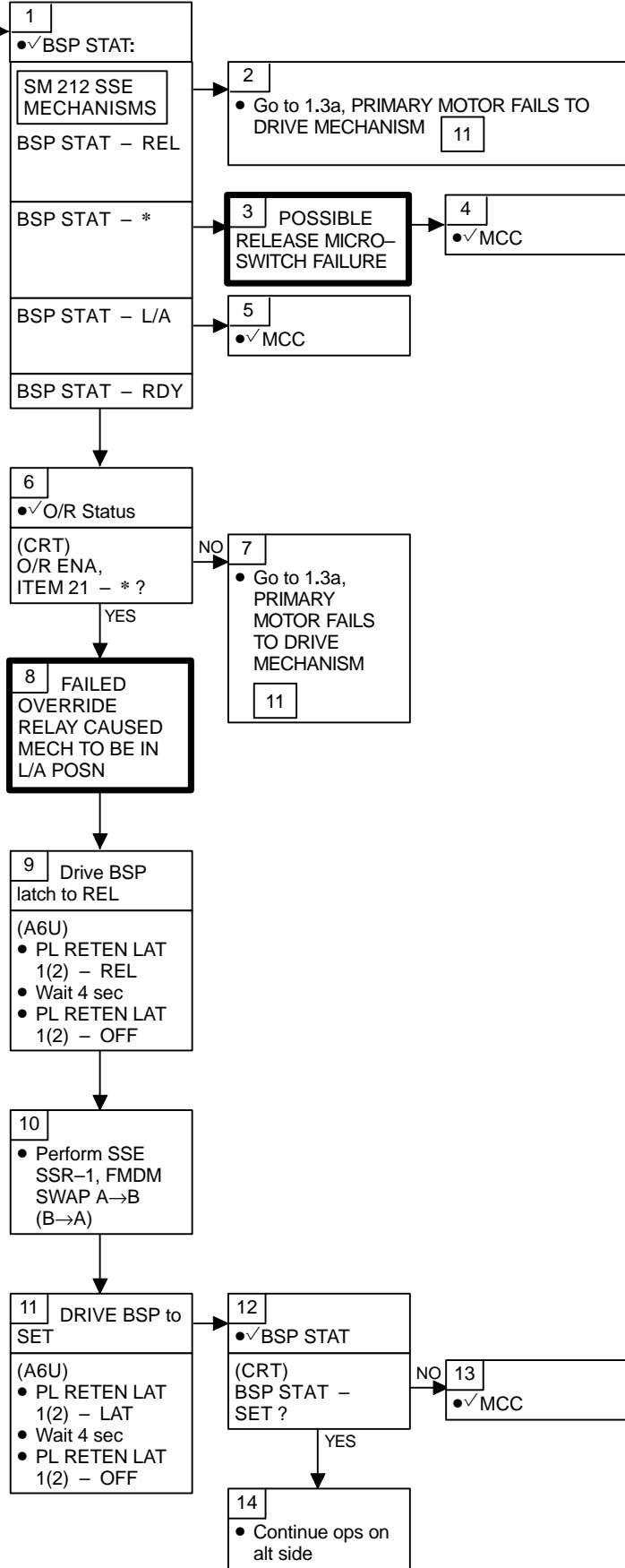
1.3a 11

SSE MECH

1.3c BSP FAILS TO SET

BSP STAT Not 'SET'

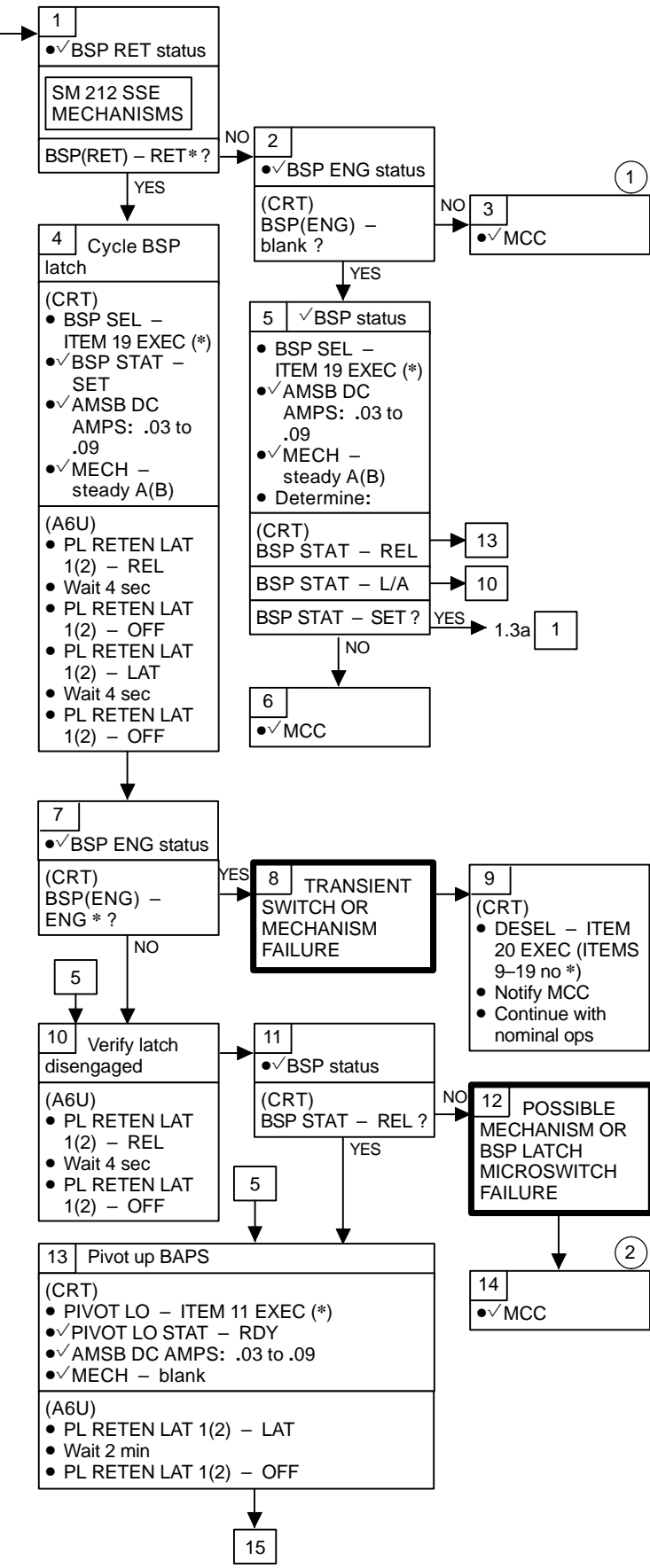
Nominal Config:
 (R1)
 PL PRI MNC tb - ON
 PL CAB - MNA (MNB) (A6U)
 PL RETEN PL SEL - 1
 PL RETEN LOGIC PWR SYS 1(2) - ON
 (R13)
 PL BAY MECH PWR 1(2) - ON
 (L12U)
 cb FSS A SIDE PWR - cl
 FSS FMDM A(B) PWR - ON (tb-gray)
 (S212)
 AMSB ON, ITEM 7 - A(B)



SSE MECH

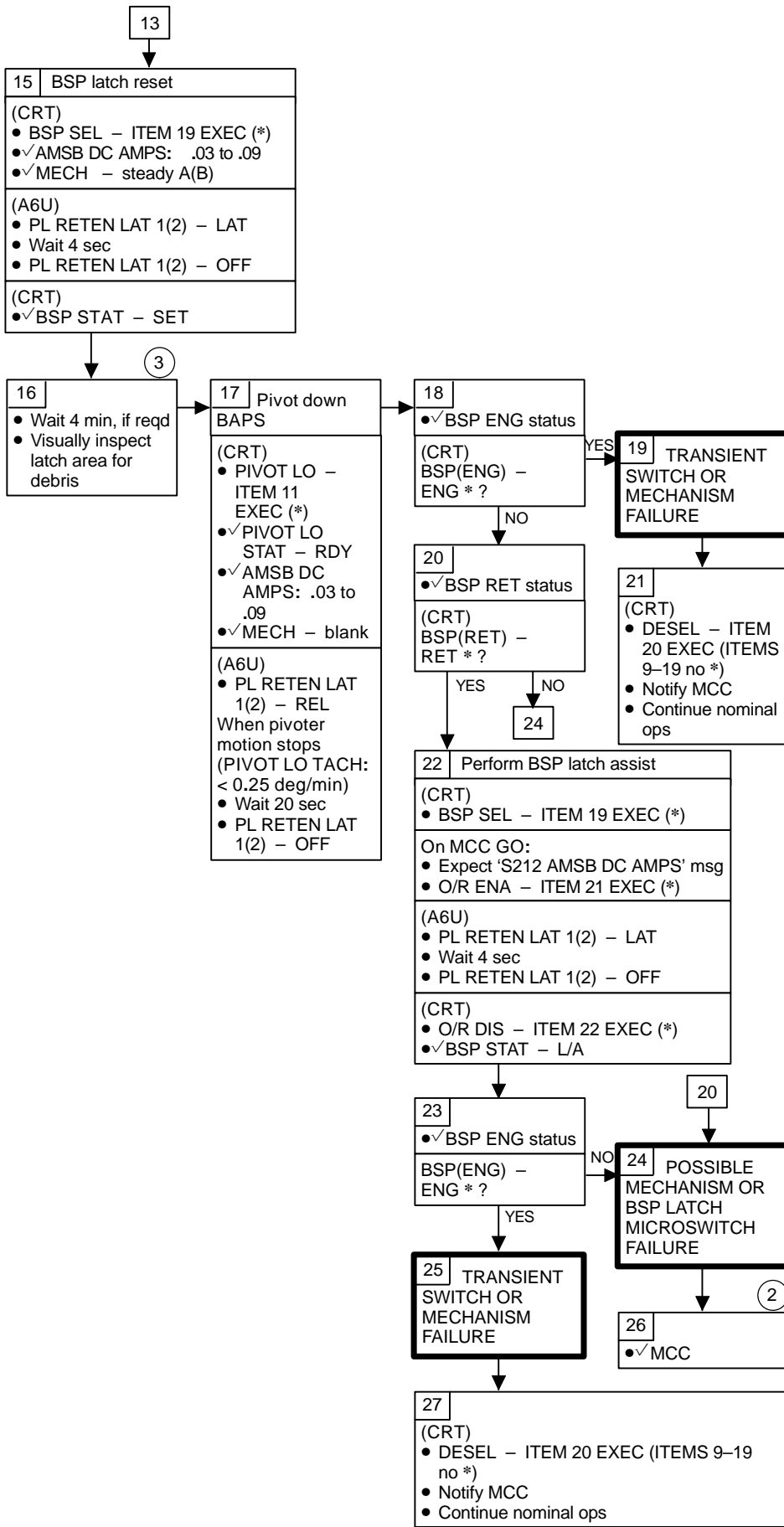
1.3d BSP FAILS TO ENGAGE

Nominal Config:
 (R1)
 PL PRI MNC tb – ON
 PL CAB – MNA (MNB) (A6U)
 PL RETEN PL SEL – 1
 PL RETEN LOGIC PWR SYS 1(2) – ON
 PL BAY MECH PWR 1(2) – ON (L12U)
 cb FSS A SIDE PWR – cl
 FMDM–A(B) PWR – ON (tb–gray) (S212)
 AMSB ON, ITEM 7 – A(B)



① If BSP (ENG)–A and (RET)–A or BSP (ENG)–B and (RET)–B then possible power supply failure
 ② BSP latch configuration is indeterminate

SSE MECH 1.3d (Cont)



- ② BSP latch configuration is indeterminate
- ③ Wait period not reqd after both SA–3s have been installed or after both SA–2s have been fully retracted

SSE MECH

1.3e 'S212 PVT(ROT) STALL'

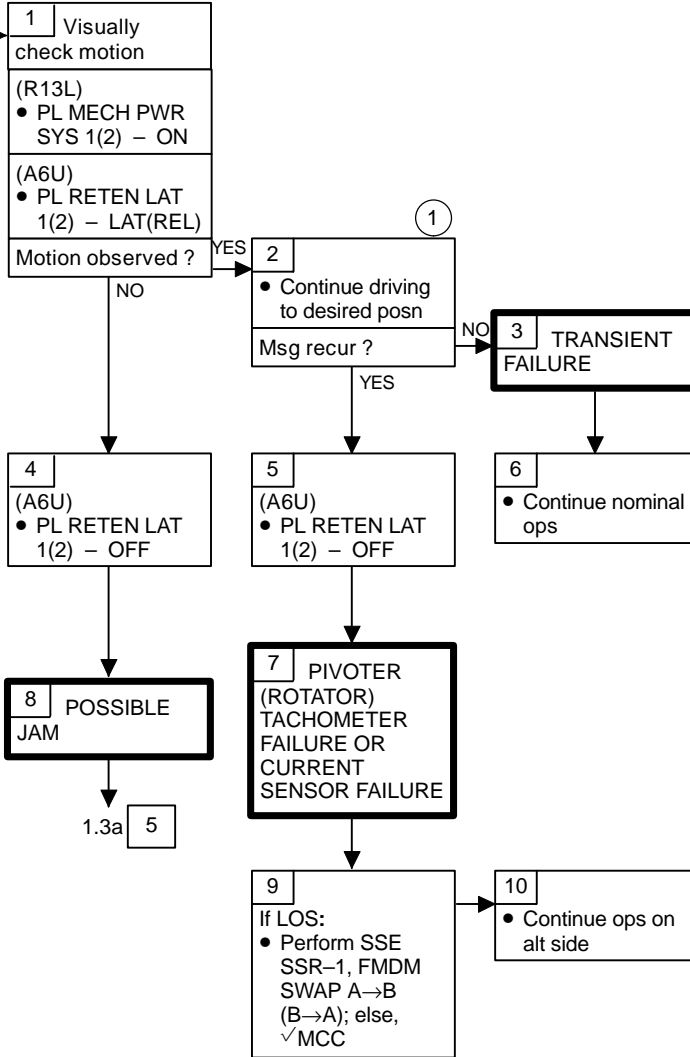
SM
ALERT

'S212 PVT
(ROT) STALL'

If PVT(ROT)
Selected and
AMSB AC AMPS
> 0.30 and (PVT
Tach
< 0.2 deg/min or
ROT Tach < 0.4
deg/min)

Nominal Config:

(R1)
PL PRI MNC
tb - ON
PL CAB - MNA
(MNB)
(A6U)
PL RETEN LAT
1(2) - OFF
PL RETEN LOGIC
PWR SYS
1(2) - ON
PL RETEN
PL SEL - 1
(R13)
PL BAY MECH PWR
1(2) - OFF
(L12U)
cb FSS A SIDE
PWR - cl
FSS FMDM - A(B)
PWR - ON
(tb-gray)
(S212)
AMSB ON,
ITEM 7 - A(B)



① PVT(ROT) STALL condition must exist for 30 sec before FDA message is annunciated

SSE DPS

1.4a 'I/O ERROR FLEX'

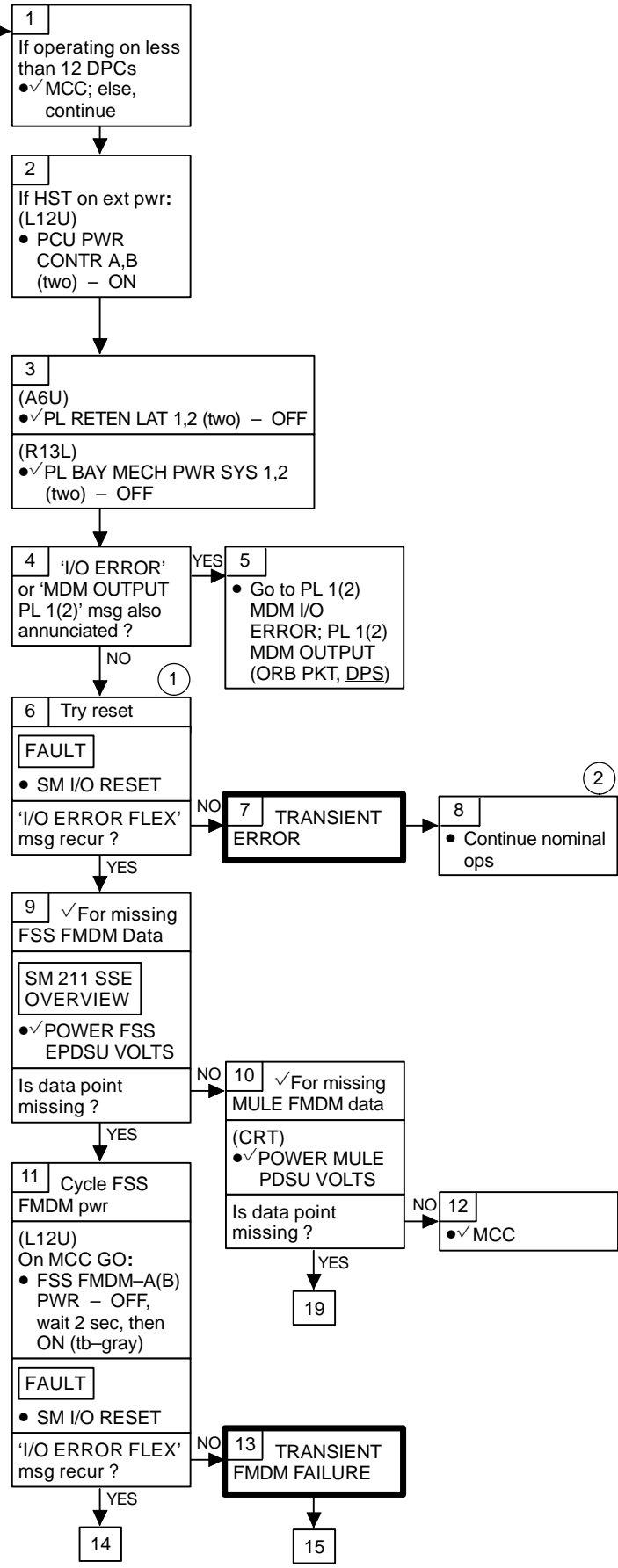
SM ALERT

'I/O ERROR FLEX'

If:
FMDM failure
IOP failure
IOP XMTR/RCVR failure

Nominal Config:
(L12U)
cb FSS A SIDE PWR - cl
FSS FMDM - A(B) PWR - ON (tb-gray)

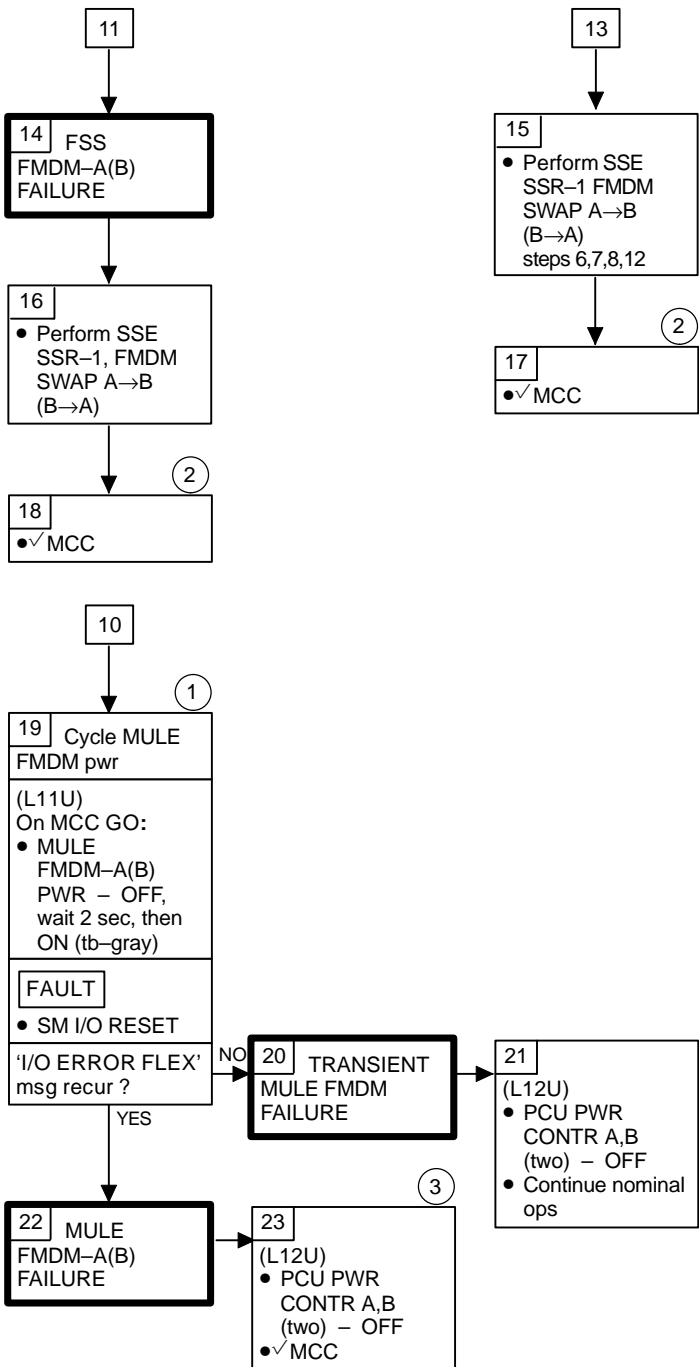
(L11U)
cb MULE SW PWR - cl
MULE FMDM PWR A(B) - ON (tb-gray)



① Port moding or I/O RESET causes fault msgs to occur for all previously bypassed LRU(s), BTU(s), Payload Signal Processor, mission selectable processes, and mission unique processes

② MCC will determine if clean-up step to turn off PCUs is necessary

SSE DPS 1.4a (Cont)



- ① Port moding or I/O RESET causes fault msgs to occur for all previously bypassed LRU(s), BTU(s), Payload Signal Processor, mission selectable processes, and mission unique processes
- ② MCC will determine if clean-up step to turn off PCUs is necessary
- ③ MCC will determine if SSE SSR-1, FMDM SWAP A->B (B->A) is performed

SSE
DPS

1.4

SSE DPS

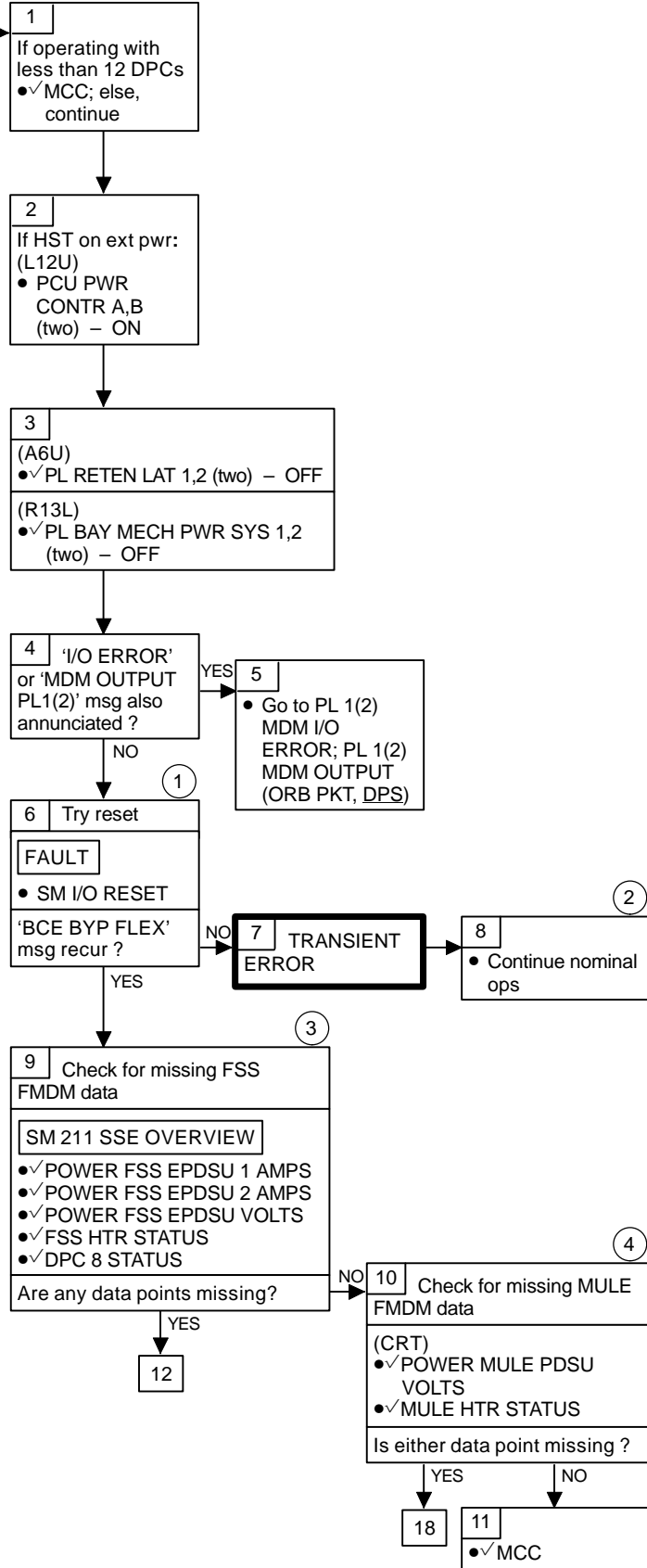
1.4b 'BCE BYP FLEX'

