International Space Station
Assembly Operations Book

ISS-4A

Mission Operations Directorate
Operations Division

November 14, 2000

Applicable @ 4A transfer
These procedures are available electronically on the SODF Homepage at http://fltproc.jsc.nasa.gov

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, Texas

NASA

United Space Alliance

USA
INTERNATIONAL SPACE STATION
ASSEMBLY OPERATIONS BOOK
ISS-4A

November 14, 2000

APPROVED BY:

_____________________________ _____________________________
Christina A. Smith
Book Manager

_____________________________ _____________________________
John A. McCullough
Debbie D. Stapleton
Lead, Cargo Support Planning Group
Chief, Cargo Integration and Operations Branch

_____________________________ _____________________________
Jeffery L. Wilson
Michael T. Hurt
SODF Coordinator
SODF Manager

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## INTERNATIONAL SPACE STATION

### ASSEMBLY OPERATIONS BOOK - 4A

#### LIST OF EFFECTIVE PAGES

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APCU
NOTE
When the shuttle is not docked to the ISS, the APCU telemetry will not be valid. Use APCU talkbacks only.

CRT
SM 200 APCU Status

1. VERIFYING ORBITER PAYLOAD BUS CONFIGURATION
   R1
   √ PL PRI MNC tb – ON
   √ PL CAB – MNB(MNA)
   √ PL AUX – ON

2. VERIFYING SWITCH POWER
   SSP1
   √ SW PWR 1 cb – CL

3. CLOSING APCU OUTPUT RELAY
   √ APCU 1(2) CONV tb – bp

   APCU 1(2) OUTPUT RLY – CL

4. TURNING APCU CONVERTER ON
   APCU 1(2) CONV – ON

   √ APCU 1(2) CONV tb – gray
   √ APCU 1(2) OUTPUT RLY tb – gray

CRT
SM 200 APCU Status

√ APCU 1(2) OUT VOLTS RES HIGH: 140 ± 4
NOTE
When the shuttle is not docked to the ISS, the APCU telemetry will not be valid. Use APCU talkbacks only.

CRT

SM 200 APCU Status

1. Turning APCU Converter Off
   
   1.1. APCU 1(2) CONV – OFF
   
   √APCU 1(2) CONV tb – bp
   √APCU 1(2) OUTPUT RLY tb – bp

2. Opening APCU Output Relay
   
   2.1. APCU 1(2) OUTPUT RLY – OP
1. **UNSTOW EQUIPMENT**

   **MF14E**
   Unstow:
   - NCU
   - Antenna
   - Parallel port data cable assembly

2. **SWIS SETUP**

   **PGSC**
   Close all applications, exit Windows.
   - Pwr – Off
   Move SWIS hardware to AFD.
   - Antenna →|← NCU
   - Data cable →|← NCU PARALLEL PORT
   - Data cable →|← PGSC LPT port
   Secure NCU to port side aft bulkhead behind CCTV monitors.

3. **ACTIVATING WIS**

   **PGSC**
   Pwr – On
   At start menu select appropriate chassis configuration.
   - NCU Pwr – On
   - PGSC From Desktop select Shuttle Aps.
   Select SWIS folder.
   Double click on SWIS icon.

4. **SETTING NCU SERIAL NUMBER**

   Preferences: Misc. Settings

   ‘NCU S/N’
   - sel 1005
   - cmd SET

5. **NCU GMT WITH PGSC SYNCRONIZATION**

   Commands: Set/Get GMT Time
   - Set/Get NCU GMT

   - cmd Sync NCU clock w/PC
   - cmd Get NCU time

   √ Date/Time agrees with GMT within ± 5 seconds

   - cmd RETURN
6. **EDITING COMMAND FILE ACQUISITION START TIME**

**Commands:** Initialize for Data Collection

- Initialize Network and Acquire Data

- ‘CMD File’

- `sel Swis 4A Cmd v1r2`

- `cmd Open`

- ‘ACQ. Start Time(GMT)’

  - `enter` The time in hh:mm:ss format corresponds to the hour of shuttle launch in GMT and in military time. Round to the nearest hour prior to launch (ex: if the launch occurred at 4:12 pm CST [10:12pm GMT], enter < 22:00:00>)

  - `enter` The launch date in mm/dd/yyyy format (all launches after 6:00 pm CST will have the next day’s date in GMT)

- ‘CMD File’

  - `cmd Save`

  - `enter Swis 4A Cmd v1r2`

  - In Dialog window, confirm replace file.

  - `cmd Save`

  - `cmd Return`

  Notify **MCC-H**, “Modified SWIS Command File acquisition start time for mm/dd/yyyy launch date and hh:mm:ss: launch time in GMT rounded to the nearest hour prior to launch.”

7. **CONFIGURING NCU**

**Utilities:** Network Utility

- Network Utility

- ‘Network Configure’

- ‘Action’

- `sel Reset NCU`

- `cmd Configure`

- `cmd OK in confirmation dialog`

- ‘Update New NCU’

- ‘Command File Name’

- `sel Swis 4A Cmd v1r2`

- `cmd Open`

- ‘Command File Editor/Viewer’

Report ACQ start time to **MCC-H**.
sel RSU Scroll [X] where X = [0 1 2 3 4 5 6 7]

√RSU S/N per table

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</tr>
<tr>
<td>7</td>
<td>1023</td>
<td>Orb</td>
</tr>
</tbody>
</table>

NOTE
Location provided for information only.

√ACQ Setup File – RSU1 4A Subv1r2

Repeat

**cmd** Update NCU

At Confirmation dialog box
- **cmd** OK
- **cmd** RETURN

8. **NETWORK CHECKOUT**

WIS PGSC SW

Utilities: Network Monitor
- Network Monitor

**cmd** Get Status

Wait 120 seconds.
sel RSU Scroll \([X]\) where \([X] = 0 \underline{1} 2 \underline{3} 4 5 6 7\)

- √ERROR – none
- √Data signal strength meter – in green range

Report signal strength: __________

Repeat

Report signal strength to **MCC-H**.

**cmd** RETURN

9. **DATA DOWNLOAD**

Commands: Download Data

- Download Data
- ‘Periodic Download’

sel Download Rate – Every 30 minutes

Record MET: ___ /__ːː__

**cmd** Periodic Download

√Window disappears

**NOTE**

The user may need to wait a few minutes to plot the results while the network harvests all remaining data.

Window: Download Data

√‘Stop Download’ grayed out

**NOTE**

Clicking outside of the Download Data window will hide it.

If Stop Download button is not grayed out, then data downloading is inactive.
Repeat step 9 to restore data download.

Notify **MCC-H**, “SWIS setup complete.”
1. **VIEWING CHANNEL DATA**

   WIS PGSC SW
   'Data'

   sel Desired color for plot trace

   **SELECT CHANNEL FILE**

   In Temp folder, select desired filename.

   **NOTE**
   For RTD channel filenames, refer to {WIS REFERENCE} (SODF: ASSY OPS: REFERENCE).

   sel Open
   Repeat as required for other channels.

   WIS PGSC SW

   **cmd** Refresh (auto refresh as desired)
   Scale as needed.

---

**Figure 1.- Channel Data.**
As required, close all other PGSC software applications.

Data cable ←—→ PGSC LPT port
Data cable ←—→ NCU parallel port
Remove NCU from bulkhead.
Antenna ←—→ NCU

Stow NCU, NCU Antenna, and data cable for return to ground.

Notify **MCC**, “SWIS Deact complete.”
This Page Intentionally Blank
1. **NCU GMT WITH PGSC SYNCRONIZATION**
   
   Commands: Set/Get GMT Time
   
   | Set/Get NCU GMT | cmd Get NCU time |
   |
   | Date/Time agrees with GMT within ± 5 seconds |
   |
   **********************************************************
   If date/time does not agree
   | cmd Sync NCU clock with PC |
   |
   Repeat step 1.
   | ********************************************************** |
   |
   | cmd Return |
   |

2. **DATA DOWNLOAD**
   
   | WIS PGSC SW |
   |
   Commands: Download Data
   
   | Download Data |
   |
   sel Download Rate – every 30 minutes |
   |
   | cmd Periodic Download |
   |
   √Window disappears
   The user may have to wait a few minutes to plot the results while the network harvests all remaining data.
   |
   Window: Download Data
   |
   √'Stop Download' grayed out
   |
   If the Periodic Download button is indicated in blue
   Data downloading is inactive.
   Repeat step 2.
   |
   Record MET: ___/___:__:__
   |
   Notify MCC-H, “SWIS downlinking resumed.”
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1. **DISABLING DOWNLOAD**

   **WIS PGSC SW**

   **Commands:** Download Data
   - Download Data

   *cmd* Stop Download
   *cmd* Return

   ********************************************
   If Return pressed before download is complete,
   expect pop-up dialog.

   sel 'Cancel' to return

   Wait 60 seconds

   *cmd* Return (again)

   ********************************************

   *cmd* Return
OBJECTIVE:
Set up IWIS in Node 1.

LOCATION:
Installed: Node 1

Stowed: √MCC-H

DURATION:
4 hours

PARTS:
IWIS CTB:
Accelerometer Interface Plate (#1, #2)(PN 0060-04-015)
Accelerometers (#1, #2) (PN 0060-04-012)
Remote Sensing Unit (RSU)(#1, #2) (PN SEG161022889-301)
Accelerometer Cable Assembly (25') (PN 0060-04-13)
Antenna (two) (PN 0060-04-005)

MATERIALS:
IWIS CTB:
Cable Restraints
ISS IVA TOOL KIT:
1" Gray Tape
Dry Wipes
Velcro Ties (already installed to Node 1 struts on orbit)

TOOLS REQUIRED:
35 mm Camera

INSTALLING REMOTE SENSING UNIT (RSU) #1
1. If required, install Handrail at NOD1S2 fwd side of Hatch.

2. Install Antenna onto RSU #1.
Figure 1.- RSU #1, Accelerometer #1 Installation.
3. Install RSU #1 to Handrail with Antenna toward port side. Install, in series, strain gage ports aft using Velcro Ties (three). Refer to Figure 1.

Figure 2.- Node 1 Stbd Side Cable Routing (Starboard Side View).

**CAUTION**
Do not route Strain Gage Cables over hatch track and portable fire extinguisher door.

**NOTE**
Attach Strain Gage Cables approximately every two feet with Velcro Ties, Gray Tape.
4. Uncoil stbd side Strain Gage Cables (four),(NOD1S2).
   Route Cable #6 up, forward along cross tube to meet with Cable #5.
   Attach both cables at corner of cross tube.
   Pull up and over outboard side of footbridge, up to Handrail then to
   RSU #1.
   Route Cable #8 up, foward along cross tube to meet with Cable #7.
   Attach both cables at corner of cross tube.
   Pull up and over inboard side of footbridge, down to Handrail and
   RSU #1.
   All cables →|← RSU #1 as listed below.
   Refer to Figures 1,2.
   Strain Gage Cable →|← RSU port
   5 →|← 5
   6 →|← 6
   7 →|← 7
   8 →|← 8

INSTALLING ACCELEROMETER INTERFACE PLATE #1 (NOD1O1)

5. Locate fwd, stbd corner of Closeout Panel NOD1O1-01.
   Flush 3” X 3” area with stbd edge of panel, fwd edge of closeout panel
   fastener.
   Clean area with Dry Wipe.
   Install three 1” wide X 3” long plus courtesy tabs, strips of Gray Tape side
   by side.
   Refer to Figure 1.

6. Peel backing off Accelerometer Interface Plate #1.
   Attach plate onto Gray Tape with thumbscrew to port side.
   Flush stbd side with stbd edge of panel.
   Flush aft side with closeout panel fastener.
   Refer to Figure 1.

   **NOTE**
   Orientation of Interface Plate relative to
   Closeout Panel must be visible in photo.

7. Photodocument Accelerometer Interface Plate #1 location.

INSTALLING ACCELEROMETER #1

8. Install Accelerometer #1 onto Interface Plate.
   Use fingers to firmly tighten thumbscrew while holding Accelerometer with
   other hand.

   **NOTE**
   Bend radius of relief coil in Accelerometer
   Cable not to be less than one inch.
9. Route Accelerometer Cable, starting with a relief coil, continuing aft along Closeout Panel.
   Velcro coil with excess Strain Gage Cables to Handrail, then pull coil down Handrail to RSU#1.
   Attach with Gray Tape and cable restraints approximately every two feet.
   Refer to Figure 2.

10. Accelerometer #1 Cable →|← RSU #1 Accelerometer port

   **NOTE**
   Strain Gage Cable labels should be visible in photo, as in Figure 4.

11. Photodocument RSU #1, cable installation.

**INSTALLING REMOTE SENSING UNIT (RSU) #2**

12. If required, install Handrail at NOD1P2 aft side of Hatch.

13. Install Antenna onto RSU #2.
   Refer to Figure 4.
Figure 5.- Node 1 Port Side Cable Routing (Port Side View).

**CAUTION**
Do not route Strain Gage Cables over hatch track.

**NOTE**
Attach strain gage cables approximately every two feet with Velcro Ties, cable restraints, Gray Tape.
15. Uncoil port side Strain Gage Cables (four), (NOD1P2).
   Route Cable #3 down, aft along cross tube to meet with Cable #4.
   Attach both cables at corner of cross tube then up and under inboard side
   of footbridge.
   Pull cables up to Handrail to RSU #2.
   Route Cable #1 down, aft along cross tube to meet with Cable #2.
   Attach both cables at corner of cross tube, then down and under
   footbridge.
   Pull cables down to Handrail then to RSU #2.
   All cables →|← RSU #2 (as listed below)
   Refer to Figures 4, 5.
   Strain Gage Cable →|← RSU port
   1 →|← 1
   2 →|← 2
   3 →|← 3
   4 →|← 4

ACCESS

INSTALLING ACCELEROMETER INTERFACE PLATE #2 (NOD1S4)

Figure 6.- Accelerometer #2 Installation.

NOTE
Once Accelerometer Interface Plate
is attached, adhesive is permanent.
17. Locate aft zenith I-beam, clean, install Accelerometer Interface Plate #2.
   Peel backing off Accelerometer Interface Plate #2.
   Attach Accelerometer Interface Plate #2 to I-beam with thumbscrew aft
   side of Accelerometer Interface Plate.
   Opposite thumbscrew is to be aligned with fwd edge of I-beam, inboard
   edge of Interface Plate is to be aligned with outboard edge of bracket for
   zenith Early Comm Horizontal Crossbeam.
   Refer to Figure 6.

18. Cut two 12” strips of Gray Tape.
   Wrap Gray Tape around Accelerometer Interface Plate, I-beam, crossing
   the second piece of tape over the first at the interface plate.
   Do not place tape over stubs of Interface Plate.

   **NOTE**
   Orientation of Accelerometer Interface Plate relative
   to I-beam, bracket must be visible in photo.

19. Photodocument Accelerometer Interface Plate #2 location.

**INSTALLING ACCELEROMETER #2**

20. Install Accelerometer #2 onto Accelerometer Interface Plate.
    Use fingers to firmly tighten thumbscrew.

   **NOTE**
   Bend radius of relief coil in Accelerometer
   Cable not to be less than one inch.

21. Route Accelerometer Cable, starting with a relief coil, above I-beam to
    inboard edge of Rack Bay.
    Attach 25’ Extension Cable to RSU #2 then route up Handrail.
    Continue up to top of Closeout Panel, tape, then route aft to seat track.
    Continue to aft side of Rack Bay, then toward stbd along seat track to
    Early Comm Rack Bay.
    Use Velcro Ties, cable restraints, Gray Tape to attach cable.

22. Coil excess Accelerometer cable, Extension Cable.
    Accelerometer Cable →|← Extension Cable
    Attach both to top of I-beam structure with Velcro Ties.

23. Photodocument Accelerometer #2 (as in Figure 6), RSU #2 (as in
    Figure 4).

**CLOSEOUT**

24. Rotate and close Rack Volume Closeout (NOD1S4).

**POST MAINTENANCE**

25. Stow tools, materials, equipment.
NOTE
1. If IWIS ACTIVATION is being performed in preparation for the Checkout data acquisition period, then begin procedures with step 1.

2. If IWIS ACTIVATION is being performed in preparation for the Test 1/Test 2 data acquisition period, then some of the IWIS hardware may be temporarily stowed in the Node. Complete the portions of step 1 and step 2 that have not been previously performed.

1. **UNSTOW EQUIPMENT**

IWIS CTB

Unstow:
- NCU (P/N SEG16102890-301, S/N 1032)
- Antenna (1) (P/N 0060-04-005)
- Parallel Port Data Cable (P/N 0060-04-014)
- PCMCIA Hard Disk Card (P/N SED33105832-304)

SSC

Locate SSC assigned for IWIS and transfer to Node 1.

2. **IWIS HARDWARE SETUP**

NOTE

To minimize RF transmission errors, all IWIS units (NCU and RSUs) should be located at least two feet apart when operating.

SSC

Close all applications.
Shut down Windows.

Pwr – Off

Data cable →|← NCU Parallel Port
Data cable →|← SSC LPT Port
Antenna →|← NCU

Install Hard Disk Card into SSC.
Secure NCU to any convenient location with Antenna oriented inboard.
3. **ACTIVATING IWIS SOFTWARE**

<table>
<thead>
<tr>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The standard setting for the SSC parallel port is the bi-directional mode. The port must be reconfigured to the ECP mode in order for the IWIS software and hardware to function properly.</td>
</tr>
<tr>
<td>2. Shortcuts to the IWIS software files are located in the Station Apps folder on the Windows desktop.</td>
</tr>
<tr>
<td>3. The shortcuts perform the following functions:</td>
</tr>
<tr>
<td>The ECP routine reconfigures the parallel port from bi-directional to ECP mode.</td>
</tr>
<tr>
<td>The BiDirect routine reconfigures the parallel port from ECP to bi-directional mode.</td>
</tr>
<tr>
<td>IWIS starts the user interface for control and command of the IWIS hardware.</td>
</tr>
<tr>
<td>4. Resetting the parallel port requires the SSC to be rebooted. All nonessential Windows applications should be shut down and not reactivated until IWIS operations are complete.</td>
</tr>
</tbody>
</table>

SSC Pwr – On
Close all nonessential Windows applications.

sel ECP shortcut (c:/Windows/Desktop/Station Apps/ folder)
sel Yes in response to *Would you like to continue* in Verify dialog box
sel Yes in response to *Would you like to restart now* in Reboot dialog box

*******************************************************************
If at any time during this configuration process a dialog box entitled “Laptop Configuration Error” appears with the message *Do you want to run AutoXD to attempt to correct?* 

sel No
*******************************************************************

*******************************************************************
If at any time during this reboot and software activation process a Windows Notepad dialog box appears with the title “bad.log – Notepad” then close the window.

The message *LTPORT settings are incorrect!* should be ignored.
*******************************************************************
4. ACTIVATING IWIS HARDWARE

NCU
Pwr – On
RSU 1  Pwr – On
RSU 2  Pwr – On

5. SETTING NCU SERIAL NUMBER

SSC
Preferences: Misc.Settings
Misc.Settings

sel  NCU S/N [X]  where [X] = 1032
cmd  Set

6. SYNCHRONIZING SSC CLOCK

Obtain current GMT from SSC FS, PCS, or other time source.

SSC
Select clock from lower right corner of MS Windows display.

Date/Time Properties

Verify that SSC clock matches time source.

If required, manually adjust SSC clock to match time source.

cmd  OK (close Data/Time Properties window)

7. SYNCHRONIZING NCU GMT WITH SSC

SSC
Commands: Set/Get GMT Time

GMT.vi

NOTE
1. The PCs GMT display on left continually updates to show current time.

2. The NCUs GMT display on right is static and displays the instantaneous time when selected.

cmd  Sync NCU Clock w/PC
If Message Box – ‘Unknown Error’ indicates that incorrect NCU serial number was entered in software
   Verify correct serial number from ID plate on NCU
   Repeat step 5 and then proceed from beginning of step 7.

\ncmd Get NCU Time

√NCUs GMT

If NCUs GMT – displays 16:00:00 12/31/98
   NCU is not responding to commands from SSC.
   Perform (NCU NOT RESPONDING TO SSC COMMANDS), all (SODF: ASSY OPS: MALFUNCTION: IWIS SOFTWARE MAL), then:

If NCUs GMT – does not agree with PC’s GMT within ± 1 second
   Repeat step 7.

\ncmd RETURN

8. SET UP NETWORK WITH RSU 1 AND RSU 2

SSC
Utilities: Network Utility
  Network Utility

Use right-hand window labeled “Network Configure.”

   input RSU S/N [X] where [X] = 1026 1027
   sel Add RSU to Network (click in data window labeled “Action”)
   \ncmd Configure
   \ncmd OK (response to ‘Proceed Configure?’)

Repeat

   \ncmd RETURN

9. INITIALIZING BATTERY CAPACITY SETTING

   NOTE
   This step is to be performed once when the units are operated for the first time prior CHECKOUT. Do not repeat this step prior to the DTO 261 TEST operations.
Utilities: Sys. Diagnostics & Battery

Sel Node ID [X] where \( X = 1032 \) (NCU) 1026 1027

**cmd** Reset Battery Capacity

reset battery capacity.vi

Input 12000 (in battery capacity dialog box)

**cmd** Confirm

Repeat

**cmd** RETURN

10. **CHECKING BATTERY VOLTAGE AND CAPACITY VALUES**

<table>
<thead>
<tr>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>The following check of the battery voltage and capacity is to be performed before both the CHECKOUT operation and the DTO 261 TEST operation.</td>
</tr>
</tbody>
</table>

Utilities: Node Status

Node Status
input Node ID [X] where [X] = 1032 (NCU) 1026 1027

cmd Get Status

Wait for Response portion of window to fill with data.

√Errors – None

******************************************************************
If Errors – ‘XXXX Unable to contact target node’
where XXXX is any S/N other than 1026 or 1027
Return to beginning of step 10.
******************************************************************

******************************************************************
If Errors – ‘1026 Unable to contact target node’
Perform (UNABLE TO CONTACT TARGET
NODE), all (SODF: ASSY OPS:
MALFUNCTION: IWIS SOFTWARE), then:
******************************************************************

******************************************************************
If Errors – ‘1027 Unable to contact target node’
Perform (UNABLE TO CONTACT TARGET
NODE), all (SODF: ASSY OPS:
MALFUNCTION: IWIS SOFTWARE), then:
******************************************************************

Record Bat. Supply Voltage: _________
Record Battery Capacity: ___________

<table>
<thead>
<tr>
<th>IWIS Unit S/N</th>
<th>Voltage (VDC)</th>
<th>Capacity (A-hrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1032 (NCU)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1026</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1027</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Repeat

cmd RETURN
1. **SELECTING CALIBRATION SETTINGS FILE**

   SSC Utilities: Calibration Settings
   
   RSU/Ch Calibration Settings
   
   cmd Select
   sel 4A_BASE.clb
   cmd Open
   cmd Make Active

   If ‘Replace existing “c:\wis\cal\Active.clb”?’ message appears
   cmd Replace

   cmd RETURN

2. **RESETTING RSU 1 AND RSU 2**

   SSC Commands: Init. for Data Collection
   
   Initialize Network & Acquire Data
   
   cmd Reset RSUs
   cmd Confirm (response to ‘Please confirm your request...’)

   Wait until data blocks in Response portion of window fill.

   √Status: 1026 resetting
   √Status: 1027 resetting

   ************************************************************
   If Status – ‘XXXX resetting’
   where XXXX is any S/N other than 1026 or 1027
   Return to beginning of step 2.
   ************************************************************

   ************************************************************
   If Status – ‘XXXX Unable to contact target node’
   where XXXX is any S/N other than 1026 or 1027
   Return to beginning of step 2.
   ************************************************************

   ************************************************************
   If Status – ‘1026 Unable to contact target node’
   Performed {UNABLE TO CONTACT TARGET NODE}, all
   (SODF: ASSY OPS: MALFUNCTION: IWIS SOFTWARE), then:
   ************************************************************

   ************************************************************
   If Status – ‘1027 Unable to contact target node’
   Performed {UNABLE TO CONTACT TARGET NODE}, all
   (SODF: ASSY OPS: MALFUNCTION: IWIS SOFTWARE), then:
   ************************************************************

   cmd RETURN
3. **PERFORMING HARDWARE WARMUP FOR RSU 1 AND RSU 2**

**SSC**

 Commands: Init. for Data Collection

- Initialize Network & Acquire Data

**cmd** Select (blue button in upper right quadrant)

**sel** 4A_WARMUP_CO

**cmd** Open

√ACQ. Start Time toggle button – Use Current Time

If toggle button – Select Start Time

- **sel** Use Current Time (update display to current time and date)

- **sel** Select Start Time (input desired time)

**NOTE**

1. The ACQ Start Time must be equal to the current time plus a minimum of 12 minutes.

2. The input time will be GMT in hrs:min:sec format with seconds input as zero.

Use mouse to highlight time portion of ACQ Start Time display.

- **input** [XX:XX:00] where XX:XX:00 is GMT in hr:min:sec format

**cmd** Execute

Record ACQ. Start Time: _____ : _____ : _____

√Message Box

If Message Box – ‘CLEAR MEMORY REMINDER’

**cmd** Confirm

**************************************************************************

If Message Box – ‘MESSAGE …This file could not execute because:

* insufficient time for warmup’

**cmd** Confirm (to close MESSAGE window)

input Updated test start time that is increased by at least one minute

**************************************************************************
If Message Box – ‘MESSAGE...This file could not execute because:
* a data folder with same name exists’
  cmd Confirm (to close MESSAGE window)
  cmd Save (blue button in upper right quadrant)
  input 4A_WARMUP_CO_1 (file_name from beginning of this step with _1 appended)
  cmd Save (in Save Command File dialog box)

input Updated test start time that is increased by at least one minute

Return to cmd Execute in step 3.

*********************************************************************

If Message Box – ‘MESSAGE...This file could not execute because:
* Some subfiles are incompatible/missing
* Listen schedule for Events are inconsistent
  Indicates that command file must be rebuilt.

√MCC-H

Perform {COMMAND FILE WILL NOT EXECUTE}, all
  (SODF: ASSY OPS: MALFUNCTION: IWIS SOFTWARE), then:

√Message Box – ‘CONFIRMATION’

  cmd Confirm

  Wait until Status table fills with data.

√RSU Status – ‘Initialization Pending’
If RSU Status – ‘Initialization Pending: 2 Hr’
Verify the GMT input for data acquisition.

If correct GMT was input, then perform [NODE NOT CONFIGURED IN NETWORK], all (SODF: ASSY OPS: MALFUNCTION: IWIS SOFTWARE), then:

If incorrect GMT was input, then proceed as follows:
   *cmd ABORT RSUs
   *cmd Confirm

√Status – XXXX aborting
Wait 30 seconds to 1 minute.
√Status – XXXX aborted

   *cmd Save (blue button in upper right quadrant)
   input 4A_WARMUP_CO_1 (file_name from beginning of this step with _1 appended)
   *cmd Save (in Save Command File dialog box)

   input Updated test start time that is increased by at least one minute

Return to *cmd Execute in step 3.

---------------------------------------------

Wait until RSU Status updates (approximately 30 seconds to 1 minute).

√RSU Status – Initialized

   Verify # of Events: 1
   Verify Event 0 Start – same GMT value as input above
   Verify Event 0 To Start ≥ 10:00, <decrementing>

√Event 0 Remaining time on counter

   When Event 0 Remaining: 00:00:00
   Warmup is complete.

4. **RESETTING RSU 1 AND RSU 2**

   [Initialize Network & Acquire Data]

   *cmd Reset RSUs
   *cmd Confirm (response to ‘Please confirm your request…’)
Wait until data blocks in Response portion of window fill.

√ Status: 1026 resetting
√ Status: 1027 resetting

**********************************************************************
If Status – ‘Unable to contact target node’
Perform (UNABLE TO CONTACT TARGET NODE), all
(SODF: ASSY OPS: MALFUNCTION: IWIS
SOFTWARE), then:
**********************************************************************

5. SELECTING COMMAND FILE FOR CHECKOUT TEST 1
(RSU 1 AND RSU 2)

Initialize Network & Acquire Data

**cmd** Select (blue button in upper right quadrant)
**sel** 4A_CO1_RSU12

**cmd** Open

√ ACQ. Start Time toggle button – Use Current Time

If toggle button – Select Start Time
   **sel** Use Current Time (update display to current time and date)

**sel** Select Start Time (input desired time)

<table>
<thead>
<tr>
<th><strong>NOTE</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The ACQ Start Time must be equal to the current time plus a minimum of 5 minutes.</td>
</tr>
<tr>
<td>2. The input time will be GMT in hrs:min:sec format with seconds input as zero.</td>
</tr>
</tbody>
</table>

Use mouse to highlight time portion of ACQ Start Time display.

input [XX:XX:00] where XX:XX:00 is GMT in hr:min:sec format

**cmd** Execute

Record ACQ. Start Time: _____ : _____ : _____

√ Message Box

If Message Box – ‘CLEAR MEMORY REMINDER’

**cmd** Confirm
If Message Box – ‘MESSAGE…This file could not execute because:
* insufficient time for warmup’
  *cmd Confirm (to close MESSAGE window)

input Updated test start time that is increased by at least one minute

If Message Box – ‘MESSAGE…This file could not execute because:
* a data folder with same name exists’
  *cmd Confirm (to close MESSAGE window)
  *cmd Save (blue button in upper right quadrant)
input 4A_CO1_RSU12_1 (file_name from beginning of this step with _1 appended)
  *cmd Save (in Save Command File dialog box)

input Updated test start time that is increased by at least one minute

Return to *cmd Execute in step 5.

If Message Box – ‘MESSAGE…This file could not execute because:
* Some subfiles are incompatible/missing
* Listen schedule for Events are inconsistent
  Indicates that command file must be rebuilt.

√MCC-H

Perform {COMMAND FILE WILL NOT EXECUTE}
(SODF: ASSY OPS: MALFUNCTION: IWIS SOFTWARE), then:

√Message Box – ‘CONFIRMATION’

*cmd Confirm

Wait until Status table fills with data.

√RSU Status – ‘Initialization Pending’
If RSU Status – ‘Initialization Pending: 2 Hr’
Verify the GMT input for data acquisition.

If correct GMT was input, then perform (NODE NOT CONFIGURED IN NETWORK), all (SODF: ASSY OPS: MALFUNCTION: IWIS SOFTWARE), then:

If incorrect GMT was input, then proceed as follows:

\[\text{cmd ABORT RSUs}\]
\[\text{cmd Confirm}\]

√ Status – XXXX aborting

Wait 30 seconds to 1 minute.

√ Status – XXXX aborted

\[\text{cmd Save (blue button in upper right quadrant)}\]
\[\text{input 4A_CO1_RSU12_1 (file name from beginning of this step with } \_1 \text{ appended)}\]
\[\text{cmd Save (in Save Command File dialog box)}\]

input Updated test start time that is increased by at least one minute

Return to \text{cmd Execute in step 5.}

Wait until RSU Status updates (~30 seconds to 1 minute)

√ RSU Status – Initialized

Verify # of Events: 9
Verify Event 0 Start – same GMT value as input above
Verify Event 0 To Start ≥ 03:30, <decrementing>

Notify ISS crew, “Data acquisition for IWIS checkout begins at XX:XX.”

6. MONITORING IWIS EVENT COUNTERS

**NOTE**

1. During the Checkout data acquisition period, there will be 9 IWIS events (designated as Event 0, Event 1, …, Event 8).

2. Data will be downloaded to SSC and saved for assessment by MCC-H.
√ Event 0 Remaining – <decrementing>
   When Remaining = 00:00, proceed.

√ Event 1 Remaining – <decrementing>
   When Remaining = 00:00, proceed.

√ Event 2 Remaining – <decrementing>
   When Remaining = 00:00
   sel EVENT SCROLL (down arrow button)
   sel EVENT SCROLL (down arrow button)
   sel EVENT SCROLL (down arrow button)

√ Event 3 Remaining – <decrementing>
   When Remaining = 00:00, proceed.

√ Event 4 Remaining – <decrementing>
   When Remaining = 00:00, proceed.

√ Event 5 Remaining – <decrementing>
   When Remaining = 00:00,
   sel EVENT SCROLL (down arrow button)
   sel EVENT SCROLL (down arrow button)
   sel EVENT SCROLL (down arrow button)

√ Event 6 Remaining – <decrementing>
   When Remaining = 00:00, proceed.

√ Event 7 Remaining – <decrementing>
   When Remaining = 00:00, proceed.

√ Event 8 Remaining – <decrementing>
   When Event 8 Remaining = 00:00, data acquisition is complete.
   Notify ISS crew, “Data acquisition for IWIS checkout test 1 complete.”

**7. DOWNLOADING DATA FROM RSU 1 AND RSU 2**

SSC Commands: Download Data

Download Data

sel Download Remaining Data (button will blink once)

<table>
<thead>
<tr>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Leave IWIS software running in background.</td>
</tr>
</tbody>
</table>
sel Start: Programs: Windows Explorer

**Exploring – (C:)**

Use Windows Explorer to monitor progress of download.

√ Time tag for last file to be downloaded
   If time > 3 minutes since last file, download error has occurred.

√ File size of downloaded files
   If size of any file equals 0 bytes, download error has occurred.

√ Number of downloaded files
   If number of files is incorrect, download error has occurred.

Download is complete when the following folders have the number of files shown and all files have size greater than zero.

<table>
<thead>
<tr>
<th>Folder Name</th>
<th># of Files</th>
<th>File Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>C:\wis\data\4A_CO_RSU12\RSU1_Node_Fwd_C1</td>
<td>12</td>
<td>&gt; 0</td>
</tr>
<tr>
<td>C:\wis\data\4A_CO_RSU12\RSU2_Node_Aft_C1</td>
<td>12</td>
<td>&gt; 0</td>
</tr>
</tbody>
</table>

If a download error has occurred, perform following corrective actions

Check communications with RSU that caused download error.

**Utilities: Node Status**

**Node Status**

sel Node ID – [X] where [X] is RSU serial number
(Left click in data window)

**cmd** Get Status

Verify Get Status button changes to gray Updating button.

Wait until Get Status changes back to blue and data windows fill.

√ Errors

If Errors – None
   Communications with RSU is okay.
   Return to beginning of step 7 and repeat download attempt.

If Errors – Unable to contact target node
   Perform **(UNABLE TO CONTACT TARGET NODE)**, all
   (SODF: ASSY OPS: MALFUNCTION: IWIS SOFTWARE), then:

***************************************************************************
sel Exploring: Minimize

**cmd** RETURN (in Download Data window of IWIS software)

---

### 8. PERFORMING AUTO RANGE FUNCTION

**SSC** Commands: Auto Range

**cmd** Start Auto Range (button changes to ‘RANGING Please Wait’)

**********************************************************

If MESSAGE – ‘MISSING COMMAND FILE…’

**cmd** Confirm

Commands: Init. for Data Collection

[Initialize Network and Acquire Data]

**cmd** Select (blue button)

sel 4A_CO1_RSU12 (use mouse pointer)

**cmd** Open

**cmd** RETURN

Window: Auto Range

[Auto Range]

Return to beginning of step 8.

**********************************************************

Wait until button changes back to Start Auto Range (requires 5 to 10 minutes).

√ List of gain values on right side of screen

If list of gains values – grayed out

Error has occurred – most likely cause is that download was incomplete

If this is first attempt to perform Auto Range, repeat steps 7 and 8.
If this is second attempt to perform Auto Range, proceed to step 9.

If list of gains values – filled with values

**cmd** Save Command File

input 4A_CO1_RSU12_RR (in file input block of Save As window)

**cmd** Save

**cmd** RETURN
9. **RESETTING RSU 1 AND RSU 2**

**SSC**

Commands: Init. for Data Collection

| Initialize Network & Acquire Data |

**cmd** Reset RSUs

**cmd** Confirm (response to ‘**Please confirm your request...**’)

Wait until data blocks in Response portion of window fill.

√ Status: 1026 resetting

√ Status: 1027 resetting

**********************************************************************

If Status – ‘Unable to contact target node’

Perform [{UNABLE TO CONTACT TARGET NODE}], all
(SODF: ASSY OPS: MALFUNCTION: IWIS SOFTWARE), then:

**********************************************************************

**cmd** RETURN

10. **SELECTING COMMAND FILE FOR CHECKOUT TEST**

(RSU 1 AND RSU 2)

**SSC**

Commands: Init. for Data Collection

| Initialize Network & Acquire Data |

**cmd** Select (blue button in upper right quadrant)

`sel 4A_CO1_RSU12_RR`

**cmd** Open

<table>
<thead>
<tr>
<th><strong>NOTE</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The ACQ Start Time must be equal to the current time plus a minimum of 5 minutes.</td>
</tr>
<tr>
<td>2. The input time will be GMT in hrs:min:sec format with seconds input as zero.</td>
</tr>
</tbody>
</table>

√ ACQ. Start Time toggle button – Use Current Time

If toggle button – Select Start Time

`sel Use Current Time (update display to current time and date)`

`sel Select Start Time (input desired time)`

Use mouse to highlight time portion of ACQ Start Time display.
input [XX:XX:00]  where XX:XX:00 is GMT in hr:min:sec format

**cmd** Execute

Record ACQ. Start Time:  _____ : _____ : _____

Notify ISS crew: “Data acquisition for IWIS checkout begins at XX:XX.”

√Message Box

If Message Box – ‘CLEAR MEMORY REMINDER’

**cmd** Confirm

********************************************************************************

If Message Box – ‘MESSAGE ... This file could not execute because:

* insufficient time for warmup’

Return to √ACQ. Start Time toggle button in step 10.

input Updated test start time that is increased by at least one minute

********************************************************************************

If Message Box – ‘MESSAGE ... This file could not execute because:

* a data folder with same name exists’

**cmd** Save (blue button in upper right quadrant)

input file_name_1 (Use same file_name as at beginning of this step and append _1, i.e., input 4A_CO1_RSU12_RR_1)

**cmd** Save

Return to √ACQ. Start Time toggle button in step 10.

input Updated test start time

********************************************************************************

If Message Box – ‘MESSAGE ... This file could not execute because:

* Some subfiles are incompatible/missing
* Listen schedule for Events are inconsistent’

Indicates that command file must be rebuilt.

√MCC-H

Perform {COMMAND FILE WILL NOT EXECUTE}, all
(SODF: ASSY OPS: MALFUNCTION: IWIS SOFTWARE), then:

********************************************************************************
√ Message Box – ‘CONFIRMATION’

cmd Confirm

Wait until Status table fills with data.

√ RSU Status – ‘Initialization Pending’

*******************************************************************
If RSU Status – ‘Initialization Pending: 2 Hr’
Verify the GMT input for data acquisition

If correct GMT was input, then perform (NODE NOT CONFIGURED IN NETWORK), all (SODF: ASSY OPS: MALFUNCTION: IWIS SOFTWARE), then:

If incorrect GMT was input, then proceed as follows:

  cmd ABORT RSUs
  cmd Confirm

  √ Status – XXXX aborting
  Wait 30 seconds to 1 minute.

  √ Status – XXXX aborted

    cmd Save (blue button in upper right quadrant)
    input 4A_CO1_RSU12_RR_1 (file_name from beginning of this step with _1 appended)
    cmd Save (in Save Command File dialog box)

    input Updated test start time that is increased by at least one minute

    Return to cmd Execute in step 10.

*******************************************************************
Wait until RSU Status updates (~30 seconds to 1 minute)

√ RSU Status – Initialized

Verify # of Events: 9
Verify Event 0 Start – same GMT value as input above
Verify Event 0 To Start ≥ 03:30, <decrementing>

11. MONITORING IWIS EVENT COUNTERS

   NOTE
   1. During the Checkout data acquisition period, there will be 9 IWIS events (designated as Event 0, Event 1, …, Event 8).

   2. This data will be downloaded and saved for assessment by MCC-H.
√ Event 0 Remaining – <decrementing>
   When Remaining = 00:00, proceed.

√ Event 1 Remaining – <decrementing>
   When Remaining = 00:00, proceed.

√ Event 2 Remaining – <decrementing>
   When Remaining = 00:00
   sel EVENT SCROLL (down arrow button)
   sel EVENT SCROLL (down arrow button)
   sel EVENT SCROLL (down arrow button)

√ Event 3 Remaining – <decrementing>
   When Remaining = 00:00, proceed.

√ Event 4 Remaining – <decrementing>
   When Remaining = 00:00, proceed.

√ Event 5 Remaining – <decrementing>
   When Remaining = 00:00
   sel EVENT SCROLL (down arrow button)
   sel EVENT SCROLL (down arrow button)
   sel EVENT SCROLL (down arrow button)

√ Event 6 Remaining – <decrementing>
   When Remaining = 00:00, proceed.

√ Event 7 Remaining – <decrementing>
   When Remaining = 00:00, proceed.

√ Event 8 Remaining – <decrementing>
   When Event 8 Remaining = 00:00, data acquisition is complete.
   Notify ISS crew: “Data acquisition for IWIS checkout test 2 complete.”

**cmd** RETURN

12. **DOWNLOADING DATA FROM RSU 1 AND RSU 2**

SSC Commands: Download Data

| Download Data |

sel Download Remaining Data (button will blink once)

**NOTE**


2. Leave IWIS software running in background.
sel Start: Programs: Windows Explorer

Exploring – (C:)

Use Windows Explorer to monitor progress of download.

√Time tag for last file to be downloaded
If time > 3 minutes since last file, download error has occurred.

√File size of downloaded files
If size of any file equals 0 bytes, download error has occurred.

√Number of downloaded files
If number of files is incorrect, download error has occurred.

Download is complete when the following folders have the number of files shown and all files have size greater than zero.

<table>
<thead>
<tr>
<th>Folder Name</th>
<th># of Files</th>
<th>File Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>C:\wis\data\4A_CO1_RSU12_RR\RSU1_Node_Fwd_C2</td>
<td>12</td>
<td>&gt; 0</td>
</tr>
<tr>
<td>C:\wis\data\4A_CO1_RSU12_RR\RSU2_Node_Aft_C2</td>
<td>12</td>
<td>&gt; 0</td>
</tr>
</tbody>
</table>

***************************************************************************

If a download error has occurred, perform following corrective actions

Check communications with RSU that caused download error.

Utilities: Node Status

[Node Status]

sel Node ID – [X] where [X] is RSU serial number
(left click in data window)

cmd Get Status

Verify Get Status button changes to gray Updating button.

Wait until Get Status changes back to blue and data windows fill.

√Errors
If Errors – None
Communications with RSU is okay.
Return to beginning of step 12 and repeat download attempt.

If Errors – Unable to contact target node
input RSU S/N [X] where [X] = S/N of RSU causing error

    sel Add RSU to Network (click in data window labeled “Action”)
    cmd Configure
    cmd OK (response to ‘Proceed Configure?’)

Return to beginning of step 12.
Repeat download attempt.

******************************************************************************

    sel Exploring: Minimize
    cmd RETURN (in Download Data window of IWIS software)

13. COPYING DATA FILES TO REMOVABLE HARD DISK CARD

SSC
sel Start: Programs: Windows Explorer

    Exploring – (C:)

Create new folder on Hard Disk Card: /wis/data/.

    sel c:\wis\data\4A_CO1_RSU12

Copy folder and contents to /wis/data/ folder on Hard Disk Card.

    sel c:\wis\data\4A_CO1_RSU12_RR

Copy entire contents of folder to Hard Disk Card.

14. RESETTING RSU 1 AND RSU 2

SSC
Commands: Init. for Data Collection
Initialize Network & Acquire Data

    cmd Reset RSUs
    cmd Confirm (response to ‘Please confirm your request…’)

Wait until data blocks in Response portion of window fill.

√ Status: 1026 resetting
√ Status: 1027 resetting
If Status – ‘Unable to contact target node’
Perform (UNABLE TO CONTACT TARGET NODE), all
(SODF: ASSY OPS: MALFUNCTION: IWIS
SOFTWARE), then:

cmd RETURN
OVERVIEW
The Internal Wireless Instrumentation System (IWIS) uses a flight-certified lithium Battery Pack for power (refer to Figure 1).
As illustrated in Figure 2, the IWIS Battery Pack Assembly (Invocon part number 0060-04-004) contains three lithium-bromine-chloride (LiBCXII) D-cells that are connected in series with special safeguards to ensure safety.

The dimensions of the Battery Pack are 2.88 inches x 3.85 inches x 1.5 inches and it weighs 1.5 pounds.

A keyed connector is used to prevent incorrect application of power. The IWIS NCU and RSU each have a removable panel for access to the battery as indicated in Figure 3 and Figure 4. A 5/64-inch hex-head torque drive is required to remove and replace the access panel.

The NCU and RSU shall be powered off during battery replacement operations. The spare or used lithium IWIS Battery Packs shall be stored in watertight packaging away from moisture or excessive humidity. The battery packs shall not be exposed to an environment outside of the temperature range of -40°F to +130°F. The Battery Packs use primary cells and are not rechargeable.

Both charged and depleted IWIS Battery Packs can be stored together in one location. Depleted or expired Battery Packs shall be returned to earth as soon as possible. The returned Batteries will be shipped to NASA JSC where their classification will be downgraded from Flight Hardware and they will be disposed of by personnel at the ESTA facility.

Figure 1.- IWIS Battery Pack.
Figure 2.- Interior Layout of IWIS Battery Pack.

Figure 3.- IWIS Network Control Unit.

Figure 4.- IWIS Remote Sensing Unit.
HANDLING, STOWAGE, AND OPERATING PRECAUTIONS
The following precautions must be observed during handling, stowing, and operation of the IWIS Battery Packs.

Battery Packs are not rechargeable.
Battery Packs are not to exceed a temperature of 200° F (95° C)
Battery Packs must not be opened, crushed, or punctured.
Spare Battery Packs must be stowed in waterproof packaging.
Depleted Battery Packs must be labeled as “USED” and stowed in waterproof packaging.
Depleted or expired Battery Packs must be returned to NASA JSC for disposal as soon as possible.
Removal and replacement of Battery Packs should be performed on an ESD dissipative surface.
Avoid contacting the Battery Pack with metal surfaces.
Metal jewelry should not be worn while handling the Battery Packs.

TOOLS REQUIRED:
The following items are required for RSU/NCU battery access. They are manifested in the IVA Hand Tool Kit Assembly.

5/64 inch Hex Head Driver (Kit D, 00005-14)
Torque driver, 1/4 inch drive, 5-30 in-lbs (Kit G, item G3, 00008-1J)
Jewelers screwdriver, flat tip (Kit I, 00010-1)
Static wrist tether (Lid #1, 00021-10)
Electrostatic discharge (ESD) dissipative surface (IVA workstation)

IWIS NCU AND RSU BATTERY PACK REMOVAL AND INSTALLATION
The following procedures must be followed for safe removal and installation of the IWIS Battery Packs.

1. Relocate IWIS NCU (RSU) to the IVA workstation.
2. Put on the Static Wrist Tether and attach to IVA workstation.
3. Ensure that NCU (RSU) power is off.
4. Remove the Antenna from NCU (RSU) top cover.
5. Turn the NCU (RSU) over to reveal bottom cover.
6. While holding the bottom cover in place, loosen the four 5/64-inch hex head screws, by alternately unscrewing each screw a few turns at a time until all screws are loose.
   Refer to Figure 5.
7. Remove bottom cover.

8. Using a small flat head screwdriver, loosen the two battery pack cable connector screws, by alternately unscrewing each screw a few turns at a time until the connector is loose. Refer to Figure 6.

9. Remove the used Battery Pack from the NCU (RSU).

10. Place non-conductive tape over the battery cable connector socket.

11. Mark the battery as “USED” and indicate the date of removal.

12. Place the used Battery in watertight packaging and store in an approved location (IWIS CTB) or transfer to orbiter for return to earth.

13. Obtain a new Battery Pack from IWIS CTB.

14. Remove the protective packaging from the new Battery Pack. Stow packaging material in IWIS CTB for later use.

15. Remove the tape from the connector.

16. Install the new Battery Pack into the NCU (RSU) battery compartment. Ensure that the warning label is visible and the connector wires extend toward the connector in the electronics compartment.
17. Insure that the battery pack screws mate with the mating connector screws male to female.

18. Using a small flat head screwdriver, alternately tighten the battery pack cable connector screws until both screws are secure. Do not overtorque.

19. Replace the bottom cover of the NCU (RSU).

20. Tighten the four hex-head screws using 1/4" Trq Driver, torque to 10.0 in-lbs.

21. Turn over the NCU (RSU) to reveal the top cover.

22. Replace the Antenna.

23. Stow tools and IVA workstation (as required).

24. Relocate IWIS unit to previous location (install or stow as required).

25. Use IWIS software to reset battery capacity (refer to next section).

**IWIS BATTERY CAPACITY RESET OVERVIEW**
Following the installation of a new Battery into an RSU, the IWIS operator must reset the level of the battery capacity.

26. sel Reset Battery Capacity button on the System Diagnostics & Battery dialog box
    Refer to Figure 7.
    A data entry window will open.
    Refer to Figure 8.
    input Value of the battery capacity with units of milliamp-hours,
    step-by-step procedures are listed following the displays.
Following installation of the Batteries into the flight units, the following procedure should be followed to set the battery capacity to the correct initial value and verify the value.

27. From the Utilities pulldown menu, choose the Sys. Diagnostics & Battery option.

28. In the Node ID window, choose the serial number for the unit with the new Battery.

29. Press the Reset Battery Capacity button.

30. Enter a value of 12000 in the Battery Capacity dialog box.
31. Press the Confirm button.
32. Repeat steps 2 --- 5 for each IWIS unit with a new Battery.
33. Close the window by pressing the RETURN button.
34. From the Utilities pulldown menu, choose the Node Status option.
35. In the Node ID window, choose the serial number for the unit with the new Battery.
36. Press the Get Status button.
37. Wait for the windows in the Response section to fill with data.
38. Verify that the response for Battery Capacity > 11.9 A-h.
39. Verify that the response for Battery Voltage > 9.5 VDC
40. Record the Battery Voltage.
41. Repeat steps 8 ---12 for each IWIS unit with a new Battery.
42. Close the window by pressing the RETURN button.
43. Exit IWIS software.
44. If the Battery Voltage is < 9.5 VDC, notify MCC-H.
1. **CHECKING IWIS BATTERY VOLTAGE AND CAPACITY**

**SSC Utilities: Network Utility**

Use right-hand window labeled “Network Configure.”

- **Input RSU S/N [X]** where [X] = 1026 1027
- **Select** Add RSU to Network (click in data window labeled “Action”)
- **Cmd** Configure
- **Cmd** OK (response to ‘Proceed Configure?’)

Repeat

**Cmd RETURN**

**Utilities: Node Status**

**Node Status**

- **Input Node ID [X]** where [X] = 1032 (NCU) 1026 1027

  - **Cmd** Get Status

  Wait for Response portion of window to fill with data.

  √Errors – None

************************************************************

If Errors – ‘XXXX Unable to contact target node’
where XXXX is any S/N other than 1026 or 1027
Return to beginning of step 1.

************************************************************

********************************************************************

If Errors – ‘1026 Unable to contact target node’
Perform {UNABLE TO CONTACT TARGET NODE}, all
(SODF: ASSY OPS: MALFUNCTION: IWIS SOFTWARE), then:

********************************************************************

********************************************************************

If Errors – ‘1027 Unable to contact target node’
Perform {UNABLE TO CONTACT TARGET NODE}, all
(SODF: ASSY OPS: MALFUNCTION: IWIS SOFTWARE), then:

********************************************************************

Record Bat. Supply Voltage: __________
Record Battery Capacity: __________

Repeat
2. SHUTDOWN IWIS SOFTWARE

SSC File: Exit (from menu of IWIS software)

3. RECONFIGURING SSC PARALLEL PORT FOR POST TEST OPERATIONS

SSC sel BiDirect shortcut (c:/Windows/Desktop/Station Apps/IWIS folder)
sel Yes in response to ‘Would you like to continue’ in Verify dialog box
sel Yes in response to ‘Would you like to restart now’ in Reboot dialog box
sel Yes in response to ‘Okay to terminate batch file’ in message box

*******************************************************************
If at any time during this configuration process a dialog box entitled “Laptop Configuration Error” appears with the message ‘Do you want to run AutoXD to attempt to correct?’
sel No
*******************************************************************

*******************************************************************
If at any time during this reboot and software activation process a Windows Notepad dialog box appears with the title “bad.log - Notepad,” then close the window.

The message ‘LTPORT settings are incorrect!’ should be ignored.
*******************************************************************

Wait until reboot process is complete.

4. DEACTIVATING AND STOW IWIS HARDWARE

NCU Pwr – off

NCU Data cable ←|→ NCU parallel port
SSC Data cable ←|→ SSC parallel port

RSU 1 Pwr – off
RSU 2 Pwr – off
RSU 3 Pwr – off
RSU 4 Pwr – off

IWIS Unit S/N Voltage (VDC) Capacity (A-hrs)
1032 (NCU) 1026 (RSU 1) 1027 (RSU 2)

cmd RETURN

<table>
<thead>
<tr>
<th>IWIS Unit S/N</th>
<th>Voltage (VDC)</th>
<th>Capacity (A-hrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1032 (NCU)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1026 (RSU 1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1027 (RSU 2)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
NOTE
At crew’s discretion, IWIS hardware may remain in place. If it will interfere with other operations, it should be stowed in IWIS CTB.

If IWIS hardware is to remain in place
Leave all accelerometers installed.
Attach NCU (with Antenna and data cable) to convenient location.
Leave RSU 1 and RSU 2 installed in Node 1.

Node 1

If IWIS hardware is to be returned to CTB
NCU data cable ←→ NCU parallel port
Coil NCU data cable and secure with Velcro Tie.
Antenna ←→ NCU
Stow NCU, Antenna, and data cable in IWIS CTB.

For RSU 1 and RSU 2,
Strain gauge cable ←→ RSU port
Accelerometer cable ←→ RSU port
Coil accelerometer cables and secure in place with Velcro Straps.
Coil strain gauge cables and secure in place with Velcro Straps.
Stow RSU 1, RSU 2, and Antennas in CTB.

If IWIS SHUTDOWN follows completion of TEST1/TEST2 OPS proceed with step 5.
If IWIS SHUTDOWN follows CHECKOUT, then skip step 5 and proceed with step 6.

5. ARCHIVING IWIS DATA

SSC
sel Start: Programs: Windows Explorer

[Exploring – (C:)]

Create new folder on Hard Disk Card – \wis_archive\

sel c:\wis\

Copy folder and all subfolders to \wis_archive\ folder on Hard Disk Card.

Pwr – off

Remove Hard Disk Card from SSC

Label Hard Disk Card “Flight 4A, DTO-261, IWIS Data.”

Stow Hard Disk Card for return in orbiter.
6. NOTIFYING MCC-H IWIS TASKS COMPLETE

SSC  Prepare SSC for data download to MCC-H using OCA.

ISS ↓ MCC-H: “IWIS hardware deactivated and stowed.
Data archived on hard disk card. Ready for data downlink from SSC.”
<table>
<thead>
<tr>
<th>Item #</th>
<th>A14</th>
<th>B14</th>
<th>B15</th>
<th>B4</th>
<th>B5</th>
<th>B6</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRI</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ROT RATE</td>
<td>30(50)</td>
<td>0.1000</td>
<td>0.1000</td>
<td>0.1000</td>
<td>0.1000</td>
<td>0.1000</td>
</tr>
<tr>
<td>ATT DB</td>
<td>31(51)</td>
<td>40.00</td>
<td>40.00</td>
<td>40.00</td>
<td>40.00</td>
<td>40.00</td>
</tr>
<tr>
<td>RATE DB</td>
<td>32(52)</td>
<td>5.00</td>
<td>5.00</td>
<td>5.00</td>
<td>5.00</td>
<td>5.00</td>
</tr>
<tr>
<td>ROT PLS</td>
<td>33(53)</td>
<td>0.04</td>
<td>0.13</td>
<td>0.07</td>
<td>0.07</td>
<td>0.06</td>
</tr>
<tr>
<td>COMP</td>
<td>34(54)</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>P OPTION</td>
<td>35(55)</td>
<td>TAIL</td>
<td>TAIL</td>
<td>TAIL</td>
<td>TAIL</td>
<td>TAIL</td>
</tr>
<tr>
<td>Y OPTION</td>
<td>36(56)</td>
<td>TAIL</td>
<td>TAIL</td>
<td>TAIL</td>
<td>TAIL</td>
<td>TAIL</td>
</tr>
<tr>
<td>TRAN PLS</td>
<td>37(57)</td>
<td>0.10</td>
<td>0.03</td>
<td>0.03</td>
<td>*</td>
<td>0.03</td>
</tr>
<tr>
<td>ALT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RATE DB</td>
<td>38(58)</td>
<td>0.070</td>
<td>0.070</td>
<td>0.070</td>
<td>0.070</td>
<td>0.070</td>
</tr>
<tr>
<td>JET OPT</td>
<td>39(59)</td>
<td>TAIL</td>
<td>TAIL</td>
<td>TAIL</td>
<td>TAIL</td>
<td>TAIL</td>
</tr>
<tr>
<td># JETS</td>
<td>40(60)</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>ON TIME</td>
<td>41(61)</td>
<td>0.16</td>
<td>0.32</td>
<td>0.24</td>
<td>0.24</td>
<td>0.24</td>
</tr>
<tr>
<td>DELAY</td>
<td>42(62)</td>
<td>5.68</td>
<td>5.68</td>
<td>1.68</td>
<td>1.68</td>
<td>0.00</td>
</tr>
<tr>
<td>VERN</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ROT RATE</td>
<td>43(63)</td>
<td>0.0500</td>
<td>0.0500</td>
<td>0.0500</td>
<td>0.0500</td>
<td>0.0500</td>
</tr>
<tr>
<td>ATT DB</td>
<td>44(64)</td>
<td>40.00</td>
<td>40.00</td>
<td>40.00</td>
<td>40.00</td>
<td>40.00</td>
</tr>
<tr>
<td>RATE DB</td>
<td>45(65)</td>
<td>.500</td>
<td>.500</td>
<td>.500</td>
<td>.500</td>
<td>.500</td>
</tr>
<tr>
<td>ROT PLS</td>
<td>46(66)</td>
<td>0.002</td>
<td>0.002</td>
<td>0.002</td>
<td>0.002</td>
<td>0.002</td>
</tr>
<tr>
<td>COMP</td>
<td>47(67)</td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
</tr>
<tr>
<td>CNTL ACC</td>
<td>48(68)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>PURPOSE</td>
<td>DTO 261 PITCH</td>
<td>DTO 261 PITCH</td>
<td>DTO 261 YAW1</td>
<td>DTO 261 AFT</td>
<td>DTO 261 YAW2</td>
<td>DTO 261 ROLL</td>
</tr>
</tbody>
</table>

* Check with MCC for value
1. **CHECKING FOR READINESS TO PROCEED WITH TEST OPERATIONS**

   **NOTE**
   1. GMT start times for Test 1 and Test 2 operations have been predetermined relative to the beginning of the orbital day and night periods. These times will be up-linked with the Execute Package.

   2. The following test procedures assume orbiter control of mated stack using VRCS mode.

   ISS ⇒ orbiter, “IWIS activation complete.”

   **************************************************
   If ISS is controlling mated stack prior to test operations, then
   Perform {HANDOVER ATTITUDE CONTROL RS THRUSTERS TO ORBITER}, all (SODF: JNT OPS: MATED OPERATIONS), then:
   **************************************************

2. **SELECTING CALIBRATION SETTINGS FILE**

   SSC
   Utilities: Calibration Settings
   RSU/Ch Calibration Settings

   **cmd** Select
   **sel** 4A_BASE.clb
   **cmd** Open
   **cmd** Make Active

   If ‘Replace existing c:\wis\cal\Active.clb?’ message appears
   **cmd** Replace

   **cmd** RETURN

3. **RESETTING RSU 1 AND RSU 2**

   SSC
   Commands: Init. for Data Collection
   Initialize Network & Acquire Data

   **cmd** Reset RSUs
   **cmd** Confirm (response to ‘Please confirm your request…’)

   Wait until data blocks in Response portion of window fill.

   √Status:  1026 resetting
   √Status:  1027 resetting

   **************************************************
   If Status – **XXXX resetting** where XXXX is any S/N other than 1026 or 1027, then
   Return to beginning of step 3.
   **************************************************
If Status – ‘XXXX Unable to contact target node’ where XXXX is any S/N other than 1026 or 1027, then
Return to beginning of step 3.

*********************************************************************

If Status: ‘1026 Unable to contact target node’
Perform [UNABLE TO CONTACT TARGET NODE], all
(SODF: ASSY OPS: MALFUNCTION: IWIS SOFTWARE), then:

*********************************************************************

If Status: ‘1027 Unable to contact target node’
Perform [UNABLE TO CONTACT TARGET NODE], all
(SODF: ASSY OPS MALFUNCTION: IWIS SOFTWARE), then:

*********************************************************************

cmd RETURN

4. PERFORMING HARDWARE WARMUP FOR RSU 1 AND RSU 2
 SSC Commands: Init. for Data Collection
 Initialize Network & Acquire Data

cmd Select (blue button in upper right quadrant)
 sel 4A_WARMUP_TEST
 cmd Open

√ACQ. Start Time toggle button – Use Current Time

If toggle button – Select Start Time
 sel Use Current Time (update display to current time and date)

sel Select Start Time (input desired time)

NOTE
1. The ACQ Start Time must be equal to the current time plus a minimum of 12 minutes.
2. The input time will be GMT in hrs:min:sec format with seconds input as zero.

Use mouse to highlight time portion of ACQ Start Time display.

input [XX:XX:00] where XX:XX:00 is GMT in hr:min:sec format
 cmd Execute

Record ACQ. Start Time: _____ : _____ : _____

√Message Box
If Message Box – ‘CLEAR MEMORY REMINDER’

**cmd** Confirm

************************************************************************************

If Message Box – ‘MESSAGE ...This file could not execute because:
* insufficient time for warmup’

Return to step 4, √ACQ. Start Time toggle button.
input Updated test start time that is increased by at least one minute

*************************************************************************************

If Message Box – ‘MESSAGE ...This file could not execute because:
* a data folder with same name exists’

**cmd** Save (blue button in upper right quadrant)
input file_name_1 (Use same file_name as at beginning of this step
and append_1, i.e., input 4A_WARMUP_TEST_1)

**cmd** Save
Return to step 4, √ACQ. Start Time toggle button.
input Updated test start time

*************************************************************************************

If Message Box – ‘MESSAGE ...This file could not execute because:
* Some subfiles are incompatible/missing
* Listen schedule for Events are inconsistent’

The command file must be rebuilt.

√MCC-H

Perform (COMMAND FILE WILL NOT EXECUTE), all (SODF: ASSY
OPS: MALFUNCTION: IWIS SOFTWARE), then:

*************************************************************************************

√Message Box – ‘CONFIRMATION’

**cmd** Confirm

Wait until Status table fills with data.

√RSU Status – ‘Initialization Pending’
If RSU Status – ‘Initialization Pending: 2 Hr’
Verify the GMT input for data acquisition.

If correct GMT was input, then
Perform [NODE NOT CONFIGURED IN NETWORK], all (SODF: ASSY OPS: MALFUNCTION: IWIS SOFTWARE), then:

If incorrect GMT was input, then proceed as follows

cmd ABORT RSUs

cmd Confirm

√ Status – XXXX aborting

Wait 30 seconds to 1 minute.

√ Status – XXXX aborted

/cmd Save (blue button in upper right quadrant)
input 4A_WARMUP_TEST_1 (file_name from beginning of this step with _1 appended)
/cmd Save (in Save Command File dialog box)

input Updated test start time that is increased by at least one minute
Return to step 4, cmd Execute.

************************************************************************************

Wait until RSU Status updates (approximately 30 seconds to 1 minute).

√ RSU Status – Initialized

Verify # of Events: 1
Verify Event 0 Start – same GMT value as input above
Verify Event 0 To Start ≥ 10:00, <decrementing>

√ Event 0 Remaining time on counter

 When Event 0 Remaining: 00:00:00, warmup is complete.

/cmd RETURN

5. RESETTING RSU 1 AND RSU 2

SSC
Commands: Init. for Data Collection
 Initialize Network & Acquire Data

/cmd Reset RSUs
/cmd Confirm (response to ‘Please confirm your request...’)

Wait until data blocks in Response portion of window fill.

√ Status: 1026 resetting
√ Status: 1027 resetting
6. SELECTING COMMAND FILE FOR TEST 1 DATA ACQUISITION (RSU 1 AND RSU 2)

SSC Commands: Init. for Data Collection

![Initialize Network & Acquire Data](image)

**cmd** Select (blue button in upper right quadrant)

**sel** 4A_TEST1_RSU12

**cmd** Open

√ACQ. Start Time toggle button – Use Current Time

If toggle button – Select Start Time

**sel** Use Current Time (update display to current time and date)

**sel** Select Start Time (input desired time)

**NOTE**

1. The ACQ Start Time must be equal to the current time plus a minimum of 15 minutes.

2. The input time will be GMT in hrs:min:sec format with seconds input as zero.

3. The pad of 15 minutes is to allow time for IWIS to initialize prior to time synchronization with orbiter at ET-10:00 in next step.

Use mouse to highlight time portion of ACQ Start Time display.

input [XX:XX:00] where XX:XX:00 is GMT in hr:min:sec format

**cmd** Execute

Record ACQ. Start Time: _____ : _____ : _____

√Message Box

If Message Box – ‘CLEAR MEMORY REMINDER’

**cmd** Confirm
If Message Box – ‘MESSAGE …This file could not execute because:  
* insufficient time for warmup’
Return to step 6, √ACQ. Start Time toggle button.
input Updated test start time that is increased by at least one minute
*******************************************************************************

If Message Box – ‘MESSAGE …This file could not execute because:  
* a data folder with same name exists’
cmd Save (blue button in upper right quadrant)
input file_name_1 (Use same file_name as at beginning of this step 
and append_1, i.e., input 4A_TEST1_RSU12_1)
cmd Save

Return to step 6, √ACQ. Start Time toggle button.
input Updated test start time
*******************************************************************************

If Message Box – ‘MESSAGE …This file could not execute because:  
* Some subfiles are incompatible/missing  
* Listen schedule for Events are inconsistent
The command file must be rebuilt.

√MCC-H

Perform {COMMAND FILE WILL NOT EXECUTE}, all (SODF: ASSY 
OPS: MALFUNCTION: IWIS SOFTWARE), then:
*******************************************************************************

√Message Box – ‘CONFIRMATION’
cmd Confirm

Wait until Status table fills with data.
√RSU Status – ‘Initialization Pending’
If RSU Status – ‘Initialization Pending: 2 Hr’
Verify the GMT input for data acquisition.

If correct GMT was input, then
Perform {NODE NOT CONFIGURED IN NETWORK}, all (SODF:
ASSY OPS: MALFUNCTION: IWIS SOFTWARE), then:

If incorrect GMT was input, then proceed as follows

**cmd** ABORT RSUs

**cmd** Confirm

√Status – XXXX aborting

Wait 30 seconds to 1 minute.

√Status – XXXX aborted

**cmd** Save (blue button in upper right quadrant)
input 4A_TEST1_RSU12_1 (file_name from beginning of this step with _1 appended)

**cmd** Save (in Save Command File dialog box)

input Updated test start time that is increased by at least one minute
Return to step 6, **cmd** Execute.

************************************************************************************

Wait approximately 30 seconds to 1 minute.

√RSU Status – Initialized

Verify # of Events: 5
Verify Event 0 Start – same GMT value as input above
Verify Event 0 To Start ≥ 12:00, <decrementing>
### 7. MONITORING IWIS EVENT COUNTERS

<table>
<thead>
<tr>
<th>Event 0 To Start</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NOTE</strong></td>
</tr>
<tr>
<td>In order to synchronize the orbiter event timer with the IWIS software countdown clock, a call will be made to the orbiter by the IWIS operator at the ET-10:00 mark. The orbiter event timer should begin a 10 minute countdown on this mark.</td>
</tr>
</tbody>
</table>

√ Event 0 To Start

When To Start = 10:30, ISS ➔ orbiter, “10 minutes to test start on my mark…”

When To Start = 10:00, ISS ➔ orbiter, “Mark”

<table>
<thead>
<tr>
<th>Time</th>
<th>Action</th>
</tr>
</thead>
</table>
| ET-10:00 | **PLT**  
|        | On call from IWIS operator  
|        | Start orbiter event timer.  
|        | **A7**  
|        | PI BAY FLOOD (all) – OFF  
|        | **CDR**  
|        | Configure DAP. |
| ET-10:00 | √ DAP: A12/AUTO/VERN NO LO Z  
|        | **CRT**  
|        | GNC 20 DAP CONFIG  
|        | EDIT DAP A12 – ITEM 3 +1 2 EXEC  
|        | VERN ROT RATE – ITEM 63 +0.0 5 EXEC  
|        | ITEM 5 EXEC  
|        | Verify DAPs A14, B14, B15, B4, B5, B6 are loaded per DTO 261 DAP SETUP.  
| CDR     | Configure flight controller power.  
| ET-3:00 | O14,  
|        | Pri RJD LOGIC, DRIVER (sixteen) – cl  
|        | O15,  
|        | √ cb MNA, B DDU L (two) – cl  
|        | O16  
| CRT     | GNC 25 RM ORBIT  
|        | SW RM INH – ITEM 16 EXEC (*)  
|        | F7  
|        | L FLT CNTLR PWR – ON  
|        | SW RM INH – ITEM 16 EXEC (no *)  
|        | √ Event 0 To Start  
|        | When To Start = 00:30, orbiter goes Free Drift.  
| CDR     | Initiate DAP FREE.  
| ET-0:30 | C3  
|        | DAP: FREE  
|        | DAP: A/ALT  
|        | Orbiter ➔ ISS, “DAP FREE”  

10 NOV 00
Set up for Subtest 1.0: PITCH fires L2U,R2U (L2D,R2D).

**CAUTION**

Do not select DAP: AUTO, INRTL, or LVLH while control accel 0 is loaded. This will result in loss of vehicle control and potentially damage hardware.

**NOTE**

Vehicle rates displayed on Universal Pointing and the ADIs will be incorrect when control accel 0 is loaded.

**CRT**

<table>
<thead>
<tr>
<th>GNC 20 DAP CONFIG</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOAD DAP A14 AND B14</td>
</tr>
</tbody>
</table>

√Event 0 To Start
When To Start = 00:00, ISS ⇒ orbiter, “TØ” (orbiter initiates Subtest 1.0).

**CDR**
Initiate Subtest 1.0: PITCH fires L2U,R2U (L2D,R2D).

- **ET = 0:00 (T=0)**
  Wait 2 seconds.
- **ET = 0:02 (T=2)**
  L RHC +PITCH, 1 pulse
- **ET = 0:03 (T=3)**
  DAP: B
- **ET = 0:05 (T=5)**
  L RHC -PITCH, 1 pulse

√Event 0 Remaining
When Remaining = 00:00, Subtest 1.0 is complete.

**CDR**
Remain in FREE for next subtest.

**ET = 3:30**
Proceed to next subtest setup: YAW1 fires L1L (R1R).

**CRT**
Load DAP A12 (Required before AUTO).
Load DAP B15.

√Event 1 To Start
When To Start = 00:00, ISS ⇒ orbiter, “TØ” (orbiter initiates Subtest 1.1).

**CDR**
Initiate Subtest 1.1: YAW1 fires L1L (R1R).

- **ET = 4:20 (T=0)**
  Wait 2 seconds.
- **ET = 4:22 (T=2)**
  L RHC -YAW, 1 pulse
- **ET = 4:28.4 (T=8.4)**
  L RHC +YAW, 1 pulse
√Event 1 Remaining
When Remaining = 00:00, Subtest 1.1 is complete
(or orbiter resumes attitude control).

cdr EVENT SCROLL (down arrow button)

<table>
<thead>
<tr>
<th>CDR</th>
<th>Configure for DAP AUTO.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ET = 7:50</td>
<td>DAP: A12/VERN</td>
</tr>
<tr>
<td></td>
<td>DAP: A/AUTO</td>
</tr>
<tr>
<td></td>
<td>Orbiter ⇒ ISS, “DAP AUTO”</td>
</tr>
</tbody>
</table>

Setup for Subtest 1.2: AFT fires R1A, L1A.

CRT Load DAP B4.

√Event 2 To Start
When To Start = 00:30, orbiter goes Free Drift.

<table>
<thead>
<tr>
<th>CDR</th>
<th>Initiate DAP FREE.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ET = 8:50</td>
<td>DAP: FREE</td>
</tr>
<tr>
<td></td>
<td>Orbiter ⇒ ISS, “DAP FREE”</td>
</tr>
<tr>
<td></td>
<td>DAP: B</td>
</tr>
<tr>
<td></td>
<td>DAP TRANS: PLS, PLS</td>
</tr>
</tbody>
</table>

√Event 2 To Start
When To Start = 00:00, ISS ⇒ orbiter, “TØ”
(or orbiter initiates Subtest 1.2)

<table>
<thead>
<tr>
<th>CDR</th>
<th>Initiate Subtest 1.2: AFT fires R1A, L1A.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ET = 9:20 (T=0)</td>
<td>Wait 2 seconds.</td>
</tr>
<tr>
<td>ET = 9:22 (T=2)</td>
<td>THC: +X, 1 pulse</td>
</tr>
</tbody>
</table>

√Event 2 Remaining
When Remaining = 00:00, Subtest 1.2 is complete
(or orbiter resumes attitude control).

cdr EVENT SCROLL (down arrow button)

<table>
<thead>
<tr>
<th>CDR</th>
<th>Configure for DAP AUTO.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ET = 12:50</td>
<td>DAP: A12/VERN</td>
</tr>
<tr>
<td></td>
<td>DAP: A/AUTO</td>
</tr>
<tr>
<td></td>
<td>Orbiter ⇒ ISS, “DAP AUTO”</td>
</tr>
</tbody>
</table>

CDR Setup for Subtest 1.3: YAW2 fires L1L (R1R).

CRT Load DAP B5.
Reconfig CCTV.
<table>
<thead>
<tr>
<th>Event 3 To Start</th>
<th>Event 3 Remaining</th>
</tr>
</thead>
<tbody>
<tr>
<td>When To Start = 00:30, orbiter goes Free Drift.</td>
<td></td>
</tr>
<tr>
<td>When Remaining = 00:00, Subtest 1.3 is complete (orbiter resumes attitude control).</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Event 3 To Start</th>
<th>Event 3 Remaining</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDR ET = 13:50</td>
<td>Initiate DAP FREE and setup for Subtest 1.3.</td>
</tr>
<tr>
<td>DAP: FREE</td>
<td>DAP: B/ALT</td>
</tr>
<tr>
<td>Orbiter ⇒ ISS, “DAP FREE”</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Event 3 To Start</th>
<th>Event 3 Remaining</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDR ET = 14:20 (T=0)</td>
<td>Wait 2 seconds.</td>
</tr>
<tr>
<td>ET = 14:22 (T=2)</td>
<td>L RHC -YAW, 1 pulse</td>
</tr>
<tr>
<td>ET = 16:02 (T=1:42)</td>
<td>L RHC +YAW, 1 pulse</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Event 4 To Start</th>
</tr>
</thead>
<tbody>
<tr>
<td>When To Start = 00:30, orbiter goes Free Drift.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Event 4 To Start</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDR ET = 18:50</td>
</tr>
<tr>
<td>DAP: FREE</td>
</tr>
<tr>
<td>Orbiter ⇒ ISS, “DAP FREE”</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Event 4 To Start</th>
</tr>
</thead>
<tbody>
<tr>
<td>Configure for DAP AUTO.</td>
</tr>
<tr>
<td>DAP: A12/VERN</td>
</tr>
<tr>
<td>DAP: A/AUTO</td>
</tr>
<tr>
<td>Orbiter ⇒ ISS, “DAP AUTO”</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Event 4 To Start</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setup for Subtest 1.4: ROLL fires L2U, R2D (L2D, R2U).</td>
</tr>
<tr>
<td>CRT Load DAP B6.</td>
</tr>
<tr>
<td>Reconfig CCTV.</td>
</tr>
</tbody>
</table>
Event 4 To Start
When To Start = 00:00, ISS ⇒ orbiter, “T0”
(or orbiter initiates Subtest 1.4).

<table>
<thead>
<tr>
<th>CDR</th>
<th>Initiate Subtest 1.4: ROLL fires L2U, R2D (L2D, R2U).</th>
</tr>
</thead>
<tbody>
<tr>
<td>ET = 19:20 (T=0)</td>
<td>Wait 2 seconds.</td>
</tr>
<tr>
<td>ET = 19:22 (T=2)</td>
<td>L RHC -ROLL, 1 pulse</td>
</tr>
<tr>
<td>ET = 19:28.4 (T=8.4)</td>
<td>L RHC +ROLL, 1 pulse</td>
</tr>
</tbody>
</table>

Event 4 Remaining
When Remaining = 00:00, ISS ⇒ orbiter, “Test 1 complete.”

**cmd** RETURN

<table>
<thead>
<tr>
<th>CDR</th>
<th>Configure for DAP AUTO.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ET = 22:50</td>
<td>DAP: A12/VERN</td>
</tr>
<tr>
<td>DAP: A/AUTO</td>
<td>Orbiter ⇒ ISS, “DAP AUTO”</td>
</tr>
</tbody>
</table>

Proceed to SAFE RHC.

**F7** L FLT CNTLR PWR – OFF

Perform post-test DAP Reconfiguration.

