Payload Systems Data and Malfunction Procedures

STS–109

Mission Operations Directorate
Operations Division

Final, Rev A
November 28, 2001

Verify this is the correct version for the pending operation (training, simulation or flight). Electronic copies of FDF books are available. URL: http://fltproc.jsc.nasa.gov/fdf
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
4. Replace 4–3 & 4–4
5. Replace 8–5 & 8–6
6. Replace 9–3 thru 9–6

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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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PL SYS/109/FIN A
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* – Omit from flight book
## SSE

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

1.1b **POWER MULE HTR NOT * (S211)**

### SSE EPS

1.2a **POWER FSS HTR AMPS ↑ (S211)**

1.2b **‘S212 AMSB DC AMPS’**

1.2c **‘S212 MECH SEL’**

1.2d **‘S211 DPC 1(2,3,4,...12) AMPS’**

1.2e **RESERVED**

1.2f **POWER SAC EPDSU AMPS ↑ (S211)**

1.2g **POWER MULE HTR AMPS ↑ (S211)**

1.2h **POWER MULE ESM AMPS ↑ (S211)**

1.2i **POWER MULE SOPE AMPS ↑ (S211)**

### SSE MECH

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1.3a **PRIMARY MOTOR FAILS TO DRIVE MECHANISM**

1.3b **BSP FAILS TO DISENDAGE**

1.3c **BSP FAILS TO SET**

1.3d **BSP FAILS TO ENGAGE**

1.3e **‘S212 PVT(ROT) STALL’**

### SSE DPS

1.4a **‘I/O ERROR FLEX’**

1.4b **‘BCE BYP FLEX’**

### SSE SSR–1 FMDM SWAP A→B(B→A)

### HST

2.1 **HST**

2.1a **ESS BUS INT PWR tb – bp WHEN SHOULD BE tb – UP**

2.1b **ESS BUS INT PWR tb – UP WHEN SHOULD BE tb – bp**

### HST SSR–1 PWR LOSS RECOVERY

### PL COMM

3.1a **‘S62 PDI DECOM FAIL’**

3.1b **NO RESPONSE TO RF COMMAND**

### COMM SSR–1 PI RF REACQ

### COMM SSR–2 SWAP S–BD PL COMM STRINGS

### COMM SSR–3 HPGSCA PDIP PORT SWAP

### PL/DPS RECONFIG

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

1. Determine status:
   - SM 211 SSE OVERVIEW
     - FSS HTR 1/2
     - FSS HTR 1/\_\_\_
     - FSS HTR \_/2
     - FSS HTR \_/\_/\_ (L12U)
   - FSS HTR PWR \_ gray?
     - YES
     - NO

2. TRANSIENT FAILURE
   - Switch to alt htrs
   - (L12U)
     - FSS HTR PWR - OFF
     - FSS HTR PWR - RED(PRI)
   - (CRT) POWER FSS HTR 1/2?
     - YES
     - NO

3. Continue nominal ops

4. Switch to alt htrs
   - (L12U)
     - FSS HTR PWR - OFF
     - FSS HTR PWR - RED(PRI)
   - (CRT) POWER FSS HTR 1/2?
     - YES
     - NO

5. FSS FMDM MONITOR FAILURE
   - Continue ops on alt htrs

6. FSS FMDM TELEMETRY CARD FAILURE
   - Continue ops on alt htrs

7. Switch to alt htrs
   - (L12U)
     - FSS HTR PWR - OFF
     - FSS HTR PWR - RED(PRI)
   - (CRT) POWER FSS HTR 1/2?
     - YES
     - NO

8. HTR CONTROLLER FAILURE

9. MCC

10. Switch to alt htrs
    - (L12U)
      - FSS HTR PWR - RED(PRI)
    - (CRT) POWER FSS HTR 1/2?
      - YES
      - NO

11. FSS FMDM TELEMETRY OR POSSIBLE SSP CONTACT/POLE FAILURE

12. Continue ops on alt htrs

13. MCC

14. Switch to alt htrs
    - (L12U)
      - FSS HTR PWR - RED(PRI)
    - (CRT) POWER FSS HTR 1/2?
      - YES
      - NO

15. POSSIBLE SSP SW FAILURE

16. MCC

17. Continue ops on alt htrs

18. MCC

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 tim 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 tim failure or multiple failures
1 If all tlm 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

---

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

**SSE THERMAL**

1.1b POWER MULE HTR NOT * (S211)

1. MULE SURV HTR PWR tb – gray?
   - YES → 11
   - NO → 2

2. Determine status:
   - SM 211 SSE OVERVIEW
   - POWER MULE HTR – *?
     - YES → 3
     - NO → 5

3. TRANSIENT FAILURE
   - YES → 4
   - NO → 6

4. Continue nominal ops

5. Switch to alt htrs
   - (L11U) MULE SURV HTR–B(A) PWR – ON
   - (CRT) POWER MULE HTR – *?
     - YES → 7
     - NO → 8

6. FAILED MULE FMDM CARD OR MONITOR FAILURE
   - YES → 4
   - NO → 9

7. Switch off alt htr
   - (L11U) MULE SURV HTR–B(A) PWR – OFF
   - SM 211 SSE OVERVIEW
   - POWER MULE HTR – *?
     - YES → 12
     - NO → 10

8. FAILED HTR STATUS CIRCUIT
   - YES → 9
   - NO → 11

9. FAILED MULE FMDM CARD OR MONITOR FAILURE
   - YES → 4
   - NO → 12

10. Turn off primary htr
    - (L11U) MULE SURV HTR–B(A) PWR – OFF
    - SM 211 SSE OVERVIEW
    - POWER MULE HTR – *?
      - YES → 12
      - NO → 14

11. Switch to alt htrs
    - (L11U) MULE SURV HTR–B(A) PWR – ON
    - SM 211 SSE OVERVIEW
    - POWER MULE HTR – *?
      - YES → 12
      - NO → 14

12. PRIMARY SSP HTR SWITCH OR PDSU RELAY FAILED
    - YES → 13
    - NO → 7

13. Continue on alt htr

---
SSE/HST POWER TRANSFER OVERVIEW

NOTES: INDIVIDUAL DPC OUTPUTS REDUNDANTLY FUSED
EXH. LT PWR
EXT. C/E PWR A, B
INH. MAIN PWR CNTRL ON, OFF
ACP ALLOWS REMOTE CONTROL OF PWR RELAYS TO MAIN AND C/E PWR OF EVA PERSONNEL

PL SYS/109/FIN A
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 FDMM CHANNELIZATION
   CHART MOD1
   CH 8 – Htr 1A
   CH 21 – Htr 2B
   MOD 0
   CH 13 – Htr 2A
   CH 15 – Htr 1B

1. POWER FSS HTR AMPS ↑ (S211)

   1. SM 211 SSE OVERVIEW
   
   POWER FSS HTR AMPS A1(B2) > 14
   or
   POWER FSS HTR AMPS B1(A2) > 11 ?
   
   2. TRANSIENT CURRENT SPIKE
      OR EPDSU SSPC TRIPPED OFF
      YES
      NO
      3. MCC

   4. Record FSS EPDSU 1/2 AMPS:
      YES
      NO

   5. For short
      (L12U)
      • FSS HTR PWR – OFF
      • SM 211 SSE OVERVIEW
      • POWER FSS HTR AMPS A1,B1 (A2,B2) < 1.0 (both) ?
      NO
      YES
      6. SHORT CIRCUIT ON FSS HTR PRI(RED)

   7. EPDSU AMPS
      YES
      NO
      8. CURRENT MONITOR FAILURE OR FSS
         FMDM MOD FAILURE
      • FSS HTR PWR – RED(PRI)
      • Continue ops on all heater
      • SM 211 SSE OVERVIEW

   9. Switch to alt heaters
      (L12U)
      • FSS HTR PWR – RED(PRI)
      • Continue ops on all heater

   10. POSSIBLE CURRENT
        MONITOR SMART SHORT OR
             FAILURE

   11. MCC
**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

If:

AMSB DC AMPS $> 0.09$

1.2b ‘S212 AMSB DC AMPS’

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’?

2. SM 212 SSE MECHANISMS
   - AMSB DC AMPS ↑?

3. TRANSIENT FAILURE

4. SM 212 SSE MECHANISMS
   - • Record selected Mech and corresponding status:
     - Item # Status
     - ______ ______

5. AMSB status
   - AMSB ON, ITEM 7 – blank?

6. AMSB CURRENT SENSOR FAILURE

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 – *?

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

11. AMSB CURRENT SENSOR FAILURE OR EPDSU SHORT

12. IF LOS:
    - • Go to SSE SSR–1, FMDEM SWAP A→B (B→A); else, √MCC
Multiple mechanisms may have driven and need to be reconfigured to a nominal state prior to continuing operations.

1. Override

- If HST berthed and B LAT not CL (Item 14, 15, or 16) then, DAP: FREE

2. Deselect mech

- DESEL – ITEM 20 EXEC

3. All mech stat – blank?

- Resend original MECH select cmd

4._msgs recur?

- YES

- NO

5. Transient multi select failure

6. AMSB O/R electrical relay failure

7. If LOS:

   - Go to SSE SSR–1, FMDM SWAP A→B (B→A); else, MCC

8. AMSB O/R ENA, ITEM 21 – *?

9. O/R DIS – ITEM 22 EXEC (*)

10. AMSB O/R ENA, ITEM 21 – *?

11. NO

12. Transient multi select failure

13. Override

14. O/R ENA, ITEM 21 – *?

15. AMSB O/R electrical relay failure

16. If LOS:

   - Go to SSE SSR–1, FMDM SWAP A→B (B→A); else, MCC

17. If HST berthed and B LAT not CL (Item 14, 15, or 16) then, DAP: FREE

18. Transient multi select failure

19. Continue ops

20. Deselect mech

21. All mech stat – blank?

22. Transient multi select failure

23. Continue ops

24. Multi select failure or command structure error

25. AMSB relay electrical failure

26. If LOS:

   - Go to SSE SSR–1, FMDM SWAP A→B (B→A); else, MCC

27. AMSB ON – ITEM 7 EXEC (A(B))

28. Unexplained high current on AMSB

29. AMSB OFF – ITEM 8 EXEC (*)

30. If LOS:

   - Go to SSE SSR–1, FMDM SWAP A→B (B→A); else, MCC

31. Transient failure

32. Continue ops
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

1.2c ‘S212 MECH SEL’

1. Verify inhibits
   - (A6U)
     * PL RETEN LAT 1,2 (both) – OFF
   - (R13)
     * PL BAY MECH PWR SYS 1,2 (both) – OFF

2. SM 212 SSE MECHANISMS
   - MECH STAT – ITEMS 9–19

3. TRANSIENT AMSB RELAY STATUS FAILURE

4. Continue ops

5. Deselect mech
   - DESEL – ITEM 20 EXEC

6. AMSB RELAY PHYSICALLY FAILED CLOSED

7. (CRT)
   - Resend original MECH select cmd

8. MULTISELECT FAILURE OR COMMAND STRUCTURE ERROR

9. Go to SSE SSR–1, FMDM SWAP A→B (B→A)

10. TRANSIENT MULTISELECT FAILURE

11. Continue ops
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

1.2f POWER SAC EPDSU AMPS $\uparrow$ (S211)

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–gray)
SAC OPA HTR–A
PWR – ON
(tb–UP)
SAC SAP HTR–B
PWR – ON
(tb–gray)

1 SM 211 SSE OVERVIEW

POWER SAC EPDSU AMPS > 42 ?

NO

2 TRANSIENT CURRENT SPIKE
OR EPDSU SSPC TRIPPED OFF

YES

3 $\checkmark$ MCC

4 • Record SAC EPDSU AMPS:

SM 67 ELECTRIC

• Record FC 3 AMPS:

5 $\checkmark$ For short

(L12L)
• SAC SAP HTR–B(A)
PWR – OFF

SM 211 SSE OVERVIEW

SAC AMPS decr by 10 or more ?

6 SHORT CIRCUIT ON
SAP–B(A) HTR

YES

7 Switch to alt SAP htrs

(L12L)
• SAC SAP HTR–A(B)
PWR – ON
(tb–gray)

• Continue ops on
all SAP heater

8 (CRT)
• Record SAC EPDSU AMPS:

(L12L)
• SAC ASIPE HTR–A(B)
PWR – OFF

SAC AMPS decr by 14 or more ?

YES

9 SHORT CIRCUIT ON
ASIPE A(B) HTR

NO

10 Switch to alt
ASIPE htrs

(L12L)
• SAC ASIPE
HTR–B(A)
PWR – ON
(tb–UP)

11 (CRT)
• Record SAC EPDSU AMPS:

(L12L)
• SAC OPA HTR–A(B)
PWR – OFF

SAC AMPS decr by 10 or more ?

YES

12 Restore SAP
htrs

(L12L)
• SAC SAP
HTR–B(A)
PWR – ON
(tb–gray)

• Continue ops on
all ASIPE heater

13 SHORT CIRCUIT ON OPA
A(B) HTR

NO

14

15

SAC AMPS decr by 10 or more ?