SM ALERT

BCE BYP FLEX

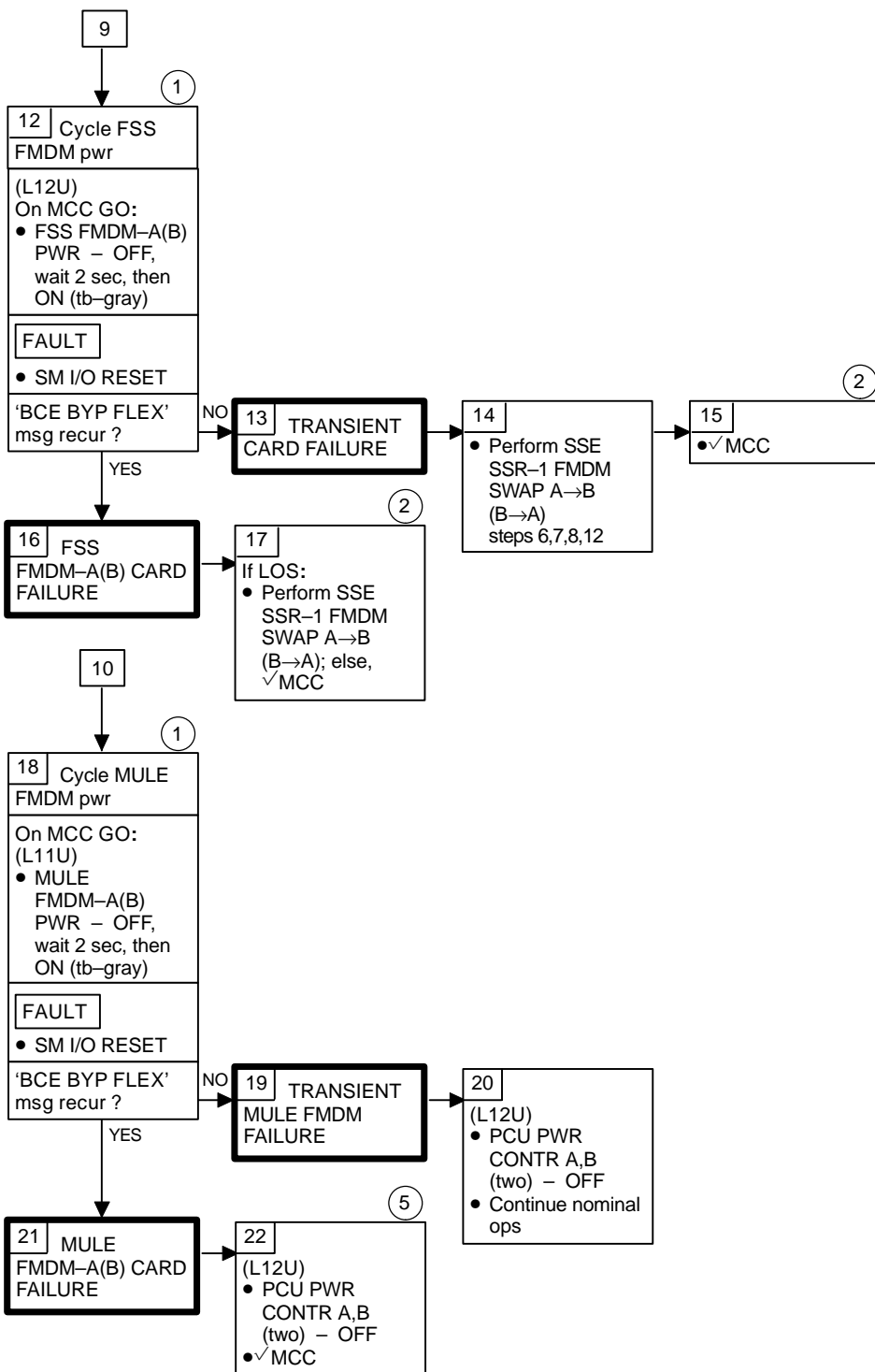
If:
MDM FLEX card failure
MDM/LRU FLEX interface failure
IOP failure
IOP XMTR/RCVR failure

Nominal Config:
(L12U)
cb FSS A SIDE PWR - cl
FSS FMDM-A(B) PWR - ON (tb-gray)
(L11U)
cb MULE SW PWR - cl
MULE FMDM PWR A(B) - ON



- ① Port moding or I/O RESET causes fault msgs to occur for all previously bypassed LRU(s), BTU(s), Payload Signal Processor, mission selectable processes, and mission unique processes
- ② MCC will determine if clean-up step to turn off PCUs is necessary
- ③ FSS FMDM Channelization Data:
IOM 0 – FSS EPDSU 1 AMPS
IOM 1 – FSS EPDSU 2 AMPS
IOM 2 – FSS EPDSU VOLTS
IOM 4 – FSS HTR STATUS
IOM 7 – DPC 8 STATUS
- ④ MULE FMDM Channelization Data:
IOM 1 – MULE PDSU VOLTS
IOM 4 – MULE HTR STATUS

SSE DPS 1.4b (Cont)



① Port moding or I/O RESET causes fault msgs to occur for all previously bypassed LRU(s), BTU(s), Payload Signal Processor, mission selectable processes, and mission unique processes

② MCC will determine if clean-up step to turn off PCUs is necessary

⑤ MCC will determine if SSE SSR-1, FMDM SWAP A→B (B→A) is performed

SSE SSR-1

FMDM SWAP A→B(B→A)

1. If operating on less than 12 DPCs, ✓MCC; else, continue
- L12U 2. If HST on ext pwr:
 ✓cb FSS A SIDE PWR – cl
 PCU POWER CONTR A,B (two) – ON
- A6U 3. Verify mechanism unpwr:
 ✓PL RETEN LAT 1,2 (two) – OFF
 ✓LOGIC PWR SYS 1,SYS2 (two) – OFF
 ✓PL SEL – 1
- R13L ✓BAY MECH PWR SYS 1,2 (two) – OFF

SM 212 SSE MECHANISMS

- ✓AMSB OFF, ITEM 8 – *
 - * If AMSB OFF – not *, *
 - * AMSB OFF – ITEM 8 EXEC (*) *
- L12U 4. Pwr on alt FMDMs:
 FSS FMDM-B(A) PWR – ON (tb-gray)
 MULE FMDM-B(A) PWR – ON (tb-gray)
 - L11U

NOTE

Port moding causes fault msgs to occur for all previously bypassed units and processes

5. Port Mode
 SM 1 DPS UTILITY
 PORT ASSIGN STRING PL 1/2 PRI(SEC) – ITEM 23(24) EXEC (*)
6. Verify SSE status:
 SM 211 SSE OVERVIEW

POWER

- ✓FSS FMDM A/B AMPS: .5 to 1.1 (both)
 - ✓HTR – 1/2
 - ✓A1/A2 AMPS: < 0.4 (both)
 - ✓B1/B2 AMPS: < .4 (both)
 - ✓CCTV HTR AMPS: < .9
- ✓MULE FMDM A/B AMPS: .7 to 1.3 (both)
 - ✓HTR – *
 - ✓ESM 1&2/3 AMPS: < 4/< 2
 - ✓SOPE 1A/2A AMPS: < 2.0/< 3.1
 - ✓1B&2B: < 5.1
 - ✓3A/3B: < 2.6 (both)
- ✓SAC EPDSU AMPS: < 35
- ✓FSS EPDSU VOLTS: 24.0 to 32.0 (both)
- ✓MULE PDSU VOLTS: 24.0 to 32.0
- ✓SAC EPDSU VOLTS: 24.0 to 32.0 (both)

THERMAL

- ✓FSS EPDSU TEMP: –20 to 50 degC (both)
 - ✓FMDM TEMP: –3 to 55 degC (both)
 - ✓PCU TEMP: –20 to 50 degC (both)
 - ✓IPCU TEMP: –30 to 50 degC
 - ✓AMSB TEMP: –20 to 50 degC
- ✓MULE PDSU TEMP: –20 to 50 degC
 - ✓FMDM TEMP: –3 to 55 degC (both)
- ✓SAC EPDSU TEMP: –20 to 50 degC (both)

Determine steps necessary to reconfigure new FMDM(s):

7. If HST on external power:
 Apply redundant pwr to DPCs
 PCU ON – ITEM 1 EXEC (*)
 ✓PCU – P/S
 ✓DPC 1–12 – *
 ✓DPC AMPS: < 11.0
 ✓VOLTS: 33.8 to 35.2
8. If during FSS CCTV operations:
 CCTV ENA ON – ITEM 3 EXEC (*)
 PWR ON – ITEM 5 EXEC (*)

- L11U 9. MULE HTR SWAP
 - MULE SURV HTR-B(A) PWR - ON
 - HTR-A(B) PWR - OFF
 - ✓ HTR PWR tb - gray
 - ESM HTR-B(A) PWR - ON (tb-gray)
 - HTR-A(B) PWR - OFF (tb-bp)
 - SOPE HTR-B(A) PWR - ON (tb-gray)
 - HTR-A(B) PWR - OFF (tb-bp)
- L12U 10. FSS FMDM-A(B) PWR - OFF (tb-bp)
- L11U 11. MULE FMDM-A(B) PWR - OFF (tb-bp)
- A6U 12. If failure occurred during mechanism operations:
 - PL RETEN LOGIC PWR SYS 2(SYS 1) - ON

SM 212 SSE MECHANISMS

- AMSB ON - ITEM 7 EXEC (B(A))
 - ✓ DC AMPS: < .04
 - ✓ AC AMPS: < .2
 - ✓ MECH - blank
 - ✓ SEL (ITEMS 9-19) - no *
 - ✓ STAT (ITEMS 9-19) - blank
 - ✓ O/R DIS - *
- R13L PL BAY MECH PWR SYS 2(1) - ON
- 13. Return to step where failure occurred

HST

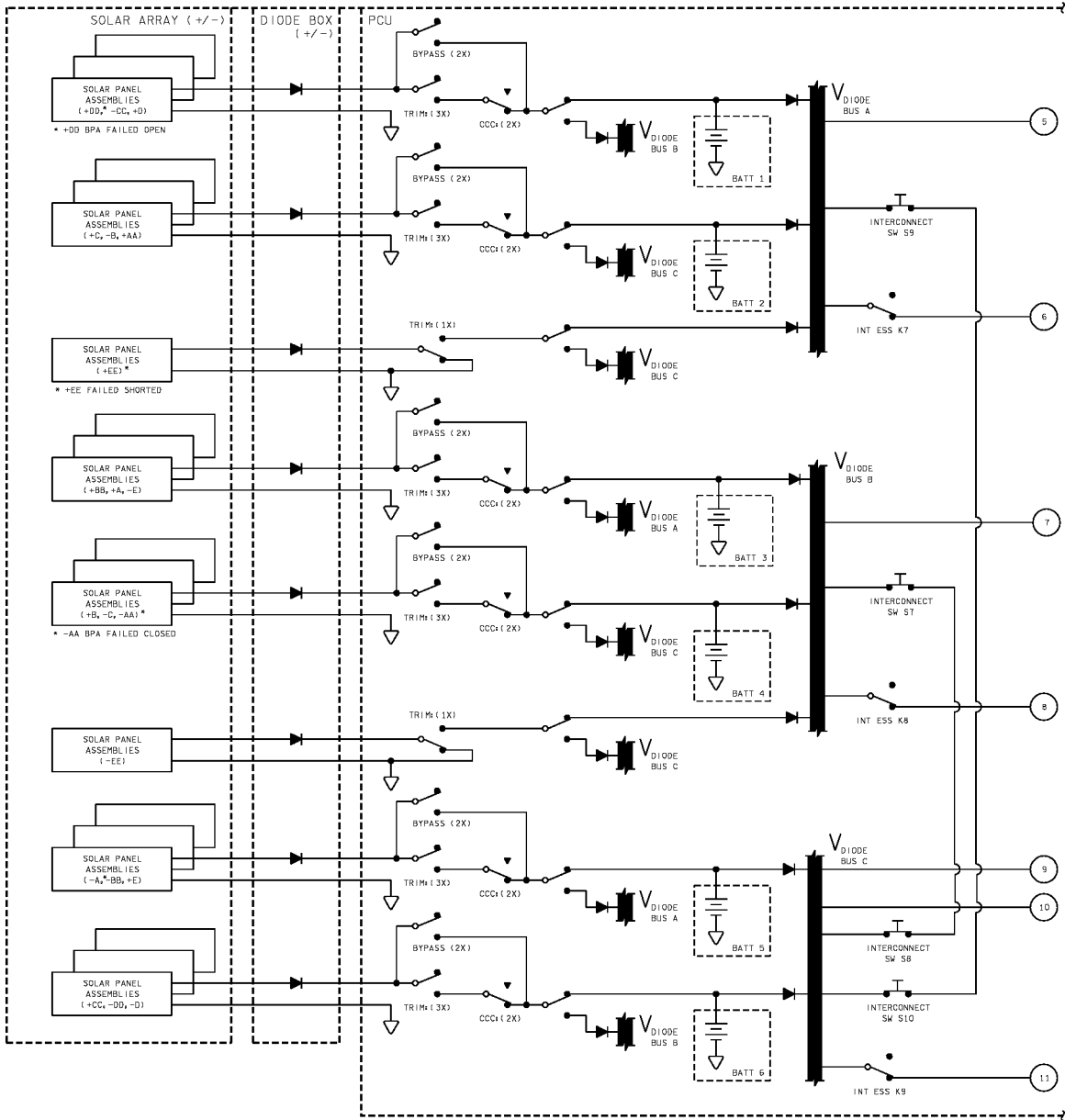
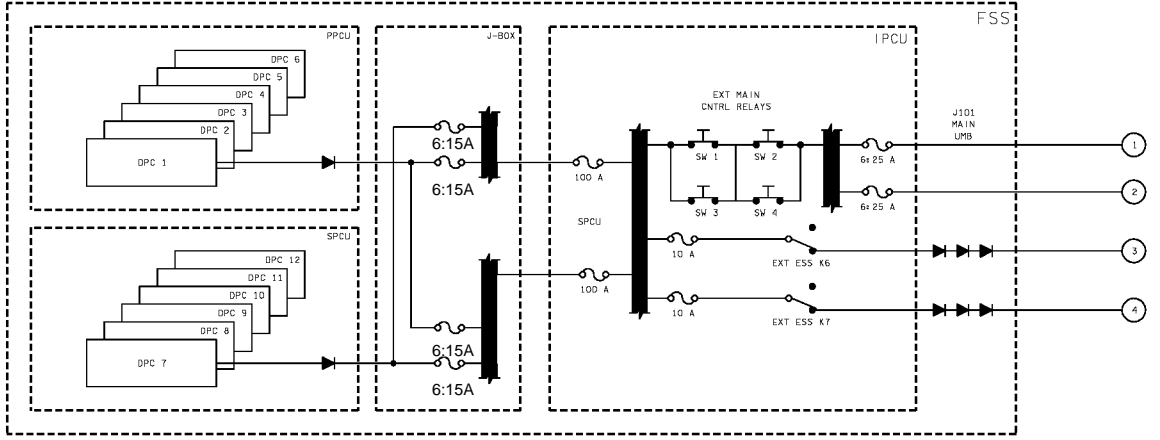
2.1 HST

EPS CONFIGURATION FOR SOLAR ARRAY 2	2-2
3	2-4
2.1a ESS BUS INT PWR tb - bp WHEN SHOULD BE tb - UP (WHEN CMDED DURING PCU FT)	2-6
2.1b ESS BUS INT PWR tb - UP WHEN SHOULD BE tb - bp (AUTO SWITCHOVER)	2-8
HST SSR-1 PWR LOSS RECOVERY	2-9

HST

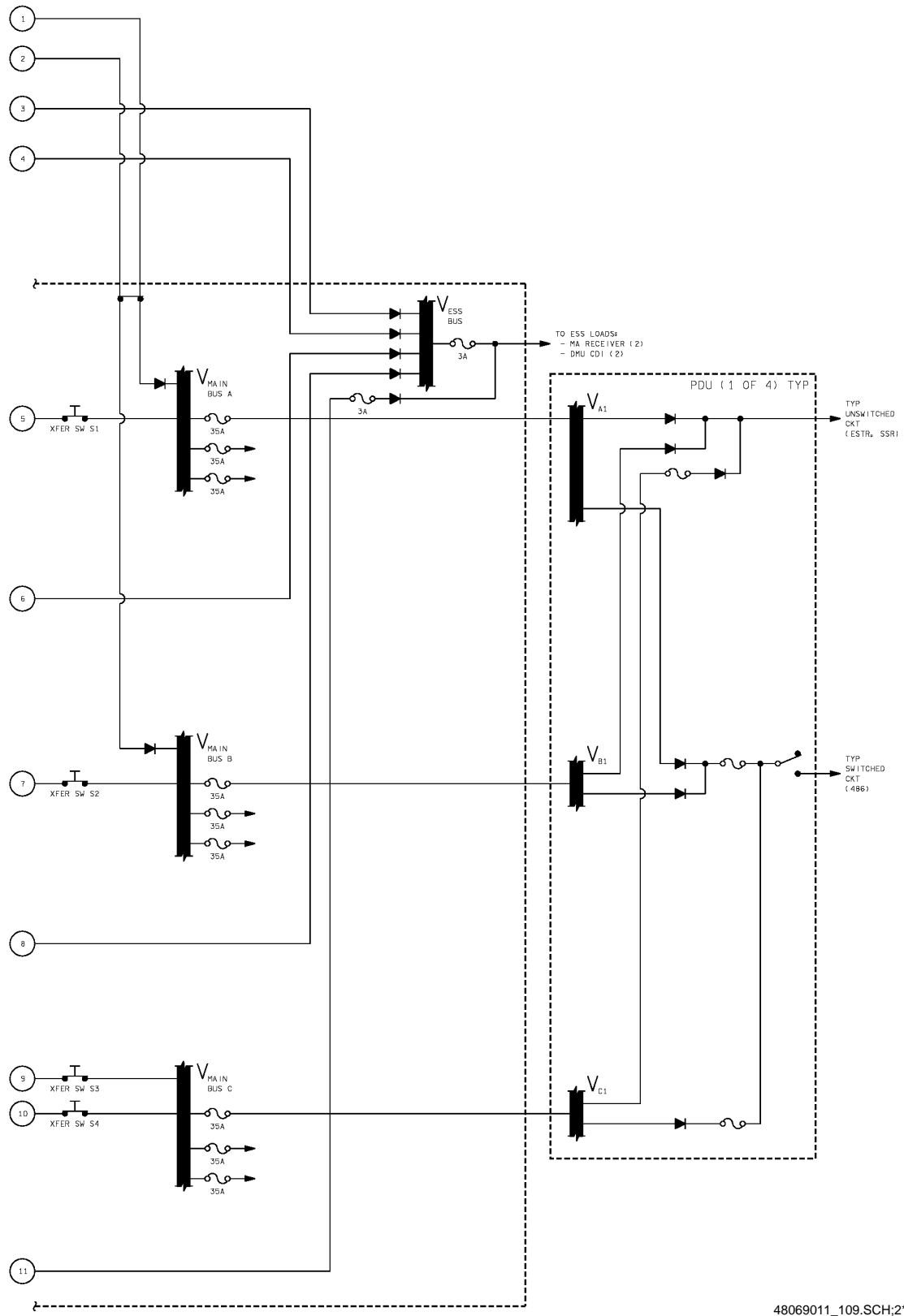
EPS CONFIGURATION FOR SOLAR ARRAY 2

HST



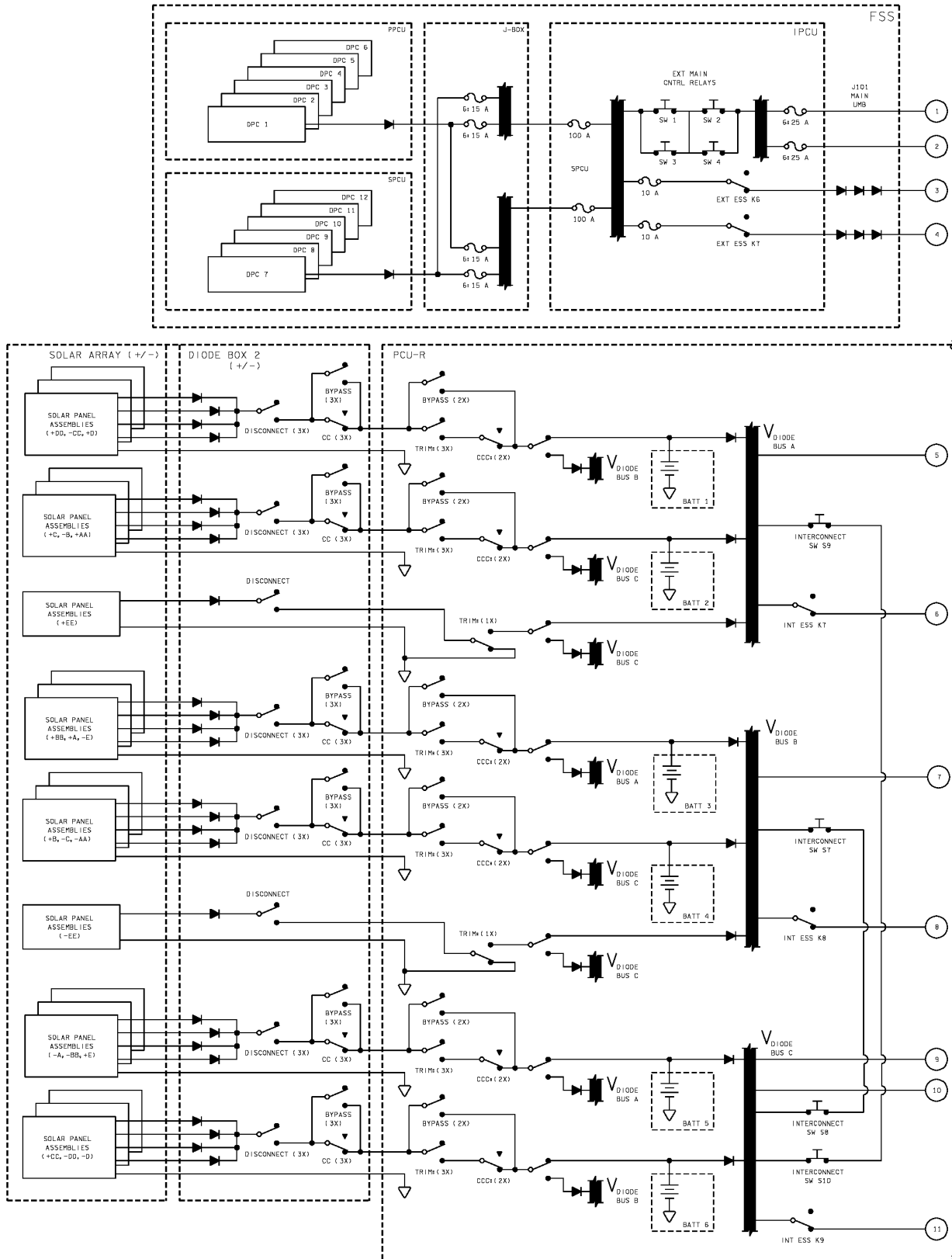
48069004_109.SCH; 3*

EPS CONFIGURATION FOR SOLAR ARRAY 2 (Cont)



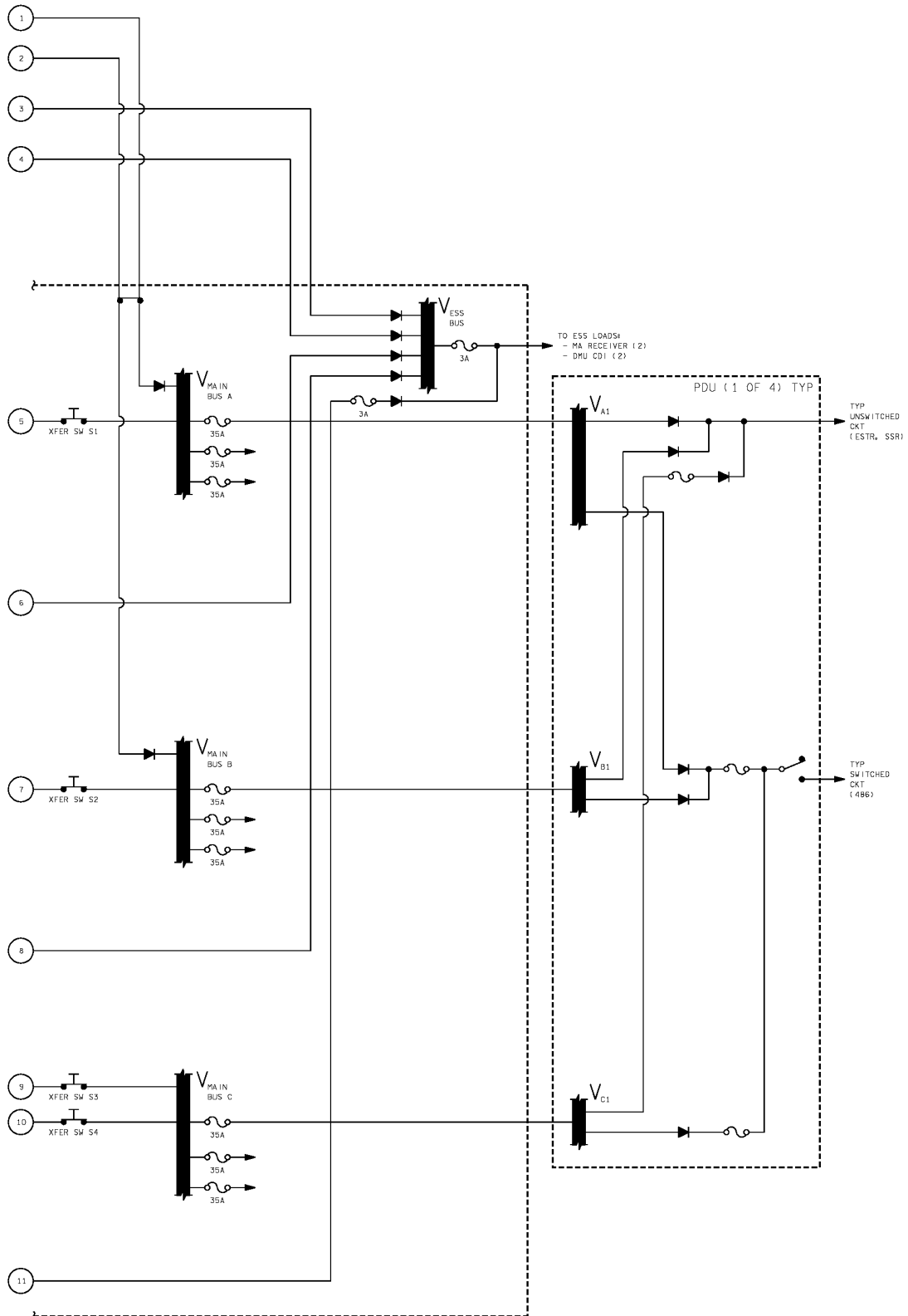
48069011_109.SCH:2*

EPS CONFIGURATION FOR SOLAR ARRAY 3



48069012_109, SCH 2

EPS CONFIGURATION FOR SOLAR ARRAY 3 (Cont)



48069011_109. SCH; 2*

HST

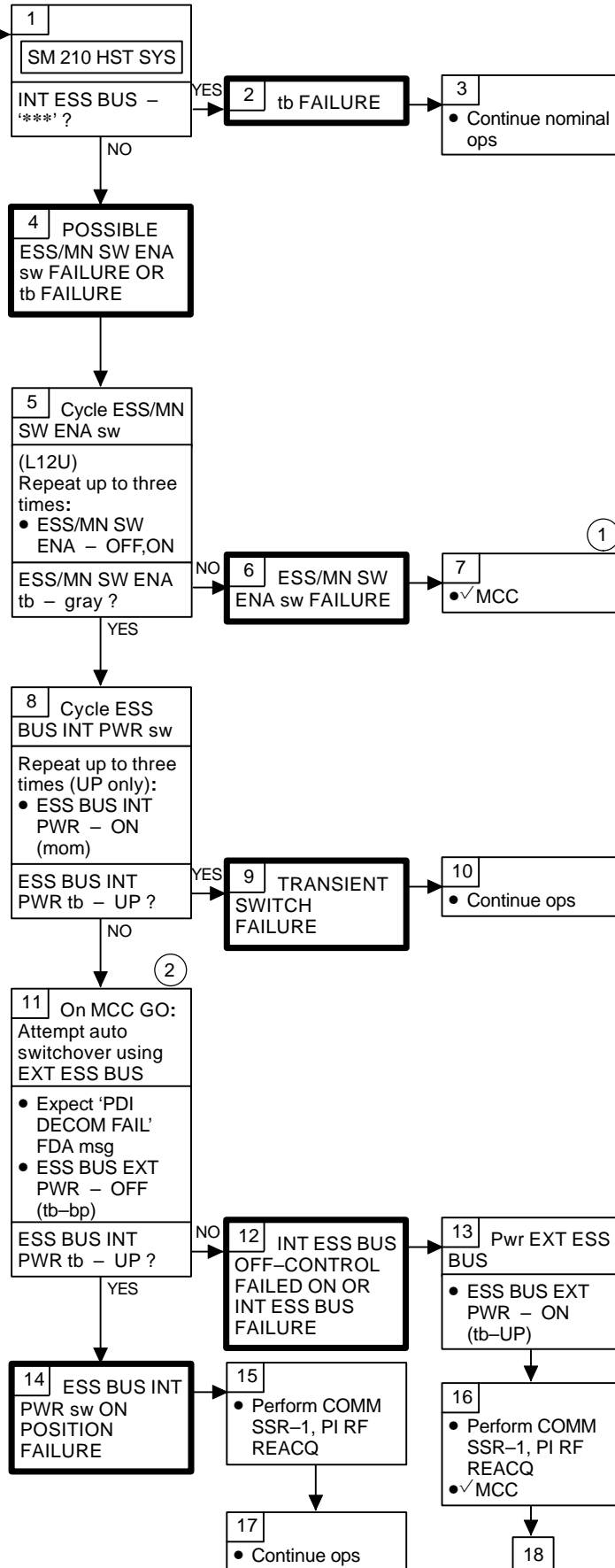
**2.1a ESS BUS INT PWR tb – bp
WHEN SHOULD BE tb – UP
(WHEN CMDED DURING PCU FT)**