**CRT**

- GNC 20 DAP CONFIG
- LOAD DAP B12
- EDIT DAP A12 – ITEM 3 +1 2 EXEC
- VERN ROT RATE – ITEM 63 +0.1 EXEC
- ITEM 5 EXEC

**F7** √ L FLT CNTLR PWR – OFF

**O14, O15**

- cb MNA, B DDU L (two) – as required

**√MCC-H** for Pri RJD LOGIC, DRIVER configuration

*****************************************************************************
If ISS is to control mated stack following test operations, then
Perform {HANDOVER ATTITUDE CONTROL ORBITER TO RS THRUSTERS}, all (SODF: JNT OPS), then:
*****************************************************************************

**PLT**

Allow the orbiter event timer to continue running so that Test 2 preparations can be properly coordinated.
8. **DOWNLOADING DATA FROM RSU 1 AND RSU 2**

SSC

Commands: Download Data

![Download Data]

sel Download Remaining Data (button will blink once)

```plaintext
NOTE
2. Leave IWIS software running in background.
```

sel Start: Programs: Windows Explorer

```plaintext
Exploring – (C:)
```

Use Windows Explorer to monitor progress of download.

- **√ Time tag for last file to be downloaded**
  - If time > 3 minutes since last file, download error has occurred.

- **√ File size of downloaded files**
  - If size of any file equals 0 bytes, download error has occurred.

- **√ Number of downloaded files**
  - If number of files is incorrect, download error has occurred.

Download is complete when the following folders have the number of files shown and all files have size greater than zero (directory path will correspond to name of command file chosen in step 6).

<table>
<thead>
<tr>
<th>Directory Path</th>
<th># of Files</th>
<th>File Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>C:\wis\data\4A_TEST1\RSU12\RSU1_Node_Fwd_T1</td>
<td>12</td>
<td>&gt; 0</td>
</tr>
<tr>
<td>C:\wis\data\4A_TEST1\RSU12\RSU2_Node_Aft_T1</td>
<td>12</td>
<td>&gt; 0</td>
</tr>
</tbody>
</table>
If a download error has occurred, perform following corrective actions
Check communications with RSU that caused download error.

Utilities: Node Status

sel Node ID – [X] where [X] is RSU serial number (left click in data window)

cmd Get Status

Verify Get Status button changes to gray Updating button. Wait until Get Status changes back to blue and data windows fill.

√ Errors
If Errors – None
Communications with RSU is okay.
Return to beginning of step 8 and repeat download attempt.

If Errors – Unable to contact target node
input RSU S/N [X] where [X] = S/N of RSU causing error
sel Add RSU to Network (click in data window labeled “Action”)

cmd Configure

cmd OK (response to ‘Proceed Configure?’)
Return to beginning of step 8 and repeat download attempt.

***********************************************************************************

sel Exploring: Minimize

cmd RETURN (in Download Data window of IWIS software)

ISS ⇒ orbiter, “Download to SSC complete.”
9. **PERFORMING AUTO RANGE FUNCTION**

**SSC**

Commands: Auto Range

**Auto Range**

**cmd** Start Auto Range (button changes to ‘RANGING Please Wait’)

**********************************************************
If MESSAGE – ‘MISSING COMMAND FILE…’
**cmd** Confirm

Commands: Init. for Data Collection

[Initialize Network and Acquire Data]

**cmd** Select (blue button)

sel 4A_TEST1_RSU12 (use mouse pointer)

**cmd** Open

**cmd** RETURN

Window: Auto Range

[Auto Range]

Return to the step, **cmd** Start Auto Range.

**********************************************************

Wait until button changes back to Start Auto Range (requires 5 to 10 minutes)

√

List of gain values on right side of screen

If list of gains values – grayed out

Error has occurred – most likely cause is that download was incomplete

If this is first attempt to perform Auto Range – repeat steps 8 and 9

If this is second attempt to perform Auto Range – Proceed to step 10

If list of gains values – filled with values

**cmd** Save Command File

input 4A_TEST1_RSU12_RR (in file input block of Save As window)

**cmd** Save

**cmd** RETURN

10. **COPYING FILES TO REMOVABLE HARD DISK CARD**

**SSC**

sel Start: Programs: Windows Explorer

[Exploring – (C:)]

sel c:\wis\data\4A_TEST1_RSU12

Copy folder and contents to /wis/data/ folder on Hard Disk Card.

sel Exploring: Minimize
11. **RESETTING RSU 1 AND RSU 2**

SSC Commands: Init. for Data Collection

| Initialize Network & Acquire Data |

**cmd** Reset RSUs

**cmd** Confirm (response to ‘Please confirm your request…’)  

Wait until data blocks in Response portion of window fill.

√ Status: 1026 resetting
√ Status: 1027 resetting

**************************************************************************

If Status – ‘Unable to contact target node’

Perform {UNABLE TO CONTACT TARGET NODE}, all (SODF: ASSY OPS: MALFUNCTION: IWIS SOFTWARE), then:

**************************************************************************

**cmd** RETURN

12. **SELECTING COMMAND FILE FOR TEST 2 DATA ACQUISITION (RSU 1 AND RSU 2)**

SSC Commands: Init. for Data Collection

| Initialize Network & Acquire Data |

**cmd** Select (blue button in upper right quadrant)

If 4A_TEST1_RSU12_RR is available

| sel 4A_TEST1_RSU12_RR |

If 4A_TEST1_RSU12_RR is not available

| sel 4A_TEST2_RSU12 |

**cmd** Open

**NOTE**

1. The ACQ Start Time must be equal to the current time plus a minimum of 7 minutes.
2. The input time will be GMT in hrs:min:sec format with seconds input as zero.

√ACQ. Start Time toggle button – Use Current Time

If toggle button – Select Start Time

| sel Use Current Time (update display to current time and date) |

sel Select Start Time (input desired time)

Use mouse to highlight time portion of ACQ Start Time display.
input [XX:XX:00] where XX:XX:00 is GMT in hr:min:sec format

**cmd** Execute

Record ACQ. Start Time: _____ : _____ : _____

√Message Box

If Message Box – ‘CLEAR MEMORY REMINDER’

**cmd** Confirm

************************************************************************************
If Message Box – ‘MESSAGE …This file could not execute because:
* insufficient time for warmup’
Return to step 12, √ACQ. Start Time toggle button.
input Updated test start time that is increased by at least one minute
************************************************************************************

************************************************************************************
If Message Box – ‘MESSAGE …This file could not execute because:
* a data folder with same name exists’
**cmd** Save (blue button in upper right quadrant)
input file_name_1 (Use same file_name as at beginning of this step
and append _1, i.e., input either 4A_TEST1_RSU12_RR_1 or
4A_TEST2_RSU12_1)
**cmd** Save
Return to step 12, √ACQ. Start Time toggle button.
input Updated test start time
************************************************************************************

************************************************************************************
If Message Box – ‘MESSAGE …This file could not execute because:
* Some subfiles are incompatible/missing
* Listen schedule for Events are inconsistent’
The command file must be rebuilt.

√MCC-H

Perform [COMMAND FILE WILL NOT EXECUTE], all (SODF: ASSY
OPS: MALFUNCTION: IWIS SOFTWARE), then:

************************************************************************************

√Message Box – ‘CONFIRMATION’

**cmd** Confirm

Wait until Status table fills with data.

√RSU Status – ‘Initialization Pending’
If RSU Status – ‘Initialization Pending: 2 Hr’
Verify the GMT input for data acquisition.

If correct GMT was input, then
   Perform {NODE NOT CONFIGURED IN NETWORK}, all (SODF: ASSY OPS: MALFUNCTION: IWIS SOFTWARE), then:

If incorrect GMT was input, then proceed as follows
   cmd ABORT RSUs
   cmd Confirm

   √ Status – XXXX aborting
   Wait 30 seconds to 1 minute.

   √ Status – XXXX aborted

   cmd Save (blue button in upper right quadrant)
   input file_name_1 (Use same file_name as at beginning of this step and append _1, i.e., input either 4A_TEST1_RSU12_RR_1 or 4A_TEST2_RSU12_1)
   cmd Save (in Save Command File dialog box)

   input Updated test start time that is increased by at least one minute
   Return to step 12, cmd Execute.

Wait until RSU Status updates (~30 seconds to 1 minute).

√ RSU Status – Initialized

Verify # of Events: 5
Verify Event 0 Start – same GMT value as input above
Verify Event 0 To Start ≥ 05:00, <decrementing>
### 13. MONITORING IWIS EVENT COUNTERS

<table>
<thead>
<tr>
<th><strong>NOTE</strong></th>
<th>When the orbiter event timer reaches ET = 47:00, there is approximately ten minutes remaining until the start of Test 2.</th>
</tr>
</thead>
</table>

**CDR**
Configure DAP.

**ET = 47:00**
√DAP: A12/AUTO/VERN NO LO Z

**CRT**
GNC 20 DAP CONFIG
EDIT DAP A12 – ITEM 3  +1  2 EXEC
VERN ROT RATE – ITEM 63  +0.0  5 EXEC
ITEM 5 EXEC

**CDR**
Configure flight controller power.

**O14, O15, O16**
Pri RJD LOGIC, DRIVER (sixteen) – ON
√cb MNA, B DDU L (two) – cl

**CRT**
GNC 25 RM ORBIT
SW RM INH – ITEM 16 EXEC (*)
F7 L FLT CNTLR PWR – ON
SW RM INH – ITEM 16 EXEC (no *)

<table>
<thead>
<tr>
<th><strong>NOTE</strong></th>
<th>The orbiter event timer must be reset prior to Test 2 start to synchronize with the IWIS software counters. The IWIS operator will make a call at 3 minutes prior to Test 2 start. The orbiter event timer should begin a 3 minute countdown on this mark.</th>
</tr>
</thead>
</table>

√Event 0 To Start
When To Start = 03:30, ISS ⇒ orbiter, “3 minutes to test start on my mark…”
When To Start = 03:00, ISS ⇒ orbiter, “Mark”

**PLT**
On call from IWIS operator

- **ET-3:00**
Start orbiter event timer.

√Event 0 To Start
When To Start = 00:30, orbiter goes Free Drift.

**CDR**
Initiate DAP FREE.
DAP: FREE
DAP: A/ALT
Orbiter ⇒ ISS, “DAP FREE”
CAUTION
Do not select DAP: AUTO, INRTL, or LVLH while control accel 0 is loaded. This will result in loss of vehicle control and potentially damage hardware.

NOTE
Vehicle rates displayed on Universal Pointing and the ADIs will be incorrect when control accel 0 is loaded.

CDR
Set up for Subtest 2.0: PITCH fires L2U, R2U (L2D, R2D).

CRT
GNC 20 DAP CONFIG
LOAD DAP A14 AND B14

√Event 0 To Start
When To Start = 00:00, ISS ⇒ orbiter, “TØ” (orbiter initiates Subtest 2.0).

CDR
 Initiate Subtest 2.0: PITCH fires L2U, R2U (L2D, R2D).

 ET = 0:00 (T=0)
 Wait 2 seconds.

 ET = 0:02 (T=2)
 L RHC +PITCH, 1 pulse

 ET = 0:03 (T=3)
 DAP: B

 ET = 0:05 (T=5)
 L RHC -PITCH, 1 pulse

√Event 0 Remaining
When Remaining = 00:00, Subtest 2.0 complete.

CDR
Remain in FREE for next subtest.

ET = 3:30
Setup for Subtest 2.1: YAW1 fires L1L (R1R).

CRT
Load DAP A12 (required before AUTO).
Load DAP B15.

√Event 1 To Start
When To Start = 00:00, ISS ⇒ orbiter, “TØ” (orbiter initiates Subtest 2.1).

CDR
Initiate Subtest 2.1: YAW1 fires L1L (R1R).

 ET = 4:20 (T=0)
 Wait 2 seconds.

 ET = 4:22 (T=2)
 L RHC -YAW, 1 pulse

 ET = 4:28.4 (T=8.4)
 L RHC +YAW, 1 pulse
Event 1 Remaining
When Remaining = 00:00, Subtest 2.1 is complete
(orbiter resumes attitude control).

sel EVENT SCROLL (down arrow button)

<table>
<thead>
<tr>
<th>CDR</th>
<th>Configure for DAP AUTO.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ET = 7:50</td>
<td>DAP: A12/VERN</td>
</tr>
<tr>
<td></td>
<td>DAP: A/AUTO</td>
</tr>
<tr>
<td></td>
<td>Orbiter ⇒ ISS, “DAP AUTO”</td>
</tr>
<tr>
<td></td>
<td>Setup for Subtest 2.2: AFT fires R1A, L1A.</td>
</tr>
</tbody>
</table>

| CRT     | Load DAP B4. |

Event 2 To Start
When To Start = 00:30, orbiter goes Free Drift.

<table>
<thead>
<tr>
<th>CDR</th>
<th>Initiate DAP FREE.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ET = 8:50</td>
<td>DAP: FREE</td>
</tr>
<tr>
<td></td>
<td>Orbiter ⇒ ISS, “DAP FREE”</td>
</tr>
<tr>
<td></td>
<td>DAP: B</td>
</tr>
<tr>
<td></td>
<td>DAP TRANS: PLS, PLS, PLS</td>
</tr>
</tbody>
</table>

Event 2 To Start
When To Start = 00:00, ISS ⇒ orbiter: “TØ”
(orbiter initiates Subtest 2.2).

<table>
<thead>
<tr>
<th>CDR</th>
<th>Initiate Subtest 2.2: AFT: fires R1A, L1A.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ET = 9:20 (T=0)</td>
<td>Wait 2 seconds.</td>
</tr>
<tr>
<td>ET = 9:22 (T=2)</td>
<td>THC: +X, 1 pulse</td>
</tr>
</tbody>
</table>

Event 2 Remaining
When Remaining = 00:00, Subtest 2.2 is complete
(orbiter resumes attitude control).

sel EVENT SCROLL (down arrow button)

<table>
<thead>
<tr>
<th>CDR</th>
<th>Configure for DAP AUTO.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ET = 12:50</td>
<td>DAP: A12/VERN</td>
</tr>
<tr>
<td></td>
<td>DAP: A/AUTO</td>
</tr>
<tr>
<td></td>
<td>Orbiter ⇒ ISS, “DAP AUTO”</td>
</tr>
<tr>
<td></td>
<td>Setup for Subtest 2.3: YAW2 fires L1L (R1R).</td>
</tr>
</tbody>
</table>

| CRT     | Load DAP B5. |

10 NOV 00
Event 3 To Start
When To Start = 00:30, orbiter goes Free Drift.

<table>
<thead>
<tr>
<th>Event</th>
<th>Time</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td></td>
<td>Initiate DAP FREE and setup for next subtest.</td>
</tr>
</tbody>
</table>
|      | ET = 13:50 | DAP: FREE  
DAP: B/ALT  
Orbiter ⇒ ISS, “DAP FREE” |

Event 3 To Start
When To Start = 00:00, ISS ⇒ orbiter: “TØ”  
(or orbiter initiates Subtest 2.3).

<table>
<thead>
<tr>
<th>Event</th>
<th>Time</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td></td>
<td>Initiate Subtest 2.3: YAW2 fires L1L (R1R).</td>
</tr>
<tr>
<td></td>
<td>ET = 14:20 (T=0)</td>
<td>Wait 2 seconds.</td>
</tr>
<tr>
<td></td>
<td>ET = 14:22 (T=2)</td>
<td>L RHC -YAW, 1 pulse</td>
</tr>
<tr>
<td></td>
<td>ET = 16:02 (T=1:42)</td>
<td>L RHC +YAW, 1 pulse</td>
</tr>
</tbody>
</table>

Event 3 Remaining
When Remaining = 00:00, Subtest 2.3 is complete  
(or orbiter resumes attitude control).

<table>
<thead>
<tr>
<th>Event</th>
<th>Time</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>sel EVENT SCROLL (down arrow button)</td>
</tr>
</tbody>
</table>
|      | ET = 17:50 | Configure for DAP AUTO.  
DAP: A12/VERN  
DAP: A/AUTO  
Orbiter ⇒ ISS, “DAP AUTO”  
Setup for Subtest 2.4: ROLL fires L2U, R2D (L2D, R2U). |
| CRT   | | Load DAP B6. |

Event 4 To Start
When To Start = 00:30, orbiter goes Free Drift.

<table>
<thead>
<tr>
<th>Event</th>
<th>Time</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td></td>
<td>Initiate DAP FREE.</td>
</tr>
</tbody>
</table>
|      | ET = 18:50 | DAP: FREE  
DAP: B/ALT  
Orbiter ⇒ ISS, “DAP FREE” |
**Event 4 To Start**

When To Start = 00:00, ISS ⇒ orbiter, “TØ”

(orbiter initiates Subtest 2.4).

<table>
<thead>
<tr>
<th>Event</th>
<th>Time</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>Initiate Subtest 2.4: ROLL fires L2U, R2D (L2D, R2U).</td>
</tr>
<tr>
<td>2</td>
<td>19:20 (T=0)</td>
<td>Wait 2 seconds.</td>
</tr>
<tr>
<td>3</td>
<td>19:22 (T=2)</td>
<td>L RHC -ROLL, 1 pulse</td>
</tr>
<tr>
<td>4</td>
<td>19:28.4 (T=8.4)</td>
<td>L RHC +ROLL, 1 pulse</td>
</tr>
</tbody>
</table>

**Event 4 Remaining**

When Remaining = 00:00, ISS ⇒ orbiter, “Test 2 complete.”

**cmd RETURN**

<table>
<thead>
<tr>
<th>Event</th>
<th>Time</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td></td>
<td>Configure for DAP AUTO.</td>
</tr>
<tr>
<td>6</td>
<td>22:50</td>
<td>DAP: A12/VERN</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>DAP: A/AUTO</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>Orbiter ⇒ ISS, “DAP AUTO”</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>Proceed to SAFE RHC.</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>L FLT CNTLR PWR – OFF</td>
</tr>
</tbody>
</table>

**CDR**

<table>
<thead>
<tr>
<th>Event</th>
<th>Time</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td></td>
<td>Perform post Test DAP Reconfiguration.</td>
</tr>
<tr>
<td>12</td>
<td></td>
<td>CRT GNC 20 DAP CONFIG</td>
</tr>
<tr>
<td>13</td>
<td></td>
<td>LOAD DAP B12</td>
</tr>
<tr>
<td>14</td>
<td></td>
<td>EDIT DAP A12 – ITEM 3 +1 2 EXEC</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td>VERN ROT RATE – ITEM 63 +0.1 EXEC</td>
</tr>
<tr>
<td>16</td>
<td></td>
<td>ITEM 5 EXEC</td>
</tr>
<tr>
<td>17</td>
<td></td>
<td>L FLT CNTLR PWR – OFF</td>
</tr>
<tr>
<td>18</td>
<td></td>
<td>cb MNA, B DDU L (two) – as reqd</td>
</tr>
</tbody>
</table>

**MCC-H** for Pri LOGIC, DRIVER configuration

---

If ISS is to control mated stack following test operations, then

Perform **{HANDOVER ATTITUDE CONTROL ORBITER TO RS THRUSTERS}**, all (SODF: JNT OPS), then:

---

**PLT**

<table>
<thead>
<tr>
<th>Event</th>
<th>Time</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>19</td>
<td></td>
<td>Post Test Reconfiguration.</td>
</tr>
<tr>
<td>20</td>
<td>22:50</td>
<td>Stop Orbiter event timer.</td>
</tr>
</tbody>
</table>
14. **DOWNLOADING DATA FROM RSU 1 AND RSU 2**

**SSC**

**Commands:** Download Data

Download Data

sel Download Remaining Data (button will blink once)

**NOTE**


2. Leave IWIS software running in background.

sel Start: Programs: Windows Explorer

*Exploring – (C:)*

Use Windows Explorer to monitor progress of download.

√ Time tag for last file to be downloaded
   If time > 3 minutes since last file, download error has occurred.

√ File size of downloaded files
   If size of any file equals 0 bytes, download error has occurred.

√ Number of downloaded files
   If number of files is incorrect, download error has occurred.

Download is complete when the following folders have the number of files shown and all files have size greater than zero (directory path will correspond to name of command file chosen in step 12).

<table>
<thead>
<tr>
<th>Directory Path</th>
<th># of Files</th>
<th>File Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>C:\wis\data\4A_TEST1_RSU12_RR\RSU1_Node_Fwd_T2</td>
<td>12</td>
<td>&gt; 0</td>
</tr>
<tr>
<td>C:\wis\data\4A_TEST1_RSU12_RR\RSU2_Node_Aft_T2</td>
<td>12</td>
<td>&gt; 0</td>
</tr>
</tbody>
</table>
If a download error has occurred, perform following corrective actions
Check communications with RSU that caused download error.

Utilities: Node Status

sel Node ID – [X] where [X] is RSU serial number (left click in data window)
cmd Get Status

Verify Get Status button changes to gray Updating button.
Wait until Get Status changes back to blue and data windows fill.

√ Errors

If Errors – None
Communications with RSU is okay.
Return to beginning of step 14 and repeat download attempt.

If Errors – Unable to contact target node
input RSU S/N [X] where [X] = S/N of RSU causing error
sel Add RSU to Network (click in data window labeled “Action”)  
cmd Configure  
cmd OK (response to ‘Proceed Configure?’)

Return to beginning of step 14 and repeat download attempt.

sel Exploring: Minimize

cmd RETURN (in Download Data window of IWIS software)

15. COPYING DATA FILES TO REMOVABLE HARD DISK CARD

sel Start: Programs: Windows Explorer

Exploring – (C:)

If directory c:\wis\data\4A_TEST2_RSU12 exists
sel c:\wis\data\4A_TEST2_RSU12

If directory c:\wis\data\4A_TEST1__RSU12_RR exists
sel c:\wis\data\4A_TEST1__RSU12_RR

Copy folder and contents to /wis/data/ folder on Hard Disk Card.
16. **RESETTING RSU 1 AND RSU 2**

SSC

Commands: Init. for Data Collection

[Initialize Network & Acquire Data]

- **cmd** Reset RSUs
- **cmd** Confirm (response to ‘Please confirm your request…’)

Wait until data blocks in Response portion of window fill.

- √ Status: 1026 resetting
- √ Status: 1027 resetting

******************************************************************************

If Status – ‘Unable to contact target node’

Perform (UNABLE TO CONTACT TARGET NODE), all
(SODF: ASSY OPS: MALFUNCTION: IWIS SOFTWARE), then:

******************************************************************************

**cmd** RETURN
1. **CHECK FOR READINESS TO PROCEED WITH TEST OPERATIONS**

   **NOTE**
   1. GMT start times for Test 1 and Test 2 operations have been predetermined relative to the beginning of the orbital day and night periods. These times were up-linked with the Execute Package.

   2. The following test procedures assume orbiter control of mated stack using ALT mode.

   ISS ⇒ orbiter, “IWIS activation complete.”

   ******************************************************

   If ISS is controlling mated stack prior to test operations

   Perform {HANDOVER ATTITUDE CONTROL RS THRUSTERS TO ORBITER}, all (SODF: JNT OPS: MATED OPERATIONS), then:

   ******************************************************

   2. **SELECT CALIBRATION SETTINGS FILE**

   SSC Utilities: Calibration Settings
   RSU/Ch Calibration Settings

   **cmd** Select
   sel  4A_BASE.clb
   **cmd** Open
   **cmd** Make Active

   If ‘Replace existing c:\wis\cal\Active.clb?’ message appears
   **cmd** Replace

   **cmd** RETURN

   3. **RESETTING RSU 1 AND RSU 2**

   SSC Commands: Init. for Data Collection
   Initialize Network & Acquire Data

   **cmd** Reset RSUs
   **cmd** Confirm (response to ‘Please confirm your request…’)

   Wait until data blocks in Response portion of window fill.

   √ Status:  1026 resetting
   √ Status:  1027 resetting

   ******************************************************

   If Status – ‘XXXX resetting’

   where XXXX is any S/N other than 1026 or 1027, then

   Return to beginning of step 3.
10 NOV 00

If Status – *XXXX Unable to contact target node* where
XXXX is any S/N other than 1026 or 1027, then
Return to beginning of step 3.

If Status: *1026 Unable to contact target node*
Perform [UNABLE TO CONTACT TARGET NODE], all (SODF:
ASSY OPS: MALFUNCTION: IWIS SOFTWARE), then:

If Status: *1027 Unable to contact target node*
Perform [UNABLE TO CONTACT TARGET NODE], all (SODF:
ASSY OPS: MALFUNCTION: IWIS SOFTWARE), then:

**cmd** RETURN

4. PERFORMING HARDWARE WARMUP FOR RSU 1 AND RSU 2

SSC Commands: Init. for Data Collection
Initialize Network & Acquire Data

**cmd** Select (blue button in upper right quadrant)
sel 4A_WARMUP_TALT
**cmd** Open

√ACQ. Start Time toggle button – Use Current Time

If toggle button – Select Start Time
sel Use Current Time (update display to current time and date)

sel Select Start Time (input desired time)

**NOTE**
1. The ACQ Start Time must be equal to the current time plus a minimum of 12 minutes.
2. The input time will be GMT in hrs:min:sec format with seconds input as zero.

Use mouse to highlight time portion of ACQ Start Time display.

input [XX:XX:00] where XX:XX:00 is GMT in hr: min: sec format
**cmd** Execute

Record ACQ. Start Time: _____ : _____ : _____

√Message Box
If Message Box – ‘CLEAR MEMORY REMINDER’

cmd Confirm

********************************************************************

If Message Box – ‘MESSAGE...This file could not execute because: * insufficient time for warmup’

Return to step 4, √ ACQ. Start Time toggle button.
input Updated test start time that is increased by at least one minute

********************************************************************

****************************************************************************

If Message Box – ‘MESSAGE...This file could not execute because: * a data folder with same name exists’

cmd Save (blue button in upper right quadrant)
input file_name_1 (Use same file_name as at beginning of this step and append 1, i.e., input 4A_WARMUP_TALT_1)

cmd Save

Return to step 4, √ ACQ. Start Time toggle button.
input Updated test start time

***************************************************************************

****************************************************************************

If Message Box – ‘MESSAGE...This file could not execute because:

* Some subfiles are incompatible/missing
* Listen schedule for Events are inconsistent

The command file must be rebuilt.

√MCC-H

Perform {COMMAND FILE WILL NOT EXECUTE), all (SODF: ASSY OPS: MALFUNCTION: IWIS SOFTWARE), then:

****************************************************************************

√Message Box – ‘CONFIRMATION’

cmd Confirm

Wait until Status table fills with data.

√RSU Status – ‘Initialization Pending’
If RSU Status – ‘Initialization Pending: 2 Hr’
Verify the GMT input for data acquisition.

If correct GMT was input, perform (NODE NOT CONFIGURED IN NETWORK), all (SODF: ASSY OPS: MALFUNCTION: IWIS SOFTWARE), then:

If incorrect GMT was input, then proceed as follows
  cmd ABORT RSUs
  cmd Confirm

√Status – XXXX aborting

Wait 30 seconds to 1 minute

√Status – XXXX aborted

  cmd Save (blue button in upper right quadrant)
  input file_name_1 Use same file_name as at beginning of this step
  and append 1 (i.e., input 4A_WARMUP_TALT_1)
  cmd Save (in Save Command File dialog box)

  input Updated test start time that is increased by at least one minute
  Return to step 4, cmd Execute.

Wait until RSU Status updates (approximately 30 seconds to 1 minute)

√RSU Status – Initialized

Verify # of Events: 1
Verify Event 0 Start – same GMT value as input above
Verify Event 0 To Start ≥ 10:00, <decrementing>

√Event 0 Remaining time on counter
When Event 0 Remaining – 00:00:00
Warmup is complete.

cmd RETURN

5. RESETTING RSU 1 AND RSU 2

SSC Commands: Init. for Data Collection
[Initialize Network & Acquire Data]

  cmd Reset RSUs
  cmd Confirm (response to ‘Please confirm your request…’)

Wait until data blocks in Response portion of window fill.
√Status: 1026 resetting
√Status: 1027 resetting

***********************************************************************
If Status – 'Unable to contact target node'
    Perform [UNABLE TO CONTACT TARGET NODE], all
    (SODF: ASSY OPS: MALFUNCTION: IWIS SOFTWARE), then:
***********************************************************************

cmd RETURN

6. SELECTING COMMAND FILE FOR TEST 1 DATA ACQUISITION
   (RSU 1 AND RSU 2)

SSC Commands: Init. for Data Collection
   Initialize Network & Acquire Data

cmd Select (blue button in upper right quadrant)
  sel 4A_TALT1_RSU12

Cmd Open

√ACQ. Start Time toggle button – Use Current Time

If toggle button – Select Start Time
    sel Use Current Time (update display to current time and date)

sel Select Start Time (input desired time)

<table>
<thead>
<tr>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The ACQ Start Time must be equal to the current time plus a minimum of 15 minutes.</td>
</tr>
<tr>
<td>2. The input time will be GMT in hrs:min:sec format with seconds input as zero.</td>
</tr>
<tr>
<td>3. The pad of 15 minutes is to allow time for IWIS to initialize prior to time synchronization with Orbiter at ET-10:00 in next step.</td>
</tr>
</tbody>
</table>

Use mouse to highlight time portion of ACQ Start Time display.

input [XX:XX:00] where XX:XX:00 is GMT in hr:min:sec format

Cmd Execute

Record ACQ. Start Time: _____ : _____ : _____

√Message Box

If Message Box – ‘CLEAR MEMORY REMINDER’

Cmd Confirm
If Message Box – ‘MESSAGE ...This file could not execute because:
* insufficient time for warmup’

Return to step 6, √ACQ. Start Time toggle button.
input Updated test start time that is increased by at least one minute

If Message Box – ‘MESSAGE ...This file could not execute because:
* a data folder with same name exists’

(cmd Save (blue button in upper right quadrant)
input 4A_TALT1_RSU12_1 Use same file_name as at beginning of this step and append _1
(cmd Save

Return to step 6, √ACQ. Start Time toggle button.
input Updated test start time

If Message Box – ‘MESSAGE ...This file could not execute because:
* Some subfiles are incompatible/missing
* Listen schedule for Events are inconsistent
   The command file must be rebuilt.

√MCC-H

Perform {COMMAND FILE WILL NOT EXECUTE}, all (SODF: ASSY OPS: MALFUNCTION: IWIS SOFTWARE), then:

√Message Box – ‘CONFIRMATION’

(cmd Confirm

Wait until Status table fills with data.

√RSU Status – ‘Initialization Pending’
If RSU Status – ‘Initialization Pending: 2 Hr’
Verify the GMT input for data acquisition.

If correct GMT was input, then perform (NODE NOT CONFIGURED IN NETWORK), all (SODF: ASSY OPS: MALFUNCTION: IWIS SOFTWARE), then:

If incorrect GMT was input, then proceed as follows:
  `cmd` ABORT RSUs
  `cmd` Confirm

√Status – XXXX aborting

Wait 30 seconds to 1 minute.

√Status – XXXX aborted

  `cmd` Save (blue button in upper right quadrant)
  input <4A_TALT1_RSU12_1> Use same file_name as at beginning of this step and append_1
  `cmd` Save (in Save Command File dialog box)

input Updated test start time that is increased by at least one minute
Return to step 6, `cmd` Execute.

***********************************************************************
Wait approximately 30 seconds to 1 minute.

√RSU Status – Initialized

Verify # of Events:  5
Verify Event 0 Start – same GMT value as input above
Verify Event 0 To Start ≥ 03:30, <decrementing>

7. MONITORING IWIS EVENT COUNTERS

    NOTE
In order to synchronize the Orbiter event timer with the IWIS software countdown clock, a call will be made to the Orbiter by the IWIS operator at the ET-10:00 mark. The Orbiter event timer should begin a 10 minute countdown on this mark.

√Event 0 To Start
When To Start = 10:30, ISS ⇒ orbiter, “Ten minutes to test start on my mark...”
When To Start = 10:00, ISS ⇒ orbiter, “Mark”
<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>ET-10:00</td>
<td>Start orbiter event timer.</td>
</tr>
<tr>
<td>A7</td>
<td>PI BAY FLOOD (all) – OFF</td>
</tr>
<tr>
<td>CDR</td>
<td>Configure DAP.</td>
</tr>
<tr>
<td>ET-10:00</td>
<td>√DAP: A12/AUTO/ALT NO LO Z</td>
</tr>
<tr>
<td>CRT</td>
<td>GNC 20 DAP CONFIG</td>
</tr>
<tr>
<td></td>
<td>Verify DAPs A14, B14, B15, B4, B5, B6 are loaded per DTO 261 DAP SETUP.</td>
</tr>
<tr>
<td>CDR</td>
<td>Configure flight controller power.</td>
</tr>
<tr>
<td>O14, O15, O16</td>
<td>MANF F1, F2, F3, F4 Pri LOGIC, DRIVER (eight) – ON</td>
</tr>
<tr>
<td></td>
<td>√cb MNA, B DDU L (two) – cl</td>
</tr>
<tr>
<td>CRT</td>
<td>GNC 25 RM ORBIT</td>
</tr>
<tr>
<td></td>
<td>SW RM INH – ITEM 16 EXEC (*)</td>
</tr>
<tr>
<td>F7</td>
<td>L FLT CNTLR PWR – ON</td>
</tr>
<tr>
<td></td>
<td>SW RM INH – ITEM 16 EXEC (no *)</td>
</tr>
<tr>
<td></td>
<td>√Event 0 To Start</td>
</tr>
<tr>
<td></td>
<td>When To Start = 02:00, orbiter goes Free Drift.</td>
</tr>
<tr>
<td>CDR</td>
<td>Initiate DAP FREE</td>
</tr>
<tr>
<td>ET-2:00</td>
<td>C3</td>
</tr>
<tr>
<td></td>
<td>Orbiter ⇒ ISS, “DAP FREE”</td>
</tr>
<tr>
<td></td>
<td>Setup for Subtest 1.0: PITCH fires L2U,R2U (L2D,R2D).</td>
</tr>
<tr>
<td></td>
<td>√DAP: A/ALT</td>
</tr>
</tbody>
</table>

**CAUTION**

Do not select DAP: AUTO, INRTL, or LVLH while control accel 0 is loaded. This will result in loss of vehicle control and potentially damage hardware.

**NOTE**

Vehicle rates displayed on Universal Pointing and the ADIs will be incorrect when control accel 0 is loaded.

| CRT | GNC 20 DAP CONFIG |
| LOAD DAP A14 AND B14 |
**Event 0 To Start**
When To Start = 00:00, ISS \(\Rightarrow\) orbiter, “TØ” (orbiter initiates Subtest 1.0).

<table>
<thead>
<tr>
<th>Event</th>
<th>Time</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0:00</td>
<td>Wait 2 seconds.</td>
</tr>
<tr>
<td></td>
<td>0:02</td>
<td>L RHC +PITCH, 1 pulse</td>
</tr>
<tr>
<td></td>
<td>0:03</td>
<td>DAP: B</td>
</tr>
<tr>
<td></td>
<td>0:05</td>
<td>L RHC -PITCH, 1 pulse</td>
</tr>
</tbody>
</table>

**Event 0 Remaining**
When Remaining = 00:00, Subtest 1.0 is complete (orbiter resumes attitude control).

<table>
<thead>
<tr>
<th>Event</th>
<th>Time</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0:00</td>
<td>Configure for DAP AUTO.</td>
</tr>
<tr>
<td></td>
<td>0:00</td>
<td>Load DAP A12 (Required before AUTO)</td>
</tr>
<tr>
<td></td>
<td>0:00</td>
<td>DAP: A/ALT</td>
</tr>
<tr>
<td></td>
<td>0:00</td>
<td>DAP: A/AUTO</td>
</tr>
<tr>
<td></td>
<td>0:00</td>
<td>Orbiter (\Rightarrow) ISS, “DAP AUTO”</td>
</tr>
<tr>
<td></td>
<td>0:00</td>
<td>Setup for Subtest 1.1: YAW1 fires L1L (R1R).</td>
</tr>
<tr>
<td></td>
<td>0:00</td>
<td>Load DAP B15.</td>
</tr>
</tbody>
</table>

**Event 1 To Start**
When To Start = 02:00, orbiter goes Free Drift

<table>
<thead>
<tr>
<th>Event</th>
<th>Time</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2:00</td>
<td>Initiate DAP FREE.</td>
</tr>
<tr>
<td></td>
<td>2:00</td>
<td>DAP: FREE</td>
</tr>
<tr>
<td></td>
<td>2:00</td>
<td>Orbiter (\Rightarrow) ISS, “DAP FREE”</td>
</tr>
</tbody>
</table>

**Event 1 Remaining**
When Remaining = 00:00, Subtest 1.1 is complete (orbiter resumes attitude control).

<table>
<thead>
<tr>
<th>Event</th>
<th>Time</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0:00</td>
<td>Initiate Subtest 1.1: YAW1 fires L1L (R1R)</td>
</tr>
<tr>
<td></td>
<td>0:00</td>
<td>Wait 2 seconds.</td>
</tr>
<tr>
<td></td>
<td>0:00</td>
<td>L RHC -YAW, 1 pulse</td>
</tr>
<tr>
<td></td>
<td>0:00</td>
<td>L RHC +YAW, 1 pulse</td>
</tr>
</tbody>
</table>

**Event 1 Remaining**
When Remaining = 00:00, Subtest 1.1 is complete (orbiter resumes attitude control).

sel EVENT SCROLL (down arrow button)
CDR Configure for DAP AUTO.

ET = 11:00

DAP: A12/ALT
DAP: A/AUTO
Orbiter ⇒ ISS, “DAP AUTO”

Setup for Subtest 1.2: AFT fires R1A, L1A.

CRT Load DAP B4.

√ Event 2 To Start
When To Start = 02:00, orbiter goes Free Drift.

CDR Initiate DAP FREE.

ET = 13:00

DAP: FREE
Orbiter ⇒ ISS, “DAP FREE”

DAP: B
DAP TRANS: PLS, PLS, PLS

√ Event 2 To Start
When To Start = 00:00, ISS ⇒ orbiter, “TØ” (orbiter initiates Subtest 1.2).

CDR Initiate Subtest 1.2: AFT: fires R1A, L1A.

► ET = 15:00 (T=0) Wait 2 seconds.
► ET = 15:02 (T=2) THC: +X, 1 pulse

√ Event 2 Remaining
When Remaining = 00:00, Subtest 1.2 is complete (orbiter resumes attitude control).

sel EVENT SCROLL (down arrow button)

CDR Configure for DAP AUTO.

ET = 18:30

DAP: A12/ALT
DAP: A/AUTO
Orbiter ⇒ ISS, “DAP AUTO”

Setup for Subtest 1.3: YAW2 fires L1L (R1R).

CRT Load DAP B5.

Reconfig CCTV.

√ Event 3 To Start
When To Start = 02:00, orbiter goes Free Drift.
### DTO-261 TEST OPS (ALT)

#### (ASSY OPS/4A/FIN) Page 11 of 26 pages

<table>
<thead>
<tr>
<th>CDR</th>
<th>Initiate DAP FREE.</th>
</tr>
</thead>
</table>
| ET = 20:30 | DAP: FREE  
| | DAP: B/ALT  
| | Orbiter ⇒ ISS, “DAP FREE” |

√Event 3 To Start  
When To Start = 00:00, ISS ⇒ orbiter, “TØ” (orbiter initiates Subtest 1.3).  

<table>
<thead>
<tr>
<th>CDR</th>
<th>Initiate Subtest 1.3: YAW2 fires L1L (R1R).</th>
</tr>
</thead>
<tbody>
<tr>
<td>ET = 22:30  (T=0)</td>
<td>Wait 2 seconds.</td>
</tr>
<tr>
<td>ET = 22:32  (T=2)</td>
<td>L RHC -YAW, 1 pulse</td>
</tr>
<tr>
<td>ET = 24:12  (T=1:42)</td>
<td>L RHC +YAW, 1 pulse</td>
</tr>
</tbody>
</table>

√Event 3 Remaining  
When Remaining = 00:00, Subtest 1.3 is complete (orbiter resumes attitude control).  

sel EVENT SCROLL (down arrow button)  

<table>
<thead>
<tr>
<th>CDR</th>
<th>Configure for DAP AUTO.</th>
</tr>
</thead>
</table>
| ET = 26:00 | DAP: A12/ALT  
| | DAP: A/AUTO  
| | Orbiter ⇒ ISS, “DAP AUTO” |

CRT Load DAP B6.  
Reconfig CCTV.  

√Event 4 To Start  
When To Start = 02:00, orbiter goes Free Drift.  

<table>
<thead>
<tr>
<th>CDR</th>
<th>Initiate DAP FREE.</th>
</tr>
</thead>
</table>
| ET = 28:00 | DAP: FREE  
| | DAP: B/ALT  
| | Orbiter ⇒ ISS, “DAP FREE.” |

√Event 4 To Start  
When To Start = 00:00, ISS ⇒ orbiter, “TØ” (orbiter initiates Subtest 1.4).
CDR Initiate Subtest 1.4: ROLL fires L2U, R2D (L2D, R2U).

- ET = 30:00 (T=0) Wait 2 seconds.
- ET = 30:02 (T=2) L RHC -ROLL, 1 pulse
- ET = 30:08.4 (T=8.4) L RHC +ROLL, 1 pulse

√Event 4 Remaining
When Remaining = 00:00, ISS ⇒ orbiter, “Test 1 complete.”

**cmd** RETURN

CDR Configure for DAP AUTO.

ET = 33:30

DAP: A12/ALT
DAP: A/AUTO
Orbiter ⇒ ISS, “DAP AUTO”

Proceed to SAFE RHC.

F7 L FLT CNTLR PWR – OFF

Perform post Test DAP Reconfiguration.

CRT [GNC 20 DAP CONFIG]

LOAD DAP B12.

F7 √L FLT CNTLR PWR – OFF

O14, cb MNA, B DDU L (two) – as required
O15, MANF F1, F2, F3, F4 Pri LOGIC, DRIVER (eight) – OFF
O16

**********************************************************************
If ISS is to control mated stack following test operations,
Perform {HANDOVER ATTITUDE CONTROL ORBITER TO RS THRUSTERS}, all (SODF: JNT OPS), then:
**********************************************************************

PLT Allow the orbiter event timer to continue running so that Test 2 preparations can be properly coordinated.
8. **DOWNLOADING DATA FROM RSU 1 AND RSU 2**

**SSC**

**Commands:** Download Data

| Download Data |

**sel** Download Remaining Data (button will blink once)

**NOTE**

2. Leave IWIS software running in background.

**sel** Start: Programs: Windows Explorer

**Exploring – (C:)**

Use Windows Explorer to monitor progress of download.

√ Time tag for last file to be downloaded
   If time > 3 minutes since last file, download error has occurred.

√ File size of downloaded files
   If size of any file equals 0 bytes, download error has occurred.

√ Number of downloaded files
   If number of files is incorrect, download error has occurred.

Download is complete when the following folders have the number of files shown and all files have size greater than zero (directory path will correspond to name of command file chosen in step 6).

<table>
<thead>
<tr>
<th>Directory Path</th>
<th># of Files</th>
<th>File Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>C:\wis\data\4A_TALT1_RSU12\RSU1_Node_Fwd_A1</td>
<td>12</td>
<td>&gt; 0</td>
</tr>
<tr>
<td>C:\wis\data\4A_TALT1_RSU12\RSU2_Node_Fwd_A1</td>
<td>12</td>
<td>&gt; 0</td>
</tr>
</tbody>
</table>
If a download error has occurred, perform following corrective actions
Check communications with RSU that caused download error.

Utilities: Node Status

sel Node ID – [X] where [X] is RSU serial number (left click in data window)

cmd Get Status

Verify Get Status button changes to gray Updating button.

Wait until Get Status changes back to blue and data windows fill.

√ Errors

If Errors – None
Communications with RSU is okay.
Return to beginning of step 8 and repeat download attempt.

If Errors – Unable to contact target node
input RSU S/N [X] where [X] = S/N of RSU causing error
sel Add RSU to Network (click in data window labeled “Action”)

cmd Configure

cmd OK (response to ‘Proceed Configure?’)

Return to beginning of step 8.
Repeat download attempt.

************

sel Exploring: Minimize

cmd RETURN (in Download Data window of IWIS software)

ISS ⇒ orbiter, “Download to SSC complete.”

9. PERFORMING AUTO RANGE FUNCTION

SSC

Commands: Auto Range

Auto Range

cmd Start Auto Range (button changes to ‘RANGING Please Wait’)

************
If MESSAGE – ‘MISSING COMMAND FILE…’

**cmd** Confirm

Commands: Init. for Data Collection

[Initialize Network and Acquire Data]

**cmd** Select (blue button)

sel 4A_TALT1_RSU12 (use mouse pointer)

**cmd** Open

**cmd** RETURN

Window: Auto Range

[Auto Range]

Return to beginning of step 9.

**********************************************************

Wait until button changes back to Start Auto Range (requires 5 to 10 minutes).

√List of gain values on right side of screen

If list of gains values – grayed out

Error has occurred – most likely cause: incomplete download

If this is first attempt to perform Auto Range, repeat step 8 and step 9.

If this is second attempt to perform Auto Range, proceed to step 10.

If list of gains values – filled with values

**cmd** Save Command File

input 4A_TALT1_RSU12_RR (in file input block of Save As window)

**cmd** Save

**cmd** RETURN

10. **COPYING FILES TO REMOVABLE HARD DISK CARD**

SSC  sel Start: Programs: Windows Explorer

[Exploring – (C:)]

sel c:\wis\data\4A_TALT1_RSU12

Copy folder and contents to /wis/data/ folder on Hard Disk Card.

sel Exploring: Minimize

11. **RESETTING RSU 1 AND RSU 2**

SSC  Commands: Init. for Data Collection

[Initialize Network & Acquire Data]

**cmd** Reset RSUs

**cmd** Confirm (response to ‘Please confirm your request…’)

10 NOV 00 111
Wait until data blocks in Response portion of window fill.

√ Status: 1026 resetting
√ Status: 1027 resetting

******************************************************************************
If Status – ‘Unable to contact target node’
Perform [UNABLE TO CONTACT TARGET NODE], all (SODF: ASSY OPS: MALFUNCTION: IWIS SOFTWARE), then:
******************************************************************************

**cmd** RETURN

ISS ⇒ orbiter, “Confirm Test 2 starts at XX:XX:XX GMT.”

12. **SELECTING COMMAND FILE FOR TEST 2 DATA ACQUISITION (RSU 1 AND RSU 2)**

SSC

Commands: Init. for Data Collection
 Initialize Network & Acquire Data

**cmd** Select (blue button in upper right quadrant)

If 4A_TALT1_RSU12_RR is available
sel 4A_TALT1_RSU12_RR

If 4A_TALT1_RSU12_RR is not available
sel 4A_TALT2_RSU12

**cmd** Open

\[\text{NOTE}\]
1. The ACQ Start Time must be equal to the current time plus a minimum of 7 minutes.
2. The input time will be GMT in hrs:min:sec format with seconds input as zero.

√ ACQ. Start Time toggle button – Use Current Time

If toggle button – Select Start Time
sel Use Current Time (update display to current time and date)

sel Select Start Time (input desired time)

Use mouse to highlight time portion of ACQ Start Time display.

input [XX:XX:00] where XX:XX:00 is GMT in hr:min:sec format

**cmd** Execute

Record ACQ. Start Time: _____ : _____ : _____
√Message Box

If Message Box – ‘CLEAR MEMORY REMINDER’
   cmd Confirm

******************************************************************************
If Message Box – ‘MESSAGE ...This file could not execute because:
   * insufficient time for warmup’
   Return to step 12, √ ACQ. Start Time toggle button.
   input Updated test start time that is increased by at least one minute
******************************************************************************

******************************************************************************
If Message Box – ‘MESSAGE ...This file could not execute because:
   * a data folder with same name exists’
   cmd Save (blue button in upper right quadrant)
   input file_name_1 (Use same file_name as at beginning of this step and append _1, i.e., input either 4A_TALT1_RSU12_RR_1 or 4A_TALT2_RSU12_1)
   cmd Save
   Return to step 12, √ ACQ. Start Time toggle button.
   input Updated test start time
******************************************************************************

******************************************************************************
If Message Box – ‘MESSAGE ...This file could not execute because:
   * Some subfiles are incompatible/missing
   * Listen schedule for Events are inconsistent
   The command file must be rebuilt.

√MCC-H

Perform [COMMAND FILE WILL NOT EXECUTE],
all (SODF: ASSY OPS: MALFUNCTION: IWIS SOFTWARE), then:

******************************************************************************
√Message Box – ‘CONFIRMATION’

   cmd Confirm

   Wait until Status table fills with data.

√RSU Status – ‘Initialization Pending’
If RSU Status – ‘Initialization Pending: 2 Hr’
Verify the GMT input for data acquisition.

If correct GMT was input, then
Perform [NODE NOT CONFIGURED IN NETWORK], all
(SODF: ASSY OPS: MALFUNCTION: IWIS
SOFTWARE), then:

If incorrect GMT was input, then proceed as follows:
  cmd ABORT RSUs
  cmd Confirm

√ Status – XXXX aborting

Wait 30 seconds to 1 minute.
√ Status – XXXX aborted
  cmd Save (blue button in upper right quadrant)
  input file_name_1 (Use same file_name as at beginning of
  this step and append _1, i.e., input either
  4A_TALT1_RSU12_RR_1 or 4A_TALT2_RSU12_1)
  cmd Save (in Save Command File dialog box)

  input Updated test start time that is increased by at least one
minute
Return to step 12, cmd Execute.

************************************************************************

13. MONITORING IWIS EVENT COUNTERS

NOTE
When the orbiter event timer reaches ET = 55:00, there is
approximately ten minutes remaining until the start of Test 2.

CDR Configure DAP.

ET-10:00 √ DAP: A12/AUTO/ALT NO LO Z

CRT GNC 20 DAP CONFIG

Verify DAPs A14, B14, B15, B4, B5, B6 are loaded per
DTO 261 DAP SETUP.
**NOTE**
The orbiter event timer must be reset prior to Test 2 start to synchronize with the IWIS software counters. The IWIS operator will make a call at 3 minutes prior to Test 2 start. The orbiter event timer should begin a 3 minute countdown on this mark.

- Event 0 To Start
  - When To Start = 03:30, ISS ⇒ orbiter, “Three minutes to test start on my mark…”
  - When To Start = 03:00, ISS ⇒ orbiter, “Mark”

**CAUTION**
Do not select DAP: AUTO, INRTL, or LVLH while control accel 0 is loaded. This will result in loss of vehicle control and potentially damage hardware.

- Event 0 To Start
  - When To Start = 02:00, orbiter goes Free Drift.
√Event 0 To Start
When To Start = 00:00, ISS ⇒ orbiter, “TØ” (orbiter initiates Subtest 2.0).

CDR
Initiate Subtest 2.0: PITCH fires L2U,R2U (L2D,R2D).

<table>
<thead>
<tr>
<th>ET</th>
<th>(T=0)</th>
<th>ET</th>
<th>(T=2)</th>
<th>ET</th>
<th>(T=3)</th>
<th>ET</th>
<th>(T=5)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ET</td>
<td>0:00</td>
<td>ET</td>
<td>0:02</td>
<td>ET</td>
<td>0:03</td>
<td>ET</td>
<td>0:05</td>
</tr>
<tr>
<td></td>
<td>(T=0)</td>
<td></td>
<td>(T=2)</td>
<td></td>
<td>(T=3)</td>
<td></td>
<td>(T=5)</td>
</tr>
<tr>
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<td></td>
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<td>√</td>
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<td>√</td>
<td></td>
<td>√</td>
<td></td>
<td>√</td>
<td></td>
</tr>
</tbody>
</table>
| Event 0 Remaining
When Remaining = 00:00, Subtest 2.0 is complete (orbiter resumes attitude control).

CDR
Configure for DAP AUTO.

CRT
Load DAP A12 (Required before AUTO)
DAP: A/ALT
DAP: A/AUTO
Orbiter ⇒ ISS: “DAP AUTO”

Setup for Subtest 2.1: YAW1 fires L1L (R1R).

CRT
Load DAP B15.

√Event 1 To Start
When To Start = 02:00, orbiter goes Free Drift.

CDR
Initiate DAP FREE

ET = 5:30

DAP: FREE
Orbiter ⇒ ISS, “DAP FREE.”

√Event 1 To Start
When To Start = 00:00, ISS ⇒ orbiter, “TØ” (orbiter initiates Subtest 2.1).

CDR
Initiate Subtest 2.1: YAW1 fires L1L (R1R).

<table>
<thead>
<tr>
<th>ET</th>
<th>(T=0)</th>
<th>ET</th>
<th>(T=2)</th>
<th>ET</th>
<th>(T=4.4)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ET</td>
<td>7:30</td>
<td>ET</td>
<td>7:32</td>
<td>ET</td>
<td>7:38.4</td>
</tr>
<tr>
<td></td>
<td>(T=0)</td>
<td></td>
<td>(T=2)</td>
<td></td>
<td>(T=4.4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>√</td>
<td></td>
<td>√</td>
<td></td>
<td>√</td>
<td></td>
</tr>
</tbody>
</table>
| Event 1 Remaining
When Remaining = 00:00, Subtest 2.1 is complete (orbiter resumes attitude control).

sel EVENT SCROLL (down arrow button)
<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Description</th>
</tr>
</thead>
</table>
| 11:00 | CDR   | Configure for DAP AUTO.  
DAP: A12/ALT  
DAP: A/AUTO  
Orbiter ⇒ ISS, “DAP AUTO”  
Setup for Subtest 2.2: AFT fires R1A, L1A.  
|       | CRT   | Load DAP B4.  
√ Event 2 To Start  
When To Start = 02:00, orbiter goes Free Drift.  
|       | CDR   | Initiate DAP FREE.  
ET = 13:00  
DAP: FREE  
Orbiter ⇒ ISS, “DAP FREE”  
DAP: B  
DAP TRANS: PLS, PLS, PLS  
√ Event 2 To Start  
When To Start = 00:00, ISS ⇒ orbiter, “TØ” (orbiter initiates Subtest 2.2).  
|       | CDR   | Initiate Subtest 2.2: AFT: fires R1A, L1A.  
ET = 15:00 (T=0)  
Wait 2 seconds.  
ET = 15:02 (T=2)  
THC: +X, 1 pulse  
√ Event 2 Remaining  
When Remaining = 00:00,. Subtest 2.2 is complete  
(orbiter resumes attitude control)  
|       | CDR   | Configure for DAP AUTO.  
ET = 18:30  
DAP: A12/ALT  
DAP: A/AUTO  
Orbiter ⇒ ISS, “DAP AUTO”  
Setup for Subtest 2.3: YAW2 fires L1L (R1R).  
|       | CRT   | Load DAP B5.  
Reconfig CCTV.  
√ Event 3 To Start  
When To Start = 02:00, orbiter goes Free Drift.  

CDR - Crawler Data Recorder  
CRT - Control Panel Recorder  
DAP - Data Acquisition Processor  
ET - Estimated Time
CDR Initiate DAP FREE.

ET = 20:30

DAP: FREE
DAP: B/ALT
Orbiter ⇒ ISS, “DAP FREE.”

√Event 3 To Start
When To Start = 00:00, ISS ⇒ orbiter, “TØ” (orbiter initiates Subtest 2.3).

CDR Initiate Subtest 2.3: YAW2 fires L1L (R1R).

- ET = 22:30 (T=0) Wait 2 seconds.
- ET = 22:32 (T=2) L RHC -YAW, 1 pulse
- ET = 24:12 (T=1:40) L RHC +YAW, 1 pulse

√Event 3 Remaining
When Remaining = 00:00, Subtest 2.3 is complete (orbiter resumes attitude control).

sel EVENT SCROLL (down arrow button)

CDR Configure for DAP AUTO.

ET = 26:00

DAP: A12/ALT
DAP: A/AUTO
Orbiter ⇒ ISS, “DAP AUTO”

Setup for Subtest 2.4: ROLL fires L2U, R2D (L2D, R2U).

CRT Load DAP B6.

√Event 4 To Start
When To Start = 02:00, orbiter goes Free Drift.

CDR Initiate DAP FREE.

ET = 28:00

DAP: FREE
DAP: B/ALT
Orbiter ⇒ ISS, “DAP FREE.”

√Event 4 To Start
When To Start = 00:00, ISS ⇒ orbiter, “TØ” (orbiter initiates Subtest 2.4).
CDR | Initiate Subtest 2.4: ROLL fires L2U, R2D (L2D, R2U).
---|---
- ET = 30:00 (T=0) | Wait 2 seconds.
- ET = 30:02 (T=2) | L RHC -ROLL, 1 pulse
- ET = 30:08.4 (T=8.4) | L RHC +ROLL, 1 pulse

√Event 4 Remaining
When Remaining = 00:00, ISS ⇒ orbiter, “Test 2 complete.”

<table>
<thead>
<tr>
<th>CDR</th>
<th>cmd RETURN</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>CDR</th>
<th>Configure for DAP AUTO.</th>
</tr>
</thead>
</table>
| ET = 33:30 | DAP: A12/ALT
DAP: A/AUTO
Orbiter ⇒ ISS, “DAP AUTO” |

<table>
<thead>
<tr>
<th>CDR</th>
<th>Proceed to SAFE RHC.</th>
</tr>
</thead>
<tbody>
<tr>
<td>F7</td>
<td>L FLT CNTRL PWR – OFF</td>
</tr>
</tbody>
</table>
Perform post Test DAP Reconfiguration.

| CRT | GNC 20 DAP CONFIG
LOAD DAP B12 |
| F7 | √L FLT CNTRL PWR – OFF |
O14, MANF F1, F2, F3, F4 Pri LOGIC, DRIVER (eight) – OFF
O15, cb MNA, B DDU L (two) – as required
O16 |

******************************************************************
If ISS is to control mated stack following test operations,
Perform (HANDOVER ATTITUDE CONTROL ORBITER TO RS THRUSTERS), all (SODF: JNT OPS: MATED OPERATIONS), then:
******************************************************************

<table>
<thead>
<tr>
<th>PLT</th>
<th>Perform post test configuration.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ET = 33:30</td>
<td>Stop orbiter event timer.</td>
</tr>
</tbody>
</table>
14. **DOWNLOADING DATA FROM RSU 1 AND RSU 2**

SSC

**Commands:** Download Data

**Download Data**

{sel} Download Remaining Data (button will blink once)

<table>
<thead>
<tr>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Leave IWIS software running in background.</td>
</tr>
</tbody>
</table>

{sel} Start: Programs: Windows Explorer

**Exploring – (C::)**

Use Windows Explorer to monitor progress of download.

√ Time tag for last file to be downloaded
   If time > 3 minutes since last file, download error has occurred.

√ File size of downloaded files
   If size of any file equals 0 bytes, download error has occurred.

√ Number of downloaded files
   If number of files is incorrect, download error has occurred.

Download is complete when the following folders have the number of files shown and all files have size greater than zero (directory path will correspond to name of command file chosen in Step 12).

<table>
<thead>
<tr>
<th>Directory Path</th>
<th># of Files</th>
<th>File Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>\wis\data\4A_TALT1_RSU12_RR\RSU1_Node_Fwd_A2</td>
<td>12</td>
<td>&gt; 0</td>
</tr>
<tr>
<td>\wis\data\4A_TALT1_RSU12_RR\RSU2_Node_Aft_A2</td>
<td>12</td>
<td>&gt; 0</td>
</tr>
</tbody>
</table>
If a download error has occurred, perform following corrective actions
Check communications with RSU that caused download error.

Utilities: Node Status

sel Node ID – [X]   where [X] is RSU serial number (left click in data window)

cmd Get Status

Verify Get Status button changes to gray Updating button.

Wait until Get Status changes back to blue and data windows fill.

√ Errors

If Errors – None
Communications with RSU is okay.
Return to beginning of step 14 and repeat download attempt.

If Errors – Unable to contact target node
Perform (UNABLE TO CONTACT TARGET NODE), all (SODF: ASSY OPS: MALFUNCTION: IWIS SOFTWARE), then:

sel Exploring: Minimize

cmd RETURN (in Download Data window of IWIS software)

ISS ⇒ orbiter, “Download to SSC complete.”

15. COPYING DATA FILES TO REMOVABLE HARD DISK CARD

sel Start: Programs: Windows Explorer

Exploring – (C:)

If directory c:\wis\data\4A_TALT2_RSU12_RR exists
    sel c:\wis\data\4A_TALT2_RSU12_RR

If directory c:\wis\data\4A_TALT1_RSU12 exists
    sel c:\wis\data\4A_TALT1_RSU12

Copy folder and contents to /wis/data/ folder on Hard Disk Card.

sel Exploring: Minimize
16. **RESETTING RSU 1 AND RSU 2**

SSC

Commands: Init. for Data Collection
- Initialize Network & Acquire Data

**cmd** Reset RSUs

**cmd** Confirm (response to ‘Please confirm your request…’)

Wait until data blocks in Response portion of window fill.

√ Status: 1026 resetting
√ Status: 1027 resetting

*****************************************************************************

If Status – ‘Unable to contact target node’

Perform **[UNABLE TO CONTACT TARGET NODE]**, all
(SODF: ASSY OPS: MALFUNCTION: IWIS SOFTWARE), then:

*****************************************************************************

**cmd** RETURN
HARDWARE REQUIRED:
Passive Dosimeter Kit (SEG 46116951-304)

1. DOSIMETER EXCHANGE
   1.1 Unstow:

   MF57C Passive Dosimeter Kit
   Camera F5 with flash

   NOTE
   Radiation Area Monitor Dosimeters are color-coded.
   For Mission 4A:
   Deploy:  Blue Radiation Area Monitor
   Return:  White Radiation Area Monitor

   1.2 Transfer Passive Dosimeter Kit to Node 1 or SM.

   NOTE
   1. When in Node, perform step 2.
   2. When in SM, perform step 3.

   1.3 Temporarily stow kit and remove Ziplock for corresponding modules

   Node 1 RADIATION AREA SUBPACK ASSY: NODE 1 DOSIMETERS
   SM RADIATION AREA SUBPACK ASSY: SM DOSIMETERS

   1.4 At each deployment site in Table 1 (Node) or Table 2 (SM)
   - Remove White Radiation Area Monitor from Node 1.
   - Stow White Radiation Area Monitor in Ziplock.
   - Retrieve Blue Radiation Area Monitor label from Ziplock and verify label
     corresponds to location decal.
   - Attach Blue Radiation Area Monitor to corresponding location.

   1.5 Return Ziplock containing White Radiation Area Monitors to Passive
   Dosimeter Kit.

   MF57C 1.6 If steps 2 and 3 are also complete, stow Passive Dosimeter Kit and Camera
   F5 with flash.
Table 1. Radiation Area Monitor Dosimeter Locations in Node 1

<table>
<thead>
<tr>
<th>Dosimeter Number</th>
<th>ISS Interior Location Code</th>
<th>Dosimeter Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Node 1 #1</td>
<td>NOD1P4_03</td>
<td>Closeout Panel on the port side of Aft Hatch on the Zenith end of the Closeout Panel NOD1P4_03</td>
</tr>
<tr>
<td>Node 1 #2</td>
<td>NOD1OP2</td>
<td>On the Zenith side of the footbridge across the Port Hatch</td>
</tr>
<tr>
<td>Node 1 #3</td>
<td>NOD1S1_02</td>
<td>Closeout on Stbd side near the Fwd Hatch Zenith side of the Closeout Panel NOD1S1_02</td>
</tr>
</tbody>
</table>

Table 2. Radiation Area Monitor Dosimeter Locations in Service Module

<table>
<thead>
<tr>
<th>Dosimeter Number</th>
<th>ISS Interior Location Code</th>
<th>Dosimeter Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>SM #1</td>
<td>SM - P 339</td>
<td>Panel 339 aft section behind treadmill, upper center part of the panel</td>
</tr>
<tr>
<td>SM #2</td>
<td>SM - P 327</td>
<td>Panel 327, overhead, forward of treadmill</td>
</tr>
<tr>
<td>SM #3</td>
<td>SM - P 307</td>
<td>Panel 307, TsP overhead, near center</td>
</tr>
<tr>
<td>SM #4</td>
<td>SM - W 14</td>
<td>Window #14, Transfer Compartment Adapter section, Stbd Nadir quadrant</td>
</tr>
</tbody>
</table>

Figure 1.- SM Dosimeter Locations.
2. **HIGH RATE DOSIMETER (HRD) POUCH STOW**
   2.1 Remove High Rate Dosimeter Pouch from Passive Dosimeter Kit.
   TBD 2.2 Stow HRD Pouch.
   2.3 Return to step 1.

3. **SM (CREW QUARTERS) DOSIMETER INSTALLATION**
   3.1 Remove Ziplock labeled “RADIATION AREA INSTALLATION SUBPACK:” Service Module (Crew Quarters) Dosimeters from temporarily stowed Passive Dosimeter Kit.

   3.2 Transfer Ziplock to SM Crew Quarters.

   3.3 At each deployment site in Table 3.
   Retrieve Blue Radiation Area Monitor label from Ziplock and verify label corresponds to location decal.

   3.4 Attach Blue Radiation Area Monitor to corresponding location.
   At each deployment site in Table 3.
   Select “Radiation Area Monitor” label to match corresponding target location.
   Affix the Radiation Area Monitor with its Velcro attachment/tether to panel.

   **Table 3. Radiation Area Monitor Dosimeter Locations in Service Module**

<table>
<thead>
<tr>
<th>Dosimeter number</th>
<th>ISS Interior Location Code</th>
<th>Dosimeter Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>SM #1</td>
<td>SM - P 242</td>
<td>Inside Port SM Crew Quarters, outboard wall aft upper corner</td>
</tr>
<tr>
<td>SM #2</td>
<td>SM - P 442</td>
<td>Inside Starboard SM Crew Quarters, outboard wall aft upper corner</td>
</tr>
</tbody>
</table>

   3.5 Place all trash in Ziplock and return Ziplock to Passive Dosimeter Kit.

   3.6 Photograph all six SM deployed locations using F5 with flash.

   3.7 Return to step 1.
ASSEMBLY
NOTE

1. Step 1 must be performed before the APCU is powered. Initial PVCU MDM BIT will be missed otherwise.

2. MCC-H will perform steps 1 --- 4.

3. STS crew will perform steps 5 --- 8.

4. MCC-H will perform steps 9 --- 17.

1. **CONFIGURING NCS FOR PVCU ACTIVATION**

   PCS
   
P6: EPS: EPS Software (Lower Right)
   
   EPS Software
   
   sel NCS Software
   
   NCS SW
   
   sel NCS PVCU Config
   
   NCS PVCU Config
   
   ‘PVCU Switchover’
   
   √PVCU Switchover – Inh
   
   √NCS to PVCU Comm Path – 4B
   
   NCS_SW
   
   sel NCS EPS PV Cntl Functions
   
   NCS PV Control
   
   √Ancillary Data Dist To PVCA 2B, 4B – Ena
   
   √EPS Primary Pwr Cntl Status – Ena
   
   √EPS Primary Pwr Cntl Init – blank
   
   √DDCU Cntl Status – Ena
   
   √DDCU Cntl Init – blank
   
   √PCU Cntl Status – Ena
   
   √PCU Cntl Init – blank
   
2. **VERIFYING S-BAND XPDR 2 AND SASA (P6 SOURCE) DEADFACED**

   Z1: EPS: RPCM Z1 3B B
   
   RPCM Z1 3B B
   
   √RPCM Z1 3B B RPC 2 icon is open
   
   sel RPC 2
3. **VERIFYING S-BAND XPDR 2 AND SASA (P6 SOURCE) HEATERS**

**DEADFACED**

Z1: EPS: RPCM Z1 4B B

 RPCM Z1 4B B

√RPCM Z1 4B B RPC 2 icon is open

 sel RPC 2

 RPCM Z14B B RPC 02

 cmd Close Cmd – Inhibit

√Close Cmd – Inh

 RPCM Z1 4B B

√RPCM Z1 4B B RPC 3 icon is open

 sel RPC 3

 RPCM Z1 4B B RPC 03

 cmd Close Cmd – Inhibit

√Close Cmd – Inh
4. **VERIFYING DATA BUSES ON CHANNEL B FOR P253 CONNECTION**

Node 1: C&DH: MDM N1-2

Primary NCS MDM Node1

- sel UB EPS N1-14
  
  **UB_EPS_N1_14**

- sel Bus Status
  
  **UB_EPS_N1_14_Bus_Status**

- √ Channel Selected – B

  If Channel Selected – A
  
  **cmd** Select Ch B **Execute**

  - √ Channel Selected – B

  - √ Auto Channel Switch Status – Inh

  If Auto Channel Switch Status – Ena
  
  **cmd** Inhibit **Execute**

  - √ Auto Channel Switch Status – Inh

Node 1: C&DH: MDM N1-2

Primary NCS MDM Node1

- sel UB EPS N1-23
  
  **UB_EPS_N1_23**

- sel Bus Status
  
  **UB_EPS_N1_23_Bus_Status**

- √ Channel Selected – B

  If Channel Selected – A
  
  **cmd** Select Ch B **Execute**

  - √ Channel Selected – B

  - √ Auto Channel Switch Status – Inh
If Auto Channel Switch Status – Ena
\textbf{cmd} Inhibit \textbf{Execute}

√Auto Channel Switch Status – Inh

Node 1: C&DH: MDM N1-2
\begin{tabular}{|c|c|}
\hline
Primary NCS MDM Node1 \hline
\end{tabular}

sel LB SYS LAB 2
\begin{tabular}{|c|c|}
\hline
LB_SYS_LAB_2 \hline
\end{tabular}

sel Bus Status
\begin{tabular}{|c|c|}
\hline
LB_SYS_LAB_2_Bus_Status \hline
\end{tabular}

√Channel Selected – B

If Channel Selected – A
\textbf{cmd} Select Ch B \textbf{Execute}

√Channel Selected – B

√Auto Channel Switch Status – Inh

If Auto Channel Switch Status – Ena
\textbf{cmd} Inhibit \textbf{Execute}

√Auto Channel Switch Status – Inh

5. \textbf{VERIFYING APCU POWER OFF}

L12U

√APCU 1,2 CONVERTER tb – bp
√APCU 1,2 OUTPUT tb – bp

6. \textbf{P6 TO Z1 UTILITY CONNECTIONS – ALL BUT P254}

MCC-H \textbullet STS, “Go for Attach P6 to Z1 Utility Cables (EVA C/L), all P6/Z1 Utility Connections except P254.”
IV ⇒ EV, “Go all for P6/Z1 Utility Connections except P254.”
EV ⇒ IV, “Utility connection P253 complete.”

7. \textbf{VERIFYING DATA BUSSES ON CHANNEL A FOR P254 CONNECTION}

PCS

Node 1: C&DH: MDM N1-2
\begin{tabular}{|c|c|}
\hline
Primary NCS MDM Node1 \hline
\end{tabular}

sel UB EPS N1-14
\begin{tabular}{|c|c|}
\hline
UB_EPS_N1_14 \hline
\end{tabular}
sel Bus Status

UB_EPS_N1_14_Bus_Status

√Auto Channel Switch Status – Inh
√Channel Selected – A

If Channel Selected – B
cmd Select Ch A Execute

√Channel Selected – A

Node 1: C&DH: MDM N1-2
Primary NCS MDM Node1

sel UB EPS N1-23

UB_EPS_N1_23

sel Bus Status

UB_EPS_N1_23_Bus_Status

√Auto Channel Switch Status – Inh
√Channel Selected – A

If Channel Selected – B
cmd Select Ch A Execute

√Channel Selected – A

Node 1: C&DH: MDM N1-2
Primary NCS MDM Node1

sel LB SYS LAB 2

LB_SYS_LAB_2

sel Bus Status

LB_SYS_LAB_2_Bus_Status

√Auto Channel Switch Status – Inh
√Channel Selected – A

If Channel Selected – B
cmd Select Ch A Execute

√Channel Selected – A
8. **P6 TO Z1 UTILITY CONNECTIONS - P254**
   
   8.1 **Go For P6/Z1 Connector P254**
   
   IV ⇒ EV, “Go for P6/Z1 Utility Connection P254.”
   
   8.2 **P6/Z1 EVA Utility Connections Complete**
   
   EV ⇒ IV, “Utility Connection complete”
   
   STS ↓ **MCC-H**: “Attach P6 to Z1 Utility Cables complete. Go for powerup.”
   
9. **ACTIVATING S-BAND XPDR 2 HEATER**
   
   **PCS**
   
   Z1: EPS: RPCM Z14B B: RPC 3
   
   ```plaintext
   RPCM Z14B B RPC 03
   ```
   
   _cmd_ Close Cmd – Ena
   
   √Close Cmd – Ena
   
   _cmd_ RPC Position – Close (Verify – Cl)
   
10. **VERIFYING RT (BUS) FDIR INHIBIT FOR S-BAND XPDR 2**
    
    **C&T**: CB CT 3 RT Status
    
    ```plaintext
    LB SYS LAB 2 RT Status
    ```
    
    ‘RT Address and Name: 16 XPDR 2’
    
    √Inhibit FDIR – Inh
    
11. **ACTIVATING S-BAND XPDR 2**
    
    **Z1**: EPS: RPCM Z13B B: RPC 3
    
    ```plaintext
    RPCM Z13B B RPC 03
    ```
    
    _cmd_ Close Cmd – Ena
    
    √Close Cmd – Ena
    
    _cmd_ RPC Position – Close (Verify – Cl)
    
12. **ENABLING RT (BUS I/O) FOR S-BAND XPDR 2**
    
    **C&T**: CB CT 3 RT Status
    
    ```plaintext
    LB SYS LAB 2 RT Status
    ```
    
    ‘RT Address and Name: 16 XPDR 2’
    
    sel Enable
    
    _cmd_ Execute
    
    Verify Enable – Ena
13. **VERIFYING S-BAND XPDR 2 HEALTH**
   C&T: Transponder 2
   S Band 4A Transponder 2
   ‘BIT Summary’

   Verify POST/ECM – Pass
   Verify Environmental – Pass

14. **VERIFYING COMMUNICATION ON BOTH 1553 CHANNELS**
   Node 1: C&DH: Primary Node 1 MDM
   Primary NCS MDM Node 1

   sel LB SYS LAB 2
   sel Bus Status

   LB SYS LAB 2 Bus Status

   Record Channel Selected: ______________

   If Channel Selected is A
   **cmd** Select Ch B **Execute**

   If Channel Selected is B
   **cmd** Select Ch A **Execute**

   C&T: Transponder 2
   S Band 4A Transponder 2

   Verify no loss of Transponder 2 telemetry.

15. **INHIBITING RT (BUS I/O) FOR S-BAND XPDR 2**
   C&T: CB CT 3 RT Status
   LB SYS LAB 2 RT Status
   ‘RT Address and Name: 16 XPDR 2’

   sel Inhibit
   **cmd** Execute

   Verify Inhibit – Inh

16. **DEACTIVATING S-BAND XPDR 2**
   Z1: EPS: RPCM Z13B B: RPC 3
   RPCM Z13B B RPC 03

   **cmd** RPC Position – Open (Verify – Op)
17. **ENABLING AUTO CHANNEL SWITCHING ON DATA BUSSES**

**Node 1: C&DH: MDM N1-2**

Primary NCS MDM Node1

- sel UB EPS N1-14
- 
  UB_EPS_N1_14
- sel Bus Status
  
  UB_EPS_N1_14_Bus_Status
  
  ‘Auto Channel Switch’
  
  **cmd Enable Execute**

  √Auto Channel Switch Status – Ena

**Node 1: C&DH: MDM N1-2**

Primary NCS MDM Node1

- sel UB EPS N1-23
- 
  UB_EPS_N1_23
- sel Bus Status
  
  UB_EPS_N1_23_Bus_Status
  
  ‘Auto Channel Switch’
  
  **cmd Enable Execute**

  √Auto Channel Switch Status – Ena

**Node 1: C&DH: MDM N1-2**

Primary NCS MDM Node1

- sel LB SYS LAB 2
- 
  LB_SYS_LAB_2
- sel Bus Status
  
  LB_SYS_LAB_2_Bus_Status
  
  ‘Auto Channel Switch’
  
  **cmd Enable Execute**

  √Auto Channel Switch Status – Ena
PARTS AND TOOLS FOR IVA NODE1 PATCH PANEL RECONFIGURATION

PARTS:
Flash Lights
FGB (Headset)

TOOLS REQUIRED:
Kit D:
  5/32 " Hex Head, 1/ 4" Drive
Kit E:
  Ratchet 1 /4 " Drive
Kit J:
  Connector Pliers (If required)
IVA Tool Kit LID #2:
  Gray Tape
IVA Tool Kit LID #1:
  Static Wrist Tether

WARNING
Failure to remove power can result in electrical shock hazard.

NOTE
1. All loads (excluding Node 1 fans) downstream of RACU 6 will be powered off by deactivating the RACU.
2. Connector deadfacing will be confirmed at RACU 6 and not at each individual RPC.
3. P6 source connectors and RACU 5 source connectors will be verified independently.
4. Steps 1 --- 6 performed by MCC-H.

1. **ENABLING MCC-M FOR COMMAN DiNG VIA MCC-H TO OIU**
   MCC-H
   Enable Moscow for commanding through OIU via MCC-H.