11/19/01
SSE EPS 1.2f (Cont)

14
(CRT)
- Record SAC EPDSU AMPS: 

(L12L)
- SAC EPDSU HTR PWR – OFF (tb-bp)

15
- SAC OPA HTR – B(A) PWR – ON (tb-gray)

16
POSSIBLE EPDSU SMART SHORT OR CURRENT SENSOR FAILURE

17
- SAC ASIPE HTR–A(B) PWR – ON (tb–UP)
- SAC SAP HTR–B(A) PWR – ON (tb–gray)

18
SHORT CIRCUIT ON SAC EPDSU B(A) HTRS

19
- Record FC 3 AMPS: 

SM 67 ELECTRIC

20
Switch to alt SAC EPDSU htrs

(L12L)
- SAC EPDSU HTR–A(B) PWR – ON (tb–gray)

21
- MCC

22
- SAC OPA HTR–A(B) PWR – ON (tb-gray)
- SAC ASIPE HTR–A(B) PWR – ON (tb–UP)
- SAC SAP HTR–B(A) PWR – ON (tb–gray)

- Continue ops on alt EPDSU heater

23
- Restore OPA, ASIPE, and SAP htrs

11/19/01 1–14 PL SYS/109/FIN A
1.2g POWER MULE HTR AMPS \(\uparrow\) (S211)

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

If MULE HTR AMPS > 12.5

1. SM 211 SSE OVERVIEW

   NO

2. TRANSIENT FAILURE OR FUSE BLEW

   NO

3. \(\checkmark\) MCC

   YES

4. SM 67 ELECTRIC
- Record FC 3 AMPS:

5. \(\checkmark\) For short
- (L11U) MULE SURV HTR–A(B) PWR – OFF (tb–bp)
- (S211) MULE HTR AMPS \(\leq 0.4\) ?

6. SHORT CIRCUIT ON MULE SURV HTR–A(B)

7. Switch to MULE alt heaters
   - (L11U) MULE SURV HTR B(A) PWR – ON (tb–gray)

8. Did FC 3 AMPS decrease ?

9. POSSIBLE SMART SHORT OR CURRENT SENSOR FAILURE OR MULE FMDF IOM–1 FAILURE

10. \(\checkmark\) MCC

11. \(\checkmark\) MCC

12. \(\checkmark\) MCC

13. Restore Heaters
   - (L11U) MULE SURV HTR A(B) PWR – ON (tb–gray)

14. \(\checkmark\) MCC

   YES

   NO

   4

   POSSIBLE SSE SSR–1 FMDF SWAP reqd

   3

   Ref FMDF CHANNELIZATION CHART MOD 1 CH 26–MULE SURV HTR CURRENT

   2

   Single analog input failure

   1

   MULE HTR AMPS Invalid
**SSE EPS**

**1.2h POWER MULE ESM AMPS ↑ (S211)**

1. **POWELL 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)

If MULE ESM 1&2 AMPS > 4.0
If MULE ESM 3 AMPS > 3.5

If MULE ESM 1&2 AMPS > 4/3.5 ?

- YES
  - SM 211 SSE
  - OVERVIEW
  - MULE ESM 1&2 AMPS > 4/3.5 ?

- NO
  - TRANSIENT FAILURE OR FUSE BLEW
  - MULE ESM 1&2/3 AMPS > 4/3.5 ?

4. **SM 67 ELECTRIC**
   - Record FC 3 AMPS:

5. For short
   - (L11U)
   - MULE ESM HTR–A(B)
  - PWR – OFF
  - (tb–bp)

6. SHORT CIRCUIT ON ESM HTR A(B)

7. **SM 211 SSE OVERVIEW**
   - MULE ESM 1&2/3 AMPS ≤ 0.4 ?

8. Did FC 3 AMPS decrease ?
   - NO
   - POSSIBLE SHORT OR CURRENT SENSOR FAILURE OR MULE FMDM IOM–1 FAILURE
   - YES

9. **CURRENT SENSOR FAILURE OR MULE FMDM IOM–1 FAILURE**

10. **SM 67 ELECTRIC**
    - Record FC 3 AMPS:

11. **SM 211 SSE OVERVIEW**
    - MULE ESM 1&2 AMPS ≤ 0.4 ?

12. Switch to ESM alt heaters
    - (L11U)
    - MULE ESM HTR A(B) PWR – OFF
    - (tb–bp)

13. **CURRENT SENSOR FAILURE OR MULE FMDM IOM–1 FAILURE**

14. POSSIBLE SMART SHORT OR CURRENT SENSOR FAILURE OR MULE FMDM IOM–1 FAILURE

15. Restore heaters
    - (L11U)
    - MULE ESM HTR A(B) PWR – ON
    - (tb–gray)

16. **SM 211 SSE OVERVIEW**
    - MULE ESM 1&2 AMPS ≤ 0.4 ?

17. POSSIBLE SMART SHORT OR CURRENT SENSOR FAILURE OR MULE FMDM IOM–1 FAILURE

18. Switch to ESM alt heaters
    - (L11U)
    - MULE ESM HTR A(B) PWR – OFF
    - (tb–bp)

19. **CURRENT SENSOR FAILURE OR MULE FMDM IOM–1 FAILURE**

20. **SM 67 ELECTRIC**
    - Record FC 3 AMPS:

21. **POWELL MULE ESM AMPS ↑**

22. **SM 211 SSE OVERVIEW**
    - MULE ESM 1&2 AMPS > 4/3.5 ?

23. **SM 67 ELECTRIC**
    - Record FC 3 AMPS:

24. **POWELL MULE ESM AMPS ↑**

25. **SM 211 SSE OVERVIEW**
    - MULE ESM 1&2 AMPS > 4/3.5 ?

26. **SM 67 ELECTRIC**
    - Record FC 3 AMPS:

27. **POWELL MULE ESM AMPS ↑**

28. **SM 211 SSE OVERVIEW**
    - MULE ESM 1&2 AMPS > 4/3.5 ?

29. **SM 67 ELECTRIC**
    - Record FC 3 AMPS:

30. **POWELL MULE ESM AMPS ↑**

31. **SM 211 SSE OVERVIEW**
    - MULE ESM 1&2 AMPS > 4/3.5 ?

32. **SM 67 ELECTRIC**
    - Record FC 3 AMPS:

33. **POWELL MULE ESM AMPS ↑**

34. **SM 211 SSE OVERVIEW**
    - MULE ESM 1&2 AMPS > 4/3.5 ?

35. **SM 67 ELECTRIC**
    - Record FC 3 AMPS:

36. **POWELL MULE ESM AMPS ↑**

37. **SM 211 SSE OVERVIEW**
    - MULE ESM 1&2 AMPS > 4/3.5 ?

38. **SM 67 ELECTRIC**
    - Record FC 3 AMPS:

39. **POWELL MULE ESM AMPS ↑**

40. **SM 211 SSE OVERVIEW**
    - MULE ESM 1&2 AMPS > 4/3.5 ?

41. **SM 67 ELECTRIC**
    - Record FC 3 AMPS:

42. **POWELL MULE ESM AMPS ↑**

43. **SM 211 SSE OVERVIEW**
    - MULE ESM 1&2 AMPS > 4/3.5 ?

44. **SM 67 ELECTRIC**
    - Record FC 3 AMPS:
1.2i POWER MULE SOPE AMPS ↑ (S211)

1. Isolate SOPE HTR ZONE
   - SM 211 SSE OVERVIEW
   - Any MULE SOPE AMPS high?
     - Yes -> 2 TRANSIENT FAILURE OR FUSE BLEW
     - No
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 3 RED HTR CURRENT
4. Nominal Config:
   - (R1)
   - PL PRI MNC - ON
   - PL CAB - MNA (MNB)
   - (L11U)
   - cb MULE SW PWR - cl
   - MULE SOPE HTR A(B) PWR - ON (lb-gray)
5. For short
   - (L11U)
   - MULE SOPE HTR A(B) PWR OFF (lb-bp)
   - All MULE SOPE AMPS ≤ 0.4 ?
     - Yes -> 8 SHORT CIRCUIT ON SOPE HTR A(B)
     - No
   - Did FC 3 AMPS decrease?
     - Yes -> 7 POSSIBLE SMART SHORT OR CURRENT SENSOR FAILURE OR MULE FMDM IOM-1 FAILURE
     - No
9. CURRENT SENSOR FAILURE OR MULE FMDM IOM-1 FAILURE
   - Switch to SOPE alt heaters
     - (L11U)
     - MULE SOPE HTR B(A) PWR - ON (tb-gray)
   - Continue ops on all heaters
   - Notify MCC

11/19/01
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)

1.3d 5
1.3e 8

1.3b 5

1 Is mechanism visually observed in correct posn?

YES

2 EOT/BOT MICROSWITCH FAILURE

• Continue without EOT/BOT sw feedback

YES

4 Isolate electrical/mechanical failure

(A6U)
• PL RETEN LAT 1(2) – LAT(REL) (operate 10 sec maximum)

NO

SM 212 SSE MECHANISMS

• Record AMSB AC AMPS:

NO

Current change expected for mech selected?

YES

5 Reverse motor/mechanism

(A6U)
On MCC GO:
• PL RETEN LAT 1(2) – REL(LAT) (opposite of before) max 30 sec
• PL RETEN LAT 1(2) – OFF

On MCC GO:
• PL RETEN LAT 1(2) – LAT(REL) for desired drive time or MCC call

NO

Jam recurs during second LAT(REL) motion?

YES

6 MECHANISM OPERATING PROPERLY, TEMPORARY PHYSICAL BLOCKAGE OF MECHANISM

• PL RETEN LAT 1(2) – OFF

7

NO

8 PL RETEN LAT 1(2) – OFF

10

9

• Inform MCC
• Continue ops

11
**SSE MECH 1.3a (Cont)**

8

10 - Inform MCC of mech posn at jam

11 - Switch motor

If during rotate, pivot up, latch close, umb mate:
- MCC; else, continue

If HST on external pwr:
(L12U)
- PCU PWR CONTR A,B (two) – ON

(R13)
- PL BAY MECH PWR 1(2) – OFF

(A6U)
- PL RETEN LOGIC PWR SYS 1(2) – OFF

SM 212 SSE MECHANISMS
- DESEL – ITEM 20 EXEC
- AMSB OFF – ITEM 8 EXEC (*)

(L12U)
- FSS FDM–B(A) PWR – ON (tb–gray)

(L11L)
- MULE FDM–B(A) PWR – ON (tb–gray)

SM 1 DPS UTILITY
- PORT ASSIGN STRING PL 1/2 PRI(SEC) – ITEM 23(24) EXEC (*)

SM 212 SSE MECHANISMS
- AMSB ON – ITEM 7 EXEC (B(A))
- ITEMS 9–19 – OFF (no *)
- O/R DIS, ITEM 22 – *
- AMSB DC AMPS: < 0.04

(A6U)
- PL RETEN LOGIC PWR SYS 2(1) – ON

(R13)
- PL BAY MECH PWR 2(1) – ON

(CRT)
- Select mechanism: ITEMS 9–19 EXEC (*) (as reqd)

12

(A6U)
- PL RETEN LAT 2(1) – LAT(REL) (original direction)

Movement visually observed?

YES

13

- Wait EOT/BOT microsw or expected pivot/rotate time, then:
  (A6U)
- PL RETEN LAT 2(1) – OFF

NO

15

- PL RETEN LAT 2(1) – OFF

18

14 - PRIMARY SYS FAILED

16 - Deactivate pri side

On MCC GO:
- Perform SSE SSR–1, FDM SWAP A→B (B→A), steps 6,7,9,10,11

17 - Continue ops using alt side
18 Attempt dual motor drive
If during rotate, pivot up, latch close, umb mate:
• MCC; else, continue

SM 1 DPS UTILITY
• PORT ASSIGN STRING PL 1/2 SEC(PRI) – ITEM 24(23) EXEC (*)

SM 212 SSE MECHANISMS
• AMSB ON – ITEM 7 EXEC (*)
• Select mechanism: ITEMS 9–19 EXEC (*)
  (as reqd)
  (R13)
• PL BAY MECH PWR 1(2) – ON
  √2(1) – ON
  (A6U)
• PL RETEN LOGIC PWR SYS 1(2) – ON
  √2(1) – ON

19
• PL RETEN LAT 1,2 – LAT/REL (original direction)
Movement observed?

SM 1 DPS UTILITY
• PORT ASSIGN STRING PL 1/2 SEC(PRI) – ITEM 24(23) EXEC (*)

SM 212 SSE MECHANISMS
• DESEL – ITEM 20 EXEC
• AMSB OFF – ITEM 8 EXEC (B(A))

SM 1 DPS UTILITY
• PORT ASSIGN STRING PL 1/2 SEC(PRI) – ITEM 24(23) EXEC (*)

21 (A6U)
• PL RETEN LAT 1,2 – OFF

22 MECHANISM FAILURE, PHYSICAL BLOCKAGE OF MECHANISM

23 DIFFERENTIAL FAILURE IN MECHANISM OR TWO BRAKE FAILURES

24 Deactivate mechanism
(A6U)
• PL RETEN LOGIC PWR SYS 1,2 – OFF
(R13)
• PL BAY MECH PWR 1,2 – OFF

SM 1 DPS UTILITY
• PORT ASSIGN STRING PL 1/2 SEC(PRI) – ITEM 24(23) EXEC (*)

SM 212 SSE MECHANISMS
• DESEL – ITEM 20 EXEC
• AMSB OFF – ITEM 8 EXEC (B(A))

SM 1 DPS UTILITY
• PORT ASSIGN STRING PL 1/2 SEC(PRI) – ITEM 24(23) EXEC (*)

26 On MCC GO:
  (L11U)
• MULE FMDM–B(A) PWR – OFF (tb–bp)
(L12U)
• FSS FMDM–B(A) PWR – OFF (tb–bp)
• PCU PWR CNTRL A,B (two) – OFF

27 Continue ops

20
• Wait for EOT/BOT microsw or expected pivot/rotate time, then:
  (A6U)
• PL RETEN LAT 1,2 – OFF

25 Deactivate mechanism
(A6U)
• PL RETEN LOGIC PWR SYS 2(1) – OFF
(R13)
• PL BAY MECH PWR 2(1) – OFF

SM 1 DPS UTILITY
• PORT ASSIGN STRING PL 1/2 SEC(PRI) – ITEM 24(23) EXEC (*)