ESS BUS INT PWR tb – bp

Nominal Config:
(R1)
PL PRI MNC tb – ON
PL CAB – MNA(MNB) (L12U)
cb ST SW PWR – cl

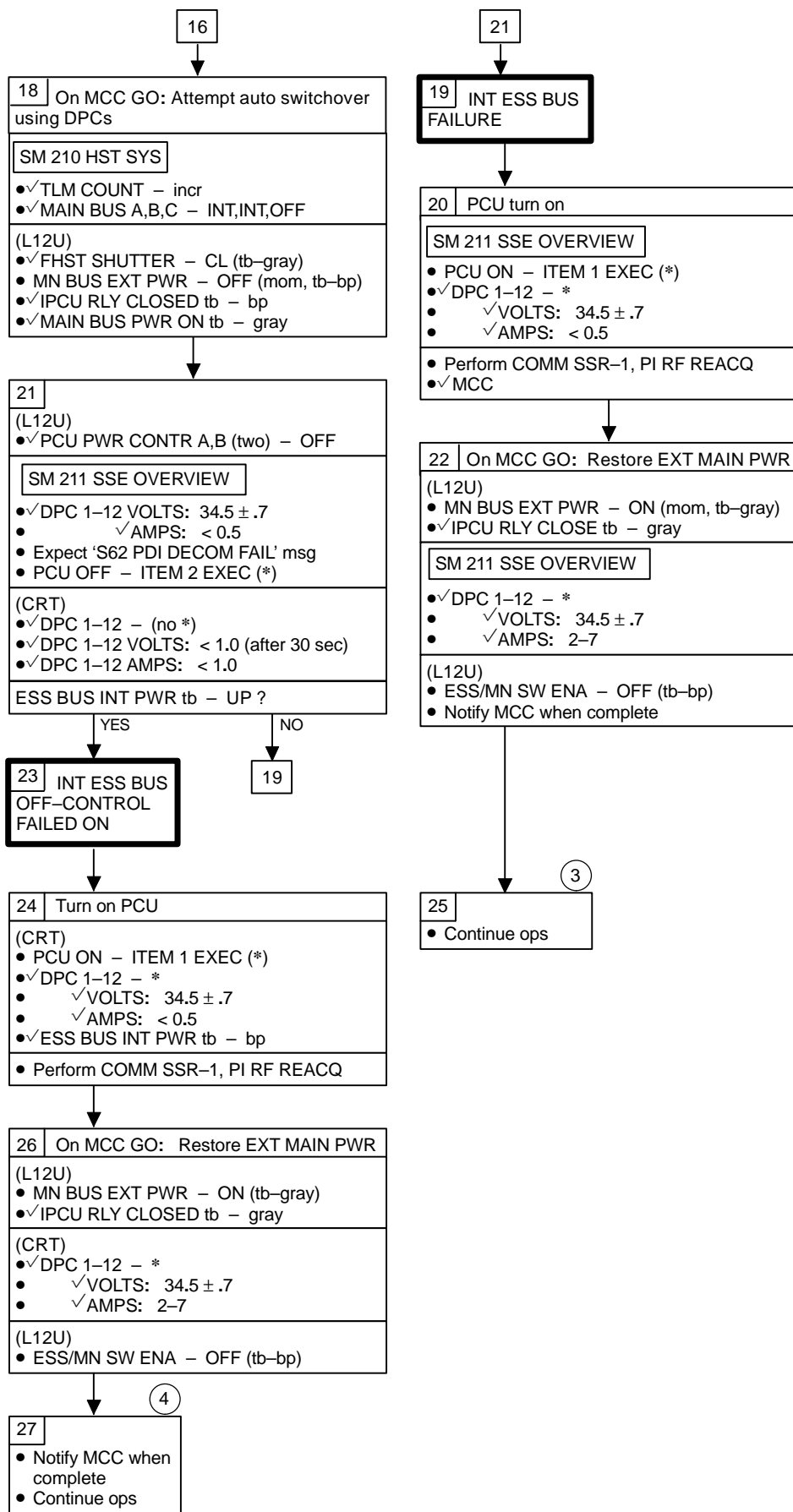
SM 211 SSE OVERVIEW

PCU – 'P/S'
DPC 1–12: '*'
DPC 1–12 VOLTS: 34.5 ± .7



- ① Possible STANDARD SWITCH PANEL (SSP) CABLE CHANGEOUT IFM
- ② Loss or interruption of HST ESS BUS forces MA transponder into pwr on reset (transmitter off)

HST 2.1a (Cont)



HST

2.1b ESS BUS INT PWR tb – UP WHEN SHOULD BE tb – bp (AUTO SWITCHOVER)

① Automatic switchover to INT ESS BUS pwr occurs whenever EXT ESS BUS pwr lost or interrupted

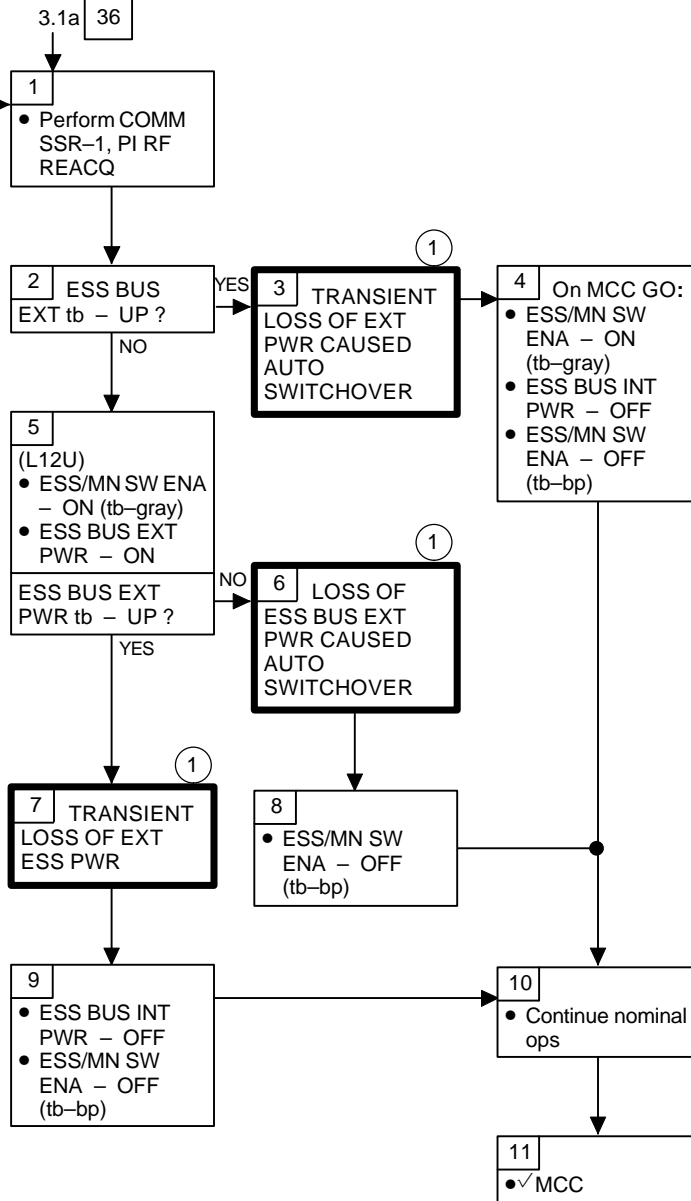
ESS BUS INT PWR tb – UP

Nominal Config:

(R1)
PL PRI MNC tb – ON
PL CAB – MNA(MNB)
(L12U)
cb ST SW PWR – cl

SM 211 SSE OVERVIEW

PCU – 'P/S'
DPC 1-2 – '*'
DPC 1-12 VOLTS: 34.5 ± .7



HST SSR-1 PWR LOSS RECOVERY

- L12U
1. Disable ext pwr:
ESS/MN SW ENA – ON (tb-gray)
✓ ESS BUS INT PWR tb – UP
EXT PWR – OFF (tb-bp)
ESS/MN SW ENA – OFF (tb-bp)
✓ PCU PWR CONTR–A,B (two) – OFF

SM 211 SSE CONTROL

SM I/O RESET EXEC
PCU OFF – ITEM 2 EXEC (*)
 2. XFER to EXT:
On MCC GO:
PCU ON – ITEM 1 EXEC
✓ DPC 1–12 – *
✓ VOLTS: 33.8 to 35.2
✓ AMPS: 2 to 7
- CRT
- L12U
- ✓ MAIN BUS EXT PWR tb – gray
ESS/MN SW ENA – ON (tb-gray)
ESS BUS EXT PWR – ON (tb-UP)
 3. On MCC GO:
ESS BUS INT PWR – OFF (tb-bp)
 4. ESS/MN SW ENA – OFF (tb-bp)

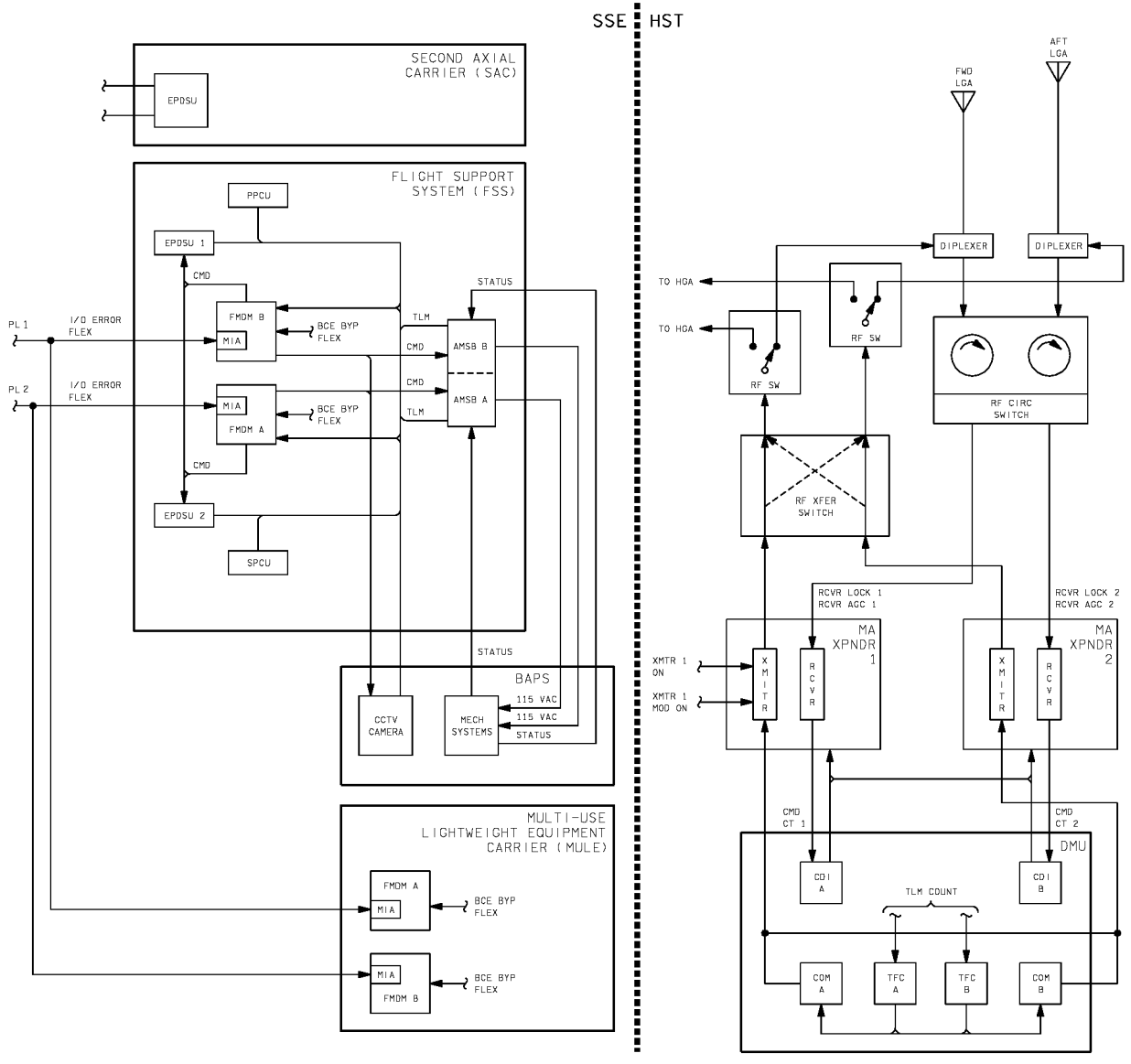
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PL COMM

STS-109 COMM MALFUNCTION POINTS	3-2
3.1a 'S62 PDI DECOM FAIL'	3-4
3.1b NO RESPONSE TO RF COMMAND	3-10
COMM SSR-1 PI RF REACQ	3-12
SSR-2 SWAP S-BD PL COMM STRINGS	3-13
SSR-3 HPGSCA PDIP PORT SWAP	3-14

PL COMM

STS-109 COMM MALFUNCTION POINTS (Cont)



48069010_109. SCH, 1

HST COMM

3.1a 'S62 PDI DECOM FAIL'

SM
ALERT

S62 PDI
DECOM FAIL

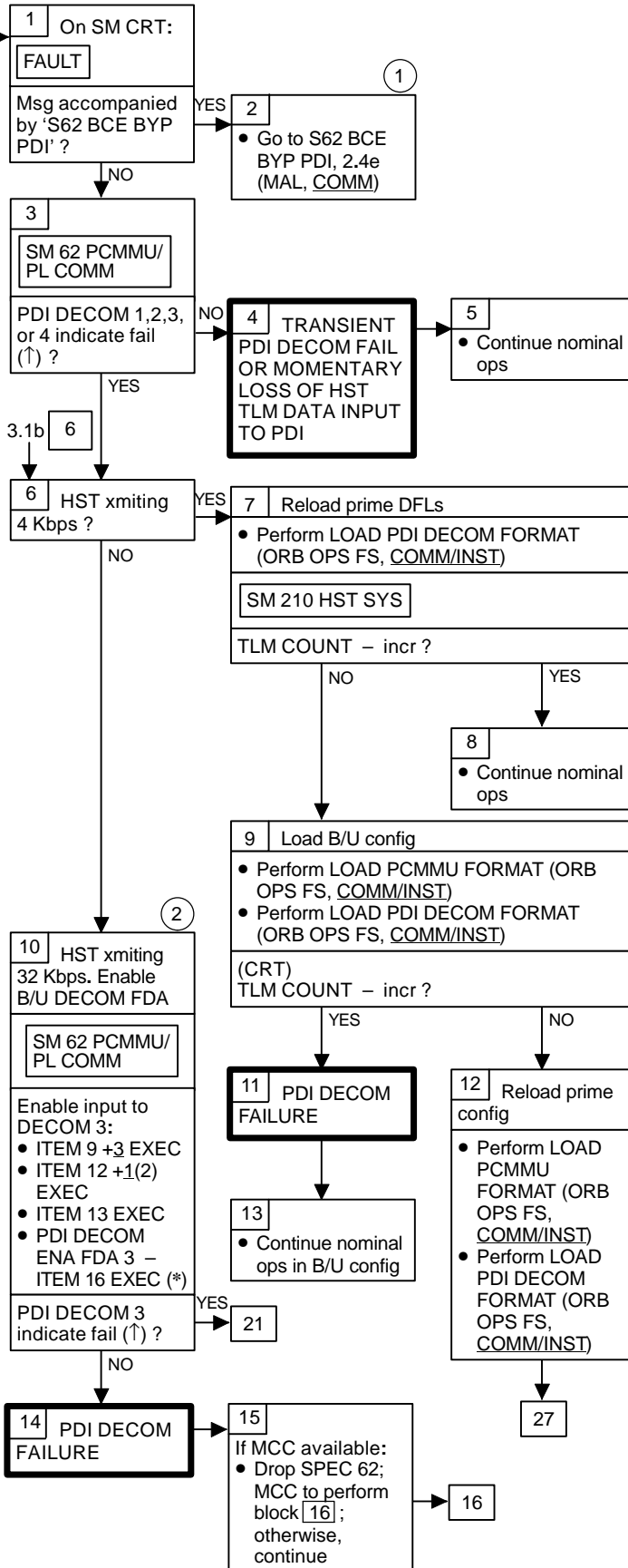
Nominal Config:

SM 210 HST
SYS

PSP ENA 1 ID 1
(R1)
PL PRI MNC - ON
PL CAB -
MNA(MNB)
(L12L)
cb SW PWR - cl
PSP BYP - ENA
(L12U)
cb SPACE TEL SW
PWR - cl
(A1L)
If S-BD PL CNTL -
CMD, ✓MCC
Else, ✓config:
If HST RF link:
S-BD PL ANT
POLAR - L CIRC
S-BD PL XMTR
PWR:
LO (as reqd)
MED (> 40 ft)
HI (> 125 ft)
S-BD PL CH SEL
INTRG 1,2 (six) -
701,701
S-BD PL FREQ
SWEEP - OFF
S-BD PL MOD -
ON
S-BD PL PWR
SYS - 1(2)
S-BD PL PWR
SEL - BOTH
S-BD PL PSP COM
OUTPUT - PL
UMB

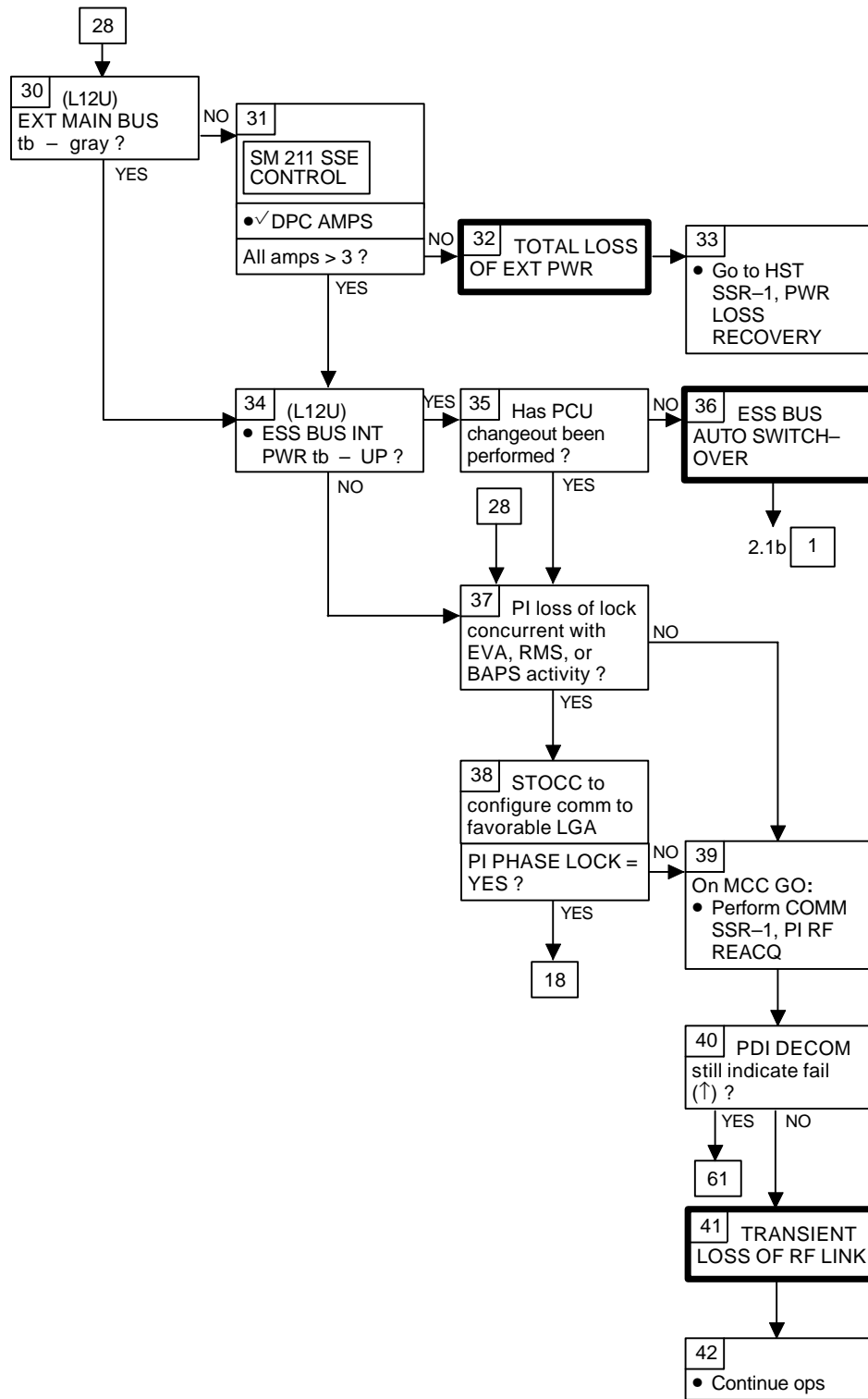
HPGSCA

INPUT SOURCE: A
BIT RATE: 32(4)
LOOP B/W: .1 %
INPUT PCM CODE:
BIOL +
OUTPUT PCM
CODE: BIOL



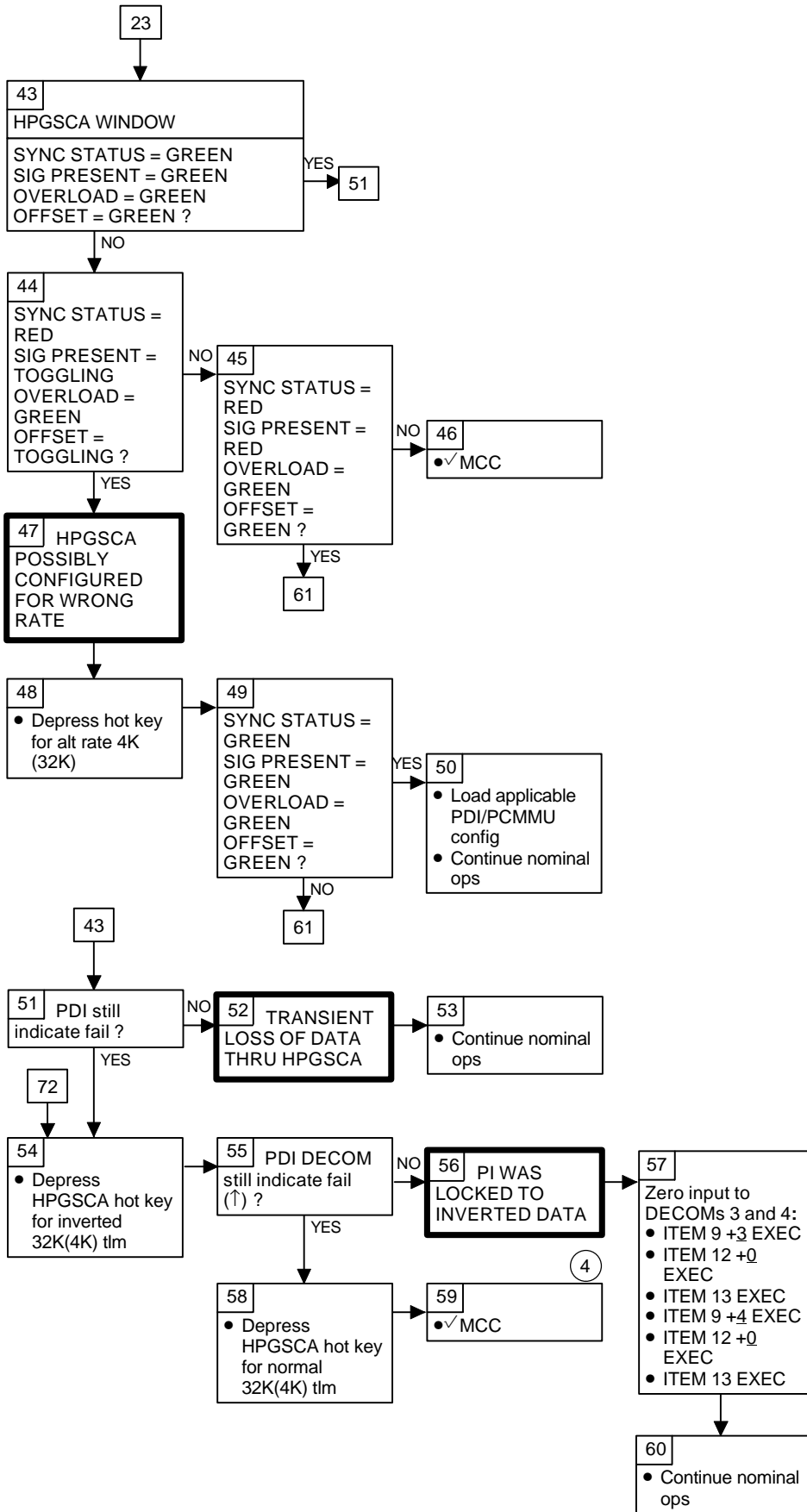
- ① Possible PDI Replacement IFM
- ② MCC will have B/U DECOM loaded in 32K format

HST COMM 3.1a (Cont)