2. **VERIFYING RPCM 4B B RPC 1 OPEN**
P6: EPS: RPCM 4B B
RPCM 4B B

√Integ Counter – incrementing
sel RPC 01

√RPC 01 – Op
cmd Close Cmd – Inhibit (Verify – Inh)
3. **VERIFYING RPCM 2B B RPC 1 OPEN**
   
P6: EPS: RPCM 2B B
   
   √Integ Counter – incrementing
   
   sel RPC 01
   
   √RPC 01 – Op
   
   **cmd** Close Cmd – Inhibit (Verify – Inh)

4. **CONFIRMING DDCU Z14B CONVERTER OFF**
   
   Z1: EPS: DDCU Z14B
   
   √Integration Counter – incrementing
   
   ‘Converter’
   
   √Status: 0
   
   ‘Output’
   
   √Current, A: -4 --- 4
   √Voltage, V: -4 --- 4

5. **CONFIRMING DDCU Z13B CONVERTER OFF**
   
   Z1: EPS: DDCU Z13B
   
   √Integration Counter – incrementing
   
   ‘Converter’
   
   √Status: 0
   
   ‘Output’
   
   √Current, A: -4 --- 4
   √Voltage, V: -4 --- 4

6. **CONFIRMING S-BAND OFF (FOR SASA RELOCATION)**
   
   Z1: EPS
   
   sel RPCM Z13B B
   
   **RPCM Z13B B**
   
   √RPC 1, 2 – Open (Icon – gray)
7. **CLOSEOUT PANEL REMOVALS (If required)**

NOD1

Remove Closeout Panel NOD1P1-01, fasteners (ten) (Ratchet 1/4" Drive, 5/32" Hex Head)

Remove Closeout Panel NOD1D1-01 fasteners (ten) (Ratchet 1/4" Drive, 5/32" Hex Head)

---

**WARNING**

1. Steps 8 and 9 remove all ventilation inside and to Node 1/PMA1.

2. If possible, limit Crew time to 3.5 person hours.

3. If present, wipe condensation from surfaces of Node 1 and PMA1.

---

8. **DEACTIVATING NODE 1 IMV FAN**

PCS

Node 1: ECLSS: IMV Aft Port Fan

| Node 1 IMV Aft Port Fan |

---

**NOTE**

1. Upon IMV Fan deactivation, rpm sensor registers 0 volts. MDM conversion translates 0 volts (counts) to $7164 ± 50$ rpm. Reference SPN 8437.

2. For steps 8 and 9, upon arming, the arm status will indicate unarmed. Valid for equipment connected to MDM N1-1 when mode is secondary. Reference SPN 259.

‘Off’

```
cmd Arm
cmd Off
```

√ Status – Off
√ Speed, rpm: $\sim 7164 ± 50$

---

9. **DEACTIVATING NODE 1 CABIN FAN**

PCS

Node 1: ECLSS: Cab Fan

| Node 1 Cabin Fan |

---

‘State – Off’

```
cmd Arm
cmd Off
```

√ Status – Off
√ Speed, rpm: $2000 ± 50$
10. **NODE 1 SMOKE DETECTOR 1 DEACTIVATION**

PCS

Node 1: ECLSS: SD 1

Node 1 Smoke Detector 1

‘Monitoring’

√Status – Enabled

**cmd** Inhibit

√Status – Inhibited

11. **VERIFYING MDM N1-2 IS HEALTHY**

PCS

Node 1: C&DH: MDM N1-2

Primary NCS MDM Node 1

Verify Frame Count – <incrementing>

Verify MDM ID – N1-2

12. **DISABLING NCS AUTO RETRY**

‘Software Control’

sel MDM Utilities

Primary NCS MDM Utilities

If Auto Retry Status – Ena

**cmd** Inhibit  **Execute**

√Auto Retry Status – Inh

**NOTE**

When RACU 6 is deactivated expect the following:

Power will be removed from all Node 1 lights.

C&W tone and Caution message ‘**MDM N1-2 Detected RT Fail MDM N1-1 - PMA-1**’.

UB EPS Buses will switch channels and N1-2 MDM will also switch from UB EPS N1-14 to UB EPS N1-23 attempting to communicate with N1-1 MDM.

ISS Early Comm Capability lost.

Advisory messages

‘**RPCM N1RS1 A Loss of Comm**’

‘**RPCM N1RS1 B Loss of Comm**’

‘**RPCM N1RS1 C Loss of Comm**’

‘**RPCM Z14B A Loss of Comm**’

‘**RPCM Z14B B Loss of Comm**’

‘**Shuttle FDA SPEC 224 RACU 6 VOLT LMT**’ message
13. **DISABLING AUTO TRANSITION TO DIAGNOSTIC**

   Node1: CDH: Primary Node1 MDM: Processing State
   Primary NCS Processing State Transitions

   cmd Auto Transition to Diag State Inhibit **Execute**

   √Auto Transition to Diag State – Inh

14. **RACU 6 DEACTIVATION TO REMOVE POWER FROM N1RS1, Z14B, AND N14B RPDAs**

   14.1 **MCC-M** Commanding FGB RACU 6 Off

      Crew ↓ **MCC-H**, “Ready for RACU 6 Power Off.”

      14.1.1 If via OIU Through **MCC-H** (Primary)

         **MCC-H**

         √**MCC-M** enabled for commands via **MCC-H** to OIU
         **MCC-H** ⇒ **MCC-M**, “Go for RACU 6 Power Off.”
         **MCC-M** ⇒ **MCC-H** ⇒ crew,
         “RACU 6 Powered Off at __/___:___:__ GMT.”

         Go to step 14.2.

      14.1.2 If via RGS (Secondary)

         **MCC-H** ⇒ **MCC-M**, “Go for RACU 6 Power Off.”

         **MCC-M** ⇒ **MCC-H** ⇒ crew,
         “RACU 6 Powered Off at __/___:___:__ GMT.”

         Go to step 14.2.

      14.1.3 If via PCS (Tertiary)

         **MCC-H** ⇒ **MCC-M**, “Go for RACU 6 Power Off.”
         **MCC-H** ⇒ crew, “Go for RACU 6 Power Off.”

         FGB: EPS: RACU
         **FGB_RACUs**
         ‘RACU 6’

         cmd Converter – OFF (Verify – OFF)

         Crew ↓ **MCC-H**, “RACU 6 Powered Off at __/___:___:__
         GMT.”
         **MCC-H** ⇒ **MCC-M**, “RACU 6 Powered Off at
         __/___:___:__ GMT.”

         Go to step 14.2.
14.2 Verifying FGB RACU 6 Off

PCS

- FGB: EPS: RACU
- FGB_RACUs

√ RACU 6 Converter – Off
√ Input Current < 2.0 A
√ Output Voltage ~ 90 V

NOTE

Z1 CPP1 (Z14B) Reconfiguration and Y Cable removal/N1CPP A1 (N14B) Reconfiguration should be performed in parallel.

14.3 Z1 CPP1 (Z14B) Reconfiguration, ‘Y’ Cable Removal and N1CPP A1 (N14B) Reconfiguration

MCC-H announce on A/G1 to STS crew:
“Go for Reconfigure Patch Panel 4B, Z1 PATCH PANEL RECONFIG (EVA C/L)” and
“Go for SASA RELOCATION (EVA C/L)”

MCC-H announce on A/G2 to ISS crew:
“Go for Y Cable Removal and N1CPP A1 (N14B) Reconfiguration (continuing with step 15).”

15. Y CABLE REMOVAL AND NODE1 CONNECTOR PATCH PANEL A1 (N14B) RECONFIGURATION

15.1 Demating Connectors at Node 1 CPP A1 (N14B)

NOD1

P1-02

Don Static Wrist Tether by connecting to any unpainted metal surface.

W0155P301 ← J301
W0155P302 ← J302
W0155J301 ← W0103P301
Dummy Connector ← J304

15.2 Reconfiguring Node 1 CPP A1 (N14B)

W0103P301 ← J301
W0123P303 ← J304
Dummy Connector → J302
Temporarily stow.
15.3 Verifying N14B and Z14B Patch Panel Reconfig Complete
ISS ↓ MCC-H, “N1 CPP A1 (N14B) Reconfig Complete”
STS ↓ MCC-H, “Z1 CPP 1 (Z14B) Reconfig Complete”

16. RACU 6 ACTIVATION
16.1 MCC-M Commanding
16.1.1 If via OIU Through MCC-H (Primary)

MCC-H

\√MCC-M enabled for commands via MCC-H to OIU
MCC-H ⇒ MCC-M, “Go for RACU 6 Power On.”
MCC-M ⇒ MCC-H ↑ crew,
“RACU 6 Powered On at __/___:___:__ GMT.”

Go to step 16.2.

16.1.2 If Via RGS
MCC-H ⇒ MCC-M, “Go for RACU 6 Power On.”

RUSSIAN GROUND   AOS   LOS

<p>| | | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Pass 1</td>
<td><strong>/</strong><em>:</em>__</td>
<td><strong>/</strong><em>:</em>__</td>
</tr>
<tr>
<td>Pass 2</td>
<td><strong>/</strong><em>:</em>__</td>
<td><strong>/</strong><em>:</em>__</td>
</tr>
</tbody>
</table>

MCC-M ⇒ MCC-H ↑ crew,
“RACU 6 Power On at __/___:___:___ GMT.”

Go to step 16.2.

16.1.3 If via PCS (Tertiary)
MCC-H ⇒ MCC-M, “Go for RACU 6 Power On.”
MCC-H ↑ crew, “Go for RACU 6 Power On.”
FGB: EPS: RACU
\[ \text{RACU 6} \]

**cmd** Converter – ON (Verify – ON)

Crew \( \uparrow \) **MCC-H**, "RACU 6 Powered On at \__/___:___:__ GMT."

**MCC-H \( \Rightarrow \) MCC-M**, "RACU 6 Powered On at \__/___:___:__ GMT."

Go to step 16.2.

16.2 Verifying FGB RACU 6 On

\[ \text{FGB: EPS: RACU} \]
\[ \text{RACU 6} \]

- RACU 6 Converter – On
- Input Current < 2.5 A
- Output Voltage: 121 --- 125 V
- Output Current: 0.3 --- 10 A

***************************************************
If RACU 6 OUT AMPS > 10
\[ \text{FGB: EPS: RACU} \]
\[ \text{RACU 6} \]

**cmd** Converter – OFF (Verify – OFF)

***************************************************

EVA crew proceeds to SASA relocation.

ISS crew proceeds to step 38.

**MCC-H** continues with step 17.

NOTE
Once steps 17 --- 21 are complete, steps 22 --- 37 can be performed concurrently in sections by each appropriate **MCC-H** discipline.

17. TRANSITIONING N1-1 TO SECONDARY

**MCC-H**

Node 1: C&DH: MDM N1-1: Processing State
\[ \text{Secondary NCS Processing State Transitions} \]

**cmd** Transition to Secondary State \( \text{Execute} \)

- Processing State – Secondary
18. **ACTIVATING Z14B DDCU**

   Z1: EPS: DDCU Z14B

   ![DDCU Z14B](image)

   √Integration Counter – incrementing
   √Input Voltage, V: 148 --- 164 V

   sel Converter

   ![DDCU Z14B CONVERTER](image)

   **cmd** On Arm
   **cmd** On

   √Output Voltage, V: 121 --- 128 V

   sel Firmware

   ![DDCU Z14B Firmware](image)

   **cmd** Clear Cmds – Common Clear

   √Power On Reset – blank

19. **VERIFYING SOURCE POWER TO Z14B POWER BUSSES**

   P6: EPS: RPCM 4B B

   ![RPCM 4B B](image)

   √Integration Counter – incrementing
   √Bus Voltage: 120 --- 129 V

20. **Z14B POWER BUS ACTIVATION**

   sel RPC 01

   ![RPCM 4B B RPC 01](image)

   **cmd** Close Cmd – Enable (Verify – Ena)
   **cmd** RPC Position – Close (Verify – Cl)

21. **VERIFYING Z14B RPCMS ACTIVE**

   Z1: EPS

   ![Z1 EPS](image)

   √RPCM Z14B A, B – Active (blue icon)
22. **APPLYING POWER TO PCU 2**
   Z1: EPS: RPCM Z14B B
   
   ```
   sel RPC 15
   ```
   
   ```
   RPCM Z14B B RPC 15
   ```
   
   **cmd** RPC Position – Close (Verify – Cl)

23. **VERIFYING PCU REMOTE TERMINAL ENABLED**
   Z1: EPS: Plasma Contactor 2
   
   ```
   √ RT State – Enabled
   √ Integration Counter – Incrementing
   ```

24. **VERIFYING PCU 2 IN SHUTDOWN STATE**
   Z1: EPS: PCU 2
   
   Record Xenon Tank Temp: _______ deg C
   
   ‘PEU’
   
   √ Mode/State – Shutdown

25. **COMMANDING PCU 2 TO STANDBY MODE**
    sel PCU 2 Normal Operation
    
    ```
    PCU 2 Normal Operation
    ```
    
    **NOTE**
    The PCU Graphical display will indicate ‘Standby’ rather than ‘Standby Routine’. Use only the PCU 2 Normal Operation display to monitor PCU Mode/State. (SPN 628).

    ```
    cmd PCU 2 – Standby Arm
    cmd PCU 2 – Standby
    ```
    
    √ PCU Mode/State – Standby Routine
    √ PCU Mode/State – Standby

26. **VERIFYING PCU 2 IN STANDBY**
   Z1: EPS: Plasma Contactor 2
   
   √ Integration counter – incrementing
   
   ‘PEU’
27. **PLACING PCU 2 IN DISCHARGE STATE**

**NOTE**

Only one PCU should be in Discharge Mode at a time. Contactor On command may be attempted up to three times if ignition failures occur.

 sel ‘Normal Operation’

**PCU 2 Normal Operation**

√PCU Mode/State – Standby

**PCU 2**

√Tank Temp > 37° C

 sel Normal Operation

**PCU 2 Normal Operation**

**cmd** Contactor On Arm

**cmd** Contactor On

√Mode/State – Ignition

Wait up to 30 minutes.

√Mode/State – Discharge

**************************************************************************************************************

If Mode/State – Standby

 sel ‘Firmware’

√Ignition Failed – <blank>
√Loss of Discharge – <blank>
√Low Discharge – <blank>

**cmd** All Indicators Clear

√Ignition Failed – <blank>
√Loss of Discharge – <blank>
√Low Discharge – <blank>

Repeat step 27.

**************************************************************************************************************

**PCU 2**

√Xenon Tank Temp: 33 --- 43 deg C
√Xenon Tank Press: 10963 --- 164815 mmHg
√Anode Voltage: 8 --- 18 V
√Discharge Current: 0 --- 12 amps
28. **TERMINATING PCU 1 DISCHARGE**

Z1: EPS: Plasma Contactor 1

PCU 1

PEU

Verify Mode/State – Discharge

sel ‘Normal Operation’

PCU 1 Normal Operation

**cmd** Contactor Off Arm  
**cmd** Contactor Off

√PCU Mode/State – Standby

29. **PLACING PCU 1 IN SHUTDOWN STATE**

**NOTE**

The normal 4 hour wait for the PCU to report itself in Shutdown state is not required because after the Z13B CPP reconfiguration, the PCU will be placed back into Standby state. Issuing the Shutdown command is sufficient to prepare PCU 1 for powerdown.

PCU 1

√Latch Valve 1 – Op  
√Latch Valve 2 – Cl

PCU 1 Normal Operation

**cmd** Shutdown Arm  
**cmd** Shutdown

30. **REMOVING PCU 1 OPERATIONAL POWER**

PCU 1

sel RPCM Z13B B RPC 15

RPCM_Z13B_B_RPC 15

**cmd** RPC Position – Open (Verify – Op)

31. **ENABLING AUTOMATIC FIRE ISOLATION FOR MDM N1-1**

Node 1: ECLSS: FDIR

Node 1 FDIR

**cmd** Node 1-1 MDM IMV FDIR – Enable
32. **NODE 1 IMV AFT PORT VALVE ACTIVATION**
   Node 1: ECLSS: Node 1 IMV Aft Port Vlv
   sel RPCM N14B C RPC 05
   RPCM N14B C RPC 05
   **cmd** RPC Position – Close (Verify – Cl)
   Node 1 IMV Aft Port Vlv
   **cmd** Enable
   √ Status – Enabled

33. **NODE 1 IMV AFT STBD VALVE ACTIVATION**
   Node 1: ECLSS: Node 1 IMV Aft Stbd Vlv
   sel RPCM N14B C RPC 04
   RPCM N14B C RPC 04
   **cmd** RPC Position – Close (Verify – Cl)
   Node 1 IMV Aft Stbd Vlv
   **cmd** Enable
   √ Status – Enabled

34. **NODE 1 CABIN FAN ACTIVATION**
   Node 1: ECLSS: Cab Fan
   sel RPCM N14B B RPC 17
   RPCM N14B B RPC 17
   **cmd** RPC Position – Close (Verify – Cl)
   Node 1 Cabin Fan
   ‘State – On’
cmd On
√State – On
√Speed, rpm: 3549 --- 4251
√dP, mmHg: ≤ 5.0
‘Speed Limiting’
√Status – Enabled

35. **NODE 1 IMV FAN ACTIVATION**
Node 1: ECLSS: IMV Aft Port Fan
Node 1 IMV Aft Port Fan
sel RPCM N14B C RPC 12

RPCM N14B C RPC 12

**cmd** Position – Close (Verify – Cl)

Node 1 IMV Aft Port Fan

**cmd** On
√Status – On

Wait 15 seconds.
√Speed, rpm: 7745 --- 9278
‘Speed Limiting’
√Status – Enabled

36. **POWER UP SMOKE DETECTOR**
sel ‘Node1 Smoke Detector 1’

Node 1 Smoke Detector 1

sel ‘RPCM N14B C RPC 03’

**cmd** RPC Position – Close (Verify – Cl)

√Obscuration, % Contamination < 45
√Scatter, % Obscuration/meter: ~0

If using time-tagged commands, wait 2 seconds between issuance of RPC close and SD Monitoring Enable commands.

‘Monitoring’
NODE 1 AND Z1 PATCH PANEL RECONFIGURATION

(cmd) Enable

√Status – Enabled

Wait 11 seconds.

√Active BIT Failure – blank
√Passive BIT Lens Status – Clean
√Failure – blank

37. NODE 1 N14B LIGHTS ON
Node 1: EPS: Lights
Node1_Lights

(cmd) RPCM N14B C RPC 2 position – Close (Verify – Cl)
(cmd) RPCM N14B B RPC 1 position – Close (Verify – Cl)
(cmd) RPCM N14B C RPC 15 position – Close (Verify – Cl)
(cmd) RPCM N14B C RPC 16 position – Close (Verify – Cl)

NOTE
ISS crew proceeds with step 38 after RACU 6 activation.

38. VERIFIYING MDM N1-1 STATE AND POWER OPERATIONAL HEATER

(cmd) RPCM N14B C RPC 2 position – Close (Verify – Cl)
(cmd) RPCM N14B B RPC 1 position – Close (Verify – Cl)
(cmd) RPCM N14B C RPC 15 position – Close (Verify – Cl)
(cmd) RPCM N14B C RPC 16 position – Close (Verify – Cl)

RPCM N1RS1 A RPC 05

Select RPC 5

Select NCS MDM Node 1

Select Secondary NCS MDM Node 1

Select MDM Utilities

Select Secondary NCS-MDM Utilities

√Auto Retry Status – Inh

If Auto Retry Status – Ena
(cmd) Inhibit Execute

√Auto Retry Status – Inh
38.1 Disabling Auto Transition to Diagnostic
Node1: CDH: Secondary Node1 MDM: Processing State
Secondary NCS Processing State Transitions

**cmd** Auto Transition to Diag State Inhibit  **Execute**

√Auto Transition to Diag State – Inh

**NOTE**
IVA crew must wait for EVA crew to report complete with SASA relocation before proceeding with step 39.

**WARNING**
Executing step 39 before SASA relocation is complete exposes the EVA Crew to a shock hazard.

39. **S-BAND AND KU-BAND HEATERS POWERUP**
Z1: EPS: RPCM Z1 4B B
RPCM Z1 4B B

sel RPC [X] where [X] = 2 5 3 4 6

**cmd** RPC Position – Close (Verify – Cl)
Repeat
NOTE
When RACU 5 is deactivated, expect the following:

C&W tone and Caution message ‘MDM N1-1 Detected RT Fail MDM N1-2 - PMA-1’

MDM N1-1 transition to Primary will take 1 minute. N1-1 should begin to transition to Primary after 50 seconds of not detecting a BC.

When N1-1 becomes Primary, UB EPS Buses will switch channels and N1-1 MDM will also switch from UB EPS N1-14 to UB EPS N1-23 attempting to communicate with N1-2 MDM.

Temporary Loss of Comm with PVCU MDMs causing PVCU Channel Modes to be set to Contingency/Safe Mode.

Loss of telemetry on PCS and through OIU until reconfigured to receive telemetry via MDM N1-1.

Advisory messages
‘RPCM N1RS2 A Loss of Comm’
‘RPCM N1RS2 B Loss of Comm’
‘RPCM N1RS2 C Loss of Comm’
‘RPCM Z13B A Loss of Comm’
‘RPCM Z13B B Loss of Comm’

ISS S-Band C&W messages.

‘Shuttle FDA SPEC 224 RACU5 VOLT LMT’ message.

Loss of ISS Early Comm Capability.

Lab Low Temp Loop IFHX NH3 In Temp Low – Bypass

Loss of PCU-2.

RACU 5 Deactivation must not occur until successful ignition on PCU-1.
40. RACU 5 DEACTIVATION TO REMOVE POWER FROM N1RS2 AND Z13B RPDA

40.1 MCC-M Commanding RACU 5 Off

   Crew \(\downarrow\) MCC-H, “Ready for RACU 5 Power Off.”

40.1.1 If via OIU Through MCC-H (Primary)

   MCC-H \(\sqrt{\text{MCC-M}}\) enabled for commands via MCC-H to OIU
   MCC-H \(\Rightarrow\) MCC-M, “Go for RACU 5 Power Off.”
   MCC-M \(\Rightarrow\) MCC-H \(\uparrow\) crew,
   “RACU 5 Powered Off at ___/___:___:___ GMT.”

   Go to step 40.2.

40.1.2 If via RGS

   MCC-H \(\Rightarrow\) MCC-M, “Go for RACU 5 Power Off.”

   MCC-M \(\Rightarrow\) MCC-H \(\uparrow\) crew,
   “RACU 5 Powered Off at ___/___:___:___ GMT.”

   Go to step 40.2.

40.1.3 If via PCS (Tertiary)

   MCC-H \(\Rightarrow\) MCC-M, “Go for RACU 5 Power Off.”
   MCC-H \(\uparrow\) crew, “Go for RACU 5 Power Off.”

   FGB: EPS: RACU
   FGB_RACUs
   ‘RACU 5’

   cmd Converter – OFF (Verify – OFF)

   Crew \(\downarrow\) MCC-H, “RACU 5 Powered Off
   at ___/___:___:___ GMT.”
   MCC-H \(\Rightarrow\) MCC-M, “RACU 5 Powered Off
   at ___/___:___:___ GMT.”

   Go to step 40.2.
40.2 Verifying FGB RACU 5 Off
RS Laptop
FGB: EPS: RACU

- RACU 5 Converter – Off
- Input Current < 2.0 A
- Output Voltage ~90 V

41. RECOVERING TELEMETRY ON PCS1 AND OIU

NOTE
Telemetry recovery on ISS and Shuttle PCS and OIU should be performed in parallel.

MCC-H
Configure OIU for N1-1.

ISS
Reconnect PCS on GNC-1 bus.

AFD
Reconnect PCS on ORB N1-1 bus.

42. VERIFYING MDM N1-1 STATE

PCS
Node 1: C&DH: MDM N1-1

Primary NCS MDM Node 1

Verify Frame Count – incrementing
Verify MDM ID – N1-1
Verify Processing State – Primary

NOTE
Z1 CPP 2 (Z13B) Reconfiguration and N1 CPP A2 (N13B) Patch Panel Reconfiguration should be done in parallel.

43. Z1 CPP 2 (Z13B) RECONFIGURATION AND N1 CPP A2 (N13B) PATCH PANEL RECONFIGURATION

MCC-H announce simo on A/G1 and A/G2 to both ISS and STS Crews:
“Go for Reconfigure Patch Panel 3B, Z13B Patch Panel Reconfig (EVA C/L)” and
“Go for N1 CPP A2 (N13B) Reconfig (continuing with step 44).”

44. N1 CONNECTOR PATCH PANEL A2 (N13B) RECONFIGURATION

44.1 Demating Connectors at N1 CPP A2 (N13B)

NOD1
Don Static Wrist Tether by connecting to Patch Panel A2.

D1-01
W0104P307 ← | → J307
Dummy Connector ← | → J308

44.2 Installing W0104P307 to J308 at N1 CPP A2 (N13B)

W0104P307 → | ← J308
Dummy Connector → | ← J307
Temporarily stow.
44.3 Closeout Panel Installation

NOD1-01
Install Closeout Panel NOD1D1-01, tighten fasteners (ten)
(Ratchet 1/4" Driver, 5/32" Hex Head).

Install Closeout Panel NOD1P1-01, tighten fasteners (ten)
(Ratchet 1/4" Driver, 5/32" Hex Head).

45. VERIFYING N13B AND Z13B PATCH PANEL RECONFIG COMPLETE

ISS ↓ MCC-H, N1 CPP A2 (N13B) Reconfiguration complete
STS ↓ MCC-H, Z1 CPP 2 (Z13B) Reconfiguration complete

NOTE
If the DDCU Z13B thermal shroud has not been removed,
MCC-H will closely monitor DDCU temperatures after activation.

46. DDCU Z13B ACTIVATION
Z1: EPS: DDCU Z13B

√Integration Counter – incrementing
√Input Voltage, V: 148 --- 164 V

sel Converter

DDCU Z13B Converter

cmd On Arm
cmd On

√Output Voltage, V: 121 --- 128
47. CONFIGURING MDM N1-2 TO PRIMARY AND MDM N1-1 TO SECONDARY

47.1 Verifying MDM States

PCS

Node 1: C&DH: MDM N1-1

Primary NCS MDM Node 1

Verify Frame Count – <incrementing>
Verify MDM ID – N1-1
Verify Processing State – Primary

Node 1: C&DH: MDM N1-2

Secondary NCS MDM Node 1

Verify Frame Count – <incrementing>
Verify MDM ID – N1-2
Verify Processing State – Standby

47.2 Commanding N1-1 to Secondary (N1-2 should go to Primary)

Node 1: C&DH: MDM N1-1

Primary NCS MDM Node 1

NOTE
Sending the following command will cause the loss of telemetry on PCS1 and OIU. PCS2 must be reconnected.

sel Processing State

Primary NCS State Transitions
‘N1-1 MDM Transitions’

cmd Transition to Secondary State Execute

Node 1: C&DH: MDM N1-1

Primary NCS MDM Node 1

Verify Frame Count static (loss of PCS1 telemetry)
NOTE
1. N1-2 should begin to transition to Primary after 20 seconds of detecting no BC.

2. Note that several Node 1 and PMA1 B heaters may be powered if the temperature is below the Lower Setpoint. If the temperature is below the Failure Lower Limit, expect heater Advisory messages that can be ignored at this point.

3. Ignore S-Band C&W messages.

47.3 Recovering Telemetry on PCS2 and OIU

NOTE
Telemetry recovery on ISS and Shuttle PCS and OIU should be performed in parallel.

MCC-H
Configure OIU for N1-2.
ISS
Reconnect PCS on GNC-2 bus.
AFD
Reconnect PCS on ORB N1-2 bus.

47.4 Verifying MDM States

PCS

Node 1: C&DH: MDM N1-2

Primary NCS MDM Node 1

Verify Frame Count – <incrementing>
Verify MDM ID – N1-2
Verify Processing State – Primary

Node 1: C&DH: MDM N1-1

Secondary NCS MDM Node 1

Verify Frame Count – <incrementing>
Verify MDM ID – N1-1
Verify Processing State – Secondary

NOTE
The NCS to PVCU Logical Device IO will revert back to its default state (PVCU 4B Primary). MCC-H will configure the Logical Device IO as required.

47.5 Enabling NCS Auto Retry and Auto Transition to Diagnostics

PCS

Node 1: C&DH: MDM N1-1

Secondary NCS MDM Node 1

'Software Control'

sel MDM Utilities

Secondary NCS MDM Utilities
√Auto Retry Status – Ena

If Auto Retry Status – Inh
   cmd Enable Execute

√Auto Retry Status – Ena

Secondary NCS MDM Node 1

sel Processing State

Secondary NCS State Transitions
   ‘Secondary MDM Transitions’

√Auto Transition to Diag State – Ena

If Auto Transition to Diag State – Inh
   cmd Enable Execute

√Auto Transition to Diag State – Ena

47.6 Configuring MDM Heaters

PCS

Node 1: EPS: RPCM N1RS2 C
RPCM_N1RS2_C

sel RPC 4
RPCM N1RS2 C RPC 04

cmd RPC Position – Close (Verify – Cl)

47.7 Checking PVCU MDM Time Sync

PCS

P6: CDH: PVCU 4B
Primary PVCU MDM

If Sync Status – Loss of Sync
sel Sync Status

Primary P6 PVCA Sync Status

cmd Sync to BIA
Primary PVCU MDM

√Sync Status – In Sync
P6: CDH: PVCU 2B
Backup PVCU MDM

If Sync Status – Loss of Sync
sel Sync Status

Backup P6 PVCA Sync Status

NOTE
BGA 2B integration counter does not work SPN #14835.

47.8 Disabling PCU RT FDIR on EPS N1-14 and EPS N1-23
Node 1: C&DH MDM N1-2: UB EPS N1-14: RT Status
UB_EPS_N1_14_RT_Status

cmd 28 PCU Z1-4B Inhibit FDIR   Execute

√28 PCU Z1-4B RT FDIR Status – INH

Node 1: C&DH MDM N1-2: UB EPS N1-23: RT Status
UB_EPS_N1_23_RT_Status

cmd 28 PCU Z1-3B Inhibit FDIR   Execute

√28 PCU Z1-3B RT FDIR Status – INH

48. CLEARING BST A LATCH IN THE NODE 1 MDMS
Node 1: C&DH: MDM N1-2: MDM Utilities
Primary_NCS_MDM_Utilities
‘Clear Latched Data in BST A’

cmd Clear   Execute

Node 1: C&DH: MDM N1-1: MDM Utilities
Secondary_NCS_MDM_Utilities
‘Clear Latched Data in BST A’

cmd Clear   Execute

49. COMMANDING SURVIVAL HEATERS TO ENABLE TO BACKUP
N1 2 MDM Survival Heater

cmd Enable Bkup   Execute
Verify Availability – Ena Bkup

Node 1: C&DH: MDM N1-2: N1-1 Heaters: Sur
| N1 1 MDM Survival Heater |

**cmd** Enable Bkup **Execute**

Verify Availability – Ena Bkup

---

**50. ENABLING NCS ANCILLARY DATA TO PVCU MDMS**

Node 1: C&DH: MDM N1-2: PVCU Control
| Primary _NCS_PVCU_Control |

**cmd** Enable PVCU Point to Point Data **Execute**

Verify PVCU 2B Point to Point Data – ENA
Verify PVCU 4B Point to Point Data – ENA

---

**51. CONFIGURING CHANNEL 2B MODES**

P6: EPS: BGA 2B: Channel Targeted Modes
| BGA 2B Ch Targeted Modes |

row heading = ‘Directed Position’
column heading = ‘Non-Solar Tracking’

input Cmded Angle, deg = 180
**cmd** set

√BGA Mode – Directed Position
√Ch 2B Mode – Non-Solar Tracking

**BGA 2B**

Wait until Angle Error is approximately 0.0.

√Actual Angle, deg: 179.5 --- 180.5

---

**52. CONFIGURING CHANNEL 4B MODES**

P6: EPS: BGA 4B: Channel Targeted Modes
| BGA 4B Ch Targeted Modes |

row heading = ‘Directed Position’
column heading = ‘Non-Solar Tracking’

input Cmded Angle, deg = 180
**cmd** set

√BGA Mode – Directed Position
√Ch 4B Mode – Non-Solar Tracking

**BGA 4B**
Wait until Angle Error is approximately 0.0.

\[ \text{Actual Angle, deg: 179.5 --- 180.5} \]

53. **VERIFYING EVA TASKS ARE COMPLETE**
Verify with STS that SASA Relocation is completed before proceeding.

54. **VERIFYING SOURCE POWER TO Z13B POWER BUSES**

P6: EPS: RPCM 2B B

\[
\text{Integration Counter – incrementing}
\]

\[ \text{Input Voltage: 120 --- 129 V} \]

55. **Z13B POWER BUS ACTIVATION**

sel RPC 01

\[
\text{RPCM 2B B RPC 01}
\]

\text{cmd} \text{ Close Cmd – Enable (Verify – Ena)}

\text{cmd} \text{ RPC Position – Close (Verify – Cl)}

56. **VERIFYING Z13B RPCMS ACTIVE**

Z1: EPS

\[
\text{RPCM Z13B A, B – Active (icon blue)}
\]

\[
\text{NOTE}
\]

Commanding may be handed over to **MCC-H** anytime after step 56.

57. **ENABLE Z1 POWER BUS HEATERS**

Z1: EPS: Pwr Bus Z13B Rail Heaters

\[
\text{Pwr Bus Z13B Rail Htrs}
\]

\text{cmd} \text{ Z13B HtrA Ena Backup (√Availability – Ena Bu)}

\text{cmd} \text{ Z13B HtrB Ena Operate (√Availability – Ena Op)}

Z1: EPS: Pwr Bus Z14B Rail Heaters

\[
\text{Pwr Bus Z14B Rail Htrs}
\]

\text{cmd} \text{ Z14B HtrA Ena Backup (√Availability – Ena Bu)}

\text{cmd} \text{ Z14B HtrB Ena Operate (√Availability – Ena Op)}
58. **Z1 DDCU HEATER POWER UP**

Z1: EPS

`cmd` RPC 11 – Cl (Verify – Cl)

‘DDCU Htrs - 1’
‘RPCM Z13B B’

`cmd` RPC 6 – Cl (Verify – Cl)

‘DDCU Htrs - 2’
‘RPCM Z13B B’

`cmd` RPC 11 – Cl (Verify – Cl)

‘DDCU Htrs - 1’
‘RPCM Z14B B’

`cmd` RPC 16 – Cl (Verify – Cl)

‘DDCU Htrs - 2’
‘RPCM Z14B B’

59. **CMG HEATER POWER UP**

‘CMG External Htrs’

‘RPCM Z14B B’

`cmd` RPC 10 – Cl (Verify – Cl)

`cmd` RPC 12 – Cl (Verify – Cl)

‘CMG External Htrs’

‘RPCM Z13B B’

`cmd` RPC 10 – Cl (Verify – Cl)

`cmd` RPC 12 – Cl (Verify – Cl)

60. **Z1 EETCS HEATER POWER UP**

‘EEATCS Loop A Non Op Htr1’
‘RPCM Z13B B’

`cmd` RPC 7 – Cl (Verify – Cl)

‘EEATCS Loop B Non Op Htr1’
‘RPCM Z14B B’

`cmd` RPC 7 – Cl (Verify – Cl)
61. **PCU HEATER POWER UP**
   ‘PCU 2 and PCU 1 Htr’
   ‘RPCM Z14B B’

   **cmd** RPC 14 − Cl (Verify − Cl)
   ‘PCU 1 and PCU 2 Htr’
   ‘RPCM Z13B B’

   **cmd** RPC 16 − Cl (Verify − Cl)

   **NOTE**
   1. In step 62, when PCU 1 is powered on, it will be in Manual State, because it was powered down in step 29 before completing the transition to Shutdown State.
   2. Step 63 commands the PCU into Shutdown State, and up to 4 hours may be required for that transition to take place.
   3. Once the transition to Shutdown State has taken place, step 64 can be executed to place the PCU into Standby State.
   4. While waiting for the completion of step 63, step 65 and subsequent may be performed.

62. **APPLYING POWER TO PCU 1**
   Z1: EPS: RPCM Z13B B

   **RPCM Z13B B** sel RPC 15
   RPCM Z13B B RPC 15

   **cmd** RPC Position − Close (Verify − Cl)

63. **COMMANDING PCU 1 TO SHUTDOWN STATE**
   Z1: EPS: PCU 1

   PCU 1

   √Latch Valve 1 − Op
   √Latch Valve 2 − Cl

   sel Normal Operation

   **PCU 1 Normal Operation**

   **cmd** Shutdown Arm
   **cmd** Shutdown
64. **COMMANDING PCU 1 TO STANDBY MODE**

Z1: EPS: PCU 1

sel Normal Operation

![PCU 1 Normal Operation]

**NOTE**
The PCU Graphical display will indicate ‘Standby’ rather than ‘Standby Routine’. Use only the PCU 1 Normal Operation display to monitor PCU Mode/State. (SPN 628).

**cmd** PCU 1 – Standby Arm

**cmd** PCU 1 – Standby

√PCU Mode/State – Standby Routine

√PCU Mode/State – Standby

65. **CONFIGURING NODE1/Z1 RPCMS FOR NOMINAL OPERATIONS**

**MCC-H**

Perform {RPCM POWER ON RESET}, all (SODF: EPS: NOMINAL: SEC PWR SYS), then:

66. **ENABLING AUTOMATIC FIRE ISOLATION FOR MDM N1-2**

**Node 1: ECLSS: FDIR**

![Node 1 FDIR]

**cmd** Node 1-2 MDM IMV FDIR – Enable

√Status – Enabled

**cmd** Node 1-2 MDM Fire Isolation – Enable

√Status – Enabled

67. **ENABLING CABIN PRESSURE LIMITING**

**Node 1: ECLSS: Atmos**

![Node 1 Atmosphere]

Pressure Limiting

**cmd** Cabin Pressure Limiting – Enable

√Status – Enabled

68. **NODE 1 SMOKE DETECTOR 2 ACTIVATION**

To Activate Node 1 Smoke Detector 2, perform {SMOKE DETECTOR ACTIVATION}, all (SODF: EXPEDITION 1: ECLSS), then:

69. **NODE 1 IMV DECK AFT VALVE ACTIVATION**

To Activate Node 1 Deck Aft IMV Valve, go to {NODE 1 IMV VALVE RECONFIGURATION}, all steps 1 and 2 (SODF: EXPEDITION 1: ECLSS).
OBJECTIVE:
Reconfigure the Early Communication System (ECS) Transciever, Command
and Telemetry Processor (CTP), and RF Power Distribution Box (RFPDB) to
receive power from RPCM N1 RS2 A instead of RPCM N1 4B B.

LOCATION:
Installed: Node 1

DURATION:
1 Hour

PARTS:
Velcro Straps

MATERIALS:
None

TOOLS REQUIRED:
ISS Common IVA Tool Kit:
Kit D:
5/32” Hex Head, 1/4” Drive
1/8” Hex Head, 1/4” Drive
Kit E:
Ratchet 1/4” Drive
Lid #1:
Anti-Static Wrist Tether

SAFINING

WARNING
Failure to remove power can result in
electrical shock hazard.

1. Perform {1.202 EARLY COMM POWERDOWN PRE-CCS}, all (SODF:
ISS OPS: C&T), then:
Figure 1.- Early Communication System (RVCO Rotated).

Figure 2.- RFPDB Switches (Pictured Switches in OFF Position).
EARLY COMMUNICATION SYSTEM (ECS) RPCM N1 RS2 A POWER RECONFIGURATION

NOD1S4 2. Rotate Starboard Rack Volume Closeout (RVCO).
Refer to Figure 1.

3. Configure Early Comm switches.
Refer to Figures 1 and 2.

RFPDB
- PGSC/RF → Off
- CTP → Off
- SPARE → Off
- XCVR → Off
- SBANT → Off
- PTANT → Off

ACCESS

Figure 3.- Node 1 Closeout Panels to be Removed.

4. Remove Closeout Panels NOD1OS2-28, NOD1SD2-28 (fifteen fasteners each) (Ratchet 1/4" Drive, 5/32" Hex Head).
Refer to Figure 3.
5. Reconfigure Deck Radial Bulkhead.
   W0137P110 ←|→ NV97/RFPDB2-J97
   Connector Cap ←|→ J110
   Temporarily stow Cap.
   W0137P110 →|← J110
   Refer to Figure 4.

6. Route NV97/RFPDB-J97, Connector Cap to Overhead Radial Bulkhead Starboard Side area (Velcro Straps).
   Refer to Figure 5.
7. Reconfigure Starboard Radial Bulkhead.
   W0144 P97 ←|→ J97
   Connector Cap →|← J97
   W0144 P97 →|← NV97/RPDB-J97
   Refer to Figure 5.

CHECKOUT
8. Configure ECS RFPDB switches.
   Refer to Figures 1 and 2.

<table>
<thead>
<tr>
<th>RFPDB</th>
<th>On</th>
</tr>
</thead>
<tbody>
<tr>
<td>PGSC/RF</td>
<td>On</td>
</tr>
<tr>
<td>CTP</td>
<td>On</td>
</tr>
<tr>
<td>SPARE</td>
<td>On</td>
</tr>
<tr>
<td>XCVR</td>
<td>On</td>
</tr>
<tr>
<td>SBANT</td>
<td>On</td>
</tr>
<tr>
<td>PTANT</td>
<td>On</td>
</tr>
</tbody>
</table>

9. Perform {1.205 EARLY COMM POWERUP (PRE-POWER RECONFIGURE) PRE-CCS}, all (SODF: ISS OPS: C&T), then:

CLOSEOUT
10. Install Closeout Panels NOD1OS2-28, NOD1SD2-28 (fifteen fasteners each) (Ratchet 1/4" Drive, 5/32" Hex Head).
    Refer to Figure 3.

11. Install RVCO.

POST MAINTENANCE
12. Inform MCC-H of task completion.

OBJECTIVE:
Reconfigure the Early Communication System (ECS) Transceiver, Command and Telemetry Processor (CTP), and RF Power Distribution Box (RFPDB) to receive power from RPCM N1 4B B instead of RPCM N1 RS2 A.

LOCATION:
Installed: Node 1

DURATION:
1 Hour

PARTS:
Velcro Straps

MATERIALS:
None

TOOLS REQUIRED:
ISS Common IVA Tool Kit:
Kit D:
  5/32” Hex Head, 1/4” Drive
  1/8” Hex Head, 1/4” Drive
Kit E:
  Ratchet 1/4” Drive
Lid #1:
  Anti-Static Wrist Tether

SAFING

WARNING
Failure to remove power can result in electrical shock hazard.

1. Perform {1.206 EARLY COMM POWERDOWN (PRE-POWER RECONFIGURE) - PRE-CCS}, all (SODF: ISS OPS: C&T), then:
Figure 1.- Early Communication System (RVCO Rotated).

Figure 2.- RFPDB Switches (Pictured Switches in OFF Position).
NOD1S4 2. Rotate Starboard Rack Volume Closeout (RVCO). Refer to Figure 1.

3. Configure Early Comm switches. Refer to Figures 1 and 2.

RFPDB

- PGSC/RF → Off
- CTP → Off
- SPARE → Off
- XCVR → Off
- SBANT → Off
- PTANT → Off

ACCESS

Figure 3.- Node 1 Closeout Panels to be Removed.

4. Remove Closeout Panels NOD1OS2-28, NOD1SD2-28 (fifteen fasteners each) (Ratchet 1/4” Drive, 5/32” Hex Head). Refer to Figure 3.
ECS POWER CABLE RECONFIGURATION

Figure 4.- Starboard Radial Bulkhead Overhead Side (NOD1OS-28 Panel Removed).

5. Reconfigure Starboard Radial Bulkhead.
   W0144 P97 ←|→ NV97/RPDB-J97
   Connector Cap ←|→ J97
   Temporarily stow Cap.
   W0144 P97 →|← J97
   Refer to Figure 4.

Figure 5.- Deck Radial Bulkhead Starboard Side (NOD1SD2-28 Panel Removed).

6. Route NV97/RFPDB-J97, Connector Cap to Deck Radial Bulkhead Starboard Side area (Velcro Straps).
   Refer to Figure 5.
7. Reconfigure Deck Radial Bulkhead.
    W0137P110 ←|→ J110
    W0137P110 →|← NV97/RFPDB2-J97
    Connector Cap →|← J110
    Refer to Figure 5.

CHECKOUT
8. Configure ECS RFPDB switches.
   Refer to Figures 1 and 2.

   RFPDB
   PGSC/RF → On
   CTP → On
   SPARE → On
   XCVR → On
   SBANT → On
   PTANT → On

9. Perform {1.204 EARLY COMM POWERUP PRE-CCS}, all (SODF: ISS
    OPS: C&T), then:

CLOSEOUT
10. Install Closeout Panels NOD1OS2-28, NOD1SD2-28 (fifteen fasteners
    each) (Ratchet 1/4" Drive, 5/32" Hex Head).
    Refer to Figure 3.

11. Install RVCO.

POST MAINTENANCE
12. Inform MCC-H of task completion.

OBJECTIVE: Install Utility Outlet Panel (UOP) N1-2 in NOD1PD4 location.

LOCATION: NOD1PD4

DURATION: 40 minutes

PARTS: Utility Outlet Panel (P/N 683-27710)

MATERIALS: Dry Wipes

TOOLS REQUIRED:
ISS IVA Tool Kit:
Kit D:
  1/8" Hex Head Driver, 1/4" Drive
Kit E:
  Driver Handle 1/4" Drive
Kit G:
  (5-35 in-lbs) Trq Driver
IVA Tool Box, Lid # 1
  Static Wrist Tether
Tools

SAFING

WARNING
Failure to remove power may result in electrical shock hazard.

1. Verify UOP N1-2 location safe for installation.

Node 1: EPS: RPCM N1-3B-A
RPCM N13B A

sel RPC 17

RPCM N13B A RPC 17

√RPC Position – Op
√Close Cmd – Inh
2. Remove Protective Plate from NOD1PD4 standoff (1/8” Hex Head Driver, 1/4” Drive, Driver Handle 1/4” Drive). Refer to Figure 1. Temporarily stow.

3. Clean UOP mounting location in NOD1PD4 Standoff and the mating surface of UOP N1-2 with Dry Wipes.

**CAUTION**

Failure to don Static Wrist Tether may result in equipment damage.

4. Don Static Wrist Tether by attaching to unpainted surface of NOD1PD4 Standoff.
Figure 2.- Installation of UOP N1-2 into NOD1SD4 Standoff.

5. Demate W0136P435 from Dummy Connector mounted inside NOD1PD4 Standoff.
Refer to Figure 2.

Temporarily stow.

7. W0136P435 $\rightarrow$|← J1 Input Power Connector (A110)

8. Mount UOP N1-2 into NOD1PD4 Standoff.
Refer to Figure 2.

9. Tighten, torque UOP N1-2 captive fasteners (six) to 30 in-lbs
(1/8" Hex Head Driver, 1/4" Drive, Driver Handle 1/4" Drive,
(5-35 in-lbs) Trq Driver).

CHECKOUT
10. Perform \{1.215 UOP CHECKOUT\}, all for UOP 2
(SODF: EPS: ACTIVATION AND CHECKOUT), then:

POST MAINTENANCE
11. Stow tools, materials.
OBJECTIVE:
Install Utility Outlet Panel (UOP) N1-1 in NOD1SD4 location.

LOCATION:
NOD1SD4

DURATION:
40 minutes

PARTS:
Utility Outlet Panel (P/N 683-27710)

MATERIALS:
Dry Wipes

TOOLS REQUIRED:
ISS IVA Tool Kit:
Kit D:
   1/8” Hex Head Driver, 1/4” Drive
Kit E:
   Driver Handle 1/4” Drive
Kit G:
   (5-35 in-lbs) Trq Driver
IVA Tool Box, Lid # 1
Static Wrist Tether
Tools

SAFING

WARNING
Failure to remove power may result in electrical shock hazard.

1. Verify UOP N1-1 location safe for installation.

Node 1: EPS: RPCM N1-4B-C
RPCM N14B C

sel RPC 17

RPCM N14B C 17

√RPC Position – Op
√Close Cmd – Inh
Figure 1.- Protective Plate Mounted on NOD1SD4 Standoff.

2. Remove Protective Plate from NOD1SD4 Standoff (1/8" Hex Head Driver, 1/4" Drive, Driver Handle 1/4" Drive).
Refer to Figure 1.
Temporarily stow.

3. Clean UOP mounting location in NOD1SD4 Standoff and the mating surface of UOP N1-1 with Dry Wipes.

**CAUTION**
Failure to don Static Wrist Tether may result in equipment damage.

4. Don Static Wrist Tether by attaching to unpainted surface of NOD1SD4 Standoff.
5. Demate W0137P398 from Dummy Connector mounting location inside NOD1SD4 Standoff. Refer to Figure 2.


7. W0137P398 $\rightarrow$ J1 Input Power Connector (A92)

8. Mount UOP N1-1 into NOD1SD4 Standoff. Refer to Figure 2.

9. Tighten, torque UOP N1-1 captive fasteners (six) to 30 in-lbs (1/8" Hex Head Driver, 1/4" Drive, Driver Handle 1/4" Drive, (5-35 in-lbs) Trq Driver).

**CHECKOUT**

10. Perform {1.215 UOP CHECKOUT}, all for UOP 1 (SODF: EPS: ACTIVATION AND CHECKOUT), then:

**POST MAINTENANCE**

11. Stow tools, materials.
ACTIVATION AND CHECKOUT
1. **ACTIVATING APCU 2 FOR CHANNEL 4B**

**NOTE**
1. When APCU 2 is activated the following Caution message with tone is expected
   
   "PVCU Detected PMCU Local Bus Ancillary Data Error - P6"

2. When APCU 2 is activated the following Advisory message may occur
   
   "Primary PVCU MDM Detected Loss of Sync with Prim Node 1 MDM - P6"

---

**CRT**

<table>
<thead>
<tr>
<th>SM 200 APCU Status</th>
</tr>
</thead>
</table>

1.1 **Verifying Orbiter Payload Bus Configuration**

R1

- √PL PRI MNC tb – ON
- √PL CAB – MNA
- √PL AUX – ON

1.2 **Verifying Switch Power**

SSP1

- √SW PWR 1 cb – CL

1.3 **Closing APCU Output Relay**

L12

- √APCU 2 CONV tb – bp

   APCU 2 OUTPUT RLY – CL

1.4 **Turning APCU Converter On**

APCU 2 CONV – ON

- √APCU 2 CONV tb – gray
- √APCU 2 OUTPUT RLY tb – gray

**CRT**

<table>
<thead>
<tr>
<th>SM 200 APCU Status</th>
</tr>
</thead>
</table>

- √APCU 2 OUT VOLTS RES LOW ≥ 140 ±4
NOTE
Node 1 MDMs will not be loaded with Configuration 4 until after PVCU activation (uplinked on FDS). Configuration 3 will be used, which defaults to PVCU RTs disabled and PVCU switchover inhibited.

Wait 2 minutes for PVCU MDM to boot up and go to Wait state.

2. **ENABLING PVCU 4B RT I/O**
   Node 1: C&DH: Primary N1 MDM
   Primary NCS MDM Node 1

   Verify Frame Count – <Incrementing>
   Verify Processing State – Primary

   sel UB EPS N1 14
   sel RT Status

   **UB_EPS_N1_14_RT_Status**

   **cmd** 23 MDM PVCU 4B RT Enable  **Execute**

   Verify 23 MDM PVCU 4B RT Status – Ena

3. **CHECKING PVCU 4B MDM BIT STATUS FOR CHANNEL 4B**
   PCS
   P6: C&DH

   sel PVCU 4B

   **Primary PVCU MDM**

   √Frame Count incrementing
   √Processing State – Wait

   If MDM BIT Status – <X>
   ‘Software Control’

   sel MDM Utilities

   **Pri P6 PVCA MDM Utilities**

   **cmd** Clear Latch Data  **Execute**

   **Primary PVCU MDM**

   √MDM BIT Status – <blank>
4. **ACTIVATING APCU 1 FOR CHANNEL 2B**

**NOTE**
When APCU 1 is activated, the Bit for the following PV MDM C&W may be set without displaying a message (not in C&W downlink):
- Backup PVCU Detected PMCU Local Bus Ancillary Data Error - P6'
- Backup PVCU MDM Detected Loss of Sync with Prim Node 1 MDM - P6'

<table>
<thead>
<tr>
<th>CRT</th>
<th>SM 200 APCU Status</th>
</tr>
</thead>
</table>

4.1 **Verifying Orbiter Payload BUS Configuration**

<table>
<thead>
<tr>
<th>R1</th>
<th>√ PL PRI MNC tb – ON</th>
<th>√ PL CAB – MNA</th>
<th>√ PL AUX – ON</th>
</tr>
</thead>
</table>

4.2 **Verifying Switch Power**

<table>
<thead>
<tr>
<th>SSP1</th>
<th>√ SW PWR 1 cb – CL</th>
</tr>
</thead>
</table>

4.3 **Closing APCU Output Relay**

<table>
<thead>
<tr>
<th>L12</th>
<th>√ APCU 1 CONV tb – bp</th>
</tr>
</thead>
</table>

   APCU 1 OUTPUT RLY – CL

4.4 **Turning APCU Converter On**

<table>
<thead>
<tr>
<th>APCU 1 CONV – ON</th>
</tr>
</thead>
</table>

| √ APCU 1 CONV tb – gray |
| √ APCU 1 OUTPUT RLY tb – gray |

CRT | SM 200 APCU Status |
|-----|---------------------|

| √ APCU 1 OUT VOLTS RES LOW ≥ 140 ±4 |

**NOTE**
Due to 4A PCS errors, the PVCU MDM 2B Enable/Inhibit RT I/O can only be performed by ground.

Wait 2 minutes for PVCU MDM to boot up and go to Wait state.

5. **ENABLING PVCU 2B RT I/O**

Node 1: C&DH: Primary N1 MDM

<table>
<thead>
<tr>
<th>Primary NCS MDM Node 1</th>
</tr>
</thead>
</table>

sel UB EPS N1 23
sel RT Status
6. **CHECKING PVCU 2B MDM BIT STATUS FOR CHANNEL 2B**

P6: C&DH

```
 sel PVCU 2B

Backup PVCU MDM

√Frame Count incrementing
√Processing State – Wait

If MDM BIT Status – <X>
  ‘Software Control’

 sel MDM Utilities

Bkup P6 PVCA MDM Utilities

cmd Clear Latch Data Execute

Backup PVCU MDM

√MDM BIT Status – <blank>
```

*******************************************************************

If no MDM data for either MDM

On MCC GO

L12L (L12U)  APCU 1(2) CONV – Off
L12U  APCU 1(2) CONV – On

PCS  P6: C&DH

 sel PVCU 4B(2B)

√PVCU 4B(2B) Frame Count incrementing
√PVCU 4B(2B) – Wait

√MCC-H

*******************************************************************
7. SYNCHRONIZING PVCUS WITH NODE MDMS

NOTE
If set on PV MDM activation, the following Advisory message will clear after the PVCU is synchronized with the Node MDM

‘PVCU Detected PMCU Local Bus Ancillary Data Error - P6’

P6: EPS: EPS Software (lower right)
EPS Software

sel PVCU Software

PV SW
‘Primary P6 MDM’

If Loss of Sync – <X>
  sel Sync

PV SW Sync
‘PVCU Sync’

cmd Prim PVCU Sync to BIA
Wait 10 seconds.

PV SW
‘Primary P6 MDM’

√Loss of Sync – <blank>
√Primary P6 Time Phase – <blank>

‘Backup P6 MDM’

If Loss of Sync – <X>
  sel Sync

PV SW Sync
‘PVCU Sync’

cmd Backup PVCU Sync to BIA
Wait 10 seconds.

PV SW
‘Backup P6 MDM’

√Loss of Sync – <blank>
√Backup P6 Time Phase – <blank>
8. RECONFIGURING BCDU AND BATTERY FDIR FOR CHANNEL 4B AND 2B ACTIVATION

8.1 Inhibiting BCDU FDIR for 4B1

P6: EPS: Energy Storage 4B
Energy Storage 4B
'BCDU 4B1'

sel Software Inhibits

**BCDU 4B1 Software**

`cmd` LOC Failure Reconf – Inh Arm
`cmd` LOC Failure Reconf – Inh

√LOC Failure Reconf – Inh

sel BCDU 4B1 Software BU

**BCDU 4B1 Software BU**

`cmd` LOC Failure Reconf – Inh Arm
`cmd` LOC Failure Reconf – Inh

√LOC Failure Reconf – Inh

8.2 Inhibiting BCDU FDIR for 4B2

Energy Storage 4B
'BCDU 4B2'

sel Software Inhibits

**BCDU 4B2 Software**

`cmd` LOC Failure Reconf – Inh Arm
`cmd` LOC Failure Reconf – Inh

√LOC Failure Reconf – Inh

sel BCDU 4B2 Software BU

**BCDU 4B2 Software BU**

`cmd` LOC Failure Reconf – Inh Arm
`cmd` LOC Failure Reconf – Inh

√LOC Failure Reconf – Inh
8.3 Inhibiting BCDU FDIR for 4B3

Energy Storage 4B

'BCDU 4B3'

sel Software Inhibits

BCDU 4B3 Software

**cmd** LOC Failure Reconf – Inh Arm

**cmd** LOC Failure Reconf – Inh

√LOC Failure Reconf – Inh

sel BCDU 4B3 Software BU

BCDU 4B3 Software BU

**cmd** LOC Failure Reconf – Inh Arm

**cmd** LOC Failure Reconf – Inh

√LOC Failure Reconf – Inh

8.4 Inhibiting BCDU FDIR for 2B1

P6: EPS: Energy Storage 2B

Energy Storage 2B

'BCDU 2B1'

sel Software Inhibits

BCDU 2B1 Software

**cmd** LOC Failure Reconf – Inh Arm

**cmd** LOC Failure Reconf – Inh

√LOC Failure Reconf – Inh

sel BCDU 2B1 Software BU

BCDU 2B1 Software BU

**cmd** LOC Failure Reconf – Inh Arm

**cmd** LOC Failure Reconf – Inh

√LOC Failure Reconf – Inh
8.5 Inhibiting BCDU FDIR for 2B2

Energy Storage 2B
'BCDU 2B2'

sel Software Inhibits

BCDU 2B2 Software

**cmd** LOC Failure Reconf – Inh Arm
**cmd** LOC Failure Reconf – Inh

√LOC Failure Reconf – Inh

sel BCDU 2B2 Software BU

BCDU 2B2 Software BU

**cmd** LOC Failure Reconf – Inh Arm
**cmd** LOC Failure Reconf – Inh

√LOC Failure Reconf – Inh

8.6 Inhibiting BCDU FDIR for 2B3

Energy Storage 2B
'BCDU 2B3'

sel Software Inhibits

BCDU 2B3 Software

**cmd** LOC Failure Reconf – Inh Arm
**cmd** LOC Failure Reconf – Inh

√LOC Failure Reconf – Inh

sel BCDU 2B3 Software BU

BCDU 2B3 Software BU

**cmd** LOC Failure Reconf – Inh Arm
**cmd** LOC Failure Reconf – Inh

√LOC Failure Reconf – Inh
9. **INHIBITING RT FDIR FOR UNPOWERED PVCU MDM CONTROLLED RTs**

P6: C&DH: PVCU 4B: UB PVB 24-1: RT Status

UB PVB 24-1 RT Status

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>01 RPCM 4B-A Inhibit FDIR</td>
<td>Execute</td>
<td>Inh</td>
</tr>
<tr>
<td>02 RPCM 4B-B Inhibit FDIR</td>
<td>Execute</td>
<td>Inh</td>
</tr>
<tr>
<td>03 BCDU 4B-1 Inhibit FDIR</td>
<td>Execute</td>
<td>Inh</td>
</tr>
<tr>
<td>04 DDCU 4B Inhibit FDIR</td>
<td>Execute</td>
<td>Inh</td>
</tr>
<tr>
<td>05 PFCS 4B (LWR) Inhibit FDIR</td>
<td>Execute</td>
<td>Inh</td>
</tr>
<tr>
<td>06 ECU 4B/2B Inhibit FDIR</td>
<td>Execute</td>
<td>Inh</td>
</tr>
<tr>
<td>07 ECU 4B/2B Inhibit FDIR</td>
<td>Execute</td>
<td>Inh</td>
</tr>
<tr>
<td>08 SSU 4B Inhibit FDIR</td>
<td>Execute</td>
<td>Inh</td>
</tr>
<tr>
<td>09 PFCS 4B (SPA) Inhibit FDIR</td>
<td>Execute</td>
<td>Inh</td>
</tr>
<tr>
<td>12 BCDU 4B-2 Inhibit FDIR</td>
<td>Execute</td>
<td>Inh</td>
</tr>
<tr>
<td>25 BCDU 4B-3 Inhibit FDIR</td>
<td>Execute</td>
<td>Inh</td>
</tr>
</tbody>
</table>

P6: C&DH: PVCU 4B: UB PVB 24-2: RT Status:
UB PVB 24 2 RT Status

**cmd** 01 RPCM 2B-A Inhibit FDIR  **Execute**
√01 RPCM 2B-A RT FDIR Status – Inh

**cmd** 02 RPCM 2B-B Inhibit FDIR  **Execute**
√02 RPCM 2B-B RT FDIR Status – Inh

**cmd** 03 BCDU 2B-1 Inhibit FDIR  **Execute**
√03 BCDU 2B-1 RT FDIR Status – Inh

**cmd** 04 DDCU 2B Inhibit FDIR  **Execute**
√04 DDCU 2B RT FDIR Status – Inh

**cmd** 05 PFCS 2B (LWR) Inhibit FDIR  **Execute**
√05 PFCS 2B (LWR) RT FDIR Status – Inh

**cmd** 06 ECU 2B/4B Inhibit FDIR  **Execute**
√06 ECU 2B/4B RT FDIR Status – Inh

**cmd** 07 ECU 2B/4B Inhibit FDIR  **Execute**
√07 ECU 2B/4B RT FDIR Status – Inh

**cmd** 08 SSU 2B Inhibit FDIR  **Execute**
√08 SSU 2B RT FDIR Status – Inh

**cmd** 09 PFCS 2B (SPA) Inhibit FDIR  **Execute**
√09 PFCS 2B (SPA) RT FDIR Status – Inh

**cmd** 12 BCDU 2B-2 Inhibit FDIR  **Execute**
√12 BCDU 2B-2 RT FDIR Status – Inh

**NOTE**
The display line for 25 BCDU 2B-3 does not exist in the 4A.024 PCS build. The following command may need to be sent by **MCC-H**.
cmd 25 BCDU 2B-3 Inhibit FDIR  Execute

\(\sqrt{25} \) BCDU 2B-3 RT FDIR Status – Inh

10. **COMMANDING PVCU TO NORMAL OPERATIONAL STATE**

<table>
<thead>
<tr>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The following Caution messages with tone will occur if the one hour Loss of Comm (LOC) timer limit expires for a BCDU. Each BCDU LOC time limit starts when the PVCU MDM is commanded to Normal Ops and stops when the RBI to a BCDU is closed</td>
</tr>
<tr>
<td>'BCDU 4B1 Loss of Comm Time Limit Expired - P6'</td>
</tr>
<tr>
<td>'BCDU 2B1 Loss of Comm Time Limit Expired - P6'</td>
</tr>
<tr>
<td>'BCDU 4B2 Loss of Comm Time Limit Expired - P6'</td>
</tr>
<tr>
<td>'BCDU 2B2 Loss of Comm Time Limit Expired - P6'</td>
</tr>
<tr>
<td>'BCDU 4B3 Loss of Comm Time Limit Expired - P6'</td>
</tr>
<tr>
<td>'BCDU 2B3 Loss of Comm Time Limit Expired - P6'</td>
</tr>
</tbody>
</table>

2. Expect the following Advisory messages when the PVCU MDM is commanded to operational state

| Primary PVCU MDM Failed to Shutdown Backup PVCU MDM - P6 |
| Backup PVCU MDM Failed to Shutdown Primary PVCU MDM - P6 |
| DCSU 4B Non Trip Anomaly - P6 |
| DCSU 2B Non Trip Anomaly - P6 |

P6: EPS: EPS Software (lower right)

[EPS Software]

sel PVCU Software

[PV SW]

sel PV State

[PV SW State]

‘PVCU State’

**cmd** P6 Primary PVCU State – To Normal Ops  **Execute**

\(\sqrt{P6} \) Primary PVCU State – Norm Ops

[PV SW]

‘Primary P6 MDM’
If Loss of Sync – <X>

On MCC GO

[PV SW]

sel Sync

[PV SW Sync]

‘PVCU Sync’

**cmd** Prim PVCU Sync to BIA

Wait 10 seconds.

[PV SW]

‘Primary P6 MDM’

√Loss of Sync – <blank>

√Primary P6 Time Phase – <blank>

### 11. CONFIGURING CHANNEL OPERATIONAL MODES

**NOTE**
The nominal channel mode for 4A is non-solar tracking. This mode of operation prevents the ECU-BGA from turning to the beta angle supplied by the GNC MDM, which is not active until 5A.

P6: EPS: BGA 4B

[BGA 4B]

sel Channel Targeted Modes

[BGA 4B Ch Targeted Modes]

‘Row = Null, Column = Non-Solar Tracking’

**cmd** Set

√BGA Mode – Null

√Ch 4B Mode – Non-solar Tracking

P6: EPS: BGA 2B

[BGA 2B]

sel Channel Targeted Modes
BGA 2B Ch Targeted Modes
‘Row = Null, Column = Non-Solar Tracking’

cmd Set

√BGA 2B Mode – Null
√Ch 2B Mode – Non-solar Tracking

NOTE
Expect the following Advisory messages
‘PVTCS PFCS 4B FCV Control Command Response Failed - P6’
‘PVTCS PFCS 2B FCV Control Command Response Failed - P6’
‘PVTCS PFCS 4B FWC Not Receiving Commands - P6’
‘PVTCS PFCS 2B FWC Not Receiving Commands - P6’

P6: EPS

sel EPS Software

[EPS Software]

sel PVCU Software

[PV SW]

sel RT Cmd Fail Clear

[PV RT Clear]
‘PFCS RT Command Fail’

cmd Clear Arm

cmd Clear

12. **ENABLING NCS FOR PVCU SWITTOVER**

P6: EPS: EPS Software (lower right)

[EPS Software]

sel NCS Software

[NCS SW]

sel NCS PVCU Config

[NCS PVCU Config]
‘PVCU Switchover’
cmd PVCU Switchover – Enable

√ PVCU Switchover – Ena

13. VERIFYING NCS CONFIGURATION FOR PVCU SWITCHOVER
(GROUND ONLY)

NOTE
The telemetry for the NCS switchover mode can not be displayed on PCS. The switchover mode should not change until 5A when the GNC MDMs are available.

Verify with MCC-H.

√ Switchover Modes 2B,4B Channel – Non-Solar Track
√ Switchover Modes 2B,4B BGA – Null

**********************************************************
If switchover modes 2B, 4B (Channel, BGA) not Non-Solar Track, Null respectively

P6: EPS: EPS Software (lower right)

 EPS Software

sel NCS Software

 NCS_SW

sel NCS PVCU Config

 NCS PVCU Config
‘PVCU Switchover’

input Command Header: 2
Pick Channel number – Ch 4B
Pick Channel/ECU Mode – Ch Non-Solar Track/ECU Null

cmd Channel/ECU Switchover Mode

input Command Header: 2
Pick Channel Number – Ch 2B
Pick Channel/ECU Mode – Ch Non-Solar Track/ECU Null

cmd Channel/ECU Switchover Mode

**********************************************************
1. **DCSU ACTIVATION**

1.1 Performing DCSU Clear Command

| NOTE | The Clear command must be sent after DCSU Power On to clear the power on reset bit to identify whether or not the bit gets set again. |

PCS

P6: EPS: DCSU 4B(2B)

DCSU 4B(2B)

√ Integration Counter incrementing

sel Firmware

DCSU 4B(2B) Firmware

‘Clear Cmds’

**cmd** Common Clear

√ Power On Reset – blank

1.2 Verifying DCSU Telemetry

DCSU 4B(2B)

√ Integration Counter incrementing

√ Power Supply Temperature: -43 --- 41°C

√ RBI 6 Current: -7.5 --- 7.5 A

√ RBI 6 Voltage: 131 --- 149 V

√ Baseplate Temp: -43 --- 41°C

1.3 Powering On DCSU Primary Power Bus

DCSU 4B(2B)

sel RBI 6

DCSU 4B(2B) RBI 6

| NOTE | SPN #620 (PR 16334) The Hot Switch Open commands are reversed; therefore, the Inhibit command must be sent in order to change Hot Switch Open telemetry status from Inh to Ena. |

**cmd** Hot Switch Open – Inhibit Arm

**cmd** Hot Switch Open – Inhibit

√ Hot Switch Open – Ena

‘Cmd Stat’
1.4 Activating DDCU

**CAUTION**
RBI 5 must be the next switch closed after RBI 6 has been successfully closed to prevent the APCU from tripping.

**NOTE**
Expect Advisory message 'DDCU 4B(2B) Non Trip Anomaly - P6' to occur when RBI 5 is closed.

DCSU 4B(2B)

sel RBI 5

DCSU 4B(2B) RBI 5

‘Cmd Stat’

cmd Close Arm

cmd Close

√Cmd Stat – Cl

√Bus Voltage: 131 --- 149 V

√Voltage: 131 --- 149 V

√Current: -4 --- 4 A

DCSU 4B(2B)

sel DDCU 4B(2B)

DDCU 4B(2B)

√Integration Counter incrementing

sel Firmware

DDCU 4B(2B) Firmware

**NOTE**
The Advisory message ‘DDCU 4B(2B) Non Trip Anomaly - P6’ will be cleared after common clear command is sent.
'Clear Cmds'

**cmd** Common Clear

√Power On Reset – blank

<table>
<thead>
<tr>
<th>Integration Counter incrementing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Current: -4 --- 4 A</td>
</tr>
<tr>
<td>Input Voltage: 131 --- 149 V</td>
</tr>
<tr>
<td>Power Supply Temp &lt; 87° C</td>
</tr>
<tr>
<td>Baseplate Temp &lt; 87° C</td>
</tr>
<tr>
<td>Status: 0</td>
</tr>
</tbody>
</table>

1.5 Enabling RT FDIR for Powered PVCU MDM Controller RT

P6: C&DH: PVCU 4B: UB PVB 24-1(2): RT Status

<table>
<thead>
<tr>
<th>cmd 04 DDCU 4B(2B) Enable FDIR Execute</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>√04 DDCU 4B(2B) RT FDIR Status – Ena</td>
</tr>
</tbody>
</table>
1.6 Activating BCDU 4B1(2B1)

NOTE

1. Expect the following C&W messages when BCDU 4B1(2B1) RBI 2 is closed

‘BCDU 4B1(2B1) Trip - P6’
‘BCDU 4B1(2B1) Measurement Out of Range - P6’
‘Battery 4B11(2B11) Trip - P6’
‘Battery 4B12(2B12) Trip - P6’
‘Batt 4B11(2B11) Undervoltage Condition - P6’
‘Batt 4B12(2B12) Undervoltage Condition - P6’
‘Batt 4B11(2B11) Measurement Out of Range - P6’
‘Batt 4B12(2B12) Measurement Out of Range - P6’
‘BCDU 4B1(2B1) Battery SOC Low Failure - P6’
‘BCDU 4B1(2B1) Non Trip Anomaly - P6’
‘Batt 4B12(2B12) Undervoltage Condition - P6’
‘Batt 4B11(2B11) Undervoltage Condition - P6’

2. When BCDU 4B1(2B1) RBI 2 is closed, the following Advisory messages may occur

‘Batt 4B11(2B11) Temp Out of Range Trip - P6’
‘Batt 4B12(2B12) Temp Out of Range Trip - P6’


[DCSU 4B(2B)]

sel RBI 2

[DCSU 4B1(2B1) RBI 2]  
‘Cmd Stat’

cmd Close Arm

cmd Close

√Cmd Stat – Cl
√Current: -4 --- 4 A
√Voltage: 131 --- 149 V

[DCSU 4B(2B)]

sel Energy Storage 4B(2B)

[Energy Storage 4B(2B)]

‘BCDU 4B1(2B1)’
Integration Counter incrementing

sel Firmware

BCDU 4B1(2B1) Firmware
'Clear Cmds'

**cmd** Common Clear

Power On Reset – blank

Energy Storage 4B(2B)
'BCDU 4B1(2B1)'

Integration Counter incrementing
Primary Voltage: 131 --- 149 V
Primary Current: -3 --- 3 A
Split Temp < 83° C

1.7 Enabling RT FDIR for Powered PVCU MDM Controller RT
P6: C&DH: PVCU 4B: UB PVB 24-1(2): RT Status
[UB PVB 24 1(2) RT Status]

**cmd** 03 BCDU 4B-1(2B-1) Enable FDIR **Execute**

03 BCDU 4B-1(2B-1) RT FDIR Status – Ena
1.8 Activating BCDU 4B2(2B2)

**NOTE**

1. Expect the following C&W messages when BCDU 4B2(2B2) RBI 3 is closed
   - 'BCDU 4B2(2B2) Trip - P6'
   - 'Battery 4B21(2B21) Trip - P6'
   - 'Battery 4B22(2B22) Trip - P6'
   - 'Batt 4B21(2B21) Undervoltage Condition - P6'
   - 'Batt 4B22(2B22) Undervoltage Condition - P6'
   - 'Batt 4B21(2B21) Measurement Out of Range - P6'
   - 'Batt 4B22(2B22) Measurement Out of Range - P6'
   - 'BCDU 4B2(2B2) Battery SOC Low Failure - P6'
   - 'BCDU 4B2(2B2) Non Trip Anomaly - P6'
   - 'Batt 4B21(2B21) Undervoltage Condition - P6'
   - 'Batt 4B22(2B22) Undervoltage Condition - P6'

2. When BCDU 4B2(2B2) RBI 3 is closed, the following Advisory messages may occur
   - 'Batt 4B21(2B21) Temp Out of Range Trip - P6'
   - 'Batt 4B22(2B22) Temp Out of Range Trip - P6'


```
DCSU 4B(2B)

sel RBI 3

DCSU 4B2(2B2) RBI 3
  'Cmd Stat'

  cmd Close Arm
  cmd Close

  √Cmd Stat – Cl
  √Current: -4 --- 4 A
  √Voltage: 131 --- 149 V

DCSU 4B(2B)

sel Energy Storage 4B(2B)

Energy Storage 4B(2B)
  BCDU 4B2(2B2)
```
\checkmark Integration Counter incrementing

sel Firmware

<table>
<thead>
<tr>
<th>BCDU 4B2(2B2) Firmware</th>
</tr>
</thead>
<tbody>
<tr>
<td>'Clear Cmds'</td>
</tr>
</tbody>
</table>

**cmd** Common Clear

\checkmark Power On Reset – blank

<table>
<thead>
<tr>
<th>Energy Storage 4B(2B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>'BCDU 4B2(2B2)'</td>
</tr>
</tbody>
</table>

\checkmark Integration Counter incrementing

\checkmark Primary Voltage: 131 --- 149 V

\checkmark Primary Current: -3 --- 3 A

\checkmark Bsplt Temp < 83° C

1.9 **Enabling RT FDIR for Powered PVCU MDM Controller RT**
P6: C&DH: PVCU 4B: UB PVB 24-1(2): RT Status

<table>
<thead>
<tr>
<th>UB PVB 24 1(2) RT Status</th>
</tr>
</thead>
</table>

**cmd** 12 BCDU 4B-2(2B-2) Enable FDIR **Execute**

\checkmark 12 BCDU 4B-2(2B-2) RT FDIR Status – Ena
1.10 Activating BCDU 4B3(2B3)

**NOTE**

1. Expect the following C&W messages when BCDU 4B3(2B3) RBI 4 is closed
   - 'BCDU 4B3(2B3) Trip - P6'
   - 'Battery 4B31(2B31) Trip - P6'
   - 'Battery 4B32(2B32) Trip - P6'
   - 'Batt 4B31(2B31) Undervoltage Condition - P6'
   - 'Batt 4B32(2B32) Undervoltage Condition - P6'
   - 'BCDU 4B3(2B3) Measurement Out of Range - P6'
   - 'Batt 4B31(2B31) Measurement Out of Range - P6'
   - 'Batt 4B32(2B32) Measurement Out of Range - P6'
   - 'BCDU 4B3(2B3) Battery SOC Low Failure - P6'
   - 'BCDU 4B3(2B3) Non Trip Anomaly - P6'
   - 'Batt 4B31(2B31) Undervoltage Condition - P6'
   - 'Batt 4B32(2B32) Undervoltage Condition - P6'

2. When BCDU 4B3(2B3) RBI 4 is closed, the following Advisory messages may occur
   - 'Batt 4B31(2B31) Temp Out of Range Trip - P6'
   - 'Batt 4B32(2B32) Temp Out of Range Trip - P6'

4. When the Caution message 'BCDU 4B3(2B3) Loss of Comm Time Limit Expired - P6' has occurred, closing BCDU 4B3(2B3) RBI 4 will clear it.

```
DCSU 4B(2B)

sel RBI 4

DCSU 4B3(2B3) RBI 4
'Cmd Stat'

`cmd` Close Arm
`cmd` Close

√Cmd Stat – Cl
√Current: -4 --- 4 A
√Voltage: 131 --- 149 V

DCSU 4B(2B)

sel Energy Storage 4B(2B)

Energy Storage 4B(2B)
BCDU 4B3(2B3)
```
Integration Counter incrementing

sel Firmware

BCDU 4B3(2B3) Firmware

'Clear Cmds'

**cmd** Common Clear

Power On Reset – blank

Energy Storage 4B(2B)

'BCDU 4B3(2B3)'

Integration Counter incrementing

Primary Voltage: 131 --- 149 V

Primary Current: -3 --- 3 A

Split Temp < 83° C

1.11 Enabling RT FDIR for Powered PVCU MDM Controller RT

**P6: C&DH: PVCU 4B: UB PVB 24-1(2): RT Status**

**UB PVB 24 1(2) RT Status**

**cmd** 25 BCDU 4B-3(2B-3) Enable FDIR  **Execute**

25 BCDU 4B-3(2B-3) RT FDIR Status – Ena

1.12 Activating SSU 4B(2B)

**NOTE**

The Advisory message ‘SSU 4B(2B) Non Trip Anomaly - P6’ will occur when DCSU 4B(2B) RBI 1 is closed.