SM 212 SSE MECHANISMS
• DESEL – ITEM 20 EXEC
• AMSB OFF – ITEM 8 EXEC (B(A))

SM 1 DPS UTILITY
• PORT ASSIGN STRING PL 1/2 SEC(PRI) – ITEM 24(23) EXEC (*)

(L11U)
• MULE FMDM–B(A) PWR – OFF (tb–bp)
(L12U)
• FSS FMDM–B(A) PWR – OFF (tb–bp)
• PCU PWR CNTRL A,B (two) – OFF

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
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

11/19/01 1–21 PL SYS/109/FIN A
### SSE MECH

**1.3b BSP FAILS TO DISENGAGE**

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pivot BAPS down to relieve latch interference</td>
</tr>
<tr>
<td></td>
<td>SM 212 SSE MECHANISMS</td>
</tr>
<tr>
<td></td>
<td>- PIVOT LO SEL – ITEM 11 EXEC (*)</td>
</tr>
<tr>
<td></td>
<td>(A6U)</td>
</tr>
<tr>
<td></td>
<td>- PL RETEN LAT 1(2) – REL</td>
</tr>
<tr>
<td></td>
<td>(CRT)</td>
</tr>
<tr>
<td></td>
<td>When PIVOT TACH: &lt; 0.25 deg/min</td>
</tr>
<tr>
<td></td>
<td>(A6U)</td>
</tr>
<tr>
<td></td>
<td>- PL RETEN LAT 1(2) – OFF</td>
</tr>
<tr>
<td>2</td>
<td>Reattempt BSP release</td>
</tr>
<tr>
<td></td>
<td>(CRT)</td>
</tr>
<tr>
<td></td>
<td>- BSP SEL – ITEM 19 EXEC (*)</td>
</tr>
<tr>
<td></td>
<td>(A6U)</td>
</tr>
<tr>
<td></td>
<td>- PL RETEN LAT 1(2) – REL</td>
</tr>
<tr>
<td></td>
<td>- Wait 4 sec</td>
</tr>
<tr>
<td></td>
<td>- PL RETEN LAT 1(2) – OFF</td>
</tr>
<tr>
<td></td>
<td>√BSP DIS, BSP STAT</td>
</tr>
<tr>
<td>3</td>
<td>TRANSIENT LATCH INTERFERENCE RELIEVED</td>
</tr>
<tr>
<td>4</td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>NO</td>
</tr>
<tr>
<td>5</td>
<td>√BSP engage status</td>
</tr>
<tr>
<td></td>
<td>BSP ENG – blank?</td>
</tr>
<tr>
<td></td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>NO</td>
</tr>
</tbody>
</table>

#### 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

1.3c  BSP FAILS TO SET

Nominal Config:
(R1) PL PRI MNC tbl – 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
• ✓ BSP STAT:
SM 212 SSE MECHANISMS
BSP STAT – REL

2
• Go to 1.3a, PRIMARY MOTOR FAILS TO
  DRIVE MECHANISM

3
• POSSIBLE RELEASE MICRO–SWITCH FAILURE

4
• ✓ MCC

5
• ✓ MCC

6
• ✓ O/R Status

(CRT) O/R ENA, ITEM 21 – * ?

7
• Go to 1.3a, PRIMARY
  MOTOR FAILS TO
  DRIVE MECHANISM

8
• FAILED OVERRIDE RELAY CAUSED
  MEC CH BE IN
  L/A POSN

9
Drive BSP latch to REL

(A6U)
• PL RETEN LAT 1(2) – REL
• Wait 4 sec
• PL RETEN LAT 1(2) – OFF

10
• Perform SSE SSR–1, FMDM
  SWAP A→B
  (B→A)

11
• DRIVE BSP to SET

(A6U)
• PL RETEN LAT 1(2) – LAT
• Wait 4 sec
• PL RETEN LAT 1(2) – OFF

12
• ✓ BSP STAT

(CRT) BSP STAT – SET ?

13
• ✓ MCC

14
• Continue ops on alt side

07/06/01
If BSP (ENG)–A and (RET)–A or BSP (ENG)–B and (RET)–B then possible power supply failure

BSP latch configuration is indeterminate

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 BSP latch reset

- BSP SEL – ITEM 19 EXEC (*)
- / AMSB DC AMPS: .03 to .09
- / MECH – steady A(B)

2 Wait period not reqd after both SA–3s have been installed or after both SA–2s have been fully retracted

3 BSP latch configuration is indeterminate

4 \text{SSE MECH 1.3d (Cont)}

13

15 BSP latch reset

- (CRT)
  - BSP SEL – ITEM 19 EXEC (*)
  - / AMSB DC AMPS: .03 to .09
  - / MECH – steady A(B)

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

- (CRT)
  - / BSP STAT – SET

17 Pivot down BAPS

- (CRT)
  - PIVOT LO – ITEM 11 EXEC (*)
  - / PIVOT LO STAT – RDY
  - / AMSB DC AMPS: .03 to .09
  - / MECH – blank

- (AU)
  - PL RETEN LAT 1(2) – REL
  - When pivoter motion stops (PIVOT LO TACH: < 0.25 deg/min)
  - Wait 20 sec
  - PL RETEN LAT 1(2) – OFF

18 / BSP ENG status

- (CRT)
  - BSP(ENG) – ENG # ?

19 TRANSIENT SWITCH OR MECHANISM FAILURE

- (CRT)
  - BSP(ENG) – ENG # ?

20 / BSP RET status

- (CRT)
  - BSP(RET) – RET # ?

21 TRANSIENT SWITCH OR MECHANISM FAILURE

- (CRT)
  - DESEL – ITEM 20 EXEC (ITEMS 9–19 no *)
  - Notify MCC
  - Continue nominal ops

22 Perform BSP latch assist

- (CRT)
  - BSP SEL – ITEM 19 EXEC (*)

- On MCC GO:
  - Expect 'S212 AMSB DC AMPS' msg
  - O/R ENA – ITEM 21 EXEC (*)

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

- (CRT)
  - O/R DIS – ITEM 22 EXEC (*)
  - /BSP STAT – L/A

23 / BSP ENG status

- BSP(ENG) – ENG # ?

24 POSSIBLE MECHANISM OR BSP LATCH MICROSWITCH FAILURE

- (CRT)
  - BSP(ENG) – ENG # ?

25 TRANSIENT SWITCH OR MECHANISM FAILURE

- (CRT)
  - DESEL – ITEM 20 EXEC (ITEMS 9–19 no *)
  - Notify MCC
  - Continue nominal ops

26 / MCC

27 TRANSIENT SWITCH OR MECHANISM FAILURE

- (CRT)
  - DESEL – ITEM 20 EXEC (ITEMS 9–19 no *)
  - Notify MCC
  - Continue nominal ops
If PVT(ROT) Selected and AMSB AC AMPS > 0.30 and (PVT Tach < 0.2 deg/min or ROT Tach < 0.4 deg/min) and AMSB ON, ITEM 7 = A(B) and (A6U) and (R13) and (tb–gray) and (S212) then if PVT(ROT) StALL condition must exist for 30 sec before FDA message is annunciated.

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
cb FSS A SIDE PWR – cl
FSS FMDM – A(B) PWR – ON (tb–gray) (S212)

1. Visually check motion
   • PL MECH PWR SYS 1(2) – ON
   • PL RETEN LAT 1(2) – LAT(REL)

2. Motion observed?
   NO
   • Continue nominal ops
   YES
   • Continue driving to desired posn

3. TRANSIENT FAILURE
   NO
   • Continue transonic ops
   YES
   • Continue nominal ops

4. (A6U)
   • PL RETEN LAT 1(2) – OFF

5. (A6U)
   • PL RETEN LAT 1(2) – OFF
   • Continue driving to desired posn

6. POSSIBLE JAM
   • If LOS:
     • Continue ops on all side

7. PIVOTER (ROTATOR) TACHOMETER FAILURE OR CURRENT SENSOR FAILURE

8. (R13)
   • PL MECH PWR SYS 1(2) – ON
   • PL RETEN LAT 1(2) – LAT(REL)

9. (R12U)
   • PL MECH PWR SYS 1(2) – ON
   • PL RETEN LAT 1(2) – LAT(REL)
   • Continue driving to desired posn

10. TRANSIENT FAILURE
    • Continue nominal ops

09/07/01
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

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)
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.

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

MCC will determine if SSE SSR–1, FMDM SWAP A → B (B → A) is performed.
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 3 – FSS HTR STATUS
   - IOM 7 – DPC 8 STATUS

4 MULE FMDM Channelization Data:
   - IOM 1 – MULE PDSU VOLTS
   - IOM 4 – MULE HTR STATUS

If operating with less than 12 DPCs
- √ MCC; else, continue.

If HST on ext pwr:
- (L12U)
  - PCU PWR CONTR A,B (two) – ON

3
- (A6U)
  - √ PL RETEN LAT 1,2 (two) – OFF
- (R13L)
  - √ PL BAY MECH PWR SYS 1,2 (two) – OFF

If 'I/O ERROR' or 'MDM OUTPUT PL1(2)' msg also annunciated?

NO
- 1
  - Try reset
  - √ SM I/O RESET
  - 'BCE BYP FLEX' msg recur?

YES
- 6
  - FAULT
  - √ SM ALERT
  - BCE BYP FLEX msg recur?

NO
- 7
  - TRANSIENT ERROR
  - 8
    - √ Continue nominal ops

YES
- 9
  - Check for missing FSS FMOM data
  - SM 211 SSE OVERVIEW
  - √ POWER FSS EPDSU 1 AMPS
  - √ POWER FSS EPDSU 2 AMPS
  - √ POWER FSS EPDSU VOLTS
  - √ FSS HTR STATUS
  - √ DPC 8 STATUS
  - Are any data points missing?

NO
- 10
  - Check for missing MULE FMOM data
  - (CRT)
    - √ POWER MULE PDSU VOLTS
    - √ MULE HTR STATUS
  - Is either data point missing?

YES
- 11
  - 12

NO
- 13
  - Check for missing FSS FMOM data
  - SM 211 SSE OVERVIEW
  - √ POWER FSS EPDSU 1 AMPS
  - √ POWER FSS EPDSU 2 AMPS
  - √ POWER FSS EPDSU VOLTS
  - √ FSS HTR STATUS
  - √ DPC 8 STATUS
  - Are any data points missing?

YES
- 14
  - 15

NO
- 16
  - Check for missing MULE FMOM data
  - (CRT)
    - √ POWER MULE PDSU VOLTS
    - √ MULE HTR STATUS
  - Is either data point missing?

YES
- 17
  - 18

NO
- 19
  - MCC
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.

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

MCC will determine if SSE SSR–1, FMDM SWAP A → B (B → A) is performed.
1. If operating on less than 12 DPCs, √MCC; else, continue

2. If HST on ext pwr:
   cb FSS A SIDE PWR – cl
   PCU POWER CONTR A,B (two) – ON

3. Verify mechanism unpwr:
   √PL RETEN LAT 1,2 (two) – OFF
   √LOGIC PWR SYS 1,SYS2 (two) – OFF
   √PL SEL – 1
   √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 (*)

4. Pwr on alt FMDMs:
   L12U FSS FMDM–B(A) PWR – ON (tb–gray)
   L11U MULE FMDM–B(A) PWR – ON (tb–gray)

   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 PDSU 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 (*)
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)

10. FSS FMDM–A(B) PWR – OFF (tb–bp)

11. MULE FMDM–A(B) PWR – OFF (tb–bp)

12. If failure occurred during mechanism operations:

   A6U
   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 – *

13. Return to step where failure occurred
2.1 HST
   EPS CONFIGURATION FOR SOLAR ARRAY 2
   3

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

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

HST SSR–1 PWR LOSS RECOVERY
EPS CONFIGURATION FOR SOLAR ARRAY 2

Diagram of EPS Configuration for Solar Array 2

48069004_109.SCH; 3*
EPS CONFIGURATION FOR SOLAR ARRAY 2 (Cont)
EPS CONFIGURATION FOR SOLAR ARRAY 3
EPS CONFIGURATION FOR SOLAR ARRAY 3 (Cont)
Possible STANDARD SWITCH PANEL (SSP) CABLE CHANGEOUT IFM

Loss or interruption of HST ESS BUS forces MA transponder into pwr on reset (transmitter off)

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

SM 211 SSE OVERVIEW
PCU – ‘P/S’
DPC 1–12: *'
DPC 1–12 VOLTS: 34.5 ± .7

1. SM 210 HST SYS
   INT ESS BUS – ****’?
   YES 2. tb FAILURE
   NO

3. • Continue nominal ops

4. POSSIBLE ESS/MN SW ENA sw FAILURE OR tb FAILURE

5. Cycle ESS/MN SW ENA sw
   (L12U)
   Repeat up to three times:
   • ESS/MN SW ENA – OFF,ON
   ESS/MN SW ENA tb – gray ?
   NO
   YES

6. ESS/MN SW ENA sw FAILURE

7. • MCC

8. Cycle ESS BUS INT PWR sw
   Repeat up to three times (UP only):
   • ESS BUS INT PWR – ON (mom)
   ESS BUS INT PWR tb – UP ?
   NO
   YES

9. TRANSIENT SWITCH FAILURE

10. • Continue ops

11. On MCC GO:
    Attempt auto switchover using EXT ESS BUS
    • Expect ‘PDI DECOM FAIL’
    • FDA msg
    • ESS BUS EXT PWR – OFF (tb–bp)
   ESS BUS INT PWR tb – UP ?
   NO
   YES

12. INT ESS BUS OFF–CONTROL FAILED ON OR INT ESS BUS FAILURE

13. Pwr EXT ESS BUS
   • ESS BUS EXT PWR – ON (tb–UP)

14. ESS BUS INT PWR sw ON POSITION FAILURE

15. • Perform COMM SSR–1, PI RF REACQ

16. • Perform COMM SSR–1, PI RF REACQ
   • MCC

17. • Continue ops

18.
Possible EVA reqd for ACP actions or PCU essential bus harness installation

Perform remainder of mission without Internal ESS Bus available. Auto-Switchover using DPCs reqd to recover INT ESS on deploy day

18 On MCC GO: Attempt auto switchover using DPCs

SM 210 HST SYS
- TLM COUNT – incr
- MAIN BUS A,B,C – INT,INT,OFF

(L12U)
- HST SHUTTER – CL (tb–gray)
- MN BUS EXT PWR – OFF (mom, tb–bp)
- IPCU RLY CLOSED tb – bp
- MAIN BUS PWR ON tb – gray

21 (L12U)
- PCU PWR CONTR A,B (two) – OFF

SM 211 SSE OVERVIEW
- DPC 1–12 VOLTS: 34.5 ± .7
- AMPS: < 0.5
- Expect ‘S62 PDI DECOM FAIL’ msg
- PCU OFF – ITEM 2 EXEC (*)

(CRT)
- DPC 1–12 – (no *)
- DPC 1–12 VOLTS: < 1.0 (after 30 sec)
- DPC 1–12 AMPS: < 1.0

ESS BUS INT PWR tb – UP?