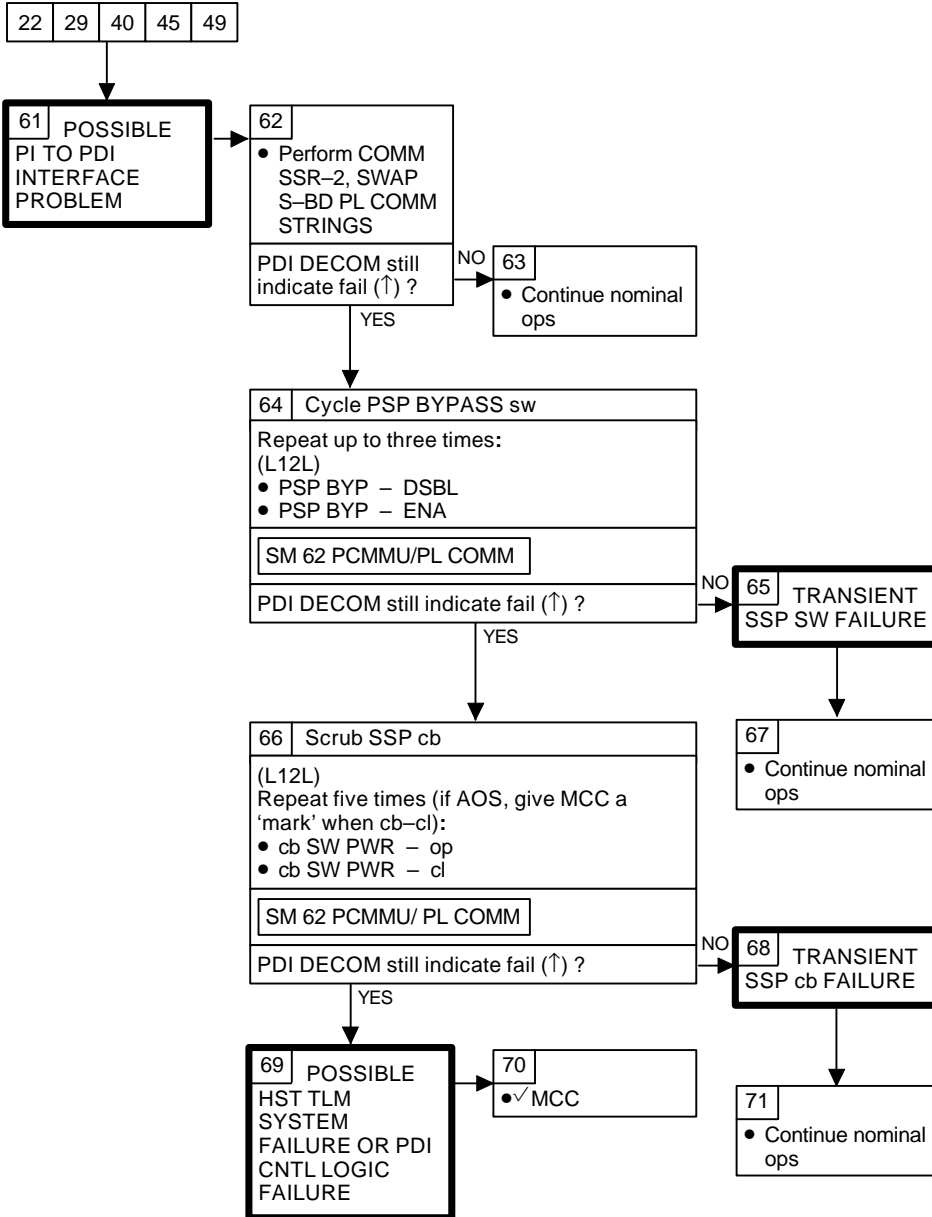


HST COMM 3.1a (Cont)

④ Possible PDI Data Inversion IFM

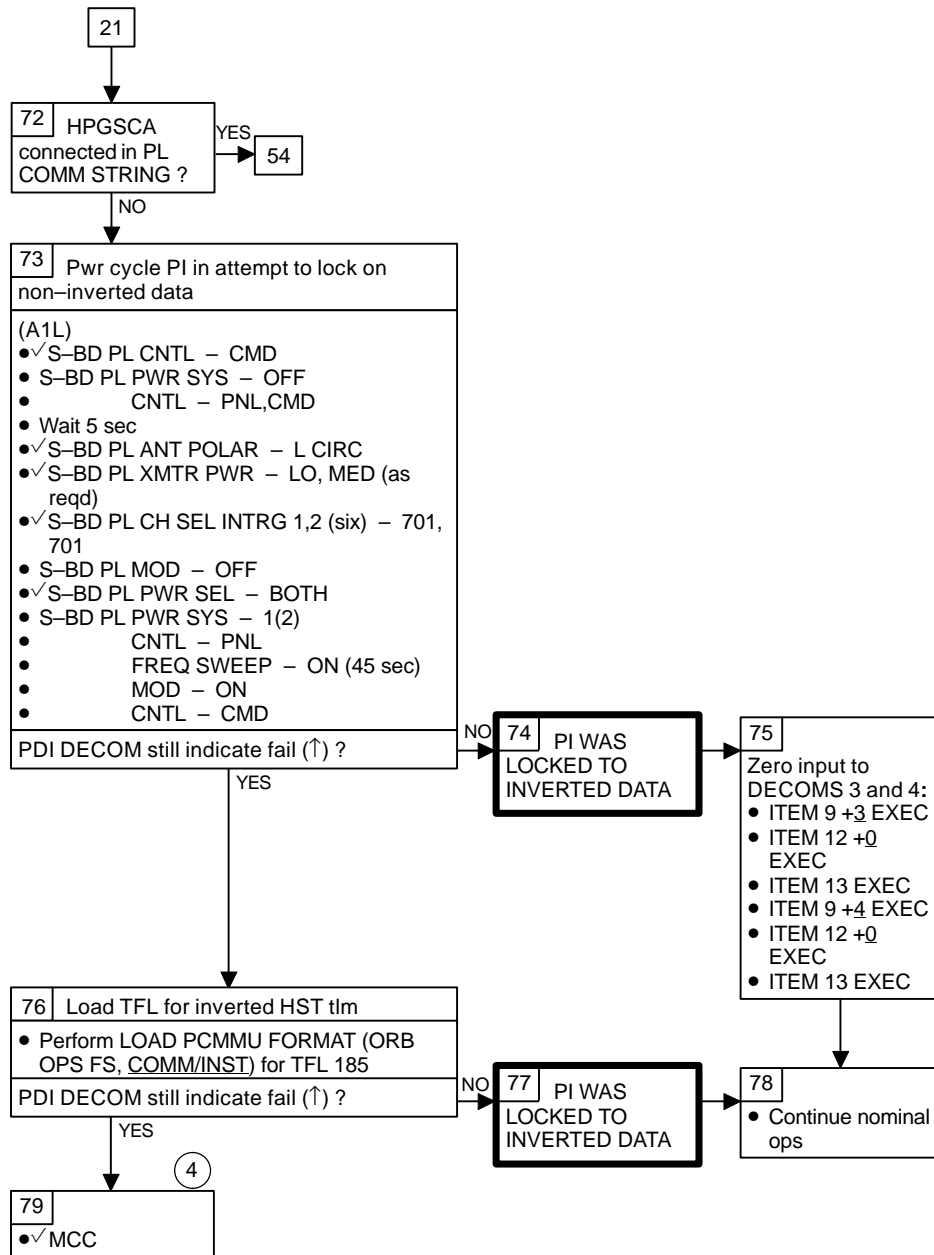


HST COMM 3.1a (Cont)



HST COMM 3.1a (Cont)

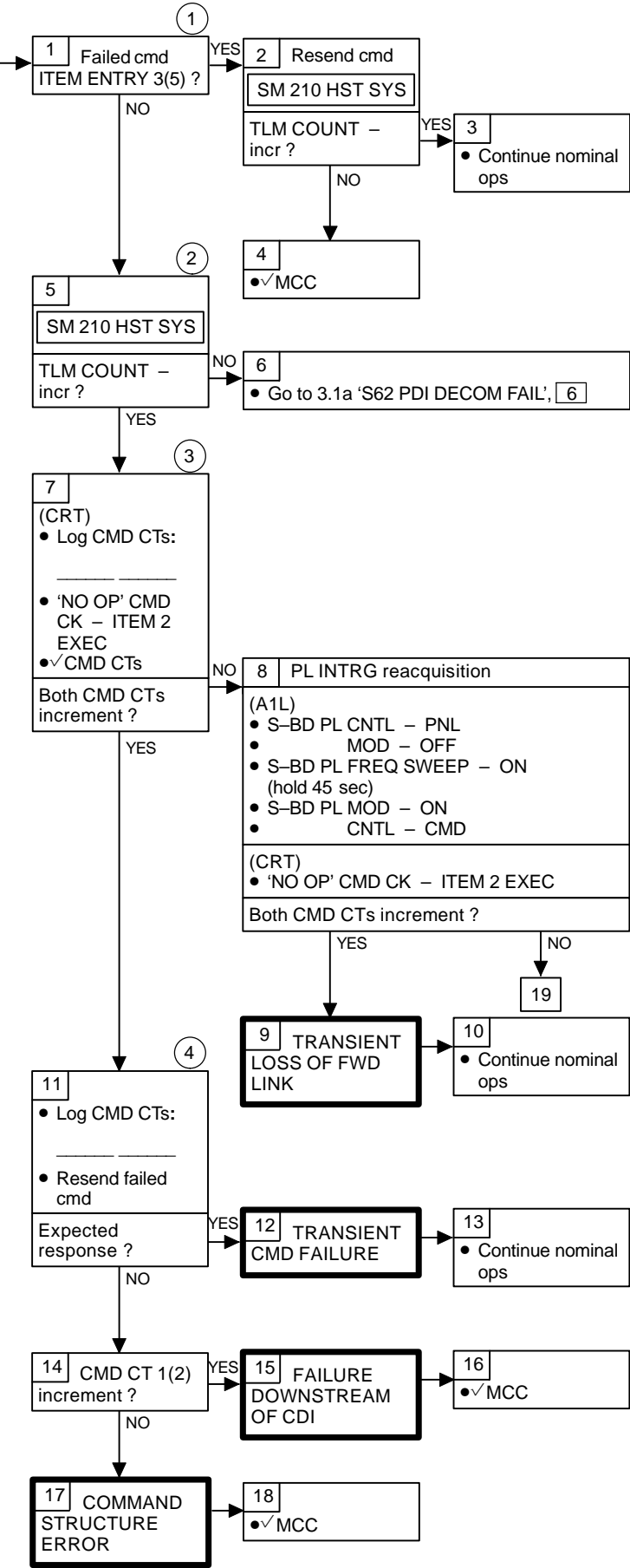
④ Possible PDI Data Inversion IFM



HST COMM

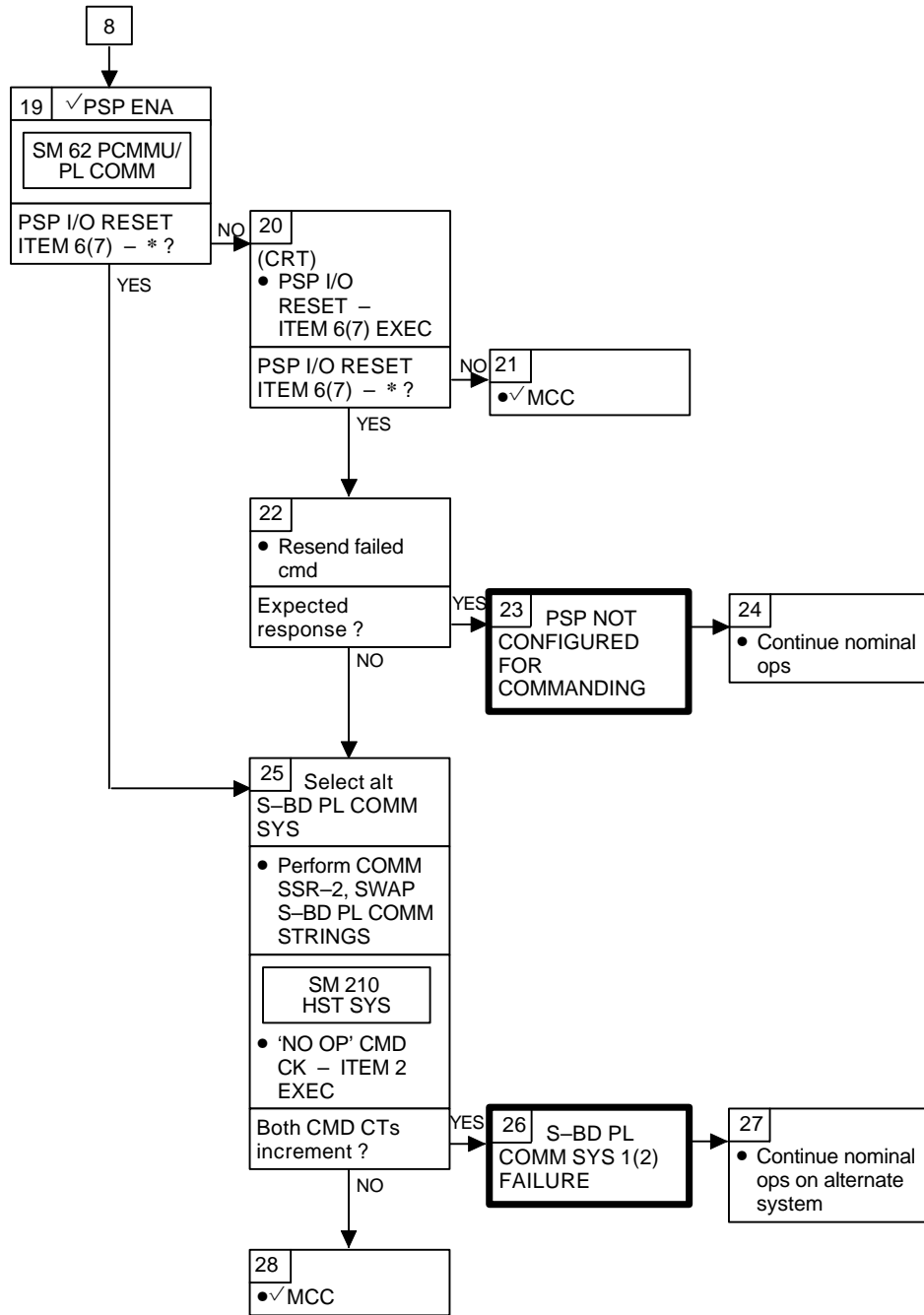
3.1b NO RESPONSE TO RF COMMAND

Nominal Config:
 PI link setup (A1L)
 S-BD PL CNTL - CMD
 S-BD PL ANT POLAR - L CIRC
 S-BD PL XMTR PWR:
 LO (as reqd)
 MED (> 40 ft)
 HI (> 125 ft)
 S-BD PL CH SEL INTRG 1,2 tw (six) - 701, 701
 S-BD PL PWR SYS 1(2)
 S-BD PL PWR SEL - BOTH
 S-BD PL PSP CMD OUTPUT - PL UMB
 S-BD PL XMTR FREQ SWEEP - OFF
 S-BD PL XMTR MOD - ON
 S-BD PL CNTL - PNL,CMD
 SM 210 HST SYS
 PSP ENA 1 ID - (1)

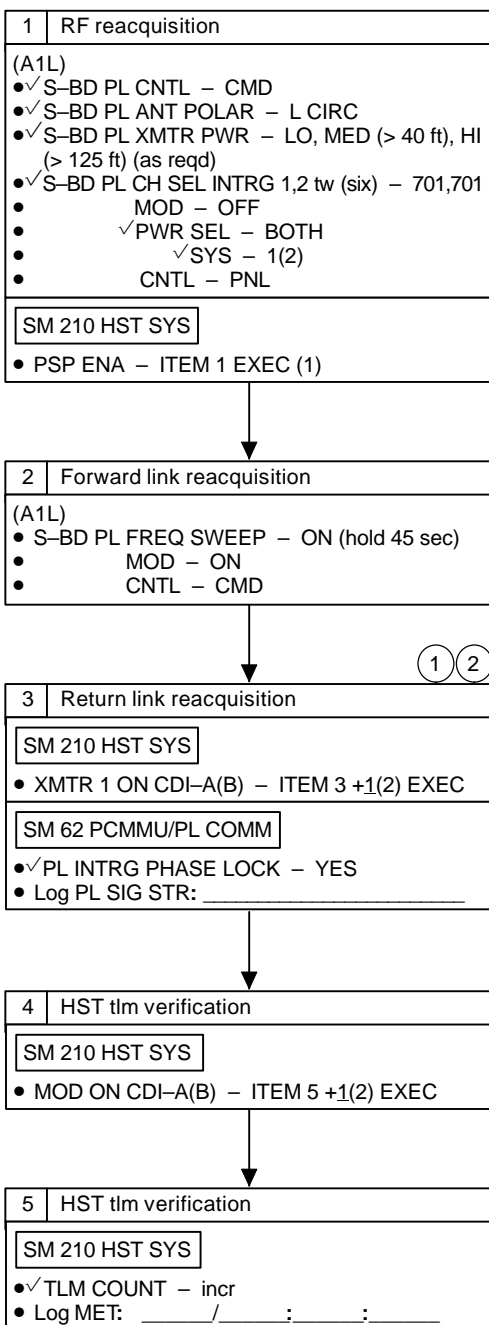


- ① If failed cmd was XMTR 1 ON, ITEM 3, then XMTR MOD ON, ITEM 5 must be sent before tlm is received
- ② Must be in 32K T format or 4K A format, or 4K D format to receive valid tlm (DFL 6,7,9,16 or 19). If not, when AOS, ✓MCC
- ③ HST RCVR could have lock but pwr level (AGC) could be too low for cmd processing. For this case, MCC may decide to go to PI MED pwr
- ④ CMD CT 1 corresponds to CDI A cmds and CMD CT 2 corresponds to CDI B

HST COMM 3.1b (Cont)



COMM SSR-1 PI RF REACQ



① STOCC can perform blocks 3-5 if necessary

② XMTR 1 ON cmd also turns off HST modulation

COMM SSR-2 SWAP S-BD PL COMM STRINGS

1 | Transfer HPGSCA, if reqd (✓MCC)

(A1L)

- Perform COMM SSR-3 HPGSCA PDIP
- PORT SWAP, if reqd
- ✓MCC

3 | RF reacquisition

(A1L)

- S-BD PL CNTL – CMD
- ANT POLAR – L CIRC
- XMTR PWR – LO
- S-BD PL CH SEL INTRG 1,2 tw (six) – 701,701
- S-BD PL MOD – OFF
- PWR SEL – BOTH
- PWR SYS – 2(1)
- CNTL – PNL
- Fault msg ‘S62 BCE BYP PSP 1(2)’

- Perform PSP I/O RESET

SM 62 PCMMU/PL COMM

- I/O RESET PSP 2(1) – ITEM 7(6) EXEC (*)

SM 210 HST SYS

- PSP ENA – ITEM 1 EXEC (1)

5 | Reload PDI switch matrix for alternate

- Proceed with input source swap using SOURCE 2 for input for DECOMs 1,2,3,4

NOTE

PI 1 = INPUT SOURCE 1
PI 2 = INPUT SOURCE 2

SM 62 PCMMU/PL COMM

- I/O RESET – ITEM 8 EXEC (*)

PDI: (DECOM 1)

- SEL DECOM – ITEM 9 +1 EXEC
- INPUT – ITEM 12 +2(1) EXEC
- LOAD – ITEM 13 EXEC

PDI: (DECOM 2)

- SEL DECOM – ITEM 9 +2 EXEC
- INPUT – ITEM 12 +2(1) EXEC
- LOAD – ITEM 13 EXEC

PDI: (DECOM 3)

- SEL DECOM – ITEM 9 +3 EXEC
- INPUT – ITEM 12 +2(1) EXEC
- LOAD – ITEM 13 EXEC

PDI: (DECOM 4)

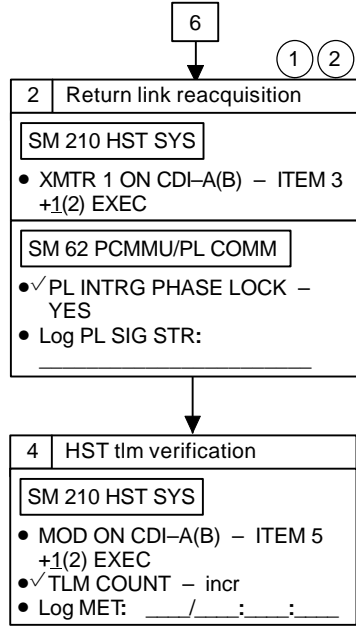
- SEL DECOM – ITEM 9 +4 EXEC
- INPUT – ITEM 12 +2(1) EXEC
- LOAD – ITEM 13 EXEC

6 | Forward link reacquisition

(A1L)

- S-BD PL FREQ SWEEP – ON (hold 45 sec)
- S-BD PL MOD – ON
- CNTL – CMD

2



- ① STOCC can perform blocks 2,4 if necessary
- ② XMTR 1 ON cmd also turns off HST modulation

COMM SSR-3 HPGSCA PDIP PORT SWAP

NOTE

Possible 'S62 PDI DECOM FAIL' msg

- L12L 1. REMOVE PI DATA FROM HPGSCA
PSP BYP – DSBL
cb SW PWR – op
- HPGSCA 2. HPGSCA PWR OFF
Laptop pwr (side) – off
Expansion Chassis pwr (rear) – off
- PDIP 3. PDIP PORT SWAP
Disconnect Y-cable from HST PI NO 1(2)
Remove Turn-Around Plug on HST PI NO 2(1)
Install Turn-Around Plug on HST PI NO 1(2)
Connect Y-cable to HST PI NO 2(1)
- HPGSCA 4. HPGSCA PWR ON
Expansion Chassis pwr (rear) – on
Laptop pwr (side) – on
- * If pwr to HPGSCA fails: *
 - * ✓Pwr cable connection *
 - * Press pwr sw again (both) *
- Allow 'Windows'/'Hubble 1' to start
- L12L 5. ENABLE PSP BYPASS
cb SW PWR – cl
PSP BYP – ENA
- HPGSCA 6. CONFIGURE HPGSCA TO CURRENT HST DATA RATE
✓MCC for current data rate (if unknown)
Depress hot key (F1–F6) for correct rate
7. STATUS INDICATORS
- Signal Status
- ✓Sync Status = Green
 - ✓Signal Present = Green
 - ✓Overload = Green
 - ✓Offset = Green
- Report status to MCC

PL/DPS RECONFIG

PL/DPS
RECONFIG

PL/DPS RECONFIG

PROCEDURE	SECURE ACTION	RECOVERY ACTION	INFO ONLY
PL1(2) MDM I/O ERROR; PL1(2) MDM OUTPUT (ORB PKT, <u>DPS</u>)	A,B	E	I
PASS SM GPC FAIL (ORB PKT, <u>DPS</u>)	N/A	F	J
GNC RECOVERY VIA G2FD (ORB PKT, <u>DPS</u>)	N/A	F	J
5.1a CS SPLIT (MAL, <u>DPS</u>)	N/A	F	J
5.3c I/O ERROR PL1(2), MDM OUTPUT PL1(2) (MAL, <u>DPS</u>)	---	D,E	I
5.3e I/O ERROR FLEX (MAL, <u>DPS</u>)	A,C	G	
5.3f BCE BYP FLEX (MAL, <u>DPS</u>)	A,C	G	
5.3g BCE BYP PL1(2) (MAL, <u>DPS</u>)	A,B	D,E	I
GPC FRP-4 PASS RECOVERY AFTER BFS ENGAGE (ASCENT/ORBIT/ENTRY) (MAL, <u>DPS</u>)	N/A	*F	J
GPC FRP-7 DPS RECONFIG FOR LOSS OF AV BAY COOLING (MAL, <u>DPS</u>)	N/A	*F,H	J
DPS SSR-3 GNC REASSIGNMENT (MAL, <u>DPS</u>)	N/A	N/A	J
DPS SSR-4 SM REASSIGNMENT (MAL, <u>DPS</u>)	N/A	F,H	J
ECLS SSR-10 H2O PUMP OPS VIA GPC (MAL, <u>ECLSS</u>)	N/A	N/A	

*Recovery procedure is not called from GPC FRP-7, specified actions are reqd to return to a nominal config

ACTION A

If during FSS MECH OPS, terminate motor drive immediately

A6U PL RETEN LAT 1,2 (both) – OFF
 R13L PL BAY MECH PWR SYS 1,2 (both) – OFF

NOTE

If port mode reqd, and operating on less than 12 DPC, √MCC; else, enable PCU hardline to ensure continuous HST ext pwr

If HST on ext pwr:

L12U PCU CONTR A,B (two) – ON

ACTION B

If port moding to alternate ports, do not power off any flex MDMs. All 4 FMDMs can be powered

If port moding back to primary ports, power off alternate FMDMs, primary FMDMs will still be powered

PL/DPS
RECONFIG

ACTION C

If entering from 5.3e, 'I/O ERROR FLEX' (MAL, DPS):

Go to 1.4a, 'I/O ERROR FLEX' (SSE), 9

If entering from 5.3f, 'BCE BYP FLEX' (MAL, DPS):

Go to 1.4b, 'BCE BYP FLEX' (SSE), 9

ACTION D

If procedure swapped to alternate FMDM,

Perform SSE SSR-1 FMDM SWAP A→B (B→A) (SSE), steps 6-13

ACTION E

L12U PCU CONTR A,B (two) – OFF

ACTION F (Can be performed by MCC if AOS)

If SM GPC recovered:

SM 62 PCMMU/PL COMM

I/O RESET PSP1(2) – ITEM 6(7) EXEC (*)

SM 210 HST SYS

PSP ENA – ITEM 1 EXEC (1)

ACTION G

Verify SSE status:

SM 211 SSE OVERVIEW

POWER

- ✓FSS FMDM A/B AMPS: 5 to 1.1 (both)
 - ✓HTR – 1/2
 - ✓A1 AMPS: < 14
 - ✓B1 AMPS: < 11
 - ✓CCTV HTR AMPS: < .9
- ✓MULE FMDM A/B AMPS: .7 to 1.3 (both)
 - ✓HTR – *
 - ✓ESM 1&2/3 AMPS: < 4/< 2
 - ✓SOPE 1A2A AMPS: < 2.0/< 3.1
 - ✓1B&2B: < 5.1
 - ✓3A/3B: < 2.6 (both)
- ✓FSS EPDSU VOLTS: 24.0 to 32.0 (both)
- ✓MULE PDSU VOLTS: 24.0 to 32.0
- ✓SAC EPDSU VOLTS: 24.0 to 32.0 (both)

If HST on external power:

PCU ON – ITEM 1 EXEC (*)

✓DPC 1-12 – *

✓PCU – P/S

✓DPC AMPS: < 11.0

✓VOLTS: 34.5 ± .7

If during FSS CCTV operations:

CCTV ENA ON – ITEM 3 EXEC (*)

PWR ON – ITEM 5 EXEC (*)

ACTION H (Can be performed by MCC if AOS)

Perform LOAD PDI DECOM FORMAT (ORB OPS FS, COMM/INST)

Reenable PDI DECOM FDA as reqd

ACTION I

If 'I/O ERROR PL1' msg, note following losses:

- Loss of onboard and ground cmd capability via PL comm string 1 (PF1/PSP1/PI1) to HST

If 'I/O ERROR PL2' msg, note following losses:

- Loss of onboard and ground cmd capability via PL comm string 2 (PF2/PSP2/PI2) to HST

ACTION J

If affected GPC SM:

- Note PL commanding (onboard and ground) via SM GPC not possible until SM machine restored and PF1(2) MDM I/F restored

If affected GPC GNC:

- Ground commanding not possible until GNC machine restored

HST DATA INVERSION 5-2

CRITICAL EQUIPMENT LOST

BUS LOSS MATRIX 6-2
MDM BUS LOSS IMPACTS 6-3

CRITICAL
EQUIP LOST

MDM BUS LOSS IMPACTS

OF1

PL BAY MECH PWR SYS 1 & 2 mon
PL RETEN LOGIC PWR SYS 1 & 2
mon
AC1 PBM MMC 1 BUS ENA 1 & 2 mon
PRLA B SIDE TLM OF:
RAC LATCHES
FSS KEEL LATCH
SAC KEEL LATCH