**DCSU 4B(2B)**

sel RBI 1

**DCSU 4B(2B) RBI 1**

'Cmd Stat'

**cmd** Close Arm

**cmd** Close

Cmd Stat – Cl

Voltage: 131 --- 149 V

Current: -8 --- 8 A
1.13 Enabling RT FDIR for Powered PVCU MDM Controller RT
P6: C&DH: PVCU 4B: UB PVB 24-1(2): RT Status
UB PVB 24 1(2) RT Status

\[\text{cmd} \ 08 \ \text{SSU 4B(2B) Enable FDIR} \ \text{Execute}\]

\[\sqrt{08 \ \text{SSU 4B(2B) RT FDIR Status – Ena}}\]

2. DDCU 4B(2B) ACTIVATION

2.1 Verifying DDCU 4B(2B) Input and Output Power
P6: EPS: DCSU 4B(2B)

\[\text{DCSU 4B(2B)}\]

\[\sqrt{\text{Integration Counter incrementing}}\]
\[\sqrt{\text{Status: 0}}\]
\[\sqrt{\text{Input Current: -4 --- 4 A}}\]
\[\sqrt{\text{Input Voltage: 131 --- 149 V}}\]
\[\sqrt{\text{Output Current < 4 A}}\]
\[\sqrt{\text{Output Voltage < 3 V}}\]

\[\text{DDCU 4B(2B)}\]
2.2 Turning DDCU 4B(2B) Converter On

```
sel Converter

CMD 4B(2B) Converter
```

**cmd** On – Arm

**cmd** On

```
CMD 4B(2B)
```

√Status:  1
√Output Current:  0 --- 4 A
√Output Voltage:  121 --- 128 V
√Converter Temp < 87° C
√Pwr Supply Temp < 87° C
√Baseplate Temp < 87° C

2.3 Verifying RPCM A Operation

```
CMD 4B(2B)
```

sel RPCM 4B(2B) A

```
RPCM 4B(2B) A
```

√Integration Counter incrementing

sel Firmware

```
RPCM 4B(2B) A Firmware
```

‘Clear Cmds’

**cmd** Common Clear

√Power On Reset – blank
√ORU Health – OK

```
RPCM 4B(2B) A
```

√Integration Counter incrementing
√RPCs (1 --- 8) – Op
√Input Current:  0 --- 4 A
√Bus Voltage:  121 --- 128 V
√Baseplate Temp < 49° C
2.4 Enabling RT FDIR for Powered PVCU MDM Controller RT
P6: C&DH: PVCU 4B: UB PVB 24-1(2): RT Status
[UB PVB 24 1(2) RT Status]

**cmd 01 RPCM 4B(2B)-A Enable FDIR Execute**

√01 RPCM 4B(2B)-A RT FDIR Status – Ena

2.5 Verifying RPCM B Operation

[DDCU 4B(2B)]

sel RPCM 4B(2B) B

RPCM 4B(2B) B

√Integration Counter incrementing

sel Firmware

RPCM 4B(2B) Firmware

‘Clear Cmds’

**cmd Common Clear**

√Power On Reset – blank
√ORU Health – OK

RPCM 4B(2B) B

√Integration Counter incrementing
√RPC 1 – Op
√Input Current: 0 --- 4 A
√Bus Voltage: 121 --- 128 V
√Baseplate Temp < 49°C

2.6 Enabling RT FDIR for Powered PVCU MDM Controller RT
P6: C&DH: PVCU 4B: UB PVB 24-1(2): RT Status
[UB PVB 24 1(2) RT Status]

**cmd 02 RPCM 4B(2B)-B Enable FDIR Execute**

√02 RPCM 4B(2B)-B RT FDIR Status – Ena
1. **VERIFYING DCSU 4B(2B) RBI 1 VOLTAGE AND CURRENT**
   PCS
   P6: EPS: SSU 4B(2B)
   SSU 4B(2B)
   ‘DCSU 4B(2B)’
   √RBI 1 Current: -8.25 --- 6.75 A
   √RBI 1 Voltage: 132.0 --- 148.0 V

2. **VERIFYING PVCU MDM COMMUNICATION WITH SSU 4B(2B)**
   √Integration Counter incrementing

3. **VERIFYING SSU 4B(2B) LFDP POWER STATUS**
   
   **NOTE**
   The SSU LFDP defaults to the Off state in the LDI upon SSU activation. However, the PVCU SSU Coldstart software sends the LFDP On commands after a SSU power cycle. If the C&W SSU XX Coldstart Cmd Response Failed is received, the LFDPs will need to be commanded On in this step.
   ‘LFDP Pwr Status’
   √1 – On
   √2 – On
   √3 – On

4. **VERIFYING SSU 4B(2B) SENSOR & SETPOINT OPERATION**
   
   **NOTE**
   SPN # 17415 - The 2B SSU Shunt Current sensor shows a value that is 2 times the value it should be in the PCS.
   ‘Output’
   √Current : 0 --- 4.5 A
   √Voltage: 131 --- 149 V
   √Bus Voltage Setpoint: 149.5 --- 150.5 or 166.5 --- 167.5 V
   √Error Bus Voltage > 23.5 V
   ‘Power Supply’
   √Output Status – Good
   √Power On Reset – <blank>
   ‘BCDU 4B1(2B1)’
√CP RBI – Op

‘PVCE Error Voltage’

√1 > 23.5 V
√2 > 23.5 V
√3 > 23.5 V

sel PVCE

SSU 4B(2B) PVCE

√PVCE1 Bus Voltage Setpt:  149.5 --- 150.5 or 166.5 --- 167.5 V
√PVCE2 Bus Voltage Setpt:  149.5 --- 150.5 or 166.5 --- 167.5 V
√PVCE3 Bus Voltage Setpt:  149.5 --- 150.5 or 166.5 --- 167.5 V

5. CONFIGURING SSU 4B(2B) TO FULL SHUNT MODE

NOTE
This step must be completed prior to deploying the Solar Array to avoid transients on the DCSU primary power bus.

PVCE [X] Error Voltage  where [X] = 1 2 3

cmd Off Arm
cmd Off (Verify < 0.6 V)

Repeat

SSU 4B(2B)

√Shunt Circuit1 (LBB) Current:  0 --- 2.2 A (PCS: 0 --- 4.4 A)
√Shunt Circuit2 (RBB) Current:  0 --- 2.2 A

‘Output’

√Error Bus Voltage < 0.6 V
NOTE
MCC-H will be primary for performing steps 1 --- 15.
STS Crew will be primary for performing steps 16 --- 22.

1. REDUCING LOAD ON APCU PRIOR TO SAW DEPLOY OPERATIONS

PCS
P6: EPS: DCSU 4B(2B)
DCSU 4B(2B)

 sel RPCM 4B(2B) A

 RPCM 4B(2B) A
cmd RPC Position – Open (Verify – Op)

 sel RPC 07

 RPCM 4B(2B) A  RPC 07
cmd RPC Position – Open (Verify – Op)

 sel RPC 08

 RPCM 4B(2B) A  RPC 08
cmd RPC Position – Open (Verify – Op)

2. VERIFYING APCU POWER LEVEL

CRT
SM 200 APCU Status

Record data.
APCU 2(1) OUT VOLTS RES LOW:________________
APCU 2(1) CONV A OUT AMPS:__________________
APCU 2(1) CONV B OUT AMPS:__________________

Verify (CONV A OUT AMPS + CONV B OUT AMPS) X (OUT VOLTS RES LOW) < 1420 W.

3. PROVIDING PRIME POWER INPUT TO ECU

P6: EPS: BGA 4B(2B)
BGA 4B(2B)

 sel RPCM 4B(2B) A RPC 01

 RPCM 4B(2B) A  RPC 01
cmd RPC Position – Close (Verify – Cl)
NOTE
May receive Caution message ‘BGA 4B(2B) 1552/FWC Errors - P6’ due to the addition of the power on reset flag as a driver to this C&W message. This message will be cleared in step 7.

4. VERIFYING COMM WITH BGA CONTROLLER

BGA 4B(2B)
‘ECU 4B(2B)’

Verify Integ Cnt – <incrementing>

5. VERIFYING COMM WITH SAW CONTROLLER

sel SAW 4B(2B)

SAW 4B(2B)
‘ECU 4B(2B)’

Verify Integ Cnt – <incrementing>

6. SENDING SAW COMMON CLEAR

sel SAW Firmware

SAW 4B(2B) Firmware
‘Clear Commands’

cmd Common Clear

√Power on Reset – <blank>

7. SENDING BGA COMMON CLEAR

sel BGA 4B(2B)

BGA 4B(2B)
‘ECU 4B(2B)’

sel BGA Firmware

BGA 4B(2B) Firmware
‘Clear Commands’

cmd Common Clear

Verify Power on Reset – <blank>

8. ENABLING RT FDIR FOR POWERED PVCU MDM CONTROLLER RT

PCS

P6: C&DH: PVCU 4B: UB PVB 24-1(2): RT Status
UB PVB 24-1(2) RT Status

cmd 06 ECU 4B/2B(2B/4B) Enable FDIR Execute
9. PROVIDING REDUNDANT POWER INPUT TO ECU

P6: EPS: BGA 4B(2B)

sel RPCM 2B(4B) A RPC 02

RPCM 2B(4B) A RPC 02

**cmd** RPC Position – Close (Verify – Cl)

10. VERIFYING ECU PWR SUPPLY TEMPS AND VOLTAGE STATUS

BGA 4B(2B)

‘ECU 4B(2B)’

Verify SAW PS Temp, °C: -45 --- 54
Verify SAW PS Voltage, V: 115 --- 125

Verify BGA PS Temp, °C: -45 --- 54
Verify BGA PS Voltage, V: 115 --- 125

11. VERIFYING BGA STATUS

BGA 4B(2B)

‘BGA 4B(2B)’

Verify Actual Angle, deg: 0.000 (expected range 359.5 --- 0.5)
Verify Cmded Angle, deg: 0.000
Verify Angle Error, deg < 0.000 (±0.500)

Verify Actual Angle Rate, deg/s: 0.000
Verify Cmded Angle Rate, deg/s: 0.000
Verify Divergence Indicator – <blank>

‘Motor’

Verify State – OFF
Verify Velocity, deg/s: 0.000
Verify Current, A: 0.00 (±0.4)

**NOTE**
SPN 17161 (PR 17161). BGA 4B(2B) Latch 2 Abort parameter is incorrect on the BGA Graphical Display and is indicated as “?”. (Fixed for 5A and subsequent flights) Refer to same parameters on Latch 2 command window for correct status.
‘Latch 1’

Verify Pin Status – Latched
Verify Actuator – Inactive
Verify Voltage, V: 0.0 (±8.0)
Verify Abort – <blank>

‘Latch 2’

Verify Pin Status – Unlatched
Verify Actuator – Inactive
Verify Voltage, V: 0 (±8.0)
Verify Abort – <blank>

‘Latch 1,2’

Verify Current, A: 0.00 (±0.64)

12. VERIFYING INITIAL CHANNEL MODE AND BGA MODE

BGA 4B(2B)

‘BGA 4B(2B)’

Verify PV Ch 4B(2B) Mode, Primary PVCU – Non-Solar Tracking or Fully Commanded
Verify BGA Mode, Primary PVCU – Null

13. VERIFYING SAW STATUS

13.1 Verifying Saw Operational Ranges and Limiting Switch Status

NOTE
Disconnects are present in the MDA Over Temp Trip FDIR. The software implements an MDA Over Temp Trip at 74.4 °C. The ECU firmware implements an MDA Over Temp Trip at 140 °C. These FDIR responses remove power to the MDA. Potential damage to the hardware occurs at 120 °C. MDA upper limit temperatures indicated in this step are conservative. At a minimum a 30 °C, Mast MDA temperature increase should be protected for during mast deployment.

sel SAW 4B(2B)

SAW 4B(2B)

‘LBB’

Verify SW 01,02 Pin Released – No
Verify SW 01,02 Pin Latched – Yes
Verify SW 01,02 Pin Unlatched – No
Verify MDA Slow Alert – Nominal
Verify MDA Voltage: 000.0 (±2.8)
Verify MDA Temp, °C: -55 --- 48
Verify MDA Over Temp Trip – <blank>
‘MAST’

Verify SW 01,02 Retracted – Yes
Verify SW 01,02 Deployed – No (SAW 2B SW 02 failed, always No)
Verify MDA Slow Alert – Nominal
Verify MDA Voltage: 000.0 (±2.8)
Verify MDA Temp, °C: -55 --- 48
Verify MDA Over Temp Trip – <blank>

‘RBB’

Verify SW 01,02 Pin Released – No
Verify SW 01,02 Pin Latched – Yes
Verify SW 01,02 Pin Unlatched – No
Verify MDA Slow Alert – Nominal
Verify MDA Voltage: 000.0 (±2.8)
Verify MDA Temp, °C: -55 --- 48
Verify MDA Over Temp Trip – <blank>

‘ECU 4B(2B)’

Verify MDA Current, A: 0.00 (±0.4)
Verify MDA Over Current Trip – <blank>
If any MDA Temp is out of range √MCC-H before proceeding

If MCC-H unavailable and MDA Temp is greater than -55° C but less than 70° C, inhibit MDA Over Temp Safing.

‘ECU 4B(2B)’

sel SAW Software Inhibits

SAW 4B(2B) Software Inhibits

sel SAW 4B(2B) Temp Safing

SAW 4B(2B) Temp Safing

‘LBB (RBB)(Mast) Over Temp Safing’

‘Primary PVCU’

cmd Inhibit – Arm

cmd Inhibit

√Over Temp Safing – Inh

‘Backup PVCU’

cmd Inhibit – Arm

cmd Inhibit

√Over Temp Safing – Inh

Continue procedure.

13.2 Overriding Limit Switch Failure to Allow LBB and RBB Unlatch Commanding and BGA Operations (Perform for SAW 2B only.)

SAW 4B(2B) ‘ECU 4B(2B)’

sel SAW Software Inhibits

SAW 4B(2B) Software Inhibits

NOTE
(PR 15629) SAW 4B(2B) Latch Reject enumerations are reversed on EPCS displays for flights 4A and e5A (Fixed for 5A and subsequent flights). Must send Enable command in order to inhibit function.
‘Latch Reject’

**cmd** Enable – Arm

**cmd** Enable

√Latch Reject – Ena (Allows SABB Unlatch/Latch commands when Mast state is undetermined)

P6: EPS: BGA 4B(2B)

[**BGA 4B(2B)**]

sel BGA Software Inhibits

[**BGA 4B(2B) Software Inhibits**]

‘SAW Deployment’

‘Primary PVCU’

**cmd** Enable – Arm

**cmd** Enable

√SAW Deployment – Ena (Allows BGA to be operated when SAW Mast is in an undetermined state)

‘Backup PVCU’

**cmd** Enable – Arm

**cmd** Enable

√SAW Deployment – Ena

14. **INHIBITING MDA HI TEMP REJECT FUNCTION**

P6: EPS: SAW 4B(2B)

[**SAW 4B(2B)**]

sel SAW Software Inhibits

[**SAW 4B(2B) Software Inhibits**]

sel SAW 4B(2B) Temp Safing

[**SAW 4B(2B) Temp Safing**]

**NOTE**

(PR 156929). BGA 4B(2B) Enumerations are reversed on EPCS displays for flights 4A and e5A. (Fixed for 5A and subsequent flights) Must send Enable command in order to inhibit function. Low Temp Reject label should be Hi Temp Reject.

‘Low Temp Reject’
13 NOV 00 Page 8 of 25 pages

15. **VERIFYING MDA SAFING ENABLED**
   sel SAW Software Inhibits

   ![SAW 4B(2B) Software Inhibits]

   - Config Complete MDA Off Safing, Primary PVCU – Ena
   - Config Complete MDA Off Safing, Backup PVCU – Ena
   - Limit software Turnoff Function – Ena (stops motor upon limit software contact but does not turn motor off)

   sel SAW 4B(2B) Motor Stall Safing

   ![SAW 4B(2B) Motor Stall Safing]

   - Motor Stall Safing, Primary PVCU – Ena
   - Motor Stall Safing, Backup PVCU – Ena

---

**WARNING**

All P6 Upper and Lower EPS Prep EVA activities must be completed prior to performing the following steps. Upper and Lower EPS preparation includes the deployment of the 4-bar linkage, the release of three bolts on the mast tip fitting and rotating the blanket boxes 90 degrees from the launch configuration. Verify the EVA crew is clear of the mechanism before proceeding.

---

16. **UNLATCHING LEFT BLANKET BOX (LBB)**

16.1 Verifying Temperatures are within Nominal Ranges Prior to Unlatch

   PCS P6: EPS: SAW 4B(2B)

   ![SAW 4B(2B)]

   Verify SAW PS Temp, °C: -45 --- 54
   Verify BGA PS Temp, °C: -45 --- 54
   Verify LBB MDA Temp, °C: -55 --- 48

16.2 Power On LBB Motor Drive Assembly (MDA)

   ![NOTE]
   MDA Slow Alert will be ‘Nominal’ until MDA power is applied. Once power is applied, the indication is ‘Slow’.

   ![SAW 4B(2B)]
   ‘LBB’
16.3 Performing Visual Verification Via RMS End Effector/PLB Camera (PDRS C/L)

NOTE
Crew will perform a visual verification prior to, during, and at the completion of each blanket box unlatch operation. There are eight latches and seven launch restraint pins to be removed for each blanket box prior to SAW deployment. Seven gold colored posts protrude through the containment box base to provide visual indication of successful pin release.

SAW 4B LBB = Port Aft Solar Array Blanket
SAW 2B LBB = Stbd Fwd Solar Array Blanket

Verify BRS Pin (seven) – restraint pins engaged
Verify Latch Position (four of eight) – latched

16.4 Verifying Initial SAW Left Blanket Box Configuration

Verify parameters in column titled “LATCHED” in step 16.6 before executing unlatch command.

16.5 Unlatching SAW Left Blanket Box

NOTE
Upon successful commanding, the Slow Alert will go ‘Nominal’ during transition, then return to ‘Slow’ Once power is removed from the MDA the Slow Alert will indicate ‘Nominal’.

If possible, record the duration of the physical motion observed during the unlatch sequence:_____________

cmd LBB – Unlatch Arm
cmd LBB – Unlatch
16.6 Monitoring LBB Launch Restraint Pin and Latch Parameters during Unlatch (Approximately 30 Seconds)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Latched →</th>
<th>Transition → (approx. 30 seconds)</th>
<th>Unlatched</th>
</tr>
</thead>
<tbody>
<tr>
<td>LBB SW 01,02 Pin Released</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>LBB SW 01,02 Latched</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>LBB SW 01,02 Unlatched</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>MDA Slow Alert</td>
<td>Slow</td>
<td>Nominal</td>
<td>Slow</td>
</tr>
<tr>
<td>MDA Voltage, V</td>
<td>120 --- 125</td>
<td>120 --- 125</td>
<td>120 --- 125</td>
</tr>
<tr>
<td>MDA Temp, °C</td>
<td>-55 --- 48</td>
<td>-55 --- 48</td>
<td>-55 --- 48</td>
</tr>
<tr>
<td>MDA Over Temp Trip</td>
<td>&lt;blank&gt;</td>
<td>&lt;blank&gt;</td>
<td>&lt;blank&gt;</td>
</tr>
<tr>
<td>MDA Current, A</td>
<td>~0.10 (±0.4)</td>
<td>0.20 --- 3.00 (±0.4)</td>
<td>~0.10 (±0.4)</td>
</tr>
<tr>
<td>MDA Over Current Trip</td>
<td>&lt;blank&gt;</td>
<td>&lt;blank&gt;</td>
<td>&lt;blank&gt;</td>
</tr>
</tbody>
</table>
If one Latched, Unlatched, or Pin Released limit switch fails
sel SAW Software Inhibits

SAW 4B(2B) Software Inhibits

NOTE
(PR 15629) SAW 4B(2B) Enumerations are reversed on EPCS displays for flights 4A and e5A (Fixed for 5A and subsequent flights). Must send Enable command in order to inhibit function.

‘Deploy Reject’

**cmd** Enable – Arm
**cmd** Enable

√ Deploy Reject – Ena (Allows Deploy/Retract commands when SABB state is undetermined)

Continue with nominal procedure steps.

If two Latched, Unlatched, or Pin Released limit switches fail
Perform step 16.7.

√ MCC-H before proceeding

******************************************************************************************

16.7 Performing Visual Verification via RMS End Effector/PLB Camera
(PDRS C/L)
Verify BRS Pin Release (seven) – restraint pins released
Verify Latch Position (four of eight) – unlatched
Verify Separation of BB top and bottom – Uniform (~3 inch gap)

CAUTION
Visual verification of all seven BRS pins is required before performing subsequent steps in this procedure.

******************************************************************************************

If Unlatch sequence is not successful, √ MCC-H before proceeding.
If MCC-H unavailable, perform {FAILURE TO UNLATCH SABB REMOTELY}, all (SODF: ASSY OPS: MALFUNCTION), then:

******************************************************************************************
16.8 Powering Off Left Blanket Box MDA

**SAW 4B(2B) LBB Commands**

**cmd** MDA Power – Off

\[ \sqrt{\text{MDA Voltage, } V < 10 \ (\pm 2.8)} \]

17. **UNLATCHING RIGHT BLANKET BOX (RBB)**

17.1 Verifying Temperatures are within Nominal Ranges Prior to Unlatch

PCS

**P6: EPS: SAW 4B(2B)**

**SAW 4B(2B)**

Verify SAW PS Temp, °C: -45 --- 54
Verify BGA PS Temp, °C: -45 --- 54
Verify RBB MDA Temp, °C: -55 --- 48

17.2 Powering on RBB Motor Drive Assembly (MDA)

**NOTE**

MDA Slow Alert will be ‘Nominal’ until MDA power is applied. Once this is done, the indication is ‘Slow’.

**SAW 4B(2B)**

‘RBB’

**sel** RBB Commands

**SAW 4B(2B) RBB Commands**

**cmd** MDA Power – ON Arm

**cmd** MDA Power – ON

\[ \sqrt{\text{MDA Voltage, } V: 120 --- 125} \]

17.3 Performing Visual Verification via RMS End Effector/PLB Cameras (PDRS C/L)

**NOTE**

Crew will perform a visual verification prior to, during, and at the completion of each blanket box un latch operation. There are eight latches and seven launch restraint pins to be removed for each blanket box prior to deployment. Seven gold colored posts protrude through the containment box base to provide visual indication of successful pin release.

**SAW 4B RBB** = Port Fwd Solar Array Blanket
**SAW 2B RBB** = Stbd Aft Solar Array Blanket

Verify BRS Pin (seven) – restraint pins engaged
Verify Latch Position (four of eight) – latched
17.4 Verifying Initial SAW Right Blanket Box Configuration

**SAW 4B(2B) RBB Commands**

Verify parameters in column titled “LATCHED” in step 17.6 before executing unlatch command.

17.5 Unlatching SAW Right Blanket Box

**NOTE**

Upon successful Unlatch/Latch/Deploy/Retract commanding, the Slow Alert will go to ‘Nominal’ during transition then return to ‘Slow’. Once power is removed from the MDA, the Slow Alert will indicate ‘Nominal’.

**SAW 4B(2B) RBB Commands**

If possible, record the duration of the physical motion observed during the Unlatch sequence: ____________

**cmd** RBB – Unlatch Arm

**cmd** RBB – Unlatch

17.6 Monitoring RBB Launch Restraint Pin and Latch Parameters During Unlatch (Approximately 30 Seconds)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Latched →</th>
<th>Transition → (approx. 30 seconds)</th>
<th>Unlatched</th>
</tr>
</thead>
<tbody>
<tr>
<td>LBB SW 01,02 Pin Released</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>LBB SW 01,02 Latched</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>LBB SW 01,02 Unlatched</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>MDA Slow Alert</td>
<td>Slow</td>
<td>Nominal</td>
<td>Slow</td>
</tr>
<tr>
<td>MDA Voltage, V</td>
<td>120 --- 125</td>
<td>120 --- 125</td>
<td>120 --- 125</td>
</tr>
<tr>
<td>MDA Temp, °C</td>
<td>-55 --- 48</td>
<td>-55 --- 48</td>
<td>-55 --- 48</td>
</tr>
<tr>
<td>MDA Over Temp Trip</td>
<td>&lt;blank&gt;</td>
<td>&lt;blank&gt;</td>
<td>&lt;blank&gt;</td>
</tr>
<tr>
<td>MDA Current, A</td>
<td>~0.10 (±0.4)</td>
<td>0.20 --- 3.00 (±0.4)</td>
<td>~0.10 (±0.4)</td>
</tr>
<tr>
<td>MDA Over Current Trip</td>
<td>&lt;blank&gt;</td>
<td>&lt;blank&gt;</td>
<td>&lt;blank&gt;</td>
</tr>
</tbody>
</table>
If one Latched, Unlatched, or Pin Released limit switch fails sel SAW Software Inhibits

}&\text{SAW 4B(2B) Software Inhibits}

\textbf{NOTE}
(PR 15629) SAW 4B(2B) Enumerations are reversed on EPCS displays for flights 4A and e5A (Fixed for 5A and subsequent flights). Must send Enable command in order to inhibit function.

‘Deploy Reject’

\begin{itemize}
  \item \textit{cmd} Enable – Arm
  \item \textit{cmd} Enable
\end{itemize}

√\text{Deploy Reject – Ena (Allows Deploy/Retract commands when SABB state is undetermined)}

Continue with nominal procedure steps.

If two Latched, Unlatched, or Pin Released limit switches fail Perform step 17.7.

√\text{MCC-H before proceeding}

17.7 \textbf{Perform Visual Verification via RMS End Effector/PLB Cameras (PDRS C/L)}

Verify BRS Pin Release (seven) – restraint pin released
Verify Latch Position (four of eight) – unlatched
Verify Separation of BB top and bottom – Uniform (~3 inch gap)

\textbf{CAUTION}
Visual verification of all seven BRS pins is required before performing subsequent steps in this procedure.

If Unlatch sequence is not successful, √\text{MCC-H}
before proceeding.
If \text{MCC-H} unavailable, perform \{\text{FAILURE TO UNLATCH SABB REMOTELY}\}, all (SODF: ASSY OPS: MALFUNCTION), then:

************************************************************************************
17.8 Powering Off Right Blanket Box MDA

**SAW 4B(2B) RBB Commands**

**cmd** MDA Power – Off

√MDA Voltage, V < 10 (±2.8)

18. **DEPLOYING SOLAR ARRAY**

18.1 Verifying Temperatures are within Nominal Ranges Prior to SAW Deploy

**SAW 4B(2B)**

Verify SAW PS Temp, deg C: -45 --- 54
Verify BGA PS Temp, °C: -45 --- 54
Verify Mast MDA Temp, deg C: -55 --- 48

18.2 Powering on Mast Motor Drive Assembly (MDA)

**NOTE**

MDA Slow Alert will be 'Nominal' until MDA power is applied, once this is done the indication is 'Slow'.

**SAW 4B(2B)**

‘Mast’

**sel Mast Commands**

**SAW 4B(2B) Mast Commands**

**cmd** MDA Power – ON Arm
**cmd** MDA Power – ON

√MDA Voltage, V: 120 --- 125

18.3 Verifying Camera Configuration (Photo/TV 25)

**NOTE**

Crew should perform a visual verification prior to, during, and at the completion of the Mast Deploy operation to insure all launch restraints have been removed, minimize the risk of potential collision hazards, monitor for any obvious anomalies, and to verify solar array deployment. Mast deploy should take about 12 minutes. (Total # of visible Mast Bays = 31.5, 1 bay = rigid batten to rigid batten)

Verify camera configuration per P/TV25 (P/TV C/L) and IMAX support before proceeding.
18.4 Verifying Initial SAW Mast Configuration

SAW 4B(2B) Mast Commands

Verify parameters in column titled “RETRACTED” in step 18.7 before executing unlatch command.

18.5 Mated Stack to Free Drift (as appropriate)

Perform {HANDOVER ATTITUDE CONTROL RS THRUSTERS TO ORBITER}, step 2 (SODF: JNT OPS: MATED OPERATIONS), then:

or

C3(A6) DAP: FREE
Orbiter ⇒ ISS, MCC-H, “Orbiter is in Free Drift.”

CAUTION
Confirm Mated Stack in Free Drift and no crew exercise before proceeding.

18.6 Deploying SAW

NOTE
Upon successful Deploy commanding, the Slow Alert will go to ‘Nominal’ during transition then return to ‘Slow’. Once power is removed from the MDA, the Slow Alert will indicate ‘Nominal’.

SAW 4B(2B) Mast Commands

cmd Mast – Deploy Arm
cmd Mast – Deploy

Wait approximately 13 minutes.

**************************************************************
If significant Solar Array binding or deformation is indicated,
   cmd Mast – Abort

 Notify MCC-H.
**************************************************************
18.7 Monitoring Mast Limit Switch and MDA Parameters During SAW Deploy (Approximately 13 Minutes)

**NOTE**
SAW 2B SW 02 Deployed parameter is static and will be indicated as No even if Mast is fully deployed. This is due to a failure of the limit switch doing pre-flight testing.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Latched →</th>
<th>Transition → (approx. 30 seconds)</th>
<th>Deployed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mast SW 01,02 Retracted</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Mast SW 01,02 Deployed</td>
<td>No</td>
<td>No</td>
<td>Yes, Yes (SAW 4B) Yes, No* (SAW 2B)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>*Off-Nominal situation not required for SAW 2B one limit switch failed case)</td>
</tr>
<tr>
<td>MDA Slow Alert</td>
<td>Slow</td>
<td>Nominal</td>
<td>Slow</td>
</tr>
<tr>
<td>MDA Voltage, V</td>
<td>120 --- 125</td>
<td>120 --- 125</td>
<td>120 --- 125</td>
</tr>
<tr>
<td>MDA Temp, °C</td>
<td>-55 --- 48</td>
<td>-55 --- 48</td>
<td>-55 --- 48</td>
</tr>
<tr>
<td>MDA Over Temp Trip</td>
<td>&lt;blank&gt;</td>
<td>&lt;blank&gt;</td>
<td>&lt;blank&gt;</td>
</tr>
<tr>
<td>MDA Current, A</td>
<td>~0.10 (±0.4)</td>
<td>0.20 --- 3.00 (±0.4)</td>
<td>~0.10 (±0.4)</td>
</tr>
<tr>
<td>MDA Over Current Trip</td>
<td>&lt;blank&gt;</td>
<td>&lt;blank&gt;</td>
<td>&lt;blank&gt;</td>
</tr>
</tbody>
</table>
If one Deployed or Retracted limit switch fails
sel SAW Software Inhibits

| **SAW 4B(2B) Software Inhibits** |

**NOTE**
(PR 15629) SAW 4B(2B) Latch Reject enumerations are reversed on EPCS displays for flights 4A and e5A (Fixed for 5A and subsequent flights). Must send Enable command in order to inhibit function.

‘Latch Reject’

| cmd | Enable – Arm |
| cmd | Enable |

√Latch Reject – Ena (Allows SABB Unlatch/Latch commands when Mast state is undetermined)

P6: EPS: BGA 4B(2B)

| **BGA 4B(2B)** |

sel BGA Software Inhibits

| **BGA 4B(2B) Software Inhibits** |

‘SAW Deployment’

‘Primary PVCU’

| cmd | Enable – Arm |
| cmd | Enable |

√SAW Deployment – Ena (Allows BGA to be operated when SAW Mast is in an undetermined state)

‘Backup PVCU’

| cmd | Enable – Arm |
| cmd | Enable |

√SAW Deployment – Ena

P6: EPS: SAW 4B(2B)

| **SAW 4B(2B)** |

Continue with nominal procedure steps.

If two Deployed or Retracted limit switches fail
Perform step 18.8.

√MCC-H before proceeding

********************************************************************
18.8 Performing Visual Verification via RMS End Effector/PLB Cameras (Photo/TV 25)

- Mast Position – Deployed
- Tension Bar – pulled away from blanket box (as last mast bay deploys)
- Number of visible mast bays: 31.5
- Guide rollers on final bay – visible (final yellow flex batten)
- Solar Array Blanket – flat

**NOTE**
Last bay barber pole indication can only be seen with the Cameras when the array is positioned at or near 180 degrees (Mast MDA side only).

***************************************************************************
If Deploy sequence is not successful, \(\text{MCC-H}\) before proceeding. If \(\text{MCC-H}\) unavailable, perform \{FAILURE TO EXTEND MAST REMOTELY\}, all \(\text{SODF: ASSY OPS: MALFUNCTION}\), then:

***************************************************************************

18.9 Powering Off Mast MDA

**SAW 4B(2B) Mast Commands**

- **cmd** MDA Power – Off

- \(\text{MDA Voltage, V} < 10 \pm 2.8\)

19. TENSIONING LEFT SOLAR ARRAY BLANKET

19.1 Powering On LBB Motor Drive Assembly (MDA)

**NOTE**
MDA Slow Alert will be ‘Nominal’ until MDA power is applied. Once this is done, the indication is ‘Slow’.

**SAW 4B(2B)**

LBB

**sel LBB Commands**

**SAW 4B(2B) LBB Commands**

- **cmd** MDA Power – ON Arm
- **cmd** MDA Power – ON

- \(\text{MDA Voltage, V} \: 120 \text{ --- 125}\)
19.2 Verifying SAW Left Blanket Box Configuration
Verify parameters in column titled “UNLATCHED” in step 19.4 before executing latch command.

19.3 Latching (Tensioning) SAW Left Blanket Box

**NOTE**
Upon successful Latch commanding, the Slow Alert will go to ‘Nominal’ during transition, then return to ‘Slow’. Once power is removed from the MDA the Slow Alert will indicate ‘Nominal’.

### SAW 4B(2B) LBB Commands

If possible record the duration of physical motion observed during the latch sequence:__________

**cmd** LBB – Latch Arm  
**cmd** LBB – Latch

19.4 Monitoring LBB Latch Parameters during Latch (Approximately 20 seconds)

**NOTE**
Crew should perform a visual verification prior to, during, and at the completion of each blanket tensioning to monitor for any obvious anomalies and to verify blanket box tensioning operation.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unlatched →</th>
<th>Transition → (approx. 20 seconds)</th>
<th>Latched</th>
</tr>
</thead>
<tbody>
<tr>
<td>LBB SW 01,02 Pin Released</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>LBB SW 01,02 Latched</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>LBB SW 01,02 Unlatched</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>MDA Slow Alert</td>
<td>Slow</td>
<td>Nominal</td>
<td>Slow</td>
</tr>
<tr>
<td>MDA Voltage, V</td>
<td>120 --- 125</td>
<td>120 --- 125</td>
<td>120 --- 125</td>
</tr>
<tr>
<td>MDA Temp, °C</td>
<td>-55 --- 48</td>
<td>-55 --- 48</td>
<td>-55 --- 48</td>
</tr>
<tr>
<td>MDA Over Temp Trip</td>
<td>&lt;blank&gt;</td>
<td>&lt;blank&gt;</td>
<td>&lt;blank&gt;</td>
</tr>
<tr>
<td>MDA Current, A</td>
<td>~0.10 (±0.4)</td>
<td>0.20 --- 3.00 (±0.4)</td>
<td>~0.10 (±0.4)</td>
</tr>
<tr>
<td>MDA Over Current Trip</td>
<td>&lt;blank&gt;</td>
<td>&lt;blank&gt;</td>
<td>&lt;blank&gt;</td>
</tr>
</tbody>
</table>
If one Latched Unlatched, or Pin Released limit switch fails
sel SAW Software Inhibits

SAW 4B(2B) Software Inhibits

NOTE
(PR 15629) SAW 4B(2B) Enumerations are reversed on EPCS displays for flights 4A and e5A (Fixed for 5A and subsequent flights). Must send Enable command in order to inhibit function.

‘Deploy Reject’

cmd Enable – Arm
cmd Enable

√Deploy Reject – Ena (Allows Deploy/Retract commands when SABB state is undetermined)

Continue with nominal procedure steps.

If two Latched or Unlatched limit switches fail
Perform step 19.5.

√MCC-H before proceeding

19.5 Performing Visual Verification via RMS End Effector/PLB Cameras
(Photon/TV 25)
Verify Latch Position (four of eight) – tensioned position
Verify Tension Bar – pulled toward blanket box
(translation ~6 inches)
Verify Solar Array Blanket – rigid and flat

If Latch sequence is not successful, √MCC-H before proceeding.
If MCC-H unavailable, perform {FAILURE TO TENSION SABB REMOTELY}, all (SODF: ASSY OPS: MALFUNCTION), then:

19.6 Powering Off Left Blanket Box MDA

SAW 4B(2B) LBB Commands

cmd MDA Power – Off

√MDA Voltage, V < 10 (±2.8)
20. **TENSIONING RIGHT SOLAR ARRAY BLANKET**

20.1 Powering On RBB Motor Drive Assembly (MDA)

<table>
<thead>
<tr>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDA Slow Alert will be ‘Nominal’ until MDA power is applied. Once this is done, the indication is ‘Slow’.</td>
</tr>
</tbody>
</table>

SAW 4B(2B) RBB Commands

sel RBB Commands

.cmd MDA Power – ON Arm
.cmd MDA Power – ON

√MDA Voltage, V: 120 --- 125

20.2 Verifying SAW Right Blanket Box Configuration

Verify parameters in column titled “UNLATCHED” in step 20.4 before executing latch command.

20.3 Latching (Tensioning) SAW Right Blanket Box

<table>
<thead>
<tr>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upon successful Latch commanding, the Slow Alert will go to ‘Nominal’ during transition, then return to ‘Slow’. Once power is removed from the MDA, the Slow Alert will indicate ‘Nominal’.</td>
</tr>
</tbody>
</table>

SAW 4B(2B) RBB Commands

If possible record the duration of physical motion observed during the Latch sequence:__________________

.cmd RBB – Latch Arm
.cmd RBB – Latch
20.4 Monitoring RBB Latch Parameters during Latch (Approximately 20 Seconds)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unlatched</th>
<th>Transition → (Approx. 20 seconds)</th>
<th>Latched</th>
</tr>
</thead>
<tbody>
<tr>
<td>RBB SW 01,02 Pin Released</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>RBB SW 01,02 Latched</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>RBB SW 01,02 Unlatched</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>MDA Slow Alert</td>
<td>Slow</td>
<td>Nominal</td>
<td>Slow</td>
</tr>
<tr>
<td>MDA Voltage, V</td>
<td>120 --- 125</td>
<td>120 --- 125</td>
<td>120 --- 125</td>
</tr>
<tr>
<td>MDA Temp, °C</td>
<td>-55 --- 48</td>
<td>-55 --- 48</td>
<td>-55 --- 48</td>
</tr>
<tr>
<td>MDA Over Temp Trip</td>
<td>&lt;blank&gt;</td>
<td>&lt;blank&gt;</td>
<td>&lt;blank&gt;</td>
</tr>
<tr>
<td>MDA Current, A</td>
<td>~0.10 (±0.4)</td>
<td>0.20 --- 3.00 (±0.4)</td>
<td>~0.10 (±0.4)</td>
</tr>
<tr>
<td>MDA Over Current Trip</td>
<td>&lt;blank&gt;</td>
<td>&lt;blank&gt;</td>
<td>&lt;blank&gt;</td>
</tr>
</tbody>
</table>

**NOTE**
Crew should perform a visual verification prior to, during, and at the completion of each blanket tensioning to monitor for any obvious anomalies and to verify blanket box tensioning operation.
If one Latched or Unlatched limit switch fails

sel SAW Software Inhibits

SAW 4B(2B) Software Inhibits

NOTE
(PR 15629) SAW 4B(2B) Enumerations are reversed on EPCS displays for flights 4A and e5A (Fixed for 5A and subsequent flights). Must send Enable command in order to inhibit function.

‘Deploy Reject’

**cmd** Enable – Arm

**cmd** Enable

√Deploy Reject – Ena (Allows Deploy/Retract commands when SABB state is undetermined)

Continue with nominal procedure steps.

If two Latched or Unlatched limit switches fail

Perform step 20.5.

√MCC-H before proceeding

20.5 Performing Visual Verification via RMS End Effector/PLB Cameras

(With/TW 25)

Verify Latch Position (four of eight) – tensioned position

Verify Tension Bar – pulled toward blanket box

(translation ~6 inches)

Verify Solar Array Blanket – rigid and flat

If Latch sequence is not successful, √MCC-H before proceeding.

If MCC-H unavailable, perform (FAILURE TO TENSION SABB REMOTELY), all (SODF: ASSY OPS: MALFUNCTION), then:

20.6 Powering Off Right Blanket Box MDA

**cmd** MDA Power – Off

√MDA Voltage, V < 10 (±2.8)
21. UPDATING DAP AND RESUMING ATTITUDE CONTROL

21.1 Editing Control Accel

CRT  GNC 20 DAP CONFIG

If DAP A12 and B12 CNTL ACCEL not 9, then
EDIT A12 CNTL ACCEL
  ITEM 3 +1 2 EXEC
  ITEM 68 +9 EXEC
  ITEM 5 EXEC
EDIT B12 CNTL ACCEL.
  ITEM 4 +1 2 EXEC
  ITEM 68 +9 EXEC
  ITEM 5 EXEC

21.2 Resuming Attitude Control (as appropriate)

Perform {HANDOVER ATTITUDE CONTROL ORBITER TO RS THRUSTERS}, steps and 4 (SODF: JNT OPS: MATED OPERATIONS), then:

or

DAP: A12/INRTL/VERN (ALT)
When rates damped
DAP: AUTO

22. POSTING SAW DEPLOY RECONFIGURATION

P6: EPS: DCSU 4B(2B)
DCSU 4B(2B)

sel RPCM 4B(2B) A
RPCM 4B(2B) A

sel RPC 07
RPCM 4B(2B) A RPC 07

**cmd** RPC Position – Close (Verify – Cl)
RPCM 4B(2B) A

sel RPC 08
RPCM 4B(2B) A RPC 08

**cmd** RPC Position – Close (Verify – Cl)
1. **CONFIGURING PVTCS 4B(2B) ALGORITHMS FOR INITIAL ACTIVATION**

   **P6: EPS: PVTCS 4B(2B)**
   - **PVTCS 4B(2B)**
   - **PFCS 4B(2B)**
   - **‘Primary PVCU’**

   sel FCV

   **PVTCS PFCS 4B(2B) FCV**

   - **‘Primary PVCU’**

   **cmd FCV Control – Inhibit Arm**
   **cmd FCV Control – Inhibit**

   √FCV Control – Inh

   - ‘Backup PVCU’

   **cmd FCV Control – Inhibit Arm**
   **cmd FCV Control – Inhibit**

   √FCV Control – Inh

   - ‘Primary PVCU’

   **cmd FCV Batt Warm Recal – Inhibit Arm**
   **cmd FCV Batt Warm Reacl – Inhibit**

   √FCV Batt Warm Recal – Inh

   - ‘Backup PVCU’

   **cmd FCV Batt Warm Recal – Inhibit Arm**
   **cmd FCV Batt Warm Reacl – Inhibit**

   √FCV Batt Warm Recal – Inh

   **PVTCS 4B(2B)**

   sel Software Inhibits

   **PVTCS PFCS 4B(2B) Software Inhibits**

   - **‘Primary PVCU’**

   **cmd Min Inlet Temp Sfng – Inhibit Arm**
   **cmd Min Inlet Temp Sfng – Inhibit**

   √Min Inlet Temp Sfng – Inh
‘Backup PVCU’

**cmd** Min Inlet Temp Sfng – Inhibit Arm
**cmd** Min Inlet Temp Sfng – Inhibit

√Min Inlet Temp Sfng – Inh

PVTCS 4B(2B)

sel Pump (either icon)

PVTCS PFCS 4B(2B) Pump

‘PVCU Primary’

**cmd** Pump Auto Switchover – Inhibit Arm
**cmd** Pump Auto Switchover – Inhibit

√Pump Auto Switchover – Inh

‘PVCU Backup’

**cmd** Pump Auto Switchover – Inhibit Arm
**cmd** Pump Auto Switchover – Inhibit

√Pump Auto Switchover – Inh

**NOTE**
The PVTCS PFCS Pump Deadhead commands will be sent from the MCC-H. They are not on PCS display.

For Primary PVCU

<Cmd Inv: P6 PVTCS PFCS Pump Deadhead Sfng Inhib On Tmplt – (P6PT96Im0068K)> (two Steps Command)

√PVTCS PFCS Pump Deadhead – <Inh>

For Backup PVCU

<Cmd Inv: P6 PVTCS PFCS Pump Deadhead Sfng Inhib On Tmplt – (P6PT96Im0069K)> (two Step Commands)

√PVTCS PFCS Pump Deadhead – <Inh>
2. APPLYING POWER TO PFCS

**NOTE**
1. Expect the following Advisory messages when RPCM 4B(2B) A RPC 03 is closed
   - PVTCS PFCS 4B(2B) Non Trip Anomaly - P6
   - PVTCS PFCS 4B(2B) Measurement Out of Range - P6

2. When RPCM 4B(2B) A RPC 03 is closed the following Caution messages may occur
   - PVTCS PFCS 4B(2B) Maximum Outlet Temp Violation - P6
   - PVTCS PFCS 4B(2B) Warm FCV Recalibration In Prog

**CAUTION**
Once the PFCS is powered on, the operator should record the average of Out Temp1, Out Temp 2, Bypass Temp and Inlet Temp as soon as possible. The PFCS can remain powered on without a pump running for the length of time specified below (temperature dependent). The pump on command in step 5 should be performed within this time limit.

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Time Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>T &gt; 37° C</td>
<td>15 minutes</td>
</tr>
<tr>
<td>10° C &lt; T &lt; 37° C</td>
<td>1 hour</td>
</tr>
<tr>
<td>T &lt; 10° C</td>
<td>2 hours</td>
</tr>
</tbody>
</table>

**sel RPCM 4B(2B) A RPC 03**

**RPCM 4B(2B) A RPC 03 cmd** RPC Position – Close (Verify – Cl)

Record RPC Closed: ____/____:____:_____ GMT

3. ISSUING COMMON CLEAR TO PFCS

**NOTE**
The Advisory message ‘PVTCS PFCS 4B(2B) Non Trip Anomaly - P6’ will be cleared when PFCS 4B(2B) Common Clear is sent.

**PVTCS 4B(2B)**

√Integration Counter incrementing

**sel Firmware**

**PVTCS 4B(2B) Firmware**

‘Clear Cmds’
4. **ENABLING RT FDIR FOR POWERED PVCU MDM CONTROLLER RT**

```
P6: C&DH: PVCU 4B: UB PVB 24-1(2): RT Status
UB PVB 24 1(2) RT Status
```

**cmd** 05 PFCS 4B(2B) (LWR) Enable FDIR **Execute**

```
05 PFCS 4B(2B) (LWR) RT FDIR Status – Ena
```

5. **CALIBRATING FLOW CONTROL VALVE**

**NOTE**

1. The Advisory message ‘**PVTCS 4B(2B) FWC Lost or Rejected Command - P6**’ will occur when calibration command is sent.

2. The Advisory message ‘**PVTCS 4B(2B) FCV Control Command Response Failed - P6**’ will be cleared when calibration command is sent.

3. FCV calibration will last for approximately 93 seconds.

```
PVTCS 4B(2B)
‘PFCS 4B(2B)’
```

**sel FCV**

```
PVTCS PFCS 4B(2B) FCV
```

**NOTE**

SPN 16990 - After the Recal, the PVCU ends the PFCS FCV LOC setpoint command. The PFCS is expecting an Arm and Fire command and will reject the command resulting in the Warning message, ‘**PVTCS PFCS 4B(2B) FCV Recalibration Safing Failed - P6**’. To avoid the Warning message, send the Arm command to PFCS prior to FCV calibration.

**cmd** FCV LOC Setpt – Arm

‘FCV Calibrate’

**cmd** FCV Calibrate – Cal Arm
**cmd** FCV Calibrate – Cal

Wait 93 seconds.

```
√FCV Position: -5.3 --- 5.3 deg (Full Bypass)
```
Record FCV Recal: _____/_____:_____ :_____ GMT

NOTE
The Advisory message 'PVTCS PFCS 4B(2B) FWC Lost or Rejected Command - P6' will be cleared when PFCS 4B(2B) Common Clear is sent.

PVTCS 4B(2B)

√ Integration Counter incrementing
sel Firmware

PVTCS 4B(2B) Firmware
‘Clear Cmds’

cmd Common Clear

√ Power On Reset – blank

6. PERFORMING MANUAL FCV CHECKOUT

PVTCS PFCS 4B(2B) FCV
‘Manual Recal’

input FCV Position:  1.0 (1.0 = 90 deg - Full Rad Flow)
cmd FCV Position – Set

Wait 30 seconds.

√ FCV Position:  84.7 --- 95.3 deg (Full Radiator)

input FCV Position:  0.0 (0.0 = 0 deg - Full Bypass Flow)
cmd FCV Position – Set

Wait 30 seconds.

√ FCV Position:  -5.3 --- 5.3 deg (Full Bypass)

7. VERIFYING PFCS 4B(2B) PARAMETERS PRIOR TO PUMP ACTIVATION

PVTCS 4B(2B)
‘PFCS 4B(2B)’

√ Inlet Temp > -42.7° C
√ Inlet Press:  5950 --- 15001 mmHg
√ Outlet Temp 1,2: -42.7 --- 10° C
√ Outlet Press:  5950 --- 15001 mmHg
√ Bypass In temp: -42.7 --- 10° C
√ Accum Qty 1,2:  20 --- 70 %
8. ACTIVATING PFCS 4B(2B) PUMP

NOTE
The following Caution/Advisory messages will be cleared after PVTCS Pump is activated
‘PVTCS PFCS 4B(2B) Measurement Out of Range - P6’
‘PVTCS PFCS 4B(2B) Maximum Outlet Temp Violation - P6’

CAUTION
If PFCS Inlet Press is less than the calculated startup pressure, do not start the pump. There is a potential for cavitation below this pressure.

Determine the Startup pressure using the chart below after calculating the Average Temperature in degrees Celsius: Startup Pressure = __________ mmHg

Average Temperature = 1/4 (inlet Temp + Outlet Temp 1 + Outlet Temp 2 + Bypass Temp)

Figure 1.- PVTCS Startup Pressure vs Temperature.
Verify the following parameter is within range.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Lower Limit</th>
<th>Upper Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>INLET PRESS</td>
<td>STARTUP PRESSURE</td>
<td>15,001 MMHg</td>
</tr>
<tr>
<td>OUTLET TEMP</td>
<td>-42.7 DEG C</td>
<td>10°C</td>
</tr>
</tbody>
</table>

If Inlet Press is out of range, √MCC-H.

WARNING
Both pumps are not allowed to operate simultaneously.

NOTE
The PFCS pump will spin up within 10 seconds.

PVTCS 4B(2B)
‘PFCS 4B(2B)’

sel Pump A (either icon)

PVTCS PFCS 4B(2B) Pump

cmd Pmp A – On

Record Pump A On: _____/_____/_____/____: GMT

√Pmp X Spd: 12605 --- 14555 rpm

9. **VERIFYING PVTCS 4B(2B) PARAMETERS POST ACTIVATION**

PVTCS 4B(2B)
‘PFCS 4B(2B)’

√Flow Rate: 595 --- 800 Kg/hr
√Inlet Temp > -75°C
√Inlet Press: 5430 --- 13000 mmHg
√Outlet Temp 1,2: -42.7 --- 10°C
√Outlet Press: 6300 --- 14200 mmHg
√Bypass In temp: -30 --- 30°C

‘PFCS & PVR Accum’

√Avg Qty: 20 --- 70%
10. **APPLYING RPC OPEN COMMAND - INHIBIT**

**PVTCS 4B(2B)**

sel RPCM 4B(2B) A RPC 03

RPCM 4B(2B) A RPC 03

**cmd** Open Cmd – Inh

√Open Cmd – Inh

11. **ENABLING PVTCS CLOSED LOOP CONTROL AND PUMP SWITCHOVER ALGORITHMS**

**PVTCS 4B(2B)**

‘PFCS 4B(2B)’

**NOTE**

Enabling the FCV Control algorithm will initiate the PVTCS close loop control, which may cause the present FCV position to change.

sel FCV

‘Primary PVCU’

**cmd** FCV Control – Enable Arm

**cmd** FCV Control – Enable

√FCV Control – Ena

‘Backup PVCU’

**cmd** FCV Control – Enable Arm

**cmd** FCV Control – Enable

√FCV Control – Ena

**PVTCS 4B(2B)**

sel Pump A(B)

PVTCS PFCS 4B(2B) Pump

‘PVCU Primary’

**cmd** Pump Auto Switchover – Enable Arm

**cmd** Pump Auto Switchover – Enable

√Pump Auto Switchover – Ena
‘PVCU Backup’

**cmd** Pump Auto Switchover – Enable Arm  
**cmd** Pump Auto Switchover – Enable

√Pump Auto Switchover – Ena

**NOTE**  
The PVTCS PFCS Pump Deadhead commands will be sent from the **MCC-H**. They are not on PCS display.

For Primary PVCU  
<Cmd Inv:  P6 PVTCS PFCS Pump Deadhead Sfng Inhib Off Tmplt – (P6PT96lm0070K)> (two Steps Command)

√PVTCS PFCS Pump Deadhead – <Inh>

For Backup PVCU  
<Cmd Inv:  P6 PVTCS PFCS Pump Deadhead Sfng Inhib Off Tmplt – (P6PT96lm0071K)> (two Step Commands)

√PVTCS PFCS Pump Deadhead – <Inh>

Wait 1 minute for thermal stabilization.

12. **CONFIGURING PFCS MAX OUTLET TEMP ALGORITHM FOR NOMINAL OPERATIONS**

If PFCS Outlet Temp 1,2 < 10° C  
sel Software Inhibits

‘Primary PVCU’

**cmd** Max Outlet Temp Sfng – Enable Arm  
**cmd** Max Outlet Temp Sfng – Enable

√Max Outlet Temp Sfng – Ena

‘Backup PVCU’

**cmd** Max Outlet Temp Sfng – Enable Arm  
**cmd** Max Outlet Temp Sfng – Enable

√Max Outlet Temp Sdng – Ena

If PFCS Outlet Temp 1,2 > 10° C, notify **MCC**.
13. CONFIGURING PFCS MIN INLET TEMP ALGORITHM FOR NOMINAL OPERATIONS

PVTCS 4B(2B)

If PFCS Outlet Temp > -42.7° C

sel Software Inhibits

PVTCS PFCS 4B(2B) Software Inhibits

‘Primary PVCU’

cmd Min Inlet Temp Sfng – Enable Arm

cmd Min Inlet Temp Sfng – Enable

√Min Inlet Temp Sfng – Ena

‘Backup PVCU’

cmd Min Inlet Temp Sfng – Enable Arm

cmd Min Inlet Temp Sfng – Enable

√Min Inlet Temp Sfng – Ena

If PFCS Outlet Temp < -42.7° C, notify MCC.

14. CLOSING RPCS FOR EETCS AND PVTCS RADIATOR BASEPLATE HEATERS

If Channel 4B is being activated
P6: TCS: Loop B Line Heater (select either icon)

Loop B Line Heater Commands

sel RPCM 4B A RPC 07

RPCM 4B A RPC 07

cmd RPC Position – Close (Verify – Cl)

P6: EPS: PVTCS 4B

PVTCS 4B

sel RPCM 4B A RPC 8

RPCM 4B A RPC 8

cmd RPC Position – Close (Verify – Cl)
If Channel 2B is being activated

P6: TCS: Loop A Line Heater (select either icon)

[Loop A Line Heater Commands]

sel RPCM 2B A RPC 07

[RPCM 2B A RPC 07]

cmd RPC Position – Close (Verify – Cl)

P6: EPS: PVTCS 2B

[PVTCS 2B]

sel RPCM 2B A RPC 8

[RPCM 2B A RPC 8]

cmd RPC Position – Close (Verify – Cl)
1. **CONFIRMING RADIATOR IS READY FOR DEPLOYMENT**

**WARNING**
If deployment takes place during an EVA, ensure no EVA activities are being held within the deploy envelope of the radiator to avoid potential injury to EVA crewmember.

**CAUTION**
Pressure in both loops should be less than 12929 mmHg in order to avoid damaging the radiator during deployment.

PCS
P6: EPS: PVTCS 4B(2B)
PVTCS 4B

sel PVR P6
PVTCS PVR P6 Deploy

Verify PFCS 2B Outlet Press < 12929 mmHg
Verify PFCS 4B Outlet Press < 12929 mmHg

2. **INHIBITING TURNOFF AND VERIFYING RADIATOR ALGORITHM STATUS**

**NOTE**
SPN # 17412 - The PVR Turnoff and Timeout enumeration values are reversed; therefore, Inh indication means firmware algorithms PVR Turnoff and Timeout are enabled, and Ena means the algorithms are inhibited.

**cmd**
PVR Turnoff – Inhibit Arm
PVR Turnoff – Inhibit

√PVR Turnoff – Ena
√PVR Timeout – Inh

**NOTE**
SPN # 17146 - The Inhibit button under PVCU Backup PVR Config Complete is mislabeled and should be “Enable”.

‘PVCU Primary’
√PVR Config Complete – Ena
‘PVCU Backup’
√PVR Config Complete – Ena
3. PVR POWER-ON, STATUS VERIFICATION AND ACCUMULATOR READINGS

**NOTE**

SPN # 13374 - PVR Power On/Off indication uses command status telemetry and not the physical indication of the PVR Power. When the PVR autonomously shuts down, the telemetry will still show on (Last commanded state).

**cmd** PVR Power – On Arm
**cmd** PVR Power – On

Verify PVR Power – On
Verify PVR Deploy – <blank>
Verify PVR Retract – Retracted
Verify Overcurrent Trip – < 0 >

PCS

P6: EPS: PVTCS 4B

‘PFCS 4B’ (midlower section of display)

Record Accum Qty 1: _____ %

Record Accum Qty 2: _____ %

‘PVR P6’ (midright section of display)

**NOTE**

SPN # 548 documents the problem with PVR accumulator quantities. They do not show expected value and they are off by 35 %.

Record Accum Qty 1: _____ %

Record Accum Qty 2: _____ %

P6: EPS: PVTCS 2B

‘PFCS 2B’ (midsection of display)

Record Accum Qty 1: _____ %

Record Accum Qty 2: _____ %
NOTE
SPN # 548 documents the problem with PVR accumulator quantities. They do not show expected value and they are off by 35%.

‘PVR P6’ (midright section of display)

Record Accum Qty 1: _____ %

Record Accum Qty 2: _____ %

CAUTION
Station should be placed in Free Drift in order to avoid damaging the radiator during deployment.

4. CONFIGURING STATION TO FREE DRIFT
Perform as appropriate.

Either perform [HANDOVER ATTITUDE CONTROL RS THRUSTERS TO ORBITER], step 2 (SODF: JNT OPS: MATED OPERATION), then:

or

DAP: FREE
Orbiter ⇒ ISS, MCC-H, “Orbiter is in Free Drift.”

5. STARTING RADIATOR DEPLOYMENT AND MONITORING STATUS

NOTE
1. The Turnoff algorithm is inhibited because the Deploy motor needs to run for one additional minute after PVR Position indicating Deployed in order to ensure the cables are at the proper tension.

2. The PVR Timeout resides in the firmware controller and protects the drive motor from continued operation after a loss of communication with the PVCA or the PVCA fails to command the motor off. The PVR Timeout will command the motor to stop, power it off, and set the Timeout Trip after 13 minutes if deploy conditions are not met.

3. The PVR Config Complete resides in the PVCU and will command the motor to off after 15 minutes if deploy conditions are not met.

4. Accumulator quantity sensor data may fluctuate due to radiator motion.
PCS

P6: EPS: PVTCS
PVTCS 4B

sel PVR (upper right corner)

cmd PVR Deploy – Deploy Arm

cmd PVR Deploy – Deploy

Start event timer and record time: GMT ___/__________________.

Monitor and verify the following parameters during operation.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Stowed</th>
<th>Transition</th>
</tr>
</thead>
<tbody>
<tr>
<td>PVR Stop</td>
<td>Stop</td>
<td>Run</td>
</tr>
<tr>
<td>PVR Deploy</td>
<td>On</td>
<td>On</td>
</tr>
<tr>
<td>PVR Retract</td>
<td>Retracted</td>
<td></td>
</tr>
<tr>
<td>PVR Trip</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Over-Current Trip</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Timeout Trip</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Record time when PVR position transition to “Deployed”:
GMT ___/__________________.

After PVR Position indicates deployed and has been set for 60 seconds,
perform the following commands.

.cmd PVR Stop – Stop Arm
.cmd PVR Stop – Stop

√PVR Stop – Stop

**NOTE**
SPN # 16517 - The arm command is not required to
depower off the PVR. This command defaults to one step.

.cmd PVR Power – Off

√PVR Power – Off

**NOTE**
The ISS should be transitioned back to active attitude control
after PVR Power has been turned off.
6. **RESUMING ATTITUDE CONTROL**
   Perform as appropriate.

   Either perform **(HANDOVER ATTITUDE CONTROL ORBITER TO RS THRUSTERS)**, steps 2 and 4 (SODF: JNT OPS: MATED OPERATIONS), then:

   or

   **C3(A6)**
   DAP: INRTL
   When rates are damped
   DAP: AUTO

7. **CONCLUDING RADIATOR OPERATIONS**

   **PCS**
   P6: EPS: PVTCS 4B
   [PVTCS 4B]
   ‘PFCS 4B’ (midlower section of display)
   Record Accum Qty 1: _____ %
   Record Accum Qty 2: _____ %

   **NOTE**
   SPN # 548 documents the problem with PVR accumulator quantities. They do not show expected value and they are off by 35 %.

   ‘PVR P6’ (midright section of display)
   Record Accum Qty 1: _____ %
   Record Accum Qty 2: _____ %

   **PCS**
   P6: EPS: PVTCS 2B
   [PVTCS 2B]
   ‘PFCS 2B’ (midsection of display)
   Record Accum Qty 1: _____ %
   Record Accum Qty 2: _____ %

   **NOTE**
   SPN # 548 documents the problem with PVR accumulator quantities. They do not show expected value and they are off by 35 %.

   ‘PVR P6’ (midright section of display)
   Record Accum Qty 1: _____ %
   Record Accum Qty 2: _____ %

   Notify **MCC-H** that procedure is complete.
1. **VERIFYING COMM WITH BGA CONTROLLER**

PCS
P6: EPS: BGA 4B(2B)

BGA 4B(2B)

‘ECU 4B(2B)’

\(\checkmark\) Verify Cnt – <incrementing>

2. **VERIFYING ECU PWR SUPPLY TEMPS AND VOLTAGE STATUS**

Verify SAW PS Temp, °C: -45 --- 54
Verify BGA PS Temp, °C: -45 --- 54
Verify BGA PS Voltage, V: 115 --- 125

3. **CONTINGENCY MODES CONFIGURATION**

3.1 Verifying BGA 4B(2B) Blind Mode Config - Primary PVCU

BGA 4B(2B)

‘BGA 4B(2B)’

sel Blind Modes

‘Primary PVCU’

Verify Preselected Blind Mode – Null
Verify LOC Timer – Ignore
Verify Time After LOC, sec: 0.0
Verify Parameter, deg or deg/sec: 0.0

3.2 Verifying BGA 4B(2B) Blind Mode Configuration - Backup PVCU

‘Backup PVCU’

Verify Preselected Blind Mode – Null
Verify LOC Timer – Ignore
Verify Time After LOC, sec: 0.0
Verify Parameter, deg or deg/sec: 0.0

3.3 Verifying BGA 4B(2B) Contingency Control

BGA 4B(2B)

‘BGA 4B(2B)’

sel Contingency Control

BGA 4B(2B) Contingency Control
NOTE
SPN 15635 (PR 15635) BGA 2B and BGA 4B Contingency Control parameter static indicates Angle Hold (Fixed for 5A and subsequent flights).

Verify Contingency Control – Angle Hold

3.4 Verifying BGA 4B(2B) Contingency Mode
Confirm Contingency Control status with MCC-H when time permits; continue procedure.

4. POSITIONING ARRAY TO SUPPORT BATTERY CHARGING

4.1 Verifying New BGA Angle
\[ \text{MCC-H} \]
for new BGA angle

If MCC-H not available, use 180 degrees for both BGA 4B and BGA 2B.

Record Directed Position, Cmded Angle
BGA4B: ______ deg (0 --- 360)
BGA2B: ______ deg

Copy Cmded Angle Value into steps 4.4 and into columns titled “FINAL” in step 4.6.

4.2 Monitoring BGA Rotation Via PLB Cameras B(C) (Photo/TV 25)

WARNING
Ensure EVA crew members are outside of the SAW rotation path before proceeding.

NOTE
In order to save time, one BGA can be commanded to Directed Position Mode while the other is still in transition. Analysis has shown that perturbations due to additive torque disturbances are minimal.

4.3 Verifying Initial BGA Configuration
BGA 4B(2B)
BGA 4B(2B)

Verify parameters in column titled “INITIAL” in steps 4.5 and 4.6 before executing Directed Position command.
4.4 Configuring BGA 4B(2B) Mode to Directed Position

**NOTE**
This step will unlatch the BGA anti-rotation pin and rotate the solar array approximately 180°. It can take up to 30 minutes for the BGA to rotate to the commanded angle, 15 minutes to unlatch the pin, and 15 minutes to complete the rotation.

[BGA 4B(2B)]
'BGA 4B(2B)'

sel Channel Targeted Modes

[BGA 4B(2B) Ch Targeted Modes]
'Row = Directed Position, Column = Non-Solar Tracking'

input Cmded Angle (from step 4.1)

- BGA 4B ______ deg
- BGA 2B ______ deg

**cmd** Set

Verify BGA Mode – Directed Position
Verify Ch 4B(2B) Mode – Non-Solar Tracking

[BGA 4B(2B)]
'BGA 4B(2B)'

**NOTE**
SPN 17198 (PR 17198) Cmded Angle parameter contains a positive bias and can be as much as 1° greater than the value issued during commanding. This bias does not affect the Actual Angle parameter.

Verify Cmded Angle (from step 4.1)

- BGA 4B: ______ deg (± 1.0)
- BGA 2B: ______ deg (± 1.0)
4.5 Verifying BGA 4B(2B) Unlatch Sequence

Table 1. BGA 4B(2B) Unlatch Sequence

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>Initial</th>
<th>Column A: Voltage/ Current ON</th>
<th>Column B: Unlatched Indication</th>
<th>Column C: Active Actuator Indication</th>
<th>Column D: Inactive Actuator Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>BGA Latch 1 Pin Status</td>
<td>Latched</td>
<td>Latched</td>
<td>Unlatched</td>
<td>Unlatched</td>
<td>Unlatched</td>
</tr>
<tr>
<td>BGA Latch 1 Actuator</td>
<td>Inactive</td>
<td>Inactive</td>
<td>Inactive</td>
<td>Active</td>
<td>Inactive</td>
</tr>
<tr>
<td>BGA Latch 1 Current, A</td>
<td>Off Scale Low</td>
<td>~1.25</td>
<td>~1.25</td>
<td>Off Scale Low</td>
<td>Off Scale Low</td>
</tr>
<tr>
<td>BGA Latch 1 Voltage, V</td>
<td>0.0 --- 0.1</td>
<td>~15</td>
<td>~15</td>
<td>0.0 --- 0.1</td>
<td>0.0 --- 0.1</td>
</tr>
<tr>
<td>BGA Latch 1 Abort</td>
<td>&lt;Blank&gt;</td>
<td>&lt;Blank&gt;</td>
<td>&lt;Blank&gt;</td>
<td>&lt;Blank&gt;</td>
<td>&lt;Blank&gt;</td>
</tr>
<tr>
<td>BGA Motor State</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>ON*</td>
</tr>
</tbody>
</table>

*Just after Column D in the BGA unlatch sequence, the motor will come on and the BGA will begin to rotate to the commanded angle. Temperature differences can contribute to longer unlatching times.

4.6 Verifying BGA 4B(2B) Transition to Directed Position and Commanded Angle

Table 2. BGA 4B(2B) Transition to Directed Position and Commanded Angle

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>INITIAL</th>
<th>TRANSITION</th>
<th>FINAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>BGA Actual Angle, deg</td>
<td>0.000 (Range 359.9 --- 0.1)</td>
<td>Approaching target angle</td>
<td>_____ (± 0.1) (4B)</td>
</tr>
<tr>
<td>BGA Error Angle, deg</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>BGA Actual Angle Rate, deg/s</td>
<td>0.000</td>
<td>+0.07 --- +0.28 or -0.07 to -0.28</td>
<td>0.000</td>
</tr>
<tr>
<td>BGA Cmded Angle Rate, deg/s</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>Divergence Indicator</td>
<td>&lt;blank&gt;</td>
<td>&lt;blank&gt;</td>
<td>&lt;blank&gt;</td>
</tr>
<tr>
<td>BGA Motor State</td>
<td>OFF</td>
<td>ON*</td>
<td>ON</td>
</tr>
<tr>
<td>(from Table 1, Column C)</td>
<td></td>
<td>(from Table 1, Column D)</td>
<td></td>
</tr>
<tr>
<td>BGA Motor Velocity, deg/s</td>
<td>0.000</td>
<td>0.07 --- 0.28 or -0.07 to -0.28</td>
<td>0.00</td>
</tr>
<tr>
<td>BGA Motor Current, A</td>
<td>0.00 (± 0.4)</td>
<td>0.10 --- 0.70</td>
<td>0.10 (± 0.4)</td>
</tr>
</tbody>
</table>

*Just after Column D in the BGA unlatch sequence, the motor will come on and the BGA will begin to rotate to the commanded angle. Temperature differences can contribute to longer unlatching times.
5. VERIFYING SSU PERFORMANCE

PCS

P6: EPS: SSU 4B(2B)

Verify Integ Cnt – <incrementing>

<table>
<thead>
<tr>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSU PVCEs are off and Solar Array strings are completely shunted. SSU PVCEs will be configured for power output in the P6 Ch 4B, 2B Battery Thermal Conditioning procedure.</td>
</tr>
</tbody>
</table>

If in Insolation

Verify Output Current, A: 0.0 (±4.4)
Shunt Circuit 1 (SAW LBB) Current, A: 70.0 --- 110.0
Shunt Circuit 2 (SAW RBB) Current, A: 70.0 --- 110.0

If in Eclipse

Verify Output Current, A: 0.0 (±4.4)
Shunt Circuit 1 (SAW LBB) Current, A: 0.0 (± 4.4)
Shunt Circuit 2 (SAW RBB) Current, A: 0.0 (± 4.4)
This Page Intentionally Blank
1. **RECONFIGURING BATTERY FDIR FOR CHANNEL 4B AND 2B ACTIVATION**


   sel Software Inhibits

   **BCDU 4B1 Software**

   **cmd** Batt 4B11 Rev Polarity – Inh Arm
   **cmd** Batt 4B11 Rev Polarity – Inh

   √ Batt 4B11 Rev Polarity – Inh

   **cmd** Batt 4B12 Rev Polarity – Inh Arm
   **cmd** Batt 4B12 Rev Polarity – Inh

   √ Batt 4B12 Rev Polarity – Inh

   **cmd** Batt 4B11 Thermal Trip – Inh Arm
   **cmd** Batt 4B11 Thermal Trip – Inh

   √ Batt 4B11 Thermal Trip – Inh

   **cmd** Batt 4B12 Thermal Trip – Inh Arm
   **cmd** Batt 4B12 Thermal Trip – Inh

   √ Batt 4B12 Thermal Trip – Inh

   **cmd** Batt 4B11 Htr Safing – Inh Arm
   **cmd** Batt 4B11 Htr Safing – Inh

   √ Batt 4B11 Htr Safing – Inh

   **cmd** Batt 4B12 Htr Safing – Inh Arm
   **cmd** Batt 4B12 Htr Safing – Inh

   √ Batt 4B12 Htr Safing – Inh

   sel BCDU 4B1 Software BU

   **BCDU 4B1 Software BU**

   **cmd** Batt 4B11 Rev Polarity – Inh Arm
   **cmd** Batt 4B11 Rev Polarity – Inh

   √ Batt 4B11 Rev Polarity – Inh
1.2 Inhibiting Battery FDIR for 4B2

Energy Storage 4B
'BCDU 4B2'

sel Software Inhibits

BCDU 4B2 Software

Batt 4B21 Rev Polarity – Inh Arm
Batt 4B21 Rev Polarity – Inh

Batt 4B21 Rev Polarity – Inh
Batt 4B22 Rev Polarity – Inh Arm
Batt 4B22 Rev Polarity – Inh

Batt 4B22 Rev Polarity – Inh
Batt 4B21 Thermal Trip – Inh Arm
Batt 4B21 Thermal Trip – Inh

Batt 4B21 Thermal Trip – Inh
cmd Batt 4B22 Thermal Trip – Inh Arm
cmd Batt 4B22 Thermal Trip – Inh

√Batt 4B22 Thermal Trip – Inh

cmd Batt 4B21 Htr Safing – Inh Arm
cmd Batt 4B21 Htr Safing – Inh

√Batt 4B21 Htr Safing – Inh

cmd Batt 4B22 Htr Safing – Inh Arm
cmd Batt 4B22 Htr Safing – Inh

√Batt 4B22 Htr Safing – Inh

sel BCDU 4B2 SoftwareBU

BCDU 4B2 Software BU

cmd Batt 4B21 Rev Polarity – Inh Arm
cmd Batt 4B21 Rev Polarity – Inh

√Batt 4B21 Rev Polarity – Inh

cmd Batt 4B22 Rev Polarity – Inh Arm
cmd Batt 4B22 Rev Polarity – Inh

√Batt 4B22 Rev Polarity – Inh

cmd Batt 4B21 Thermal Trip – Inh Arm
cmd Batt 4B21 Thermal Trip – Inh

√Batt 4B21 Thermal Trip – Inh

cmd Batt 4B22 Thermal Trip – Inh Arm
cmd Batt 4B22 Thermal Trip – Inh

√Batt 4B22 Thermal Trip – Inh

cmd Batt 4B21 Htr Safing – Inh Arm
cmd Batt 4B21 Htr Safing – Inh

√Batt 4B21 Htr Safing – Inh

cmd Batt 4B22 Htr Safing – Inh Arm
cmd Batt 4B22 Htr Safing – Inh

√Batt 4B22 Htr Safing – Inh
1.3 Inhibiting Battery FDIR for 4B3

Energy Storage 4B
‘BCDU 4B3’

sel Software Inhibits

BCDU 4B3 Software

**cmd**: Batt 4B31 Rev Polarity – Inh Arm
**cmd**: Batt 4B31 Rev Polarity – Inh

√Batt 4B31 Rev Polarity – Inh

**cmd**: Batt 4B32 Rev Polarity – Inh Arm
**cmd**: Batt 4B32 Rev Polarity – Inh

√Batt 4B32 Rev Polarity – Inh

**cmd**: Batt 4B31 Thermal Trip – Inh Arm
**cmd**: Batt 4B31 Thermal Trip – Inh

√Batt 4B31 Thermal Trip – Inh

**cmd**: Batt 4B32 Thermal Trip – Inh Arm
**cmd**: Batt 4B32 Thermal Trip – Inh

√Batt 4B32 Thermal Trip – Inh

**cmd**: Batt 4B31 Htr Safing – Inh Arm
**cmd**: Batt 4B31 Htr Safing – Inh

√Batt 4B31 Htr Safing – Inh

**cmd**: Batt 4B32 Htr Safing – Inh Arm
**cmd**: Batt 4B32 Htr Safing – Inh

√Batt 4B32 Htr Safing – Inh

sel BCDU 4B3 Software BU

BCDU 4B3 Software BU

**cmd**: Batt 4B31 Rev Polarity – Inh Arm
**cmd**: Batt 4B31 Rev Polarity – Inh

√Batt 4B31 Rev Polarity – Inh

**cmd**: Batt 4B32 Rev Polarity – Inh Arm
**cmd**: Batt 4B32 Rev Polarity – Inh
√Batt 4B32 Rev Polarity – Inh

cmd Batt 4B31 Thermal Trip – Inh Arm
cmd Batt 4B31 Thermal Trip – Inh

√Batt 4B31 Thermal Trip – Inh

cmd Batt 4B32 Thermal Trip – Inh Arm
cmd Batt 4B32 Thermal Trip – Inh

√Batt 4B32 Thermal Trip – Inh

cmd Batt 4B31 Htr Safing – Inh Arm
cmd Batt 4B31 Htr Safing – Inh

√Batt 4B31 Htr Safing – Inh

cmd Batt 4B32 Htr Safing – Inh Arm
cmd Batt 4B32 Htr Safing – Inh

√Batt 4B32 Htr Safing – Inh

1.4 Inhibiting Battery FDIR for 2B1

P6: EPS: Energy Storage 2B

Energy Storage 2B

'BCDU 2B1'

sel Software Inhibits

BCDU 2B1 Software

cmd Batt 2B11 Rev Polarity – Inh Arm
cmd Batt 2B11 Rev Polarity – Inh

√Batt 2B11 Rev Polarity – Inh

cmd Batt 2B12 Rev Polarity – Inh Arm
cmd Batt 2B12 Rev Polarity – Inh

√Batt 2B12 Rev Polarity – Inh

cmd Batt 2B11 Thermal Trip – Inh Arm
cmd Batt 2B11 Thermal Trip – Inh

√Batt 2B11 Thermal Trip – Inh

cmd Batt 2B12 Thermal Trip – Inh Arm
cmd Batt 2B12 Thermal Trip – Inh
√ Batt 2B12 Thermal Trip – Inh
  
  cmd Batt 2B11 Htr Safing – Inh Arm
  cmd Batt 2B11 Htr Safing – Inh

√ Batt 2B11 Htr Safing – Inh
  
  cmd Batt 2B12 Htr Safing – Inh Arm
  cmd Batt 2B12 Htr Safing – Inh

√ Batt 2B12 Htr Safing – Inh
  
  sel BCDU 2B1 Software BU

BCDU 2B1 Software BU
  
  cmd Batt 2B11 Rev Polarity – Inh Arm
  cmd Batt 2B11 Rev Polarity – Inh

√ Batt 2B11 Rev Polarity – Inh
  
  cmd Batt 2B12 Rev Polarity – Inh Arm
  cmd Batt 2B12 Rev Polarity – Inh

√ Batt 2B12 Rev Polarity – Inh
  
  cmd Batt 2B11 Thermal Trip – Inh Arm
  cmd Batt 2B11 Thermal Trip – Inh

√ Batt 2B11 Thermal Trip – Inh
  
  cmd Batt 2B12 Thermal Trip – Inh Arm
  cmd Batt 2B12 Thermal Trip – Inh

√ Batt 2B12 Thermal Trip – Inh
  
  cmd Batt 2B11 Htr Safing – Inh Arm
  cmd Batt 2B11 Htr Safing – Inh

√ Batt 2B11 Htr Safing – Inh
  
  cmd Batt 2B12 Htr Safing – Inh Arm
  cmd Batt 2B12 Htr Safing – Inh

√ Batt 2B12 Htr Safing – Inh
1.5 Inhibiting Battery FDIR for 2B2

Energy Storage 2B
‘BCDU 2B2’

sel Software Inhibits

BCDU 2B2 Software

**cmd** Batt 2B21 Rev Polarity – Inh Arm

**cmd** Batt 2B21 Rev Polarity – Inh

√Batt 2B21 Rev Polarity – Inh

**cmd** Batt 2B22 Rev Polarity – Inh Arm

**cmd** Batt 2B22 Rev Polarity – Inh

√Batt 2B22 Rev Polarity – Inh

**cmd** Batt 2B21 Thermal Trip – Inh Arm

**cmd** Batt 2B21 Thermal Trip – Inh

√Batt 2B21 Thermal Trip – Inh

**cmd** Batt 2B22 Thermal Trip – Inh Arm

**cmd** Batt 2B22 Thermal Trip – Inh

√Batt 2B22 Thermal Trip – Inh

**cmd** Batt 2B21 Htr Safing – Inh Arm

**cmd** Batt 2B21 Htr Safing – Inh

√Batt 2B21 Htr Safing – Inh

**cmd** Batt 2B22 Htr Safing – Inh Arm

**cmd** Batt 2B22 Htr Safing – Inh

√Batt 2B22 Htr Safing – Inh

sel BCDU 2B2 Software BU

**BCDU 2B2 Software BU**

**cmd** Batt 2B21 Rev Polarity – Inh Arm

**cmd** Batt 2B21 Rev Polarity – Inh

√Batt 2B21 Rev Polarity – Inh
cmd Batt 2B22 Rev Polarity – Inh Arm
cmd Batt 2B22 Rev Polarity – Inh

√Batt 2B22 Rev Polarity – Inh

cmd Batt 2B21 Thermal Trip – Inh Arm
cmd Batt 2B21 Thermal Trip – Inh

√Batt 2B21 Thermal Trip – Inh

cmd Batt 2B22 Thermal Trip – Inh Arm
cmd Batt 2B22 Thermal Trip – Inh

√Batt 2B22 Thermal Trip – Inh

cmd Batt 2B21 Htr Safing – Inh Arm
cmd Batt 2B21 Htr Safing – Inh

√Batt 2B21 Htr Safing – Inh

cmd Batt 2B22 Htr Safing – Inh Arm
cmd Batt 2B22 Htr Safing – Inh

√Batt 2B22 Htr Safing – Inh

1.6 Inhibiting Battery FDIR for 2B3

Energy Storage 2B
‘BCDU 2B3’

sel Software Inhibits

BCDU 2B3 Software

cmd Batt 2B31 Rev Polarity – Inh Arm
cmd Batt 2B31 Rev Polarity – Inh

√Batt 2B31 Rev Polarity – Inh

cmd Batt 2B32 Rev Polarity – Inh Arm
cmd Batt 2B32 Rev Polarity – Inh

√Batt 2B32 Rev Polarity – Inh

cmd Batt 2B31 Thermal Trip – Inh Arm
cmd Batt 2B31 Thermal Trip – Inh

√Batt 2B31 Thermal Trip – Inh
cmd Batt 2B32 Thermal Trip – Inh Arm
cmd Batt 2B32 Thermal Trip – Inh
√Batt 2B32 Thermal Trip – Inh

cmd Batt 2B31 Htr Safing – Inh Arm
cmd Batt 2B31 Htr Safing – Inh
√Batt 2B31 Htr Safing – Inh

cmd Batt 2B32 Htr Safing – Inh Arm
cmd Batt 2B32 Htr Safing – Inh
√Batt 2B32 Htr Safing – Inh

sel BCDU 2B3 SoftwareBU

BCDU 2B3 Software BU

cmd Batt 2B31 Rev Polarity – Inh Arm
cmd Batt 2B31 Rev Polarity – Inh
√Batt 2B31 Rev Polarity – Inh

cmd Batt 2B32 Rev Polarity – Inh Arm
cmd Batt 2B32 Rev Polarity – Inh
√Batt 2B32 Rev Polarity – Inh

cmd Batt 2B31 Thermal Trip – Inh Arm
cmd Batt 2B31 Thermal Trip – Inh
√Batt 2B31 Thermal Trip – Inh

cmd Batt 2B32 Thermal Trip – Inh Arm
cmd Batt 2B32 Thermal Trip – Inh
√Batt 2B32 Thermal Trip – Inh

cmd Batt 2B31 Htr Safing – Inh Arm
cmd Batt 2B31 Htr Safing – Inh
√Batt 2B31 Htr Safing – Inh

cmd Batt 2B32 Htr Safing – Inh Arm
cmd Batt 2B32 Htr Safing – Inh
√Batt 2B32 Htr Safing – Inh
2. SETTING ORBITAL PARAMETERS FOR BATTERY CHARGING
  P6: EPS: EPS Software (Lower Right)

  sel PVCU Software

  PV SW
  'Primary P6 MDM'

  Calculate the time for Orbital Parameters (MCC-H only).