23 INT ESS BUS OFF–CONTROL FAILED ON

24 Turn on PCU

(CRT)
- PCU ON – ITEM 1 EXEC (*)
- DPC 1–12 – *
- VOLTS: 34.5 ± .7
- AMPS: < 0.5
- ESS BUS INT PWR tb – bp

26 On MCC GO: Restore EXT MAIN PWR

(L12U)
- MN BUS EXT PWR – ON (mom, tb–gray)
- IPCU RLY CLOSE tb – gray

(CRT)
- DPC 1–12 – *
- VOLTS: 34.5 ± .7
- AMPS: 2–7

(L12U)
- ESS/MN SW ENA – OFF (tb–bp)

27 Notify MCC when complete

Continue ops

3 Possible EVA reqd for ACP actions or PCU essential bus harness installation

4 Perform remainder of mission without Internal ESS Bus available. Auto-Switchover using DPCs reqd to recover INT ESS on deploy day
Automatic switchover to INT ESS BUS pwr occurs whenever EXT ESS BUS pwr is lost or interrupted.

Nominal Config:
- PL PRI MNC tb – ON
- PL CAB – MNA(MNB)
- (L12U)
- cb ST SW PWR – cl
- PCU – 'P/S'
- DPC 1–2 – '*'
- DPC 1–12 VOLTS: 34.5 ± 0.7

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

1. Platform COMM REACQ
2. ESS BUS EXT PWR tb – UP?
3. ESS/MN SW ENA – ON (tb–gray)
4. ESS BUS INT PWR  – OFF
5. ESS/MN SW ENA – OFF (tb–bp)
6. ESS BUS INT PWR  – OFF
7. ESS/MN SW ENA – OFF (tb–bp)
8. ESS BUS Ext PWR – ON
9. ESS/MN SW ENS – OFF (tb–bp)
10. Continue normal ops

- ESS BUS INT PWR – OFF
- ESS BUS EXT PWR – ON
- ESS/MN SW ENA – OFF
HST SSR–1
PWR LOSS RECOVERY

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

2. XFER to EXT:
   - CRT PCU ON – ITEM 1 EXEC
   - PCU OFF – ITEM 2 EXEC (*)
   - PCU OFF – ITEM 2 EXEC (*)
   - DPC 1–12 – *
     - VOLTS: 33.8 to 35.2
     - AMPS: 2 to 7

3. On MCC GO:
   - ESS BUS INT PWR – OFF (tb–bp)

4. ESS/MN SW ENA – OFF (tb–bp)
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
STS-109 COMM MALFUNCTION POINTS
MCC will have B/U DECOM loaded in 32K format.

If KU downlink of HST tlm available, Ground will check with STOCC. If STOCC not receiving tlm via KU, then possible HST tlm system failure or PI receiver failure.

Inhibit failed DECOM FDA:
- ITEM 14, 15, 16, 17 EXEC

Zero input to failed DECOM:
- ITEM 9 +1 (2, 3, 4) EXEC
- ITEM 12 +0 EXEC
- ITEM 13 EXEC

Enable FDA for new DECOM:
- ITEM 14 (15, 16, 17) EXEC

Return to LOAD PDI DECOM FORMAT (ORB OP FS, COMM/INST) to perform remaining B/U config.

Enable input to DECOM 4:
- ITEM 9 +4 EXEC
- ITEM 12 +1 (2) EXEC
- ITEM 13 EXEC
- PDI DECOM ENA FDA 4 – ITEM 17 EXEC (*)

PDI DECOM 4 indicate fail (T)?

Enable inverted tlm DECOM FDA
- ITEM 9 +4 EXEC
- ITEM 12 +1 (2) EXEC
- ITEM 13 EXEC
- PDI DECOM ENA FDA 4 – ITEM 17 EXEC (*)

PDI DECOM 4 indicate fail (T)?

HPGSCA connected in PL COMM STRING?

Perform PDI DECOM ENA FDA 3 – ITEM 16 EXEC (no *)
- PDI DECOM ENA FDA 4 – ITEM 17 EXEC (no *)

Zero input to DECOMs 3 and 4:
- ITEM 9 +3 EXEC
- ITEM 12 +0 EXEC
- ITEM 13 EXEC
- ITEM 9 +4 EXEC
- ITEM 12 +0 EXEC
- ITEM 13 EXEC

Determine if PL INTRG operating correctly
- PI PHASE LOCK = YES?

Determine mission phase
- ACTIVATE HST EXTERNAL PWR (PL OPS, RETRIEVAL OPS) completed?

MCC connected in PL COMM STRING?

Execute HPGSCA RESTART (Cue Card)

HPGSCA monitor displaying normal window?

POSSIBLE HPGSCA S/W FAILURE

Determine if PL INTRG operating correctly
- PI PHASE LOCK = YES?

Activate HST EXTERNAL PWR (PL OPS, RETRIEVAL OPS) completed?

MCC connected in PL COMM STRING?
43 HPGSCA WINDOW
SYNC STATUS = GREEN
SIG PRESENT = GREEN
OVERLOAD = GREEN
OFFSET = GREEN ?

NO 51
YES

44 SYNC STATUS = RED
SIG PRESENT = TOGGING
OVERLOAD = GREEN
OFFSET = TOGGING ?

NO

45 SYNC STATUS = RED
SIG PRESENT = RED
OVERLOAD = GREEN
OFFSET = GREEN ?

NO 46

47 HPGSCA POSSIBLY CONFIGURED FOR WRONG RATE

YES 61

48 • Depress hot key for alt rate 4K (32K)

49 SYNC STATUS = GREEN
SIG PRESENT = GREEN
OVERLOAD = GREEN
OFFSET = GREEN ?

NO

50 • Load applicable PDI/PCMMU config
• Continue nominal ops

51 PDI still indicate fail ?

NO 62
YES

52 TRANIENT LOSS OF DATA THRU HPGSCA

53 • Continue nominal ops

54 • Depress HPGSCA hot key for inverted 32K(4K) tlm

55 PDI DECOM still indicate fail (↑) ?

YES 56

56 PI WAS LOCKED TO INVERTED DATA

57 Zero input to DECOMs 3 and 4:
• ITEM 9 +3 EXEC
• ITEM 12 +9 EXEC
• ITEM 13 EXEC
• ITEM 9 +4 EXEC
• ITEM 12 +9 EXEC
• ITEM 13 EXEC

NO

58 • Depress HPGSCA hot key for normal 32K(4K) tlm

59 • MCC

60 • Continue nominal ops
61 POSSIBLE PI TO PDI INTERFACE PROBLEM

62 Perform COMM SSR–2, SWAP S–BD PL COMM STRINGS

PDI DECOM still indicate fail (↑) ?

---

63 YES

• Continue nominal ops

---

64 Cycle PSP BYPASS sw

Repeat up to three times:
(L12L)
• PSP BYP – DSBL
• PSP BYP – ENA

SM 62 PCMMU/PL COMM

PDI DECOM still indicate fail (↑) ?

---

65 NO

65 TRANSIENT SSP SW FAILURE

---

66 YES

66 Scrub SSP cb

(L12L)
Repeat five times (if AOS, give MCC a ‘mark’ when cb–cl):
• cb SW PWR – op
• cb SW PWR – cl

SM 62 PCMMU/PL COMM

PDI DECOM still indicate fail (↑) ?

---

67 NO

67 Continue nominal ops

---

68 YES

68 TRANSIENT SSP cb FAILURE

---

69 NO

69 POSSIBLE HST TLM SYSTEM FAILURE OR PDI CNTL LOGIC FAILURE

---

70 YES

70 MCC

---

71 NO

71 Continue nominal ops
HST COMM 3.1a (Cont)

21

72 HPGSCA connected in PL COMM STRING ?

YES → 54

NO

73 Pwr cycle PI in attempt to lock on non–inverted data

(A1L)

• S–BD PL CNTL – CMD
• S–BD PL PWR SYS – OFF
• CNTL – PNL,CMD
• Wait 5 sec
• S–BD PL ANT POLAR – L CIRC
• S–BD PL XMTR PWR – LO, MED (as reqd)
• S–BD PL CH SEL INTRG 1,2 (six) – 701, 701
• S–BD PL MOD – OFF
• S–BD PL PWR SEL – BOTH
• S–BD PL PWR SYS – 1(2)
• CNTL – PNL
• FREQ SWEEP – ON (45 sec)
• MOD – ON
• CNTL – CMD

PDI DECOM still indicate fail (↑) ?

YES

74 PI WAS LOCKED TO INVERTED DATA

NO

75 Zero input to DECOMS 3 and 4:

• ITEM 9 +3 EXEC
• ITEM 12 +0 EXEC
• ITEM 13 EXEC
• ITEM 9 +4 EXEC
• ITEM 12 +0 EXEC
• ITEM 13 EXEC

76 Load TFL for inverted HST tlm

• Perform LOAD CMU DD (ORB OPS FS, COMM/INST) for TFL 185

PDI DECOM still indicate fail (↑) ?

YES

77 PI WAS LOCKED TO INVERTED DATA

NO

78 Continue nominal ops

• MCC
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
  - PWR: LO (as reqd)
  - MED (> 40 ft)
  - HI (> 125 ft)
  - 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 XMTMOD – OFF
- S-BD PL XMTMOD – ON
- S-BD PL CNTL – PNLCMD
- SM 210 HST SYS
- PSPENA 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** 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.

3. **CMD CT 1 corresponds to CDI A cmds and CMD CT 2 corresponds to CDI B.**

---

**Flowchart:**
- **No Response to RF Cmd**
  - **1. Failed cmd ITEM ENTRY 3(5)?**
    - NO: Continue nominal ops
    - YES: **2.** Resend cmd
      - SM 210 HST SYS
        - TLM COUNT – incr?
          - NO: Go to 3.1a ‘S62 PDI DECOM FAIL’, 6
          - YES: Continue nominal ops
      - **3.** Continue nominal ops
  - **4.** No response to RF Cmd
    - **5.** SM 210 HST SYS TLM COUNT – incr?
      - NO: Continue nominal ops
      - YES: Go to 3.1a ‘S62 PDI DECOM FAIL’, 6
  - **6.** Log CMD CTs:
    - ‘NO OP’ CMD CK – ITEM 2 EXEC
    - Both CMD CTs increment?
      - NO: Resend failed cmd
      - YES: Continue nominal ops
  - **7.** (CRT)
    - Log CMD CTs:
    - ‘NO OP’ CMD CK – ITEM 2 EXEC
    - Both CMD CTs increment?
      - NO: Resend failed cmd
      - YES: Continue nominal ops
  - **8.** PL INTRG reacquisition
    - (A1L)
      - S-BD PL CNTL – PNL
      - MOD – OFF
      - S-BD PL FREQ SWEEP – ON
      - (hold 45 sec)
    - S-BD PL MOD – ON
    - CNTL – CMD
    - (CRT)
      - ‘NO OP’ CMD CK – ITEM 2 EXEC
    - Both CMD CTs increment?
      - NO: Continue nominal ops
      - YES: Continue nominal ops
  - **9.** TRANSIENT LOSS OF FWD LINK
    - Expected response?
      - NO: Continue nominal ops
      - YES: Continue nominal ops
  - **10.** CMD CT 1(2) increment?
      - NO: Continue nominal ops
      - YES: Continue nominal ops
  - **11.** COMMAND STRUCTURE ERROR
    - Resend failed cmd
HST COMM 3.1b (Cont)

19. Yes
   PSP ENA
   SM 62 PCMU/PL COMM
   PSP I/O RESET
   ITEM 6(7) ≠ ?
   NO
   YES

20. (CRT)
   • PSP I/O
   RESET
   ITEM 6(7) EXEC
   YES
   NO

21. NO
   MCC

22. • Resend failed
   cmd
   Expected
   response ?
   YES
   NO

23. PSP NOT
   CONFIGURED
   FOR
   COMMANDING

24. • Continue nominal
   ops

25. Select alt
   S–BD PL COMM SYS
   • Perform COMM
   SSR–2, SWAP
   S–BD PL COMM
   STRINGS
   SM 210
   HST SYS
   • 'NO OP' CMD
   CK
   ITEM 2
   EXEC
   Both CMD CTs
   increment ?
   YES
   NO