OF2

ALL PL RETEN LATCH CMD mon
REL CMD mon
PRLA A SIDE TLM OF:
RAC LATCHES
FSS KEEL LATCH
SAC KEEL LATCH
PRLA B SIDE TLM OF:
FSS MECH PWR 1,2
PL INTRG SIG STR FROM PI 1,2

OF3

FC 2 & 3 AMPS INDICATION

OF4

PL RETEN PL SELECT SW mon
(AND THUS SPEC 097 UPDATE
FORMAT)

OA1

AC2 PBM MMC 3 BUS ENA 1 & 2 mon

OA3

PRLA A SIDE TLM OF:
FSS MECH PWR 1,2

PF1 MDM

PRI RF CMD PATH VIA PSP1
(HST)
KU BAND ANTENNA CNTL
SAC TLM (FOR MORE DETAIL SEE
SAC PF 1 MDM CHANNELIZATION
CHARTS)

PF2 MDM

REDUN RF CMD PATH VIA PSP2
(HST)
SAC TLM (FOR MORE DETAIL SEE
SAC PF 2 MDM CHANNELIZATION
CHARTS)

FF1

UPLINK THRU NSP1

FF3

UPLINK THRU NSP2

FSS FMDM A(B)

MECHANISM SELECTION VIA S212
FSS CCTV CONTROL VIA S211
PCU CONTROL VIA S211
AMSB CONTROL VIA S212
TLM INDICATIONS VIA S211 & S212
(FOR MORE DETAIL SEE FSS FMDM
CHANNELIZATION CHART)

MULE FMDM A(B)

TLM INDICATIONS VIA S211 (FOR
MORE DETAIL SEE MULE FMDM
CHANNELIZATION CHARTS)

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FMDM CHANNELIZATION

FSS FMDM ANALOG INPUT CARDS	7-2
DISCRETE OUTPUT CARDS	7-3
INPUT CARDS	7-4
MULE FMDM ANALOG INPUT CARDS	7-5
DISCRETE INPUT CARDS	7-6
SAC PF01 ANALOG INPUT CARDS	7-7
DISCRETE INPUT CARDS	7-7
PF02 ANALOG INPUT CARDS	7-8
DISCRETE INPUT CARDS	7-8

FMDM CHAN

FSS FMDM ANALOG INPUT CARDS

CH	AID CARD 00		AID CARD 01		AID CARD 02	
	MSID	NOMENCLATURE	MSID	NOMENCLATURE	MSID	NOMENCLATURE
0 1 2 3						
4 5 6 7	P34T1025V P34T1021V P34V1035V	FSIPE LATCH B TEMP FSIPE BOTTOM B TEMP HST EXT ESS BUS VOLTAGE			P34T1030V	PALLET STBD FWD STRUCT TEMP
8 9 10 11	P34T2003V P34V1009V	AMSB TEMP HST EXT MAIN BUS VOLTAGE	P34C2026V P34T2004V P34C2008V	FSS HTR-1A CURRENT FSS EPDSU-1 TEMP DPC 1 CURRENT	P34C2022V P34V2040V P34C2025V P34C2010V	FSS FMDM B CURRENT FSS EPDSU-1 BUS VOLTAGE AMSB DC CURRENT DPC 3 CURRENT
12 13 14 15	P34T1029V P34C2027V P34C2024V	PALLET STBD AFT STRUCT TEMP FSS HTR 2A CURRENT ¹ FSS HTR 1B CURRENT ²	P34C2009V P34C2014V P34C2015V P34C2095V	DPC 2 CURRENT DPC 7 CURRENT DPC 8 CURRENT CCTV HTR CURRENT	P34C2011V P34C2012V P34C2013V P34V2041V	DPC 4 CURRENT DPC 5 CURRENT DPC 6 CURRENT FSS EPDSU-2 VOLTAGE
16 17 18 19			P34V1027V P34V1026V	HST MAIN BUS VOLTAGE HST INT ESS BUS VOLTAGE	P34T2117V P34T1028V P34T2118V	FSS STRUCTURE A TEMP PALLET PORT AFT STRUCT TEMP FSS STRUCTURE B TEMP
20 21 22 23	P34R2108V P34C2111V P34C2113V	PIVOTER TACHOMETER AMSB TOTAL AC CURRENT FSS EPDSU-1 TOTAL CURRENT	P34R2109V P34C2114V P34C2115V P34C2116V	ROTATOR TACHOMETER FSS HEATER 2B CURRENT ³ FSS FMDM A CURRENT FSS EPDSU-2 TOTAL CURRENT	P34R2110V	TRANSLATOR TACHOMETER
24 25 26 27	P34T2001V P34T2002V	FSS FMDM A TEMP FSS FMDM B TEMP	P34V2028V P34V2029V P34V2030V P34V2031V	DPC 1 VOLTAGE DPC 2 VOLTAGE DPC 3 VOLTAGE DPC 4 VOLTAGE	P34V2034V P34V2035V P34V2036V P34V2037V	DPC 7 VOLTAGE DPC 8 VOLTAGE DPC 9 VOLTAGE DPC 10 VOLTAGE
28 29 30 31	P34C2016V P34C2017V P34C2018V P34C2019V	DPC 9 CURRENT DPC 10 CURRENT DPC 11 CURRENT DPC 12 CURRENT	P34V2032V P34V2033V P34T2005V P34T2007V	DPC 5 VOLTAGE DPC 6 VOLTAGE PPCU TEMP FSS EPDSU-2 TEMP	P34V2038V P34V2039V P34T2006V P34T2093V	DPC 11 VOLTAGE DPC 12 VOLTAGE SPCU TEMP IPCU TEMP

¹ Mislabeled, provides current for 2B heater circuit
² Mislabeled, provides current for 2A heater circuit
³ Mislabeled, provides current for 1B heater circuit

FSS FMDM DISCRETE OUTPUT CARDS

BIT	DOH CARD 03 CH 1		DOH CARD 03 CH 2	
	MSID	NOMENCLATURE	MSID	NOMENCLATURE
0	P34K4001U	KEEL LATCH JAW 1 SELECT	P34K4041J	FSS CCTV ON CNTL (OFF-4042)
1	P34K4002U	KEEL LATCH JAW 2 SELECT	P34K4050J	DPC 4 ON CNTL (OFF-4051)
2	P34K4003J	PIVOTER LOW TORQUE SELECT	P34K4052J	DPC 5 ON CNTL (OFF-4053)
3	P34K4004J	PIVOTER SELECT	P34K4054J	DPC 6 ON CNTL (OFF-4055)
4	P34K4005J	ROTATOR SELECT	P34K4056J	DPC 2 ON CNTL (OFF-4057)
5	P34K4006J	TRANSLATOR SELECT	P34K4058J	DPC 10 ON CNTL (OFF-4059)
6	P34K4007J	DOWNLOCK SELECT	P34K4060J	DPC 11 ON CNTL (OFF-4061)
7	P34K4008J	BERTH LATCH 1 SELECT	P34K4062J	DPC 12 ON CNTL (OFF-4063)
8	P34K4009J	BERTH LATCH 2 SELECT	P34K4064J	DPC 8 ON CNTL (OFF-4065)
9	P34K4010J	BERTH LATCH 3 SELECT	P34K4017J	AMSB ON CNTL (OFF-4020)
10	P34K4011J	MAIN UMBILICAL SELECT	P34K4039J	CCTV PWR ENABLE 2 (DSBL-4040)
11	P34K4012J	B/U UMBILICAL SELECT	P34K4039J	CCTV PWR ENABLE 1 (DSBL-4040)
12	P34K4013J	BSP SELECT	P34K4024J	DPC 3 ON CNTL (OFF-4025)
13			P34K4026J	DPC 1 ON CNTL (OFF-4027)
14	P34K4015J	AMSB EOT/BOT OVERRIDE ENBL (DSBL-4019)	P34K4028J	DPC 9 ON CNTL (OFF-4029)
15			P34K4030J	DPC 7 ON CNTL (OFF-4031)

- * AMSB DESELECT will disable all AMSB mechanisms and the override with 1 command
- ** PCU ON/OFF command will power on all 12 DPCs with 1 command (bits 1-8, 12-15)

FSS FMDM DISCRETE INPUT CARDS

BIT	DIH CARD 04 CH 00		DIH CARD 04 CH 01		DIH CARD 04 CH 02	
	MSID	NOMENCLATURE	MSID	NOMENCLATURE	MSID	NOMENCLATURE
0	P34X2098Y	FHST SHUTTER CLOSE PWR STATUS	P34X2073Y	FSS ALT FMDM POWER STATUS	P34X2102Y	BSP RETRACTED SWITCH B STATUS
1	P34X2099Y	RSU SURVIVAL HTRS PWR STATUS	P34X2119Y	DPC 4 ON/OFF STATUS	P34X2103Y	BSP ENGAGED SWITCH B STATUS
2	P34X2100Y	AFT WRKLT PWR-1 STATUS	P34X2120Y	DPC 6 ON/OFF STATUS	P34X2104Y	BSP DISENGAGED SWITCH B STATUS
3	P34X2101Y	AFT WRKLT PWR-2 STATUS	P34X2076Y	AMSB-A PWR STATUS		
4			P34X2077Y	AMSB-B PWR STATUS	P34X2105Y	BSP RETRACTED SWITCH A STATUS
5			P34X2049Y	DPC 3 ON/OFF STATUS	P34X2106Y	BSP ENGAGED SWITCH A STATUS
6			P34X2050Y	DPC 5 ON/OFF STATUS	P34X2107Y	BSP DISENGAGED SWITCH A STATUS
7			P34X2047Y	DPC 1 ON/OFF STATUS		
8			P34X2048Y	DPC 2 ON/OFF STATUS	P34X2087Y	AMSB PRI LATCHED STATUS
9			P34X2082Y	FSS HTR-1 PWR STATUS	P34X2088Y	AMSB SEC LATCHED STATUS
10					P34X2089Y	AMSB PRI RELEASED STATUS
11			P34X2096Y	FSS CCTV PWR-1 STATUS	P34X2090Y	AMSB SEC RELEASED STATUS
12			P34X2097Y	FSS CCTV PWR-2 STATUS	P34X2091Y	AMSB PRI RTL STATUS
13			P34X2083Y	FSS HTR-2 PWR STATUS	P34X2092Y	AMSB SEC RTL STATUS
14						
15						

BIT	DIH CARD 07 CH 01		DIH CARD 07 CH 02	
	MSID	NOMENCLATURE	MSID	NOMENCLATURE
0	P34X2058Y	KEEL LATCH JAW 1 SEL STATUS		
1	P34X2059Y	KEEL LATCH JAW 2 SEL STATUS		
2	P34X2060Y	PIVOTER LOW TORQUE SEL STATUS		
3	P34X2061Y	PIVOTER SEL STATUS		
4	P34X2062Y	ROTATOR SEL STATUS		
5	P34X2063Y	TRANSLATOR SEL STATUS		
6	P34X2064Y	DOWNLOCK SEL STATUS		
7	P34X2065Y	BERTH LATCH 1 SEL STATUS		
8	P34X2066Y	BERTH LATCH 2 SEL STATUS		
9	P34X2067Y	BERTH LATCH 3 SEL STATUS		
10	P34X2068Y	MAIN UMB DRIVE SEL STATUS	P34X2121Y	DPC 10 ON/OFF STATUS
11	P34X2069Y	B/U UMBILICAL SEL STATUS	P34X2122Y	DPC 12 ON/OFF STATUS
12	P34X2070Y	BAPS SUPPORT POST SEL STATUS	P34X2053Y	DPC 9 ON/OFF STATUS
13			P34X2054Y	DPC 11 ON/OFF STATUS
14	P34X2072Y	AMSB EOT/BOT O/R STATUS	P34X2051Y	DPC 7 ON/OFF STATUS
15			P34X2052Y	DPC 8 ON/OFF STATUS

MULE FMDM ANALOG INPUT CARDS

CH	AID CARD 01		CH	AID CARD 01	
	MSID	NOMENCLATURE		MSID	NOMENCLATURE
0	P34T8101V	MULE SOPE PRIMARY TEMP*	16		
1	P34T8102V	ESM PRIMARY TEMP*	17		
2	P34T8103V	MULE LOPE PRIMARY TEMP*	18		
3	P34T8104V	MULE SOPE REDUNDANT TEMP**	19		
4	P34T8105V	ESM REDUNDANT TEMP**	20		
5	P34T8106V	MULE LOPE REDUNDANT TEMP**	21		
6			22		
7			23		
8	P34C8107V	MULE SOPE ZONE 2 PRIMARY HTR CURRENT	24	P34C8115V	SOPE ZONES 1&2 REDUNDANT HTR CURRENT
9			25	P34C8116V	SOPE ZONE 3 REDUNDANT HTR CURRENT
10	P34C8109V	MULE FMDM A CURRENT	26	P34C8117V	MULE SURVIVAL HTR CURRENT
11	P34C8110V	ESM ZONES 1&2 HTR CURRENT***	27		
12	P34C8111V	ESM ZONE 3 HTR CURRENT***	28	P34T8119V	MULE PDSU TEMP
13	P34C8112V	MULE SOPE ZONE 1 PRIMARY HTR CURRENT	29	P34T8120V	MULE FMDM A TEMP
14	P34C8113V	MULE SOPE ZONE 3 PRIMARY HTR CURRENT	30	P34T8121V	MULE FMDM B TEMP
15	P34C8114V	MULE FMDM B CURRENT	31	P34V8122V	MULE PDSU VOLTS

* FMDM A provides power for these sensors, data is only valid when FMDM A is powered on

** FMDM B provides power for these sensors, data is only valid when FMDM B is powered on

*** ESM A—heater current sensors are wired to FMDM A, ESM B—heater current sensors are wired to FMDM B

MULE FMDM DISCRETE INPUT CARDS

BIT	DIH CARD 04 CH 01	
	MSID	NOMENCLATURE
0	P34X8401Y	ESM ZONES 1&2 PRIMARY HEATER EN STATUS
1	P34X8402Y	ESM ZONE 3 PRIMARY HEATER EN STATUS
2	P34X8403Y	ALT FMDM ON STATUS
3		
4	P34X8404Y	ESM ZONES 1&2 REDUNDANT HEATER EN STATUS
5	P34X8405Y	ESM ZONE 3 REDUNDANT HEATER EN STATUS
6	P34X8406Y	SOPE ZONES 1&2 PRIMARY HEATER EN STATUS
7	P34X8407Y	SOPE ZONE 3 PRIMARY HEATER EN STATUS
8		
9		
10	P34X8409Y	SOPE ZONES 1&2 REDUNDANT HEATER EN STATUS
11	P34X8410Y	SOPE ZONE 3 REDUNDANT HEATER EN STATUS
12	P34X8411Y	MULE SURVIVAL HTRS EN STATUS
13		
14		
15		

SAC PF01 ANALOG INPUT CARDS

CH	AID CARD 01		CH	AID CARD 11	
	MSID	NOMENCLATURE		MSID	NOMENCLATURE
0	P34T5213V	SAC STRUCTURE B TEMP	0		
1	P34T5214V	SAC STBD ENVIRONMENT B TEMP	1		
2	P34T5215V	SAC OPA MID B TEMP	2	P34T6158V	SAC ASIPE LID A TEMP
3	P34V5216V	SAC EPDSU B VOLTS	3	P34T6159V	SAC ASIPE B-LATCH A TEMP
4	P34T5217V	SAC SAP PORT B TEMP	4		
5	P34T5218V	SAC SAP FWD B TEMP	5		
6	P34T5219V	ASIPE AFT TEMP	6		
7	P34T5220V	ASIPE FWD TEMP	7		
8	P34T5221V	SAC EPDSU TEMP 1	8		
9	P34C5222V	SAC EPDSU MODULE 7 CURRENT	9		
10	P34C5223V	SAC EPDSU MODULE 6 CURRENT	10		
11	P34C5224V	SAC EPDSU MODULE 5 CURRENT	11		
12	P34C5225V	SAC EPDSU MODULE 4 CURRENT	12		
13			13		
14			14		
15			15		

SAC PF01 DISCRETE INPUT CARDS

BIT	DIL CARD 13 CH 02	
	MSID	NOMENCLATURE
0	P34X6133Y	SAC ASIPE B-LATCH NOT READY STATUS
1	P34X6134Y	SAC ASIPE A-LATCH NOT SEATED STATUS
2	P34X6135Y	SAC ASIPE A-LATCH NOT LATCHED STATUS
3		

SAC PF02 ANALOG INPUT CARDS

CH	AID CARD 01		SAMPLE RATE
	MSID	NOMENCLATURE	
0	P34T5201V	SAC PORT ENVIRONMENT A TEMP	5
1	P34T5202V	SAC OPA FWD A TEMP	5
2	P34T5203V	SAC OPA AFT A TEMP	5
3	P34T5204V	SAC SAP STBD A TEMP	5
4	P34T5205V	SAC EPDSU TEMP 2	5
5	P34T5206V	SAC EPDSU TOTAL CURRENT	1
6	P34T5207V	SAC ASIPE B-LATCH B TEMP	5
7	P34T5208V	SAC EPDSU A VOLTS	5
8	P34T5209V	SAC SAP AFT A TEMP	5
9	P34T5210V	SAC ASIPE STBD TEMP	5
10	P34T5211V	SAC ASIPE PORT TEMP	5
11	P34T5212V	SAC ASIPE LID B TEMP	5

SAC PF02 DISCRETE INPUT CARDS

BIT	DIH CARD 05 CH 01		DIH CARD 05 CH 02	
	MSID	NOMENCLATURE	MSID	NOMENCLATURE
0				
1			P34X5235Y	SAC OPA HTR B PWR STATUS
2			P34X5236Y	SAC SAP HTR B PWR STATUS
3				
4				
5				
6				
7				
8	P34X5226Y	SAC ASIPE HTR A PWR STATUS		
9				
10	P34X5228Y	SAC EPDSU HTR A PWR STATUS		
11	P34X5229Y	SAC ASIPE HTR B PWR STATUS		
12				
13	P34X5231Y	SAC EPDSU HTR B PWR STATUS		
14	P34X5232Y	SAC OPA HTR A PWR STATUS		
15	P34X5233Y	SAC SAP HTR A PWR STAT		