2.1 Taking a Snapshot of PV Internal Time with a GMT Time-Tag
  Record PV Internal Time = ______________ seconds @ GMT
  XXX/XX:XX:XX = PV_GMT

2.2 Acquiring and Recording the Following Times from TOPO
  Rise_GMT = Next Orbit Solar Rise Time @ GMT XXX/XX:XX:XX
  Set_GMT = Next Orbit Solar Set Time @ GMT XXX/XX:XX:XX
  Next Orbit Duration = ______________ seconds

2.3 Calculating Next Orbit Solar Rise Time for PV
  PV_Rise = Rise_GMT – PV_GMT = ______________ seconds
  If PV_Rise < 6000, then
  Next Orbit Solar Time for PV = PV Internal Time + PV_Rise
  = ______________ seconds

2.4 Calculating Next Orbit Solar Set Time for PV
  PV_Set = Set_GMT – PV_GMT = ______________ seconds
  If PV_Set < 6000, then
  Next Orbit Solar Set Time for PV = PV Internal Time + PV_Set
  = ______________ seconds

  Record values reported by MCC-H.
  Solar Rise Time = ______________ seconds
  Solar Set Time = ______________ seconds
  Orbit Duration Time = ______________ seconds

  Use recorded values to complete template commands.

  NOTE
  If PV-Rise or PV-Set are > 6000 seconds
  the PVCU MDM will reject the command.

  sel Orbit Parameters

  PV EPS Orbit Parameters
  'Primary P6 MDM'
input Solar Rise Time, second = __________
input Solar Rise Time, subsecond = 0
input Solar Set Time, second = ____________
input Solar Set Time, subsecond = 0
Pick Quality Ind – Valid

**cmd** Primary P6 MDM – Solar Times

‘Backup P6 MDM’

input Solar Rise Time, seconds = __________
input Solar Rise Time, subsecond = 0
input Solar Set Time, seconds = __________
input Solar Set Time, subsecond = 0
Pick Quality Ind – Valid

**cmd** Backup P6 MDM – Solar Times

‘Primary P6 MDM’

input Orbit Duration Time = __________

**cmd** Primary P6 MDM – Orbit Duration Set

‘Backup P6 MDM’

input Orbit Duration Time = __________

**cmd** Backup P6 MDM – Orbit Duration Set

3. **ENABLING BCDU 4B1(2B1) LOC ALGORITHM**

P6: EPS: Energy Storage 4B(2B)

Energy Storage 4B(2B)

‘BCDU 4B1(2B1)’

sel ‘Software Inhibits’

**BCDU 4B1(2B1) Software**

**cmd** LOC Failure Reconf – Ena Arm

**cmd** LOC Failure Reconf – Ena

√LOC Failure Reconf – Ena

sel BCDU 4B1(2B1) SoftwareBU

**BCDU 4B1(2B1) Software BU**
4. **ENABLING BCDU 4B2(2B2) LOC ALGORITHM**

   Energy Storage 4B(2B)
   ‘BCDU 4B2(2B2)’

   sel Software Inhibits

   BCDU 4B2(2B2) Software

   cmd LOC Failure Reconf – Ena Arm
   cmd LOC Failure Reconf – Ena

   √ LOC Failure Reconf – Ena

   sel BCDU 4B2(2B2) SoftwareBU

   BCDU 4B2(2B2) Software BU

   cmd LOC Failure Reconf – Ena Arm
   cmd LOC Failure Reconf – Ena

   √ LOC Failure Reconf – Ena

5. **ENABLING BCDU 4B3(2B3) LOC ALGORITHM**

   Energy Storage 4B(2B)
   ‘BCDU 4B3(2B3)’

   sel Software Inhibits

   BCDU 4B3(2B3) Software

   cmd LOC Failure Reconf – Ena Arm
   cmd LOC Failure Reconf – Ena

   √ LOC Failure Reconf – Ena

   sel BCDU 4B3(2B3) SoftwareBU

   BCDU 4B3(2B3) Software BU

   cmd LOC Failure Reconf – Ena Arm
   cmd LOC Failure Reconf – Ena

   √ LOC Failure Reconf – Ena
NOTE
Execute steps 6 --- 18 of this procedure one BDCU/Battery string at a time.

6. CHECKING IF BCDU 4B1(2B1) IS COMMUNICATING WITH PVCU
   PCS
   P6: EPS: ENERGY STORAGE 4B(2B)
   ENERGY STORAGE 4B(2B)
   ‘BCDU 4B1(2B1)’

   √ Integ Cnt incrementing

7. VERIFYING BCDU 4B1(2B1) BASEPLATE TEMPERATURE IS WITHIN
   SURVIVAL RANGE
   √ Bsplt Temp: -42.8 --- 82.2° C

8. VERIFYING BCDU 4B1(2B1) VOLTAGE AND CURRENT SENSORS
   √ Primary Voltage: 131.0 --- 149.0 V
   √ Primary Current: -2.6 --- 1.4 A
   √ FI Input Voltage < 4.0 V
   √ FI Input Current: -2 --- 2 A
   √ Battery Voltage < 90 V
   √ Battery Current: -2 --- 2 A
   √ CP RBI Voltage < 3.0 V
   √ CP RBI Current: -0.7 --- 0.7 A

9. VERIFYING BATTERY 4B11,2(2B11,2) SWITCH CONFIGURATION,
   ORU, AND CELL VOLTAGES
   ‘Battery 4B11(2B11)’

   √ Vbus < 45 V
   √ Avg Temp: -25 --- 30° C
   √ Avg Press < 500 kPa
   √ Htr 1 Sw posn – Open
   √ Htr 2 Sw posn – Open
   √ Drain Sw posn – Open

   ‘Battery 4B12(2B12)’

   √ Vbus < 45 V
   √ Avg Temp: -25 --- 30° C
   √ Avg Press < 500 kPa
   √ Htr 1 Sw posn – Open
   √ Htr 2 Sw posn – Open
   √ Drain Sw posn – Open

   sel Cells

   ‘Battery 4B11(2B11)’
   ‘Cells’
√02, 08, 20, 28 Volt < 1.3 V

‘Battery 4B12(2B12)’
‘Cells’

√02, 08, 20, 28 Volt < 1.3 V

10. **CHECKING IF BCDU 4B2(2B2) IS COMMUNICATING WITH PVCU**

   **ENERGY STORAGE 4B(2B)**
   **BCDU 4B2(2B2)**

   √Integ Cnt incrementing

11. **VERIFYING BCDU 4B2(2B2) BASEPLATE TEMPERATURE IS WITHIN SURVIVAL RANGE**

   √Bsplit Temp: -42.8 --- 82.2° C

12. **VERIFYING BCDU 4B2(2B2) VOLTAGE AND CURRENT SENSORS**

   √Primary Voltage: 131.0 --- 149.0 V
   √Primary Current: -2.6 --- 1.4 A
   √FI Input Voltage < 4.0 V
   √FI Input Current: -2 --- 2 A
   √Battery Voltage < 90 V
   √Battery Current: -2 --- 2 A
   √CP RBI Voltage < 3.0 V
   √CP RBI Current: -0.7 --- 0.7 A

13. **VERIFYING BATTERY 4B21,2(2B21,2) SWITCH CONFIGURATION, ORU, AND CELL VOLTAGES**

   ‘Battery 4B21(2B21)’

   √Vbus < 45 V
   √Avg Temp: -25 --- 30° C
   √Avg Press < 500 kPa
   √Htr 1 Sw posn – Open
   √Htr 2 Sw posn – Open
   √Drain Sw posn – Open

   ‘Battery 4B22(2B22)’

   √Vbus < 45 V
   √Avg Temp: -25 --- 30° C
   √Avg Press < 500 kPa
   √Htr 1 Sw posn – Open
   √Htr 2 Sw posn – Open
   √Drain Sw posn – Open
sel Cells

‘Battery 4B21(2B21)’
‘Cells’

√ 02, 08, 20, 28 Volt < 1.3 V

‘Battery 4B22(2B22)’
‘Cells’

√ 02, 08, 20, 28 Volt < 1.3 V

14. **CHECKING IF BCDU 4B3(2B3) IS COMMUNICATING WITH PVCU**

   ENERGY STORAGE 4B(2B)

   ‘BCDU 4B3(2B3)’

   √ Integ Cnt incrementing

15. **VERIFYING BCDU 4B3(2B3) BASEPLATE TEMPERATURE IS WITHIN SURVIVAL RANGE**

   √ Bsplit Temp: -42.8 --- 82.2° C

16. **VERIFYING BCDU 4B3(2B3) VOLTAGE AND CURRENT SENSORS**

   √ Primary Voltage: 131.0 --- 149.0 V
   √ Primary Current: -2.6 --- 1.4 A
   √ FI Input Voltage < 4.0 V
   √ FI Input Current: -2 --- 2 A
   √ Battery Voltage < 90 V
   √ Battery Current: -2 --- 2 A
   √ CP RBI Voltage < 3.0 V
   √ CP RBI Current: -0.7 --- 0.7 A

17. **VERIFYING BATTERY 4B31,2(2B31,2) SWITCH CONFIGURATION, ORU, AND CELL VOLTAGES**

   ‘Battery 4B31(2B31)’

   √ Vbus < 90 V
   √ Avg Temp: -25 --- 30° C
   √ Avg Press < 500 kPa
   √ Htr 1 Sw posn – Open
   √ Htr 2 Sw posn – Open
   √ Drain Sw posn – Open

   ‘Battery 4B32(2B32)’
√Vbus < 90 V
√Avg Temp: -25 --- 30° C
√Avg Press < 500 kPa
√Htr 1 Sw posn – Open
√Htr 2 Sw posn – Open
√Drain Sw posn – Open

sel Cells

‘Battery 4B31(2B31)’
‘Cells’

√02, 08, 20, 28 Volt < 1.3 V

‘Battery 4B32(2B32)’
‘Cells’

√02, 08, 20, 28 Volt < 1.3 V

18. **DATA DUMP**

<table>
<thead>
<tr>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>This is an <strong>MCC-H</strong> ground step only. If time permits, dump the cell voltages for each battery ORU.</td>
</tr>
</tbody>
</table>

To dump battery cell voltages, perform **{NCS BUILD DATA DUMP AND NCS FMT UPLINK MANAGER DATA DUMP MANAGEMENT}**, all (SODF: GND), then:

Print a hard copy of the display containing the dump data.

√Cell 01 through 38 Volt < 1.3 V
1. **BCDUs LOSS OF COMM AND MODE REGULATION SETPOINTS UPDATE FOR CHANNEL 4B AND 2B**

1.1 Channel 4B BCDU 4B1 Update (Ground Only)

<table>
<thead>
<tr>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPN # 15881 - Loss of Comm setpoint for BCDU 4B1 is incorrect. Therefore, ground will send BCDU 4B1 LOC setpoint form command inventory.</td>
</tr>
</tbody>
</table>

<Cmd Inv: P6 BCDU LOC Setpt Tmplt – (P6PB96IM0037K)> Arm

- input Batt Htr Off Temp LOC Setpt Arm: 1.67° C
- input Batt Htr On Temp LOC Setpt Arm: 1.11° C
- input Current LOC Setpt Arm: 2 A
- input Mode Rgltn LOC Setpt Arm: 130 V

<Cmd Inv: P6 BCDU LOC Setpt Tmplt – (P6PB96IM0037K)> Fire

- input Batt Htr Off Temp LOC Setpt: 1.67° C
- input Batt Htr On Temp LOC Setpt: 1.11° C
- input Current LOC Setpt: 2 A
- input Mode Rgltn LOC Setpt: 130 V

√Batt Htr Off Temp: 1.67° C
√Batt Htr On Temp: 1.11° C
√Current: 2 A
√Mode Rgltn: 130 V

1.2 Channel 4B BCDU 4B2 Update

P6: EPS: Energy Storage 4B

Energy Storage 4B
‘BCDU 4B’

sel Conv

BCDU 4B2 ConverterFI
‘BCDU LOC Setpts’

- input Batt Htr Off Temp LOC Setpt Arm: 1.67° C
- input Batt Htr On Temp LOC Setpt Arm: 1.11° C
- input Current LOC Setpt Arm: 2 A
- input Mode Rgltn LOC Setpt Arm: 130 V

‘LOC Setpt’

**cmd** LOC Setpt Arm
input Batt Htr Off Temp LOC Setpt: 1.67° C
input Batt Htr On Temp LOC Setpt: 1.11° C
input Current LOC Setpt: 2 A
input Mode Rgltn LOC Setpt: 130 V

'LOC Setpt'

cmd LOC Setpt

√Batt Htr Off Temp: 1.67° C
√Batt Htr On Temp: 1.11° C
√Current: 2 A
√Mode Rgltn: 130 V

1.3 Channel 4B BCDU 4B3 Update (Ground Only)

NOTE
SPN # 15881 - Loss of Comm setpoint for BCDU 4B3 is incorrect. Therefore, ground will send BCDU 4B3 LOC setpoint from command inventory.

<Cmd Inv: P6 BCDU LOC Setpt Tmplt – (P6PB96IM0037K)> Arm

input Batt Htr Off Temp LOC Setpt Arm: 1.67° C
input Batt Htr On Temp LOC Setpt Arm: 1.11° C
input Current LOC Setpt Arm: 2 A
input Mode Rgltn LOC Setpt Arm: 130 V

<Cmd Inv: P6 BCDU LOC Setpt Tmplt – (P6PB96IM0037K)> Fire

input Batt Htr Off Temp LOC Setpt: 1.67° C
input Batt Htr On Temp LOC Setpt: 1.11° C
input Current LOC Setpt: 2 A
input Mode Rgltn LOC Setpt: 130 V

√Batt Htr Off Temp: 1.67° C
√Batt Htr On Temp: 1.11° C
√Current: 2 A
√Mode Rgltn: 130 V

1.4 Channel 2B BCDU 2B1 Update
P6: EPS: Energy Storage 2B
Energy Storage 2B
'BCDU 2B1'

sel Conv

BCDU 2B1 ConverterFI
'BCDU LOC Setpts'
input Batt Htr Off Temp LOC Setpt Arm: 1.67° C
input Batt Htr On Temp LOC Setpt Arm: 1.11° C
input Current LOC Setpt Arm: 2 A
input Mode Rgltn LOC Setpt Arm: 130 V

'LOC Setpt'

**cmd LOC Setpt Arm**

input Batt Htr Off Temp LOC Setpt: 1.67° C
input Batt Htr On Temp LOC Setpt: 1.11° C
input Current LOC Setpt: 2 A
input Mode Rgltn LOC Setpt: 130 V

'LOC Setpt'

**cmd LOC Setpt**

√Batt Htr Off Temp: 1.67° C
√Batt Htr On Temp: 1.11° C
√Current: 2 A
√Mode Rgltn: 130 V

1.5 Channel 2B BCDU 2B2 Update

P6: EPS: Energy Storage 2B
Energy Storage 2B
'BCDU 2B2'

sel Conv

<table>
<thead>
<tr>
<th>BCDU 2B2 ConverterFI</th>
</tr>
</thead>
<tbody>
<tr>
<td>'BCDU LOC Setpts'</td>
</tr>
</tbody>
</table>

input Batt Htr Off Temp LOC Setpt Arm: 1.67° C
input Batt Htr On Temp LOC Setpt Arm: 1.11° C
input Current LOC Setpt Arm: 2 A
input Mode Rgltn LOC Setpt Arm: 130 V

'LOC Setpt'

**cmd LOC Setpt Arm**

input Batt Htr Off Temp LOC Setpt: 1.67° C
input Batt Htr On Temp LOC Setpt: 1.11° C
input Current LOC Setpt: 2 A
input Mode Rgltn LOC Setpt: 130 V

'LOC Setpt'
1.6 Channel 2B BCDU 2B3 Update

P6: EPS: Energy Storage 2B

Energy Storage 2B

‘BCDU 2B3’

sel Conv

BCDU 2B3 ConverterFI

‘BCDU LOC Setpts’

input Batt Htr Off Temp LOC Setpt Arm: 1.67° C
input Batt Htr On Temp LOC Setpt Arm: 1.11° C
input Current LOC Setpt Arm: 2 A
input Mode Rgltn LOC Setpt Arm: 130 V

‘LOC Setpt’

cmd LOC Setpt Arm

input Batt Htr Off Temp LOC Setpt: 1.67° C
input Batt Htr On Temp LOC Setpt: 1.11° C
input Current LOC Setpt: 2 A
input Mode Rgltn LOC Setpt: 130 V

‘LOC Setpt’

cmd LOC Setpt

√Batt Htr Off Temp: 1.67° C
√Batt Htr On Temp: 1.11° C
√Current: 2 A
√Mode Rgltn: 130 V

2. CONFIGURING FUNCTIONAL INHIBITS TO ENABLE BATTERY HEATER CONTROL FOR CHANNEL 4B AND 2B

2.1 Enabling Battery Heater Control for String 4B1

PCS

P6: EPS: Energy Storage 4B

Energy Storage 4B

‘BCDU 4B1’

sel Software Inhibits

BCDU 4B1 Software
2.2 Enabling Battery Heater Control for String 4B2

P6: EPS: Energy Storage 4B

Energy Storage 4B
'BCDU 4B2'

sel Software Inhibits

BCDU 4B2 Software

cmd Htr Power Cntl – Ena Arm
cmd Htr Power Cntl – Ena

√Htr Power Cntl – Ena

sel BCDU 4B2 SoftwareBU

BCDU 4B2 Software BU

cmd Htr Power Cntl – Ena Arm
cmd Htr Power Cntl – Ena

√Htr Power Cntl – Ena

Energy Storage 4B
'BCDU 4B2'

√Htr Sw A – Open
√Htr Sw B – Open

Energy Storage 4B
'BCDU 4B2'

√Htr Sw A – Open
√Htr Sw B – Open
2.3 Enabling Battery Heater Control for String 4B3

P6: EPS: Energy Storage 4B

Energy Storage 4B

'BCDU 4B3' sel Software Inhibits

BCDU 4B3 Software

cmd Htr Power Cntl – Ena Arm

cmd Htr Power Cntl – Ena

√ Htr Power Cntl – Ena

sel BCDU 4B3 Software BU

BCDU 4B3 Software BU

cmd Htr Power Cntl – Ena Arm

cmd Htr Power Cntl – Ena

√ Htr Power Cntl – Ena

Energy Storage 4B

'BCDU 4B3'

√ Htr Sw A – Open

√ Htr Sw B – Open

2.4 Enabling Battery Heater Control for String 2B1

P6: EPS: Energy Storage 2B

Energy Storage 2B

'BCDU 2B1' sel Software Inhibits

BCDU 2B1 Software

cmd Htr Power Cntl – Ena Arm

cmd Htr Power Cntl – Ena

√ Htr Power Cntl – Ena

sel BCDU 2B1 Software BU

BCDU 2B1 Software BU

cmd Htr Power Cntl – Ena Arm

cmd Htr Power Cntl – Ena
2.5 Enabling Battery Heater Control for String 2B2
P6: EPS: Energy Storage 2B
Energy Storage 2B
‘BCDU 2B2’

sel Software Inhibits

[BCDU 2B2 Software]

cmd Htr Power Cntl – Ena Arm
cmd Htr Power Cntl – Ena

√ Htr Power Cntl – Ena

sel BCDU 2B2 Software BU

[BCDU 2B2 Software BU]

cmd Htr Power Cntl – Ena Arm
cmd Htr Power Cntl – Ena

√ Htr Power Cntl – Ena

[Energy Storage 2B]
‘BCDU 2B2’

√ Htr Sw A – Open
√ Htr Sw B – Open

2.6 Enabling Battery Heater Control for String 2B3
P6: EPS: Energy Storage 2B
Energy Storage 2B
‘BCDU 2B3’

sel Software Inhibits

[BCDU 2B3 Software]

cmd Htr Power Cntl – Ena Arm
cmd Htr Power Cntl – Ena

√ Htr Sw A – Open
√ Htr Sw B – Open
√Htr Power Cntl – Ena
sel BCDU 2B3 Software BU

BCDU 2B3 Software BU

**cmd** Htr Power Cntl – Ena Arm
**cmd** Htr Power Cntl – Ena

√Htr Power Cntl – Ena

Energy Storage 2B
‘BCDU 2B3’

√Htr Sw A – Open
√Htr Sw B – Open

3. **CONFIGURING SSU 4B AND 2B PVCEs FOR POWER OUTPUT**

3.1 Commanding SSU 4B PVCEs On
P6: EPS: SSU 4B

SSU 4B

sel PVCE

SSU 4B PVCE

**cmd** All PVCEs – On Arm
**cmd** All PVCEs – On

SSU 4B
‘Error Signal Selected’

√1 – Yes
√2 – Yes
√3 – Yes

3.2 Commanding SSU 2B PVCEs On
P6: EPS: SSU 2B

SSU 2B

sel PVCE

SSU 2B PVCE

**cmd** All PVCEs – On Arm
**cmd** All PVCEs – On

SSU 2B
‘Error Signal Selected’
4. CONFIGURING BATTERY HEATER CONTROL FOR CHANNEL 4B AND 2B

4.1 Enabling Battery Heater Control for String 4B1

PCS
P6: EPS: Energy Storage 4B
Energy Storage 4B
'BCDU 4B1'

Sel Software Inhibits

[BCDU 4B1 Software]

Cmd Batt 4B11 Htr Cntl – Ena Arm
Cmd Batt 4B11 Htr Cntl – Ena

√ Batt 4B11 Htr Cntl – Ena

Cmd Batt 4B12 Htr Cntl – Ena Arm
Cmd Batt 4B12 Htr Cntl – Ena

√ Batt 4B12 Htr Cntl – Ena

Sel BCDU 4B1 Software BU

[BCDU 4B1 Software BU]

Cmd Batt 4B11 Htr Cntl Ena Arm
Cmd Batt 4B11 Htr Cntl Ena

√ Batt 4B11 Htr Cntl – Ena

Cmd Batt 4B12 Htr Cntl – Ena Arm
Cmd Batt 4B12 Htr Cntl – Ena

√ Batt 4B12 Htr Cntl – Ena

4.2 Enabling Battery Heater Control for String 4B2

PCS
P6: EPS: Energy Storage 4B
Energy Storage 4B
'BCDU 4B2'

Sel Software Inhibits

[BCDU 4B2 Software]

Cmd Batt 4B21 Htr Cntl – Ena Arm
Cmd Batt 4B21 Htr Cntl – Ena

√ Batt 4B21 Htr Cntl – Ena
4.3 Enabling Battery Heater Control for String 4B3

 sel BCDU 4B3 SoftwareBU

 select BCDU 4B3 SoftwareBU

 cmd Batt 4B31 Htr Cntl – Ena Arm
 cmd Batt 4B31 Htr Cntl – Ena

 √ Batt 4B31 Htr Cntl – Ena

 cmd Batt 4B32 Htr Cntl – Ena Arm
 cmd Batt 4B32 Htr Cntl – Ena

 √ Batt 4B32 Htr Cntl – Ena

 sel BCDU 4B3 SoftwareBU

 select BCDU 4B3 SoftwareBU

 cmd Batt 4B31 Htr Cntl – Ena Arm
 cmd Batt 4B31 Htr Cntl – Ena

 √ Batt 4B31 Htr Cntl – Ena
4.4 Enabling Battery Heater Control for String 2B1

P6: EPS: Energy Storage 2B

Energy Storage 2B

'BCDU 2B1'

sel Software Inhibits

BCDU 2B1 Software

cmd Batt 2B11 Htr Cntl – Ena Arm

Batt 2B11 Htr Cntl – Ena

cmd Batt 2B11 Htr Cntl – Ena

cmd Batt 2B12 Htr Cntl – Ena Arm

Batt 2B12 Htr Cntl – Ena

cmd Batt 2B12 Htr Cntl – Ena

4.5 Enabling Battery Heater Control for String 2B2

P6: EPS: Energy Storage 2B

Energy Storage 2B

'BCDU 2B2'

sel Software Inhibits

BCDU 2B2 Software

cmd Batt 2B21 Htr Cntl – Ena Arm

cmd Batt 2B21 Htr Cntl – Ena
4.6 Enabling Battery Heater Control for String 2B3

P6: EPS: Energy Storage 2B

 sel Software Inhibits

 sel BCDU 2B3 SoftwareBU

 cmd Batt 2B31 Htr Cntl – Ena Arm
 cmd Batt 2B31 Htr Cntl – Ena

 sel BCDU 2B3 SoftwareBU

 cmd Batt 2B31 Htr Cntl – Ena Arm
 cmd Batt 2B31 Htr Cntl – Ena

 sel BCDU 2B3 SoftwareBU

 cmd Batt 2B31 Htr Cntl – Ena Arm
 cmd Batt 2B31 Htr Cntl – Ena
5. VERIFYING SSU OUTPUT VOLTAGE AND BCDU HEATER SWITCH CONFIGURATION FOR CHANNEL 4B

**NOTE**
It is necessary to verify all BCDUs Heater Switches A, B are operating properly in insolation, transition from insolation to eclipse, and in eclipse prior to continuing with battery charging.

P6: EPS
P6 EPS
‘Orbit’

If in Insolation
sel SSU 4B

‘Output’

\(\sqrt{\text{Output Voltage: 163 --- 171 V}}\)

Energy Storage 4B
‘BCDU 4B1’

\(\sqrt{\text{Primary Voltage: 163 --- 171 V}}\)
\(\sqrt{\text{Htr Sw A,B – Closed}}\)

‘BCDU 4B2’

\(\sqrt{\text{Primary Voltage: 163 --- 171 V}}\)
\(\sqrt{\text{Htr Sw A,B – Closed}}\)

‘BCDU 4B3’

\(\sqrt{\text{Primary Voltage: 163 --- 171 V}}\)
\(\sqrt{\text{Htr Sw A,B – Closed}}\)

Energy Storage 2B
‘BCDU 2B1’
Primary Voltage: 163 --- 171 V
Htr Sw A,B – Closed

‘BCDU 2B2’

Primary Voltage: 163 --- 171 V
Htr Sw A,B – Closed

‘BCDU 2B3’

Primary Voltage: 163 --- 171 V
Htr Sw A,B – Closed

‘BCDU 2B4’

---

P6 EPS

‘Orbit’

If in Transition from Insolation to Eclipse (lasts for ~180 seconds)

sel SSU 4B
‘Output’

Output Voltage: 145 --- 155 V

Energy Storage 4B

‘BCDU 4B1’

Primary Voltage: 145 --- 155 V
Htr Sw A,B – Open

‘BCDU 4B2’

Primary Voltage: 145 --- 155 V
Htr Sw A,B – Open

‘BCDU 4B3’

Primary Voltage: 145 --- 155 V
Htr Sw A,B – Open

P6 EPS

sel SSU 2B
‘Output’

Output Voltage: 145 --- 155 V

Energy Storage 2B

‘BCDU 2B1’
Primary Voltage: 145 --- 155 V
Htr Sw A,B – Open

'BCDU 2B2'

Primary Voltage: 145 --- 155 V
Htr Sw A,B – Open

'BCDU 2B3'

Primary Voltage: 145 --- 155 V
Htr Sw A,B – Open

'BCDU 2B3'

Primary Voltage: 145 --- 155 V
Htr Sw A,B – Open

'BCDU 2B3'

Primary Voltage: 145 --- 155 V
Htr Sw A,B – Open

'BCDU 2B3'

Primary Voltage: 131 --- 149 V

Energy Storage 4B

'BCDU 4B1'

Primary Voltage: 131 --- 149 V
Htr Sw A,B – Open

'BCDU 4B2'

Primary Voltage: 131 --- 149 V
Htr Sw A,B – Open

'BCDU 4B3'

Primary Voltage: 131 --- 149 V
Htr Sw A,B – Open

Energy Storage 2B

'BCDU 2B1'
Primary Voltage: 131 --- 149 V
Htr Sw A,B – Open
‘BCDU 2B2’

Primary Voltage: 131 --- 149 V
Htr Sw A,B – Open
‘BCDU 2B3’

Primary Voltage: 131 --- 149 V
Htr Sw A,B – Open

6. MONITORING AND ENSURING BATTERY PARAMETERS ARE WITHIN ACCEPTABLE RANGE FOR CHANNEL 4B AND 2B

6.1 Monitoring Channel 4B

NOTE
1. Check both the insolation and eclipse columns in Table 1.
2. Thermal conditioning complete when all battery cell temps (02, 08, 20, 28) on all BCDUs have reached 0 --- 10° C.
3. The following Caution messages will be cleared when battery thermal conditioning complete
   ‘Batt 4B11 Temp Out of Range - P6’
   ‘Batt 4B12 Temp Out of Range - P6’
   ‘Batt 4B21 Temp Out of Range - P6’
   ‘Batt 4B22 Temp Out of Range - P6’
   ‘Batt 4B31 Temp Out of Range - P6’
   ‘Batt 4B32 Temp Out of Range - P6’
   ‘PVTCS PFCS 4B Warm Flow Control Valve Recalibration In Prog - P6’
### Table 1. Insolation, Eclipse Parameters

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Insolation</th>
<th>Eclipse</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Storage 4B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>‘BCDU 4B1,2,3’</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary Voltage</td>
<td>150 or 167 V</td>
<td>131 --- 149 V</td>
</tr>
<tr>
<td>Htr Sw A,B</td>
<td>Closed if Primary Voltage &gt; 161 V</td>
<td>Open</td>
</tr>
<tr>
<td></td>
<td>Open if Primary Voltage &lt; 155 V</td>
<td></td>
</tr>
<tr>
<td>‘Battery 4B11,12,21,22,31,32’</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Htr 1 Sw Posn</td>
<td>Op if Avg Temp &gt; 1.7° C</td>
<td>Op</td>
</tr>
<tr>
<td></td>
<td>Cl if Avg Temp &lt; 1.1° C</td>
<td></td>
</tr>
<tr>
<td>Htr 2 Sw Posn</td>
<td>Op</td>
<td>Op</td>
</tr>
</tbody>
</table>

 sel BCDU 4B [X] where [X] = [1 2 3]

 sel Cells

 Batt 4B [X] where [X] = [11 12 21 22 31 32]

 ‘Cells’

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>02 Temp</td>
<td>0 --- 10° C</td>
<td>0 --- 10° C</td>
</tr>
<tr>
<td>08 Temp</td>
<td>0 --- 10° C</td>
<td>0 --- 10° C</td>
</tr>
<tr>
<td>20 Temp</td>
<td>0 --- 10° C</td>
<td>0 --- 10° C</td>
</tr>
<tr>
<td>28 Temp</td>
<td>0 --- 10° C</td>
<td>0 --- 10° C</td>
</tr>
</tbody>
</table>

 ‘Cells’

 Press A          | < 10343 mmHg      | < 10343 mmHg      |
 Press B          | < 10343 mmHg      | < 10343 mmHg      |
 Press C          | < 10343 mmHg      | < 10343 mmHg      |
 Press D          | < 10343 mmHg      | < 10343 mmHg      |

Repeat

### 6.2 Monitoring Channel 2B

**NOTE**

1. Check both the insolation and eclipse columns in Table 2.

2. Thermal conditioning complete when all battery cell temps (02, 08, 20, 28) on all BCDUs have reached 0 --- 10 deg C.

3. The following Caution messages will be cleared when battery thermal conditioning complete:

   ‘Batt 2B11 Temp Out of Range - P6’
   ‘Batt 2B12 Temp Out of Range - P6’
   ‘Batt 2B21 Temp Out of Range - P6’
   ‘Batt 2B22 Temp Out of Range - P6’
   ‘Batt 2B31 Temp Out of Range - P6’
   ‘Batt 2B32 Temp Out of Range - P6’
   ‘PVTCS PFCS 2B Warm Flow Control Valve Recalibration In Prog - P6’
Table 2. Insolation, Eclipse Parameters

<table>
<thead>
<tr>
<th>PARAMETERS</th>
<th>INSOLATION</th>
<th>ECLIPSE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Energy Storage 2B</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>‘BCDU 2B1,2,3’</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary Voltage</td>
<td>150 or 167 V</td>
<td>131 --- 149 V</td>
</tr>
<tr>
<td>Htr Sw A,B</td>
<td>Closed if Primary Voltage &gt; 161 V</td>
<td>Open</td>
</tr>
<tr>
<td></td>
<td>Open if Primary Voltage &lt; 155 V</td>
<td></td>
</tr>
<tr>
<td>‘Battery 2B11,12,21,22,31,32’</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Htr 1 Sw Posn</td>
<td>Op if Avg Temp &gt; 1.7° C</td>
<td>Op</td>
</tr>
<tr>
<td></td>
<td>Cl if Avg Temp &lt; 1.1° C</td>
<td></td>
</tr>
<tr>
<td>Htr 2 Sw Posn</td>
<td>Op</td>
<td>Op</td>
</tr>
<tr>
<td>sel BCDU 2B [X]</td>
<td>where [X] = 1 2 3</td>
<td></td>
</tr>
<tr>
<td>‘Cells’</td>
<td></td>
<td></td>
</tr>
<tr>
<td>02 Temp</td>
<td>0 --- 10° C</td>
<td>0 --- 10° C</td>
</tr>
<tr>
<td>08 Temp</td>
<td>0 --- 10° C</td>
<td>0 --- 10° C</td>
</tr>
<tr>
<td>20 Temp</td>
<td>0 --- 10° C</td>
<td>0 --- 10° C</td>
</tr>
<tr>
<td>28 Temp</td>
<td>0 --- 10° C</td>
<td>0 --- 10° C</td>
</tr>
<tr>
<td>‘Cells’</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Press A</td>
<td>&lt; 10343 mmHg</td>
<td>&lt; 10343 mmHg</td>
</tr>
<tr>
<td>Press B</td>
<td>&lt; 10343 mmHg</td>
<td>&lt; 10343 mmHg</td>
</tr>
<tr>
<td>Press C</td>
<td>&lt; 10343 mmHg</td>
<td>&lt; 10343 mmHg</td>
</tr>
<tr>
<td>Press D</td>
<td>&lt; 10343 mmHg</td>
<td>&lt; 10343 mmHg</td>
</tr>
<tr>
<td>Repeat</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

7. **ENABLING BATTERY THERMAL TRIP FOR CHANNEL 4B AND 2B**

7.1 **Enabling String 4B1**

PCS

P6: EPS: Energy Storage 4B

Energy Storage 4B

‘BCDU 4B1’

sel Software Inhibits

BCDU 4B1 Software

**cmd** Batt 4B11 Thermal Trip – Ena Arm

**cmd** Batt 4B11 Thermal Trip – Ena

√Batt 4B11 Thermal Trip – Ena

**cmd** Batt 4B12 Thermal Trip – Ena Arm

**cmd** Batt 4B12 Thermal Trip – Ena

√Batt 4B12 Thermal Trip – Ena
P6 CH 4B,2B BATTERY THERMAL CONDITIONING

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sel BCDU 4B1 SoftwareBU

**BCDU 4B1 Software BU**

- **cmd** Batt 4B11 Thermal Trip – Ena Arm
- **cmd** Batt 4B11 Thermal Trip – Ena

√Batt 4B11 Thermal Trip – Ena

- **cmd** Batt 4B12 Thermal Trip – Ena Arm
- **cmd** Batt 4B12 Thermal Trip – Ena

√Batt 4B12 Thermal Trip – Ena

7.2 Enabling String 4B2

P6: EPS: Energy Storage 4B

**Energy Storage 4B**

‘BCDU 4B2’

sel Software Inhibits

**BCDU 4B2 Software**

- **cmd** Batt 4B21 Thermal Trip – Ena Arm
- **cmd** Batt 4B21 Thermal Trip – Ena

√Batt 4B21 Thermal Trip – Ena

- **cmd** Batt 4B22 Thermal Trip – Ena Arm
- **cmd** Batt 4B22 Thermal Trip – Ena

√Batt 4B22 Thermal Trip – Ena

sel BCDU 4B2 SoftwareBU

**BCDU 4B2 Software BU**

- **cmd** Batt 4B21 Thermal Trip – Ena Arm
- **cmd** Batt 4B21 Thermal Trip – Ena

√Batt 4B21 Thermal Trip – Ena

- **cmd** Batt 4B22 Thermal Trip – Ena Arm
- **cmd** Batt 4B22 Thermal Trip – Ena

√Batt 4B22 Thermal Trip – Ena
7.3  Enabling String 4B3
P6: EPS: Energy Storage 4B

 sel BCDU 4B3 Software

 cmd Batt 4B31 Thermal Trip – Ena Arm
 cmd Batt 4B31 Thermal Trip – Ena

√ Batt 4B31 Thermal Trip – Ena

 cmd Batt 4B32 Thermal Trip – Ena Arm
 cmd Batt 4B32 Thermal Trip – Ena

√ Batt 4B32 Thermal Trip – Ena

 sel BCDU 4B3 Software BU

 BCDU 4B3 Software BU

 cmd Batt 4B31 Thermal Trip – Ena Arm
 cmd Batt 4B31 Thermal Trip – Ena

√ Batt 4B31 Thermal Trip – Ena

 cmd Batt 4B32 Thermal Trip – Ena Arm
 cmd Batt 4B32 Thermal Trip – Ena

√ Batt 4B32 Thermal Trip – Ena

7.4  Enabling String 2B1
P6: EPS: Energy Storage 2B

 sel BCDU 2B1 Software

 BCDU 2B1 Software

 cmd Batt 2B11 Thermal Trip – Ena Arm
 cmd Batt 2B11 Thermal Trip – Ena

√ Batt 2B11 Thermal Trip – Ena

 cmd Batt 2B12 Thermal Trip – Ena Arm
 cmd Batt 2B12 Thermal Trip – Ena

√ Batt 2B12 Thermal Trip – Ena
Batt 2B12 Thermal Trip – Ena

sel BCDU 2B1 Software BU

BCDU 2B1 Software BU

cmd Batt 2B11 Thermal Trip – Ena Arm
cmd Batt 2B11 Thermal Trip – Ena

Batt 2B11 Thermal Trip – Ena

cmd Batt 2B12 Thermal Trip – Ena Arm
cmd Batt 2B12 Thermal Trip – Ena

Batt 2B12 Thermal Trip – Ena

7.5 **Enabling String 2B2**
P6: EPS: Energy Storage 2B

Energy Storage 2B

‘BCDU 2B2’

sel Software Inhibits

BCDU 2B2 Software

cmd Batt 2B21 Thermal Trip – Ena Arm
cmd Batt 2B21 Thermal Trip – Ena

Batt 2B21 Thermal Trip – Ena

cmd Batt 2B22 Thermal Trip – Ena Arm
cmd Batt 2B22 Thermal Trip – Ena

Batt 2B22 Thermal Trip – Ena

sel BCDU 2B2 Software BU

BCDU 2B2 Software BU

cmd Batt 2B21 Thermal Trip – Ena Arm
cmd Batt 2B21 Thermal Trip – Ena

Batt 2B21 Thermal Trip – Ena

cmd Batt 2B22 Thermal Trip – Ena Arm
cmd Batt 2B22 Thermal Trip – Ena

Batt 2B22 Thermal Trip – Ena
7.6 Enabling String 2B3

P6: EPS: Energy Storage 2B

Energy Storage 2B

'BCDU 2B3'

sel Software Inhibits

[BCDU 2B3 Software]

**cmd** Batt 2B31 Thermal Trip – Ena Arm

**cmd** Batt 2B31 Thermal Trip – Ena

√ Batt 2B31 Thermal Trip – Ena

**cmd** Batt 2B32 Thermal Trip – Ena Arm

**cmd** Batt 2B32 Thermal Trip – Ena

√ Batt 2B32 Thermal Trip – Ena

sel BCDU 2B3 Software BU

[BCDU 2B3 Software BU]

**cmd** Batt 2B31 Thermal Trip – Ena Arm

**cmd** Batt 2B31 Thermal Trip – Ena

√ Batt 2B31 Thermal Trip – Ena

**cmd** Batt 2B32 Thermal Trip – Ena Arm

**cmd** Batt 2B32 Thermal Trip – Ena

√ Batt 2B32 Thermal Trip – Ena
1. CHANNEL 4B, 2B BATTERY DISCHARGE CONTROL ENABLE

1.1 Enabling Channel 4B String 4B1

P6: EPS: Energy Storage 4B

Energy Storage 4B

'BCDU 4B1'

- sel Software Inhibits

  BCDU 4B1 Software

- cmd Discharge Cntl – Ena Arm
- cmd Discharge Cntl – Ena

- √ Discharge Cntl – Ena

- sel BCDU 4B1 Software BU

  BCDU 4B1 Software BU

- cmd Discharge Cntl – Ena Arm
- cmd Discharge Cntl – Ena

- √ Discharge Cntl – Ena

1.2 Enabling Channel 4B String 4B2

Energy Storage 4B

'BCDU 4B2'

- sel Software Inhibits

  BCDU 4B2 Software

- cmd Discharge Cntl – Ena Arm
- cmd Discharge Cntl – Ena

- √ Discharge Cntl – Ena

- sel BCDU 4B2 Software BU

  BCDU 4B2 Software BU

- cmd Discharge Cntl – Ena Arm
- cmd Discharge Cntl – Ena

- √ Discharge Cntl – Ena
1.3 **Enabling Channel 4B String 4B3**

*Energy Storage 4B*

'BCDU 4B3’

- sel Software Inhibits

**BCDU 4B3 Software**

- cmd Discharge Cntl – Ena Arm
  - cmd Discharge Cntl – Ena

√Discharge Cntl – Ena

- sel BCDU 4B3 Software BU

**BCDU 4B3 Software BU**

- cmd Discharge Cntl – Ena Arm
  - cmd Discharge Cntl – Ena

√Discharge Cntl – Ena

1.4 **Enabling Channel 2B String 2B1**

*P6: EPS: Energy Storage 2B*

<table>
<thead>
<tr>
<th>Energy Storage 2B</th>
</tr>
</thead>
<tbody>
<tr>
<td>'BCDU 2B1’</td>
</tr>
</tbody>
</table>

- sel Software Inhibits

**BCDU 2B1 Software**

- cmd Discharge Cntl – Ena Arm
  - cmd Discharge Cntl – Ena

√Discharge Cntl – Ena

- sel BCDU 2B1 Software BU

**BCDU 2B1 Software BU**

- cmd Discharge Cntl – Ena Arm
  - cmd Discharge Cntl – Ena

√Discharge Cntl – Ena
1.5 Enabling Channel 2B String 2B2

Energy Storage 2B

‘BCDU 2B2’

sel Software Inhibits

BCDU 2B2 Software

`cmd` Discharge Cntl – Ena Arm
`cmd` Discharge Cntl – Ena

√Discharge Cntl – Ena

sel BCDU 2B2 SoftwareBU

BCDU 2B2 Software BU

`cmd` Discharge Cntl – Ena Arm
`cmd` Discharge Cntl – Ena

1.6 Enabling Channel 2B String 2B3

Energy Storage 2B

√Discharge Cntl – Ena

‘BCDU 2B3’

sel Software Inhibits

BCDU 2B3 Software

`cmd` Discharge Cntl – Ena Arm
`cmd` Discharge Cntl – Ena

√Discharge Cntl – Ena

sel BCDU 2B3 SoftwareBU

BCDU 2B3 Software

`cmd` Discharge Cntl – Ena Arm
`cmd` Discharge Cntl – Ena

√Discharge Cntl – Ena
2. **VERIFYING FI AND CONVERTER CONFIGURATION FOR CHANNEL 4B,2B**

   P6: EPS

   **P6: EPS**

   ‘Orbit’

   If in Eclipse  
   sel Energy Storage 4B

   ![Energy Storage 4B]
   ![‘BCDU 4B1, 4B2, 4B3’]

   √FI – Open
   √Conv – Off

   ![P6: EPS]

   sel Energy Storage 2B

   ![Energy Storage 2B]
   ![‘BCDU 2B1, 2B2, 2B3’]

   √FI – Open
   √Conv – Off

   If in Insolation  
   sel Energy Storage 4B

   ![Energy Storage 4B]
   ![‘BCDU 4B1, 4B2, 4B3’]

   √FI – Closed
   √Conv – On

   ![P6: EPS]

   sel Energy Storage 2B

   ![Energy Storage 2B]
   ![‘BCDU 2B1, 2B2, 2B3’]

   √FI – Closed
   √Conv – On
### 3. MONITORING FOR COMPLETION OF BATTERY CHARGING FOR CHANNEL 4B,2B

<table>
<thead>
<tr>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Battery charging may require four orbits.</td>
</tr>
<tr>
<td>2. Expect the following Caution messages when station transition to eclipse</td>
</tr>
<tr>
<td>- 'BCDU 4B1,2B1 Trip - P6'</td>
</tr>
<tr>
<td>- 'BCDU 4B2,2B2 Trip - P6'</td>
</tr>
<tr>
<td>- 'BCDU 4B3,2B3 Trip - P6'</td>
</tr>
<tr>
<td>3. Expect the following Advisory messages during the first eclipse of the battery charging and then they will clear</td>
</tr>
<tr>
<td>- 'BCDU 4B1,2B1 Battery did not reach 100% SOC - P6'</td>
</tr>
<tr>
<td>- 'BCDU 4B2,2B2 Battery did not reach 100% SOC - P6'</td>
</tr>
<tr>
<td>- 'BCDU 4B3,2B3 Battery did not reach 100% SOC - P6'</td>
</tr>
<tr>
<td>4. The following Caution messages will be cleared when each battery cell voltage is greater than 0.4 volt</td>
</tr>
<tr>
<td>- 'Batt 4B11,2B11 Undervoltage condition - P6'</td>
</tr>
<tr>
<td>- 'Batt 4B12,2B12 Undervoltage condition - P6'</td>
</tr>
<tr>
<td>- 'Batt 4B21,2B21 Undervoltage condition - P6'</td>
</tr>
<tr>
<td>- 'Batt 4B22,2B22 Undervoltage condition - P6'</td>
</tr>
<tr>
<td>- 'Batt 4B31,2B31 Undervoltage condition - P6'</td>
</tr>
<tr>
<td>- 'Batt 4B32,2B32 Undervoltage condition - P6'</td>
</tr>
<tr>
<td>5. The following Advisory messages will be cleared when each Battery reaches its nominal range</td>
</tr>
<tr>
<td>- 'Batt 4B11,2B11 Measurement Out Of Range - P6'</td>
</tr>
<tr>
<td>- 'Batt 4B12,2B12 Measurement Out Of Range - P6'</td>
</tr>
<tr>
<td>- 'Batt 4B21,2B21 Measurement Out Of Range - P6'</td>
</tr>
<tr>
<td>- 'Batt 4B22,2B22 Measurement Out Of Range - P6'</td>
</tr>
<tr>
<td>- 'Batt 4B31,2B31 Measurement Out Of Range - P6'</td>
</tr>
<tr>
<td>- 'Batt 4B32,2B32 Measurement Out Of Range - P6'</td>
</tr>
<tr>
<td>6. The following Caution messages will be cleared when each Battery exceeds 35 % SOC</td>
</tr>
<tr>
<td>- 'BCDU 4B1,2B1 Battery SOC Low Failure - P6'</td>
</tr>
<tr>
<td>- 'BCDU 4B2,2B2 Battery SOC Low Failure - P6'</td>
</tr>
<tr>
<td>- 'BCDU 4B3,2B3 Battery SOC Low Failure - P6'</td>
</tr>
</tbody>
</table>
## P6 CH 4B(2B) BATTERY CHARGING

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### Energy Storage 4B

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Insolation</th>
<th>Eclipse</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>BCDU 4B1,2,3</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conv</td>
<td>On</td>
<td>Off</td>
</tr>
<tr>
<td>FI</td>
<td>Closed</td>
<td>Open</td>
</tr>
<tr>
<td>Primary Voltage</td>
<td>146 -- 171</td>
<td>131 -- 149</td>
</tr>
<tr>
<td>Primary Current</td>
<td>1.0 to -30.0 A ± X where (1 ≤ X ≤ 10 A sensor error ± 5 A) or (10 &lt; X sensor error ± 2.4 A)</td>
<td>&lt; 3.0 A</td>
</tr>
<tr>
<td>FI Input Voltage</td>
<td>112.0 --- 130.0 ± 3.8 V</td>
<td>&lt; 4.0 ± 3.8 V</td>
</tr>
<tr>
<td>FI Input Current</td>
<td>1.0 --- 30.0 A</td>
<td>&lt; 2.0 A</td>
</tr>
<tr>
<td>Battery Voltage</td>
<td>112.0 --- 130.0 ± 3.8 V</td>
<td>112.0 --- 130.0 ± 3.8 V</td>
</tr>
<tr>
<td>Battery Current</td>
<td>1.0 to -30.0 A ± X where (1 ≤ X ≤ 10 A sensor error ± 5 A) or (10 &lt; X sensor error ± 2.4 A)</td>
<td>&lt; 2.0 A</td>
</tr>
<tr>
<td>Htr Sw A,B</td>
<td>Closed if Primary Voltage &gt; 161 V</td>
<td>Open</td>
</tr>
<tr>
<td>SOC%</td>
<td>0 --- 100 %</td>
<td>0 --- 100 %</td>
</tr>
<tr>
<td>Vbus</td>
<td>56.0 --- 65.0 V</td>
<td>56.0 --- 65.0 V</td>
</tr>
<tr>
<td>Avg Temp</td>
<td>0 --- 10° C</td>
<td>0 --- 10° C</td>
</tr>
<tr>
<td>Avg Press</td>
<td>3447 --- 6890 kPa</td>
<td>3447 --- 6890 kPa</td>
</tr>
</tbody>
</table>

### Energy Storage 2B

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Insolation</th>
<th>Eclipse</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>BCDU 2B1,2,3</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conv</td>
<td>On</td>
<td>Off</td>
</tr>
<tr>
<td>FI</td>
<td>Closed</td>
<td>Open</td>
</tr>
<tr>
<td>Primary Voltage</td>
<td>146 -- 171</td>
<td>131 -- 149</td>
</tr>
<tr>
<td>Primary Current</td>
<td>1.0 to -30.0 A ± where (1 ≤ X ≤ 10 A sensor error ± 5 A) or (10 &lt; X sensor error ± 2.4 A)</td>
<td>&lt; 3.0 A</td>
</tr>
<tr>
<td>FI Input Voltage</td>
<td>112.0 --- 130.0 ± 3.8 V</td>
<td>&lt; 4.0 ± 3.8 V</td>
</tr>
<tr>
<td>FI Input Current</td>
<td>1.0 --- 30.0 A</td>
<td>&lt; 2.0 A</td>
</tr>
<tr>
<td>Battery Voltage</td>
<td>112.0 --- 130.0 ± 3.8 V</td>
<td>112.0 --- 130.0 ± 3.8 V</td>
</tr>
<tr>
<td>Battery Current</td>
<td>1.0 to -30.0 A ± X where (1 ≤ X ≤ 10 A sensor error ± 5 A) or (10 &lt; X sensor error ± 2.4 A)</td>
<td>&lt; 2.0 A</td>
</tr>
<tr>
<td>Htr Sw A,B</td>
<td>Closed if Primary Voltage &gt; 161 V</td>
<td>Open</td>
</tr>
<tr>
<td>SOC%</td>
<td>0 --- 100 %</td>
<td>0 --- 100 %</td>
</tr>
<tr>
<td>Vbus</td>
<td>56.0 --- 65.0 V</td>
<td>56.0 --- 65.0 V</td>
</tr>
<tr>
<td>Avg Temp</td>
<td>0 --- 10° C</td>
<td>0 --- 10° C</td>
</tr>
<tr>
<td>Avg Press</td>
<td>3447 --- 6890 kPa</td>
<td>3447 --- 6890 kPa</td>
</tr>
</tbody>
</table>

10 NOV 00
NOTE
Reverse polarity protection can be enabled once battery cell voltages exceed 1 V.

4. **ENABLING BATTERY REVERSE POLARITY PROTECTION FOR CHANNEL 4B AND 2B**

**NOTE**
Channel 4B and 2B battery reverse polarity is a single step command. Enable Arm is not required.

### 4.1 Channel 4B String 4B1

PCS

P6: EPS: Energy Storage 4B

<table>
<thead>
<tr>
<th>Energy Storage 4B</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCDU 4B1</td>
</tr>
</tbody>
</table>

sel Software Inhibits

**BCDU 4B1 Software**

**cmd** Batt 4B11 Rev Polarity – Ena

√Batt 4B11 Rev Polarity – Ena

**cmd** Batt 4B12 Rev Polarity – Ena

√Batt 4B12 Rev Polarity – Ena

sel BCDU 4B1 Software BU

**BCDU 4B1 Software BU**

**cmd** Batt 4B11 Rev Polarity – Ena

√Batt 4B11 Rev Polarity – Ena

**cmd** Batt 4B12 Rev Polarity – Ena

√Batt 4B12 Rev Polarity – Ena

### 4.2 Channel 4B String 4B2

Energy Storage 4B

| BCDU 4B2 |

sel Software Inhibits

**BCDU 4B2 Software**
4.3 Channel 4B String 4B3

Energy Storage 4B

'BCDU 4B3'

sel Software Inhibits

BCDU 4B3 Software

cmd Batt 4B31 Rev Polarity – Ena

√Batt 4B31 Rev Polarity – Ena

cmd Batt 4B32 Rev Polarity – Ena

√Batt 4B32 Rev Polarity – Ena

sel BCDU 4B3 SoftwareBU

BCDU 4B3 Software BU

cmd Batt 4B31 Rev Polarity – Ena

√Batt 4B31 Rev Polarity – Ena

cmd Batt 4B32 Rev Polarity – Ena

√Batt 4B32 Rev Polarity – Ena
4.4 Channel 2B String 2B1
P6: EPS: Energy Storage 2B

Energy Storage 2B
‘BCDU 2B1’

sel Software Inhibits

[BCDU2B1 Software]

**cmd** Batt 2B11 Rev Polarity – Ena

√Batt 2B11 Rev Polarity – Ena

**cmd** Batt 2B12 Rev Polarity – Ena

√Batt 2B12 Rev Polarity – Ena

sel BCDU 2B1 Software BU

[BCDU 2B1 Software BU]

**cmd** Batt 2B11 Rev Polarity – Ena

√Batt 2B11 Rev Polarity – Ena

**cmd** Batt 2B12 Rev Polarity – Ena

√Batt 2B12 Rev Polarity – Ena

√Batt 4B12 Rev Polarity – Ena

4.5 Channel 2B String 2B2

Energy Storage 2B
‘BCDU 2B2’

sel Software Inhibits

[BCDU 2B2 Software]

**cmd** Batt 2B21 Rev Polarity – Ena

√Batt 2B21 Rev Polarity – Ena

**cmd** Batt 2B22 Rev Polarity – Ena

√Batt 2B22 Rev Polarity – Ena

sel BCDU 2B2 Software BU

[BCDU 2B2 Software BU]
4.6 Channel 2B String 2B3

* Energy Storage 2B
  * BCDU 2B3’

sel Software Inhibits

* BCDU 2B3 Software

** cmd Batt 2B31 Rev Polarity – Ena
** Batt 2B31 Rev Polarity – Ena
** cmd Batt 2B32 Rev Polarity – Ena
** Batt 2B32 Rev Polarity – Ena

sel BCDU 2B3 Software BU

* BCDU 2B3 Software BU

** cmd Batt 2B31 Rev Polarity – Ena
** Batt 2B31 Rev Polarity – Ena
** cmd Batt 2B32 Rev Polarity – Ena
** Batt 2B32 Rev Polarity – Ena

5. BATTERY CHARGING COMPLETE

** cmd Batt 2B31 Rev Polarity – Ena
** Batt 2B31 Rev Polarity – Ena
** cmd Batt 2B32 Rev Polarity – Ena
** Batt 2B32 Rev Polarity – Ena

** SOC% > 99 %

‘Battery 4B11/4B12’

** SOC% > 99 %

‘Battery 4B21/4B22’

** SOC% > 99 %
P6 CH 4B(2B) BATTERY CHARGING

6. CLOSING BCDU CONTROL POWER RBIs FOR CHANNELS 4B AND 2B

NOTE

The following Advisory messages will be cleared when Control Power RBIs are closed

- 'BCDU 4B1 Non Trip Anomaly - P6'
- 'SSU 4B Non Trip Anomaly - P6'
- 'BCDU 4B2 Non Trip Anomaly - P6'
- 'DCSU 4B Non Trip Anomaly - P6'
- 'BCDU 4B3 Non Trip Anomaly - P6'

6.1 Closing Channel 4B BCDU 4B1,2,3 CP RBIs

P6: EPS: Energy Storage 4B

Energy Storage 4B

'BCDU 4B1'

sel CP RBI

BCDU 4B CP RBIs

'4B1 CP RBI'

cmd Close Arm

cmd Close

√4B1 CP RBI Posn – Cl

√4B1 CP RBI Vout = battery voltage ± 2 V

√4B1 CP RBI Iout < 1.0 A

'4B2 CP RBI'
cmd Close Arm
cmd Close

√4B2 CP RBI Posn – Cl
√4B2 CP RBI Vout – battery voltage ± 2 V
√4B2 CP RBI Iout < 1.0 A

‘4B3 CP RBI’

cmd Close Arm
cmd Close

√4B3 CP RBI Posn – Cl
√4B3 CP RBI Vout – battery voltage ± 2 V
√4B3 CP RBI Iout < 1.0 A

NOTE
The following Advisory messages will be cleared when Control Power RBIs are closed
‘BCDU 2B1 Non Trip Anomaly - P6’
‘SSU 2B Non Trip Anomaly - P6’
‘BCDU 2B2 Non Trip Anomaly - P6’
‘DCSU 2B Non Trip Anomaly - P6’
‘BCDU 2B3 Non Trip Anomaly - P6’

6.2 Closing Channel 2B BCDU 2B1,2,3 CP RBIs
P6: EPS: Energy Storage 2B
Energy Storage 2B
‘BCDU 2B1’

sel CP RBI

[BCDU 2B CP RBIs]
‘2B1 CP RBI’

cmd Close Arm
cmd Close

√2B1 CP RBI Posn – Cl
√2B1 CP RBI Vout – battery voltage ± 2 V
√2B1 CP RBI Iout < 1.0 A

‘2B2 CP RBI’
cmd Close Arm
cmd Close

√2B2 CP RBI Posn – Cl
√2B2 CP RBI Vout – battery voltage ± 2 V
√2B2 CP RBI Iout < 1.0 A

‘2B3 CP RBI’

cmd Close Arm
cmd Close

√2B3 CP RBI Posn – Cl
√2B3 CP RBI Vout – battery voltage ± 2 V
√2B3 CP RBI Iout < 1.0 A
**CAUTION**

Steps 1 and 2 must both be performed sequentially during an insolation period to prevent a possible APCU overcurrent trip in eclipse once the discharge control and heater power control algorithms are inhibited.

1. **DISABLING BCDU DISCHARGE CONTROL AND HEATER POWER CONTROL FOR CHANNEL 4B AND 2B**

1.1 Channel 4B String 4B1
P6: EPS: Energy Storage 4B
Energy Storage 4B
'BCDU 4B1'

sel Software Inhibits

<table>
<thead>
<tr>
<th>BCDU 4B1 Software</th>
</tr>
</thead>
</table>

**cmd**

Discharge Cntl – Inh Arm
Discharge Cntl – Inh

√
Discharge Cntl – Inh

**cmd**

Htr Power Cntl – Inh Arm
Htr Power Cntl – Inh

√
Htr Power Cntl – Inh

sel BCDU 4B1 Software BU

<table>
<thead>
<tr>
<th>BCDU 4B1 Software BU</th>
</tr>
</thead>
</table>

**cmd**

Discharge Cntl – Inh Arm
Discharge Cntl – Inh

√
Disch Cntl – Inh

**cmd**

Htr Power Cntl – Inh Arm
Htr Power Cntl – Inh

√
Htr Power Cntl – Inh

<table>
<thead>
<tr>
<th>Energy Storage 4B</th>
</tr>
</thead>
</table>

'BCDU 4B1'

√
Conv – On (blue icon, green corners)

√
Fl – Cl

√
Htr Sw A,B – Cl
1.2 Channel 4B String 4B2
'BCDU 4B2'

sel Software Inhibits

BCDU 4B2 Software

**cmd** Discharge Cntl – Inh Arm
**cmd** Discharge Cntl – Inh

√ Discharge Cntl – Inh

**cmd** Htr Power Cntl – Inh Arm
**cmd** Htr Power Cntl – Inh

√ Htr Power Cntl – Inh

sel BCDU 4B2 Software BU

BCDU 4B2 Software BU

**cmd** Discharge Cntl – Inh Arm
**cmd** Discharge Cntl – Inh

√ Disch Cntl – Inh

**cmd** Htr Power Cntl – Inh Arm
**cmd** Htr Power Cntl – Inh

√ Htr Power Cntl – Inh

[Energy Storage 4B]
'BCDU 4B2'

√ Conv – On (blue icon, green corners)
√ FI – Cl
√ Htr Sw A,B – Cl

1.3 Channel 4B String 4B3
'BCDU 4B3'

sel Software Inhibits

BCDU 4B3 Software

**cmd** Discharge Cntl – Inh Arm
**cmd** Discharge Cntl – Inh
√Discharge Cntl – Inh

(cmd) Htr Power Cntl – Inh Arm
(cmd) Htr Power Cntl – Inh

√Htr Power Cntl – Inh

sel BCDU 4B3 SoftwareBU

[BCDU 4B3 Software BU]

(cmd) Discharge Cntl – Inh Arm
(cmd) Discharge Cntl – Inh

√Disch Cntl – Inh

(cmd) Htr Power Cntl – Inh Arm
(cmd) Htr Power Cntl – Inh

√Htr Power Cntl – Inh

[Energy Storage 4B]

‘BCDU 4B3’

√Conv – On (blue icon, green corners)
√FI – Cl
√Htr Sw A,B – Cl

1.4 Channel 2B String 2B1

P6: EPS: Energy Storage 2B
[Energy Storage 2B]

‘BCDU 2B1’

sel Software Inhibits

[BCDU 2B1 Software]

(cmd) Discharge Cntl – Inh Arm
(cmd) Discharge Cntl – Inh

√Discharge Cntl – Inh

(cmd) Htr Power Cntl – Inh Arm
(cmd) Htr Power Cntl – Inh

√Htr Power Cntl – Inh

sel BCDU 2B1 SoftwareBU
BCDU 2B1 Software BU

**cmd** Discharge Cntl – Inh Arm
**cmd** Discharge Cntl – Inh

\[\text{\(\sqrt{\)}\text{Disch Cntl} – \text{Inh}\]

**cmd** Htr Power Cntl – Inh Arm
**cmd** Htr Power Cntl – Inh

Htr Power Cntl – Inh

Energy Storage 2B

‘BCDU 2B1’

\[\text{\(\sqrt{\text{Conv}}\) – On (blue icon, green corners)}\]
\[\text{\(\sqrt{\text{FI}}\) – Cl}\]
\[\text{\(\sqrt{\text{Htr Sw A,B}}\) – Cl}\]

1.5 Channel 2B String 2B2

‘BCDU 2B2’

sel Software Inhibits

BCDU 2B2 Software BU

**cmd** Discharge Cntl – Inh Arm
**cmd** Discharge Cntl – Inh

\[\text{\(\sqrt{\text{Discharge Cntl}}\) – Inh}\]

**cmd** Htr Power Cntl – Inh Arm
**cmd** Htr Power Cntl – Inh

\[\text{\(\sqrt{\text{Htr Power Cntl}}\) – Inh}\]

sel BCDU 2B2 Software BU

BCDU 2B2 Software BU

**cmd** Discharge Cntl – Inh Arm
**cmd** Discharge Cntl – Inh

\[\text{\(\sqrt{\text{Disch Cntl}}\) – Inh}\]

**cmd** Htr Power Cntl – Inh Arm
**cmd** Htr Power Cntl – Inh
\[ \sqrt{\text{Htr Power Cntl} - \text{Inh}} \]

\[ \boxed{\text{Energy Storage 2B}} \]
\[ '\text{BCDU 2B2}' \]

\[ \sqrt{\text{Conv} - \text{On (blue icon, green corners)}} \]
\[ \sqrt{\text{FI} - \text{Cl}} \]
\[ \sqrt{\text{Htr Sw A,B} - \text{Cl}} \]

1.6 Channel 2B String 2B3
\[ '\text{BCDU 2B3}' \]

\[ \text{sel Software Inhibits} \]

\[ \boxed{\text{BCDU 2B3 Software}} \]

\[ \text{cmd} \text{ Discharge Cntl} - \text{Inh Arm} \]
\[ \text{cmd} \text{ Discharge Cntl} - \text{Inh} \]

\[ \sqrt{\text{Discharge Cntl} - \text{Inh}} \]

\[ \text{cmd} \text{ Htr Power Cntl} - \text{Inh Arm} \]
\[ \text{cmd} \text{ Htr Power Cntl} - \text{Inh} \]

\[ \sqrt{\text{Htr Power Cntl} - \text{Inh}} \]

\[ \text{sel BCDU 2B3 SoftwareBU} \]

\[ \boxed{\text{BCDU 2B3 Software BU}} \]

\[ \text{cmd} \text{ Discharge Cntl} - \text{Inh Arm} \]
\[ \text{cmd} \text{ Discharge Cntl} - \text{Inh} \]

\[ \sqrt{\text{Disch Cntl} - \text{Inh}} \]

\[ \text{cmd} \text{ Htr Power Cntl} - \text{Inh Arm} \]
\[ \text{cmd} \text{ Htr Power Cntl} - \text{Inh} \]

\[ \sqrt{\text{Htr Power Cntl} - \text{Inh}} \]

\[ \boxed{\text{Energy Storage 2B}} \]
\[ '\text{BCDU 2B3}' \]

\[ \sqrt{\text{Conv} - \text{On (blue icon, green corners)}} \]
\[ \sqrt{\text{FI} - \text{Cl}} \]
\[ \sqrt{\text{Htr Sw A,B} - \text{Cl}} \]
2. **OPENING DCSU RBI FOR CHANNEL 4B AND 2B**

2.1 Channel 4B DCSU RBI-6 Open

P6: EPS: DCSU 4B

<table>
<thead>
<tr>
<th>sel RBI 6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DCSU 4B</strong></td>
</tr>
<tr>
<td>RBI 6</td>
</tr>
<tr>
<td><strong>'Cmd Stat'</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>cmd</th>
<th>Open</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>√</strong></td>
<td><strong>Cmd Stat</strong> – Op</td>
</tr>
<tr>
<td><strong>√</strong></td>
<td>Current: -7.5 --- 7.5 A</td>
</tr>
<tr>
<td><strong>√</strong></td>
<td>Voltage: 131 --- 149 V</td>
</tr>
</tbody>
</table>

2.2 Channel 2B DCSU RBI-6 Open

P6: EPS: DCSU 2B

<table>
<thead>
<tr>
<th>sel RBI 6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DCSU 2B</strong></td>
</tr>
<tr>
<td>RBI 6</td>
</tr>
<tr>
<td><strong>'Cmd Stat'</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>cmd</th>
<th>Open</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>√</strong></td>
<td><strong>Cmd Stat</strong> – Op</td>
</tr>
<tr>
<td><strong>√</strong></td>
<td>Current: -7.5 --- 7.5 A</td>
</tr>
<tr>
<td><strong>√</strong></td>
<td>Voltage: 131 --- 149 V</td>
</tr>
</tbody>
</table>

3. **ENABLING BATTERY HEATER SAFING FOR CHANNEL 4B AND 2B**

3.1 Channel 4B String 4B1

P6: EPS: Energy Storage 4B

| Energy Storage 4B |
| 'BCDU 4B1' |

<table>
<thead>
<tr>
<th>sel Software Inhibits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BCDU 4B1 Software</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>cmd</th>
<th>Batt 4B11 Htr Safing – Ena Arm</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>cmd</strong></td>
<td>Batt 4B11 Htr Safing – Ena</td>
</tr>
</tbody>
</table>

| **√** | Batt 4B11 Htr Safing – Ena |
| **cmd** | Batt 4B12 Htr Safing – Ena Arm |
| **cmd** | Batt 4B12 Htr Safing – Ena |
√Batt 4B12 Htr Safing – Ena

sel BCDU 4B1 Software BU

**BCDU 4B1 Software BU**

**cmd** Batt 4B11 Htr Safing – Ena Arm
**cmd** Batt 4B11 Htr Safing – Ena

√Batt 4B11 Htr Safing – Ena

**cmd** Batt 4B12 Htr Safing – Ena Arm
**cmd** Batt 4B12 Htr Safing – Ena

√Batt 4B12 Htr Safing – Ena

### 3.2 Channel 4B String 4B2

**Energy Storage 4B**

‘BCDU 4B2’

sel Software Inhibits

**BCDU 4B2 Software BU**

**cmd** Batt 4B21 Htr Safing – Ena Arm
**cmd** Batt 4B21 Htr Safing – Ena

√Batt 4B21 Htr Safing – Ena

**cmd** Batt 4B22 Htr Safing – Ena Arm
**cmd** Batt 4B22 Htr Safing – Ena

√Batt 4B22 Htr Safing – Ena

sel BCDU 4B2 Software BU

**BCDU 4B2 Software BU**

**cmd** Batt 4B21 Htr Safing – Ena Arm
**cmd** Batt 4B21 Htr Safing – Ena

√Batt 4B21 Htr Safing – Ena

**cmd** Batt 4B22 Htr Safing – Ena Arm
**cmd** Batt 4B22 Htr Safing – Ena

√Batt 4B22 Htr Safing – Ena
3.3 Channel 4B String 4B3

Energy Storage 4B

'BCDU 4B3'

sel Software Inhibits

BCDU 4B3 Software

\textbf{cmd Batt 4B31 Htr Safing – Ena Arm}
\textbf{cmd Batt 4B31 Htr Safing – Ena}

\sqrt{Batt 4B31 Htr Safing – Ena}

\textbf{cmd Batt 4B32 Htr Safing – Ena Arm}
\textbf{cmd Batt 4B32 Htr Safing – Ena}

\sqrt{Batt 4B32 Htr Safing – Ena}

sel BCDU 4B3 Software BU

BCDU 4B3 Software BU

\textbf{cmd Batt 4B31 Htr Safing – Ena Arm}
\textbf{cmd Batt 4B31 Htr Safing – Ena}

\sqrt{Batt 4B31 Htr Safing – Ena}

\textbf{cmd Batt 4B32 Htr Safing – Ena Arm}
\textbf{cmd Batt 4B32 Htr Safing – Ena}

\sqrt{Batt 4B32 Htr Safing – Ena}

3.4 Channel 2B String 2B1

P6: EPS: Energy Storage 2B

Energy Storage 2B

'BCDU 2B1'

sel Software Inhibits

BCDU 2B1 Software

\textbf{cmd Batt 2B11 Htr Safing – Ena Arm}
\textbf{cmd Batt 2B11 Htr Safing – Ena}

\sqrt{Batt 2B11 Htr Safing – Ena}
P6 CH 4B,2B CONFIG FOR NOMINAL OPERATION
(ASSY OPS/4A/FIN) Page 9 of 23 pages

cmd Batt 2B12 Htr Safing – Ena Arm
   cmd Batt 2B12 Htr Safing – Ena

√Batt 2B12 Htr Safing – Ena

sel BCDU 2B1 SoftwareBU

   BCDU 2B1 Software BU

   cmd Batt 2B11 Htr Safing – Ena Arm
   cmd Batt 2B11 Htr Safing – Ena

   √Batt 2B11 Htr Safing – Ena

   cmd Batt 2B12 Htr Safing – Ena Arm
   cmd Batt 2B12 Htr Safing – Ena

   √Batt 2B12 Htr Safing – Ena

3.5 Channel 2B String 2B2

   Energy Storage 2B
   'BCDU 2B2'

   sel Software Inhibits

   BCDU 2B2 Software

   cmd Batt 2B21 Htr Safing – Ena Arm
   cmd Batt 2B21 Htr Safing – Ena

   √Batt 2B21 Htr Safing – Ena

   cmd Batt 2B22 Htr Safing – Ena Arm
   cmd Batt 2B22 Htr Safing – Ena

   √Batt 2B22 Htr Safing – Ena

   sel BCDU 2B2 SoftwareBU

   BCDU 2B2 Software BU

   cmd Batt 2B21 Htr Safing – Ena Arm
   cmd Batt 2B21 Htr Safing – Ena

   √Batt 2B21 Htr Safing – Ena
3.6 Channel 2B String 2B3

Energy Storage 2B

'BCDU 2B3'

sel Software Inhibits

BCDU 2B3 Software

Batt 2B22 Htr Safing – Ena

Cmd Batt 2B22 Htr Safing – Ena Arm

√Batt 2B22 Htr Safing – Ena

Batt 2B31 Htr Safing – Ena

Cmd Batt 2B31 Htr Safing – Ena Arm

Cmd Batt 2B31 Htr Safing – Ena

√Batt 2B31 Htr Safing – Ena

Batt 2B32 Htr Safing – Ena

Cmd Batt 2B32 Htr Safing – Ena Arm

Cmd Batt 2B32 Htr Safing – Ena

√Batt 2B32 Htr Safing – Ena

Sel BCDU 2B3 Software BU

BCDU 2B3 Software BU

Cmd Batt 2B31 Htr Safing – Ena Arm

Cmd Batt 2B31 Htr Safing – Ena

√Batt 2B31 Htr Safing – Ena

Cmd Batt 2B32 Htr Safing – Ena Arm

Cmd Batt 2B32 Htr Safing – Ena

√Batt 2B32 Htr Safing – Ena

4. **UPDATING SSU AND BCDU BUS VOLTAGE SETPOINTS**

4.1 To load PV SSU Bus Voltage Setpt PPL Ver ID 101 (PPL-0012) to the Primary PVCU MDM DRAM, perform [NCS BUILD DATA LOAD COMMAND AND NCS FMT UPLINK MANAGER], all (SODF: GND), then:

P6: EPS: EPS Software

EPS Software

Sel PVCU Software
PV SW

sel PPL IDs

Primary P6 PVCA PPL Version IDs
'Setpoint PPL Version IDs'

\sqrt[3]{SSU Bus Voltage Setpoint: 101}

4.2 To load PV SSU Bus Voltage Setpt PPL Ver ID 101 (PPL-0012) to the Backup PVCU MDM DRAM, perform \textit{(NCS BUILD DATA LOAD COMMAND AND NCS FMT UPLINK MANAGER)}, all (SODF: GND), then:

P6: EPS: EPS Software

EPS Software

sel PVCU Software

PV SW

sel Bkup PPL IDs

Bkup P6 PVCA PPL Version IDs
'Setpoint PPL Version IDs'

\sqrt[3]{SSU Bus Voltage Setpoint: 101}

5. \textbf{UPDATING SSU LOSS OF COMM SETPOINTS FOR CHANNEL 4B AND 2B}

5.1 Channel 4B SSU LOC Setpoint Update

P6: EPS: SSU 4B

SSU 4B

sel PVCE

SSU 4B PVCE
'New Vbus LOC Setpt'

input New Vbus LOC Setpt = 160
cmd Vbus LOC Setpt – Set Arm

cmd Vbus LOC Setpt – Set

5.2 Channel 2B SSU LOC Setpoint Update

P6: EPS: SSU 2B

SSU 2B

sel PVCE
SSU 2B PVCE

‘New Vbus LOC Setpt’

input New Vbus LOC Setpt = 160

\texttt{cmd Vbus LOC Setpt – Set Arm}

\texttt{cmd Vbus LOC Setpt – Set}

6. **UPDATING BCDU LOSS OF COMM SETPOINTS FOR CHANNEL 4B AND 2B**

6.1 Channel 4B BCDU 4B1 Update (Ground Only)

| NOTE |
| SPN # 15881 - Loss of Comm setpoint for BCDU 4B1 is incorrect. Therefore, ground will send BCDU 4B1 LOC setpoint form command inventory. |

<Cmd Inv: P6 BCDU LOC Setpt Tmplt – (P6PB96IM0037K)> Arm

input Batt Htr Off Temp LOC Setpt Arm = 1.67°C
input Batt Htr On Temp LOC Setpt Arm = 1.11°C
input Current LOC Setpt Arm = 2 A
input Mode Rgltn LOC Setpt Arm = 151 V

<Cmd Inv: P6 BCDU LOC Setpt Tmplt – (P6PB96IM0037K)> Fire

input Batt Htr Off Temp LOC Setpt Arm = 1.67°C
input Batt Htr On Temp LOC Setpt Arm = 1.11°C
input Current LOC Setpt Arm = 2 A
input Mode Rgltn LOC Setpt Arm = 151 V

√Batt Htr Off Temp: 1.67°C
√Batt Htr On Temp: 1.11°C
√Current: 2 A
√Mode Rgltn: 151 V

6.2 Channel 4B BCDU 4B2 Update

Energy Storage 4B

‘BCDU 4B2’

sel Conv

BCDU 4B2 ConverterFI

‘BCDU LOC Setpts’

input Batt Htr Off Temp LOC Setpt Arm = 1.67
input Batt Htr On Temp LOC Setpt Arm = 1.1
input Current LOC Setpt Arm = 2.0
input Mode Rgltn LOC Setpt Arm = 151
'LOC Setpt'

cmd LOC Setpt Arm

input Batt Htr Off Temp LOC Setpt = 1.67° C
input Batt Htr On Temp LOC Setpt = 1.1° C
input Current LOC Setpt = 2.0 A
input Mode Rgltn LOC Setpt = 151 V

'LOC Setpt'

cmd LOC Setpt

√Batt Htr Off Temp: 1.67° C
√Batt Htr On Temp: 1.1° C
√Current: 2.0 A
√Mode Rgltn: 151 V

6.3 Channel 4B BCDU 4B3 Update (Ground Only)

NOTE
SPN # 15881 – Loss of Comm setpoint for BCDU 4B3 is incorrect. Therefore, ground will send BCDU 4B3 LOC setpoint form command inventory.