26. S–BD PL
   COMM SYS 1(2)
   FAILURE

27. • Continue nominal
   ops on alternate
   system
COMM SSR–1
PI RF REACQ

1  RF reacquisition
   (A1L)
   • S–BD PL CNTL – CMD
   • S–BD PL ANT POLAR – L CIRC
   • S–BD PL XMTR PWR – LO, MED (> 40 ft), HI
     (> 125 ft) (as reqd)
   • S–BD PL CH SEL INTRG 1.2 tw (six) – 701,701
   • MOD – OFF
   • PWR SEL – BOTH
   • SYS – 1(2)
   • CNTL – PNL
   SM 210 HST SYS
   • PSP ENA – ITEM 1 EXEC (1)

2  Forward link reacquisition
   (A1L)
   • S–BD PL FREQ SWEEP – ON (hold 45 sec)
   • MOD – ON
   • CNTL – CMD

3  Return link reacquisition
   SM 210 HST SYS
   • XMTR 1 ON CDI–A(B) – ITEM 3 +1(2) EXEC
   SM 62 PCMMU/PL COMM
   • PL INTRG PHASE LOCK – YES
   • Log PL SIG STR: __________________

4  HST tlm verification
   SM 210 HST SYS
   • MOD ON CDI–A(B) – ITEM 5 +1(2) EXEC

5  HST tlm verification
   SM 210 HST SYS
   • TLM COUNT – incr
   • Log MET: ______/______:______:______

1  STOC 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

2 Return link reacquisition
SM 210 HST SYS
• XMTR 1 ON CDI–A(B) – ITEM 3 +1(2) EXEC
SM 62 PCMMU/PL COMM
• √ PL INTRG PHASE LOCK – YES
• Log PL SIG STR:
_______________________

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)

4 HST tlm verification
SM 210 HST SYS
• MOD ON CDI–A(B) – ITEM 5 +1(2) EXEC
• √ TLM COUNT – incr
• Log MET:
____/____:
____:

5 Reload PDI switch matrix for alternate
(A1L)
• 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 (*)
PD1: (DECOM 1)
• SEL DECOM – ITEM 9 +1 EXEC
• INPUT – ITEM 12 +2(1) EXEC
• LOAD – ITEM 13 EXEC
PD1: (DECOM 2)
• SEL DECOM – ITEM 9 +2 EXEC
• INPUT – ITEM 12 +2(1) EXEC
• LOAD – ITEM 13 EXEC
PD1: (DECOM 3)
• SEL DECOM – ITEM 9 +3 EXEC
• INPUT – ITEM 12 +2(1) EXEC
• LOAD – ITEM 13 EXEC
PD1: (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

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

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

*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
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

OBJECTIVE: To recover onboard payload tlm by reversing polarity of telemetry signal coming from PI #1(PI #2)

LOCATION: PDIP (J101(J103)) on panel L12L

TOOLS REQD: Gray Tape
Pin Kit

A1L
1. √S–BD PL PWR SEL – BOTH
   √SYS – 1(2)
2. Obtain two 5–in (22 ga) Pin/Pin Test Jumper Leads from Pin Kit
3. Demate connector from J101(J103) on PDIP
4. Install 5–in (22 ga) Pin/Pin Test Jumper Leads into following socket positions on J101(J103)

PDIP
5. Secure Jumpers with Gray Tape
6. Notify MCC: IFM complete
7. Stow tools

J101(J103)
CRITICAL EQUIPMENT LOST

BUS LOSS MATRIX .......................................................... 6–2
MDM BUS LOSS IMPACTS .................................................. 6–3
## BUS LOSS MATRIX

<table>
<thead>
<tr>
<th>STS–109 BUS LOSS MATRIX</th>
<th>CNTL</th>
<th>ESS</th>
<th>MNA DA1</th>
<th>MNB DA2</th>
<th>FC3</th>
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</tbody>
</table>

### Notes
- X – TOTAL LOSS OF CONTROL
- P – LOSS OF PRIMARY PWR SOURCE
- R – LOSS OF REDUNDANT PWR SOURCE
- PC – LOSS OF PRIMARY CONTROL SOURCE
- RC – LOSS OF REDUNDANT CONTROL SOURCE
- (R) – REQUIRES SWITCH ACTION TO REGAIN REDUNDANCY
- ① PCU CONTR (PPCU A PWR), FSS FMDM–A, CCTV HTR, FSS HTR PWR PRI
- ② PCU CONTR (SPCU A/B PWR, PPCU B PWR), FSS FMDM–B, FSS HTR PWR RED
- ③ ASIPE A HTR, SAP A HTR, OPA A HTR, EPDSU A HTR
- ④ ASIPE B HTR, SAP B HTR, OPA B HTR, EPDSU B HTR
- ⑤ MULE FMDM–B, SURV B HTR, ESM B HTR, SOPE B HTR
- ⑥ MULE FMDM–A, SURV A HTR, ESM A HTR, SOPE A HTR
- ⑦ ENABLE 1 AND ENABLE 2 REQD FOR EACH SYSTEM
- **NOTE:** IF BUS NOT SHOWN, NO STS–109 IMMEDIATE IMPACT IS FELT IF BUS IS LOST

**PL Sys/109/FIN A**
### 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 FMDDM 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 FMDDM CHANNELIZATION CHART)

#### MULE FMDDM A(B)
- TLM INDICATIONS VIA S211 (FOR MORE DETAIL SEE MULE FMDDM CHANNELIZATION CHARTS)
FMDM CHANNELIZATION

FSS FMDM ANALOG INPUT CARDS ................................................................. 7–2
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PF02 ANALOG INPUT CARDS ................................................................. 7–8
  DISCRETE INPUT CARDS .................................................................... 7–8
# FSS FMDM Analog Input Cards

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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**

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<td>KEEL LATCH JAW 2 SELECT</td>
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<td>DPC 4 ON CNTL (OFF–4051)</td>
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<td>P34K4003J</td>
<td>PIVOTER LOW TORQUE SELECT</td>
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<td>P34K4056J</td>
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<td>CCTV PWR ENABLE 2 (DSBL–4040)</td>
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* 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

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<td>DPC 2 ON/OFF STATUS</td>
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# MULE FMDM ANALOG INPUT CARDS

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* 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

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7–6

PL SYS/109/FIN A
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CRT DISPLAYS

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**PARAMETER CHARACTERISTICS: SM 210 HST SYS**

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<td>–V3</td>
<td>P34X3099E</td>
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<td>P34X3100E</td>
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## PARAMETER CHARACTERISTICS: SM 210 HST SYS (Cont)

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<tr>
<th>CRT NAME</th>
<th>MSID</th>
<th>HST SRC</th>
<th>UNITS</th>
<th>DISPLAY RANGE</th>
<th>STATUS INDICATORS</th>
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<td>HGA LAT +V3</td>
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<td>P34X3094E/</td>
<td>DIU 4</td>
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<td>P34X3067E</td>
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<td>P34X3212E/</td>
<td>DIU 2</td>
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<td>P34X3029E/</td>
<td>DIU 5</td>
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<tr>
<td>3 STAT</td>
<td>P34X3025E/</td>
<td>DIU 5</td>
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<td>SPA (A)</td>
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<td>DIU 2</td>
<td>event</td>
<td>blank or A</td>
<td></td>
</tr>
</tbody>
</table>
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:  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.
### PARAMETER CHARACTERISTICS: SM 211 SSE OVERVIEW

<table>
<thead>
<tr>
<th>CRT NAME</th>
<th>MSID</th>
<th>UNITS</th>
<th>DISPLAY RANGE</th>
<th>STATUS INDICATORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCU (P)</td>
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<td>event</td>
<td>blank, P, &quot;*&quot;</td>
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<td>(S)</td>
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<td>event</td>
<td>blank, S, &quot;*&quot;</td>
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<td>blank or &quot;*&quot;</td>
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<td>P34K4024Y/P34K4026Y/P34K4028Y/P34K4030Y/P34K4052Y/P34K4060Y</td>
<td>event</td>
<td>blank or &quot;*&quot;</td>
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<tr>
<td>CRT NAME</td>
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<td>UNITS</td>
<td>DISPLAY RANGE</td>
<td>STATUS INDICATORS</td>
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<td>P34X8411Y</td>
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<td>P34X2047Y</td>
<td>event</td>
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</tr>
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<td>2</td>
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<td>1 VOLTS</td>
<td>P34V2028V</td>
<td>volts</td>
<td>0.0 to 40.0</td>
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<td>P34V2029V</td>
<td>volts</td>
<td>0.0 to 40.0</td>
<td>M</td>
</tr>
<tr>
<td>1 AMPS</td>
<td>P34C2008V</td>
<td>amps</td>
<td>0.0 to 20.0</td>
<td>M</td>
</tr>
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<td>0.0 to 20.0</td>
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<td>P34X2049Y</td>
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<td>3 VOLTS</td>
<td>P34V2030V</td>
<td>volts</td>
<td>0.0 to 40.0</td>
<td>M</td>
</tr>
<tr>
<td>4 VOLTS</td>
<td>P34V2031V</td>
<td>volts</td>
<td>0.0 to 40.0</td>
<td>M</td>
</tr>
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<td>P34C2010V</td>
<td>amps</td>
<td>0.0 to 20.0</td>
<td>M</td>
</tr>
<tr>
<td>4 AMPS</td>
<td>P34C2011V</td>
<td>amps</td>
<td>0.0 to 20.0</td>
<td>M</td>
</tr>
<tr>
<td>5</td>
<td>P34X2050Y</td>
<td>event</td>
<td>blank or &quot;*&quot;</td>
<td>M</td>
</tr>
<tr>
<td>6</td>
<td>P34X2120Y</td>
<td>event</td>
<td>blank or &quot;*&quot;</td>
<td>M</td>
</tr>
<tr>
<td>5 VOLTS</td>
<td>P34V2032V</td>
<td>volts</td>
<td>0.0 to 40.0</td>
<td>M</td>
</tr>
<tr>
<td>6 VOLTS</td>
<td>P34V2033V</td>
<td>volts</td>
<td>0.0 to 40.0</td>
<td>M</td>
</tr>
<tr>
<td>5 AMPS</td>
<td>P34C2012V</td>
<td>amps</td>
<td>0.0 to 20.0</td>
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</tr>
<tr>
<td>6 AMPS</td>
<td>P34C2013V</td>
<td>amps</td>
<td>0.0 to 20.0</td>
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<tr>
<td>7</td>
<td>P34X2051Y</td>
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<tr>
<td>8</td>
<td>P34X2052Y</td>
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</tr>
<tr>
<td>7 VOLTS</td>
<td>P34V2034V</td>
<td>volts</td>
<td>0.0 to 40.0</td>
<td>M</td>
</tr>
<tr>
<td>8 VOLTS</td>
<td>P34V2035V</td>
<td>volts</td>
<td>0.0 to 40.0</td>
<td>M</td>
</tr>
<tr>
<td>7 AMPS</td>
<td>P34C2014V</td>
<td>amps</td>
<td>0.0 to 20.0</td>
<td>M</td>
</tr>
<tr>
<td>8 AMPS</td>
<td>P34C2015V</td>
<td>amps</td>
<td>0.0 to 20.0</td>
<td>M</td>
</tr>
<tr>
<td>9</td>
<td>P34X2053Y</td>
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<td>blank or &quot;*&quot;</td>
<td>M</td>
</tr>
<tr>
<td>10</td>
<td>P34X2121Y</td>
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<td>blank or &quot;*&quot;</td>
<td>M</td>
</tr>
<tr>
<td>9 VOLTS</td>
<td>P34V2036V</td>
<td>volts</td>
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<td>M</td>
</tr>
<tr>
<td>10 VOLTS</td>
<td>P34V2037V</td>
<td>volts</td>
<td>0.0 to 40.0</td>
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</tr>
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<td>P34C2016V</td>
<td>amps</td>
<td>0.0 to 20.0</td>
<td>M</td>
</tr>
<tr>
<td>10 AMPS</td>
<td>P34C2017V</td>
<td>amps</td>
<td>0.0 to 20.0</td>
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<td>P34X2054Y</td>
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</tr>
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<td>12</td>
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<td>blank or &quot;*&quot;</td>
<td>M</td>
</tr>
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<td>11 VOLTS</td>
<td>P34V2038V</td>
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</tr>
<tr>
<td>12 VOLTS</td>
<td>P34V2039V</td>
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<td>0.0 to 40.0</td>
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</tr>
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<td>P34C2018V</td>
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<td>0.0 to 20.0</td>
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</tr>
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<td>12 AMPS</td>
<td>P34C2019V</td>
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<td>0.0 to 20.0</td>
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</tr>
<tr>
<td>ON</td>
<td>P93J0100C</td>
<td>echo fb of item entry</td>
<td></td>
<td></td>
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<tr>
<td>OFF</td>
<td>P93J0101C</td>
<td>echo fb of item entry</td>
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### PARAMETER CHARACTERISTICS: SM 211 SSE OVERVIEW (Cont)