CRT DISPLAYS

SM 210 HST SYS 8-2
211 SSE OVERVIEW 8-9
212 SSE MECHANISMS 8-14

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1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
1  XXXX / 2 1 0 / XXX      HST SYS      XX X DDD / HH : MM : SS
2  TLM COUNT XXX          PCS              DDD / HH : MM : SS
3  COMM                    7+ MODE XX XXXX  ORU / ORI DEACT
4  PSP ENA 1 ID X          SNPT DIS 8+ XXX  FOC 12+ XXX
5  RCVR 1 LOCK X 2        PSEA XXXX      NICMOS 13+ XXX
6  AGC ±XXX ±XXX        SOLAR ARRAY  COSTAR 14+ XXX
7  NO-OP CMD 2           DCE PWR AX XXX  RSU 1 2 3
8  CMD CT XXX XXX       STOP 9 / OFF 10+ STATXXX XXX XXX
9  XMTR 1                XXXXXXSXXXXXS  MAMPXXX XXX XXX
10 3 ON X                PDM XXXX XXXX  OFF 15+ 16+ 17+
1  SEL 4K 4             SDM XXXX XXXX
2 5 MOD ON X           XXXX XXXX  FGS BUS V
3 6 SSA OFF           SLEW XXXS XXXS 3 18+2X XX.X
4  EPS ABC            POS XXX XXX  OCE 19+4X XX.X
5  INT ESS BUS XXX    SADE OFF 11+XXX EPT XX.X
6  MAIN BUS V
7  A XX.X XXX        HGA +V3 -V3 SA / DIODE BOX
8  B XX.X XXX        HNG XXXX XXXX SA DEACT 20+
9  C XX.X XXX        LAT XXX XXX  SA SECTS XXXX
10 AMPS XXX          BATT CURRENTS  SURV HTR XXX
1  UMB SG V INT EXT  1 XXX.X 4 XXX.X  SADE OLD XXX
2  MN BUS XXS XXS    2 XXX.X 5 XXX.X  SPA XXXXX
3  ESS BUS XXS XXS   3 XXX.X 6 XXX.X  SA4 CUR XX.X
4                                     (XX)
5
6

```

PARAMETER CHARACTERISTICS: SM 210 HST SYS

CRT NAME	MSID	HST SRC	UNITS	DISPLAY RANGE	STATUS INDICATORS				
					M	H	L	↑	↓
COMM:									
TLM COUNT	P34U3004A	486/DMU	integer	1 to 120					
PSP ENA ID	V92J1103C		integer						
RCVR 1 LOCK	P34X3050E	DMU	event	blank or '*'					
2 LOCK	P34X3051E	DMU	event	blank or '*'					
RCVR 1 AGC	P34Y3064A	DIU 4	dBMs	-131 to -51					
2 AGC	P34Y3065A	DIU 4	dBMs	-130 to -50.8					
CMD CT 1	P34U3001A	DMU	integer	0 to 255					
2	P34U3002A	DMU	integer	0 to 255					
XMTR 1 ON	P93J1000C		echo fb of item entry						
MOD ON	P93J1001C		echo fb of item entry						
EPS:									
INT ESS BUS A	P34X3085E	DIU 2	event	blank or '*'					
B	P34X3086E	DIU 2	event	blank or '*'					
C	P34X3087E	DIU 2	event	blank or '*'					

CRT DISPLAYS

PARAMETER CHARACTERISTICS: SM 210 HST SYS

CRT NAME	MSID	HST SRC	UNITS	DISPLAY RANGE	STATUS INDICATORS				
					M	H	L	↑	↓
MAIN BUS V									
A	P34V3061A	486/DIU 2	volts	-0.28 to 35.67					
	P34X3046E	DIU 2	event	EXT, INT, ON *					
B	P34V3062A	486/DIU 2	volts	-0.28 to 35.67					
	P34X3047E	DIU 2	event	EXT, INT, ON *					
C	P34V3063A	486/DIU 2	volts	-0.28 to 35.67					
	P34X3048E/	DIU 2	event	OFF or ON					
	P34X3049E	DIU 2							
AMPS	P34C3060A	486/DIU 2	amps	-1.80 to 151.2					
UMB SG V									
MN BUS INT	P34V1027V	FMDM	volts	0 to 40	M	H	L		
EXT	P34V1009V	FMDM	volts	0 to 40	M	H	L		
ESS BUS INT	P34V1026V	FMDM	volts	0 to 40	M	H	L		
EXT	P34V1035V	FMDM	volts	0 to 40	M	H	L		
PCS:									
MODE	P93J1002C		echo fb of item entry						
	P34X3075E/	486	event	NORM, SNPT, DRFT, blank					
	P34X3076E	486							
SNPT DIS	P34X3005E	486	event	YES or NO					
PSEA	P34X3284E/	DIU 4	event	RSET or ACTV					
	P34X3285E	DIU 5							
SOLAR ARRAY:									
DCE PWR A	P34X3011E	DIU 5	event	blank or **					
	P34X3033E	DIU 4	event	OFF or ON					
B	P34X3012E	DIU 2	event	blank or **					
	P34X3034E	DIU 4	event	OFF or ON					
+WING	P34X3035E	DIU 4	event	flashing or no flash					↓
-WING	P34X3036E	DIU 4	event	flashing or no flash					↓
PDM +WING	P34X3280E/	DIU 4	event	blank, DPLY, NDPL					
	P34X3281E/	DIU 4							
	P34X3033E/	DIU 4							
	P34X3034E	DIU 4							
-WING	P34X3282E/	DIU 4	event	blank, DPLY, NDPL					
	P34X3283E/	DIU 4							
	P34X3033E/	DIU 4							
	P34X3034E	DIU 4							
SDM +WING (main)	P34X3077E/	DIU 4	event	blank, DPLY, STWD, TRAN					
	P34X3078E/	DIU 4							
	P34X3033E/	DIU 4							
	P34X3034E	DIU 4							
(red)	P34X3079E/	DIU 4	event	blank, DPLY, STWD, TRAN					
	P34X3080E/	DIU 4							
	P34X3033E/	DIU 4							
	P34X3034E	DIU 4							
-WING (main)	P34X3081E/	DIU 4	event	blank, DPLY, STWD, TRAN					
	P34X3082E/	DIU 4							
	P34X3033E/	DIU 4							
	P34X3034E	DIU 4							
(red)	P34X3083E/	DIU 4	event	blank, DPLY, STWD, TRAN					
	P34X3084E/	DIU 4							
	P34X3033E/	DIU 4							
	P34X3034E	DIU 4							
SLEW +WING	P34X3178E/	486/DIU 4	event	blank or +OP (flashing)					
	P34X3180E	486/DIU 4							
-WING	P34X3179E/	486/DIU 4	event	blank or -OP (flashing)					
	P34X3181E	486/DIU 4							
POS +WING	P34H3127A	486/DIU 4	degrees	-508 to 504					
-WING	P34H3128A	486/DIU 4	degrees	-508 to 504					
SADE OFF	P34X3129E/	DIU 2	event	OFF or ON					
	P34X3130E	DIU 2							
HGA HNG +V3	P34X3097E/	DIU 4	event	blank, DPLY, STWD, TRAN					
	P34X3098E/	DIU 4							
	P34X3067E	DIU 5							
-V3	P34X3099E/	DIU 4	event	blank, DPLY, STWD, TRAN					
	P34X3100E/	DIU 4							
	P34X3067E	DIU 5							

PARAMETER CHARACTERISTICS: SM 210 HST SYS (Cont)

CRT NAME	MSID	HST SRC	UNITS	DISPLAY RANGE	STATUS INDICATORS				
					M	H	L	↑	↓
HGA LAT +V3	P34X3093E/ P34X3094E/ P34X3067E	DIU 4 DIU 4 DIU 5	event	blank, TRA, LAT, REL					
-V3	P34X3095E/ P34X3096E/ P34X3067E	DIU 4 DIU 4 DIU 5	event	blank, TRA, LAT, REL					
BATT CURRENTS:									
1	P34C3289A	DIU 2	amps	-25.6 to 25.4					
2	P34C3290A	DIU 2	amps	-25.6 to 25.4					
3	P34C3291A	DIU 2	amps	-25.6 to 25.4					
4	P34C3292A	DIU 2	amps	-25.6 to 25.4					
5	P34C3293A	DIU 2	amps	-25.6 to 25.4					
6	P34C3288A	DIU 2	amps	-25.6 to 25.4					
ORU/ORI DEACT:									
FOC	P34X3013E/ P34X3014E/ P34X3015E/ P34X3016E	DIU 2 DIU 5 DIU 5 DIU 5	event	OFF or ON					
NICMOS	P34X3137E/ P34X3138E/ P34X3139E/ P34X3140E	DIU 5 DIU 2 DIU 5 DIU 2	event	OFF or ON					
COSTAR	P34X3212E/ P34X3213E/ P34X3214E/ P34X3215E	DIU 2 DIU 5 DIU 5 DIU 2	event	OFF or ON					
RSU:									
1 STAT	P34X3120E/ P34X3121E/ P34X3122E/ P34X3123E	DIU 5 DIU 5 DIU 5 DIU 5	event	OFF or ON					
2 STAT	P34X3029E/ P34X3030E/ P34X3031E/ P34X3032E	DIU 5 DIU 5 DIU 5 DIU 5	event	OFF or ON					
3 STAT	P34X3025E/ P34X3026E/ P34X3027E/ P34X3028E	DIU 5 DIU 5 DIU 5 DIU 5	event	OFF or ON					
1 MAMP	P34C3124A	DIU 5	m amps	-8.4 to 705.6					
	P34C3125A	DIU 5	m amps	-8.4 to 705.6					
2 MAMP	P34C3055A	DIU 5	m amps	-8.4 to 705.6					
	P34C3056A	DIU 5	m amps	-8.4 to 705.6					
3 MAMP	P34C3057A	DIU 5	m amps	-8.4 to 705.6					
	P34C3058A	DIU 5	m amps	-8.4 to 705.6					
FGS:									
3 BUS	P34X3023E	DIU 2	event	blank or **					
V	P34V3022A	DIU 1	volts	-0.189 to 15.88					
OCE BUS	P34X3024E	DIU 2	event	blank or **					
V	P34V3022A	DIU 1	volts	-0.189 to 15.88					
EPT V	P34V3147A	DIU 1	volts	-0.09 to 7.20					
SA/DIODE BOX:									
SA SECTS	P34X3217E/ P34X3294E/ P34X3295E/ P34X3216E/ P34X3296E/ P34X3297E	DIU 4 DIU 4 DIU 4 DIU 4 DIU 4 DIU 4	event	+OFF, -OFF, ON, ****					
SURV HTR	P34X3148E/ P34X3149E/ P34X3150E/ P34X3151E/ P34X3152E	DIU 5 DIU 2 DIU 2 DIU 5 DIU 5	event	OFF or ON					
SADE OLD	P34X3176E/ P34X3177E	DIU 5 DIU 2	event	OFF or ON					
SPA (A)	P34X3155E/ P34X3156E/ P34X3157E/ P34X3158E	DIU 2 DIU 2 DIU 2 DIU 2	event	blank or A					

PARAMETER CHARACTERISTICS: SM 210 HST SYS (Cont)

CRT NAME	MSID	HST SRC	UNITS	DISPLAY RANGE	STATUS INDICATORS				
					M	H	L	↑	↓
SPA (B)	P34X3159E/ P34X3160E/ P34X3161E/ P34X3162E	DIU 2 DIU 2 DIU 2 DIU 2	event	blank or B					
(C)	P34X3163E/ P34X3164E/ P34X3165E/ P34X3166E	DIU 2 DIU 2 DIU 2 DIU 2	event	blank or C					
(D)	P34X3167E/ P34X3168E/ P34X3169E/ P34X3170E	DIU 2 DIU 2 DIU 2 DIU 2	event	blank or D					
(E)	P34X3171E/ P34X3172E/ P34X3173E/ P34X3174E	DIU 2 DIU 2 DIU 2 DIU 2	event	blank, E, '*'					
SA4 CUR	P34C3136A	DIU 2	amps	-0.80 to 50.20					

ITEM ENTRY CHARACTERISTICS AND SUMMARY: SM 210 HST SYS

- ITEM 1: PSP can be configured to output commands to HST via PI by executing an item 1. Corresponding PSP config message ID of 1 will be displayed. PSP must be configured to enable idle pattern output to HST after RF acquisition.
- ITEM 2: Integrity of forward link from PI to HST receivers provided to allow crewmembers to verify a stable link to perform RF commanding. TLM COUNT parameter (PDI frame counter provided in HST 32 kbps stream) increments when PDI processing is established to allow verification that data is being updated on display when PDI processing is established. RCVR LOCK indicates '*' when command detector unit within each receiver detects presence of a stable forward link. RCVR AGC provides crewmembers a measure of received signal strength at receiver to be used in conjunction with lock status for troubleshooting link problems. Nominal range for RCVR AGC between -51 and -123.5 dBm. Item 2 provides NO-OP command to both strings of HST command system, causing CMD CT command counter from each HST command data interface (CDI) to increment.
- ITEM 3 ⁺¹,
₊₂: Item 3 has two indexes to select CDI-A or CDI-B versions of command to turn ON multi-access transmitter no. 1 in GSTDN mode without modulation. Crewmembers have previously swept PI forward link to lock HST MA receiver to PI carrier.
- ITEM 4: Item 4 selects 4 kbps fixed format (format D) for transmission. Used only when recovering from DMU power-on reset condition onboard HST.
- ITEM 5 ⁺¹,
₊₂: Once PI phase lock verified, item 5, which also has two indexes to transmit via the proper CDI, is then transmitted to enable modulation and start transmission of telemetry to ground via PI. (Subsequent ground commands MAY be required to select a telemetry format compatible with PDI.)
- ITEM 6: Powers OFF SSA Transmitters 1 and 2 via CDIs A and B.
- EPS: Status of HST onboard electrical power config provided to allow crewmember verification of various standard switch panel functions and insight into health and status of electrical interface to SSE and orbiter.
- INT ESS BUS monitor combines three relay statuses to provide feedback on internal essential bus status. HST essential bus provides power to HST command receivers and command decoders. An '*' is driven for each of the three internal essential buses when one corresponding bus is powered.

ITEM ENTRY CHARACTERISTICS AND SUMMARY: SM 210 HST SYS (Cont)

- EPS: (Cont) MAIN BUS XFER SW statuses provide insight into internal main bus power status in response to use of main bus internal power ON/OFF switch on SSP. Transfer switches connect HST batteries to main bus when HST is on internal power. 'INT' is driven if transfer switches closed and 'EXT' if open. 'ON*' is driven if the respective main bus transfer switch is closed but one or both of the respective Diode Bus interconnect switches are open. MAIN BUS C cannot be directly powered from the external source; therefore, it will show 'ON' if transfer switch closed and 'OFF' if open.
- Bus voltages for HST MAIN BUS A and B and total MAIN BUS AMPS provide insight into interface to orbiter during attached operations. The UMB SG V for the MN INT, MN EXT, ESS INT, and ESS EXT buses provides for limited insight into the interface in the absence of HST PDI telemetry.
- ITEM 7 +9 1,
+9 2: Provides ability to command HST to free drift immediately after capture to prevent reaction wheel overspeed and to remove any torques HST might place on orbiter RMS after grapple. When executed, feedback transitions from NORM to DRFT, and SNPT DIS status transitions from NO to YES.
- ITEM 7 +9 3,
+9 4: Item 7 has two indexes to select CDI-A or CDI-B versions of a command to initiate Sun pointing via 486. When executed, SNPT DIS feedback transitions from YES to NO immediately indicating 5-min sunpoint timer macro has been activated. MODE status will transition from DRFT to SNPT 5 min later indicating HST sunpoint control law is active. SNPT DIS will transition from NO to YES approximately 22 sec after sunpoint mode is entered (5:22 after command sent), indicating macro execution has stopped. For HST jettison when the SA2 is retracted (either or both wings), 486 software sunpoint (item 7 +9 3(94)) will be initiated instead of PSEA hardware sunpoint (items 7+9 5 and 7 +9 6). While the SA2 is retracted, the HST Flight Software macros are patched so that the Software Sunpoint control law is activated 20 sec following execution of item 7 +9 3(94).
- ITEM 7 +9 5,
+9 6: Items 7 +9 5 and 7 +9 6 will bypass HST main computer to initiate hardware sunpoint. These commands will only be sent if an HST jettison or RMS Quick Deploy is required. PDI DECOM FAIL FDA msg will accompany this command. For HST jettison, both SA2 wings must be deployed or both SA3 wings installed. If not in this configuration, initiate 486 software sunpoint (item 7 +9 3(94)) instead.
- ITEM 8 +9 8: Item 8 +9 8 will reset both sides of the Pointing Safemode Electronics Assembly (PSEA). This command will be used to disable the HST hardware sunpoint pointing control after retrieval.
- ITEM 8 +9 9: During retrieval, a backup stored program command is placed onboard HST by STOCC to maneuver vehicle back to a sun-favorable attitude ~ 165 min after initiation of maneuver to capture attitude in event orbiter has not captured it. If this timer command is near its timeout time but it becomes desirable to prevent HST from maneuvering because the orbiter is within a few minutes of capture, a SUNPT DISable command (item 8 +9 9) is issued to disable timer command and is verified by transition of SUNPT DIS status from NO to YES.
- SOLAR ARRAY: Deployment control electronics (DCE) power status A and B each indicate 'blank' or '*'. DCE fail flag indicates when corresponding internal DC-DC converter is ON. During SA ops, only one side of DCE nominally indicates 'ON' at a time. 'ON' is driven in adjacent field when DCE fail flag is set high (1), indicating that converter has been successfully commanded ON and DCE internal failure logic has found no faults. 'OFF' is driven when converter is commanded OFF or DCE has sensed an internal failure (i.e., when DCE fail flag is zero). DCE internal failure logic can sense a fault condition during mechanism ops and automatically shut off unit. DCE failure detection logic turns off DCE converters for any of following conditions:
- a. Overcurrent of any motor
 - b. Undervoltage of any PDM motor
 - c. Main bus voltage outside range of 24-32 VDC
 - d. DC-DC converter input current too high
 - e. Internal supply voltage out-of-limits
 - f. Invalid content of command register

ITEM ENTRY CHARACTERISTICS AND SUMMARY: SM 210 HST SYS (Cont)

- ITEM 9,10 +9 9: Commands DCE all zeroes (command register reset) if crewmember visual monitoring of SA observes uncommanded motion. An item 10 +9 9 will shut off both DCE power supplies if item 9 unsuccessful. While mechanism is driving (DCE ± WING MOTOR OPERATE is high), +WING and/or – WING text labels will flash. POS gives the +WING and –WING SA positions in degrees, from –90 to +270.
- ITEM 11 +9 9: Powers OFF solar array drive electronics (SADE) 1 and 2. This command is routed to both CDI–A and CDI–B. When both SADE 1 and 2 are off, the display indicates 'OFF'. If either SADE 1 or 2 is on, the display indicates 'ON'.
- HGA: Telemetry data provided for monitoring high gain antenna (HGA) deploy status. Hinge status (HNG) indicates 'DPLY' for fully deployed, 'TRAN' for in transit, and 'STWD' for fully stowed. HGA latch status (LAT) indicates 'LAT' for latch closed, 'TRA' for in transit, and 'REL' for latch open. Both HNG and LAT fields will be blanked if MCU–A link power supply is OFF since data is invalid in that case.
- ITEM 12 +9 8, +9 9: These commands soft safe (98) and deadface the FOC primary, redundant, and remote interface unit (RIU) power connectors (99) to support the ACS installation. If any of these items remains ON, status will indicate 'ON'. Contains command words for issuing commands via both HST command strings in a single command load.
- ITEM 13 +9 8, +9 9: These commands soft safe (98) and deadface the NICMOS/FOS primary, redundant, and remote interface unit (RIU) power connectors (99) to support the NCS installation. If any of these items remains ON, status will indicate 'ON'. Contains command words for issuing commands via both HST command strings in a single command load.
- ITEM 14 +9 8, +9 9: These commands soft safe (98) and deadface the COSTAR/HSP primary, redundant, and remote interface unit (RIU) power connectors (99) to support the NCS installation. If any of these items remains ON, status will indicate 'ON'. Contains command words for issuing commands via both HST command strings in a single command load.
- ITEM 15 +9 9,
16 +9 9,
17 +9 9: Powers OFF rate sensor units (RSUs) 1, 2, 3, respectively. RSU STAT field indicates 'OFF' when corresponding RSU control heater, survival heater, and channel power all deactivated. In addition, RGA motor currents are provided as additional verification that RSU has been shut down. Motor currents go to less than 20 mAmps when RSU commanded OFF.
- ITEM 18 +9 8, +9 9: Powers OFF and deadfaces FGS3. Disables FGE 3 Control #1, FGE 3 Inrush Control 1, selects the FGE 3 Redundant Power Bus. Powers OFF TCE Heaters: SM Primary, PM Primary, MR Primary, FGS1 Primary, FGS2 Primary, FGS3 Primary, FPS1 Primary, FPS2 Primary, and FPS3 Primary. Disables TCE Control 1 and 2. Powers OFF OTA Primary Bus 2. This command was retained from SM3A. It will not be used during SM3B, but it is planned to be used during SM4. Separate indexes are provided for each HST command path (i.e., CDI–A and CDI–B).
- ITEM 19 +9 8, +9 9: Powers OFF and deadfaces OCE. Disables OCE Control 1, powers OFF OCE Inrush Control 1, disables FGE 3 Control 1, powers OFF FGE 3 Inrush Control 1, selects FGE 3 Redundant Power Bus, powers OFF OTA Primary Bus 4. This command was retained from SM3A. It will not be used during SM3B, but it is planned to be used during SM4. Separate indexes are provided for each HST command path (i.e., CDI–A and CDI–B).
- ITEM 20 +9 7: Prepares the HST SA and EPS systems for SA–3 installation. This command powers OFF both SADEs, powers OFF primary and redundant DCE input power, and powers OFF the SA survival heaters.

ITEM 20 +9 7:
(Cont)

SA SECTS status will indicate '+OFF' when configured for +Wing changeout (Section 1 to Diode Bus and other sections to battery). Status will indicate '-OFF' when configured for -Wing changeout (Section 4 to Diode Bus and other sections to battery). 'ON' is driven when all sections are to battery. '****' is driven for any other SA section configuration.

The SURV HTR field indicates 'OFF' when the Diode Box primary and redundant survival heaters, SADM/PDM primary and redundant survival heaters, and the SDM survival heaters are disabled. If any of these items is powered, the field will indicate 'ON'.

The SADE OLD field indicates 'OFF' when the SADE 1 and 2 Off-Load Devices are powered off. If either item is powered on, the field indicates 'ON'.

The SPA field indicates trim relay status. "ABCDE" is driven when all SPA trim relays are open with the old PCU installed. "ABCD*" is driven when all SPA trim relays are open with PCUR installed. A blank in any character field indicates one or more trim relays in that group is closed.

ITEM 20 +9 8:

Switches SA Section 1 Current from Diode Bus to Battery 1 just before SA Panel Deployment (SA-3, -V2 Wing). Contingency commands for EVA if STOCC unable to command.

ITEM 20 +9 9:

Switches SA Section 4 Current from Diode Bus to Battery 4 just before SA Panel Deployment (SA-3, +V2 Wing). Contingency commands for EVA if STOCC unable to command.

	1										2										3										4										5									
	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0
1	XXXX / 211 / XXX										SSE OVERVIEW										XX X DDD / HH : MM : SS										DDD / HH : MM : SS																			
2	ON OFF																																																	
3	PCU X / X 1 X S 2 X										D P C										V O L T S										A M P S																			
4	CCTV ENA 3 X S 4 X										1 / 2 X S / X S										XX . X S / XX . X S										XX . X S / XX . X S																			
5	PWR 5 X S 6 X										3 / 4 X S / X S										XX . X S / XX . X S										XX . X S / XX . X S																			
6	ZONE 1 & 2 3										5 / 6 X S / X S										XX . X S / XX . X S										XX . X S / XX . X S																			
7	ESM A HTR X S X S										7 / 8 X S / X S										XX . X S / XX . X S										XX . X S / XX . X S																			
8	B HTR X S X S										9 / 10 X S / X S										XX . X S / XX . X S										XX . X S / XX . X S																			
9	SOPE A HTR X S X S										11 / 12 X S / X S										XX . X S / XX . X S										XX . X S / XX . X S																			
10	B HTR X S X S										23 ON XX										24 OFF XX																													
1	POWER										A M P S										T H E R M A L										T E M P																			
2	FSS EPDSU 1 / 2										XXX . X S / XXX . X S										FSS EPDSU ± XXX X S / ± XXX X S																													
3	FMDM A / B										X . X X S / X . X X S										FMDM ± XXX X S / ± XXX X S																													
4	HTR X S / X S																				PCU ± XXX X S / ± XXX X S																													
5	A1 / A2										XX . X S / XX . X S										IPC U ± XXX X S																													
6	B1 / B2										XX . X S / XX . X S										A M S B ± XXX X S																													
7	CCTV HTR										X . X X S										M U L E P D S U ± XXX X S																													
8	MULE FMDM A / B										X . X X S / X . X X S										FMDM ± XXX X S / ± XXX X S																													
9	HTR X S										XX . X S										S A C E P D S U ± XXX X S / ± XXX X S																													
20	ESM 1 & 2 / 3										X . X X S / X . X X S																																							
1	SOPE 1A / 2A										XX . X S / XX . X S																				V O L T S																			
2											1B & 2B										XX . X S										FSS EPDSU XX . X S / XX . X S																			
3											3A / 3B										XX . X S / XX . X S										M U L E P D S U XX . X S																			
4	SAC EPDSU										XXX . X S										SAC EPDSU XX . X S / XX . X S																													
5																															(X X)																			
6																																																		

PARAMETER CHARACTERISTICS: SM 211 SSE OVERVIEW

CRT NAME	MSID	UNITS	DISPLAY RANGE	STATUS INDICATORS				
				M	H	L	↑	↓
PCU (P)	P34K4024Y/ P34K4026Y/ P34K4050Y/ P34K4052Y/ P34K4054Y/ P34K4056Y	event	blank, P, '*'					
(S)	P34K4028Y/ P34K4030Y/ P34K4058Y/ P34K4060Y/ P34K4062Y/ P34K4064Y	event	blank, S, '*'					
PCU ON	P34K4024Y/ P34K4026Y/ P34K4028Y/ P34K4030Y/ P34K4052Y/ P34K4060Y	event	blank or '*'	M				
OFF	P34K4024Y/ P34K4026Y/ P34K4028Y/ P34K4030Y/ P34K4052Y/ P34K4060Y	event	blank or '*'					

PARAMETER CHARACTERISTICS: SM 211 SSE OVERVIEW (Cont)

CRT NAME	MSID	UNITS	DISPLAY RANGE	STATUS INDICATORS				