<Cmd Inv:  P6 BCDU LOC Setpt Tmplt – (P6PB96IM0037K)> Arm

input Batt Htr Off Temp LOC Setpt Arm = 1.67° C
input Batt Htr On Temp LOC Setpt Arm = 1.11° C
input Current LOC Setpt Arm = 2.0 A
input Mode Rgltn LOC Setpt Arm = 151 V

<Cmd Inv:  P6 BCDU LOC Setpt Tmplt – (P6PB96IM0037K)> Fire

input Batt Htr Off Temp LOC Setpt Arm = 1.67° C
input Batt Htr On Temp LOC Setpt Arm = 1.11° C
input Current LOC Setpt Arm = 2.0 A
input Mode Rgltn LOC Setpt Arm = 151 V

√Batt Htr Off Temp: 1.67° C
√Batt Htr On Temp: 1.11° C
√Current: 2.0 A
√Mode Rgltn: 151 V
6.4 Channel 2B BCDU 2B1 Update
P6: EPS: Energy Storage 2B
[Energy Storage 2B]
'BCDU 2B1'

sel Conv

[BCDU 2B1 ConverterFl]
'BCDU LOC Setpts'

input Batt Htr Off Temp LOC Setpt Arm = 1.67
input Batt Htr On Temp LOC Setpt Arm = 1.1
input Current LOC Setpt Arm = 2.0
input Mode Rgltn LOC Setpt Arm = 151

'LOC Setpt'

cmd LOC Setpt Arm

input Batt Htr Off Temp LOC Setpt = 1.67
input Batt Htr On Temp LOC Setpt = 1.1
input Current LOC Setpt = 2.0
input Mode Rgltn LOC Setpt = 151

'LOC Setpt'

cmd LOC Setpt

√Batt Htr Off Temp: 1.67° C
√Batt Htr On Temp: 1.1° C
√Current: 2.0 A
√Mode Rgltn: 151 V

6.5 Channel 2B BCDU 2B2 Update

[Energy Storage 2B]
'BCDU 2B2'

sel Conv

[BCDU 2B2 ConverterFl]
'BCDU LOC Setpts'

input Batt Htr Off Temp LOC Setpt Arm = 1.67
input Batt Htr On Temp LOC Setpt Arm = 1.1
input Current LOC Setpt Arm = 2.0
input Mode Rgltn LOC Setpt Arm = 151
'LOC Setpt'

**cmd** LOC Setpt Arm

- input Batt Htr Off Temp LOC Setpt = 1.67
- input Batt Htr On Temp LOC Setpt = 1.1
- input Current LOC Setpt = 2.0
- input Mode Rgltn LOC Setpt = 151

'LOC Setpt'

**cmd** LOC Setpt

√Batt Htr Off Temp: 1.67° C
√Batt Htr On Temp: 1.1° C
√Current: 2.0 A
√Mode Rgltn: 151 V

6.6 Channel 2B BCDU 2B3 Update

[Energy Storage 2B]

'BCDU 2B3'

sel Conv

[BCDU 2B3 ConverterFI]

'BCDU LOC Setpts'

- input Batt Htr Off Temp LOC Setpt Arm = 1.67
- input Batt Htr On Temp LOC Setpt Arm = 1.1
- input Current LOC Setpt Arm = 2.0
- input Mode Rgltn LOC Setpt Arm = 151

'LOC Setpt'

**cmd** LOC Setpt Arm

- input Batt Htr Off Temp LOC Setpt = 1.67
- input Batt Htr On Temp LOC Setpt = 1.1
- input Current LOC Setpt = 2.0
- input Mode Rgltn LOC Setpt = 151

'LOC Setpt'

**cmd** LOC Setpt

√Batt Htr Off Temp: 1.67° C
√Batt Htr On Temp: 1.1° C
√Current: 2.0 A
√Mode Rgltn: 151 V
7. **UPDATING BATTERY LOSS OF COMM SETPOINTS FOR CHANNEL 4B (PSN1) AND 2B (PSN2)**

7.1 To load PSN1 Battery Current LOC Setpt PPL Ver ID 102 (PPL-0009) to the Primary PVCU MDM DRAM, perform {NCS BUILD DATA LOAD COMMAND AND NCS FMT UPLINK MANAGER}, all (SODF: GND), then:

P6: EPS: EPS Software

 sel PVCU Software

 PV SW

 sel PPL IDs

 [Primary P6 PVCA PPL Version IDs]
 ‘Setpoint PPL Version IDs’

 √Ch 4B Battery Current LOC Setpoint: 102

7.2 To load PSN2 Battery Current LOC Setpt PPL Ver ID 102 (PPL-0010) to the Primary PVCU MDM DRAM, perform {NCS BUILD DATA LOAD COMMAND AND NCS FMT UPLINK MANAGER}, all (SODF: GND), then:

P6: EPS: EPS Software

 sel PVCU Software

 PV SW

 sel PPL IDs

 [Primary P6 PVCA PPL Version IDs]
 ‘Setpoint PPL Version IDs’

 √Ch 2B Battery Current LOC Setpoint: 102

7.3 To load PSN1 Battery Current LOC Setpt PPL Ver ID 102 (PPL-0009) to the Backup PVCU MDM, perform {NCS BUILD DATA LOAD COMMAND AND NCS FMT UPLINK MANAGER}, all (SODF: GND), then:

P6: EPS: EPS Software

 EPS Software
sel PVCU Software

PV SW

sel Bkup PPL IDs

Bkup P6 PVCA PPL Version IDs
‘Setpoint PPL Version IDs’

√Ch 4B Battery Current LOC Setpoint:  102

7.4 To load PSN2 Battery Current LOC Setpt PPL Ver ID 102 (PPL-0010) to the Backup PVCU MDM DRAM, perform {NCS BUILD DATA LOAD COMMAND AND NCS FMT UPLINK MANAGER}, all (SODF: GND), then:

P6: EPS: EPS Software

EPS Software

sel PVCU Software

PV SW

sel Bkup PPL IDs

Bkup P6 PVCA PPL Version IDs
‘Setpoint PPL Version IDs’

√Ch 2B Battery Current LOC Setpoint:  102

8. **UPDATING BATTERY CHARGE PROFILE AND BCDU THRESHOLD VOLTAGE SETPOINT**

8.1 To load PSN1 Battery Current Setpt PPL Ver ID 102 (PPL-0007) to the Primary PVCU MDM DRAM, perform {NCS BUILD DATA LOAD COMMAND AND NCS FMT UPLINK MANAGER}, all (SODF: GND), then:

P6: EPS: EPS Software

EPS Software

sel PVCU Software

PV SW

sel PPL IDs

Primary P6 PVCA PPL Version IDs
‘Setpoint PPL Version IDs’

√Ch 4B Battery Current Setpoint:  102
8.2 To load PSN2 Battery Current Setpt PPL Ver ID 102 (PPL-0008) to
the Primary PVCU MDM DRAM, perform (NCS BUILD DATA LOAD
COMMAND AND NCS FMT UPLINK MANAGER), all
(SODF: GND), then:

P6: EPS: EPS Software
   [EPS Software]

sel PVCU Software
   [PV SW]

sel PPL IDs

[Primary P6 PVCA PPL Version IDs]
'Setpoint PPL Version IDs'

√Ch 2B Battery Current Setpoint: 102

8.3 To load PSN1 Battery Current Setpt PPL Ver ID 102 (PPL-0007) to
the Backup PVCU MDM DRAM, perform (NCS BUILD DATA LOAD
COMMAND AND NCS FMT UPLINK MANAGER), all
(SODF: GND), then:

P6: EPS: EPS Software
   [EPS Software]

sel PVCU Software
   [PV SW]

sel Bkup PPL IDs

[Bkup P6 PVCA PPL Version IDs]
'Setpoint PPL Version IDs'

√Ch 4B Battery Current Setpoint: 102

8.4 To load PSN2 Battery Current Setpt PPL Ver ID 102 (PPL-0008) to
the Backup PVCU MDM DRAM, perform (NCS BUILD DATA LOAD
COMMAND AND NCS FMT UPLINK MANAGER), all
(SODF: GND), then:

P6: EPS: EPS SOFTWARE
   [EPS Software]

sel PVCU Software
PV SW

sel Bkup PPL IDs

Bkup P6 PVCA PPL Version IDs
'Setpoint PPL Version IDs'

√Ch 2B Battery Current Setpoint: 102

9. MONITORING EPS CHANNEL PERFORMANCE IN ECLIPSE AND INSOLATION FOR CHANNEL 4B AND 2B
P6: EPS

'Orbit'

If in Insolation
P6: EPS: SSU 4B

'SSU 4B'
'Output'

√Voltage: 157 --- 163 V
√Bus Voltage Setpoint: 159.5 --- 160.5 V

P6: EPS: Energy Storage 4B

'Energy Storage 4B'
'BCDU 4B1,2,3'

√SOC – <increasing>
√SOC: 80 --- 110 %
√Current Setpt: 2 --- 50 A

'Battery 4B11,12'

√Avg Press – <increasing>
√Avg Press < 6890 kPa
√Avg Temp: 0 --- 10° C

'Battery 4B21,22'

√Avg Press – <increasing>
√Avg Press < 6890 kPa
√Avg Temp: 0 --- 10° C

'Battery 4B31,32'

√Avg Press – <increasing>
√Avg Press < 6890 kPa
√Avg Temp: 0 --- 10° C
Bus Volts: 157 --- 163 V

Voltage: 157 --- 163 V
Bus Voltage Setpoint: 159.5 --- 160.5 V

SOC – <increasing>
SOC: 80 --- 110 %
Current Setpt: 2 --- 50 A

‘Battery 2B11,12’

Avg Press – <increasing>
Avg Press ≤ 6890 kPa
Avg Temp: 0 --- 10° C

‘Battery 2B21,22’

Avg Press – <increasing>
Avg Press < 6890 kPa
Avg Temp: 0 --- 10° C

‘Battery 2B31,32’

Avg Press – <increasing>
Avg Press < 6890 kPa
Avg Temp: 0 --- 10° C

If in Eclipse

Bus Volts: 157 --- 163 V
Voltage: 148 --- 154 V
Bus Voltage Setpoint: 159.5 --- 160.5 V

P6: EPS: Energy Storage 4B

Energy Storage 4B
‘BCDU 4B1,2,3’

SOC – <decreasing>
SOC: 80 --- 110 %

‘Battery 4B11,12’

Avg Press – <decreasing>
Avg Press < 6890 kPa
Avg Temp: 0 --- 10 °C

‘Battery 4B21,22’

Avg Press – <decreasing>
Avg Press < 6890 kPa
Avg Temp: 0 --- 10 °C

‘Battery 4B31,32’

Avg Press – <decreasing>
Avg Press < 6890 kPa
Avg Temp: 0 --- 10 °C

P6 EPS
‘DCSU 4B’

Bus Volts: 148 --- 154 V

P6: EPS: SSU 2B

SSU 2B
‘Output’

Voltage: 148 --- 154 V
Bus Voltage Setpoint: 159.5 --- 160.5 V

P6: EPS: Energy Storage 2B

Energy Storage 2B
‘BCDU 2B1,2,3’

SOC - <decreasing>
SOC: 80 --- 110 %
‘Battery 2B11,12’
√Avg Press – <decreasing>
√Avg Press < 6890 kPa
√Avg Temp: 0 --- 10° C

‘Battery 2B21,22’
√Avg Press – <decreasing>
√Avg Press < 6890 kPa
√Avg Temp: 0 --- 10° C

‘Battery 2B31,32’
√Avg Press – <decreasing>
√Avg Press < 6890 kPa
√Avg Temp: 0 --- 10° C

P6: EPS
‘DCSU 2B’
√Bus Volts: 148 --- 154 V

10. CLOSING DCSU RBI 6 FOR CHANNEL 4B AND 2B

10.1 Channel 4B DCSU RBI-6 Close
P6: EPS: DCSU 4B

sel RBI 6
‘Cmd Stat’

\texttt{cmd} Close Arm
\texttt{cmd} Close

√Cmd Stat – Cl
√Current < 3 A
√Voltage: 146 --- 165 V

P6: EPS
‘To IDA Z14B’

√Pwr < 1 kW
√Current < 3 A
Z1: EPS: DDCU Z14B

√Integration Counter – <incrementing>

10.2 Channel 2B DCSU RBI-6 Close
P6: EPS: DCSU 2B

sel RBI 6

‘Cmd Stat’

cmd Close Arm

cmd Close

√Cmd Stat – Cl
√Current < 3 A
√Voltage: 146 --- 165 V

P6: EPS

‘To IDA Z13B’

√Pwr < 1 kW
√Current < 3 A

Z1: EPS: DDCU Z13B

√Integration Counter – <incrementing>
1. **VERIFYING CHANNEL 2B,4B IS READY TO TRANSFER POWER TO SM**

PCS

P6: EPS

‘Energy Storage 2B’

√ Batt 1,2,3 (three) SOC > 80 %

sel DDCU 2B

√ Output Voltage: 121 --- 128 V

P6: EPS

‘Energy Storage 4B’

√ Batt 1,2,3 (three) SOC > 80 %

sel DDCU 4B

√ Output Voltage: 121 --- 128 V

Z1: EPS

 sel RPCM Z13B A

√ Bus Voltage: 118 --- 125 V

Z1: EPS

 sel RPCM Z14B A

√ Bus Voltage: 118 --- 125 V

2. **APPLYING P6 POWER TO CHT AND FGB INPUT**

RPCM Z14B A

sel RPC 3

**cmd** RPC Position – Close (Verify – Cl)

sel RPC 1

**cmd** RPC Position – Close (Verify – Cl)

Z1: EPS: Z13B A

sel RPC 3
cmd RPC Position – Close (Verify – Cl)

sel RPC 1

**cmd** RPC Position – Close (Verify – Cl)

**NOTE**
FGB ARCU activation and checkout (steps 8 and 9) should be executed in parallel with steps 3 --- 7.

3. **CHECKING OUT SM CHT 2**

**NOTE**
1. Only one SM CHT per channel may be active at a time.
2. RS Laptop displays use both CHT and SNT.
3. CHTs may be activated at anytime; however, final checkout must occur during eclipse to verify that the CHTs supply power to the SM main bus.

RS Laptop

SM: EPS

**cmd** P_ONSNT 2 **Execute**

Name: Activate SNT 2

SM: EPS: SNT

√CHT 2 Input Voltage: 110 --- 126 V
√CHT 2 – On (blue icon)

CM: CEP: T_SOSB

CM: CEP: T_SOSB

√Sun not present

If Sun present
   Wait until Sun not present.

SM: EPS: SNT

√CHT 2 Output Current > 5.0 A

**cmd** P_OFFSNT 2 **Execute**

Name: Activate SNT 2
SM CHT AND FGB ARCU ACTIVATION AND CHECKOUT

4. **CHECKING OUT SM CHT 4**

   cmd P_OFFSNT 4  **Execute**

   Name: Activate SNT 4

   SM: EPS: SNT
   √

   CHT 2 – Off (gray icon)

   CHT 4 Input Voltage: 110 --- 126 V
   CHT 4 – On (blue icon)

   CM: C3Π: T_SOSB
   √

   Sun not present

   If Sun present
   Wait until Sun not present.

   SM: EPS: SNT
   √

   CHT 4 Output Current > 5.0 A

   cmd P_OFFSNT 4  **Execute**

   Name: Activate SNT 4

   SM: EPS: SNT
   √

   CHT 4 – Off (gray icon)

5. **CHECKING OUT SM CHT 1**

   cmd P_ONSNT 1  **Execute**

   Name: Activate SNT 1

   SM: EPS: SNT
   √

   CHT 1 Input Voltage: 110 --- 126 V
   CHT 1 – On (blue icon)
CM: СЭП: T_SOSB
CM: СЭП: T_SOSB

√Sun not present

If Sun present
   Wait until Sun not present.

SM: EPS: SNT
SM: EPS: SNT

√CHT 1 – Output Current > 5.0 A

**cmd P_OFFSNT 1** Execute

Name: Activate SNT 1

SM: EPS: SNT
SM: EPS: SNT

√CHT 1 – Off (gray icon)

6. **CHECKING OUT SM CHT 3**
**cmd P_ONSNT 3** Execute

Name: Activate SNT 3

SM: EPS: SNT
SM: EPS: SNT

√CHT 3 Input Voltage: 110 --- 126 V
√CHT 3 – On (blue icon)

CM: СЭП: T_SOSB
CM: СЭП: T_SOSB

√Sun not present

If Sun present
   Wait until Sun not present.

SM: EPS: SNT
SM: EPS: SNT

√CHT 3 Output Current > 5.0 A
7. **REACTIVATING SM CHT 1**

   cmd P_ONSNT 1  Execute

   Name: Activate SNT 1

   SM: EPS: SNT

   √CHT 1 Input Voltage: 110 --- 126
   √CHT 1 – On (blue icon)

8. **CHECKING OUT FGB ARCUS**

   **NOTE**
   Only one FGB ARCU Per Channel may be active at a time.

   **MCC-H**
   Enable Moscow for commanding through OIU via **MCC-H**.

   MCC-H ⇒ **MCC-M**, “Go for ARCU 2 activation.”

   Activate ARCU 2.
   **MCC-M** ⇒ **MCC-H**  ↑ ISS crew, “ARCU 2 activated at ___ /___:___:___ GMT.”

   Monitor ARCU 2 during eclipse.

   √ARCU 2 Output Current > 5.0 A

   Deactivate ARCU 2.
   **MCC-M** ⇒ **MCC-H**  ↑ ISS crew, “ARCU 2 deactivated at ___ /___:___:___ GMT.”

   **MCC-H** ⇒ **MCC-M**, “Go for ARCU 4 activation.”

   Activate ARCU 4.
   **MCC-M** ⇒ **MCC-H**  ↑ ISS crew, “ARCU 4 activated at ___ /___:___:___ GMT.”

   Monitor ARCU 4 during eclipse.

   √ARCU 4 Output Current > 5.0 A

   Deactivate ARCU 4.
   **MCC-M** ⇒ **MCC-H**  ↑ ISS crew, “ARCU 4 deactivated at ___ /___:___:___ GMT.”

   **MCC-H** ⇒ **MCC-M**, “Go for ARCU 1 activation.”
Activate ARCU 1.

MCC-M ⇒ MCC-H ↑ ISS crew, “ARCU 1 activated at ___ /___:___:___ GMT.”

Monitor ARCU 1 during eclipse.

√ ARCU 1 Output Current > 5.0 A

Deactivate ARCU 1.

MCC-M ⇒ MCC-H ↑ ISS crew, “ARCU 1 deactivated at ___ /___:___:___ GMT.”

MCC-H ⇒ MCC-M, “Go for ARCU 3 activation.”

Activate ARCU 3.

MCC-M ⇒ MCC-H ↑ ISS crew, “ARCU 3 activated at ___ /___:___:___ GMT.”

Monitor ARCU 3 during eclipse.

√ ARCU 3 Output Current > 5.0 A

Deactivate ARCU 3.

MCC-M ⇒ MCC-H ↑ ISS crew, “ARCU 3 deactivated at ___ /___:___:___ GMT.”

9. **RE-ACTVATING FGB ARCU 1**

MCC-H ⇒ MCC-M, “Go for ARCU 1 activation.”

MCC-M Activate ARCU 1.

MCC-M ⇒ MCC-H ↑ ISS crew, “ARCU 1 activated at ___ /___:___:___ GMT.”
NOTE
1. TDRS Single Access service will need to be scheduled and active to use the S-Band link.
2. The EVA will need to be out of the S-Band Keep Out during this procedure. The S-Band will not be radiating until step 25; however, the EVA inhibit pad will be violated because the XPDR and RFG will be powered on.

STATUS VERIFICATION
1. N1-2 MDM and ORU Heaters Status Verification

   MCC-H
   C&T
   S_Band_4A_Overview

   Verify N1-2 MDM – Primary

   Verify RPCM Z14B B RPC 4 is closed.
   Verify RPCM Z14B B RPC 3 is closed.
   Verify RPCM Z14B B RPC 2 is closed.

S-BAND ORU ACTIVATION
2. Power On Baseband Signal Processor and Transponder

   MCC-H
   C&T
   S_Band_4A_Overview

   sel RPCM Z13B B RPC 4

   RPCM_Z13B_B_RPC_04

   cmd RPC Position – Close (Verify – Cl)
   S_Band_4A_Overview

   sel RPCM Z13B B RPC 3

   RPCM_Z13B_B_RPC_03

   cmd RPC Position – Close (Verify – Cl)

3. Enabling RT (Bus I/O) For Baseband Signal Processor and Transponder

   MCC-H
   C&T: CB CT 3 RT Status
   LB_SYS_LAB_2_RT_Status

   cmd 17 ACBSP 2 Enable Execute (Verify RT Status – Ena)
   cmd 16 XPDR 2 Enable Execute (Verify RT Status – Ena)
4. **Baseband Signal Processor and Transponder Health Verification**

   **MCC-H**

   C&T
   
   sel Baseband Signal Processor 2

   S_Band_4A_BSP_2

   ‘BIT Summary’

   Verify POST/ECM – Pass
   Verify Environmental – Pass

   S_Band_4A_Overview

   sel Transponder 2

   S_Band_4A_Transponder_2

   ‘Bit Summary’

   Verify POST/ECM – Pass
   Verify Environmental – Pass

   **NOTE**

   The next two steps enable BDT and put the subsystem in a safe configuration. The steps are needed for the system tests to work correctly and to prevent the system from radiating until required.

5. **Data Link Activation**

   **MCC-H**

   C&T: Configuration: Activate Data Link

   S_Band_4A_Activate_Data_Link

   **cmd** Activate Data Link

   Verify BDT Status – Ena

6. **Loading No-Op Pending Configuration**

   **MCC-H**

   C&T: Configuration: Load Predefined Configuration

   S_Band_4A_Load_Predefined_Config

   **cmd** No-op

   S_Band_4A_Configuration

   ‘Pending’

   Verify Decryption – Off
   Verify Key Select: 0
   Verify Xpdr Mode – NonCoh
   Verify Antenna Pointing Mode – Inh
Verify Transmitter – Off
Verify SSPA – Muted

7. Power On Radio Frequency Group

MCC-H

C&T: RPCM Z13B B RPC 2

RPCM_Z13B_B_RPC_02

√Close Cmd – Ena

cmd RPC Position – Close (Verify – Cl)

8. Enabling RT (Bus I/O) For Radio Frequency Group

MCC-H

C&T: CB CT 3 RT Status

LB_SYS_LAB_2_RT_Status

cmd 15 RFGRP 2 Enable Execute (Verify RT Status – Ena)

9. Radio Frequency Group Health Verification

NOTE

The Rcvr Gain, Noise Gen +3 V, and Noise Gen +28 V will be approximately zero. These parameters will only change during the Receiver Gain part of the RFG Self Test.

MCC-H

C&T: Radio Frequency Group 2

S_Band_4A_RFG_2

‘BIT Summary’

Verify POST/ECM – Pass
Verify Environmental – Pass

10. Verifying CB CT 3 (LB Sys Lab 2) Data Bus Connections

MCC-H

Node 1: C&DH: N1-2: LB SYS LAB 2: Bus Status

LB_SYS_LAB_2_Bus_Status

Record Channel Selected: __________

If Channel Selected – A

cmd Select Ch B Execute

√Channel Selected – B

If Channel selected – B

cmd Select Ch A Execute

√Channel Selected – A

C&T

S_Band_Overview
Verify still receiving Telemetry on all ORUs. Verify with ODIN no bus errors have occurred.

Node 1: C&DH: N1-2: LB SYS LAB 2: Bus Status

LB_SYS_LAB_2_Bus_Status

Record Channel Selected: ________

If Channel Selected – A

**cmd** Select Ch B **Execute**

✓ Channel Selected – B

If Channel selected – B

**cmd** Select Ch A **Execute**

✓ Channel Selected – A

Verify with ODIN no bus errors have occurred.

**S-BAND ORU EQUIPMENT SELF-TESTS**

11. **Running Baseband Signal Processor Self-Test**

**NOTE**
Self-Test should take no longer than 15 seconds.

**MCC-H**

C&T: Test

S_Band_4A_ORU_Test

‘ORU Self Test Selection’

**cmd** BSP2 Self Test

12. **BSP Self-Test Status Verification**

**MCC-H**

C&T: Baseband Signal Processor 2

S_Band_4A_BSP_2

‘BIT Summary’

Verify POST/ECM – Pass
Verify Equipment Self Test – Pass

13. **Running Transponder Self-Test**

**NOTE**
Self-Test should take no longer than 15 seconds.

**MCC-H**

C&T: Test

S_Band_4A_ORU_Test

‘ORU Self Test Selection’

**cmd** Xpdr2 Self Test
14. Transponder Self-Test Status Verification  
C&T: Transponder 2  
S_Band_4A_Transponder_2  
‘BIT Summary’  
 Verify POST/ECM – Pass  
 Verify Equipment Self Test – Pass  

**NOTE**  
The next two steps may have to be performed twice because initially the High Gain Antenna will be outside of its normal operating region. So, initially, the antenna may fail its calibration test.

15. Running Radio Frequency Group Self-Test  

**NOTE**  
Self-Test should take no longer than 115 seconds.

MCC-H  
C&T: Test  
S_Band_4A_ORU_Test  
‘ORU Self Test Selection’  

**cmd** RFG2 Self Test

16. Radio Frequency Group Self-Test Status Verification  

MCC-H  
C&T: Radio Frequency Group 2  
S_Band_4A_RFG_2  
‘BIT Summary’  

Verify POST/ECM – Pass  
Verify Equipment Self Test – Pass

**S-BAND BASEBAND AND RF LOOPBACK SYSTEM TESTS**

**Figure 1.** S-Band Baseband and RF Loopback System Tests.

17. Running Baseband Loopback System Test  

**NOTE**  
Allow test to run for 1 minute.

MCC-H  
C&T: Test  
S_Band_4A_ORU_Test  
‘System Test Selection’
cmd Xpdr BB BSP Fill CADU Lpbk

‘BIT Function Configuration’

Verify BSP2 – Sys Fill CADU Lpbk
Verify Xpdr2 – Baseband Lpbk

18. BSP System Test Status Verification

**NOTE**
When a Baseband or RF loopback system test is commanded, a Forward Link Processing Error may occur. Verify Forward Link Processing Errors are not occurring at any point during either of the loopback system test configurations.

MCC-H
C&T: Baseband Signal Processor 2
S-Band_4A_BSP_2
‘Throughput Status’

Verify CADUs Received is incrementing.
Verify Fill CADUs Received is incrementing.
Verify Fill CADUs Transmitted is incrementing.

‘Fwd Link Processing Errors’

Verify Demux Packet Length Errors is not increasing.
Verify Demux R-S Decoder Failures is not increasing.
Verify Demux Sequence Errors is not increasing.
Verify CADU Headers Received in Error is not increasing.
Verify Fill CADUs Received in Error is not increasing.
Verify VCDUs Lost to Demux Overflow is not increasing.

19. Stopping Baseband Loopback System Test

MCC-H
C&T: Test
S_Band_4A_ORU_Test

**cmd** Stop Test

‘BIT Function Configuration’

Verify BSP2 – Inactive
Verify Xpdr2 – Inactive

20. Running RF Loopback System Test

**NOTE**
Allow test to run for at least 1 minute.

MCC-H
C&T: Test
S_Band_4A_ORU_Test
‘System Test Selection’
S-BAND INITIAL ACTIVATION AND CHECKOUT
(ASSY OPS/4A/FIN) Page 7 of 8 pages

**cmd** Xpdr RF BSP Fill CADU Lpbk

‘BIT Function Configuration’

Verify BSP2 – Sys Fill CADU Lpbk
Verify Xpdr2 – RF Lpbk

21. **BSP System Test Status Verification**

<table>
<thead>
<tr>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>When a baseband or RF loopback system test is commanded, a Forward Link Processing Error may occur. Verify Forward Link Processing Errors are not occurring at any point during either of the loopback system test configurations.</td>
</tr>
</tbody>
</table>

**MCC-H**

C&T: Baseband Signal Processor 2

[S_Band_4A_BSP_2]

‘Throughput Status’

Verify CADUs Received is incrementing.
Verify Fill CADUs Received is incrementing.
Verify Fill CADUs Transmitted is incrementing.

‘Fwd Link Processing Errors’

Verify Demux Packet Length Errors is not increasing.
Verify Demux R-S Decoder Failures is not increasing.
Verify Demux Sequence Errors is not increasing.
Verify CADU Headers Received in Error is not increasing.
Verify VCDUs Lost to Demux Overflow is not increasing.

22. **XPDR System Test Status Verification**

**MCC-H**

C&T: Transponder 2

[S_Band_4A_Transponder_2]

‘Telemetry’

Verify RF Pwr Out: 0.27 --- 0.32 mV
Verify Receiver AGC: 0.5 --- 0.8
Verify Digital AGC: 20 --- 120

‘Acquisition Status’

Verify Carrier Lock – Lock
Verify Long Code – Lock
Verify Short Code – Lock
Verify PN Main Lobe – Lock
Verify Bit Detector – Lock

‘Function Status’
Verify Transmitter Coherency – Norm
Verify DSP Data Rate: 192 K
Verify DSP Mode – Mode 2
Verify Transponder Configured – Yes
Verify Processor Reset – No

23. Stopping S-Band RF Loopback System Test
   MCC-H
   C&T: Test
   S_Band_4A_ORU_Test
   
   cmd Stop Test
   ‘BIT Function Configuration’
   Verify BSP2 – Inactive
   Verify Xpdr2 – Inactive

24. Enabling RT (Bus) FDIR On BSP, XPDR, and RFG
   MCC-H
   C&T: CB CT 3 RT Status
   LB_SYS_LAB_2_RT_Status
   
   cmd 17 ACBSP 2 Enable FDIR Execute (Verify RT FDIR Status – Ena)
   cmd 16 XPDR 2 Enable FDIR Execute (Verify RT FDIR Status – Ena)
   cmd 15 RFGRP 2 Enable FDIR Execute (Verify RT FDIR Status – Ena)

25. MCC-H: CATO performs [2.305 S-BAND LOW DATA RATE
   CONFIGURATION AND LINK ACTIVATION - PRE-CCS], steps 1 --- 6
   (SODF: C&T: NOMINAL: S-BAND), then:
   
   COMMAND PATH VERIFICATION
   
   Verify C&DH Standard Cmd Accept Count incremented by 1.

27. MCC-H: CATO goes to [2.232 S-BAND DES KEY CHANGE -
   PRE-CCS], all (SODF: GND: C&T).
Checklist of sequences completed.
A. ISS S-band Low Data Rate Characterization - ___
   Baseline S-Band ORU operating temperatures
   Determine operational range of RX and Digital AGC measurements.
   Gather return link signal strength measurements from WSC.
   Determine actual LGA beamwidth and performance.
B. ISS S-band & Orbiter S-band Hi Freq Compatibility - ___
C. ISS S-band & Orbiter S-band Lo Freq Compatibility - ___
D. ISS S-band & Early Comm Lo (Omni) Compatibility - ___
E. ISS S-band & Early Comm Lo (Array) Compatibility - ___
F. ISS S-band & Early Comm Hi (Array) Compatibility - ___
G. ISS S-band & Russian Comm Compatibility - ___

Above sequences do not have to be run in order.
Sequence A will run concurrently with other sequences.

PRE-COORDINATION ACTIVITIES
1. Obtain latest ISS S-Band LGA and Early Comm Omni/Array Pointing predicts from Pointers.
2. Coordinate ISS S-Band return link signal strength data recording with WSC.

SEQUENCE A
Can be run standalone or concurrently with Sequences B --- F

3. Verifying ISS S-Band Configured for LDR
   C&T: S Band 4A Overview
   ‘Baseband Signal Processor 2’
   Verify Data Rate – Low
   ‘Transponder 2’
   Verify Data Rate – Low
   ‘Radio Frequency Group 2’
   Verify Antenna Select – LGA
   Verify Transmitter – On
   Verify SSPA – Xmit

4. Determining Start and End Times of ISS S-Band TDRS SA Event
   ISS TDRS SHO
   Record TDRS SHO Start time: ________________
   Record TDRS SHO End time: ________________
5. Monitoring ISS S-Band TDRS Acquisition

   S Band 4A Overview
   ‘Transponder 2’

   Verify Carrier Lock – Lock
   ‘Baseband Signal Processor 2’

   Verify Frame Lock – Lock

   Record GMT: __/______________

   sel Transponder 2

   S Band 4A Transponder 2

   Record Digital AGC: ________________
   Record Return Link AOS time if different than above.
   Record GMT: ___________________
   Record Digital AGC: ___________________

6. Monitoring S-Band Performance during TDRS Event

   Screen print the following S-Band displays periodically throughout the TDRS event.

   S Band 4A Overview

   S Band 4A BSP 2

   S Band 4A Transponder 2

   S Band 4A RFG 2

   Monitor the following parameters to determine their operational ranges and characteristics throughout the TDRS event.

   Document in console log the ORU operational temperature ranges,
   frequency of BSP Forward Link Processing Errors (include attributable factors), characteristics of BSP Throughput Status parameters, and characteristics of Transponder AGC values.

   S Band 4A Overview
   ‘Baseband Signal Processor’

   Frame Lock
   Bsplt Temp
S-BAND LOW DATA RATE CHARACTERIZATION AND COMPATIBILITY TESTS

7. Monitoring ISS S-Band LOS

Verify Carrier Lock – blank

Record GMT: _____/___________

Record Digital AGC: ____________________

Record Return Link LOS time if different than above.

Repeat above steps (2 --- 5) throughout Sequences B --- F
SEQUENCE B
Run for one ISS S-Band LGA in-view period)

8. Verifying ISS S-Band Configured for LDR

C&T: S Band 4A Overview
[S Band 4A Overview]
‘Baseband Signal Processor 2’

Verify Data Rate – Low
‘Transponder 2’

Verify Data Rate – Low
‘Radio Frequency Group 2’

Verify Antenna Select – LGA
Verify Transmitter – On
Verify SSPA – Xmit

CATO verifies with INCO that Orbiter S-Band is configured to High Frequency.

9. Verifying ISS S-Band AOS

‘Baseband Signal Processor 2’

Verify Frame Lock – Lock
‘Transponder 2’

Verify Carrier Lock – Lock

GC verifies S-Band Return Link FEP Packet Processing.

CATO informs GC to configure MCC for ISS S-Band Forward and Return.

10. Uplinking Test Command via ISS S-Band

<Cmd Inv: Early_Comm_Spare_3 – (M1CC95SM5027K)>

11. Verifying No interference with ISS S-Band Forward/Return Link operation

Verify C&DH Standard Cmd Accept Count increments by 1.

C&T: S Band 4A Overview: Baseband Signal Processor 2
[S Band 4A BSP 2]
‘Forward Link Processing Errors’

Verify no unexpected processing error counts.
CATO verifies with INCO that ISS S-Band does not interfere with orbiter Forward/Return Link operation.

CATO informs GC to configure MCC for OIU Forward and Return.

**SEQUENCE C**
Run for one ISS S-Band LGA in-view period.

12. **Verifying ISS S-Band Configured for LDR**
   - C&T: S Band 4A Overview
   - ‘Baseband Signal Processor 2’
   - Verify Data Rate – Low
   - ‘Transponder 2’
   - Verify Data Rate – Low
   - ‘Radio Frequency Group 2’
   - Verify Antenna Select – LGA
   - Verify Transmitter – On
   - Verify SSPA – Xmit

   CATO verifies with INCO that orbiter S-Band is configured to Low Frequency.

13. **Verifying ISS S-Band Forward and Return Link AOS**
   - ‘Baseband Signal Processor 2’
   - Verify Frame Lock – Lock
   - ‘Transponder 2’
   - Verify Carrier Lock – Lock

   GC verifies S-Band Return Link FEP Packet Processing

   CATO informs GC to configure MCC for ISS S-Band Forward and Return.

14. **Uplinking Test Command via ISS S-Band**
   - <Cmd Inv: Early_Comm_Spare_3 – (M1CC95SM5027K)>
15. Verifying No Interference with ISS S-Band Forward/Return Link Operation
Verify C&DH Standard Cmd Accept Count increments by 1.

C&T: S Band 4A Overview: Baseband Signal Processor 2

‘Forward Link Processing Errors’

Verify no unexpected processing error counts.
CATO verifies with INCO that ISS S-Band does not interfere with orbiter Forward/Return Link operation.

CATO informs GC to configure **MCC** for OIU Forward and Return.

**SEQUENCE D**
Run for one ISS S-Band LGA in-view period.

16. Verifying ISS S-Band Configured for LDR

C&T: S Band 4A Overview

‘Baseband Signal Processor 2’

Verify Data Rate – Low

‘Transponder 2’

Verify Data Rate – Low

‘Radio Frequency Group 2’

Verify Antenna Select – LGA
Verify Transmitter – On
Verify SSPA – Xmit

17. Verifying ECS Configured for Low/Omni/Auto
<Cmd Inv: Early_Comm_System_Mode_Low – M1CC95SM5019K)>

**ECS Management Display NCS R2 v1.0**

Transmitter – ON
Verify Data Rate – LO
Pointing Mode – AUTO
Antenna Select – OMNI

CATO verifies that both ECS and ISS S-Band TDRS SHOs are active.
18. **Verifying ISS S-Band Forward and Return Link AOS**
   ‘Baseband Signal Processor 2’
   
   Verify Frame Lock – Lock
   ‘Transponder 2’
   
   Verify Carrier Lock – Lock
   
   GC verifies S-Band Return Link FEP Packet Processing.
   
   CATO informs GC to configure **MCC** for ISS S-Band Forward and Return.

19. **Uplinking Test Command via ISS S-Band**
   <Cmd Inv: Early_Comm_Spare_3 – (M1CC95SM5027K)>

20. **Verifying No ECS Interference with ISS S-Band Operation**
    
    **NOTE**
    This step verifies
    ECS Forward TDRS signal does not interfere with ISS S-Band Forward Link.
    ECS Forward TDRS signal does not interfere with ISS S-Band Return Link.
    ECS Transmitter does not interfere with ISS S-Band Forward Link.
    ECS Transmitter does not interfere with ISS S-Band Return Link.
    
    Verify C&DH Standard Command Accept Count increments by 1.
    
    C&T: S Band 4A Overview: Baseband Signal Processor 2
    **S Band 4A BSP 2**
    ‘Forward Link Processing Errors’
    
    Verify no unexpected processing error counts.
    
    CATO informs GC to configure **MCC** for ECS Forward and Return.

21. **Uplinking Test Command via ECS**
    <Cmd Inv: Early_Comm_Spare_3 – (M1CC95SM5027K)>
22. Verifying No ISS S-Band Interference with ECS Operation

**NOTE**

| ISS S-Band Forward TDRS signal does not interfere with ECS Forward Link. |
| ISS S-Band Forward TDRS signal does not interfere with ECS Return Link. |
| ISS S-Band Transmitter does not interfere with ECS Forward Link. |
| ISS S-Band Transmitter does not interfere with ECS Return Link. |

Verify C&DH Standard Command Accept Count increments by 1.

**ECS Management Display NCS R2 v1.0**

Verify no unexpected R-S Rejects.

CATO informs GC to configure **MCC** for OIU Forward and Return.

**SEQUENCE E**

Run for one LGA in-view period.

23. Verifying ISS S-Band Configured for LDR

C&T: S Band 4A Overview

'S Band 4A Overview'

'Baseband Signal Processor 2'

Verify Data Rate – Low

'Transponder 2'

Verify Data Rate – Low

'Radio Frequency Group 2'

Verify Antenna Select – LGA
Verify Transmitter – On
Verify SSPA – Xmit

24. Verifying ECS configured for Low/Array/Auto

<Cmd Inv: Early_Comm_Ant_Sel_Array – M1CC95SM5026K>
25. Verifying ISS S-Band Forward and Return Link AOS
   ‘Baseband Signal Processor 2’

   Verify Frame Lock – Lock
   ‘Transponder 2’

   Verify Carrier Lock – Lock

   GC verifies S-Band Return Link FEP Packet Processing

   CATO informs GC to configure MCC for ISS S-Band Forward and Return.

26. Uplinking Test Command via ISS S-Band
    <Cmd Inv: Early_Comm_Spare_3 – (M1CC95SM5027K)>

27. Verifying No ECS Interference with ISS S-Band Operation

   **NOTE**
   This step verifies
   - ECS Forward TDRS signal does not interfere with ISS S-Band Forward Link.
   - ECS Forward TDRS signal does not interfere with ISS S-Band Return Link.
   - ECS Transmitter does not interfere with ISS S-Band Forward Link.
   - ECS Transmitter does not interfere with ISS S-Band Return Link.

   Verify C&DH Standard Command Accept Count increments by 1.

   C&T: S Band 4A Overview: Baseband Signal Processor 2
   [S Band 4A BSP 2]
   ‘Forward Link Processing Errors’

   Verify no unexpected processing error counts.

   CATO informs GC to configure MCC for ECS Forward and Return.

28. Uplinking Test Command via ECS
    <Cmd Inv: Early_Comm_Spare_3 – (M1CC95SM5027K)>
29. Verifying No ISS S-Band Interference with ECS Operation

NOTE
This step verifies
ISS S-Band Forward TDRS signal does not interfere with ECS Forward Link.
ISS S-Band Forward TDRS signal does not interfere with ECS Return Link.
ISS S-Band Transmitter does not interfere with ECS Forward Link.
ISS S-Band Transmitter does not interfere with ECS Return Link.

Verify C&DH Standard Command Accept Count increments by 1.

ECS Management Display NCS R2 v1.0

Verify no unexpected R --- S Rejects.

CATO informs GC to configure MCC for OIU Forward and Return.

SEQUENCE F
Run for one LGA in-view period.

NOTE
Sequence E will be scheduled during a pre-planned OCA file transfer event during crew sleep.

30. Verifying ISS S-Band Configured for LDR

C&T: S Band 4A Overview
S Band 4A Overview
‘Baseband Signal Processor 2’

Verify Data Rate – Low
‘Transponder 2’

Verify Data Rate – Low
‘Radio Frequency Group 2’

Verify Antenna Select – LGA
Verify Transmitter – On
Verify SSPA – Xmit

CATO verifies that both ECS and ISS S-Band TDRS SHOs are active.
31. Verifying ISS S-Band Forward and Return Link AOS
   ‘Baseband Signal Processor 2’
   
   Verify Frame Lock – Lock
   ‘Transponder 2’
   
   Verify Carrier Lock – Lock
   
   GC verifies S-Band Return Link FEP Packet Processing.
   
   CATO informs GC to configure MCC for ISS S-Band Forward and Return.
   
   CATO confirms OCA file uplink activity in progress.

32. Uplinking Test Command via ISS S-Band
   <Cmd Inv: Early_Comm_Spare_3 – (M1CC95SM5027K)>

33. Verifying No ECS OCA Interference with ISS S-Band Operation

   NOTE
   This step verifies
   ECS OCA Forward TDRS signal does not interfere with ISS S-Band Forward Link.
   ECS OCA Forward TDRS signal does not interfere with ISS S-Band Return Link.
   ECS Transmitter does not interfere with ISS S-Band Forward Link.
   ECS Transmitter does not interfere with ISS S-Band Return Link.

   Verify C&DH Standard Command Accept Count increments by 1.

   C&T: S Band 4A Overview: Baseband Signal Processor 2
   S Band 4A BSP 2
   ‘Forward Link Processing Errors’

   Verify no unexpected processing error counts.

   OCA operator confirms successful file uplink.
NOTE
This step verifies
ISS S-Band Forward TDRS signal does not interfere
with ECS OCA Forward Link.
ISS S-Band Forward TDRS signal does not interfere
with ECS OCA Return Link.
ISS S-Band Transmitter does not interfere with ECS
OCA Forward Link.
ISS S-Band Transmitter does not interfere with ECS
OCA Return Link.

CATO informs GC to configure **MCC** for OIU Forward and Return.

**SEQUENCE G**
Run for one ISS S-Band LGA in-view period coinciding with Regul Ground site event.

34. **Verifying ISS S-Band Configured for LDR**
   C&T: S Band 4A Overview
   **Baseband Signal Processor 2**
   Verify Data Rate – Low
   ‘Transponder 2’
   Verify Data Rate – Low
   ‘Radio Frequency Group 2’
   Verify Antenna Select – LGA
   Verify Transmitter – On
   Verify SSPA – Xmit

35. **Verifying ISS S-Band Forward and Return Link AOS**
   ‘Baseband Signal Processor 2’
   Verify Frame Lock – Lock
   ‘Transponder 2’
   Verify Carrier Lock – Lock

   GC verifies S-Band Return Link FEP Packet Processing.

   CATO informs GC to configure **MCC** for ISS S-Band Forward and Return.

   CATO confirms with HSG - Russian Ground Site AOS with Regul.
36. **Uplinking Test Command via ISS S-Band**
    <Cmd Inv: Early_Comm_Spare_3 – (M1CC95SM5027K)>

37. **Verifying No Regul Interference with ISS S-Band Operation**

   **NOTE**
   This step verifies
   - Regul Uplink signal does not interfere with ISS S-Band Forward Link.
   - Regul Uplink signal does not interfere with ISS S-Band Return Link.
   - Regul Transmitter does not interfere with ISS S-Band Forward Link.
   - Regul Transmitter does not interfere with ISS S-Band Return Link.

   Verify C&DH Standard Command Accept Count increments by 1.

   C&T: S Band 4A Overview: Baseband Signal Processor 2
   **S Band 4A BSP 2**
   ‘Forward Link Processing Errors’

   Verify no unexpected processing error counts.

   CATO confirms with HSG no interference with Regul event.

   **NOTE**
   This step verifies
   - ISS S-Band Forward TDRS signal does not interfere with Regul Uplink.
   - ISS S-Band Forward TDRS signal does not interfere with Regul Downlink.
   - ISS S-Band Transmitter does not interfere with Regul Upink.
   - ISS S-Band Transmitter does not interfere with Regul Downlink.

   CATO informs GC to configure **MCC** for OIU Forward and Return.
1. **CONFIRMING RADIATOR IS READY FOR DEPLOYMENT**

**WARNING**

If deployment takes place during an EVA, ensure no EVA activities are being held within 3 meters of the radiator to avoid potential injury to EVA crewmember.

**CAUTION**

Pressure in both loops should be less than 1724 kPa in order to avoid damaging the radiator during deployment.

**PCS**

P6: TCS

P6: EETCS Overview

‘EETCS PFCS Loop A(B)’

Verify Out Press < 1,724 kPa

2. **VERIFYING RADIATOR ALGORITHM STATUS**

**PCS**

P6: TCS: TTCR(STCR)

TTCR(STCR) Commands

‘EETCS Loop A(B) TTCR(STCR)’

√ Config Fail FDIR – Ena

√ Auto Time Out FDIR – Ena

‘Auto Off’

**cmd** Inhibit – Arm (√ – X)

**cmd** Inhibit – Inh

√ Auto Off – Inh

3. **MOTOR POWER ON, STATUS VERIFICATION, AND ACCUMULATOR READINGS**

**PCS**

P6: TCS: TTCR(STCR)

TTCR(STCR) Commands

‘EETCS Loop A(B) TTCR(STCR)’

**cmd** Motor Power On – Arm (√ – X)

**cmd** Motor Power On – On

Verify Motor Power Cmd Stat – On

Verify Deployed – <blank>

Verify Retracted – X

Verify Overcurrent Trip – <blank>

‘EETCS LoopA TTCR(STCR)’

Record Accum Qty: _____ % (lower section of display)
2.107 EETCS RADIATOR DEPLOY
(TCS/4A - ALL/FIN A) Page 2 of 5 pages

‘EETCS LoopB TTCR(STCR)’

Record Accum Qty: _____% (lower section of display)

P6: TCS: Loop A PFCS
LoopA PFCS Nominal Commands
‘EETCS Loop A PFCS’ (midsection of display)

Record Accum Qty 1: _____%

Record Accum Qty 2: _____%

P6: TCS: Loop B PFCS
LoopB PFCS Nominal Commands
‘EETCS Loop B PFCS’ (midsection of display)

Record Accum Qty 1: _____%

Record Accum Qty 2: _____%

CAUTION
Station should be placed in free drift in order to avoid damaging the radiator during deployment.

4. CONFIGURING STATION TO FREE DRIFT
Perform as appropriate.

Either perform {HANDOVER ATTITUDE CONTROL RS THRUSTERS TO ORBITER}, steps 2, 3 (SODF: JNT OPS: MATED OPERATIONS), then:

or

C3(A6) DAP: FREE
Orbiter ⇒ ISS, MCC-H, “Orbiter is in Free Drift.”
5. **STARTING RADIATOR DEPLOYMENT AND MONITOR STATUS**

<table>
<thead>
<tr>
<th>NOTE</th>
<th>1. The auto off function is inhibited because the deploy motor needs to run for one additional minute after the deploy indicator becomes active in order to ensure the cables are at the proper tension.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. The Auto Time Out FDIR resides in the firmware controller and protects the drive motor from continued operation after a loss of communication with the PVCA or the PVCA fails to command the motor off. The Auto Time Out FDIR will command the motor to stop, power it off, and set the timeout indicator after 13 minutes if deploy conditions are not met.</td>
<td></td>
</tr>
<tr>
<td>3. The Config Fail FDIR resides in the PVCU and will command the motor off after 15 minutes if deploy conditions are not met.</td>
<td></td>
</tr>
<tr>
<td>4. Accumulator quantity sensor data may fluctuate due to radiator motion.</td>
<td></td>
</tr>
</tbody>
</table>

Crew should set an event timer upon execution of the deploy command and when the deploy indicator becomes active.

********************************************************************************
If one of the following parameters becomes true
Trip Ind
Overcurrent Trip
Timeout Ind

********************************************************************************

**PCS**

P6: TCS: TTCR(STCR)

<table>
<thead>
<tr>
<th>TTCR(STCR) Commands</th>
</tr>
</thead>
<tbody>
<tr>
<td>'EETCS Loop A(B) TTCR(STCR)'</td>
</tr>
</tbody>
</table>

**cmd** Deploy – Arm (√ – X)

**cmd** Deploy – Deploy

Start event timer and record time: GMT ______/________________.
Monitor and verify the following parameters during operation.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Stowed</th>
<th>Transition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drive Stat</td>
<td>Stop</td>
<td>Run</td>
</tr>
<tr>
<td>Motor Power Cmd Stat</td>
<td>On</td>
<td>On</td>
</tr>
<tr>
<td>Deployed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retracted</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Trip Ind</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overcurrent Trip</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Timeout Ind</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Record time when Deployed Indicator transitions to “X”:
GMT ___/________________.

After the Deployed Indicator has been set to “X” for 60 seconds, send the following commands
‘Drive Stat’

\[ \text{cmd} \] Stop – Arm (√ – X)
\[ \text{cmd} \] Stop

√Drive Stat – Stop

**NOTE**
Per SPN 16517, the arm command is not required below to turn the Motor Power off. This command defaults to “one step”.

‘Motor Power’

\[ \text{cmd} \] Off – Off

√Motor Power Cmd Stat – Off

**NOTE**
The ISS should be transitioned back to active attitude control after the radiator motor has been turned off.

6. **RESUMING ATTITUDE CONTROL**
Perform as appropriate.

Either perform ([HANDOVER ATTITUDE CONTROL ORBITER TO RS THRUSTERS](#)), steps 2, 4, 5 (SODF: JNT OPS: MATED OPERATIONS), then:

or

C3(A6) DAP: INRTL

When rates are damped
DAP: AUTO
7. **CONCLUDING RADIATOR OPERATIONS**

PCS

P6: TCS: TTCR(STCR)

**TTCR(STCR) Commands**

‘EETCS LoopA TTCR(STCR)’

Record Accum Qty: _____% (lower section of display)

‘EETCS LoopB TTCR(STCR)’

Record Accum Qty: _____% (lower section of display)

‘Auto Off’

**cmd Enable – Arm (√ – X)**

**cmd Enable – Ena**

√Auto Off – Ena

P6: TCS: Loop A PFCS

**LoopA PFCS Nominal Commands**

‘EETCS Loop A PFCS’ (midsection of display)

Record Accum Qty 1: _____%

Record Accum Qty 2: _____%

P6: TCS: Loop B PFCS

**LoopB PFCS Nominal Commands**

‘EETCS Loop B PFCS’ (midsection of display)

Record Accum Qty 1: _____%

Record Accum Qty 2: _____%

Notify **MCC-H** that procedure is complete.
This procedure is performed twice (sequentially). Once to activate LoopA and once to activate LoopB.

1. **CONFIGURING ALGORITHM STATES IN THE PRIMARY PVCU MDM**

   PCS

   P6: TCS: LoopA(B) PFCS: LoopA(B) PFCS FDIR Commands

   LoopA(B) PFCS FDIR Commands

   ‘EETCS LoopA(B) PFCS’

   ‘Inval Data FDIR’

   **NOTE**

   **cmd** Inhibit – Arm (✓ – X)

   **cmd** Inhibit – Inh

   √Inval Data FDIR – Inh

   ‘Pmp Deadhead FDIR’

   **cmd** Inhibit – Arm

   **cmd** Inhibit – Inh

   √Pmp Deadhead FDIR – Inh

   ‘Pump Switch FDIR’

   **cmd** Inhibit – Arm (✓ – X)

   **cmd** Inhibit – Inh

   √Pump Switch FDIR – Inh

   sel LoopA(B) PFCS FDIR Additional Commands

   LoopA(B) PFCS FDIR Additional Commands

   ‘EETCS LoopA(B) PFCS’

   ‘Min In Temp FDIR’

   **cmd** Inhibit – Arm (✓ – X)

   **cmd** Inhibit – Inh

   √Min In Temp FDIR – Inh

   **NOTE**

   After completing step 1, the EETCS FDIR and Closed Loop Control algorithms within the software should be in the following configuration. Refer to the following table (for information only).
Parameter | Display (EETCS LoopA(B)...) | State
--- | --- | ---
FCV Cntl | PFCS Nominal Commands | Inh
Auto FCV Recal | PFCS Nominal Additional Commands | Inh
Inval Data FD | PFCS FDIR Commands | Inh
Pump Deadhead FD | PFCS FDIR Commands | Inh
Min Out Temp FD | PFCS FDIR Commands | Inh
Pump Switch FD | PFCS FDIR Commands | Inh
Min In Temp FD | PFCS FDIR Commands | Inh
Max Out Temp FD | PFCS FDIR Commands | Inh
FCV Temp Recal FD | PFCS FDIR Commands | Inh
Invalid Data/Max Ln Temp FD | PFCS FDIR Commands | Inh
Line Htr Cntl | Line Heater Commands | Inh
Line Htr Cmd Ck | Line Heater Commands | Ena

2. **CONFIGURING ALGORITHM STATES IN THE Backup PVCU MDM**

PCS

P6: TCS: LoopA(B) PFCS: LoopA(B) Bkup PVCU Commands

‘Bkup PVCU EETCS LoopA(B)’
‘PFCS Pmp Deadhead FD’

**cmd** Inh – Arm

**cmd** Inh – Inh

√PFCS Pmp Deadhead FD – Inh

‘PFCS Pump Switch FD’

**cmd** Inh – Arm

**cmd** Inh – Inh

√PFCS Pump Switch FD – Inh

‘PFCS Inval Data FD’

**cmd** Inh – Arm

**cmd** Inh – Inh

√PFCS Inval Data FD – Inh
sel LoopA(B) Bkup PVCU Additional Commands

LoopA(B) Bkup PVCU Additional Commands
‘Bkup PVCU EETCS LoopA(B)’
‘PFCS Min In Temp FDIR’

**cmd** Inh – Arm
**cmd** Inh – Inh

√PFCS Min In Temp FDIR – Inh

3. **POWERING ON LOOPA(B) PFCS**

PCS

P6: TCS: LoopA(B) PFCS: RPCM 4B(2B) A RPC 04
RPCM 4B(2B) A RPC 04

**CAUTION**

Once the PFCS is powered on, the operator should record the higher of PFCS Out Temp1 or PFCS Out Temp2 as soon as possible (navigation provided below). The PFCS can remain powered on for the length of time specified below, dependent on the temperature.

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Time Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>T &gt; 37°C C</td>
<td>15 minutes</td>
</tr>
<tr>
<td>10°C &lt; T &lt; 37°C</td>
<td>1 hour</td>
</tr>
<tr>
<td>T &lt; 10°C C</td>
<td>2 hours</td>
</tr>
</tbody>
</table>

**cmd** RPC Position – Close  (Verify – Cl)

Record RPC closed:  _____/_____/______/______ GMT

P6: TCS: LoopA(B) Details

LoopA(B) Details
‘EETCS LoopA(B)’

Record the higher of PFCS Out Temp1 and PFCS Out Temp2. Compare the reading to the values in the previous Caution box to determine how long the PFCS can remain powered without an active pump.

Higher of PFCS Out Temp1 and PFCS Out Temp2:  _______ deg C

4. **ENABLING EETCS PFCS RT FDIR**

PCS

P6: C&DH: Primary PVCU MDM (select the MDM identified as primary)
Primary PVCU MDM
5. ISSUING CLEAR COMMANDS TO PFCS AND PRIMARY PVCU

PCS

P6: TCS: LoopA(B) Firmware

LoopA(B) Firmware

‘EETCS LoopA(B) PFCS’

NOTE
The Common Clear command is a one-step command. However, the Arm/Fire structure is built into command information. Per SPN 16517 (518), only the Fire command needs to be sent. There are no adverse affects to sending the Arm command.

cmd Common Clear – Common Clear

sel Clear Cmds: PV Cmd Response Clear

PV Cmd Response Clear

‘BFCS Cmd Response Clear’

cmd Arm

cmd Clear

√MCC-H before sending the Associated Data Clear commands

The commands clear latched data in the PVCU MDM. If there are other failures in the system, this command could erase valuable information. If MCC-H is unavailable, skip the Associated Data Clear commands and proceed to the next step. Inform MCC-H at the next opportunity.

P6: TCS: Loop A Firmware: Clear Cmds: PV Assoc Data Clear

PV Assoc Data Clear

cmd Associated Data Clear Arm

cmd Associated Data Clear
6. **VERIFYING PFCS SENSOR OPERATION**

PCS

P6: TCS

P6: EETCS Overview

‘EETCS PFCS’

Verify that the following quantities read within the specified range. If any parameter is out of range, check **MCC-H**.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Lower Limit</th>
<th>Upper Limit</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accum Fltrd Avg Qty</td>
<td>36.1 %</td>
<td>68.9 %</td>
<td></td>
</tr>
<tr>
<td>In Press</td>
<td>800 kPa</td>
<td>1800 kPa</td>
<td></td>
</tr>
<tr>
<td>Out Press</td>
<td>800 kPa</td>
<td>1800 kPa</td>
<td></td>
</tr>
<tr>
<td>Flow Rate</td>
<td>-424 kg/hr</td>
<td>424 kg/hr</td>
<td></td>
</tr>
<tr>
<td>PumpA Spd</td>
<td>-975 rpm</td>
<td>975 rpm</td>
<td></td>
</tr>
<tr>
<td>PumpB Spd</td>
<td>-975 rpm</td>
<td>975 rpm</td>
<td></td>
</tr>
<tr>
<td>FCV Posn</td>
<td>-10°</td>
<td>100°</td>
<td></td>
</tr>
<tr>
<td>Byp In Temp</td>
<td>-42.8°C</td>
<td>10°C</td>
<td></td>
</tr>
<tr>
<td>Rad Rtn Temp</td>
<td>-42.8°C</td>
<td>10°C</td>
<td></td>
</tr>
<tr>
<td>Out Fltrd Lwr Temp</td>
<td>-42.8°C</td>
<td>10°C</td>
<td></td>
</tr>
<tr>
<td>Out Line Fltrd Temp</td>
<td>-42.8°C</td>
<td>10°C</td>
<td></td>
</tr>
<tr>
<td>Integ Counter</td>
<td></td>
<td></td>
<td>Incrementing</td>
</tr>
</tbody>
</table>

sel LoopA(B) Details

LoopA(B) Details

‘EETCS LoopA(B)’

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Lower Limit</th>
<th>Upper Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z1 Feed Accum Qty</td>
<td>36.1 %</td>
<td>68.9 %</td>
</tr>
<tr>
<td>Z1 Return Accum Qty</td>
<td>36.1 %</td>
<td>68.9 %</td>
</tr>
</tbody>
</table>

sel LoopA(B) PFCS FDIR Commands: LoopA(B) PFCS FDIR Additional Commands

LoopA(B) PFCS FDIR Additional Commands

‘EETCS LoopA(B) PFCS’

Verify Accum Qty1 Sel Stat  – X
Verify Accum Qty2 Sel Stat  – X
Verify STCR Accum Qty Sel Stat  – X
Verify TTCR Accum Qty Sel Stat  – X

7. **EXECUTING FCV RECALIBRATION ALGORITHM**

PCS

P6: TCS: LoopA(B) PFCS: LoopA(B) PFCS Nominal Additional Commands

LoopA(B) PFCS Nominal Additional Commands

‘EETCS LoopA(B) PFCS’
NOTE

1. The Arm status field for the Loop B FCV Set LOC Posn command contains the Loop A PUI (reference SPN 470, PR 15644). If command tier response is nominal, proceed with the FCV Recal.

2. The FCV Set LOC Posn Arm command must be sent because the PFCS Firmware expects an Arm/Set sequence for this command (SPN 16990/673). However, the PVCU MDM only issue a FCV Set LOC Posn Set command during the FCV Recal algorithm. To prevent this command from being rejected, the FCV Set LOC Posn Arm command is sent prior to the FCV Recal.

‘FCV Set LOC Posn’

cmd Arm (√ – X)

<table>
<thead>
<tr>
<th>PCS</th>
<th>P6: TCS: LoopA(B) PFCS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LoopA(B) PFCS Nominal Commands</td>
</tr>
<tr>
<td></td>
<td>‘EETCS LoopA(B) PFCS’</td>
</tr>
</tbody>
</table>

NOTE

The FCV recalibration lasts approximately 93 seconds. During this time, the FCV is rotated until it reaches a hard stop and then back to a known position (the Full Bypass position). While in recalibration, the FCV Recal status field will indicate ‘Performing’.

cmd FCV Recal – Arm (√ – X)

Verify FCV Recal – Performing (‘Performing’ indication lasts for 93 seconds)

8. **VERIFYING FCV RECALIBRATION COMPLETION**

PCS

<table>
<thead>
<tr>
<th>PCS</th>
<th>P6: TCS: LoopA(B) PFCS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LoopA(B) PFCS Nominal Commands</td>
</tr>
<tr>
<td></td>
<td>‘EETCS LoopA(B) PFCS’</td>
</tr>
</tbody>
</table>

Verify FCV Recal – not performing
Verify FCV Posn: 0 ± 5.3 Deg (Full Bypass position)

Record FCV Recal: _____/_____ : _____ : _____ GMT

9. **FCV CHECKOUT**

PCS

<table>
<thead>
<tr>
<th>PCS</th>
<th>P6: TCS: LoopA(B) PFCS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LoopA(B) PFCS Nominal Commands</td>
</tr>
<tr>
<td></td>
<td>‘EETCS LoopA(B) PFCS’</td>
</tr>
</tbody>
</table>
input FCV Posn: 1.0 (1.0 = 90 Deg – Full Radiator flow)

\[ \text{cmd Set} \]

\[ \sqrt{\text{FCV Posn: 90 ± 5.3 Deg (Full Radiator flow)} \]

input FCV Posn: 0.5 (0.5 = 45 Deg – between full flow and bypass)

\[ \text{cmd Set} \]

\[ \sqrt{\text{FCV Posn: 45 ± 5.3 Deg (Intermediate flow position)} \]

10. **ACTIVATING PUMP B AND VERIFYING PARAMETERS**

    PCS

    P6: TCS

    P6: EETCS Overview

    **CAUTION**

    If the LoopA(B) PFCS In Press is less than the calculated startup pressure do not start the pump. There is a potential for cavitation below this pressure.

Determine the startup pressure using Figure 1. Temperature is the Out Fltrd Lwr Temp in degrees Celsius.

![EETCS Startup Pressure vs Temperature](image)

**Figure 1.- EETCS Startup Pressure vs Temperature.**

Startup Pressure: \[ \text{_______ kPa} \]

‘EETCS PFCS’
Verify the following parameters are within range.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Lower Limit</th>
<th>Upper Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>In Press Startup Pressure</td>
<td>1800 kPa</td>
<td></td>
</tr>
<tr>
<td>Out Fltrd Lwr Temp</td>
<td>-42.8°C</td>
<td>10°C</td>
</tr>
</tbody>
</table>

***********************************************************************
If In Press or Out Fltrd Lwr Temp are out of range, √MCC-H.
***********************************************************************

sel LoopA(B) PFCS

LoopA(B) PFCS Nominal Commands
‘EETCS LoopA(B) PFCS’

NOTE
With the FCV in an intermediate position, the temperature at the PFCS pump outlet may drop below the Min Out Temp FDIR limit. If these temperatures reach 1.1°C, expect the following warning messages
‘EEATCS LoopA(B) Outlet Temp Low Violation - P6’
‘Lab Low Temp Loop IFHX NH3 In Temp Low-Bypass Attempt - LAB’
‘Lab MTL IFHX NH3 In Temp Low-Bypass Attempt - LAB’

cmd Pump B – On
√Pump B – On
Record Pump B On: _____/_____:_____:_____ GMT

P6: TCS
P6: EETCS Overview
‘EETCS PFCS’

Verify the following parameters read within the specified ranges.

Allow 60 seconds for parameters to reach their nominal values.
If any parameter is out of range, check MCC-H.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Lower Limit</th>
<th>Upper Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accum Fltrd Avg Qty</td>
<td>36.1 %</td>
<td>68.9 %</td>
</tr>
<tr>
<td>Flow Rate</td>
<td>772 kg/hr</td>
<td>950 kg/hr</td>
</tr>
<tr>
<td>PumpB Spd</td>
<td>12605 rpm</td>
<td>14555 rpm</td>
</tr>
</tbody>
</table>
11. **DEACTIVATING PUMP B, ACTIVATING PUMP A AND VERIFYING PARAMETERS**

PCS  

P6: TCS: LoopA(B) PFCS  

<table>
<thead>
<tr>
<th>LoopA(B) PFCS Nominal Commands</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘EETCS LoopA(B) PFCS’</td>
</tr>
</tbody>
</table>

**cmd** Pump B – Off

√Pump B – Off

Verify Pump B Spd: 0 ± 975 rpm

Record Pump B Off: _____/_____:_____:_____ GMT

P6: TCS

P6: EETCS Overview

‘EETCS PFCS’

### CAUTION

If the LoopA(B) PFCS In Press is less than the calculated startup pressure do not start the pump. There is a potential for cavitation below this pressure.

Determine the startup pressure using the EETCS Startup Pressure vs Temperature chart in step 10.

Use the Out Fltrd Lwr Temp in degrees Celsius.

Startup Pressure: _________ kPa

Verify the following parameters are within range.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Lower Limit</th>
<th>Upper Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>In Press</td>
<td>Startup Pressure</td>
<td>1800 kPa</td>
</tr>
<tr>
<td>Out Fltrd Lwr Temp</td>
<td>-42.8°C</td>
<td>10°C</td>
</tr>
</tbody>
</table>

**********************************************************************

If In Press or Out Fltrd Lwr Temp are out of range, √MCC-H.

**********************************************************************

sel LoopA(B) PFCS

<table>
<thead>
<tr>
<th>LoopA(B) PFCS Nominal Commands</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘EETCS LoopA(B) PFCS’</td>
</tr>
</tbody>
</table>

**cmd** Pump A – On

√Pump A – On

Record Pump A On: _____/_____:_____:_____ GMT
Verify the following parameters read within the specified ranges.