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<tr>
<th>CRT NAME</th>
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<th>UNITS</th>
<th>DISPLAY RANGE</th>
<th>STATUS INDICATORS</th>
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<tr>
<td><strong>POWER:</strong></td>
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<tr>
<td>FSS EPDSU 1 AMPS</td>
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<td>amps</td>
<td>–0.3 to 150.0</td>
<td>M H L</td>
</tr>
<tr>
<td>2 AMPS</td>
<td>P34C2116V</td>
<td>amps</td>
<td>–0.6 to 150.0</td>
<td>M H L</td>
</tr>
<tr>
<td>FMMD A AMPS</td>
<td>P34C2115V</td>
<td>amps</td>
<td>0.0 to 5.0</td>
<td>M H L</td>
</tr>
<tr>
<td>B AMPS</td>
<td>P34C2022V</td>
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<td>M H L</td>
</tr>
<tr>
<td>HTR (1)</td>
<td>P34X2082Y</td>
<td>event</td>
<td>blank or 1</td>
<td>M</td>
</tr>
<tr>
<td>(2)</td>
<td>P34X2083Y</td>
<td>event</td>
<td>blank or 2</td>
<td>M</td>
</tr>
<tr>
<td>A1 AMPS</td>
<td>P34C2026V</td>
<td>amps</td>
<td>0.0 to 20.0</td>
<td>M H L ↑</td>
</tr>
<tr>
<td>A2 AMPS</td>
<td>P34C2027V</td>
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<td>0.0 to 20.0</td>
<td>M H L ↑</td>
</tr>
<tr>
<td>B1 AMPS</td>
<td>P34C2024V</td>
<td>amps</td>
<td>0.0 to 20.0</td>
<td>M H L ↑</td>
</tr>
<tr>
<td>B2 AMPS</td>
<td>P34C2114V</td>
<td>amps</td>
<td>0.0 to 20.0</td>
<td>M H L ↑</td>
</tr>
<tr>
<td>CCTV HTR AMPS</td>
<td>P34C2095V</td>
<td>amps</td>
<td>0.0 to 5.0</td>
<td>M H L</td>
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<tr>
<td>MULE FMDM A AMPS</td>
<td>P34C8109V</td>
<td>amps</td>
<td>0.0 to 5.0</td>
<td>M H L</td>
</tr>
<tr>
<td>B AMPS</td>
<td>P34C814V</td>
<td>amps</td>
<td>0.0 to 5.0</td>
<td>M H L</td>
</tr>
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<td>HTR</td>
<td>P34X8411Y</td>
<td>event</td>
<td>blank or *</td>
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</tr>
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<td>HTR AMPS</td>
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<td>amps</td>
<td>0.0 to 20.0</td>
<td>M H L ↑</td>
</tr>
<tr>
<td>ESM 1&amp;2 AMPS</td>
<td>P34C8107V</td>
<td>amps</td>
<td>0.0 to 5.0</td>
<td>M H L ↑</td>
</tr>
<tr>
<td>3 AMPS</td>
<td>P34C8111V</td>
<td>amps</td>
<td>0.0 to 5.0</td>
<td>M H L ↑</td>
</tr>
<tr>
<td>SOPE 1A AMPS</td>
<td>P34C8112V</td>
<td>amps</td>
<td>0.0 to 20.0</td>
<td>M H L ↑</td>
</tr>
<tr>
<td>2A AMPS</td>
<td>P34C8107V</td>
<td>amps</td>
<td>0.0 to 20.0</td>
<td>M H L ↑</td>
</tr>
<tr>
<td>1B&amp;2B AMPS</td>
<td>P34C8115V</td>
<td>amps</td>
<td>0.0 to 20.0</td>
<td>M H L ↑</td>
</tr>
<tr>
<td>3A AMPS</td>
<td>P34C8113V</td>
<td>amps</td>
<td>0.0 to 20.0</td>
<td>M H L ↑</td>
</tr>
<tr>
<td>3B AMPS</td>
<td>P34C8116V</td>
<td>amps</td>
<td>0.0 to 20.0</td>
<td>M H L ↑</td>
</tr>
<tr>
<td>SAC EPDSU AMPS</td>
<td>P34C5206V</td>
<td>amps</td>
<td>–1.2 to 150.0</td>
<td>M H L ↑</td>
</tr>
<tr>
<td><strong>THERMAL:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FSS EPDSU (1) TEMP</td>
<td>P34T2004V</td>
<td>deg C</td>
<td>–30 to 60</td>
<td>M H L</td>
</tr>
<tr>
<td>(2) TEMP</td>
<td>P34T2007V</td>
<td>deg C</td>
<td>–30 to 60</td>
<td>M H L</td>
</tr>
<tr>
<td>FMMD (A) TEMP</td>
<td>P34T2001V</td>
<td>deg C</td>
<td>–55 to 120</td>
<td>M H L</td>
</tr>
<tr>
<td>(B) TEMP</td>
<td>P34T2002V</td>
<td>deg C</td>
<td>–55 to 120</td>
<td>M H L</td>
</tr>
<tr>
<td>PCU (P) TEMP</td>
<td>P34T2005V</td>
<td>deg C</td>
<td>–30 to 60</td>
<td>M H L</td>
</tr>
<tr>
<td>(S) TEMP</td>
<td>P34T2006V</td>
<td>deg C</td>
<td>–30 to 60</td>
<td>M H L</td>
</tr>
<tr>
<td>IPCU TEMP</td>
<td>P34T2093V</td>
<td>deg C</td>
<td>–30 to 60</td>
<td>M H L</td>
</tr>
<tr>
<td>AMSB TEMP</td>
<td>P34T2003V</td>
<td>deg C</td>
<td>–30 to 60</td>
<td>M H L</td>
</tr>
<tr>
<td>MULE PDSU TEMP</td>
<td>P34T8119V</td>
<td>deg C</td>
<td>–30 to 60</td>
<td>M H L</td>
</tr>
<tr>
<td>FMMD (A) TEMP</td>
<td>P34T8120V</td>
<td>deg C</td>
<td>–55 to 120</td>
<td>M H L</td>
</tr>
<tr>
<td>(B) TEMP</td>
<td>P34T8121V</td>
<td>deg C</td>
<td>–55 to 120</td>
<td>M H L</td>
</tr>
<tr>
<td>SAC EPDSU TEMP (1)</td>
<td>P34T5221V</td>
<td>deg C</td>
<td>–30 to 60</td>
<td>M H L</td>
</tr>
<tr>
<td>(2)</td>
<td>P34T5205V</td>
<td>deg C</td>
<td>–30 to 60</td>
<td>M H L</td>
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<tr>
<td>FSS EPDSU (1) VOLTS</td>
<td>P34V2040V</td>
<td>volts</td>
<td>0.0 to 40.0</td>
<td>M H L</td>
</tr>
<tr>
<td>(2) VOLTS</td>
<td>P34V2014V</td>
<td>volts</td>
<td>0.0 to 40.0</td>
<td>M H L</td>
</tr>
<tr>
<td>MULE PDSU VOLTS</td>
<td>P34V8122V</td>
<td>volts</td>
<td>0.0 to 40.0</td>
<td>M H L</td>
</tr>
<tr>
<td>SAC EPDSU VOLTS (1)</td>
<td>P34V5208V</td>
<td>volts</td>
<td>0.0 to 40.0</td>
<td>M H L</td>
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<tr>
<td>(2)</td>
<td>P34V5216V</td>
<td>volts</td>
<td>0.0 to 40.0</td>
<td>M H L</td>
</tr>
</tbody>
</table>
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:

<table>
<thead>
<tr>
<th>ON ITEM 23+</th>
<th>OFF ITEM 24+</th>
<th>DPC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>71</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>72</td>
<td>2</td>
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<td>73</td>
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<td>11</td>
<td>81</td>
<td>11</td>
</tr>
<tr>
<td>12</td>
<td>82</td>
<td>12</td>
</tr>
</tbody>
</table>

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.
<table>
<thead>
<tr>
<th>CRT NAME</th>
<th>MSID</th>
<th>UNITS</th>
<th>DISPLAY RANGE</th>
<th>STATUS INDICATORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMSB ON</td>
<td>P34X2076Y/P34X2077Y</td>
<td>event</td>
<td>A, B, blank, or ‘*’</td>
<td>M</td>
</tr>
<tr>
<td>OFF</td>
<td>P34X2076Y/P34X2077Y</td>
<td>event</td>
<td>A, B, blank, or ‘*’</td>
<td>M</td>
</tr>
<tr>
<td>DC AMPS</td>
<td>P34C2025V</td>
<td>amps</td>
<td>–1.0 to 5.0</td>
<td>M H L ↑ ↓</td>
</tr>
<tr>
<td>AC AMPS</td>
<td>P34C2111V</td>
<td>amps</td>
<td>0.0 to 5.0</td>
<td>M H L ↑ ↓</td>
</tr>
<tr>
<td>TEMP</td>
<td>P34T2003V</td>
<td>deg C</td>
<td>–30 to 60</td>
<td>M H L ↑ ↓</td>
</tr>
<tr>
<td>MECH (A)</td>
<td>V54X8111E/V54X8113E/V54S8400E/V54S8402E</td>
<td>event</td>
<td>A, A flash, blank</td>
<td></td>
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<tr>
<td>MECH (B)</td>
<td>V54X8122E/V54X8124E/V54S8400E/V54S8402E</td>
<td>event</td>
<td>B, B flash, blank</td>
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<tr>
<td>DLOCK SEL STAT</td>
<td>P34X2064Y</td>
<td>event</td>
<td>blank or ‘*’</td>
<td>M \downarrow</td>
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<tr>
<td>PIVOT HI SEL STAT</td>
<td>P34X2061Y/P34X2067Y/P34X2087Y/P34X2089Y/P34X2090Y</td>
<td>event</td>
<td>RDY, DN, UP, ‘*’; blank</td>
<td>M ↓</td>
</tr>
<tr>
<td>PIVOT LO SEL STAT</td>
<td>P34X2060Y/P34X2067Y/P34X2087Y/P34X2089Y/P34X2090Y</td>
<td>event</td>
<td>blank or ‘*’</td>
<td>M ↓</td>
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<tr>
<td>TACH</td>
<td>P34R2108V</td>
<td>deg/min</td>
<td>0.0 to 5.3</td>
<td>M H L \downarrow</td>
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PARAMETER CHARACTERISTICS: SM 212 SSE MECHANISMS
### PARAMETER CHARACTERISTICS: SM 212 SSE MECHANISMS (Cont)

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<th>STATUS INDICATORS</th>
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<td>event</td>
<td>blank or &quot;*&quot;</td>
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</tr>
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<td>STAT</td>
<td>P34X2062Y/</td>
<td>event</td>
<td>RDY, CCW, CW, &quot;*&quot;, blank</td>
<td></td>
</tr>
<tr>
<td></td>
<td>P34X2087Y/</td>
<td></td>
<td></td>
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<td>P34X2088Y/</td>
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<td>P34X2089Y/</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>P34X2090Y/</td>
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<td>P34R2109V</td>
<td>deg/min</td>
<td>0.0 to 18.0</td>
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</tr>
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<td>P34X2063Y</td>
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</tr>
<tr>
<td>STAT</td>
<td>P34X2063Y/</td>
<td>event</td>
<td>RDY, FWD, AFT, &quot;*&quot;, blank</td>
<td></td>
</tr>
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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:

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

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 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.
## FDA CHARACTERISTICS: SM 210 HST SYS

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<th>Rate</th>
<th>SM Param ID</th>
<th>Sensed Parameter</th>
<th>Preconditions</th>
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<td>DCE +WING MOTOR OPER = NO–OP&lt;br&gt;DCE MAIN FAIL FLAG = *NOFA or&lt;br&gt;DCE RED FAIL FLAG = *NOFA</td>
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## FDA CHARACTERISTICS: SM 211 SSE OVERVIEW

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<td>BERTH LATCH 1 SEL STATUS</td>
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<th>Preconditions</th>
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<td>BERTH LAT 2 SEL STATUS = DSBL, B LAT 3 = ENBL or UMB MN = ENBL</td>
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<td>212 MECH SEL</td>
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<td>BERTH LAT 3 SEL STATUS = DSBL, UMB MN = ENBL</td>
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<td>212 ROT STALL</td>
<td>3</td>
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<td>ROTATOR SEL STATUS = DSBL, ROTATOR SEL STATUS = ENBL and AMSB AC CURRENT = OL</td>
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*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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<p>| REF DATA |
|-------------------------|------------|
| SA-II JETTISON MANAGEMENT | 10–2 |
| HST MECHANISM MOVEMENT TIMES | 10–3 |
| FSS MECHANISM DRIVE TIMES | 10–3 |
| SSP 1 | 10–4 |
| SWITCH PANEL FUNCTIONS (L12U) | 10–4 |
| SSP 2 | 10–11 |
| SWITCH PANEL FUNCTIONS (L12L) | 10–11 |
| SSP 3 | 10–14 |
| SWITCH PANEL FUNCTIONS (L11U) | 10–14 |</p>
<table>
<thead>
<tr>
<th>−V2 SA2 wing state</th>
<th>+V2 SA2 wing action</th>
<th>HST State (FD03)</th>
<th>FD4 action</th>
<th>HST State (FD04)</th>
<th>FD5 action</th>
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<td>Rolled up</td>
<td>Roll up OK</td>
<td>Safe for deploy</td>
<td>Stow &amp; Replace −V2 wing</td>
<td>Safe for deploy</td>
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<tr>
<td>1b</td>
<td>Rolled up</td>
<td>Roll up fails:</td>
<td>Safe for deploy</td>
<td>Stow &amp; Replace −V2 wing</td>
<td>Safe for deploy</td>
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<tr>
<td></td>
<td>Stuck, useable</td>
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</tr>
<tr>
<td>1c</td>
<td>Rolled up</td>
<td>Roll up fails:</td>
<td>HST nondeployable FD3</td>
<td>Jettison &amp; Replace +V2 wing</td>
<td>Safe for deploy</td>
</tr>
<tr>
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<td>Stuck, unusable</td>
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<td>2a</td>
<td>Stuck, useable</td>
<td>Roll up OK</td>
<td>Safe for deploy</td>
<td>Jettison &amp; Replace −V2 wing</td>
<td>Safe for deploy</td>
</tr>
<tr>
<td>2b</td>
<td>Stuck, useable</td>
<td>Roll up fails:</td>
<td>Safe for deploy</td>
<td>Jettison &amp; Replace −V2 wing</td>
<td>Safe for deploy</td>
</tr>
<tr>
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<td>Stuck, useable</td>
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<tr>
<td>2c</td>
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<td>Roll up fails:</td>
<td>HST nondeployable FD3</td>
<td>Jettison &amp; Replace +V2 wing</td>
<td>Safe for deploy</td>
</tr>
<tr>
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<td>Stuck, unusable</td>
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<tr>
<td>3a</td>
<td>Stuck, unusable</td>
<td>Roll up OK</td>
<td>HST nondeployable FD3</td>
<td>Jettison &amp; Replace −V2 wing</td>
<td>Safe for deploy</td>
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<tr>
<td>3b</td>
<td>Stuck, unusable</td>
<td>Roll up fails:</td>
<td>HST nondeployable FD3</td>
<td>Jettison &amp; Replace −V2 wing</td>
<td>Safe for deploy</td>
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<td></td>
<td>Stuck, useable</td>
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<tr>
<td>3c</td>
<td>Stuck, unusable</td>
<td>Roll up fails:</td>
<td>HST nondeployable FD3</td>
<td>Jettison &amp; Replace −V2 wing</td>
<td>Safe for deploy</td>
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### HST MECHANISM MOVEMENT TIMES