				M	H	L	↑	↓
CCTV ENA ON	P34X2096Y/ P34X2097Y	event	'*', 1, 2, blank	M				
OFF	P34X2096Y/ P34X2097Y	event	'*', 1, 2, blank					
PWR ON	P34X4041Y	event	blank or '*'	M				
OFF	P34X4041Y	event	'*' or blank					
ESM A HTR ZONE 1&2	P34X8401Y	event	blank or '*'	M				
3	P34X8402Y	event	blank or '*'	M				
B HTR ZONE 1&2	P34X8404Y	event	blank or '*'	M				
3	P34X8405Y	event	blank or '*'	M				
SOPE A HTR ZONE 1&2	P34X8406Y	event	blank or '*'	M				
3	P34X8407Y	event	blank or '*'	M				
B HTR ZONE 1&2	P34X8409Y	event	blank or '*'	M				
3	P34X8411Y	event	blank or '*'	M				
DPC 1	P34X2047Y	event	blank or '*'	M				
2	P34X2048Y	event	blank or '*'	M				
1 VOLTS	P34V2028V	volts	0.0 to 40.0	M	H	L		
2 VOLTS	P34V2029V	volts	0.0 to 40.0	M	H	L		
1 AMPS	P34C2008V	amps	0.0 to 20.0	M	H	L	↑	
2 AMPS	P34C2009V	amps	0.0 to 20.0	M	H	L	↑	
3	P34X2049Y	event	blank or '*'	M				
4	P34X2119Y	event	blank or '*'	M				
3 VOLTS	P34V2030V	volts	0.0 to 40.0	M	H	L		
4 VOLTS	P34V2031V	volts	0.0 to 40.0	M	H	L		
3 AMPS	P34C2010V	amps	0.0 to 20.0	M	H	L	↑	
4 AMPS	P34C2011V	amps	0.0 to 20.0	M	H	L	↑	
5	P34X2050Y	event	blank or '*'	M				
6	P34X2120Y	event	blank or '*'	M				
5 VOLTS	P34V2032V	volts	0.0 to 40.0	M	H	L		
6 VOLTS	P34V2033V	volts	0.0 to 40.0	M	H	L		
5 AMPS	P34C2012V	amps	0.0 to 20.0	M	H	L	↑	
6 AMPS	P34C2013V	amps	0.0 to 20.0	M	H	L	↑	
7	P34X2051Y	event	blank or '*'	M				
8	P34X2052Y	event	blank or '*'	M				
7 VOLTS	P34V2034V	volts	0.0 to 40.0	M	H	L		
8 VOLTS	P34V2035V	volts	0.0 to 40.0	M	H	L		
7 AMPS	P34C2014V	amps	0.0 to 20.0	M	H	L	↑	
8 AMPS	P34C2015V	amps	0.0 to 20.0	M	H	L	↑	
9	P34X2053Y	event	blank or '*'	M				
10	P34X2121Y	event	blank or '*'	M				
9 VOLTS	P34V2036V	volts	0.0 to 40.0	M	H	L		
10 VOLTS	P34V2037V	volts	0.0 to 40.0	M	H	L		
9 AMPS	P34C2016V	amps	0.0 to 20.0	M	H	L	↑	
10 AMPS	P34C2017V	amps	0.0 to 20.0	M	H	L	↑	
11	P34X2054Y	event	blank or '*'	M				
12	P34X2122Y	event	blank or '*'	M				
11 VOLTS	P34V2038V	volts	0.0 to 40.0	M	H	L		
12 VOLTS	P34V2039V	volts	0.0 to 40.0	M	H	L		
11 AMPS	P34C2018V	amps	0.0 to 20.0	M	H	L	↑	
12 AMPS	P34C2019V	amps	0.0 to 20.0	M	H	L	↑	
ON	P93J0100C	echo fb of item entry						
OFF	P93J0101C	echo fb of item entry						

PARAMETER CHARACTERISTICS: SM 211 SSE OVERVIEW (Cont)

CRT NAME	MSID	UNITS	DISPLAY RANGE	STATUS INDICATORS				
				M	H	L	↑	↓
POWER:								
FSS EPDSU 1 AMPS	P34C2113V	amps	-0.3 to 150.0	M	H	L		
2 AMPS	P34C2116V	amps	-0.6 to 150.0	M	H	L		
FMDM A AMPS	P34C2115V	amps	0.0 to 5.0	M	H	L		
B AMPS	P34C2022V	amps	0.0 to 5.0	M	H	L		
HTR (1)	P34X2082Y	event	blank or 1	M				
(2)	P34X2083Y	event	blank or 2	M				
A1 AMPS	P34C2026V	amps	0.0 to 20.0	M	H	L	↑	
A2 AMPS	P34C2027V	amps	0.0 to 20.0	M	H	L	↑	
B1 AMPS	P34C2024V	amps	0.0 to 20.0	M	H	L	↑	
B2 AMPS	P34C2114V	amps	0.0 to 20.0	M	H	L	↑	
CCTV HTR AMPS	P34C2095V	amps	0.0 to 5.0	M	H	L		
MULE FMDM A AMPS	P34C8109V	amps	0.0 to 5.0	M	H	L		
B AMPS	P34C8114V	amps	0.0 to 5.0	M	H	L		
HTR	P34X8411Y	event	blank or '*'	M				
HTR AMPS	P34C8117V	amps	0.0 to 20.0	M	H	L	↑	
ESM 1&2 AMPS	P34C8110V	amps	0.0 to 5.0	M	H	L	↑	
3 AMPS	P34C8111V	amps	0.0 to 5.0	M	H	L	↑	
SOPE 1A AMPS	P34C8112V	amps	0.0 to 20.0	M	H	L	↑	
2A AMPS	P34C8107V	amps	0.0 to 20.0	M	H	L	↑	
1B&2B AMPS	P34C8115V	amps	0.0 to 20.0	M	H	L	↑	
3A AMPS	P34C8113V	amps	0.0 to 20.0	M	H	L	↑	
3B AMPS	P34C8116V	amps	0.0 to 20.0	M	H	L	↑	
SAC EPDSU AMPS	P34C5206V	amps	-1.2 to 150.0	M	H	L	↑	
THERMAL:								
FSS EPDSU (1) TEMP	P34T2004V	deg C	-30 to 60	M	H	L		
(2) TEMP	P34T2007V	deg C	-30 to 60	M	H	L		
FMDM (A) TEMP	P34T2001V	deg C	-55 to 120	M	H	L		
(B) TEMP	P34T2002V	deg C	-55 to 120	M	H	L		
PCU (P) TEMP	P34T2005V	deg C	-30 to 60	M	H	L		
(S) TEMP	P34T2006V	deg C	-30 to 60	M	H	L		
IPCU TEMP	P34T2093V	deg C	-30 to 60	M	H	L		
AMSB TEMP	P34T2003V	deg C	-30 to 60	M	H	L		
MULE PDSU TEMP	P34T8119V	deg C	-30 to 60	M	H	L		
FMDM (A) TEMP	P34T8120V	deg C	-55 to 120	M	H	L		
(B) TEMP	P34T8121V	deg C	-55 to 120	M	H	L		
SAC EPDSU TEMP (1)	P34T5221V	deg C	-30 to 60	M	H	L		
(2)	P34T5205V	deg C	-30 to 60	M	H	L		
FSS EPDSU (1) VOLTS	P34V2040V	volts	0.0 to 40.0	M	H	L		
(2) VOLTS	P34V2041V	volts	0.0 to 40.0	M	H	L		
MULE PDSU VOLTS	P34V8122V	volts	0.0 to 40.0	M	H	L		
SAC EPDSU VOLTS (1)	P34V5208V	volts	0.0 to 40.0	M	H	L		
(2)	P34V5216V	volts	0.0 to 40.0	M	H	L		

ITEM ENTRY CHARACTERISTICS AND SUMMARY: SM 211 SSE OVERVIEW (Cont)

ITEM 1,2: Items 1 and 2 will set and reset, respectively, twelve FMDM discrete outputs to command the twelve FSS direct power converters (DPCs) on and off. Due to GPC limitations, the feedback for these commands is only based on command response from the six odd numbered DPCs. The feedback for item 3 ON will indicate a blank when all DPCs are commanded off (based on the BITE test 4 feedback) and an "*" when any of the DPCs are commanded on. The item 4 OFF status will be blank as long as any FMDM DPC ON discrete output is set, and will indicate an "*" when all are reset.

ITEM 3,4,5,6: Items 3 through 6 provide power control over the closed circuit television (CCTV) camera mounted on the FSS berthing and positioning system (BAPS) platform. Two power relays in series feed power to the CCTV camera by execution of item 3, whose status will nominally indicate an "*" when both relays indicate they are closed. If either relay remains open, a "1" or "2" will be displayed for the item 3 ON status to indicate the closed relay, while the item 4 OFF status will show the corresponding open relay number. When commanded off with an item 4, the item 4 OFF status will indicate an "*" upon both relays achieving an open condition. The camera iris is commanded open upon execution of an item 5, whose ON status will show an "*" driven by the setting of the corresponding FMDM discrete output (BITE test 4 feedback). This same FMDM BITE status is used for the item 6 OFF status, which is blank when the camera is commanded on (iris open) and an "*" when the camera is powered off (iris closed).

DPC: Provides status and control of twelve DPCs used for powering berthed HST. The DPC status telemetry is provided for each DPC. The voltage for the twelve DPCs is displayed, each with a range of 0 to 40 V dc. Also, the current for the twelve DPCs is displayed, each with a range of 0 to 20 amperes. DPCs are commanded as follows:

ITEM 23,24: Status and control of the twelve DPCs used for powering the berthed HST are provided. The DPCs can be commanded individually by sending indexed commands as follows:

ON ITEM 23+	OFF ITEM 24+	DPC
1	71	1
2	72	2
3	73	3
4	74	4
5	75	5
6	76	6
7	77	7
8	78	8
9	79	9
10	80	10
11	81	11
12	82	12

The corresponding number of the index command sent appears to the right of 23 ON or 24 OFF.

ITEM ENTRY CHARACTERISTICS AND SUMMARY: SM 211 SSE OVERVIEW (Cont)

POWER: SSE power distribution telemetry is provided from the FSS, MULE, and SAC. The FSS EPDSU 1 and 2 voltages, MULE PDSU voltage, and the SAC EPDSU 1 and 2 voltages provide insight into orbiter provided voltage at the interface to the FSS, MULE, and SAC. The current for active boxes on the SSE and heaters is provided. These currently include the two FSS Flex MDMs, the four heater current circuits on the FSS (along with status indications), the FSS CCTV heater circuit, the MULE Flex MDM currents, the MULE survival heater circuit (along with status indication), the two ESM heater circuit currents, and the five SOPE heater circuit currents. Status indications for the ESM and SOPE heaters are displayed in the top left corner of the display. The current for the second axial carrier (SAC) enhanced power distribution and switching unit (EPDSU) is provided.

The FSS heater current sensors were incorrectly wired. The A2 telemetry point actually displays the B2 current, the B1 telemetry point actually displays the A2 current, and the B2 telemetry point actually displays the B1 current. When the primary FSS heaters are activated, the A1 and B1 current sensors should be monitored. For redundant FSS heaters, monitor the A2 and B2 current sensors.

THERMAL: The heaters on the FSS, MULE, and SAC are controlled from the standard switch panels. Power for the FSS and MULE circuits was discussed in the POWER section, no telemetry is available for the SAC heater circuits. Box temperatures are provided to verify each is within operating limits prior to its use.

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1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
1  XXXX / 2 1 2 / XXX      SSE MECHANISMS      XX X DDD / HH : MM : SS
2                                     DDD / HH : MM : SS
3          ON   OFF   DC AMPS   AC AMPS   TEMP
4  AMSB   7XS  8X      X.XXS     X.XXS     ±XXXXS
5
6
7  MECH X X SEL STAT TACH
8  DLOCK      9XS XXX
9  PIVOT HI 10XS XXX
10         LO 11XS XXX X.XXS DEG / MIN
1  ROTATOR 12XS XXX XX.XS DEG / MIN
2  XLATOR   13XS XXX
3  BLAT 1 14XS XXX
4         2 15XS XXX
5         3 16XS XXX
6  UMB MN 17XS XXX
7         B / U 18XS XXX
8  BSP     19XS XXX XXXS / XXXXS / XXXS
9
10 DESEL 20
1
2  O / R ENA 21XS
3         DIS 22XS
4
5
6                                     ( X X )

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PARAMETER CHARACTERISTICS: SM 212 SSE MECHANISMS

CRT NAME	MSID	UNITS	DISPLAY RANGE	STATUS INDICATORS				
				M	H	L	↑	↓
AMSB ON	P34X2076Y/ P34X2077Y	event	A, B, blank, or '*'	M				
OFF	P34X2076Y/ P34X2077Y	event	A, B, blank, or '*'					
DC AMPS	P34C2025V	amps	-1.0 to 5.0	M	H	L	↑	↓
AC AMPS	P34C2111V	amps	0.0 to 5.0	M	H	L	↑	
TEMP	P34T2003V	deg C	-30 to 60	M	H	L		
MECH (A)	V54X8111E/ V54X8113E/ V54S8400E/ V54S8402E	event	A, A flash, blank					
(B)	V54X8122E/ V54X8124E/ V54S8400E/ V54S8402E	event	B, B flash, blank					
DLOCK SEL	P34X2064Y	event	blank or '*'	M				↓
STAT	P34X2064Y/ P34X2087Y/ P34X2088Y/ P34X2089Y/ P34X2090Y	event	RDY, DIS, ENG, '*', blank					
PIVOT HI SEL	P34X2061Y	event	blank or '*'	M				↓
STAT	P34X2061Y/ P34X2087Y/ P34X2088Y/ P34X2089Y/ P34X2090Y	event	RDY, DN, UP, '*', blank					
PIVOT LO SEL	P34X2060Y	event	blank or '*'	M				↓
STAT	P34X2060Y/ P34X2087Y/ P34X2088Y/ P34X2089Y/ P34X2090Y	event	RDY, DN, UP, '*', blank					
TACH	P34R2108V	deg/min	0.0 to 5.3	M	H	L		↓

PARAMETER CHARACTERISTICS: SM 212 SSE MECHANISMS (Cont)

CRT NAME	MSID	UNITS	DISPLAY RANGE	STATUS INDICATORS				
				M	H	L	↑	↓
ROTATOR SEL STAT	P34X2062Y P34X2062Y/ P34X2087Y/ P34X2088Y/ P34X2089Y/ P34X2090Y	event event	blank or '*' RDY, CCW, CW, '*', blank	M				↓
TACH XLATOR SEL STAT	P34R2109V P34X2063Y P34X2063Y/ P34X2087Y/ P34X2088Y/ P34X2089Y/ P34X2090Y	deg/min event event	0.0 to 18.0 blank or '*' RDY, FWD, AFT, '*', blank	M M	H	L		↓ ↓
B LAT 1 SEL STAT	P34X2065Y P34X2065Y/ P34X2087Y/ P34X2088Y/ P34X2089Y/ P34X2090Y	event event	blank or '*' RDY, OP, CL, '*', blank	M				↓
2 SEL STAT	P34X2066Y P34X2066Y/ P34X2087Y/ P34X2088Y/ P34X2089Y/ P34X2090Y	event event	blank or '*' RDY, OP, CL, '*', blank	M				↓
3 SEL STAT	P34X2067Y P34X2067Y/ P34X2087Y/ P34X2088Y/ P34X2089Y/ P34X2090Y	event event	blank or '*' RDY, OP, CL, '*', blank	M				↓
UMB MN SEL STAT	P34X2068Y P34X2068Y/ P34X2087Y/ P34X2088Y/ P34X2089Y/ P34X2090Y	event event	blank or '*' RDY, REL, MAT, '*', blank	M				
B/U SEL STAT	P34X2069Y P34X2069Y/ P34X2087Y/ P34X2088Y/ P34X2089Y/ P34X2090Y	event event	blank or '*' RDY, REL, MAT, '*', blank	M				
BSP SEL STAT	P34X2070Y P34X2070Y/ P34X2087Y/ P34X2088Y/ P34X2089Y/ P34X2090Y	event event	blank or '*' RDY, REL SET, L/A, '*', blank	M				
(RET)	P34X2102Y/ P34X2105Y	event	RET A, RET B, RET *, blank	M				
(ENG)	P34X2103Y/ P34X2106Y	event	ENG A, ENG B, ENG *, blank	M				
(DIS)	P34X2104Y/ P34X2107Y	event	DIS A, DIS B, DIS *, blank	M				
O/R ENA DIS	P34X2072Y P34X2072Y	event event	'*' or blank blank or '*'	M M				

ITEM ENTRY CHARACTERISTICS AND SUMMARY: SM 212 SSE MECHANISMS

ITEM 7,8: Item numbers 7 and 8 provide power ON/OFF control over the flight support system (FSS) advanced mechanism selection box (AMSB). When both AMSBs are off, the item 7 ON status will be blank and the item 8 OFF status will show an “*”. When only AMSB A is on, the item 7 ON status will indicate “A” and the item 8 OFF status will indicate “B”. When only AMSB B is ON, the item 7 ON status will indicate “B” and the item 8 OFF status will indicate “A”. Under a contingency scenario where both sides of the FSS system are being used simultaneously with both AMSBs powered on, the item 7 ON status will show * and the item 8 OFF status will be blank. When commanded on, the DC current to the commanded AMSB will be displayed. When a mechanism is operated, the AC current being drawn by the motor will be displayed. The temperature of the AMSB is also displayed.

MECH: Two parameter fields adjacent to MECH text callout provide payload retention system feedback related to A6U circuits controlling FSS mechanism operations. The left-hand field will show a flashing ‘A’ whenever the A6U panel switch 1 is taken out of the OFF posn. A steady ‘A’ is driven whenever system 1 latch 1 LATCHED or RELEASED feedbacks indicate high. The right-hand field will show a flashing ‘B’ whenever A6U panel switch 2 is taken out of OFF posn. A steady ‘B’ is driven whenever system 2 latch 2 LATCHED or RELEASED feedbacks indicate high. During nominal A-side(B-side) operations, B(A) field should be blank. Under failure conditions, a steady B(A) can be displayed while controlling on the A-side(B-side) if B-side(A-side) AMSB mechanism select relay is failed closed and that mechanism is at its beginning or end of travel.

ITEM 9,10,11, 12,13,14,15,16, 17,18,19,20 Items 9 through 19 are used to select FSS mechanisms. When a mechanism is selected, an “*” is driven next to the corresponding item number and the mechanism status is displayed in an adjacent field under the STAT heading. Item 20 deselects all mechanisms selected.

NOTE: The previously selected mechanism is deselected when a new mechanism is selected. The STAT field for each mechanism will indicate as follows:

Mechanism	REL(BOT)	MID-TRAVEL	LAT(EOT)
Downlock (DLOCK)	DIS	RDY	ENG
PIVOT HI/LO	DN	RDY	UP
ROTATOR	CW	RDY	CCW
Translator (XLATOR)	FWD	RDY	AFT
Berthing latch (BLAT 1/2/3)	OP	RDY	CL
Main umbilical (UMB MN)	REL	RDY	MAT
Backup umbilical (UMB B/U)	REL	RDY	MAT
BAPS support post (BSP)	REL	*	SET

In the event of an error condition where both the beginning and end of travel microswitches of the selected mechanism indicate high, the STAT field will show “*”, except for the BSP which will display “L/A” if the BOT and EOT are indicated for the same microswitch, which is indicative of the Latch Assist mode.

The status of the BSP retracted A and B switches is provided. When only switch A is retracted, “RETA” is displayed. When only switch B is retracted, “RETB” is displayed. When both switches A and B are retracted, “RET*” is displayed. When neither switch A or B is retracted, a blank is displayed. The next two fields below indicate the status of the BSP engaged A and B switches and the BSP disengaged A and B switches. They are handled in the same manner as the above BSP retracted A and B switches, except their feedbacks are: “ENGA”, “ENGB”, “ENG*”, and “DISA”, “DISB”, “DIS*”, respectively.

ITEM ENTRY CHARACTERISTICS AND SUMMARY: SM 212 SSE MECHANISMS (Cont)

ITEM 21,22: Items 21 and 22 provide the ability to override (O/R) limit switch cutoff of the selected mechanism in the event of microswitch failures or if the need arises to drive the selected mechanism to the mechanical limit (stall). The O/R ENA/DIS status is a direct feedback from the AMSB override relay. An "*" is driven next to the appropriated item number to indicate enabled or disabled.

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FDA

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FDA

FDA CHARACTERISTICS: SM 210 HST SYS

Msg Text	Alarm Class	Noise Filter	Rate	SM Param ID	Sensed Parameter				Preconditions
					Nomenclature	SET	LO (STATE)	HI	
210 DCE +WING 1 1	3	3	1	6343035	DCE +WING MOTOR OPER	1 2	BYPASS 1	DCE +WING MOTOR OPER = NO-OP DCE MAIN FAIL FLAG = *NOFA or DCE RED FAIL FLAG = *NOFA	
210 DCE -WING 1 1	3	3	1	6343036	DCE -WING MOTOR OPER	1 2	BYPASS 1	DCE -WING MOTOR OPER = NO-OP DCE MAIN FAIL FLAG = *NOFA or DCE RED FAIL FLAG = *NOFA	
210 SADE WING	3	3	1	6343178	SADE-1 +WING MOTOR	1	1		
210 SADE WING	3	3	1	6343179	SADE-1 -WING MOTOR	1	1		
210 SADE WING	3	3	1	6343180	SADE-2 +WING MOTOR	1	1		
210 SADE WING	3	3	1	6343181	SADE-2 -WING MOTOR	1	1		

FDA CHARACTERISTICS: SM 211 SSE OVERVIEW

Msg Text	Alarm Class	Noise Filter	Rate	SM Param ID	Sensed Parameter				Preconditions
					Nomenclature	SET	LO (STATE)	HI	
211 DPC 1 AMPS	3	3	1	6342008	DPC 1 CURRENT	1		19	
211 DPC 2 AMPS	3	3	1	6342009	DPC 2 CURRENT	1		19	
211 DPC 3 AMPS	3	3	1	6342010	DPC 3 CURRENT	1		19	
211 DPC 4 AMPS	3	3	1	6342011	DPC 4 CURRENT	1		19	
211 DPC 5 AMPS	3	3	1	6342012	DPC 5 CURRENT	1		19	
211 DPC 6 AMPS	3	3	1	6342013	DPC 6 CURRENT	1		19	
211 DPC 7 AMPS	3	3	1	6342014	DPC 7 CURRENT	1		19	
211 DPC 8 AMPS	3	3	1	6342015	DPC 8 CURRENT	1		19	
211 DPC 9 AMPS	3	3	1	6342016	DPC 9 CURRENT	1		19	
211 DPC 10 AMPS	3	3	1	6342017	DPC 10 CURRENT	1		19	
211 DPC 11 AMPS	3	3	1	6342018	DPC 11 CURRENT	1		19	

FDA CHARACTERISTICS: SM 211 SSE OVERVIEW (Cont)

Msg Text	Alarm Class	Noise Filter	Rate	SM Param ID	Sensed Parameter				Preconditions
					Nomenclature	SET	LO (STATE)	HI	
211 DPC 12 AMPS	3	3	1	6342019	DPC 12 CURRENT	1		19	
	0	3	1	6342026	FSS HEATER-1A CURRENT	1		14	
	0	3	1	6342024	FSS HEATER-1B CURRENT	1		11*	
	0	3	1	6342027	FSS HEATER-2A CURRENT	1		11	
	0	3	1	6342114	FSS HEATER-2B CURRENT	1		14*	
	0	3	1	6345206	SAC EPDSU TOTAL CURRENT	1		42*	
	0	3	1	6348107	MULE SOPE ZONE 2 HTR (PRI) CURRENT	1		3.5	
	0	3	1	6348110	MULE ESM ZONES 1&2 HTR CURRENT	1		4	
	0	3	1	6348111	MULE ESM ZONE 3 HTR CURRENT	1		3.5	
	0	3	1	6348112	MULE SOPE ZONE 1 HTR (PRI) CURRENT	1		3.5	
	0	3	1	6348113	MULE SOPE ZONE 3 HTR (PRI) CURRENT	1		3.5	
	0	3	1	6348115	MULE SOPE ZONES 1&2 HTRS (RED) CUR	1		6	
	0	3	1	6348116	MULE SOPE ZONE 3 HTR (RED) CURRENT	1		3.5	
	0	3	1	6348117	MULE SURVIVAL HEATER CURRENT	1		12.5	

*FDA limit will be updated to listed value via TMBU during Post Insertion

FDA CHARACTERISTICS: SM 212 SSE OVERVIEW

Msg Text	Alarm Class	Noise Filter	Rate	SM Param ID	Sensed Parameter				Preconditions
					Nomenclature	SET	LO (STATE)	HI	
212 AMSB DC AMPS	3	2	1	6342025	AMSB DIRECT CURRENT	1	-1	.09*	
212 MECH SEL	3	2	1	6342060	PIVOTER LOW TORQUE SEL STATUS	1	BYPASS		PIV LOW TOR SEL STATUS = DSBL
						2	1		PIVOT HI = ENBL or ROTATOR = ENBL or XLATOR = ENBL or DLOCK = ENBL
						3	1		B LAT 1 = ENBL or B LAT 2 = ENBL or B LAT 3 = ENBL or UMB MN = ENBL
212 MECH SEL	3	2	1	6342061	PIVOTER SEL STATUS	1	BYPASS		PIVOTER SEL STATUS = DSBL
						2	1		ROTATOR = ENBL or XLATOR = ENBL or DLOCK = ENBL
						3	1		B LAT 1 = ENBL or B LAT 2 = ENBL or B LAT 3 = ENBL or UMB MN = ENBL
212 MECH SEL	3	2	1	6342062	ROTATER SEL STATUS	1	BYPASS		ROTATOR SEL STATUS = DSBL
						2	1		XLATOR = ENBL or DLOCK = ENBL
						3	1		B LAT 1 = ENBL or B LAT 2 = ENBL or B LAT 3 = ENBL or UMB MN = ENBL
212 MECH SEL	3	2	1	6342063	TRANSLATOR SEL STATUS	1	BYPASS		TRANSLATOR SEL STATUS = DSBL
						2	1		DLOCK = ENBL
						3	1		B LAT 1 = ENBL or B LAT 2 = ENBL or B LAT 3 = ENBL or UMB MN = ENBL
212 MECH SEL	3	2	1	6342064	DOWNLOCK SEL STATUS	1	BYPASS		DOWNLOCK SEL STATUS = DSBL
						2	1		B LAT 1 = ENBL or B LAT 2 = ENBL or B LAT 3 = ENBL or UMB MN = ENBL
212 MECH SEL	3	2	1	6342065	BERTH LATCH 1 SEL STATUS	1	BYPASS		BERTH LAT 1 SEL STATUS = DSBL
						2	1		B LAT 2 = ENBL or B LAT 3 = ENBL or UMB MN = ENBL

*FDA limit will be updated to listed value via TMBU during Post Insertion

FDA CHARACTERISTICS: SM 212 SSE OVERVIEW (Cont)

Msg Text	Alarm Class	Noise Filter	Rate	SM Param ID	Sensed Parameter				Preconditions
					Nomenclature	SET	LO (STATE)	HI	
212 MECH SEL	3	2	1	6342066	BERTH LATCH 2 SEL STATUS	1	BYPASS		BERTH LAT 2 SEL STATUS = DSBL B LAT 3 = ENBL or UMB MN = ENBL
						2	1		
212 MECH SEL	3	2	1	6342067	BERTH LATCH 3 SEL STATUS	1	BYPASS		BERTH LAT 3 SEL STATUS = DSBL UMB MN = ENBL
						2	1		
212 PVT STALL	3	15*	1	6342108	PIVOTER TACHOMETER	1	-1		PIVOT LO SEL STATUS = DSBL PIVOT LO SEL STATUS = ENBL and AMSB AC CURRENT = OL
						2	0.2**		
212 ROT STALL	3	15*	1	6342109	ROTATER TACHOMETER	1	-1		ROTATOR SEL STATUS = DSBL ROTATOR SEL STATUS = ENBL and AMSB AC CURRENT = OL
						2	0.4**		
	0	3	1	6342111	AMSB TOTAL ALTERNATING CURRENT	1		0.30	

*FDA limit will be updated to listed value via TMBU during Post Insertion

**PVT STALL and ROT STALL FDA's have a time delay of 28 cycles after preconditioning is met

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REF DATA

SA-II JETTISION MANAGEMENT

	-V2 SA2 wing state	+V2 SA2 wing action	HST State (FD03)	FD4 action	HST State (FD04)	FD5 action
1a	Rolled up	Roll up OK	Safe for deploy	Stow & Replace -V2 wing	Safe for deploy	Stow & Replace +V2 wing
1b	Rolled up	Roll up fails: Stuck, useable	Safe for deploy	Stow & Replace -V2 wing	Safe for deploy	Jettison & Replace +V2 wing
1c	Rolled up	Roll up fails: Stuck, unusable	HST nondeployable FD3	Jettison & Replace +V2 wing	Safe for deploy	Stow & Replace -V2 wing
2a	Stuck, useable	Roll up OK	Safe for deploy	Jettison & Replace -V2 wing	Safe for deploy	Stow & Replace +V2 wing
2b	Stuck, useable	Roll up fails: Stuck, useable	Safe for deploy	Jettison & Replace -V2 wing	Safe for deploy	Jettison & Replace +V2 wing
2c	Stuck, useable	Roll up fails: Stuck, unusable	HST nondeployable FD3	Jettison & Replace +V2 wing	Safe for deploy	Jettison & Replace -V2 wing
3a	Stuck, unusable	Roll up OK	HST nondeployable FD3	Jettison & Replace -V2 wing	Safe for deploy	Stow & Replace +V2 wing
3b	Stuck, unusable	Roll up fails: Stuck, useable	HST nondeployable FD3	Jettison & Replace -V2 wing	Safe for deploy	Jettison & Replace +V2 wing
3c	Stuck, unusable	Roll up fails: Stuck, unusable	HST nondeployable FD3	Jettison & Replace -V2 wing	HST nondeployable FD4	Jettison & Replace +V2 wing

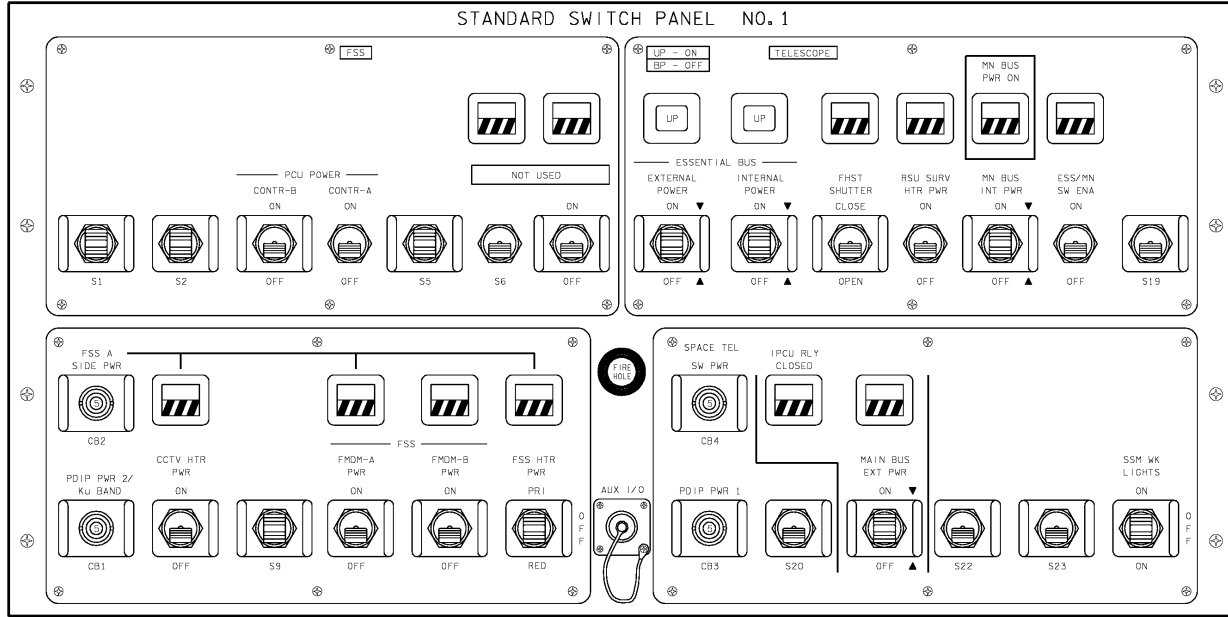
HST MECHANISM MOVEMENT TIMES

MECHANISM	NOMINAL TIME
SDM (deploy/retract)	5 min
SSM LATCHES (latch/unlatch)	136 sec
AD (open/close)	140 sec
HGA (deploy/retract)	461 sec
SA LATCH SLEW	> 11 min

FSS MECHANISM DRIVE TIMES

MECHANISM	NOMINAL TIME (single)
PIVOTER	1428 sec \pm 90 sec/90° (3.78°/min)
ROTATOR	731 sec \pm 19 sec/180° (14.77°/min)
TRANSLATOR	170 sec \pm 5 sec/1.75 in
DOWNLOCK	24 sec \pm 2 sec
BERTH LATCH	18 sec \pm 2 sec
MAIN UMB	8 sec \pm 1 sec/4.5 in stroke (mate/demate)
B/U UMB	4 sec \pm 1 sec (demate only)
BSP	~1 sec

SSP 1



1940910902_109_PNL 3

SSP 1 SWITCH PANEL FUNCTIONS (L12U)

ITEM	TYPE DEVICE	FUNCTION	USAGE