Allow 60 seconds for parameters to reach their nominal values. If any parameter is out of range, check MCC-H.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Lower Limit</th>
<th>Upper Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accum Fltrd Avg Qty</td>
<td>36.1 %</td>
<td>68.9 %</td>
</tr>
<tr>
<td>Flow Rate</td>
<td>772 kg/hr</td>
<td>950 kg/hr</td>
</tr>
<tr>
<td>PumpA Spd</td>
<td>12605 rpm</td>
<td>14555 rpm</td>
</tr>
</tbody>
</table>

12. **ENABLING CLOSED LOOP CONTROL ALGORITHMS**

PCS

P6: TCS: LoopA(B) PFCS

LoopA(B) PFCS Nominal Commands

‘EETCS LoopA(B) PFCS’

input FCV Posn: 0.0 (0.0 = Full Bypass position)

**cmd** Set

√FCV Posn: 0 ± 5.3 Deg (Full Bypass flow)

‘FCV Cntl’

**cmd** Enable – Arm (√ – X)

**cmd** Enable – Ena

√FCV Cntl – Ena

sel LoopA(B) PFCS FDIR Commands

LoopA(B) PFCS FDIR Commands

‘EETCS LoopA(B) PFCS’

‘Inval Data FDIR’

**cmd** Enable – Arm (√ – X)

**cmd** Enable – Ena

√Inval Data FDIR – Ena

‘Pmp Deadhead FDIR’

**cmd** Enable – Arm

**cmd** Enable – Ena

√Pmp Deadhead FDIR – Ena
‘Pump Switch FDIR’

**cmd** Enable – Arm (✓ – X)

**cmd** Enable – Ena

√Pump Switch FDIR – Ena

sel LoopA(B) PFCS FDIR Additional Commands

<table>
<thead>
<tr>
<th>LoopA(B) PFCS FDIR Additional Commands</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘EETCS LoopA(B) PFCS’</td>
</tr>
</tbody>
</table>

Verify Out Fltrd Lwr Temp > -42.8° C

‘Min In Temp FDIR’

**cmd** Enable – Arm (✓ – X)

**cmd** Enable – Ena

√Min In Temp FDIR – Ena

Verify Out Fltrd Lwr Temp < 10° C

‘Max Out Temp FDIR’

**cmd** Enable – Arm (✓ – X)

**cmd** Enable – Ena

√Max Out Temp FDIR – Ena

‘Invalid Data/Max Ln Temp FDIR’

**cmd** Enable – Arm (✓ – X)

**cmd** Enable – Ena

√Invalid Data/Max Ln Temp FDIR – Ena

sel LoopA(B) Line Heater Commands

<table>
<thead>
<tr>
<th>LoopA(B) Line Heater Commands</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘EETCS LoopA(B) PFCS’</td>
</tr>
<tr>
<td>‘Line Htr Cntl’</td>
</tr>
</tbody>
</table>

**NOTE**
When Line Htr Cntl is enabled, ignore the Inhibited Line Heater telemetry field. It does not update based on the Line Htr Cntl Enable command.
**NOTE**

After completing step 13, the EETCS FDIR and Closed Loop Control algorithms within the software should be in the following increment configuration. Refer to the following table (for information only).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Display</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>FCV Cntl</td>
<td>PFCS Nominal Commands</td>
<td>Ena</td>
</tr>
<tr>
<td>Auto FCV Recal</td>
<td>PFCS Nominal Additional Commands</td>
<td>Inh</td>
</tr>
<tr>
<td>Inval Data FDIR</td>
<td>PFCS FDIR Commands</td>
<td>Ena</td>
</tr>
<tr>
<td>Pump Deadhead FDIR</td>
<td>PFCS FDIR Commands</td>
<td>Ena</td>
</tr>
<tr>
<td>Min Out Temp FDIR</td>
<td>PFCS FDIR Commands</td>
<td>Inh</td>
</tr>
<tr>
<td>Pump Switch FDIR</td>
<td>PFCS FDIR Commands</td>
<td>Ena</td>
</tr>
<tr>
<td>Min In Temp FDIR</td>
<td>PFCS FDIR Additional Commands</td>
<td>Ena</td>
</tr>
<tr>
<td>Max Out Temp FDIR</td>
<td>PFCS FDIR Additional Commands</td>
<td>Ena</td>
</tr>
<tr>
<td>FCV Temp Recal FDIR</td>
<td>PFCS FDIR Additional Commands</td>
<td>Inh</td>
</tr>
<tr>
<td>Invalid Data/Max Ln Temp FDIR</td>
<td>PFCS FDIR Additional Commands</td>
<td>Ena</td>
</tr>
<tr>
<td>Line Htr Cntl</td>
<td>Line Heater Commands</td>
<td>Ena</td>
</tr>
<tr>
<td>Line Htr Cmd Ck</td>
<td>Line Heater Commands</td>
<td>Ena</td>
</tr>
</tbody>
</table>

13. **CONFIGURING FDIR AND CLOSED LOOP CONTROL ALGORITHMS IN BACKUP MDM**

PCS P6: TCS: LoopA(B) PFCS: LoopA(B) Bkup PVCU Commands

‘Bkup PVCU EETCS LoopA(B)’
‘PFCS FCV Cntl’

<table>
<thead>
<tr>
<th>cmd</th>
<th>Ena – Arm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ena – Ena</td>
</tr>
</tbody>
</table>

√PFCS FCV Cntl – Ena
‘PFCS Pmp Deadhead FDIR’

<table>
<thead>
<tr>
<th>cmd</th>
<th>Ena – Arm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ena – Ena</td>
</tr>
</tbody>
</table>
√PFCS Pmp Deadhead FDIR – Ena

‘PFCS Pump Switch FDIR’

**cmd** Ena – Arm  
**cmd** Ena – Ena

√PFCS Pump Switch FDIR – Ena

‘PFCS Ln Htr Cntl’

**cmd** Ena – Arm  
**cmd** Ena – Ena

√PFCS Ln Htr Cntl – Ena

‘PFCS Inval Data FDIR’

**cmd** Ena – Arm  
**cmd** Ena – Ena

√PFCS Inval Data FDIR – Ena

sel LoopA(B) Bkup PVCU Additional Commands

<table>
<thead>
<tr>
<th>LoopA(B) Bkup PVCU Additional Commands</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘Bkup PVCU EETCS LoopA(B)’</td>
</tr>
<tr>
<td>‘Invalid Data/Max Ln Temp FDIR’</td>
</tr>
</tbody>
</table>

**cmd** Ena – Arm  
**cmd** Ena – Ena

√Invalid Data/Max Ln Temp FDIR – Ena

‘PFCS Max Out Temp FDIR’

**cmd** Ena – Arm  
**cmd** Ena – Ena

√PFCS Max Out Temp FDIR – Ena

‘PFCS Min In Temp FDIR’

**cmd** Ena – Arm  
**cmd** Ena – Ena

√PFCS Min In Temp FDIR – Ena
14. **VERIFYING RPC STATUS FOR THERMOSTATICALLY CONTROLLED HEATERS**

PCS

P6: TCS: LoopA(B) Line Heater (select either heater icon)

- [LoopA(B) Line Heater Commands]
- ‘EETCS LoopA(B) PFCS’
- ‘Z1 Flex Hose Htr’

√ RPC Posn – CI

‘STCR Htr1(2) TTCR Htr2(1)’

√ RPC Posn – CI
1. **INHIBITING LOOP A MIN OUT TEMP FDIR**

PCS

P6: TCS: LoopA PFCS: LoopA PFCS FDIR Commands

[LoopA PFCS FDIR Commands]

‘EETCS LoopA PFCS’
‘Min Out Temp FDIR’

<table>
<thead>
<tr>
<th>cmd</th>
<th>Inhibit – Arm (√ – X)</th>
</tr>
</thead>
<tbody>
<tr>
<td>cmd</td>
<td>Inhibit – Inh</td>
</tr>
</tbody>
</table>

√Min Out Temp FDIR – Inh

sel LoopA Bkup PVCU Commands

[LoopA Bkup PVCU Commands]

‘Bkup PVCU EETCS LoopA’
‘PFCS Min Out Temp FDIR’

<table>
<thead>
<tr>
<th>cmd</th>
<th>Inh – Arm</th>
</tr>
</thead>
<tbody>
<tr>
<td>cmd</td>
<td>Inh – Arm</td>
</tr>
</tbody>
</table>

√PFCS Min Out Temp FDIR – Inh

2. **INHIBITING LOOP B MIN OUT TEMP FDIR**

PCS

P6: TCS: LoopB PFCS: LoopA PFCS FDIR Commands

[LoopB PFCS FDIR Commands]

‘EETCS LoopB PFCS’
‘Min Out Temp FDIR’

<table>
<thead>
<tr>
<th>cmd</th>
<th>Inhibit – Arm (√ – X)</th>
</tr>
</thead>
<tbody>
<tr>
<td>cmd</td>
<td>Inhibit – Inh</td>
</tr>
</tbody>
</table>

√Min Out Temp FDIR – Inh

sel LoopB Bkup PVCU Commands

[LoopB Bkup PVCU Commands]

‘Bkup PVCU EETCS LoopB’
‘PFCS Min Out Temp FDIR’

<table>
<thead>
<tr>
<th>cmd</th>
<th>Inh – Arm</th>
</tr>
</thead>
<tbody>
<tr>
<td>cmd</td>
<td>Inh – Arm</td>
</tr>
</tbody>
</table>

√PFCS Min Out Temp FDIR – Inh
3. **POWERING ON LOOP A PFCS**

PCS

P6: TCS: LoopA PFCS: RPCM 4B A RPC 04

RPCM 4B A RPC 04

**CAUTION**

Once the PFCS is powered on, the operator should record the higher of PFCS Out Temp1 or PFCS Out Temp2 as soon as possible (navigation provided below). The PFCS can remain powered on for the length of time specified below, dependent on the temperature.

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Time Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>T &gt; 37° C</td>
<td>15 minutes</td>
</tr>
<tr>
<td>10 deg C &lt; T &lt; 37° C</td>
<td>1 hour</td>
</tr>
<tr>
<td>T &lt; 10° C</td>
<td>2 hours</td>
</tr>
</tbody>
</table>

**cmd** RPC Position – Close (Verify – Cl)

Record RPC closed: ______ / ______:_____:______ GMT

P6: TCS: LoopA Details

‘EETCS LoopA’

Record the higher of PFCS Out Temp1 and PFCS Out Temp2. Compare this reading to the values in the Caution box above to determine how long the PFCS can remain powered without an active pump.

PFCS Out Temp1 and PFCS Out Temp2: _______ deg C

4. **ISSUING CLEAR COMMAND TO PFCS**

PCS

P6: TCS: LoopA Firmware

‘EETCS LoopA PFCS’

**NOTE**

The Common Clear command is a one-step command. However, the Arm/Fire structure is built into command information. Per SPN 16517 (518), only the Fire command needs to be sent. There are no adverse affects to sending the Arm command.

**cmd** Common Clear – Common Clear
NOTE
Due to display problems documented in SPN 710, the Power On Reset Indicator telemetry is in error on the Loop A display. Contact MCC-H to verify that the indicator has cleared (MSK View ground displays are correct).

Verify Power On Reset Indicator – Not Occurred

P6: TCS
P6: EETCS Overview
‘EETCS PFCS Loop A’

Verify Integ Counter – <Incrementing>

5. POWERING ON LOOP B PFCS

PCS
P6: TCS: Loop B PFCS: RPCM 2B A RPC 04
RPCM 2B A RPC 04

CAUTION
Once the PFCS is powered on, the operator should record the higher of PFCS Out Temp1 or PFCS Out Temp2 as soon as possible (navigation provided below). The PFCS can remain powered on for the length of time specified below, dependent on the temperature.

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Time Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>T &gt; 37°C</td>
<td>15 minutes</td>
</tr>
<tr>
<td>10 deg C &lt; T &lt; 37°C</td>
<td>1 hour</td>
</tr>
<tr>
<td>T &lt; 10°C</td>
<td>2 hours</td>
</tr>
</tbody>
</table>

cmd RPC Position – Close (Verify – Cl)

Record RPC closed: ______ / ______:______:______ GMT

P6: TCS: Loop B Details
[Loop B Details]
‘EETCS Loop B’

Record the higher of PFCS Out Temp1 and PFCS Out Temp2. Compare this reading to the values in the Caution box above to determine how long the PFCS can remain powered without an active pump.

PFCS Out Temp1 and PFCS Out Temp2: ________ deg C
6. **ISSUING CLEAR COMMAND TO PFCS**

PCS

P6: TCS: LoopB Firmware

[LoopB Firmware]

[‘EETCS LoopB PFCS’]

<table>
<thead>
<tr>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Common Clear command is a one-step command. However, the Arm/Fire structure is built into command information. Per SPN 16517 (518), only the Fire command needs to be sent. There are no adverse affects to sending the Arm command.</td>
</tr>
</tbody>
</table>

**cmd** Common Clear – Common Clear

Verify Power On Reset Indicator – Not Occurred

P6: TCS

[P6: EETCS Overview]

[‘EETCS PFCS LoopB’]

Verify Integ Counter – <Incrementing>
1. **POWERING OFF LOOP A PFCS**

   PCS
   P6: TCS: LoopA PFCS: RPCM 4B A RPC 04
   RPCM 4B A RPC 04

   **CAUTION**
   1. The following Warning message may be generated when the PFCS is turned off:
      `EEATCS LoopA PFCS Loss of Comm - P6`.
   2. All EETCS LoopA data (except the EETCS LoopA Out Line Fltrd Temp) are invalid after powering off the PFCS.

   **cmd** RPC Position – Open (Verify – Op)

   P6: TCS
   EETCS Overview
   ‘EETCS Loop A PFCS’

   Verify Integ Counter – <not incrementing>

2. **POWERING OFF LOOP B PFCS**

   PCS
   P6: TCS: LoopB PFCS: RPCM 2B A RPC 04
   RPCM 2B A RPC 04

   **CAUTION**
   1. The following Warning message may be generated when the PFCS is turned off
      `EEATCS LoopB PFCS Loss of Comm - P6`.
   2. All EETCS LoopB data (except the EETCS LoopB Out Line Fltrd Temp) are invalid after powering off the PFCS.

   **cmd** RPC Position – Open (Verify – Op)

   P6: TCS
   EETCS Overview
   ‘EETCS Loop B PFCS’

   Verify Integ Counter – <not incrementing>
NOTE
This procedure is command intensive and requires large amounts of ground time and forward link.

1. **VERIFYING PVCU MDM SOFTWARE ALGORITHM STATES AND INHIBITING LINE HEATER CONTROL**

PCS

P6: TCS: LoopA(B) PFCS: LoopA(B) PFCS FDIR Commands
- LoopA(B) PFCS FDIR Commands
  - ‘EETCS LoopA(B) PFCS’

√Min Out Temp FDIR – Inh

sel LoopA(B) Line Heater Commands

- LoopA(B) Line Heater Commands
  - ‘EETCS LoopA(B) PFCS’

NOTE
An “X” will appear in all the Line Htr Cntl Inh Arm status fields when any Line Htr Inh command is armed.

**cmd** Inhibit Htr1/Htr2 – Arm (√ – X)

**cmd** Inhibit Htr1/Htr2 – Inh Htr1/Htr2

√Line Htr Cntl – Inh
√Inhibited Line Heater – Both
√Line Htr Cmd Ck – Ena

‘Ln Htr1’

√RPC Posn – Op

‘Ln Htr2’

√RPC Posn – Op

2. **DESIRED EETCS UPPER AND LOWER SETPOINT**

NOTE
1. The setpoints below are intended as an initial guideline. If during realtime the operator determines that other limits are acceptable, then those values may be used.

2. The IFHX Freeze Protection FDIRs issue Warning messages when pump outlet temperatures fall below 1.1 °C. These messages should be suppressed during the 4A Stage.

3. The PFCS Max Out Temp FDIR and Invalid Data/Max Line Temp FDIR initiate when pump outlet temperatures rise above 10° C.

EETCS LoopA(B) Upper Setpoint: 7.5° C
EETCS LoopA(B) Lower Setpoint: 3.5° C
3. **INHIBITING FCV CONTROL AND COMMANDING FCV TO A SAFE POSITION**

PCS P6: TCS: LoopA(B) PFCS

<table>
<thead>
<tr>
<th>LoopA(B) PFCS Nominal Commands</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘EETCS LoopA(B) PFCS’</td>
</tr>
<tr>
<td>‘FCV Cntl’</td>
</tr>
</tbody>
</table>

**cmd** Inhibit – Arm (√ – X)

**cmd** Inhibit – Inh

√FCV Cntl – Inh

input FCV Posn: 0.0 (0.0 – Full Bypass Flow position)

**cmd** Set

√FCV Posn: 0.0 ± 5.3° (Full Bypass Flow position)

sel LoopA(B) Bkup PVCU Commands

<table>
<thead>
<tr>
<th>LoopA(B) Bkup PVCU Commands</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘Bkup PVCU EETCS LoopA(B)’</td>
</tr>
<tr>
<td>‘PFCS FCV Cntl’</td>
</tr>
</tbody>
</table>

**cmd** Inh – Arm

**cmd** Inh – Inh

√PFCS FCV Cntl – Inh

‘PFCS Ln Htr Cntl’

**cmd** Inh Htr1/Htr2 – Arm

**cmd** Inh Htr1/Htr2 – Inh

√PFCS Ln Htr Cntl – Inh

4. **EVALUATING CURRENT CONTROL TEMP AGAINST SETPOINT**

**NOTE**
This procedure is executed during nominal operations; therefore, the PFCS Out Fltrd Lwr Temp should be used as the Control Temp in the following steps. The following sensors are also valid choices for the Control Temp:

- Loop A(B) PFCS Out Temp 1
- Loop A(B) PFCS Out Temp 2
- Loop A(B) PFCS Out Line Fltrd Temp
- LTL(MTL) IFHX NH3 In Temp 1
- LTL(MTL) IFHX NH3 In Temp 2
PCS  P6: TCS: LoopA(B) PFCS

| LoopA(B) PFCS Nominal Commands |
| 'EETCS LoopA(B) PFCS' |

Record current FCV Posn: ______ deg

**NOTE**

A Normalized position is calculated by dividing the current FCV position reading in angular degrees by 90°, which is the nominal range of motion for the valve.

Calculate FCV Normalized Position: ______ (FCV Posn)/(90°)

Enter values for FCV Posn and FCV Normalized Position in the Table provided in step 5.

Round the FCV Normalized Position to the nearest tenth.

**NOTE**

The Position Deltas of +0.1 and -0.2 are intended as guidelines for the initial run through the procedure. If during realtime the operator determines that a larger or smaller increment is needed, then a different value may be used.

If Control Temp > EETCS Upper Setpoint
   FCV Command Position = FCV Normalized Position +0.1

If Control Temp < EETCS Lower Setpoint
   FCV Command Position = FCV Normalized Position -0.2

5. **LIMITING FCV POSITION TO BE WITHIN NOMINAL FLOW RANGE**

   If FCV Command Position > 1.0 (0.8 if Line Heaters are on)
      FCV Command Position: 1.0 (0.8 if Line Heaters are on)

   If FCV Command Position < 0.0
      FCV Command Position: 0.0

Enter the FCV Command Position in the table below.

<table>
<thead>
<tr>
<th>Iteration</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameter</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FCV Posn</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FCV Normalized Position</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FCV Command Position</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6. **COMMANDING FCV TO NEW POSITION**

PCS  P6: TCS: LoopA(B) PFCS

| LoopA(B) PFCS Nominal Commands |
| 'EETCS LoopA(B) PFCS' |

13 NOV 00  401
input FCV Posn = FCV Command Position (from table in step 5)

\[ \text{cmd Set} \]

\[ \sqrt{\text{FCV Posn}} = \text{FCV Command Position} \pm 5.3^\circ \]

Repeat steps 4 --- 6 whenever the Control Temp violates its Upper/Lower Setpoint (likely on the order of 5 to 10 minutes).

If the operator identifies an FCV position that does not require frequent adjustment (Control Temp remains between the Upper Setpoint and Lower Setpoint), then:

- Maintain that position for up to two orbits if possible.
- Continue to trend the loop temperatures.
- Go to step 8 when ready to resume closed loop control operations.

If steps 4 --- 6 are unable to maintain loop setpoint above the desired Lower Setpoint, go to step 7.

If steps 4 --- 6 are unable to maintain loop setpoint below the desired Upper Setpoint, go to step 8.

7. **ACTIVATING LINE HEATERS**

If unable to maintain the Control Temp above the Lower Setpoint, the Line Heaters can be activated in an attempt to add heat to the loop.

\[ \text{PCS P6: TCS} \]

\[ \text{P6: EETCS Overview} \]

\[ \text{‘EETCS PFCS LoopA(B)’} \]

**CAUTION**

The FCV Posn must be less than 72° before a Line Heater is commanded on. At FCV Positions above 72°, there is not enough flow through the Bypass Leg to remove the heat generated by the Line Heaters. There is potential damage to plumbing insulation and/or localized NH3 boiling in these situations.

Verify FCV Posn < 72°

sel Loop A(B) Line Heater (select either icon)

\[ \text{LoopA(B) Line Heater Commands} \]

\[ \text{‘EETCS LoopA(B) PFCS’} \]

**NOTE**

If desired, only one of the two Line Heaters may be commanded on. This is a realtime operator decision based on radiator performance and other environmental factors.
Repeat steps 4 --- 6 in an attempt to maintain the Control Temp within the desired Setpoints with the Line Heaters on. The maximum FCV Command Position is limited to 72° (0.8 Normalized angle) while the Line Heaters are on.

If unable to maintain the Control Temp above the Lower Setpoint with the Line Heaters on, then go to step 8.

8. **DEACTIVATING LINE HEATERS AND COMMANDING FCV TO A SAFE POSITION**

P6: TCS: Loop A(B) Line Heater (select either icon)  
LoopA(B) Line Heater Commands  
‘EETCS LoopA(B) PFCS’  
‘Ln Htr1’

sel RPCM 4B(2B) A RPC 05

RPCM 4B(2B) A RPC 05

**cmd** RPC Position – Open (Verify – Op)

P6: TCS: Loop A(B) Line Heater (select either icon)  
LoopA(B) Line Heater Commands  
‘EETCS LoopA(B) PFCS’  
‘Ln Htr2’

sel RPCM 4B(2B) A RPC 06

RPCM 4B(2B) A RPC 06

**cmd** RPC Position – Open (Verify – Op)
P6: TCS: Loop A(B) PFCS

LoopA(B) PFCS Nominal Commands

‘EETCS LoopA(B) PFCS’

input FCV Posn: 0.0 (0.0 = 0° – Full Bypass Flow position)

**cmd** Set

\[ \sqrt{FCV \text{ Posn: } 0.0 \pm 5.3\degree} \]

9. **REENABLING FCV CONTROL AND LINE HEATER CONTROL**

PCS

P6: TCS: Loop A(B) PFCS

LoopA(B) PFCS Nominal Commands

‘EETCS LoopA(B) PFCS’

‘FCV Cntl’

**cmd** Enable – Arm (\(\sqrt{}\) – X)

**cmd** Enable – Ena

\[ \sqrt{FCV \text{ Cntl – Ena}} \]

sel LoopA(B) Line Heater Commands

<table>
<thead>
<tr>
<th>LoopA(B) Line Heater Commands</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘EETCS LoopA(B) PFCS’</td>
</tr>
</tbody>
</table>

**NOTE**

When Line Htr Cntl is enabled, ignore the Inhibited Line Heater telemetry field. It does not update based on the Line Htr Cntl Enable command.

‘Line Htr Cntl’

**cmd** Enable – Arm (\(\sqrt{}\) – X)

**cmd** Enable – Ena

\[ \sqrt{Ln \text{ Htr Cntl – Ena}} \]

sel LoopA(B) Bkup PVCU Commands

<table>
<thead>
<tr>
<th>LoopA(B) Bkup PVCU Commands</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘Bkup PVCU EETCS LoopA(B)’</td>
</tr>
</tbody>
</table>

‘PFCS FCV Cntl’

**cmd** Ena – Arm

**cmd** Ena – Ena

\[ \sqrt{PFCS FCV \text{ Cntl – Ena}} \]
‘PFCS Ln Htr Cntl’

\textbf{cmd} Ena – Arm
\textbf{cmd} Ena – Ena

√PFCS Ln Htr Cntl – Ena
NOTE
Line Heater Operations are prohibited when the FCV position is greater than 72°.

Verify the FCV position is sufficiently below 72° prior to executing this procedure.

1. INHIBITING LINE HEATER CONTROL

PCS
P6: TCS: LoopA(B) Line Heater (select either icon)

LoopA(B) Line Heater Commands
‘EETCS LoopA(B) PFCS’
‘Line Htr Cntl’

NOTE
An “X” will appear in all the Line Htr Cntl Inh Arm status fields when any Line Htr Inh command is armed.

**cmd** Inhibit Htr1/Htr2 – Arm

√Arm – X

**cmd** Inhibit Htr1/Htr2 – Inh Htr1/Htr2

√Line Htr Cntl – Inh
√Inhibited Line Htr – Both

‘Ln Htr1’

√RPC Posn – Op

‘Ln Htr2’

√RPC Posn – Op

sel LoopA(B) Bkup PVCU Commands

LoopA(B) Bkup PVCU Commands
‘Bkup PVCU EETCS LoopA(B)’
‘PFCS Ln Htr Cntl’

**cmd** Inh Htr1/Htr2 – Arm
**cmd** Inh Htr1/Htr2 – Inh

√PFCS Ln Htr Cntl – Inh
2. **VERIFYING FCV CONTROL SOFTWARE ALGORITHM IS ENABLED**

PCS

P6: TCS: Loop A(B) PFCS

<table>
<thead>
<tr>
<th>LoopA(B) PFCS Nominal Commands</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘EETCS LoopA(B) PFCS’</td>
</tr>
<tr>
<td>‘FCV Cntl’</td>
</tr>
</tbody>
</table>

Verify FCV Cntl – Ena

******************************************************************************

If FCV Cntl – Inh

P6: TCS: Loop A(B) PFCS

<table>
<thead>
<tr>
<th>LoopA(B) PFCS Nominal Commands</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘EETCS LoopA(B) PFCS’</td>
</tr>
</tbody>
</table>

input FCV Posn: 0.0 (0.0 = 0° - Full Bypass position)

**cmd** Set

Wait 10 seconds for hardware response.

√FCV Posn: 0.0 ± 5.3°

‘FCV Cntl’

**cmd** Enable – Arm

√Arm – X

**cmd** Enable – Ena

√FCV Cntl – Ena

******************************************************************************

3. **VERIFYING OUTLET FILTERED LOWER TEMP IS WITHIN SETPOINT LIMITS**

PCS

P6: TCS

P6:EETCS Overview

| ‘EETCS PFCS LoopA(B)’ |

Verify Out Fltrd Lwr Temp: 3.6 ± 0.8° C

Record Out Fltrd Lwr Temp: ______________

Record FCV Posn: ______________
4. **ACTIVATING LINE HEATER 1**

PCS

P6: TCS: LoopA(B) Line Heater (select either icon): RPCM 4B(2B) A RPC 05

RPCM 4B(2B) A RPC 05

‘RPC Position’

**cmd** – Close

√RPC Position – Cl

Record time: _____/_____:_____:_____ GMT

5. **MONITORING FCV RESPONSE**

PCS

P6: TCS

P6:EETCS Overview

‘EETCS PFCS LoopA(B)’

When FCV Position remains stable for 10 seconds

Record FCV Posn: ______________

Record Out Fltrd Lwr Temp: ______________

Record time: _____/_____:_____:_____ GMT

6. **DEACTIVATING LINE HEATER 1**

PCS

P6: TCS: LoopA(B) Line Heater (select either icon): RPCM 4B(2B) A RPC 05

RPCM 4B(2B) A RPC 05

‘RPC Position’

**cmd** – Open

√RPC Position – Op

Record time: _____/_____:_____:_____ GMT

7. **MONITORING FCV RESPONSE**

PCS

P6: TCS

P6:EETCS Overview

‘EETCS PFCS LoopA(B)’

When FCV Position remains stable for 10 seconds,

Record FCV Posn: ______________

Record Out Fltrd Lwr Temp: ______________

Record time: _____/_____:_____:_____ GMT
8. **ACTIVATING LINE HEATER 2**

PCS

P6: TCS: LoopA(B) Line Heater (select either icon): RPCM 4B(2B) A RPC 06

RPCM 4B(2B) A RPC 06

‘RPC Position’

**cmd** Close

√RPC Position – Cl

Record time: _____/_____:_____:_____ GMT

9. **MONITORING FCV RESPONSE**

PCS

P6: TCS

P6:EETCS Overview

‘EETCS PFCS LoopA(B)’

When FCV Position remains stable for 10 seconds

Record FCV Posn: ______________

Record Out Fltrd Lwr Temp: ______________

Record time: _____/_____:_____:_____ GMT

10. **DEACTIVATING LINE HEATER 2**

PCS

P6: TCS: LoopA(B) Line Heater (select either icon): RPCM 4B(2B) A RPC 06

RPCM 4B(2B) A RPC 06

‘RPC Position’

**cmd** Open

√RPC Position – Op

Record time: _____/_____:_____:_____ GMT

11. **MONITORING FCV RESPONSE**

PCS

P6: TCS

P6:EETCS Overview

‘EETCS PFCS LoopA(B)’

When FCV Position remains stable for 10 seconds

Record FCV Posn: ______________

Record Out Fltrd Lwr Temp: ______________

Record time: _____/_____:_____:_____ GMT
12. **ACTIVATING LINE HEATERS 1 AND 2**

PCS

P6: TCS: LoopA(B) Line Heater (select either icon): RPCM 4B(2B) A RPC 05
RPCM 4B(2B) A RPC 05

 RPC Position

/* RPC Position */

\textbf{cmd} Close

√RPC Position – Cl

P6: TCS: LoopA(B) Line Heater (select either icon): RPCM 4B(2B) A RPC 06
RPCM 4B(2B) A RPC 06

 RPC Position

/* RPC Position */

\textbf{cmd} Close

√RPC Position – Cl

Record time: _____/_____:_____:_____ GMT

13. **MONITORING FCV RESPONSE**

PCS

P6: TCS

|P6:EETCS Overview|

‘EETCS PFCS LoopA(B)’

When FCV Position remains stable for 10 seconds

Record FCV Posn: ______________

Record Out Fltrd Lwr Temp: ______________

Record time: _____/_____:_____:_____ GMT

14. **DEACTIVATING LINE HEATERS 1 AND 2**

PCS

P6: TCS: LoopA(B) Line Heater (select either icon): RPCM 4B(2B) A RPC 05
RPCM 4B(2B) A RPC 05

 RPC Position

/* RPC Position */

\textbf{cmd} Open

√RPC Position – Op

P6: TCS: LoopA(B) Line Heater (select either icon): RPCM 4B(2B) A RPC 06
RPCM 4B(2B) A RPC 06

 RPC Position

/* RPC Position */

\textbf{cmd} Open

√RPC Position – Op

Record time: _____/_____:_____:_____ GMT
15. **MONITORING FCV RESPONSE**

PCS

P6: TCS

P6:EETCS Overview

‘EETCS PFCS LoopA(B)’

When FCV Position remains stable for 10 seconds

Record FCV Posn: ______________

Record Out Fltrd Lwr Temp: ______________

Record time: _____/_____:_____:_____ GMT

16. **ENABLING LINE HEATER CONTROL**

PCS

P6: TCS: LoopA(B) Line Heater (select either icon)

‘EETCS LoopA(B) PFCS’

‘Line Htr Cntl’

**cmd** Enable – Arm

√Arm – X

**cmd** Enable – Ena

**NOTE**

When Line Heater Control is enabled, ignore the Inhibited Line Htr telemetry field. It does not update based on the Line Htr Cntl Enable command.

√Line Htr Cntl – Ena

sel LoopA(B) Bkup PVCU Commands

**LoopA(B) Bkup PVCU Commands**

‘Bkup PVCU EETCS LoopA(B)’

‘PFCS Ln Htr Cntl’

**cmd** Ena – Arm

**cmd** Ena – Ena

√PFCS Ln Htr Cntl – Ena
**WARNING**

Do not execute this procedure if the EETCS is connected to an IFHX.

1. **RECORDING ACTIVE EETCS PUMP**

   PCS
   P6: TCS
   P6: EETCS Overview
   ‘EETCS LoopA(B)’

   **NOTE**
   The active pump is the pump whose speed is greater than 12000 rpm.

   Active LoopA(B) Pump – ______

2. **INHIBITING FCV CONTROL ALGORITHM AND POSITION FCV**

   PCS
   P6: TCS: LoopA(B) PFCS
   LoopA(B) PFCS Nominal Commands
   ‘EETCS LoopA(B) PFCS’
   ‘FCV Cntl’

   **cmd** Inhibit – Arm (√ – X)
   **cmd** Inhibit – Inh

   √FCV Cntl – Inh

   **NOTE**
   1. When the FCV is moved to the Intermediate Flow Position, temperatures may fall below 1.1°C resulting in the warning message ‘EETCS Loop A(B) Outlet Temp Low Violation - P6’ being generated.
   2. No FDIR action will take place until step 4, when the Min Out Temp FDIR is enabled.

   input FCV Posn: 0.5 (0.5 = 45 Deg – Intermediate Flow Position)

   **cmd** Set

   √FCV Posn: 45 ± 5.3 Deg (Intermediate Flow Position)

   sel LoopA(B) Bkup PVCU Commands
LoopA(B) Bkup PVCU Commands

‘Bkup PVCU EETCS LoopA(B)’
‘PFCS FCV Cntl’

**cmd** Inhibit – Arm
**cmd** Inhibit – Inh

√PFCS FCV Cntl – Inh

3. **CONFIGURING EETCS LINE HEATERS**

**NOTE**
An “X” will appear in all the Line Htr Cntl Inh Arm Status fields when any Line Htr Inh command is armed.

PCS

P6: TCS: LoopA(B) Line Heater (select either heater icon)

LoopA(B) Line Heater Commands

‘EETCS LoopA(B) PFCS’
‘Line Htr Cntl’

**cmd** Inhibit Htr1/Htr2 – Arm (√ – X)
**cmd** Inhibit Htr1/Htr2 – Inh Htr1/Htr2

√Line Htr Cntl – Inhibit
√Inhibited Line Htr – Both
√Line Htr Cmd Ck – Enable

‘Ln Htr1’

√RPC Posn – Cl

‘Ln Htr2’

√RPC Posn – Cl

sel LoopA(B) Bkup PVCU Commands

LoopA(B) Bkup PVCU Commands

‘Bkup PVCU EETCS LoopA(B)’
‘PFCS Ln Htr Cntl’

**cmd** Inhibit Htr1/Htr2 – Arm
**cmd** Inhibit Htr1/Htr2 – Inh

√PFCS Ln Htr Cntl – Inh
4. **VERIFYING LOOP TEMPERATURE AND ENABLING MIN OUT TEMP FDIR**

PCS

P6: TCS: LoopA(B) PFCS: LoopA(B) PFCS FDIR Commands

<table>
<thead>
<tr>
<th>LoopA(B) PFCS FDIR Commands</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘EETCS LoopA(B) PFCS’</td>
</tr>
</tbody>
</table>

Verify Out Fltrd Lwr Temp < 1.1 °C
Verify Out Ln Fltrd Temp < 1.1 °C

<table>
<thead>
<tr>
<th>CAUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enabling the Min Out Temp FDIR algorithm will cause an IFHX Freeze Protection action to occur. The Line Heater RPCs will be commanded open and one of the following two actions will occur:</td>
</tr>
<tr>
<td>Both Pumps commanded Off</td>
</tr>
<tr>
<td>PFCS powered off</td>
</tr>
</tbody>
</table>

Expect one or more of the following warning messages

‘EEATCS LoopA(B) PFCS ORU Failure - P6’
‘EEATCS LoopA(B) PFCS Loss of Comm - P6’

After issuing the following commands and verifying the telemetry, proceed immediately to the EETCS Overview display.

<table>
<thead>
<tr>
<th>CAUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>If the Line Heaters are not powered off, but the pumps or the PFCS are commanded off, then damage to hardware insulation can occur within 2 minutes. The RPCs powering these heaters must be opened immediately if the FDIR does not work properly.</td>
</tr>
</tbody>
</table>

The Backup PVCU MDM will not be synched to match the Min Out Temp FDIR status because this activity is just a test.

‘Min Out Temp FDIR’

<table>
<thead>
<tr>
<th>cmd Enable – Arm (√ – X)</th>
</tr>
</thead>
<tbody>
<tr>
<td>cmd Enable – Ena</td>
</tr>
</tbody>
</table>

√Min Out Temp FDIR – Ena

5. **VERIFYING SUCCESSFUL FDIR EXECUTION**

PCS

P6: TCS

P6: EETCS Overview

‘EETCS PFCS LoopA(B)’

Verify both LoopA(B) Line Heater Icons are deenergized (gray).
If either Line Heater icon is energized (blue)
  sel LoopA(B) Line Heater (select either icon)

  [LoopA(B) Line Heater Commands]
  'EETCS LoopA(B) PFCS'
  'Ln Htr1'

  sel RPCM 4B(2B) A RPC 05

  [RPCM 4B(2B) A RPC 05]

  cmd RPC Position – Open

  √RPC Position – Op

  cmd Close Cmd – Inhibit

  √Close Cmd – Inh

P6: TCS: LoopA(B) Line Heater (select either icon)

  [LoopA(B) Line Heater Commands]
  'EETCS LoopA(B) PFCS'
  'Ln Htr2'

  sel RPCM 4B(2B) A RPC 06

  [RPCM 4B(2B) A RPC 06]

  cmd RPC Position – Open

  √RPC Position – Op

  cmd Close Cmd – Inhibit

  √Close Cmd – Inh

******************************************************************************

Verify PumpA Spd:  0 ± 975 rpm
Verify PumpB Spd:  0 ± 975 rpm
If either pump speed is greater than 975 rpm, then the PFCS should have been powered off by the FDIR actions (opens RPC to PFCS). In this case the PFCS is no longer providing data to the PVCU. All EETCS data is stale.

Verify Integ Counter – <not incrementing>

Verify both pump icons are completely deenergized (gray with black corners).

6. RECORDING PFCS AND/OR PUMP ON/OFF CYCLES
Record EETCS LoopA(B) PFCS Pump ___ Off ___ /___:___:___ GMT

7. INHIBITING MIN OUT TEMP FDIR ALGORITHM
PCS
P6: TCS: LoopA(B) PFCS: LoopA(B) PFCS FDIR Commands

<table>
<thead>
<tr>
<th>‘EETCS LoopA(B) PFCS’</th>
<th>‘Min Out Temp FDIR’</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inhibit – Arm (√ – X)</td>
<td>Inhibit – Inh</td>
</tr>
</tbody>
</table>

\(\text{Min Out Temp FDIR} – \text{Inh}\)

**NOTE**
After completing step 7, the EETCS FDIR and Closed Loop Control Algorithms within the software should be in the following configuration. This table is provided for information only.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Display (LoopA(B)...)</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>FCV Cntl</td>
<td>PFCS Nominal Commands</td>
<td>Inhibit</td>
</tr>
<tr>
<td>Auto FCV Recal</td>
<td>PFCS Nominal Additional Commands</td>
<td>Inhibit</td>
</tr>
<tr>
<td>Inval Data FDIR</td>
<td>PFCS FDIR Commands</td>
<td>Enable</td>
</tr>
<tr>
<td>Pmp Deadhead FDIR</td>
<td>PFCS FDIR Commands</td>
<td>Enable</td>
</tr>
<tr>
<td>Min Out Temp FDIR</td>
<td>PFCS FDIR Commands</td>
<td>Inhibit</td>
</tr>
<tr>
<td>Pump Switch FDIR</td>
<td>PFCS FDIR Commands</td>
<td>Enable</td>
</tr>
<tr>
<td>Min In Temp FDIR</td>
<td>PFCS FDIR Commands</td>
<td>Enable</td>
</tr>
<tr>
<td>Max Out Temp FDIR</td>
<td>PFCS FDIR Additional Commands</td>
<td>Enable</td>
</tr>
<tr>
<td>FCV Temp Recal FDIR</td>
<td>PFCS FDIR Additional Commands</td>
<td>Inhibit</td>
</tr>
<tr>
<td>Invalid Data/Max Ln Temp FDIR</td>
<td>PFCS FDIR Additional Commands</td>
<td>Enable</td>
</tr>
<tr>
<td>Line Htr Cntl</td>
<td>Line Heater Commands</td>
<td>Inhibit</td>
</tr>
<tr>
<td>Line Htr Cmd Ck</td>
<td>Line Heater Commands</td>
<td>Enable</td>
</tr>
</tbody>
</table>
Steps 8 --- 10 are performed only if the PFCS was powered off by the Min Out Temp FDIR action. If the pumps were turned off (i.e., PFCS still powered), then skip to step 11.

8. **POWERING ON LOOP A(B) PFCS**

If required, perform steps 8 --- 10; if not, go to step 11.

**PCS**
- **P6: TCS**
  - **P6: EETCS Overview**
  - ‘EETCS PFCS LoopA(B)’

If LoopA(B) Integ Counter – <not incrementing>
- **P6: TCS:** LoopA(B) PFCS: RPCM 4B(2B) A RPC 04
  - **RPCM 4B(2B) A RPC 04**

**CAUTION**

Thermal analysis (performed using warm conditions and environment) indicates that the PFCS cannot remain powered for longer than 30 minutes without a pump running.

√MCC-H for additional capabilities

**NOTE**

Expect possible one or more of the following warning messages
- ‘EETCS LoopA(B) PFCS Outlet Temp Low Violation P6’
- ‘EETCS LoopA(B) PFCS Maximum Outlet Temp Violation Condition P6’
- ‘EETCS LoopA(B) PFCS Min In Temp Violation Condition P6’

**cmd** RPC Position – Close

√RPC Position – Cl

Record RPC closed: ______ /______:______:______ GMT

**P6: TCS**
- **P6: EETCS Overview**
  - ‘EETCS PFCS LoopA(B)’

Verify LoopA(B) Integ Counter – <incrementing>
9. **ISSUING CLEAR TO PFCS AND PVCU**

PCS

P6: TCS: LoopA(B) Firmware

<table>
<thead>
<tr>
<th>LoopA(B) Firmware</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘EETCS LoopA(B) PFCS’</td>
</tr>
</tbody>
</table>

### NOTE

The Common Clear command is a one-step command. However, the Arm/Fire structure is built into command information. Per SPN 16517 (518), only the Fire command needs to be sent. There are no adverse affects to sending the Arm command.

**cmd** Common Clear – Common Clear

**sel** Clear Cmds: PV Cmd Response Clear

<table>
<thead>
<tr>
<th>PV Cmd Response Clear</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘PFCS Cmd Response Clear’</td>
</tr>
</tbody>
</table>

**cmd** Arm

**cmd** Clear

√ **MCC-H** before sending the Associated Data Clear commands

The commands clear latched data in the PVCU MDM. If there are other failures in the system, this command could erase valuable information.

If **MCC-H** is unavailable, skip the Associated Data Clear commands and proceed to the next step. Inform **MCC-H** at the next opportunity.

**sel** Clear Cmds: PV Assoc Data Clear

| PV Assoc Data Clear |

**cmd** Associated Data Clear Arm

**cmd** Associated Data Clear

10. **CONFIGURING FCV SETPOINTS**

PCS

P6: TCS: LoopA(B) PFCS

<table>
<thead>
<tr>
<th>LoopA(B) PFCS Nominal Commands</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘EETCS LoopA(B) PFCS’</td>
</tr>
</tbody>
</table>

input FCV Set Init Posn: 0.5 (0.5 = 45 Deg – Intermediate Flow Position)

**cmd** Set

**sel** LoopA(B) PFCS Nominal Additional Commands
LoopA(B) PFCS Nominal Additional Commands

‘EETCS LoopA(B) PFCS’

NOTE
The Arm status field for the Loop B FCV Set LOC Posn command contains the Loop A PUI (reference SPN 470, PR 15644). To verify the command state, use the EETCS Cmd Response MSK View display available on the THOR DNAV.

input FCV Set LOC Posn: 0.0 (0.0 = 0 Deg – Full Bypass Position)

**cmd** Arm (√ – X)

**cmd** Set

11. **ACTIVATING PUMP A AND VERIFYING PARAMETERS**

PCS

P6: TCS

P6: EETCS Overview

‘EETCS PFCS LoopA(B)’

**CAUTION**

If the LoopA(B) PFCS In Press is less than the calculated startup pressure, do not start the pump. There is a potential for cavitation below this pressure.

Determine the startup pressure using the chart below where temperature is the Out Fltrd Lwr Temp in degrees Celsius.

![EETCS Startup Pressure vs Temperature](chart.png)

**Startup Pressure:** _________ kPa

08 NOV 00  420  9410.doc
Verify the following parameters are within range:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Lower Limit</th>
<th>Upper Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>In Press Startup Pressure</td>
<td>1,800 kPa</td>
<td></td>
</tr>
<tr>
<td>Out Fltrd Lwr Temp</td>
<td>-42.8°C</td>
<td>10°C</td>
</tr>
</tbody>
</table>

If In Press or Out Fltrd Lwr Temp are out of range, √MCC-H.

NOTE
This procedure uses Pump A for a nominal EETCS Loop Restart. If Pump A has failed or is unavailable, Pump B can be used in its place.

sel LoopA(B) PFCS

LoopA(B) PFCS Nominal Commands
‘EETCS LoopA(B) PFCS’

**cmd** PumpA – On

√PumpA – On

Record PumpA On: _____ /_____:_____:_____ GMT

Verify the following parameters read within the specified ranges.

Allow 60 seconds for parameters to reach their nominal values.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Lower Limit</th>
<th>Upper Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow Rate</td>
<td>772 kg/hr</td>
<td>950 kg/hr</td>
</tr>
<tr>
<td>PumpA Spd</td>
<td>12605 rpm</td>
<td>14555 rpm</td>
</tr>
</tbody>
</table>

12. **ENABLING FCV CONTROL AND LINE HEATER CONTROL ALGORITHMS**

PCS

P6: TCS: LoopA(B) PFCS

LoopA(B) PFCS Nominal Commands
‘EETCS LoopA(B) PFCS’

input FCV Posn: 0.0 (0.0 = 0 Deg – Full Bypass)

**cmd** Set

√FCV Posn: 0 ± 5.3 Deg (Full Bypass Position)

‘FCV Cntl’

**cmd** Enable – Arm (√ – X)

**cmd** Enable – Ena
√FCV Cntl – Ena

sel LoopA(B) Line Heater Commands

<table>
<thead>
<tr>
<th>LoopA(B) Line Heater Commands</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘EETCS LoopA(B) PFCS’</td>
</tr>
<tr>
<td>‘Line Htr Cntl’</td>
</tr>
</tbody>
</table>

**cmd** Enable – Arm (√ – X)
**cmd** Enable – Ena

**NOTE**
When Line Htr Cntl is enabled, ignore the Inhibited Line Heater telemetry field. It does not update based on the Line Htr Cntl Enable command.

√Line Htr Cntl – Enable

sel LoopA(B) Bkup PVCU Commands

<table>
<thead>
<tr>
<th>LoopA(B) Bkup PVCU Commands</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘Bkup PVCU EETCS LoopA(B)’</td>
</tr>
<tr>
<td>‘PFCS Ln Htr Cntl’</td>
</tr>
</tbody>
</table>

**cmd** Enable – Arm
**cmd** Enable – Ena

√PFCS Ln Htr Cntl – Ena

‘PFCS FCV Cntl’

**cmd** Enable – Arm
**cmd** Enable – Ena

√PFCS FCV Cntl – Ena
1. **VERIFYING PCU IN STANDBY**
   Z1: EPS: Plasma Contactor 1(2)
   PCU 1(2)
   ‘PEU’

   √ Integration counter incrementing

   sel Normal Operation
   PCU 1(2) Normal Operation

   √ PCU Mode/State – Standby

2. **PLACING PCU IN DISCHARGE STATE**

   **NOTE**
   Only one PCU should be in Discharge Mode at one time.
   Contactor On command may be attempted up to 3 times if ignition failures occur.

   PCU 1(2)

   √ Xenon Tank Temp > 37° C

   PCU 1(2) Normal Operation

   **cmd** Contactor On Arm
   **cmd** Contactor On

   √ Mode/State – Ignition

   Wait up to 30 minutes.

   √ Mode/State – Discharge

   *****************************************************
   If Mode/State – Standby
   sel Firmware

   √ Ignition Failed – < blank >
   √ Loss of Discharge – < blank >
   √ Low Discharge – < blank >

   **cmd** All Indicators Clear

   √ Ignition Failed – < blank >
   √ Loss of Discharge – < blank >
   √ Low Discharge – < blank >

   Repeat step 2 (three times max).
   *****************************************************
PCU ACTIVATION
(assy ops/4a/fiN)  Page 2 of 2 pages

PCU 1(2)

√Xenon Tank Temp: 33 --- 43° C
√Xenon Tank Press: 10963 --- 164815 mmHg
√Anode Voltage: 8 --- 18 V
√Discharge Current: 0 --- 12 amps
1. **PREPARING FOR CMG DAT SETUP**

   **NOTE**
   1. RPC 11 must be opened to ensure power is isolated at the J8 connector on the RFPDB used to power the CMG DAT.
   2. This RPC also powers off the ECS Receive and Transmit RF Switches therefore antenna swapping will not occur if ECS is in use.

   **RFPDB**  
   PGSC/RF sw - Off

   **MCC-H**  
   NODE 1: EPS: RPCM N1RS2 A  
   [RPCM_ N1RS2_ A]  
   sel RPC 11 (Load ECOMM RFPDB)  
   [RPCM_ N1RS2_ A_RPC_11]  
   **cmd** RPC Position – Open **Execute** (Verify – Op)

2. **SETTING UP CMG DAT**

   Tools required from orbiter:
   
   **MF71C**  
   CMG Databus Analyzer Tool (DAT) Laptop (760XD Thinkpad)  
   DAT Pass 1000 Card/Cable Assembly  
   Flash Memory Card

   **AFD**  
   DC Power Supply Adapter Cable, 10’  
   RS/ORB DC Power Supply  
   Orbiter DC Power Cable, 10’

   **CAUTION**
   Do not disconnect cable from Pass 1000 card. Severe hardware damage to PCMCIA Card may occur

**RFPDB**  
Connect

   DC Pwr Sply Adapter Cable 10’ →|← CMG DAT Laptop
   DC Pwr Sply Adapter Cable 10’ →|← J2 on RS/ORB DC Power Supply

   Orbiter DC Power Cable →|← J1 on RS/ORB DC Power Supply
   Orbiter DC Power Cable →|← J8 PGSC/PWR on RFPDB

Insert DAT PASS 1000 PCMCIA Card (1553 card) with Cable Assembly into CMG DAT top slot.

Notify **MCC–H**, “CMG DAT setup complete.”
3. **ACTIVATING DAT**

**MCC-H**
Verify DAT Setup complete.

**NODE1**: EPS: RPCM N1RS2 A

**RPCM_N1RS2_A**

`sel RPC 11 (ECOMM RFPDB)`

**RPCM_N1RS2_A_RPC_11**

`cmd` RPC Position – Close **Execute** (Verify – CI)

**MCC-H → ISS**: “RFPDB Outlet RPC for DAT is closed”

**RFPDB**
PGSC / RF sw – On

**CMG DAT**
Power sw – On

\`\`Windows95 boots

**NOTE**
Do not run any Playback operations in the PASS-1000 application. CMG test will be invalidated.

Double click ‘DAT Monitor’ icon on desktop.
(PASS 1000 application initializes)

4. **ACTIVATING RT DETAIL WINDOWS**

**NOTE**
1. Each CMG is identified as Remote Terminal 21, therefore this step only needs to be performed once.

2. See Reference Data at end of procedure to identify word positions in RT detailed windows.

**PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)**

`sel RT`

`sel View`

**MCIABRM -- View RT Select**
Left click on the 'Sel' under 21

**RT Subaddress (De)Allocate – RT=21**

Left click on the 'Sel' under '6'
Verify a window opens titled: Dev 1:RT = 21 (Rec) SA = 6

\[\text{MCIABRM -- View RT Select} \]
Left click on the 'Sel' under 21

**RT Subaddress (De)Allocate – RT=21**

‘Transmit Buffers’
Left click on the ‘Sel’ under ‘6’
Verify a window opens titled: Dev 1:RT = 21 (Trans) SA = 6

\[\text{MCIABRM -- View RT Select} \]
Left click on the ‘Sel’ under 21

**RT Subaddress (De)Allocate – RT=21**

‘Transmit Buffers’
Left click on the ‘Sel’ under ‘7’
Verify a window opens titled: Dev 1:RT = 21 (Trans) SA = 7
MCIABRM --View RT Select
Left click on the ‘Sel’ under 21

RT Subaddress (De)Allocate – RT=21
‘Transmit Buffers’
Left click on the ‘Sel’ under ‘29’
Verify a window opens titled: Dev 1:RT = 21 (Trans) SA = 29

Arrange these four windows on desktop for later viewing

MCIABRM --View RT Select
sel Cancel

The DAT is now set up for command and telemetry verification.

5. **ACTIVATING CMG 1**

**MCC-H**

Z1: EPS: RPCM Z14B B

[RPCM_Z14B_B]

sel RPC 18 (Load CMG 1 (3A_12A))

[RPCM_Z14B_B_RPC_18]

√ RPC Close Cmd – Ena
√ RPC Open Cmd – Ena

cmd RPC Position – Close (Verify – Cl)

**MCC-H → ISS:** “CMG 1 is powered on”

6. **CONNECTING CMG 1 DATA BUS TO CMG DAT**

**CMG DAT**

Remove pre-connected terminator from Bus Tee A. Temporarily stow.

Connect

Jumper Cable W0207 P1 (LB GNC-1A) →|← Bus A on SBS Cable Assembly Bus Tee.

7. **SETTING UP MONITOR FILE FOR CMG 1**

**PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)**

sel Monitor
sel Data Logging Mode

File Open

\Directory: c:\pass\dbase

Input Filename: cmg1.arc
sel OK

Monitor Control Panel: Data Logging Mode
input Filesize: 5000000
sel Run

Verify display indicates ‘Waiting for trigger…’

Move display on desktop for later use; do not close.

8. **TURNING ON CMG 1 POWER SUPPLIES USING PASS-1000 COMMAND SCRIPT**

   PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)

   sel File
   sel Load ASCII File
   sel Load BC List

   File Open
   \Directory: c:\pass\dbase

   sel ps_only.bc
   sel OK

   PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)
   sel BC

   MCIABRM – BC Control Panel

   Verify Frame Start: Interval = 1000001 usec.

   sel Loop (checkbox)
   \Forever selected

   sel Run
9. **VERIFYING CMG 1 POWER SUPPLIES ON COMMAND AND TELEMETRY**

Dev 1:RT = 21 (Rec) SA = 6
Verify command words are as shown below:

```
0000 0000 0000 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000
```

If any command words don’t match those shown in figure

√MCC-H

Dev 1:RT = 21 (Trans) SA = 6
Verify the following telemetry words (reference sample figure that follows)

- Word 1 – Time Tag
  - <Incrementing>
- Word 5 – Status Word #1
  - 0005 (hex)
- Word 6 – Status Word #2
  - 0010 (hex)
- Word 8 – Spin Bearing Temp1
  - ___________ (record)
- Word 9 – Spin Bearing Temp2
  - ___________ (record)
- Word 11 – EA current
  - ___________ (record)

√MCC-H

Read down values recorded above

10. **SPINNING UP CMG 1 USING PASS-1000 COMMAND SCRIPT**

MCIABRM – BC Control Panel

```
sel Stop
```
Verify Status – Halted OK

```
sel OK
```

PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)

```
sel File
sel Load ASCII File
sel Load BC List
```
 sel ps_sm.bc
 sel OK

 sel BC

 MCIABRM – BC Control Panel
 Verify Frame Start: Interval = 1000002 usec.

 √ Loop selected
 √ Forever selected
 sel Run

 11. VERIFYING CMG 1 SPINUP COMMAND AND TELEMETRY

 Dev 1:RT = 21 (Rec) SA = 6
 Verify command words are as shown below:

 !********************************************************************!
 !If any command words don’t match those shown in figure          !
 !********************************************************************!

 √ MCC-H

 !********************************************************************!

 NOTE
 If the spin bearing temperatures are low, it is possible that the
 spin motor will not be able to spin the wheel. If the wheel speed
 does not increase, proceed anyway.

 Dev 1:RT = 21 (Trans) SA = 6
Wait 10 minutes or until word 4 exceeds 0064, then verify the following data (reference sample figure that follows):

- Word 1 – Time Tag - <Incrementing>
- Word 4 – Wheel Speed - <Increasing> (updates once every 15 seconds)
- Word 5 – Status Word #1 - 0205 (hex)
- Word 6 – Status Word #2 - 0010 (hex)
- Word 8 – Spin Bearing Temp1 - ___________ (record)
- Word 9 – Spin Bearing Temp2 - ___________ (record)
- Word 11 – EA current - ___________ (record)

Verify the following telemetry words (reference sample figure that follows):

- Word 1 – Time Tag - <Incrementing>
- Word 22 – Sine SM Current - <non-zero, fluctuating between 0 and greater than 1000 hex>
- Word 23 – Cosine SM Current - <non-zero, fluctuating between 0 and greater than 1000 hex>
- Word 24 – SM Current Cmd - ___________ <fluctuating> (record)
- Word 28 – Analog Wheel Spd - <non-zero> (updates once every 15 seconds)

\`MCC-H\`
Read down values recorded above

12. **SHUTTING DOWN CMG 1 USING PASS-1000 COMMAND SCRIPT**

MCIABRM – BC Control Panel

sel Stop

Verify Status – Halted OK

sel OK
13. **VERIFYING CMG 1 SHUTDOWN COMMAND AND TELEMETRY**

**Dev 1:RT = 21 (Rec) SA = 6**

Verify command words are as shown below:

![Dev 1:RT = 21 (Rec) SA = 6](image)

********************************************************************************
If any command words don’t match those shown in figure

√MCC-H

********************************************************************************

**NOTE**
Spin Motor remains ON until Wheel Speed < 10 rpm. Expect transmit subaddress 6 Word 5 to be 0205 and then change to 0005 at <10 rpm. There is no need to wait for this to occur.
CMG CHECKOUT USING DATA ANALYSIS TOOL (DAT)

Verify the following telemetry words (reference figure that follows):

Word 1 – Time Tag - <Incrementing>

Word 4 – Wheel Speed - <Decreasing or 0000> (updates once every 15 seconds)

Word 5 – Status Word #1 - 0205 (0005) (hex)

Word 11 – EA current - ___________ (record)

√MCC-H
Read down value recorded above

14. COMPLETING PASS-1000 SESSION FOR CMG 1

MCIABRM – BC Control Panel
sel Stop
Verify Status – Halted OK
sel OK

Monitor Control Panel: Data Logging Mode
‘Monitor Control’
 sel Stop

Transfer Time
 sel OK

Data Logging Results
Verify Interrupts Generated = Buffers Filled = Buffers Written (± 1 acceptable)

sel OK

15. VERIFYING DATA ACQUISITION FOR CMG 1

View File
 sel Yes

Monitor Control Panel: Data Logging Mode
Verify data was acquired (similar to example below)
Monitor Control Panel: Data Logging Mode

sel File
sel Exit

16. DEACTIVATING CMG 1 AND ACTIVATING CMG 2

MCC-H

Z1: EPS: RPCM Z14B B
RPCM_Z14B_B
sel RPC 18 (Load CMG 1(3A_12A))

RPCM_Z14B_B_RPC_18

cmd RPC Position – Open (Verify – Op)

Z1: EPS: RPCM Z13B B
RPCM_Z13B_B
sel RPC 18 (Load CMG 2 (3A-12A))

RPCM_Z13B_B_RPC_18

\RPC Close Cmd – Ena
\RPC Open Cmd – Ena

cmd RPC Position – Close (Verify – Cl)

MCC-H → ISS: “CMG 1 is powered off and CMG 2 is powered on”
17. **CONNECTING CMG 2 DATA BUS TO CMG DAT**

**CMG DAT**

Disconnect

Jumper Cable W0207 P1 (LB GNC-1A) ←|→ Bus A on SBS Cable Assembly Bus Tee

Connect

Jumper Cable W0207 P2 (LB GNC-2A) →|← Bus A on SBS Cable Assembly Bus Tee.

18. **SETTING UP MONITOR FILE FOR CMG 2**

**PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)**

- sel Monitor
- sel Data Logging Mode

File Open

√Directory: c:\pass\dbase

input Filename: cmg2.arc
- sel OK

Monitor Control Panel: Data Logging Mode

input Filesize: 5000000

- sel Run

Verify display indicates ‘Waiting for trigger…’

Move display on desktop for later use – do not close

19. **TURNING ON CMG 2 POWER SUPPLIES USING PASS-1000 COMMAND SCRIPT**

**PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)**

- sel File
- sel Load ASCII File
- sel Load BC List

File Open

√Directory: c:\pass\dbase

sel ps_only.bc
- sel OK

**PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)**

sel BC

MCIABRM – BC Control Panel

Verify Frame Start: Interval = 1000001 usec.
20. VERIFYING CMG 2 POWER SUPPLIES ON COMMAND AND TELEMETRY

Dev 1:RT = 21 (Rec) SA = 6
Verify command words are as shown below:

```
<table>
<thead>
<tr>
<th>Word 1</th>
<th>Time Tag</th>
<th>Incrementing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Word 5</td>
<td>Status Word #1</td>
<td>0005 (hex)</td>
</tr>
<tr>
<td>Word 6</td>
<td>Status Word #2</td>
<td>0010 (hex)</td>
</tr>
<tr>
<td>Word 8</td>
<td>Spin Bearing Temp1</td>
<td>___________ (record)</td>
</tr>
<tr>
<td>Word 9</td>
<td>Spin Bearing Temp2</td>
<td>___________ (record)</td>
</tr>
<tr>
<td>Word 11</td>
<td>EA current</td>
<td>___________ (record)</td>
</tr>
</tbody>
</table>
```

If any command words don’t match those shown in figure

√MCC-H

21. SPINNING UP CMG 2 USING PASS-1000 COMMAND SCRIPT

MCIABRM – BC Control Panel
sel Stop
Verify Status – Halted OK
sel OK
22. **VERIFYING CMG 2 SPINUP COMMAND AND TELEMETRY**

| Dev 1:RT = 21 (Rec) SA = 6 |

Verify command words are as shown below:

![Command Words](image)

If any command words don’t match those shown in figure

**MCC-H**

---

**NOTE**

If the spin bearing temperatures are low, it is possible that the spin motor will not be able to spin the wheel. If the wheel speed does not increase, proceed anyway.
Wait 10 minutes or until word 4 exceeds 0064, then verify the following data (reference sample figure that follows):

- **Word 1**: Time Tag - Incrementing
- **Word 4**: Wheel Speed - Increasing (updates once every 15 seconds)
- **Word 5**: Status Word #1 - 0205 (hex)
- **Word 6**: Status Word #2 - 0010 (hex)
- **Word 8**: Spin Bearing Temp1 - ________ (record)
- **Word 9**: Spin Bearing Temp2 - ________ (record)
- **Word 11**: EA current - ________ (record)

Verify the following telemetry words (reference sample figure that follows):

- **Word 1**: Time Tag - Incrementing
- **Word 22**: Sine SM Current - Non-zero, fluctuating between 0 and greater than 1000 hex
- **Word 23**: Cosine SM Current - Non-zero, fluctuating between 0 and greater than 1000 hex
- **Word 24**: SM Current Cmd - ________ Fluctuating (record)
- **Word 28**: Analog Wheel Spd - Non-zero (updates once every 15 seconds)

√MCC-H - Read down value recorded above

**23. SHUTTING DOWN CMG 2 USING PASS-1000 COMMAND SCRIPT**

MCIABRM – BC Control Panel

Sel Stop

Verify Status – Halted OK

Sel OK
PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)

sel File
sel Load ASCII File
sel Load BC List

File Open
\Directory: c:\pass\dbase

sel ps_only.bc
sel OK

PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)

sel BC

MCIABRM – BC Control Panel
Verify Frame Start: Interval = 1000001 usec.

√Loop selected
√Forever selected

sel Run

24. VERIFYING CMG 2 SHUTDOWN COMMAND AND TELEMETRY

Dev 1:RT = 21 (Rec) SA = 6

Verify command words are as shown below:

*******************************************************************************
If any command words don’t match those shown in figure

√MCC-H
*******************************************************************************

NOTE
Spin Motor status remains ON until Wheel Speed < 10 rpm. Expect transmit subaddress 6 Word 5 to be 0205 and then change to 0005 at <10 rpm. There is no need to wait for this to occur.
Verify the following telemetry words (reference figure that follows):
Word 1 – Time Tag - <Incrementing>
Word 4 – Wheel Speed - <Decreasing or 0000>
(updates once every 15 seconds)
Word 5 – Status Word #1 - 0205 (0005) (hex)
Word 11 – EA current - ___________ (record)

√MCC-H
Read down value recorded above

25. **COMPLETING PASS-1000 SESSION FOR CMG 2**

MCIABRM – BC Control Panel
sel Stop
Verify Status – Halted OK
sel OK

Monitor Control Panel: Data Logging Mode
‘Monitor Control’
sel Stop

Transfer Time
sel OK

Data Logging Results
Verify Interrupts Generated = Buffers Filled = Buffers Written (± 1 acceptable)
sel OK

26. **VERIFYING DATA ACQUISITION FOR CMG 2**

View File
sel Yes

Monitor Control Panel: Data Logging Mode
Verify data was acquired (similar to example in step 15)
27. **DEACTIVATING CMG 2 AND ACTIVATING CMG 3**

MCC-H

Z1: EPS: RPCM Z13B B

RPCM Z13B_B

Sel RPC 18 (Load CMG 2 (3A-12A))

RPCM Z13B_B_RPC_18

Cmd RPC Position – Open (Verify – Op)

Z1: EPS: RPCM Z13B B

RPCM Z13B_B

Sel RPC 17 (Load CMG 3)

RPCM Z13B_B_RPC_17

√RPC Close Cmd – Ena
√RPC Open Cmd – Ena

Cmd RPC Position – Close (Verify – Cl)

**MCC-H → ISS:** “CMG 2 is powered off and CMG 3 is powered on”

28. **CONNECTING CMG 3 DATA BUS TO CMG DAT**

CMG DAT

Disconnect

Jumper Cable W0207 P2 (LB GNC-2A) ←|→ Bus A on SBS Cable
Assembly Bus Tee

Connect

Jumper Cable W0207 P3 (LB GNC-3A) →|← Bus A on SBS Cable
Assembly Bus Tee

29. **SETTING UP MONITOR FILE FOR CMG 3**

**PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)**

Sel Monitor

Sel Data Logging Mode

File Open

\Directory: c:\pass\dbase

Input Filename: cmg3.arc

Sel OK

Monitor Control Panel: Data Logging Mode

Input Filesize: 5000000

Sel Run

Verify display indicates ‘Waiting for trigger…’

Move display on desktop for later use – do not close
30. **TURNING ON CMG 3 POWER SUPPLIES USING PASS-1000 COMMAND SCRIPT**

**PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)**

sel File
sel Load ASCII File
sel Load BC List

File Open
Directory: c:\pass\dbase

sel ps_only.bc
sel OK

**PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)**

sel BC

MCIABRM – BC Control Panel
Verify Frame Start: Interval = 1000001 usec.

\Loop selected
\Forever selected

sel Run

31. **VERIFYING CMG 3 POWER SUPPLIES ON COMMAND AND TELEMETRY**

Dev 1:RT = 21 (Rec) SA = 6

Verify command words are as shown below:

```
0000 0000 0001 0010 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
```

If any command words don’t match those shown in figure

\MCC-H

*******************************************************************************
Dev 1: RT = 21 (Trans) SA = 6

Verify the following telemetry words (reference sample figure that follows)

- Word 1 – Time Tag - <Incrementing>
- Word 5 – Status Word #1 - 0005 (hex)
- Word 6 – Status Word #2 - 0010 (hex)
- Word 8 – Spin Bearing Temp1 - ___________ (record)
- Word 9 – Spin Bearing Temp2 - ___________ (record)
- Word 11 – EA current - ___________ (record)

√MCC-H

Read down values recorded above

32. SPINNING UP CMG 3 USING PASS-1000 COMMAND SCRIPT

MCIABRM – BC Control Panel

sel Stop
Verify Status – Halted OK
sel OK

PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)

sel File
sel Load ASCII File
sel Load BC List

File Open

\Directory: c:\pass\dbase

sel ps_sm.bc
sel OK

PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)

sel BC

MCIABRM – BC Control Panel
Verify Frame Start: Interval = 1000002 usec.

\Loop selected
\Forever selected

sel Run
33. VERIFYING CMG 3 SPINUP COMMAND AND TELEMETRY

Dev 1: RT = 21 (Rec) SA = 6

Verify command words are as shown below:

```
0000 0000 0201 0010 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000
```

If any command words don’t match those shown in figure

\[\text{√MCC-H}\]

If the spin bearing temperatures are low, it is possible that the spin motor will not be able to spin the wheel. If the wheel speed does not increase, proceed anyway.

Dev 1: RT = 21 (Trans) SA = 6

Wait 10 minutes or until word 4 exceeds 0064, then verify the following data (reference sample figure that follows):

- Word 1 – Time Tag - <Incrementing>
- Word 4 – Wheel Speed - <Increasing> (updates once every 15 seconds)
- Word 5 – Status Word #1 - 0205 (hex)
- Word 6 – Status Word #2 - 0010 (hex)
- Word 8 – Spin Bearing Temp1 - ______ (record)
- Word 9 – Spin Bearing Temp2 - ______ (record)
- Word 11 – EA current - ______ (record)
Dev 1: RT = 21 (Trans) SA = 7

Verify the following telemetry words (reference sample figure that follows):

Word 1 – Time Tag - <Incrementing>
Word 22 – Sine SM Current - <non-zero, fluctuating between 0 and greater than 1000 hex>
Word 23 – Cosine SM Current - <non-zero, fluctuating between 0 and greater than 1000 hex>
Word 24 – SM Current Cmd - ___________ <fluctuating> (record)
Word 28 – Analog Wheel Spd - <non-zero> (updates once every 15 seconds)

\[ MCC-H \]
Read down value recorded above

34. SHUTTING DOWN CMG 3 USING PASS-1000 COMMAND SCRIPT

MCIABRM – BC Control Panel
sel Stop
Verify Status – Halted OK
sel OK

PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)
sel File
sel Load ASCII File
sel Load BC List

File Open
\[ Directory: c:\pass\dbase \]

sel ps_only.bc
sel OK

PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)
sel BC

MCIABRM – BC Control Panel
Verify Frame Start: Interval = 1000001 usec.

\[ Loop selected \]
\[ Forever selected \]

sel Run
35. **VERIFYING CMG 3 SHUTDOWN COMMAND AND TELEMETRY**

Verify command words are as shown below:

```
Dev 1:RT = 21 (Rec) SA = 6
```

```
0000 0000 0001 0010 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000
```

If any command words don’t match those shown in figure

\textbf{√MCC-H}

---

**NOTE**

Spin Motor status remains ON until Wheel Speed < 10 rpm.
Expect transmit subaddress 6 Word 5 to be 0205 and then change to 0005 at <10 rpm. There is no need to wait for this to occur.

```
Dev 1:RT = 21 (Trans) SA = 6
```

Verify the following telemetry words (reference figure that follows):

- **Word 1** – Time Tag - <Incrementing>
- **Word 4** – Wheel Speed - <Decreasing or 0000> (updates once every 15 seconds)
- **Word 5** – Status Word #1 - 0205 (0005) (hex)
- **Word 11** – EA current - ___________ (record)

\textbf{√MCC-H}

Read down value recorded above

---

36. **COMPLETING PASS-1000 SESSION FOR CMG 3**

MCIABRM – BC Control Panel

sel Stop

Verify Status – Halted OK

sel OK

11 NOV 00
Monitor Control Panel: Data Logging Mode
‘Monitor Control’
sel Stop

Transfer Time
sel OK

Data Logging Results
Verify Interrupts Generated = Buffers Filled = Buffers Written (± 1 acceptable)

sel OK

37. VERIFYING DATA ACQUISITION FOR CMG 3
View File
sel Yes

Monitor Control Panel: Data Logging Mode
Verify data was acquired (similar to example in step 15)

Monitor Control Panel: Data Logging Mode
Sel File
Sel Exit

38. DEACTIVATING CMG 3 AND ACTIVATING CMG 4

MCC-H
Z1: EPS: RPCM Z13B B
RPCM_Z13B_B
sel RPC 17 (Load CMG 3)

RPCM_Z13B_B_RPC_17
cmd RPC Position – Open (Verify – Op)

Z1: EPS: RPCM Z14B B
RPCM_Z14B_B
sel RPC 17 (Load CMG 4)

RPCM_Z14B_B_RPC_17
\RPC Close Cmd – Ena
\RPC Open Cmd – Ena

 cmd RPC Position – Close (Verify – Cl)

MCC-H → ISS: “CMG 3 is powered off and CMG 4 is powered on”

39. CONNECTING CMG 4 DATA BUS TO DAT
CMG DAT Disconnect
Jumper Cable W0207 P3 (LB GNC-3A) ←–→ Bus A on SBS Cable
Assembly Bus Tee.
Connect
Jumper Cable W0207 P4 (LB GNC-4A) →|← Bus A on SBS Cable
Assembly Bus Tee.

40. **SETTING UP MONITOR FILE FOR CMG 4**

**PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)**

- sel Monitor
- sel Data Logging Mode

File Open
√Directory: c:\pass\dbase

input Filename: cmg4.arc
sel OK

Monitor Control Panel: Data Logging Mode
input Filesize: 5000000
sel Run

Verify display indicates ‘Waiting for trigger…’

Move display on desktop for later use – do not close

41. **TURNING ON CMG 4 POWER SUPPLIES USING PASS-1000 COMMAND SCRIPT**

**PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)**

- sel File
- sel Load ASCII File
- sel Load BC List

File Open
√Directory: c:\pass\dbase

sel ps_only.bc
sel OK

**PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)**

- sel BC

MCIABRM – BC Control Panel
Verify Frame Start: Interval = 1000001 usec.

√Loop selected
√Forever selected

sel Run
42. **VERIFYING CMG 4 POWER SUPPLIES ON COMMAND AND TELEMETRY**

Dev 1:RT = 21 (Rec) SA = 6

Verify command words are as shown below:

<table>
<thead>
<tr>
<th>Dev 1:RT = 21 (Rec) SA = 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>0000 0000 0001 0010 0000 0000 0000 0000</td>
</tr>
<tr>
<td>0000 0000 0000 0000 0000 0000 0000 0000</td>
</tr>
<tr>
<td>0000 0000 0000 0000 0000 0000 0000 0000</td>
</tr>
<tr>
<td>0000 0000 0000 0000 0000 0000 0000 0000</td>
</tr>
</tbody>
</table>

If any command words don’t match those shown in figure

√MCC-H

******************************************************************************

43. **SPINNING UP CMG 4 USING PASS-1000 COMMAND SCRIPT**

MCIABRM – BC Control Panel

sel Stop

Verify Status – Halted OK

sel OK

PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)

sel File

sel Load ASCII File

sel Load BC List
44. **VERIFYING CMG 4 SPINUP COMMAND AND TELEMETRY**

 Verify command words are as shown below:

```
Dev 1:RT = 21 (Rec) SA = 6
```

If any command words don’t match those shown in figure

```
MCC-H
```

**NOTE**

If the spin bearing temperatures are low, it is possible that the spin motor will not be able to spin the wheel. If the wheel speed does not increase, proceed anyway.
Wait 10 minutes or until word 4 exceeds 0064, then verify the following data (reference sample figure that follows):

Word 1 – Time Tag - <Incrementing>
Word 4 – Wheel Speed - <Increasing> (updates once every 15 seconds)
Word 5 – Status Word #1 - 0205 (hex)
Word 6 – Status Word #2 - 0010 (hex)
Word 8 – Spin Bearing Temp1 - ___________ (record)
Word 9 – Spin Bearing Temp2 - ___________ (record)
Word 11 – EA current - ___________ (record)

Dev 1:RT = 21 (Trans) SA = 6

Verify the following telemetry words (reference sample figure that follows):

Word 1 – Time Tag - <Incrementing>
Word 22 – Sine SM Current - <non-zero, fluctuating between 0 and greater than 1000 hex>
Word 23 – Cosine SM Current - <non-zero, fluctuating between 0 and greater than 1000 hex>
Word 24 – SM Current Cmd - ___________ <fluctuating> (record)
Word 28 – Analog Wheel Spd - <non-zero> (updates once every 15 seconds)

√MCC-H
Read down value recorded above

45. SHUTTING DOWN CMG 4 USING PASS-1000 COMMAND SCRIPT
MCIABRM – BC Control Panel
sel Stop
Verify Status – Halted OK
sel OK
PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)

sel File
sel Load ASCII File
sel Load BC List

File Open
\Directory:  c:\pass\dbase

sel ps_only.bc
sel OK

PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)

sel BC

MCIABRM – BC Control Panel
Verify Frame Start: Interval = 1000001 usec.

√ Loop selected
√ Forever selected

sel Run

46. VERIFYING CMG 4 SHUTDOWN COMMAND AND TELEMETRY

Dev 1:RT = 21 (Rec) SA = 6
Verify command words are as shown below:

Dev 1:RT = 21 (Rec) SA = 6

If any command words don’t match those shown in figure

√ MCC-H

NOTE
Spin Motor status remains ON until Wheel Speed < 10 rpm. Expect transmit subaddress 6 Word 5 to be 0205 and then change to 0005 at <10 rpm. There is no need to wait for this to occur.
Verify the following telemetry words (reference figure)

Word 1 - Time Tag - <Incrementing>
Word 4 - Wheel Speed - <Decreasing or 0000>
  (updates once every 15 seconds)
Word 5 - Status Word #1 - 0205 (0005) (hex)
Word 11 - EA current - ___________ (record)

\MCC-H
Read down value recorded above

47. COMPLETING PASS-1000 SESSION FOR CMG 4

MCIABRM – BC Control Panel
  sel Stop
  Verify Status – Halted OK
  sel OK

  Monitor Control Panel: Data Logging Mode
  ‘Monitor Control’
  sel Stop

  Transfer Time
  sel OK

  Data Logging Results
  Verify Interrupts Generated = Buffers Filled = Buffers Written (± 1 acceptable)

  sel OK

48. VERIFYING DATA ACQUISITION FOR CMG 4

  View File
  sel Yes

  Monitor Control Panel: Data Logging Mode
  Verify data was acquired (similar to example in step 15)
49. **DEACTIVATING CMG 4**  

MCC-H  

Z1: EPS: RPCM Z14B B  

RPCM_Z14B_B  

sel RPC 17 (Load CMG 4)  

RPCM_Z14B_B_RPC_17  

**cmd**  

RPC Position – Open (Verify – Op)  

**MCC-H → ISS:** “CMG 4 is powered off”

50. **PERFORMING CONTINGENCY ACTIVITY FOR POSSIBLE FAILED CMG**  

On MCC-H GO, for any CMG which did not operate nominally per this procedure, perform **(CMG KICKSTART (MILKSHAKE) USING DATA ANALYSIS TOOL (DAT)),** all (SODF: ASSY OPS: CMG), then:  

51. **RECONNECTION OF CMG 4 DATA BUS TO DAT FOR SPIN BEARING HEATER ACTIVATION**  

Perform steps 51 – 61 On MCC-H GO to enable Spin Bearing Heaters on CMG 4.  