<table>
<thead>
<tr>
<th>MECHANISM</th>
<th>NOMINAL TIME</th>
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</thead>
<tbody>
<tr>
<td>SDM (deploy/retract)</td>
<td>5 min</td>
</tr>
<tr>
<td>SSM LATCHES (latch/unlatch)</td>
<td>136 sec</td>
</tr>
<tr>
<td>AD (open/close)</td>
<td>140 sec</td>
</tr>
<tr>
<td>HGA (deploy/retract)</td>
<td>461 sec</td>
</tr>
<tr>
<td>SA LATCH SLEW</td>
<td>&gt; 11 min</td>
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</tbody>
</table>

### FSS MECHANISM DRIVE TIMES

<table>
<thead>
<tr>
<th>MECHANISM</th>
<th>NOMINAL TIME (single)</th>
</tr>
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<tbody>
<tr>
<td>PIVOTER</td>
<td>1428 sec ± 90 sec/90° (3.78°/min)</td>
</tr>
<tr>
<td>ROTATOR</td>
<td>731 sec ± 19 sec/180° (14.77°/min)</td>
</tr>
<tr>
<td>TRANSLATOR</td>
<td>170 sec ± 5 sec/1.75 in</td>
</tr>
<tr>
<td>DOWNLOCK</td>
<td>24 sec ± 2 sec</td>
</tr>
<tr>
<td>BERTH LATCH</td>
<td>18 sec ± 2 sec</td>
</tr>
<tr>
<td>MAIN UMB</td>
<td>8 sec ± 1 sec/4.5 in stroke (mate/demate)</td>
</tr>
<tr>
<td>B/U UMB</td>
<td>4 sec ± 1 sec (demate only)</td>
</tr>
<tr>
<td>BSP</td>
<td>~1 sec</td>
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### SSP 1 SWITCH PANEL FUNCTIONS (L12U)

<table>
<thead>
<tr>
<th>ITEM</th>
<th>TYPE DEVICE</th>
<th>FUNCTION</th>
<th>USAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCU POWER CONTR–B Switch (S3 – SSP 1)</td>
<td>Toggle switch, 2–position DPST</td>
<td>ON (UP) – Enables the B hardline control signal to EPDSU–1 and EPDSU–2, providing power to the PCUs&lt;br&gt;OFF (DOWN) – Disables the B control signal to EPDSU–1 and EPDSU–2, removing power to the PCUs</td>
<td>Not normally used. PCUs will normally be controlled via FMDM&lt;br&gt;NOTE: The power on/off indication is observed on telemetry</td>
</tr>
<tr>
<td>PCU POWER CONTR–A Switch (S4 – SSP 1)</td>
<td>Toggle switch, 2–position DPST</td>
<td>ON (UP) – Enables the A hardline control signal to EPDSU–1 and EPDSU–2, providing power to the PCUs&lt;br&gt;OFF (DOWN) – Disables the A control signal to EPDSU–1 and EPDSU–2, removing power to the PCUs</td>
<td>Not normally used. PCUs will normally be controlled via FMDM&lt;br&gt;NOTE: The power on/off indication is observed on telemetry</td>
</tr>
<tr>
<td>FSS A SIDE PWR Circuit breaker (CB2 – SSP 1)</td>
<td>Circuit breaker</td>
<td>OUT – Open&lt;br&gt;IN – Closed&lt;br&gt;NOTE: FSS B side power is hardwired</td>
<td>Closed during SSE activation&lt;br&gt;5–amp circuit breaker which routes orbiter power to S4, S6, S8, S10, and S12 (UP)</td>
</tr>
<tr>
<td>ITEM</td>
<td>TYPE DEVICE</td>
<td>FUNCTION</td>
<td>USAGE</td>
</tr>
<tr>
<td>------</td>
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<tr>
<td>CCTV HTR PWR Switch (S8 – SSP 1)</td>
<td>Toggle switch, 2–position DPST</td>
<td>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</td>
<td>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)</td>
</tr>
<tr>
<td>CCTV HTR PWR Status Indicator (DS8 – SSP 1)</td>
<td>Display indicator, 2–position</td>
<td>ON – gray OFF – bp</td>
<td>Status indicator</td>
</tr>
<tr>
<td>FSS FMDM–A PWR Switch (S10 – SSP 1)</td>
<td>Toggle switch, 2–position DPST</td>
<td>ON (UP) – Enables EPDSU–1 power to FMDM–A OFF (DOWN) – Disables EPDSU–1 power to FMDM–A</td>
<td>Turned on during SSE check–out for continuous control and monitoring of FSS. Turned off during SSE deactivation</td>
</tr>
<tr>
<td>FSS FMDM–A PWR Status Indicator (DS10 – SSP 1)</td>
<td>Display indicator, 2–position</td>
<td>ON – gray OFF – bp</td>
<td>Status indicator</td>
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<tr>
<td>FSS FMDM–B PWR Switch (S11 – SSP 1)</td>
<td>Toggle switch, 2–position DPST</td>
<td>ON (UP) – Enables EPDSU–2 power to FMDM–B OFF (DOWN) – Disables EPDSU–2 power to FMDM–B</td>
<td>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</td>
</tr>
<tr>
<td>FSS FMDM–B PWR Status Indicator (DS11 – SSP 1)</td>
<td>Display indicator, 2–position</td>
<td>ON – gray OFF – bp</td>
<td>Status indicator</td>
</tr>
<tr>
<td>ITEM</td>
<td>TYPE DEVICE</td>
<td>FUNCTION</td>
<td>USAGE</td>
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<tr>
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<tr>
<td>FSS HTR PWR Switch (S12 – SSP 1)</td>
<td>Toggle switch, 3–position DPDT</td>
<td>PRI (UP) – Enables EPDSU–1 and EPDSU–2 power to primary FSS heater circuits. This allows thermostatic control of primary FSS heaters&lt;br&gt;OFF (CENTER) – Disables EPDSU–1 and EPDSU–2 power from FSS primary heater and redundant heater circuits&lt;br&gt;RED (DOWN) – Enables EPDSU–1 and EPDSU–2 power to redundant FSS heater circuits. This allows thermostatic control of redundant FSS heaters</td>
<td>Turned on during SSE activation (no later than 8 hr after PLBD opening). Monitor current sensors A1 and B1 for primary heaters&lt;br&gt;Turned off during SSE deactivation (no earlier than 1 hr prior to reentry)&lt;br&gt;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</td>
</tr>
<tr>
<td>FSS HTR PWR Status Indicator (DS12 – SSP 1)</td>
<td>Display indicator, 2–position</td>
<td>ON (PRI or RED)– gray&lt;br&gt;OFF – bp</td>
<td>Status indicator</td>
</tr>
<tr>
<td>ESSENTIAL BUS EXTERNAL POWER Switch (S13 – SSP 1)</td>
<td>Toggle switch, 3–position DPDT momentary (should be held for approximately 2 sec)</td>
<td>ON (momentary UP) – Enables IPCU power latching relays K6 and K7 that provide FSS IPCU power to HST external essential bus feeds A and B. Relay K6 powers HST external essential bus A and relay K7 powers bus B&lt;br&gt;Center Position – Normal&lt;br&gt;OFF (momentary DOWN) – Disables IPCU power latching relays K6 and K7. This action disconnects FSS IPCU power from HST external essential bus A and B feeds and connects HST battery power (internal) to HST essential buses A,B, and C</td>
<td>Used to provide FSS IPCU power to HST external essential buses thru FSS umbilicals. Essential buses power the HST DMU CDIs and MA receivers. S13 is powered from S18&lt;br&gt;Normal switch position when not in use&lt;br&gt;Used to remove FSS IPCU power from HST essential buses. Removal of FSS IPCU 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</td>
</tr>
<tr>
<td>ESSENTIAL BUS EXTERNAL POWER Status (DS13 – SSP 1)</td>
<td>Display indicator, 3–position</td>
<td>ON – UP&lt;br&gt;OFF – bp&lt;br&gt;DOWN indication not used for HST</td>
<td>UP indicates that at least one external essential bus power service is activated inside the HST PCU. Indicates continuity thru HST umbilicals</td>
</tr>
<tr>
<td>ITEM</td>
<td>TYPE DEVICE</td>
<td>FUNCTION</td>
<td>USAGE</td>
</tr>
<tr>
<td>------</td>
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<tr>
<td><strong>ESSENTIAL BUS INTERNAL POWER Switch (S14 – SSP 1)</strong></td>
<td>Toggle switch, 3–position DPDT momentary (should be held for approximately 1 sec)</td>
<td>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</td>
<td>Used to configure HST essential bus to internal battery power following PCU changeout</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Center Position – Normal</td>
<td>Normal switch position when not in use</td>
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<tr>
<td></td>
<td></td>
<td>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</td>
<td>Used to remove internal essential power when external (FSS PCU) power is provided. S14 is powered from S18</td>
</tr>
<tr>
<td><strong>NOTE:</strong> 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</td>
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<tr>
<td><strong>ESSENTIAL BUS INTERNAL POWER Status (DS14 – SSP 1)</strong></td>
<td>Display indicator, 3–position</td>
<td>ON – UP</td>
<td>UP indicates that at least one internal essential bus power is activated inside the HST PCU. Indicates continuity thru HST umbilicals</td>
</tr>
<tr>
<td></td>
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<td>OFF – bp DOWN indicator not used for HST</td>
<td></td>
</tr>
<tr>
<td><strong>FHST SHUTTER Switch (S15 – SSP 1)</strong></td>
<td>Toggle switch, 2–position DPST</td>
<td>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)</td>
<td>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</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>NOTE:</strong> The IPCU is externally jumpered to provide this capability</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>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</td>
<td>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</td>
</tr>
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### SSP 1 SWITCH PANEL FUNCTIONS (L12U) (Cont)

<table>
<thead>
<tr>
<th>ITEM</th>
<th>TYPE</th>
<th>DEVICE</th>
<th>FUNCTION</th>
<th>USAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>FHST SHUTTER Status (DS15 – SSP 1)</td>
<td>Display indicator, 2–position</td>
<td>CLOSE – gray</td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td>RSU SURV HTR PWR Switch (S16 – SSP 1)</td>
<td>Toggle switch, 2–position DPST</td>
<td>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.</td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td>RSU SURV HTR PWR Status (DS16 – SSP 1)</td>
<td>Display indicator, 2–position</td>
<td>CLOSE – gray</td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td>MN BUS INT PWR Switch (S17 – SSP 1)</td>
<td>Toggle switch, 3–position DPDT momentary (should be held for approximately 2 sec). (Switch cover installed to prevent inadvertent actuation of the OFF command)</td>
<td>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.</td>
<td>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.</td>
<td></td>
</tr>
</tbody>
</table>
## SSP 1 SWITCH PANEL FUNCTIONS (L12U) (Cont)

<table>
<thead>
<tr>
<th>ITEM</th>
<th>TYPE DEVICE</th>
<th>FUNCTION</th>
<th>USAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF (momentary DOWN) –</td>
<td>Display indicator, 2–position</td>
<td>ON – gray</td>
<td>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.</td>
</tr>
<tr>
<td>Enables IPCU relay K11</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>which supplies power from</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>the FSS PCUs to open</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>motorized transfer switches</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S1 thru S4. This action</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>disconnects battery power</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>from main buses A,B,C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MN BUS PWR ON Status (DS17</td>
<td>Display indicator, 2–position</td>
<td>ON – gray</td>
<td>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.</td>
</tr>
<tr>
<td>– SSP 1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ESS/MN SW ENA Switch (S18</td>
<td>Toggle switch, 2–position DPST</td>
<td>ON (UP) – Provides orbiter power thru CB4 (from PL CAB3 bus) to SSP</td>
<td>Enables use of SSP control of HST main and essential buses via S13,S14,S17,S21</td>
</tr>
<tr>
<td>– SSP 1)</td>
<td></td>
<td>switches S13,S14,S17,S21</td>
<td></td>
</tr>
<tr>
<td>ESS/MN SW ENA Status (DS18</td>
<td>Display indicator, 2–position</td>
<td>ON – gray</td>
<td>Monitor power is provided from PL CAB3 bus thru CB4.</td>
</tr>
<tr>
<td>– SSP 1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPACE TEL SW PWR Circuit</td>
<td>Circuit breaker</td>
<td>OUT – Open</td>
<td>Opened following powerdown for PCU changeout and during umbilical deadfacing at HST redeployment</td>
</tr>
<tr>
<td>Breaker (CB4 – SSP 1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EPCU RELAYS CLOSED Status</td>
<td>Display indicator, 2–position</td>
<td>ON – gray</td>
<td>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</td>
</tr>
<tr>
<td>(DS20 – SSP 1)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td>OFF – bp</td>
<td></td>
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<tr>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
### SSP 1 SWITCH PANEL FUNCTIONS (L12U) (Cont)