PCU POWER CONTR-B Switch (S3 – SSP 1)	Toggle switch, 2-position DPST	ON (UP) – Enables the B hardline control signal to EPDSU-1 and EPDSU-2, providing power to the PCUs OFF (DOWN) – Disables the B control signal to EPDSU-1 and EPDSU-2, removing power to the PCUs	Not normally used. PCUs will normally be controlled via FMDM NOTE: The power on/off indication is observed on telemetry
PCU POWER CONTR-A Switch (S4 – SSP 1)	Toggle switch, 2-position DPST	ON (UP) – Enables the A hardline control signal to EPDSU-1 and EPDSU-2, providing power to the PCUs OFF (DOWN) – Disables the A control signal to EPDSU-1 and EPDSU-2, removing power to the PCUs	Not normally used. PCUs will normally be controlled via FMDM NOTE: The power on/off indication is observed on telemetry
FSS A SIDE PWR Circuit breaker (CB2 – SSP 1)	Circuit breaker	OUT – Open IN – Closed NOTE: FSS B side power is hardwired	Closed during SSE activation 5-amp circuit breaker which routes orbiter power to S4, S6, S8, S10, and S12 (UP)

SSP 1 SWITCH PANEL FUNCTIONS (L12U) (Cont)

ITEM	TYPE DEVICE	FUNCTION	USAGE
CCTV HTR PWR Switch (S8 – SSP 1)	Toggle switch, 2-position DPST	ON (UP) – Enables EPDSU-1 power to the CCTV heater circuits. This allows thermostatic control of the CCTV heaters OFF (DOWN) – Disables EPDSU-1 power to CCTV heater circuits	Turned on during SSE activation (no later than 8 hr after PLBD opening) Turned off during SSE deactivation (no earlier than 1 hr prior to reentry)
CCTV HTR PWR Status Indicator (DS8 – SSP 1)	Display indicator, 2-position	ON – gray OFF – bp	Status indicator
FSS FMDM-A PWR Switch (S10 – SSP 1)	Toggle switch, 2-position DPST	ON (UP) – Enables EPDSU-1 power to FMDM-A OFF (DOWN) – Disables EPDSU-1 power to FMDM-A	Turned on during SSE check-out for continuous control and monitoring of FSS Turned off during SSE deactivation
FSS FMDM-A PWR Status Indicator (DS10 – SSP 1)	Display indicator, 2-position	ON – gray OFF – bp	Status indicator
FSS FMDM-B PWR Switch (S11 – SSP 1)	Toggle switch, 2-position DPST	ON (UP) – Enables EPDSU-2 power to FMDM-B OFF (DOWN) – Disables EPDSU-2 power to FMDM-B	Turned on during SSE activation for initial control and monitoring of FSS. FMDM-B is a redundant unit and will only be used during initial FSS activation and check-out and in the event of a failure on the A-side avionics or used in contingencies in conjunction with the A-side for dual mechanism operations Turned off during completion of SSE checkout
FSS FMDM-B PWR Status Indicator (DS11 – SSP 1)	Display indicator, 2-position	ON – gray OFF – bp	Status indicator

SSP 1 SWITCH PANEL FUNCTIONS (L12U) (Cont)

ITEM	TYPE DEVICE	FUNCTION	USAGE
FSS HTR PWR Switch (S12 – SSP 1)	Toggle switch, 3–position DPDT	<p>PRI (UP) – Enables EPDSU–1 and EPDSU–2 power to primary FSS heater circuits. This allows thermostatic control of primary FSS heaters</p> <p>OFF (CENTER) – Disables EPDSU–1 and EPDSU–2 power from FSS primary heater and redundant heater circuits</p> <p>RED (DOWN) – Enables EPDSU–1 and EPDSU–2 power to redundant FSS heater circuits. This allows thermostatic control of redundant FSS heaters</p>	<p>Turned on during SSE activation (no later than 8 hr after PLBD opening). Monitor current sensors A1 and B1 for primary heaters</p> <p>Turned off during SSE deactivation (no earlier than 1 hr prior to reentry)</p> <p>Redundant FSS heaters may be activated in the event of a failure in the primary FSS heaters. Monitors current sensors A2 and B2 for redundant heaters</p>
FSS HTR PWR Status Indicator (DS12 – SSP 1)	Display indicator, 2–position	<p>ON (PRI or RED)– gray</p> <p>OFF – bp</p>	Status indicator
ESSENTIAL BUS EXTERNAL POWER Switch (S13 – SSP 1)	Toggle switch, 3–position DPDT momentary (should be held for approximately 2 sec)	<p>ON (momentary UP) – Enables IPCU power latching relays K6 and K7 that provide FSS PCU power to HST external essential bus feeds A and B. Relay K6 powers HST external essential bus A and relay K7 powers bus B</p> <p>Center Position – Normal</p> <p>OFF (momentary DOWN) – Disables IPCU power latching relays K6 and K7. This action disconnects FSS PCU power from HST external essential bus A and B feeds and connects HST battery power (internal) to HST essential buses A,B, and C</p>	<p>Used to provide FSS PCU power to HST external essential buses thru FSS umbilicals. Essential buses power the HST DMU CDIs and MA receivers. S13 is powered from S18</p> <p>Normal switch position when not in use</p> <p>Used to remove FSS PCU power from HST essential buses. Removal of FSS PCU power from HST essential buses, whether intentional or inadvertent, will automatically activate a fail–over circuit in the HST PCU which will connect HST battery power (internal) to HST essential buses</p>
ESSENTIAL BUS EXTERNAL POWER Status (DS13 – SSP 1)	Display indicator, 3–position	<p>ON – UP</p> <p>OFF – bp</p> <p>DOWN indication not used for HST</p>	<p>UP indicates that at least one external essential bus power service is activated inside the HST PCU. Indicates continuity thru HST umbilicals</p>

SSP 1 SWITCH PANEL FUNCTIONS (L12U) (Cont)

ITEM	TYPE DEVICE	FUNCTION	USAGE
ESSENTIAL BUS INTERNAL POWER Switch (S14 – SSP 1)	Toggle switch, 3–position DPDT momentary (should be held for approximately 1 sec)	<p>ON (momentary UP) – Enables IPCU relay K12 to latch HST PCU power relays K7,K8,K9 closed, and turns on HST CDI A and B. This action connects battery power from HST diode buses A,B,C to HST essential buses A,B,C and ensures that both CDIs are on</p> <p>Center Position – Normal</p> <p>OFF (momentary DOWN) – Enables IPCU relay K13 to unlatch HST PCU power relays K7,K8,K9. This action disconnects battery power from the HST essential buses A,B,C</p>	<p>Used to configure HST essential bus to internal battery power following PCU changeout</p> <p>Normal switch position when not in use</p> <p>Used to remove internal essential power when external (FSS PCU) power is provided. S14 is powered from S18 NOTE: For powerdown in preparation of PCU changeout, S14 will be held off while External Essential is powered off, to override the fail–over function and prevent unnecessary cycling of K7,K8,K9 relays</p>
ESSENTIAL BUS INTERNAL POWER Status (DS14 – SSP 1)	Display indicator, 3–position	<p>ON – UP</p> <p>OFF – bp</p> <p>DOWN indicator not used for HST</p>	<p>UP indicates that at least one internal essential bus power is activated inside the HST PCU. Indicates continuity thru HST umbilicals</p>
FHST SHUTTER Switch (S15 – SSP 1)	Toggle switch, 2–position DPST	<p>CLOSE (UP) – Provides SSP power (PL CAB3 thru CB4) to the HST FHST shutters 1,2,3. Also enables nonlatching relay K5 in the IPCU, which provides power from the FSS PCUs to the FHST shutters status indicator (DS15)</p> <p>NOTE: The IPCU is externally jumpered to provide this capability</p> <p>OPEN (DOWN) – Removes SSP power from the FHST shutters and disables relay K5 in the IPCU, removing FSS PCU power from the HST FHST shutter status indicator</p>	<p>Used to keep FHST shutter closed during SM to avoid FHST exposure directly to a bright object. Switch must be used to keep shutter closed whenever HST is on the FSS and the HST main bus is powered off unless the FHST cover has been installed</p> <p>Used following reapplication of main bus power to allow STOCC commanding of FHST shutters. Also used to deadface power to PCU, PDUs 1,2,3, and FHSTs for changeout of these units</p>

SSP 1 SWITCH PANEL FUNCTIONS (L12U) (Cont)

ITEM	TYPE DEVICE	FUNCTION	USAGE
FHST SHUTTER Status (DS15 – SSP 1)	Display indicator, 2–position	CLOSE – gray OPEN – bp	Gray indicates that external FHST shutter power is turned on at the IPCU. FHST shutter close is powered directly from SSP CAB PL3, bypassing IPCU and the SSP talkback is driven by IPCU relay. Does not indicate continuity thru HST umbilicals
RSU SURV HTR PWR Switch (S16 – SSP 1)	Toggle switch, 2–position DPST	ON (UP) – Enables IPCU nonlatching relays K16 and K17. This action provides FSS PCU power to RSU heaters 1,2,3 OFF (DOWN) – Disables IPCU relays K16 and K17, removing power from the RSU survival heaters	Used to maintain RSU survival thermal conditioning. (Not normally used for SM3B) Used to allow STOCC commanding of RSU survival heaters. Also used to deadface power to PCU, PDUs 1,2,3,4, ECUs, and RSUs for changeout of these units
RSU SURV HTR PWR Status (DS16 – SSP 1)	Display indicator, 2–position	CLOSE – gray OPEN – bp	Gray indicates that external RSU survival heater power service is turned on at the IPCU. Does not indicate continuity thru HST umbilicals. Monitor is powered from the FSS DPCs
MN BUS INT PWR Switch (S17 – SSP 1)	Toggle switch, 3–position DPDT momentary (should be held for approximately 2 sec). (Switch cover installed to prevent inadvertent actuation of the OFF command)	ON (momentary UP) – Enables IPCU relay K10 which supplies power from the FSS PCUs to close motorized main buses A and B transfer switches S1 and S2, open main bus C transfer switches S3 and S4, and to close the diode bus interconnect switches S7 thru S10. This action connects battery power from diode buses A, B, and C to main buses A and B, and disconnects bus C Center Position – None	The ON command is used to connect HST main bus to HST batteries if the batteries have been switched off–line. During PCU changeout, reqd switch operations are performed by STOCC via ground command. S17 is powered from S18 Normal switch position when not in use

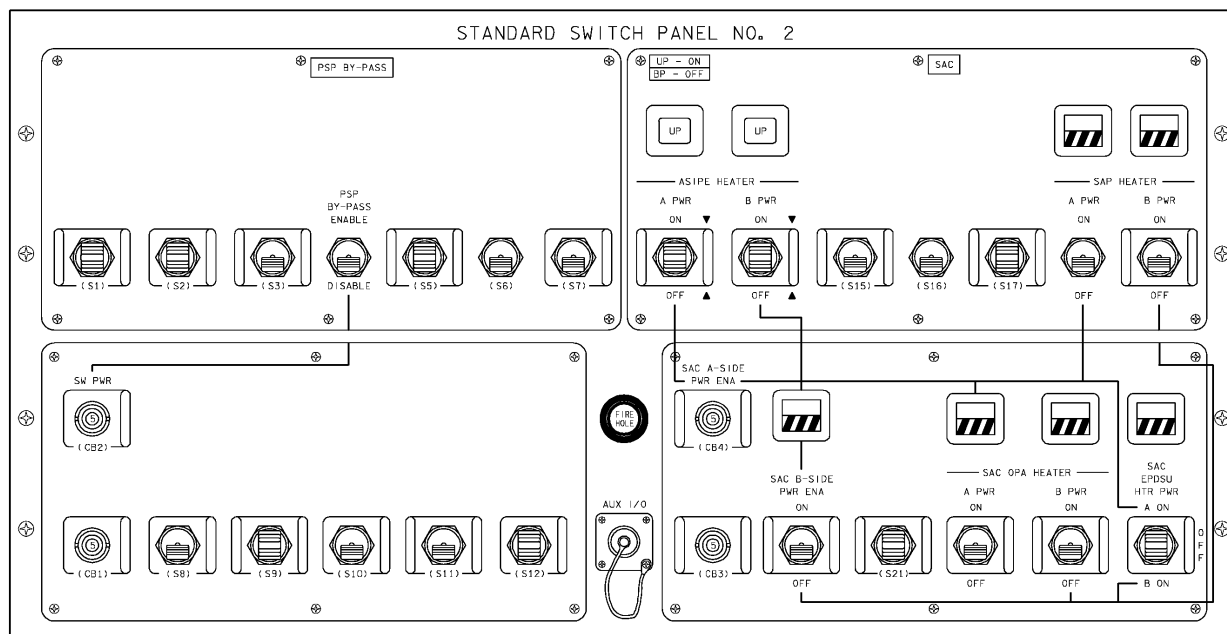
SSP 1 SWITCH PANEL FUNCTIONS (L12U) (Cont)

ITEM	TYPE DEVICE	FUNCTION	USAGE
		OFF (momentary DOWN) – Enables IPCU relay K11 which supplies power from the FSS PCUs to open motorized transfer switches S1 thru S4. This action disconnects battery power from main buses A,B,C	The OFF command is used to disconnect the HST main bus from HST batteries. This action removes one of two inhibits that could cause a catastrophic HST failure under certain conditions when an SA SPA is connected directly to its respective diode bus
MN BUS PWR ON Status (DS17 – SSP 1)	Display indicator, 2–position	ON – gray OFF – bp	Gray indicates that at least one main bus is powered. Talkback does not indicate whether power is from internal or external source. Indicates continuity thru HST umbilicals bp indicates main buses are not powered from either internal or external source
ESS/MN SW ENA Switch (S18 – SSP 1)	Toggle switch, 2–position DPST	ON (UP) – Provides orbiter power thru CB4 (from PL CAB3 bus) to SSP switches S13,S14,S17,S21 OFF (DOWN) – Removes orbiter power from SSP switches S13,S14,S17,S21	Enables use of SSP control of HST main and essential buses via S13,S14,S17,S21 Disables use of SSP control of HST main and essential buses
ESS/MN SW ENA Status (DS18 – SSP 1)	Display indicator, 2–position	ON – gray OFF – bp	Monitor power is provided from PL CAB3 bus thru CB4
SPACE TEL SW PWR Circuit Breaker (CB4 – SSP 1)	Circuit breaker	OUT – Open IN – Closed 5–amp circuit breaker which routes PL CAB3 power to S13,S14,S15,S16,S17,S18 (UP) concurrent with SSE activation	Opened following powerdown for PCU changeout and during umbilical deadfacing at HST redeployment Closed during SSE checkout and prior to PCUR powerup
IPCU RELAYS CLOSED Status (DS20 – SSP 1)	Display indicator, 2–position	ON – gray OFF – bp	Display status of IPCU relays. Indicates that IPCU main power switches (S1 and S2) or (S3 and S4) are closed. Monitor is powered from the FSS DPCs

SSP 1 SWITCH PANEL FUNCTIONS (L12U) (Cont)

ITEM	TYPE DEVICE	FUNCTION	USAGE
MAIN BUS EXT PWR Switch (S21 – SSP 1)	Toggle switch, 3–position DPDT, momentary	<p>ON (UP) – Closes motorized transfer switches S1 thru S4 in IPCU that provides orbiter power to HST main buses A and B</p> <p>Center Position – None</p> <p>OFF (DOWN) – Opens motorized transfer switches S1 thru S4 in IPCU that provide orbiter power to the HST main buses A and B</p>	<p>Used to provide FSS PCU power to the HST main buses for initial external power activation after berthing and for PCUR powerup. S21 is enabled by S18</p> <p>Normal switch position when not in use</p> <p>Used to remove orbiter power from HST prior to PCU changeout and redeployment</p>
MAIN BUS EXT PWR Status (DS21 – SSP 1)	Display indicator, 2–position	<p>ON – gray</p> <p>OFF – bp</p>	Status indicator. Gray indicates that at least one external main bus is powered inside the HST PCU. Indicates continuity thru HST umbilicals
SSM WK LIGHTS Switch (S24 – SSP 1)	Toggle switch, 3–position DPDT	<p>ON (UP) – Enables IPCU relay K18 to provide FSS PCU power to all HST site receptacles, plus all SI latch indicator lights</p> <p>OFF (CENTER) – Disables IPCU relays K18 and K19, removing power from all internal/external worklight receptacles and latch indicator lights</p> <p>ON (DOWN) – Enables IPCU relay K19 to provide HST worklight receptacles, plus all SI latch indicator lights</p>	<p>Used to provide power to aft shroud (AS) internal/external worklight receptacles and latch indicator lights. For EVA use only</p> <p>Used to disable power to AS internal/external worklight receptacles and latch indicator lights</p> <p>Used to provide power to AS internal/external worklight receptacles and latch indicator lights. For EVA use only</p>

SSP 2



1940910908_109, PNL 1

SSP 2 SWITCH PANEL FUNCTIONS (L12L)

ITEM	TYPE DEVICE	FUNCTION	USAGE
PSP BY-PASS SW PWR Circuit Breaker (CB2 – SSP 2)	Circuit breaker (5 Amps)	OUT – Open IN – Closed, provides power to PSP BY-PASS selector switch	On orbit, as reqd
PSP BY-PASS Switch (S4 – SSP 2)	Toggle switch, 2–position DPST	ENABLE (UP) – Allows PDI data flow (DOD mode). Provides unique orbiter PI/PSP/PDI command/data configuration for HST only DISABLE (DOWN) – Inhibits PDI data flow (PSP Mode)	On orbit, as reqd
ASPIPE HTR–A PWR Switch (S13 – SSP 2)	Toggle switch, 3–position DPDT momentary	ON (momentary UP) – Provides a latching signal to the SAC EPDSU. This applies power for the thermostatic control of ASPIPE A heaters Center Position – Normal OFF (momentary DOWN) – Disables the EPDSU power from the thermostatically controlled ASPIPE A heaters	Turned on during SSE activation Normal switch position when not in use Turned off during SSE deactivation
ASPIPE HTR–A PWR Status Indicator (DS13 – SSP 2)	Display indicator, 3–position	ON – UP OFF – bp DN indicator not used for HST	Status Indicator

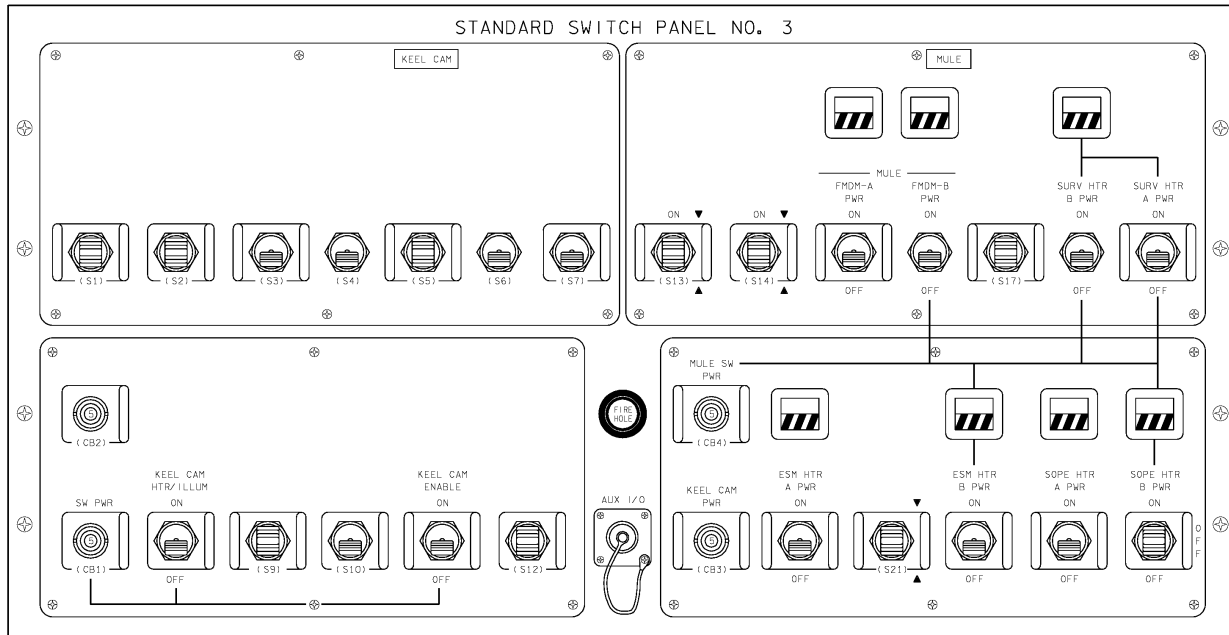
SSP 2 SWITCH PANEL FUNCTIONS (L12L) (Cont)

ITEM	TYPE DEVICE	FUNCTION	USAGE
ASIPE HTR-B PWR Switch (S14 – SSP 2)	Toggle switch, 3-position DPDT momentary	ON (momentary UP) – Provides a latching signal to the SAC EPDSU. This applies power for the thermostatic control of ASIPE B heaters Center Position – Normal OFF (momentary DOWN) – Disables the EPDSU power from the thermostatically controlled ASIPE B heaters	Redundant ASIPE heaters may be activated in the event of a failure in the A side heaters Normal switch position when not in use
ASIPE HTR-B PWR Status Indicator (DS14 – SSP 2)	Display indicator, 3-position	ON – UP OFF – bp DN indicator not used for HST	Status Indicator
SAP HTR-A PWR Switch (S18 – SSP 2)	Toggle switch, 2-position DPDT	ON (UP) – Enables the SAC EPDSU. This applies power for the thermostatic control of the SAP A heaters OFF (DOWN) – Disables the EPDSU power from the thermostatically controlled SAP A heaters	Redundant SAP heaters may be activated in the event of a failure in the B side heaters
SAP HTR-A PWR Status Indicator (DS18 – SSP 2)	Display indicator, 2-position	ON – gray OFF – bp	Status Indicator
SAP HTR-B PWR Switch (S19 – SSP 2)	Toggle switch, 2-position DPDT	ON (UP) – Enables the SAC EPDSU. This applies power for the thermostatic control of the SAP B heaters OFF (DOWN) – Disables the EPDSU power from the thermostatically controlled SAP B heaters	Turned on during SSE activation Turned off after NCC installation
SAP HTR-B PWR Status Indicator (DS19 – SSP 2)	Display indicator, 2-position	ON – gray OFF – bp	Status Indicator
SAC A-SIDE PWR ENA Circuit Breaker (CB4 – SSP 2)	Circuit breaker (5 Amps)	OUT – Open IN – Closed	Closed during SSE activation. 5-amp circuit breaker that routes orbiter power to S13,S18,S22,S24 (UP)

SSP 2 SWITCH PANEL FUNCTIONS (L12L) (Cont)

ITEM	TYPE DEVICE	FUNCTION	USAGE
SAC B–SIDE PWR ENA Switch (S20 – SSP 2)	Toggle switch, 2–position DPDT	ON (UP) – Provides fused orbiter power from the EPDSU to SSP switches S14,S19,S23,S24 (DN) for control of SAC B side circuits OFF (DOWN) – Removes orbiter power from B side circuits	Turned on during SSE activation Turned off during SSE deactivation
OPA HTR–A PWR Switch (S22 – SSP 2)	Toggle switch, 2–position DPDT	ON (UP) – Enables the SAC EPDSU. This applies power for the thermostatic control of the OPA A heaters OFF (DOWN) – Disables the EPDSU power from the thermostatically controlled OPA A heaters	Turned on during SSE activation Turned off after PCU–R successful Functional Test (FT)
OPA HTR–A PWR Status Indicator (DS22 – SSP 2)	Display indicator, 2–position	ON – gray OFF – bp	Status Indicator
OPA HTR–B PWR Switch (S23 – SSP 2)	Toggle switch, 2–position DPDT	ON (UP) – Enables the SAC EPDSU. This applies power for the thermostatic control of the OPA B heaters OFF (DOWN) – Disables the EPDSU power from the thermostatically controlled OPA B heaters	Redundant OPA heaters may be activated in the event of a failure in the A side heaters
OPA HTR–B PWR Status Indicator (DS23 – SSP 2)	Display indicator, 2–position	ON – gray OFF – bp	Status Indicator
SAC EPDSU HTR PWR Switch (S24 – SSP 2)	Toggle switch, 3–position DPDT center off	A–ON (UP) – Enables the SAC EPDSU. This applies power for the thermostatic control of the EPDSU A side heaters OFF (CENTER) – Removes power from the thermostatically controlled SAC EPDSU A and B side heaters B–ON (DOWN) – Enables the SAC EPDSU. This applies power for the thermostatic control of the EPDSU B side heaters	Turned on during SSE activation Turned off during SSE deactivation Redundant SAC EPDSU heaters may be activated in the event of a failure in the A side heaters
SAC EPDSU HTR Status Indicator (DS24 – SSP 2)	Display indicator, 2–position	ON A or B side – gray OFF – bp	Status Indicator

SSP 3



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SSP 3 SWITCH PANEL FUNCTIONS (L11U)

ITEM	TYPE DEVICE	FUNCTION	USAGE
SW PWR Circuit Breaker (CB1 – SSP 3)	Circuit breaker	OUT – Open IN – Closed	5–amp circuit breaker which routes orbiter power to S8 and S11
KEEL CAMR HTR/ILLUM Switch (S8 – SSP 3)	Toggle switch, 2–position DPST	ON (UP) – Enables power to Keel camera heaters and illuminator OFF (DN) – Disables power to Keel camera heaters and illuminator	
KEEL CAM ENABLE Switch (S11 – SSP 3)	Toggle switch, 2–position DPST	ON (UP) – Enables Keel camera controller OFF (DN) – Disables Keel camera controller	
MULE FMDM–A PWR Switch (S15 – SSP 3)	Toggle switch, 2–position DPDT	ON (UP) – Enables the PDSU power to FMDM–A, A–side thermistor biases, and PDSU current sensors OFF (DOWN) – Disables the PDSU power from FMDM–A, A–side thermistor biases, and PDSU current sensors	Turned on during SSE checkout for monitoring of the MULE Turned off during SSE deactivation
MULE FMDM–A PWR Status Indicator (DS15 – SSP 3)	Display indicator, 2–position	ON – gray OFF – bp	Status Indicator

SSP 3 SWITCH PANEL FUNCTIONS (L11U) (Cont)

ITEM	TYPE DEVICE	FUNCTION	USAGE
MULE FMDM-B PWR Switch (S16 – SSP 3)	Toggle switch, 2-position DPDT	ON (UP) – Enables the PDSU power to FMDM-B, B-side thermistor biases, and PDSU current sensors OFF (DOWN) – Disables the PDSU power from FMDM-B, B-side thermistor biases, and PDSU current sensors	Turned on during SSE activation for initial monitoring of MULE. FMDM-B is a redundant unit and will only be used during initial MULE activation and checkout, and in the event of a failure on the A-side avionics Turned off during completion of SSE checkout
MULE FMDM-B PWR Status Indicator (DS16 – SSP 3)	Display indicator, 2-position	ON – gray OFF – bp	Status Indicator
SURV HTR B PWR Switch (S18 – SSP 3)	Toggle switch, 2-position DPDT	ON (UP) – Enables the PDSU power to the B-side heaters: PDSU, LOPE, and avionics radiator plate OFF (DOWN) – Disables the PDSU power to the B-side heaters: PDSU, LOPE, and avionics radiator plate	Turned on during SSE activation Turned off during SSE checkout
SURV HTR PWR Status Indicator (DS18 – SSP 3)	Display indicator, 2-position	ON A or B side – gray OFF – bp	Status Indicator
SURV HTR A PWR Switch (S19 – SSP 3)	Toggle switch, 2-position DPDT	ON (UP) – Enables the PDSU power to the A-side heaters: PDSU, LOPE, and avionics radiator plate OFF (DOWN) – Disables the PDSU power to the A-side heaters: PDSU, LOPE, and avionics radiator plate	Turned on during SSE checkout Turned off during SSE deactivation
MULE SW PWR Circuit Breaker (CB4 – SSP 3)	Circuit breaker	OUT – Open IN – Closed	Closed during SSE activation. 5-amp circuit breaker that routes orbiter power to S16,S18,S22,S24 (UP)
KEEL CAMR PWR Circuit Breaker (CB3 – SSP 3)	Circuit breaker	OUT – Open IN – Closed	5-amp circuit breaker which routes orbiter power to Keel camera
ESM HTR A PWR Switch (S20 – SSP 3)	Toggle switch, 2-position DPDT	ON (UP) – Enables the PDSU power to ESM A-side heaters OFF (DOWN) – Disables the PDSU power from ESM A-side heaters	Turned on during SSE checkout Turned off after ESM installation on HST

SSP 3 SWITCH PANEL FUNCTIONS (L11U) (Cont)

ITEM	TYPE DEVICE	FUNCTION	USAGE
ESM HTR A PWR Status Indicator (DS20 – SSP 3)	Display indicator, 2–position	ON – gray OFF – bp	Status Indicator
ESM HTR B PWR Switch (S22 – SSP 3)	Toggle switch, 2–position DPDT	ON (UP) – Enables the PDSU power to ESM B–side heaters OFF (DOWN) – Disables the PDSU power from ESM B–side heaters	Turned on during SSE activation Turned off during SSE checkout
ESM HTR B PWR Status Indicator (DS22 – SSP 3)	Display indicator, 2–position	ON – gray OFF – bp	Status Indicator
SOPE HTR A PWR Switch (S23 – SSP 3)	Toggle switch, 2–position DPDT	ON (UP) – Enables the PDSU power to SOPE A–side heaters OFF (DOWN) – Disables the PDSU power from SOPE A–side heaters	Turned on during SSE checkout Turned off during SSE deactivation
SOPE HTR A PWR Status Indicator (DS23 – SSP 3)	Display indicator, 2–position	ON – gray OFF – bp	Status Indicator
SOPE HTR B PWR Switch (S24 – SSP 3)	Toggle switch, 3–position DPDT center off	ON (UP) – Enables the PDSU power to SOPE B–side heaters OFF (CENTER) – Disables the PDSU power from SOPE B–side heaters (DOWN) – not wired	Turned on during SSE activation Turned off during SSE checkout
SOPE HTR B PWR Status Indicator (DS24 – SSP 3)	Display indicator, 2–position	ON – gray OFF – bp	Status Indicator



PAYLOAD SYS MALFUNCTIONS

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