<table>
<thead>
<tr>
<th>ITEM</th>
<th>TYPE DEVICE</th>
<th>FUNCTION</th>
<th>USAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAIN BUS EXT PWR Switch (S21 – SSP 1)</td>
<td>Toggle switch, 3–position DPDT, momentary</td>
<td>ON (UP) – Closes motorized transfer switches S1 thru S4 in IPCU that provides orbiter power to HST main buses A and B</td>
<td>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</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Center Position – None</td>
<td>Normal switch position when not in use</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OFF (DOWN) – Opens motorized transfer switches S1 thru S4 in IPCU that provide orbiter power to the HST main buses A and B</td>
<td>Used to remove orbiter power from HST prior to PCU changeout and redeployment</td>
</tr>
<tr>
<td>MAIN BUS EXT PWR Status (DS21 – SSP 1)</td>
<td>Display indicator, 2–position</td>
<td>ON – gray</td>
<td>Status indicator. Gray indicates that at least one external main bus is powered inside the HST PCU. Indicates continuity thru HST umbilicals</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OFF – bp</td>
<td></td>
</tr>
<tr>
<td>SSM WK LIGHTS Switch (S24 – SSP 1)</td>
<td>Toggle switch, 3–position DPDT</td>
<td>ON (UP) – Enables IPCU relay K18 to provide FSS PCU power to all HST site receptacles, plus all SI latch indicator lights</td>
<td>Used to provide power to aft shroud (AS) internal/external worklight receptacles and latch indicator lights. For EVA use only</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OFF (CENTER) – Disables IPCU relays K18 and K19, removing power from all internal/external worklight receptacles and latch indicator lights</td>
<td>Used to disable power to AS internal/external worklight receptacles and latch indicator lights</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ON (DOWN) – Enables IPCU relay K19 to provide HST worklight receptacles, plus all SI latch indicator lights</td>
<td>Used to provide power to AS internal/external worklight receptacles and latch indicator lights. For EVA use only</td>
</tr>
</tbody>
</table>
## SSP 2 SWITCH PANEL FUNCTIONS (L12L)

<table>
<thead>
<tr>
<th>ITEM</th>
<th>TYPE DEVICE</th>
<th>FUNCTION</th>
<th>USAGE</th>
</tr>
</thead>
</table>
| 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 |
| ASIPE 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 ASIPE A heaters
Center Position – Normal
OFF (momentary DOWN) – Disables the EPDSU power from the thermostatically controlled ASIPE A heaters | Turned on during SSE activation
Normal switch position when not in use
Turned off during SSE deactivation |
| ASIPE HTR–A PWR Status Indicator (DS13 – SSP 2) | Display indicator, 3–position | ON – UP
OFF – bp
DN indicator not used for HST | Status Indicator |
<table>
<thead>
<tr>
<th>ITEM</th>
<th>TYPE DEVICE</th>
<th>FUNCTION</th>
<th>USAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASIPE HTR–B PWR Switch (S14 – SSP 2)</td>
<td>Toggle switch, 3–position DPDT momentary</td>
<td>ON (momentary UP) – Provides a latching signal to the SAC EPDSU. This applies power for the thermostatic control of ASIPE B heaters</td>
<td>Redundant ASIPE heaters may be activated in the event of a failure in the A side heaters</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Center Position – Normal</td>
<td>Normal switch position when not in use</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OFF (momentary DOWN) – Disables the EPDSU power from the thermostatically controlled ASIPE B heaters</td>
<td></td>
</tr>
<tr>
<td>ASIPE HTR–B PWR Status Indicator (DS14 – SSP 2)</td>
<td>Display indicator, 3–position</td>
<td>ON – UP</td>
<td>Status Indicator</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OFF – bp</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>DN indicator not used for HST</td>
<td></td>
</tr>
<tr>
<td>SAP HTR–A PWR Switch (S18 – SSP 2)</td>
<td>Toggle switch, 2–position DPDT</td>
<td>ON (UP) – Enables the SAC EPDSU. This applies power for the thermostatic control of the SAP A heaters</td>
<td>Redundant SAP heaters may be activated in the event of a failure in the B side heaters</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OFF (DOWN) – Disables the EPDSU power from the thermostatically controlled SAP A heaters</td>
<td></td>
</tr>
<tr>
<td>SAP HTR–A PWR Status Indicator (DS18 – SSP 2)</td>
<td>Display indicator, 2–position</td>
<td>ON – gray</td>
<td>Status Indicator</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OFF – bp</td>
<td></td>
</tr>
<tr>
<td>SAP HTR–B PWR Switch (S19 – SSP 2)</td>
<td>Toggle switch, 2–position DPDT</td>
<td>ON (UP) – Enables the SAC EPDSU. This applies power for the thermostatic control of the SAP B heaters</td>
<td>Turned on during SSE activation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OFF (DOWN) – Disables the EPDSU power from the thermostatically controlled SAP B heaters</td>
<td>Turned off after NCC installation</td>
</tr>
<tr>
<td>SAP HTR–B PWR Status Indicator (DS19 – SSP 2)</td>
<td>Display indicator, 2–position</td>
<td>ON – gray</td>
<td>Status Indicator</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OFF – bp</td>
<td></td>
</tr>
<tr>
<td>SAC A–SIDE PWR ENA Circuit Breaker (CB4 – SSP 2)</td>
<td>Circuit breaker (5 Amps)</td>
<td>OUT – Open</td>
<td>Closed during SSE activation. 5–amp circuit breaker that routes orbiter power to S13,S18,S22,S24 (UP)</td>
</tr>
<tr>
<td>ITEM</td>
<td>TYPE DEVICE</td>
<td>FUNCTION</td>
<td>USAGE</td>
</tr>
<tr>
<td>------</td>
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</tr>
<tr>
<td>SAC B–SIDE PWR ENA Switch (S20 – SSP 2)</td>
<td>Toggle switch, 2–position DPDT</td>
<td>ON (UP) – Provides fused orbiter power from the EPDSU to SSP switches S14,S19,S23,S24 (DN) for control of SAC B side circuits&lt;br&gt;OFF (DOWN) – Removes orbiter power from B side circuits</td>
<td>Turned on during SSE activation&lt;br&gt;Turned off during SSE deactivation</td>
</tr>
<tr>
<td>OPA HTR–A PWR Switch (S22 – SSP 2)</td>
<td>Toggle switch, 2–position DPDT</td>
<td>ON (UP) – Enables the SAC EPDSU. This applies power for the thermostatic control of the OPA A heaters&lt;br&gt;OFF (DOWN) – Disables the EPDSU power from the thermostatically controlled OPA A heaters</td>
<td>Turned on during SSE activation&lt;br&gt;Turned off after PCU–R successful Functional Test (FT)</td>
</tr>
<tr>
<td>OPA HTR–A PWR Status Indicator (DS22 – SSP 2)</td>
<td>Display indicator, 2–position</td>
<td>ON – gray&lt;br&gt;OFF – bp</td>
<td>Status Indicator</td>
</tr>
<tr>
<td>OPA HTR–B PWR Switch (S23 – SSP 2)</td>
<td>Toggle switch, 2–position DPDT</td>
<td>ON (UP) – Enables the SAC EPDSU. This applies power for the thermostatic control of the OPA B heaters&lt;br&gt;OFF (DOWN) – Disables the EPDSU power from the thermostatically controlled OPA B heaters</td>
<td>Redundant OPA heaters may be activated in the event of a failure in the A side heaters</td>
</tr>
<tr>
<td>OPA HTR–B PWR Status Indicator (DS23 – SSP 2)</td>
<td>Display indicator, 2–position</td>
<td>ON – gray&lt;br&gt;OFF – bp</td>
<td>Status Indicator</td>
</tr>
<tr>
<td>SAC EPDSU HTR PWR Switch (S24 – SSP 2)</td>
<td>Toggle switch, 3–position DPDT center off</td>
<td>A–ON (UP) – Enables the SAC EPDSU. This applies power for the thermostatic control of the EPDSU A side heaters&lt;br&gt;OFF (CENTER) – Removes power from the thermostatically controlled SAC EPDSU A and B side heaters&lt;br&gt;B–ON (DOWN) – Enables the SAC EPDSU. This applies power for the thermostatic control of the EPDSU B side heaters</td>
<td>Turned on during SSE activation&lt;br&gt;Turned off during SSE deactivation&lt;br&gt;Redundant SAC EPDSU heaters may be activated in the event of a failure in the A side heaters</td>
</tr>
<tr>
<td>SAC EPDSU HTR Status Indicator (DS24 – SSP 2)</td>
<td>Display indicator, 2–position</td>
<td>ON A or B side – gray&lt;br&gt;OFF – bp</td>
<td>Status Indicator</td>
</tr>
</tbody>
</table>
### SSP 3 SWITCH PANEL FUNCTIONS (L11U)

<table>
<thead>
<tr>
<th>ITEM</th>
<th>TYPE DEVICE</th>
<th>FUNCTION</th>
<th>USAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SW PWR Circuit Breaker (CB1 – SSP 3)</td>
<td>Circuit breaker</td>
<td>OUT – Open IN – Closed</td>
<td>5–amp circuit breaker which routes orbiter power to S8 and S11</td>
</tr>
<tr>
<td>KEEL CAMR HTR/ILLUM Switch (S8 – SSP 3)</td>
<td>Toggle switch, 2–position DPST</td>
<td>ON (UP) – Enables power to Keel camera heaters and illuminator OFF (DN) – Disables power to Keel camera heaters and illuminator</td>
<td></td>
</tr>
<tr>
<td>KEEL CAM ENABLE Switch (S11 – SSP 3)</td>
<td>Toggle switch, 2–position DPST</td>
<td>ON (UP) – Enables Keel camera controller OFF (DN) – Enables Keel camera controller</td>
<td></td>
</tr>
<tr>
<td>MULE FMDM–A PWR Switch (S15 – SSP 3)</td>
<td>Toggle switch, 2–position DPDT</td>
<td>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</td>
<td>Turned on during SSE checkout for monitoring of the MULE Turned off during SSE deactivation</td>
</tr>
<tr>
<td>MULE FMDM–A PWR Status Indicator (DS15 – SSP 3)</td>
<td>Display indicator, 2–position</td>
<td>ON – gray OFF – bp</td>
<td>Status Indicator</td>
</tr>
</tbody>
</table>
### SSP 3 SWITCH PANEL FUNCTIONS (L11U) (Cont)

<table>
<thead>
<tr>
<th>ITEM</th>
<th>TYPE DEVICE</th>
<th>FUNCTION</th>
<th>USAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MULE FMDM–B PWR Switch (S16 – SSP 3)</td>
<td>Toggle switch, 2–position DPDT</td>
<td>ON (UP) – Enables the PDSU power to FMDM–B, B–side thermistor biases, and PDSU current sensors</td>
<td>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</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OFF (DOWN) – Disables the PDSU power from FMDM–B, B–side thermistor biases, and PDSU current sensors</td>
<td>Turned off during completion of SSE checkout</td>
</tr>
<tr>
<td>MULE FMDM–B PWR Status Indicator (DS16 – SSP 3)</td>
<td>Display indicator, 2–position</td>
<td>ON – gray</td>
<td>Status Indicator</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OFF – bp</td>
<td></td>
</tr>
<tr>
<td>SURV HTR B PWR Switch (S18 – SSP 3)</td>
<td>Toggle switch, 2–position DPDT</td>
<td>ON (UP) – Enables the PDSU power to the B–side heaters: PDSU, LOPE, and avionics radiator plate</td>
<td>Turned on during SSE activation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OFF (DOWN) – Disables the PDSU power to the B–side heaters: PDSU, LOPE, and avionics radiator plate</td>
<td>Turned off during SSE checkout</td>
</tr>
<tr>
<td>SURV HTR PWR Status Indicator (DS18 – SSP 3)</td>
<td>Display indicator, 2–position</td>
<td>ON A or B side – gray</td>
<td>Status Indicator</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OFF – bp</td>
<td></td>
</tr>
<tr>
<td>SURV HTR A PWR Switch (S19 – SSP 3)</td>
<td>Toggle switch, 2–position DPDT</td>
<td>ON (UP) – Enables the PDSU power to the A–side heaters: PDSU, LOPE, and avionics radiator plate</td>
<td>Turned on during SSE checkout</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OFF (DOWN) – Disables the PDSU power to the A–side heaters: PDSU, LOPE, and avionics radiator plate</td>
<td>Turned off during SSE deactivation</td>
</tr>
<tr>
<td>MULE SW PWR Circuit Breaker (CB4 – SSP 3)</td>
<td>Circuit breaker</td>
<td>OUT – Open</td>
<td>Closed during SSE activation. 5–amp circuit breaker that routes orbiter power to S16,S18,S22,S24 (UP)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IN – Closed</td>
<td></td>
</tr>
<tr>
<td>KEEL CAMR PWR Circuit Breaker (CB3 – SSP 3)</td>
<td>Circuit breaker</td>
<td>OUT – Open</td>
<td>5–amp circuit breaker which routes orbiter power to Keel camera</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IN – Closed</td>
<td></td>
</tr>
<tr>
<td>ESM HTR A PWR Switch (S20 – SSP 3)</td>
<td>Toggle switch, 2–position DPDT</td>
<td>ON (UP) – Enables the PDSU power to ESM A–side heaters</td>
<td>Turned on during SSE checkout</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OFF (DOWN) – Disables the PDSU power from ESM A–side heaters</td>
<td>Turned off after ESM installation on HST</td>
</tr>
<tr>
<td>ITEM</td>
<td>TYPE</td>
<td>FUNCTION</td>
<td>USAGE</td>
</tr>
<tr>
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</tr>
</tbody>
</table>
| 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 |
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