If **{CMG KICKSTART (MILKSHAKE) USING DATA ANALYSIS TOOL (DAT)}** was performed  

Connect  

Jumper Cable W0207 P4 (LB GNC-4A) →|← Bus A on SBS  

Cable Assembly Bus Tee  

52. **ACTIVATING CMG 4 FOR SPIN BEARING HEATER ACTIVATION**  

MCC-H  

Z1: EPS: RPCM Z14B B  

RPCM_Z14B_B  

sel RPC 17 (Load CMG 4)  

RPCM_Z14B_B_RPC_17  

**cmd**  

RPC Position – Close (Verify – Cl)  

**MCC-H → ISS:** “CMG 4 is powered on”

53. **SETTING UP MONITOR FILE FOR CMG 4 SPIN BEARING HEATER ACTIVATION**  

**PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)**  

sel Monitor  

sel Data Logging Mode  

File Open  

`\Directory: c:\pass\dbase`  

input Filename: cmg4htr.arc  

sel OK
Monitor Control Panel: Data Logging Mode
input Filesize: 5000000

sel Run

Verify display indicates ‘Waiting for trigger…’

Move display on desktop for later use – do not close

54. SETTING TEST BITS ON CMG 4 USING PASS-1000 COMMAND SCRIPT

PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)

sel File
sel Load ASCII File
sel Load BC List

File Open
√Directory: c:\pass\dbase\power

sel tst_bits.bc
sel OK

PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)

sel BC

MCIABRM – BC Control Panel

Verify Frame Start: Interval = 1000015 usec.

√Loop selected
√Forever selected

sel Run

55. VERIFYING SETTING CMG 4 TEST BITS COMMAND AND TELEMETRY

Dev 1:RT = 21 (Rec) SA = 6

Verify command words are as shown below:
If any command words don’t match those shown in figure
√MCC-H

Dev 1: RT = 21 (Trans) SA = 6

Verify the following telemetry words (reference sample figure below)
Word 1 – Time Tag - <Incrementing>
Word 5 – Status Word #1 - 0004 (hex)
Word 6 – Status Word #2 - 0510 (hex)

56. TURNING ON CMG 4 POWER SUPPLIES (WITH TEST BITS) USING PASS-1000 COMMAND SCRIPT
MCIABRM – BC Control Panel
sel Stop
Verify Status – Halted OK
sel OK

PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)
sel File
sel Load ASCII File
sel Load BC List

File Open
√Directory: c:\pass\dbase\power

sel tps_on.bc
sel OK

PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)
sel BC

MCIABRM – BC Control Panel
Verify Frame Start: Interval = 1000011 usec.

√Loop selected
√Forever selected

sel Run
57. **VERIFYING CMG 4 POWER SUPPLIES ON (WITH TEST BITS)**

**COMMAND AND TELEMETRY**

Dev 1: RT = 21 (Rec) SA = 6

Verify command words are as shown below:

- Dev 1: RT = 21 (Rec) SA = 6

If any command words don’t match those shown in figure

√MCC-H

Dev 1: RT = 21 (Trans) SA = 6

Verify the following telemetry words (reference sample figure that follows)

- Word 1 – Time Tag - <Incrementing>
- Word 5 – Status Word #1 - 0004 (hex)
- Word 6 – Status Word #2 - 0510 (hex)
- Word 11 – EA Current - ___________ (record)

Read down value recorded above

√MCC-H

58. **ENABLING SPIN BEARING HEATERS ON CMG 4 USING PASS-1000 COMMAND SCRIPT**

MCIABRM – BC Control Panel

sel Stop

Verify Status – Halted OK

sel OK

PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)

sel File

sel Load ASCII File

sel Load BC List

File Open

√Directory: c:\pass\dbase\power
sel tps_htr.bc
sel OK

PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)

sel BC

MCIABRM – BC Control Panel
Verify Frame Start: Interval = 1000013 usec.

√ Loop selected
√ Forever selected

sel Run

59. VERIFYING CMG 4 SPIN BEARING HEATER ENABLE COMMAND AND TELEMETRY

Dev 1: RT = 21 (Rec) SA = 6
Verify command words are as shown below:

Dev 1: RT = 21 (Rec) SA = 6

verify the following telemetry words (reference sample figure that follows)

Word 1 – Time Tag - <Incrementing>
Word 5 – Status Word #1 - ___________ (record)
Word 6 – Status Word #2 - 0510 (hex)
Word 8 – Spin Bearing Temp1 - ___________ (record)
Word 9 – Spin Bearing Temp2 - ___________ (record)
Word 11 – EA current - ___________ (record)
60. **COMPLETING PASS-1000 SESSION FOR CMG 4 SPIN BEARING HEATER ACTIVATION**

- MCIABRM – BC Control Panel
  - sel Stop
  - Verify Status – Halted OK
  - sel OK

- Monitor Control Panel: Data Logging Mode
  - ‘Monitor Control’
  - sel Stop

- Transfer Time
  - sel OK

- Data Logging Results
  - Verify Interrupts Generated = Buffers Filled = Buffers Written (± 1 acceptable)
  - sel OK

61. **VERIFYING DATA ACQUISITION FOR CMG 4 SPIN BEARING HEATER ACTIVATION**

- View File
  - sel Yes

- Monitor Control Panel: Data Logging Mode
  - Verify data was acquired (similar to example in Step 15)

- Monitor Control Panel: Data Logging Mode
  - Sel File
  - Sel Exit

62. **DISCONNECTING CMG 4 DATA BUS FROM CMG DAT**

- CMG DAT Disconnect
  - Jumper Cable W0207 P4 (LB GNC-4A) ←→ Bus A on SBS Cable
  - Assembly Bus Tee
63. **CONNECTING CMG 1 DATA BUS TO CMG DAT FOR CMG 1 SPIN BEARING HEATER ACTIVATION**

Perform steps 63 – 74 on MCC-H GO to activate Spin Bearing Heaters on CMG 1.

**CMG DAT**

Connect Jumper Cable W0207 P1 (LB GNC-1A) → Bus A on SBS Cable Assembly Bus Tee

64. **ACTIVATING CMG 1 FOR SPIN BEARING HEATER ACTIVATION**

**MCC-H**

<table>
<thead>
<tr>
<th>Z1: EPS: RPCM Z14B B</th>
<th>RPCM_Z14B_B_RPC_18</th>
</tr>
</thead>
<tbody>
<tr>
<td>sel RPC 18 (Load CMG 1 (3A-12A))</td>
<td></td>
</tr>
<tr>
<td>cmd RPC Position – Close (Verify – Cl)</td>
<td></td>
</tr>
</tbody>
</table>

MCC-H → ISS: “CMG 1 is powered on”

65. **SETTING UP MONITOR FILE FOR CMG 1 SPIN BEARING HEATER ACTIVATION**

**PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)**

| sel Monitor |
| sel Data Logging Mode |

| File Open |
|√ Directory: c:\pass\dbase |

input Filename: cmg1htr.arc

| sel OK |
| Monitor Control Panel: Data Logging Mode |

| input Filesize: 5000000 |
| sel Run |

Verify display indicates ‘Waiting for trigger…’

Move display on desktop for later use – do not close

66. **SETTING TEST BITS ON CMG 1 USING PASS-1000 COMMAND SCRIPT**

**PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)**

| sel File |
| sel Load ASCII File |
| sel Load BC List |

| File Open |
|√ Directory: c:\pass\dbase\power |
sel tst_bits.bc
sel OK

PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)

sel BC

MCIABRM – BC Control Panel
Verify Frame Start: Interval = 1000015 usec.

Loop selected
Forever selected

sel Run

67. VERIFYING SETTING CMG 1 TEST BITS COMMAND AND TELEMETRY

Dev 1:RT = 21 (Rec) SA = 6
Verify command words are as shown below:

************************************************************
If any command words don't match those shown in figure

√MCC-H

************************************************************

Dev 1:RT = 21 (Trans) SA = 6
Verify the following telemetry words (reference sample figure below)

<table>
<thead>
<tr>
<th>Word 1</th>
<th>Time Tag</th>
<th>&lt;Incrementing&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Word 5</td>
<td>Status Word #1</td>
<td>0004 (hex)</td>
</tr>
<tr>
<td>Word 6</td>
<td>Status Word #2</td>
<td>0510 (hex)</td>
</tr>
</tbody>
</table>

Word 1

Word 5

Word 6
68. **TURNING ON CMG 1 POWER SUPPLIES (WITH TEST BITS) USING PASS-1000 COMMAND SCRIPT**

- MCIABRM – BC Control Panel
- sel Stop
- Verify Status – Halted OK
- sel OK

**PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)**

- sel File
- sel Load ASCII File
- sel Load BC List

![File Open](Image)

Directory: `c:\pass\dbase\power`

- sel tps_on.bc
- sel OK

**PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)**

- sel BC

MCIABRM – BC Control Panel

Verify Frame Start: Interval = 100011 usec.

- √ Loop selected
- √ Forever selected

- sel Run

69. **VERIFYING CMG 1 POWER SUPPLIES ON (WITH TEST BITS) COMMAND AND TELEMETRY**

- Dev 1:RT = 21 (Rec) SA = 6

Verify command words are as shown below:

![Command Words](Image)

If any command words don’t match those shown in figure

√ MCC-H

******************************************************************
Dev 1: RT = 21 (Trans) SA = 6

Verify the following telemetry words (reference sample figure that follows)

Word 1 – Time Tag - <Incrementing>
Word 5 – Status Word #1 - 0004 (hex)
Word 6 – Status Word #2 - 0510 (hex)
Word 11 – EA Current - ___________ (record)

√MCC-H
Read down value recorded above

70. **ENABLING SPIN BEARING HEATERS ON CMG 1 USING PASS-1000 COMMAND SCRIPT**

MCIABRM – BC Control Panel

sel Stop
Verify Status – Halted OK
sel OK

PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)

sel File
sel Load ASCII File
sel Load BC List

File Open
\Directory: c:\pass\dbase\power

sel tps_htr.bc
sel OK

PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)

sel BC

MCIABRM – BC Control Panel
Verify Frame Start: Interval = 1000013 usec.

\Loop selected
\Forever selected

sel Run
71. VERIFYING CMG 1 SPIN BEARING HEATER COMMAND AND TELEMETRY

Dev 1:RT = 21 (Rec) SA = 6  
Verify command words are as shown below:

```
Dev 1:RT = 21 (Rec) SA = 6
```

If any command words don’t match those shown in figure

√MCC-H

Dev 1:RT = 21 (Trans) SA = 6  
Verify the following telemetry words (reference sample figure that follows)

Word 1 – Time Tag - <Incrementing>
Word 5 – Status Word #1 - ___________ (record)
Word 6 – Status Word #2 - 0510 (hex)
Word 8 – Spin Bearing Temp1 - ___________ (record)
Word 9 – Spin Bearing Temp2 - ___________ (record)
Word 11 – EA current - ___________ (record)

√MCC-H
Read down values recorded above

72. COMPLETING PASS-1000 SESSION FOR CMG 1 SPIN BEARING HEATER ACTIVATION

MCIABRM – BC Control Panel
sel Stop  
Verify Status – Halted OK
sel OK

Monitor Control Panel: Data Logging Mode
‘Monitor Control’
sel Stop
Transfer Time
sel OK

Data Logging Results
Verify Interrupts Generated = Buffers Filled = Buffers Written (± 1 acceptable)
sel OK

73. VERIFYING DATA ACQUISITION FOR CMG 1 SPIN BEARING HEATER ACTIVATION

View File
sel Yes

Monitor Control Panel: Data Logging Mode
Verify data was acquired (similar to example in Step 15)

Monitor Control Panel: Data Logging Mode
Sel File
Sel Exit

74. DISCONNECTING CMG 1 DATA BUS FROM CMG DAT

CMG DAT Disconnect
Jumper Cable W0207 P1 (LB GNC-1A) ←|→ Bus A on SBS Cable Assembly Bus Tee

75. CONNECTING CMG 2 DATA BUS TO CMG DAT FOR CMG 2 SPIN BEARING HEATER ACTIVATION

Perform steps 75 – 86 On MCC-H GO to activate Spin Bearing Heaters on CMG 2.

CMG DAT Connect
Jumper Cable W0207 P2 (LB GNC-2A) →|← Bus A on SBS Cable Assembly Bus Tee.

76. ACTIVATING CMG 2 FOR SPIN BEARING HEATER ACTIVATION

MCC-H Z1: EPS: RPCM Z13B B
RPCM_Z13B_B
sel RPC 18 (Load CMG 2(3A-12A))

RPCM_Z13B_B_RPC_18
cmd RPC Position – Close (Verify – Cl)

MCC-H → ISS: “CMG 2 is powered on”
77. SETTING UP MONITOR FILE FOR CMG 2 SPIN BEARING HEATER ACTIVATION

PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)

sel Monitor
sel Data Logging Mode

File Open
√Directory: c:\pass\dbase

input Filename: cmg2htr.arc
sel OK

Monitor Control Panel: Data Logging Mode
input Filesize: 5000000
sel Run

Verify display indicates ‘Waiting for trigger…’

Move display on desktop for later use – do not close

78. SETTING TEST BITS ON CMG 2 USING PASS-1000 COMMAND SCRIPT

PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)

sel File
sel Load ASCII File
sel Load BC List

File Open
√Directory: c:\pass\dbase\power

sel tst_bits.bc
sel OK

PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)

sel BC

MCIABRM – BC Control Panel
Verify Frame Start: Interval = 1000015 usec.

√Loop selected
√Forever selected

sel Run
79. **VERIFYING SETTING CMG 2 TEST BITS COMMAND AND TELEMETRY**

Dev 1:RT = 21 (Rec) SA = 6
Verify command words are as shown below:

![Command Word Example](image)

If any command words don’t match those shown in figure

√MCC-H

80. **TURNING ON CMG 2 POWER SUPPLIES (WITH TEST BITS) USING PASS-1000 COMMAND SCRIPT**

MCIABRM – BC Control Panel
sel Stop
Verify Status – Halted OK
sel OK

PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)

File
sel File
sel Load ASCII File
sel Load BC List

File Open
DIRECTORY: c:\pas\dbase\power

sel tps_on.bc
sel OK
PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)

sel BC

MCIABRM – BC Control Panel
Verify Frame Start: Interval = 1000011 usec.

✓ Loop selected
✓ Forever selected

sel Run

81. VERIFYING CMG 2 POWER SUPPLIES ON (WITH TEST BITS)
COMMAND AND TELEMETRY

Dev 1:RT = 21 (Rec) SA = 6
Verify command words are as shown below:

Dev 1:RT = 21 (Rec) SA = 6

Verify the following telemetry words (reference sample figure that follows)

Word 1 – Time Tag - <Incrementing>
Word 5 – Status Word #1 - 0004 (hex)
Word 6 – Status Word #2 - 0510 (hex)
Word 11 – EA Current - ___________ (record)

✓ MCC-H

Read down value recorded above
82. **ENABLING SPIN BEARING HEATERS ON CMG 2 USING PASS-1000 COMMAND SCRIPT**

MCIABRM – BC Control Panel
sel Stop
Verify Status – Halted OK
sel OK

**PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)**

sel File
sel Load ASCII File
sel Load BC List

File Open
Directory: c:\pass\dbase\power

sel tps_htr.bc
sel OK

**PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)**

sel BC

MCIABRM – BC Control Panel
Verify Frame Start: Interval = 1000013 usec.

\√ Loop selected
\√ Forever selected

sel Run

83. **VERIFYING CMG 2 SPIN BEARING HEATER COMMAND AND TELEMETRY**

Dev 1:RT = 21 (Rec) SA = 6

Verify command words are as shown below:

<table>
<thead>
<tr>
<th>Dev 1:RT = 21 (Rec) SA = 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitor BC: 4</td>
</tr>
</tbody>
</table>

***************************************************************************
If any command words don’t match those shown in figure

√ MCC-H
***************************************************************************
Dev 1: RT = 21 (Trans) SA = 6

Verify the following telemetry words (reference sample figure that follows)

- Word 1 – Time Tag: Incrementing
- Word 5 – Status Word #1:
- Word 6 – Status Word #2: 0510 (hex)
- Word 8 – Spin Bearing Temp1:
- Word 9 – Spin Bearing Temp2:
- Word 11 – EA current:

√MCC-H

Read down values recorded above

84. **COMPLETING PASS-1000 SESSION FOR CMG 2 SPIN BEARING HEATER ACTIVATION**

- MCIABRM – BC Control Panel
- sel Stop
- Verify Status – Halted OK
- sel OK

- Monitor Control Panel: Data Logging Mode
  ‘Monitor Control’
  sel Stop

- Transfer Time
  sel OK

- Data Logging Results
  Verify Interrupts Generated = Buffers Filled = Buffers Written (∓ 1 acceptable)
  sel OK

85. **VERIFYING DATA ACQUISITION FOR CMG 2 SPIN BEARING HEATER ACTIVATION**

- View File
  sel Yes

- Monitor Control Panel: Data Logging Mode
  Verify data was acquired (example in Step 15)
CMG CHECKOUT USING DATA ANALYSIS TOOL (DAT)

86. **DISCONNECTING CMG 2 DATA BUS FROM CMG DAT**

CMG DAT Disconnect

Jumper Cable W0207 P2 (LB GNC-2A) ←|→ Bus A on SBS Cable Assembly Bus Tee

87. **CONNECTING CMG 3 DATA BUS TO CMG DAT FOR CMG 3 SPIN BEARING HEATER ACTIVATION**

Perform steps 87 – 98 on MCC-H GO to activate Spin Bearing Heaters on CMG 3.

CMG DAT Connect

Jumper Cable W0207 P3 (LB GNC-3A) →|← Bus A on SBS Cable Assembly Bus Tee.

88. **ACTIVATING CMG 3 FOR SPIN BEARING HEATER ACTIVATION**

MCC-H Z1: EPS: RPCM Z13B B

RPCM_Z13B_B.sel RPC 17 (Load CMG 3)

RPCM_Z13B_B_RPC_17.cmd RPC Position – Close (Verify – Cl)

MCC-H → ISS: “CMG 3 is powered on”

89. **SETTING UP MONITOR FILE FOR CMG 3 SPIN BEARING HEATER ACTIVATION**

PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)

sel Monitor

sel Data Logging Mode

File Open

√ Directory: c:\pass\dbase

input Filename: cmg3htr.arc

sel OK

Monitor Control Panel: Data Logging Mode

input Filesize: 5000000

sel Run

Verify display indicates ‘Waiting for trigger…’

Move display on desktop for later use – do not close
90. SETTING TEST BITS ON CMG 3 USING PASS-1000 COMMAND

SCRIPT

PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)

sel File
sel Load ASCII File
sel Load BC List

File Open

Directory: c:\pass\dbase\power

sel tst_bits.bc
sel OK

PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)

sel BC

MCIABRM – BC Control Panel

Verify Frame Start: Interval = 100015 usec.

√Loop selected
√Forever selected

sel Run

91. VERIFYING SETTING CMG 3 TEST BITS COMMAND AND

TELEMETRY

Dev 1:RT = 21 (Rec) SA = 6

Verify command words are as shown below:

*************************************************************

If any command words don’t match those
shown in figure

√MCC-H

*************************************************************

Dev 1:RT = 21 (Trans) SA = 6

Verify the following telemetry words (reference sample figure below)

Word 1 – Time Tag - <Incrementing>
Word 5 – Status Word #1 - 0004 (hex)
Word 6 – Status Word #2 - 0510 (hex)
92. **TURNING ON CMG 3 POWER SUPPLIES (WITH TEST BITS) USING PASS-1000 COMMAND SCRIPT**

   MCIABRM – BC Control Panel
   sel Stop
   Verify Status – Halted OK
   sel OK

   PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)
   sel File
   sel Load ASCII File
   sel Load BC List

   File Open
   √Directory: c:\pass\dbase\power

   sel tps_on.bc
   sel OK

   PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)
   sel BC

   MCIABRM – BC Control Panel
   Verify Frame Start: Interval = 1000011 usec.

   √Loop selected
   √Forever selected

   sel Run

93. **VERIFYING CMG 3 POWER SUPPLIES ON (WITH TEST BITS) COMMAND AND TELEMETRY**

   Dev 1:RT = 21 (Rec) SA = 6

   Verify command words are as shown below:
If any command words don’t match those shown in figure

√MCC-H

Verify the following telemetry words (reference sample figure that follows)

- Word 1 – Time Tag - <Incrementing>
- Word 5 – Status Word #1 - 0004 (hex)
- Word 6 – Status Word #2 - 0510 (hex)
- Word 11 – EA Current - ___________ (record)

√MCC-H

Read down value recorded above

94. ENABLING SPIN BEARING HEATERS ON CMG 3 USING PASS-1000 COMMAND SCRIPT

MCIABRM – BC Control Panel
sel Stop
Verify Status – Halted OK
sel OK

PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)
sel File
sel Load ASCII File
sel Load BC List

File Open
√Directory: c:\pass\dbase\power

sel tps_htr.bc
sel OK

PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)
sel BC

MCIABRM – BC Control Panel
Verify Frame Start: Interval = 1000013 usec.
95. **VERIFYING CMG 3 SPIN BEARING HEATER COMMAND AND TELEMETRY**

Dev 1:RT = 21 (Rec) SA = 6

Verify command words are as shown below:

```
0000 0000 0400 0510 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000
```

**MCC-H**

If any command words don’t match those shown in figure

Verify the following telemetry words (reference sample figure that follows)

- **Word 1** – Time Tag - <Incrementing>
- **Word 5** – Status Word #1 - ___________ (record)
- **Word 6** – Status Word #2 - 0510 (hex)
- **Word 8** – Spin Bearing Temp1 - ___________ (record)
- **Word 9** – Spin Bearing Temp2 - ___________ (record)
- **Word 11** – EA current - ___________ (record)

**MCC-H**

Read down values recorded above

96. **COMPLETING PASS-1000 SESSION FOR CMG 3 SPIN BEARING HEATER ACTIVATION**

MCIABRM – BC Control Panel

sel Stop

Verify Status – Halted OK

sel OK
Monitor Control Panel: Data Logging Mode
'Monitor Control'
 sel Stop

Transfer Time
 sel OK

Data Logging Results
Verify Interrupts Generated = Buffers Filled = Buffers Written (± 1 acceptable)
 sel OK

97. VERIFYING DATA ACQUISITION FOR CMG 3 SPIN BEARING HEATER ACTIVATION

View File
 sel Yes

Monitor Control Panel: Data Logging Mode
Verify data was acquired (similar to example in Step 15)

Monitor Control Panel: Data Logging Mode
Sel File
Sel Exit

98. DISCONNECTING CMG 3 DATA BUS FROM CMG DAT

CMG DAT Disconnect
 Jumper Cable W0207 P3 (LB GNC-3A) ←→ Bus A on SBS Cable Assembly Bus Tee.

99. SHUTTING DOWN PASS-1000

PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)
 sel File
 sel Exit

Warning
 sel Yes

100. RECONFIGURING CMG DAT WITH FLASHCARD

Replace Terminator on SBS Cable Assembly Bus Tee A.

CAUTION
Do not disconnect cable from card. Severe hardware damage to PCMCIA Card may occur
Remove DAT PASS 1000 PCMCIA Card (1553 card) with Cable Assembly from CMG DAT top slot.

Insert Flash Memory Card into CMG DAT top slot.

101. PREPARING LOG FILES FOR DOWNLINK

Windows Desktop
sel Start
sel Programs
sel Windows Explorer

Exploring — (C:)
Locate log files with *.arc extension in folder C:\pass\dbase

Highlight files and drag and drop them to Flashcard Drive E:

Windows Desktop
sel Start
sel Shut Down…

Shut Down Windows
sel Shut Down
sel OK

102. PREPARING FOR CMG DAT CLOSEOUT

NOTE
1. RPC 11 must be opened to ensure power is isolated at the J8 connector on the RFPDB used to power the CMG DAT.
2. This RPC also powers off the ECS Receive and Transmit RF Switches therefore antenna swapping will not occur if ECS is in use.

MCC-H
NODE1: EPS: RPCM N1RS2 A
RPCM_ N1RS2_A

sel RPC 11 (ECOMM RFPDB)

RPCM_ N1RS2_A_RPC_11
cmd RPC Position – Open Execute (Verify – Op)

MCC-H → ISS “RFPDB Outlet for DAT is unpowered”
103. CLOSING OUT CMG DAT

RFPDB  PGSC / RF sw – Off

RFPDB  Disconnect
Orbiter DC Power Cable ←|→ J8 PGSC/PWR on RFPDB
Orbiter DC Power Cable ←|→ J1 on RS/ORB DC Power Supply
DC Pwr Sply Adapter Cable 10’ ←|→ J2 on RS/ORB DC Power Supply
DC Pwr Sply Adapter Cable 10’ ←|→ CMG DAT Laptop

ISS → MCC-H “CMG DAT power cable is disconnected from RFPDB”

Remove Flash Memory Card from CMG DAT top slot and downlink all *.arc
log files to MCC

Return CMG DAT and support hardware to stowage.

Place Flash Memory Card in Return to Houston Bag.

104. REACTIVATING RFPDB RPC 11

RFPDB  PGSC/RF sw – On

MCC-H  NODE 1: EPS: RPCM N1RS2 A
RPCM_ N1RS2_A
sel RPC 11 (Load ECOMM RFPDB)

RPCM_ N1RS2_A_RPC_11

cmd  RPC Position – Close Execute (Verify – Cl)

CMG DAT REFERENCE DATA

Hexidecimal conversion and CMG 1553 subaddress data Definitions

Hexidecimal Conversion

Each subaddress has 32 words of 4 hex digits each. Note that not all words
are used in every subaddress.

Example: Spin Bearing Heater – On
For analog data, a 4 digit hex word has 65,536 equivalent decimal values which must be multiplied by a scaling factor to produce a parameter calibrated in the correct units.

For discrete data, a 4 digit hex word expands to 16 binary digits (4 bits for each hex digit) which represent parameters as specified in the tables that follow.

Example: For Subaddress 6 (transmit), word 5 is 2405 Hex.

According the Subaddress 6 Transmit table, word 5 is CMG Configuration Status #1.

Converting each hex digit to binary, it can be determined which bits are set.

<table>
<thead>
<tr>
<th>Hex Digit</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hex Value</td>
<td>2</td>
<td>4</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Binary Value</td>
<td>0010</td>
<td>0100</td>
<td>0000</td>
<td>0101</td>
</tr>
<tr>
<td>Bit order</td>
<td>15–12</td>
<td>11–8</td>
<td>7–4</td>
<td>3–0</td>
</tr>
</tbody>
</table>

Using CMG Configuration Status #1 table, it can be seen that bits 13, 10, 2 and 0 are set. This indicates that the Spin Bearing Heater is ON, the Spin Bearing Heater is ENABLE, the CPU Reset flag is indicating RESET, and the Power Supplies are ON.
Subaddress 6 Receive – Commands to CMG

<table>
<thead>
<tr>
<th>Word</th>
<th>Description</th>
<th>Units of Measure</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Inner Gimbal Rate Command</td>
<td>Degree/sec</td>
<td>±3.104</td>
</tr>
<tr>
<td>2</td>
<td>Outer Gimbal Rate Command</td>
<td>Degree/sec</td>
<td>±3.104</td>
</tr>
<tr>
<td>3</td>
<td>CMG Configuration Command #1</td>
<td></td>
<td>See Table Below</td>
</tr>
<tr>
<td>4</td>
<td>CMG Configuration Command #2</td>
<td></td>
<td>See Table Below</td>
</tr>
</tbody>
</table>

### CMG Configuration Command #1

<table>
<thead>
<tr>
<th>Hex Digit</th>
<th>Bit</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>15</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>Spin Motor Disconnect</td>
<td>1 = ON</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>OG Torquer On</td>
<td>1 = ON</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>IG Torquer On</td>
<td>1 = ON</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td>Spin Bearing Heater Enable</td>
<td>1 = ON</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>Spin Motor On</td>
<td>1 = ON</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>Wheel Speed</td>
<td>These 4 bits set to 0000 are commanded wheel speed of 6600 rpm</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>Wheel Speed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Wheel Speed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Wheel Speed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Reset Configuration Advisory Bits</td>
<td>1 = ON</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>Flight/Test Operation</td>
<td>1 = Test; 0 = Flight</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Enable Fault Isolation</td>
<td>1 = ON</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Reset BIT Status</td>
<td>1 = ON</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>Power Supplies On</td>
<td>1 = ON</td>
</tr>
</tbody>
</table>

### CMG Configuration Command #2

<table>
<thead>
<tr>
<th>Hex Digit</th>
<th>Bit</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>15</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td>Test SM PS On</td>
<td>1 = ON</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>Test OG PS On</td>
<td>1 = ON</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>Test IG PS On</td>
<td>1 = ON</td>
</tr>
<tr>
<td>3</td>
<td>7</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Spin Motor Temperature Over-ride</td>
<td>1 = ON</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>Outer Gimbal Overrate Over-ride</td>
<td>1 = ON</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Inner Gimbal Overrate Over-ride</td>
<td>1 = ON</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Wheel Overspeed Over-ride</td>
<td>1 = ON</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>Loss of Communication Over-ride</td>
<td>1 = ON</td>
</tr>
</tbody>
</table>
### Subaddress 6 Transmit – Normal CMG Output Data

**Subaddress 6 (Transmit) Words 1-4 Definition:**

<table>
<thead>
<tr>
<th>Word</th>
<th>Description</th>
<th>Units of Measure</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Time Tag</td>
<td>Seconds</td>
<td>0 — 16.777</td>
</tr>
<tr>
<td>2</td>
<td>Inner Gimbal Angle</td>
<td>Degree</td>
<td>±180</td>
</tr>
<tr>
<td>3</td>
<td>Outer Gimbal Angle</td>
<td>Degree</td>
<td>±180</td>
</tr>
<tr>
<td>4</td>
<td>Wheel Speed</td>
<td>RPM</td>
<td>0 — 8191</td>
</tr>
<tr>
<td>5</td>
<td>CMG Configuration Status #1</td>
<td>See Table Below</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>CMG Configuration Status #2</td>
<td>See Table Below</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Wheel Unbalance Sensor</td>
<td>g's</td>
<td>0 — 0.5</td>
</tr>
<tr>
<td>8</td>
<td>Spin Bearing #1 Temp.</td>
<td>° F</td>
<td>-65 — 200</td>
</tr>
<tr>
<td>9</td>
<td>Spin Bearing #2 Temp.</td>
<td>° F</td>
<td>-65 — 200</td>
</tr>
<tr>
<td>10</td>
<td>Electronic Assembly Temp.</td>
<td>° F</td>
<td>-65 — 200</td>
</tr>
<tr>
<td>11</td>
<td>Total System Current</td>
<td>Amperes</td>
<td>0 — 9.9</td>
</tr>
</tbody>
</table>

### CMG Configuration Status #1

<table>
<thead>
<tr>
<th>Hex Digit</th>
<th>Bit</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>15</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>Spin Motor Relays Disconnected</td>
<td>1 = TRUE</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>Spin Bearing Heater On</td>
<td>1 = ON</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>OG Torquer On</td>
<td>1 = ON</td>
</tr>
<tr>
<td>2</td>
<td>11</td>
<td>IG Torquer On</td>
<td>1 = ON</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>Spin Bearing Heater Enable</td>
<td>1 = ON</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>Spin Motor On</td>
<td>1 = ON</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>Wheel Speed</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>7</td>
<td>Wheel Speed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Wheel Speed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Wheel Speed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Time Tag Receipt Flag</td>
<td>1 = TRUE</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>Fault Isolation Request</td>
<td>1 = TRUE</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>CPU Reset</td>
<td>1 = RESET</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>1553 Subsystem Flag set (BIT Status Change)</td>
<td>1 = CHANGE</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>Power Supplies On</td>
<td>1 = ON</td>
</tr>
<tr>
<td>Hex Digit</td>
<td>Bit</td>
<td>Description</td>
<td>Value</td>
</tr>
<tr>
<td>-----------</td>
<td>-----</td>
<td>----------------------------------</td>
<td>-------</td>
</tr>
<tr>
<td>1</td>
<td>15</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>11</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>Test SM PS On</td>
<td>1 = ON</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>Test OG PS On</td>
<td>1 = ON</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>Test IG PS On</td>
<td>1 = ON</td>
</tr>
<tr>
<td>3</td>
<td>7</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Spin Motor Temperature Over-ride</td>
<td>1 = ON</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>Outer Gimbal Overrate Over-ride</td>
<td>1 = ON</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Inner Gimbal Overrate Over-ride</td>
<td>1 = ON</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Wheel Overspeed Over-ride</td>
<td>1 = ON</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>Loss of Communication Over-ride</td>
<td>1 = ON</td>
</tr>
</tbody>
</table>
Subaddress 7 Transmit – Health Monitoring Output Data

<table>
<thead>
<tr>
<th>Word</th>
<th>Definition</th>
<th>Units of Measure</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Time Tag</td>
<td>Seconds</td>
<td>0 — 16.777</td>
</tr>
<tr>
<td>2</td>
<td>OG +15 Volt Supply</td>
<td>Volts</td>
<td>0 — 30</td>
</tr>
<tr>
<td>3</td>
<td>OG -15 Volt Supply</td>
<td>Volts</td>
<td>-30 — 0</td>
</tr>
<tr>
<td>4</td>
<td>OG +5 Volt Supply</td>
<td>Volts</td>
<td>0 — 10</td>
</tr>
<tr>
<td>5</td>
<td>OG +6.2 Volt Supply</td>
<td>Volts</td>
<td>0 — 10</td>
</tr>
<tr>
<td>6</td>
<td>Sine OG Torquer Current</td>
<td>Amperes</td>
<td>0 — 5</td>
</tr>
<tr>
<td>7</td>
<td>Cosine OG Torquer Current</td>
<td>Amperes</td>
<td>0 — 5</td>
</tr>
<tr>
<td>8</td>
<td>OG Torquer Current Command</td>
<td>Amperes</td>
<td>0 — 5</td>
</tr>
<tr>
<td>9</td>
<td>Outer Gimbal Rate</td>
<td>Degree/sec</td>
<td>±6.208</td>
</tr>
<tr>
<td>10</td>
<td>OG D/A Converters</td>
<td>Volts</td>
<td>±10</td>
</tr>
<tr>
<td>11</td>
<td>OG Torquer Temperature</td>
<td>°F</td>
<td>-65 — 200</td>
</tr>
<tr>
<td>12</td>
<td>IG +15 Volt Supply</td>
<td>Volts</td>
<td>0 — 30</td>
</tr>
<tr>
<td>13</td>
<td>IG -15 Volt Supply</td>
<td>Volts</td>
<td>-30 — 0</td>
</tr>
<tr>
<td>14</td>
<td>IG +5 Volt Supply</td>
<td>Volts</td>
<td>0 — 10</td>
</tr>
<tr>
<td>15</td>
<td>IG +6.2 Volt Supply</td>
<td>Volts</td>
<td>0 — 10</td>
</tr>
<tr>
<td>16</td>
<td>Sine IG Torquer Current</td>
<td>Amperes</td>
<td>0 — 5</td>
</tr>
<tr>
<td>17</td>
<td>Cosine IG Torquer Current</td>
<td>Amperes</td>
<td>0 — 5</td>
</tr>
<tr>
<td>18</td>
<td>IG Torquer Current Command</td>
<td>Amperes</td>
<td>0 — 5</td>
</tr>
<tr>
<td>19</td>
<td>Inner Gimbal Rate</td>
<td>Degree/sec</td>
<td>±6.208</td>
</tr>
<tr>
<td>20</td>
<td>IG D/A Converters</td>
<td>Volts</td>
<td>±10</td>
</tr>
<tr>
<td>21</td>
<td>IG Torquer Temperature</td>
<td>°F</td>
<td>-65 — 200</td>
</tr>
<tr>
<td>22</td>
<td>Sine SM Current</td>
<td>Amperes</td>
<td>0 — 5</td>
</tr>
<tr>
<td>23</td>
<td>Cosine SM Current</td>
<td>Amperes</td>
<td>0 — 5</td>
</tr>
<tr>
<td>24</td>
<td>Spin Motor Current Command</td>
<td>Amperes</td>
<td>0 — 5</td>
</tr>
<tr>
<td>25</td>
<td>Spin Motor +15 Volt Supply</td>
<td>Volts</td>
<td>0 — 30</td>
</tr>
<tr>
<td>26</td>
<td>Spin Motor -15 Volt Supply</td>
<td>Volts</td>
<td>-30 — 0</td>
</tr>
<tr>
<td>27</td>
<td>Spin Motor +5 Volt Supply</td>
<td>Volts</td>
<td>0 — 10</td>
</tr>
<tr>
<td>28</td>
<td>Analogue Wheel Speed</td>
<td>RPM</td>
<td>0 — 8191</td>
</tr>
<tr>
<td>29</td>
<td>OG +10V DC</td>
<td>Volts</td>
<td>0 — 12.48</td>
</tr>
<tr>
<td>30</td>
<td>IG +10V DC</td>
<td>Volts</td>
<td>0 — 12.48</td>
</tr>
<tr>
<td>31</td>
<td>Spin Motor +10V DC</td>
<td>Volts</td>
<td>0 — 12.48</td>
</tr>
</tbody>
</table>

Subaddress 8 Transmit – Built In Test (BIT) History Data
This subaddress provides a time history of the last 5 BIT status changes experienced by the CMG firmware. Tables available in CMG documentation.

Subaddress 29 Transmit – Built In Test (BIT) Output Data
This subaddress provides detailed status of all BIT parameters. Tables available in CMG documentation.
1. **ACTIVATING CMG FOR CMG KICKSTART TEST PROCEDURE**

**On MCC-H GO**, perform this procedure, one CMG at a time, to resolve CMG Hall Resolver ambiguity.

If performing this procedure to resolve CMG Hall Resolver ambiguity on CMG 1, CMG 2, or CMG 3

**CMG Jumper Cable W0207 P4 (LB GNC-4A) ←→ Bus A on SBS Cable DAT Assembly Bus Tee**

If resolving ambiguity on CMG 1

**MCC-H**

Z1: EPS: RPCM Z14B B

RPCM_Z14B_B

**sel RPC 18 (Load CMG 1 (3A-12A))**

RPCM_Z14B_B_RPC_18

**cmd** RPC Position – Close (Verify – Cl)

MCC-H ⇒ ISS, “CMG 1 is powered on.”

If resolving ambiguity on CMG 2

**MCC-H**

Z1: EPS: RPCM Z13B B

RPCM_Z13B_B

**sel RPC 18 (Load CMG 2 (3A-12A))**

RPCM_Z13B_B_RPC_18

**cmd** RPC Position – Close (Verify – Cl)

MCC-H ⇒ ISS, “CMG 2 is powered on.”

If resolving ambiguity on CMG 3

**MCC-H**

Z1: EPS: RPCM Z13B B

RPCM_Z13B_B

**sel RPC 17 (Load CMG 3)**

RPCM_Z13B_B_RPC_17

**cmd** RPC Position – Close (Verify – Cl)

MCC-H ⇒ ISS, “CMG 3 is powered on.”
If resolving ambiguity on CMG 4

**MCC-H**

Z1: EPS: RPCM Z14B B

RPCM_Z14B_B

sel RPC 17 (Load CMG 4)

RPCM_Z14B_B_RPC_17

**cmd** RPC Position – Close (Verify – Cl)

MCC-H ⇒ ISS, “CMG 4 is powered on.”

2. **CONNECTING CMG DATA BUS TO CMG DAT**

If resolving ambiguity on CMG 1

CMG  
Jumper Cable W0207 P1 (LB GNC-1A) →|← Bus A on SBS Cable
DAT  
Assembly Bus Tee

If resolving ambiguity on CMG 2

Jumper Cable W0207 P2 (LB GNC-2A) →|← Bus A on SBS Cable
Assembly Bus Tee

If resolving ambiguity on CMG 3

Jumper Cable W0207 P3 (LB GNC-3A) →|← Bus A on SBS Cable
Assembly Bus Tee

3. **SETTING UP MONITOR FILE FOR CMG**

PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)

sel Monitor
sel Data Logging Mode

File Open

Directory: c:\pass\dbase

If resolving ambiguity on CMG 1

input Filename: cmg1kick.arc
sel OK

If resolving ambiguity on CMG 2

input Filename: cmg2kick.arc
sel OK

If resolving ambiguity on CMG 3

input Filename: cmg3kick.arc
sel OK
If resolving ambiguity on CMG 4
input Filename: cmg4kick.arc
sel OK

Monitor Control Panel: Data Logging Mode

input Filesize: 5000000
sel Run

Verify display indicates ‘Waiting for trigger…’

Move display on desktop for later use; do not close.

4. TURNING ON CMG POWER SUPPLIES USING PASS-1000 COMMAND

SCRIPT

PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)

sel File
sel Load ASCII File
sel Load BC List

File Open

√Directory: c:\pass\dbase

sel ps_only.bc
sel OK

PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)

sel BC

MCIABRM – BC Control Panel

Verify Frame Start: Interval = 1000001 usec.

sel Loop (checkbox)

√Forever selected

sel Run
5. VERIFYING CMG POWER SUPPLIES ON COMMAND AND TELEMETRY

Dev 1:RT = 21 (Rec) SA = 6

Verify command words are as shown below.

If any command words do not match those shown in display, √MCC-H.

-dev 1:rt = 21 (trans) sa = 6

 Verify the following telemetry words (reference sample display that follows).

Word 1 - Time Tag – <Incrementing>
Word 5 - Status Word #1: 0005 (hex)
Word 6 - Status Word #2: 0010 (hex)
Word 8 - Spin Bearing Temp1 – _________ (record)
Word 9 - Spin Bearing Temp2 – _________ (record)
Word 11 - EA current – _________ (record)

Read down values recorded above.

6. CMG INITIALIZATION COMMAND SCRIPT

MCIABRM – BC Control Panel

sel Stop
sel OK

PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)

sel File
sel Load ASCII File
sel Load BC List
NOTE
1. This command script initializes the CMG by powering on the power supplies and inner and outer gimbal torquers.
2. The initialize command script is verified using the telem.bc script in the following step that repeatedly polls the RT for data on the pertinent subaddresses.

sel Run

7. VERIFYING CMG INITIALIZATION COMMAND AND TELEMETRY

sel File
sel Load ASCII File
sel Load BC List

 sel OK

Directory: c:\pass\dbase

 sel telem.bc
 sel OK

 sel BC
Verify Frame Start: Interval = 1000052 usec.

√Loop selected
√Forever selected

sel Run

Dev 1:RT = 21 (Rec) SA = 6

Verify command words are as shown below.

If any command words do not match those shown in display, √MCC-H.

Dev 1:RT = 21 (Trans) SA = 6

Verify the following telemetry words (reference sample display that follows).

Word 1 - Time Tag – <Incrementing>
Word 5 - Status Word #1: 1805 (hex)
Word 6 - Status Word #2: 0010 (hex)
Word 11 - EA current – __________ (record)
Word 2 - Inner Gimbal Angle – __________ (record)

√MCC-H

Read down value recorded above.

8. POSITIONING CMG INNER GIMBAL TO +90 DEGREES COMMAND
8.1 Loading and Verifying Positive 1 deg/sec Script

MCIABRM – BC Control Panel

sel Stop

Verify Status – Halted OK

sel OK
PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)

sel File
sel Load ASCII File
sel Load BC List

File Open

Directory: c:\pass\dbase\contin~1

sel ig_pos1.bc
sel OK

PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)

sel BC

MCIABRM – BC Control Panel

Verify Frame Start: Interval = 1000020 usec.

8.2 Executing Positive 1 deg/sec Script

NOTE
1. The purpose of this step is to align the CMG spin axis with the outer gimbal torquer by repeatedly issuing a positive 1 deg/s rate to the inner gimbal until the script is stopped.

2. The CMG inner gimbal will continue moving for approximately five seconds after the script is stopped without further insight to position.

3. Alignment is achieved when the inner gimbal axis is at +90 deg (4000 hex) ± 5 deg.

4. After stopping the ig_pos1.bc command script to align the spin axis, the telem.bc telemetry script must be run to accurately verify inner gimbal position in transmit subaddress 6, Word 2.

<table>
<thead>
<tr>
<th>Inner Gimbal Angle</th>
<th>HEX Equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 deg</td>
<td>0000</td>
</tr>
<tr>
<td>82 deg</td>
<td>3A00</td>
</tr>
<tr>
<td>85 deg</td>
<td>3C7A</td>
</tr>
<tr>
<td>90 deg</td>
<td>4000</td>
</tr>
<tr>
<td>95 deg</td>
<td>4398</td>
</tr>
</tbody>
</table>

√Loop selected
√Forever selected

sel Run
Dev 1:RT = 21 (Trans) SA = 6

When 3AXX < Word 2 < 4000 (hex)  
MCIABRM – BC Control Panel

sel Stop
sel OK

8.3 Verifying Inner Gimbal Position

PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)

sel File
sel Load ASCII File
sel Load BC List

File Open

√Directory: c:\pass\dbase

sel telem.bc
sel OK

PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)

sel BC

MCIABRM – BC Control Panel

Verify Frame Start: Interval = 1000052 usec.

√Loop not selected

sel Run

Dev 1:RT = 21 (Trans) SA = 6

Verify the following telemetry word (reference sample display).

Word 2 - Inner Gimbal Angle = ___________ (record)

√MCC-H

Read down value recorded above.
On MCC-H GO to recover from inner gimbal angle overshoot

**PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)**

- sel File
- sel Load ASCII File
- sel Load BC List

**File Open**

Directory: c:\pass\dbase\contin-1

- sel ig_neg1.bc
- sel OK

**PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)**

- sel BC

**MCIABRM – BC Control Panel**

Verify Frame Start: Interval = 1000021 usec.

- Loop not selected

Continue sending following command until Word 2 on Trans SA-6 display < 4400 (hex).

- sel RUN (pause six seconds between sending consecutive commands)

**Dev 1:RT = 21 (Trans) SA = 6**

Verify the following telemetry words (reference sample display).

- sel OK

Go to step 8.3 to verify inner gimbal position.

*************************************************************************************
9. **CMG SPIN MOTOR ON COMMAND**

   MCIABRM – BC Control Panel

   sel OK

   **PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)**

   sel File
   sel Load ASCII File
   sel Load BC List

   File Open

   √Directory: c:\\pass\\dbase\\contin~1

   sel sm_on.bc
   sel OK

   **PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)**

   sel BC

   MCIABRM – BC Control Panel

   Verify Frame Start: Interval = 1000041 usec.

   √Loop selected
   √Forever selected

   sel Run

10. **VERIFYING CMG SPIN MOTOR ON COMMAND AND TELEMETRY**

    Dev 1:RT = 21 (Rec) SA = 6

    Verify command words are as shown below.

    If any command words do not match those shown in display, √MCC-H.

    ******************************************************

Dev 1: RT = 21 (Trans) SA = 6

Verify the following telemetry words (reference sample display).

Word 1 - Time Tag – <Incrementing>
Word 4 - Wheel Speed – __________ (record)
Word 5 - Status Word #1: 1A05 (hex)
Word 6 - Status Word #2: 0010 (hex)
Word 8 - Spin Bearing Temp1 – __________ (record)
Word 9 - Spin Bearing Temp2 – __________ (record)
Word 11 - EA current – __________ (record)

√MCC-H

Read down values recorded above.

11. CMG OUTER GIMBAL AGITATION

sel Stop
Verify Status – Halted OK
sel OK

PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)

sel File
sel Load ASCII File
sel Load BC List

File Open

√Directory: c:\pass\dbase\contin~1

sel rate_og.bc
sel OK

PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)

sel BC

MCIABRM – BC Control Panel

Verify Frame Start: Interval = 1000000 usec.
Loop selected
Forever selected

NOTE
1. This command script will repeatedly command the outer gimbal rate to negative 3 deg/s (844A hex) for 25 seconds and then positive 3 deg/s (7BB6 hex) for 25 seconds.

2. The purpose of this command is to create relative motion between the CMG flywheel and hall effect sensor.

3. Should at least one hall effect sensor perceive motion, the CMG may spinup.

4. The effects of this relative motion will be apparent in the wheel speed as seen in transmit subaddress 6, Word 4.

sel Run

12. VERIFYING CMG OUTER GIMBAL AGITATION COMMAND AND TELEMETRY

Dev 1:RT = 21 (Rec) SA = 6

Verify command words are as shown below
Word 2 - Outer Gimbal Rate Command: 844A or 7BB6 (alternating every 25 seconds)

************************************************************
If any command words do not match those shown in display, 1MCC-H.
************************************************************

Dev 1:RT = 21 (Trans) SA = 6

Wait 10 minutes or until word four exceeds 0064, then verify the following data (reference sample display that follows).

Word 1 - Time Tag – <Incrementing>
Word 4 - Wheel Speed – <Increasing> (updates once every 15 seconds)
Word 5 - Status Word #1: 1A05 (hex)
Word 6 - Status Word #2: 0010 (hex)
Word 8 - Spin Bearing Temp1 – __________ (record)
Word 9 - Spin Bearing Temp2 – __________ (record)
Word 11 - EA current – __________ (record)
Verify the following telemetry words (reference sample display that follows).

Word 1 - Time Tag – <Incrementing>
Word 9 - Outer Gimbal Rate – <fluctuating rapidly>
Word 22 - Sine SM Current – <non-zero, fluctuating>
Word 23 - Cosine SM Current – <non-zero, fluctuating>
Word 24 - SM Current Cmd – __________ <fluctuating> (record)
Word 28 - Analog Wheel Spd – <non-zero> (updates once every 15 seconds)

Read down value recorded above.

13. **SHUTTING DOWN CMG USING PASS-1000 COMMAND SCRIPT**

   MCIABRM – BC Control Panel

   sel Stop

   Verify Status – Halted OK

   sel OK

   **PROTOCOL ANALYSIS AND SIMULATION SYSTEM (PASS-1000)**

   sel File
   sel Load ASCII File
   sel Load BC List

   File Open

   √Directory: c:\pass\dbase

   sel ps_only.bc
   sel OK
14. VERIFYING CMG SHUTDOWN COMMAND AND TELEMETRY

Dev 1: RT = 21 (Rec) SA = 6

Verify command words are as shown below.

If any command words do not match those shown in display, MCC-H.

---------------------------------------------------------------------------

NOTE
Spin Motor remains ON until Wheel Speed < 10 rpm. Expect Word 5 to be 0205 and then change to 0005 at <10 rpm. There is no need to wait for this to occur.

Dev 1: RT = 21 (Trans) SA = 6

Verify the following telemetry words (reference display that follows).

Word 1 - Time Tag – <Incrementing>
Word 4 - Wheel Speed – <Decreasing or 0000> (updates once every 15 seconds)
Word 5 - Status Word #1: 0205 (0005) (hex)
Word 11 - EA current – _________ (record)

Read down value recorded above.
15. **COMPLETING PASS-1000 SESSION FOR CMG**

MCIABRM – BC Control Panel

sel Stop

Verify Status – Halted OK

sel OK

Monitor Control Panel: Data Logging Mode

‘Monitor Control’

sel Stop

Transfer Time

sel OK

Data Logging Results

Verify Interrupts Generated = Buffers Filled = Buffers Written (± 1 acceptable)

sel OK

16. **VERIFYING DATA ACQUISITION FOR CMG**

View File

sel Yes

Monitor Control Panel: Data Logging Mode

Verify data was acquired (example below).
Monitor Control Panel: Data Logging Mode

sel File
sel Exit

17. **DEACTIVATING CMG**
   If resolving ambiguity on CMG 1

**MCC-H**
Z1: EPS: RPCM Z14B B

RPCM_Z14B_B

sel RPC 18 (Load CMG 1(3A-12A))

RPCM_Z14B_B_RPC_18

**cmd** RPC Position – Open (Verify – Op)

**MCC-H** ⇒ ISS, “CMG 1 is powered off.”
If resolving ambiguity on CMG 2

MCC-H

Z1: EPS: RPCM Z13B B

RPCM_Z13B_B

sel RPC 18 (Load CMG 2 (3A-12A))

RPCM_Z13B_B_RPC_18

**cmd** RPC Position – Open (Verify – Op)

**MCC-H** ⇒ ISS, “CMG 2 is powered off.”

If resolving ambiguity on CMG 3

MCC-H

Z1: EPS: RPCM Z13B B

RPCM_Z13B_B

sel RPC 17 (Load CMG 3)

RPCM_Z13B_B_RPC_17

**cmd** RPC Position – Open (Verify – Op)

**MCC-H** ⇒ ISS, “CMG 3 is powered off.”

If resolving ambiguity on CMG 4

MCC-H

Z1: EPS: RPCM Z14B B

RPCM_Z14B_B

sel RPC 17 (Load CMG 4)

RPCM_Z14B_B_RPC_17

**cmd** RPC Position – Open (Verify – Op)

**MCC-H** ⇒ ISS, “CMG 4 is powered off.”

### 18. DISCONNECTING CMG DATA BUS TO CMG DAT

If resolving ambiguity on CMG 1

**CMG** Jumper Cable W0207 P1 (LB GNC-1A) ←|→ Bus A on SBS Cable Assembly Bus Tee

If resolving ambiguity on CMG 2

**CMG** Jumper Cable W0207 P2 (LB GNC-2A) ←|→ Bus A on SBS Cable Assembly Bus Tee

If resolving ambiguity on CMG 3

**CMG** Jumper Cable W0207 P3 (LB GNC-3A) ←|→ Bus A on SBS Cable Assembly Bus Tee
If resolving ambiguity on CMG 4 and spin bearing heaters are not to be activated in {CMG CHECKOUT USING DATA ANALYSIS TOOL (DAT)} procedure

Jumper Cable W0207 P4 (LB GNC-4A) ←|→ Bus A on SBS Cable Assembly Bus Tee
OBJECTIVE:
Install the Centerline Berthing Camera System (CBCS) and all related avionics at Node 1 Forward Hatch. Perform checkout of internal equipment utilizing the Space Station Computer (SSC).

LOCATION:
Installed: Node 1 Fwd Hatch, NOD1S4
Stowed: √Maintenance and Assembly Tasks Supplement (MATS)

DURATION:
1 hour

PARTS:
Video Interface Unit Assembly (VIU) (P/N SEG33112646-301)
Ku-Band Power Supply (P/N SEG33466711-301)
Video In/Out Cable (P/N SEZ39131213-301)
VIU/CM Camcorder Video Cable (P/N SED39122269-301)
Bungee Strap (two) (P/N 15E6-3101-200-03)

CBCS Stowage Bag:
  CBCS Camera Case Assembly (Spare S/N 1002) (P/N SEG33112759-301)
  Hatch Standoffs (four) (P/N 683-13160)
  CBCS Camera Assembly (P/N SEG33112576-301)
  LED Control Unit Assembly (LCU) (P/N SEG33112643-301)
  CBCS Camera Cable (P/N SEG33112641-301) (violet, gold/orange connectors)
  CBCS Electronics Extension Cable (P/N SEG33112639-301) (yellow, blue/light blue, green connectors)
  CBCS Electronics Cable (P/N SEG33112638-301) (pink, red/yellow, blue connectors)
  CBCS 5A Adapter Cable (P/N SEG33112637-301) (red connector)
  CBCS Power Cable, UOP (P/N SEG46116745-301)
  Handrail Clamp (P/N SEG33107633-301)
  Multi-use Bracket (P/N SEG33107633-301)

MATERIALS:
Velcro Straps
TOOLS REQUIRED:
USOS IVA Tool Kit:
   Kit C:
      1” Deep Socket, 3/8” Drive
      9/16” Socket, 3/8” Drive
   Kit E:
      Driver Handle, 3/8” Drive
      1/4” to 3/8” Adapter
   Kit G:
      (30-200 in-lbs) Trq Wrench, 3/8” Drive
      (10-50 in-lbs) Trq Wrench, 1/4” Drive
Lid #2
   Static Wrist Tether
Space Station Computer (SSC)
Scopemeter and Accessories Kit:
   Fluke 105B Scopemeter
   Red and Black banana leads
   Red and Black banana test probes
Figure 1.- Centerline Berthing Camera System Setup for Mission 4A Checkout Operations.
### CBCS Installation Steps

- **No power to NOD1SD4 UOP.** Refer to step 1.
- Rotate Ku-Band Ground Strap. Refer to step 6 and Figure 3.
- Bungee to NOD1S4 aft endcone truss. Refer to step 7 and Figure 4.
- Check-Ku Band continuity to rack. Stow P18 to unoccupied truss. Refer to Figure 4.
- Secure CBCS Electronics Cable along starboard deck standoff.
- Secure VIU, LCU to Node Fwd Hatch Handrail. Refer to steps 20 --- 22 and Figure 5.
- Set LCU, Brightness – 6, Sys Select – Sys 1&2, Mode Select – Steady. Refer to Figure 6.
- Hatch Standoff fittings to Hatch Ring Assembly – 100 in-lbs. Refer to step 26 and Figure 7.
- Mount CBCS Camera with protrusion pointing to deck. Refer to Figure 8.
- Power UOP. Refer to step 35. Ku-Band Power Supply 28V → ON.
- Internal checkout via SSC, Desktop: Station Apps: COSS Apps: Video Overlay. Camera LEDs-ON.
- Ku-Band OUTPUT 28 V → OFF, Depress UOP Power Out Switch.
- Remove SSC from VIU. Refer to steps 42 --- 46.

---

**Figure 2.- CBCS Overview Installation.**
NOTE

1. If two crewmembers are available, this procedure can be split with one crewmember performing steps 1 --- 19, while the second crewmember performs steps 20 --- 34.

2. When mating cables, several cables will be called out with a color in parentheses. These connector colors are another aid to successful mating of cables. When mating colored cables, ensure that the colors on both connectors match.

SAFING

WARNING

Failure to remove power may cause personal injury or equipment damage.

NOD1 SD4 1. Verify no power applied to J3, J4 for NOD1SD4 UOP.
   √Power Out Switch – RESET illuminated (white)
   √Fault/Test – dark
   √Test Select – DC illuminated (white)

2. CBCS Power Cable, UOP P2 → J3 of UOP
   Tether CBCS Power Cable, UOP P1 to NOD1S5 Handrail to prevent obstruction with NOD1S4 Rack Volume Closeout (RVCO) rotation (Velcro Strap).

NOD1 S4 3. Rotate down NOD1S4 Rack Volume Closeout PIP Pins (two).


   One of four captive fasteners

   Orient Ground Strap Bracket away from avionic

   Avionic Connectors

   Figure 3.- Ground Strap Bracket on Bottom of Ku-Band Power Supply.

5. Reorient Ku-Band Power Supply Ground Strap Bracket, loosen fasteners (four) on bottom side of Ku-Band Power Supply (Ratchet 3/8" Drive, # 10 Torq Tip).
   Refer to Figure 3.

6. Remove Ground Strap Bracket, rotate 180 degrees, tighten fasteners (four) with Ground Strap oriented away from avionics connectors, torque
Fasteners to 28 in-lbs (Driver Handle 3/8" Drive, #10 Torq Tip, 1/4" - 3/8" Adapter, (10-50 in-lbs) Trq Wrench).
Refer to Figure 3.

**CAUTION**

Use caution to avoid bumping or jarring any ECS cabling.

Figure 4.- Early Comm System (ECS) behind NOD1S4 RVCO.

7. Secure Ku-Band Power Supply with Bungee Straps (two) to bottom of Node 1 Aft endcone truss near Grounding Strap with connectors oriented to Overhead.
   Adjust Bungee Straps away from connectors, power switch, and fan intake.
   Refer to Figure 4.


9. Between Ku-Band Power Supply Case, Rack Ground Strap, perform {CONTINUITY CHECK GENERIC}, all (SODF: IFM: REFERENCE), then:
CAUTION

1. When mating cables, verify pins straight, inspect both connector halves for debris, mate dust caps if applicable.

2. Equipment contains parts sensitive to damage by Electrostatic Discharge (ESD). Do not touch connector pins, sockets unless wearing a Static Wrist Tether.

10. CBCS Electronics Cable P2 (pink) → | ← J2 of Ku-Band Power Supply

11. CBCS Electronics Cable (red) P1 → | ← P1 of 5A Adapter Cable (red)

12. Temporarily stow P18 of 5A Adapter Cable to unoccupied NOD1S4 Aft Endcone truss (Velcro Strap).
   Refer to Figure 4.

13. Route P3, P4 (yellow, blue connectors) of CBCS Electronics Cable out bottom of RVCO following ECS Cables.
    Continue along Stbd Deck footbridge to Node 1 Fwd Hatch, securing with Velcro Straps.
    Secure cables to NOD1S0 Handrail (Velcro Strap).

14. Route CBCS Power Cable, UOP P1 from NOD1S5 Handrail through aft bottom corner of RVCO to Ku-Band Power Supply.

15. CBCS Power Cable, UOP P1 → | ← J1 of Ku-Band Power Supply

16. Coil remaining lengths of CBCS Electronics, power cables.
    Secure coils to any unoccupied Node 1 Aft Endcone truss (Velcro Straps).

17. Rotate up, install NOD1S4 RVCO PIP Pins (two).

18. CBCS Electronics Cable (blue) P3 → | ← P3 of CBCS Electronics Extension Cable (blue)

19. CBCS Electronics Cable (yellow) P4 → | ← P4 of CBCS Electronics Extension Cable (yellow)
LED CONTROL UNIT (LCU), VIDEO INTERFACE UNIT (VIU) INSTALLATION

20. Attach Handrail Clamp to NOD1S0 Handrail.
    Attach Multi-use Bracket to Handrail Clamp (seat track).
    Refer to Figure 5.

    Refer to Figure 5.

22. Velcro VIU to LCU.
    Refer to Figure 5.

23. CBCS Electronics Extension Cable P1 (green) \(\rightarrow\) J1 of LCU (green)

24. CBCS Electronics Extension Cable P2 (light blue) \(\rightarrow\) J2 of VIU (light blue)
25. Configure LCU settings.
   Brightness Dial → 6
   System Select Switch → SYS 1&2
   Mode Switch → STEADY

   Refer to Figure 6.

   Figure 7.- Hatch Standoff Installed (one of four).

CAMERA ASSEMBLY INSTALLATION
26. Snug Hatch Standoffs (four) to Hatch Ring Assembly, torque to 100 in-lbs
    (Ratchet 3/8" Drive, 1" Deep Socket, (30-200 in-lbs) Trq Wrench).
    Refer to Figure 7.

    CAUTION
    Do not to let Camera Assembly impact hatch window glass as doing so may damage glass
    anti-reflective coating.

    Figure 8.- CBCS Camera Assembly Installed in Node 1 Forward Hatch.
CAUTION

Ensure that all 1/4 turn fasteners are fully aligned and seated in hatch standoff receptacle before engaging any fastener. Improper alignment could cause captive rubber grommet to disengage from Camera Assembly and affect centerline alignment.

27. Mount CBCS Camera Assembly to standoffs with camera protrusion pointing towards Deck, 1/4 turn fasteners (four). Refer to Figure 8.

28. CBCS Camera Cable P2 (gold) → J2 of LCU (gold)

29. CBCS Camera Cable P3 (violet) → J3 of VIU (violet)

30. CBCS Camera Cable P1 (orange) → J1 of CBCS Camera Assembly (orange)

31. √BNC connector P4 of CBCS Camera Cable, on cable near J2 of LCU (gold), mated

32. VIU/CM Camcorder Video Cable (VIU) → J1 of VIU

33. Video In/Out Cable → (Camcorder) VIU/CM Camcorder Video Cable

34. SSC ( ) → Video In/Out Cable

CHECKOUT

NOD1 SD4

35. Enable UOP, depress Power Out Switch.

√Power Out Switch – ENABLED illuminated (green)
√Fault/Test – OK illuminated (green)
√Test Select – DC illuminated (white)

36. Rotate down NOD1S4 RVCO (PIP Pins (two)).

Ku-Band Power Supply switch OUTPUT 28 V → ON

37. √SSC Power On

SSC

38. sel Station Apps (desktop icon), COSS Apps, Video Overlay

39. Confirm CBCS video via SSC.

Verify Camera Assembly LED illumination.

CLOSEOUT

40. Ku-Band Power Supply switch OUTPUT 28 V → OFF

Rotate NOD1S4 RVCO up (PIP Pins (two)).
41. Disable UOP, depress Power Out switch.

- Power Out Switch – RESET illuminated (white)
- Fault/Test – dark
- Test Select – DC illuminated (white)

42. Exit SSC Video Viewer Application, depress “Q” key.

43. If desired, power off SSC.

44. VIU/CM Camcorder Video Cable (VIU) \(\leftrightarrow\) J1 of VIU

45. Video In/Out Cable \(\leftrightarrow\) (Camcorder) VIU/CM Camcorder Video Cable

46. Video In/Out Cable \(\leftrightarrow\) SSC (㎜)

47. √MATS for stowage of VIU/CM Camcorder Video Cable, Video In/Out Cable

**POST MAINTENANCE**

48. Inform MCC-H of task completion.

49. √MATS for stowage of CBCS Stowage Bag, stow tools, materials
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OBJECTIVE:
Install the Centerline Berthing Camera System (CBCS) and all related avionics at Node 1 Forward Hatch.
Perform checkout of internal equipment utilizing the Station Support Computer (SSC).
This procedure is used when Node UOPs have not been installed.

LOCATION:
Installed: Node 1 Fwd Hatch, NOD1S4
Stowed: √Maintenance and Assembly Tasks Supplement (MATS)

DURATION:
1 hour

PARTS:
Video Interface Unit Assembly (VIU) (P/N SEG33112646-301)
Ku Band Power Supply (P/N SEG46117451-301)
Video In/Out Cable (P/N SEZ39131213-301)
VIU/CM Camcorder Video Cable (P/N SED39122269-301)
Bungee Strap (two) (P/N 15E6-3101-200-03)
CBCS Stowage Bag:
  CBCS Camera Case Assembly (Spare S/N 1002) (P/N SEG33112759-301)
  Hatch Standoffs (four) (P/N 683-13160)
  CBCS Camera Assembly (P/N SEG33112576-301)
  LED Control Unit Assembly (LCU) (P/N SEG33112643-301)
  CBCS Camera Cable (P/N SEG33112641-301)
  (violet, gold/orange connectors)
  CBCS Electronics Extension Cable (P/N SEG33112639-301)
  (yellow, blue/light blue, green connectors)
  CBCS Electronics Cable (P/N SEG33112638-301)
  (pink, red/yellow, blue connectors)
  CBCS 5A Adapter Cable (P/N SEG33112637-301)
  (red connector)
  CBCS Power Cable, UOP (P/N SEG46116745-301)
  CBCS Power Cable, Jumper (P/N SEG46116761-302)
  Handrail Clamp (P/N SEG33107633-301)
  Multi-use Bracket (P/N SEG33107631-301)

MATERIALS:
Velcro Straps

TOOLS REQUIRED:
USOS IVA Tool Kit:
Kit C:
  1" Deep Socket, 3/8" Drive
  9/16" Socket, 3/8" Drive
Kit D:
  1/8" Hex Head, 1/4" Drive
Kit E:
    Ratchet 1/4" Drive
    Driver Handle, 3/8" Drive
    1/4" to 3/8" Adapter
Kit I:
    #10 Long Torq Driver, 3/8" Drive
Kit G:
    (10-50 in-lbs) Trq Wrench, 1/4" Drive
    (30-200 in-lbs) Trq Wrench, 3/8" Drive
Lid #2
    Static Wrist Tether

Station Support Computer (SSC)

ScopeMeter and Accessories Kit:
    Fluke 105B ScopeMeter
    Red and Black banana leads
    Red and Black banana test probes
Figure 1.- Centerline Berthing Camera System Setup for Mission 4A Checkout Operations.
Figure 2.- CBCS Overview Installation.

CBCS Installation Steps

√RPCM N134B-C_RPC 17-Open. Refer to step 1.
Remove NOD1SD4 Closeout Panel. Refer to step 2. W0137←→Dum Connector. Refer to step 3.
Rotate Ku-Band Ground Strap. Refer to step 9.
Bungee to NOD1S4 aft endcone truss. Refer to step 10 and Figure 5.
Check Ku-Band continuity to rack. Stow P18 to unoccupied truss. Refer to Figure 5.
Secure CBCS Electronics Cable along starboard deck standoff.
Secure VIU, LCU to Node Fwd Hatch Handrail. Refer to steps 23 --- 25 and Figure 6.
Set LCU, Brightness – 6, Sys Select – Sys 1&2, Mode Select – Steady. Refer to Figure 7.
Hatch Standoff fittings to Hatch Ring Assembly – 100 in-lbs. Refer to step 29 and Figure 8.
Mount CBCS Camera with protrusion pointing to deck. Refer to step 30 and Figure 9.
RPCM N134B-C_RPC 17-Cmd Close. Refer to step 38. Ku-Band Power Supply 28 V → ON.
Internal checkout via SSC, Desktop: Station Apps: COSS Apps: Video Overlay. √Camera LEDs – ON
Ku-Band OUTPUT 28 V → OFF, RPCM N134B-C_RPC 17-Cmd Open. Refer to step 44.
Remove SSC from VIU.
NOTE
1. If two crewmembers are available, this procedure can be split with crewmember one performing steps 1 --- 22, while crewmember two performs steps 23 --- 37.

2. When mating cables, several cables will be called out with a color in parentheses. These connector colors are another aid to successful mating of cables. When mating colored cables, ensure that the colors on both connectors match.

WARNING
Failure to remove power may cause personal injury or equipment damage.

SAFING
PCS
1. RPCM N14B-C Safing
   Node 1: EPS
   Node 1: EPS
   sel RPCM N14B – C
   RPCM_N14B_C
   sel RPC 17
   RPCM_N14B_C_RPC_17
   √RPC Position – Open
   cmd Close Cmd – Inhibit
   √RPC Close Cmd – Inh

Figure 3.- UOP Closeout Panel on NOD1SD4 Standoff.
NOD1 SD4  2. Loosen NOD1SD4 UOP Closeout (six fasteners) (Ratchet 1/4" Drive, 1/8" Hex Head). Stow UOP Closeout Panel in CBCS Stowage Bag. Refer to Figure 3.

3. Reach through UOP hole, locate W0137-P398 in NOD1SD4 Standoff. W0137-P398 ←|→ Dummy Connector

4. CBCS Power Cable, Jumper P2 →|← W0137-P398

5. CBCS Power Cable, UOP P2 →|← P1 of CBCS Power Cable, Jumper Temporarily stow P1 of UOP Power Cable on NOD1S5 Handrail to prevent obstruction with NOD1S4 Rack Volume Closeout (RVCO) (Velcro Strap).

NOD1S4  6. Rotate down NOD1S4 Rack Volume Closeout (RVCO) (PIP Pins (two)).


![Figure 4.- Ground Strap Bracket on Bottom of Ku-Band Power Supply.](image)

8. Re-orient Ku-Band Power Supply Ground Strap Bracket, loosen fasteners (four) on bottom side of Ku-Band Power Supply (Driver Handle 3/8" Drive, # 10 Torq Tip). Refer to Figure 4.

9. Remove Ground Strap Bracket, rotate 180 degrees, tighten fasteners (four) with ground strap oriented away from avionics connectors, torque fasteners to 28 in-lbs. (Driver Handle 3/8" Drive, #10 Torq Tip, 1/4" to 3/8" Adapter, (10-50 in-lbs) Trq Wrench). Refer to Figure 4.

**CAUTION**

Use caution to avoid bumping or jarring any ECS cabling.
10. Secure Ku-Band Power Supply with Bungee Straps (two) to bottom of Node 1 Aft endcone truss near Grounding Strap with connectors oriented to Overhead. Adjust Bungee Straps away from connectors, power switch, fan intake. Refer to Figure 5.

11. Rack grounding strap →|← Ku-Band Power Supply grounding strap, 1/4 turn fastener (one) (Drive Handle 3/8” Drive, 9/16” Socket).

12. Between Ku-Band Power Supply Case, Rack Ground Strap, perform **{CONTINUITY CHECK GENERIC}**, all (SODF: IFM REFERENCE), then:

---

**CAUTION**

When mating cables, verify pins straight, inspect both connector halves for debris, mate dust caps if applicable.

---

**CAUTION**

Equipment contains parts sensitive to damage by Electrostatic Discharge (ESD). Do not touch connector pins, sockets unless wearing a Static Wrist Tether.
13. CBCS Electronics Cable P2 (pink) \(\rightarrow\) J2 of Ku-Band Power Supply

14. CBCS Electronics Cable (red) P1 \(\rightarrow\) P1 of 5A Adapter Cable (red)

15. Temporarily stow P18 of 5A Adapter Cable to unoccupied NOD1S4 Aft Endcone truss (Velcro Strap).

16. Route P3, P4 (yellow, blue connectors) of CBCS Electronics Cable out bottom of RVCO following ECS cables. Continue along Stbd Deck footbridge to Node 1 Fwd Hatch, securing with Velcro Straps. Secure cables to NOD1S0 Handrail (Velcro Strap).

17. Route CBCS Power Cable, UOP P1 from NOD1S5 Handrail through aft bottom corner of RVCO to Ku-Band Power Supply.

18. CBCS Power Cable, UOP P1 \(\rightarrow\) J1 of Ku-Band Power Supply

19. Coil remaining lengths of CBCS Electronics, Power cables. Secure coils to any unoccupied Node 1 Aft Endcone Truss (Velcro Straps).

20. Rotate up, install NOD1S4 RVCO PIP Pins (two).

21. CBCS Electronics Cable (blue) P3 \(\rightarrow\) P3 of CBCS Electronics Extension Cable (blue)

22. CBCS Electronics Cable (yellow) P4 \(\rightarrow\) P4 of CBCS Electronics Extension Cable (yellow)
23. Attach handrail clamp to NOD1S0 Handrail. 
Attach Multi-use Bracket to handrail clamp (seat track). 
Refer to Figure 6.

24. Attach LCU to Multi-use Bracket
Refer to Figure 6.

25. Velcro VIU to LCU.
Refer to Figure 6.

26. CBCS Electronics Extension Cable P1 (green) → J1 of LCU (green)

27. CBCS Electronics Extension Cable P2 (light blue) → J2 of VIU (light blue)
28. Configure LCU Settings.
   - Brightness dial → 6
   - System Select Switch → SYS 1&2
   - Mode Switch → STEADY
   Refer to Figure 7.

29. Snug Hatch Standoffs (four) to Hatch Ring Assembly, torque to 100 in-lbs
    (Ratchet 3/8" Drive, 1" Deep Socket, (30-200 in-lbs) Trq Wrench).
    Refer to Figure 8.

   CAUTION
   Do not let Camera Assembly impact hatch window glass as doing so may damage glass anti-reflective coating.

Figure 8.- Hatch Standoff Installed (one of four).

Figure 9.- CBCS Camera Assembly Installed in Node 1 Forward Hatch.
CAUTION

Ensure that all 1/4 turn fasteners are fully aligned and seated in hatch standoff receptacle before engaging any fastener. Improper alignment could cause captive rubber grommet to disengage from Camera Assembly and effect centerline alignment.

30. Mount CBCS Camera Assembly to standoffs with camera protrusion pointing towards Deck, 1/4 turn fasteners (four). Refer to Figure 9.

31. CBCS Camera Cable P2 (gold) → J2 of LCU (gold)

32. CBCS Camera Cable P3 (violet) → J3 of VIU (violet)

33. CBCS Camera Cable P1 (orange) → J1 of CBCS Camera Assembly (orange)

34. BNC connector P4 of CBCS Camera Cable, on cable near J2 of LCU (gold), mated

35. VIU/CM Camcorder Video Cable (VIU) → J1 of VIU

36. VIU/CM Camcorder Video Cable (Camcorder) → Video In/Out Cable

37. Video In/Out Cable → SSC (☞)

CHECKOUT

PCS

38. Enabling RPCM N14B-C

Node 1: EPS

Node 1: EPS

sel RPCM N14B – C

RPCM_N14B_C

sel RPC 17

RPCM_N14B_C_RPC_17

cmd Close Cmd – Enable

RPC Close Cmd – Enabled

cmd RPC Position – Closed

RPC Position – Closed
39. Rotate down NOD1S4 RVCO (PIP Pins (two)).
   Ku-Band Power Supply OUTPUT 28 V → ON

SSC  40. √SSC Power On

41. sel Station Apps (desktop icon), COSS Apps, Video Overlay

42. Confirm CBCS video via SSC.
   Verify Camera Assembly LED illumination.

CLOSEOUT
43. Ku-Band Power Supply OUTPUT 28 V → OFF
   Rotate up NOD1S4 RVCO (PIP Pins (two)).

PCS  44. RPCM N14B-C SAFING
   Node 1: EPS
   Node 1: EPS

   sel RPCM N14B – C
   
   RPCM_N14B_C

   sel RPC 17
   
   RPCM_N14B_C_RPC_17

   cmd RPC Position – Open

   √RPC Position – Open

   cmd Close Cmd – Inhibit

   √RPC Close Cmd – Inhibit

45. Exit SSC Video Viewer Application.
   Depress “Q” key.

46. If desired, power off SSC.

47. VIU/CM Camcorder Video Cable (VIU) ←|→ J1 of VIU

48. Video In/Out Cable ←|→ VIU/CM Camcorder Video Cable (Camcorder)

49. Video In/Out Cable ←|→ SSC (☐)

50. Stow VIU/CM Camcorder Video Cable, Video In/Out Cable in ISS
    Photo/TV Bag #1.
POST MAINTENANCE
51. Inform **MCC-H** of task completion.

52. √MATS for stowage of CBCS Stowage Bag, stow tools, materials
**NOTE**

1. **MCC-H** will perform Early Comm Configuration Pre and Post CBCS External Cable Installation steps 1 --- 2, 11 and 13.

2. ISS/STS crews will perform CBCS External Cable Checkout steps 3 --- 10 and 12. Step 3 can be performed ahead of time since it is a preparatory step.

---

**EARLY COMM CONFIGURATION PRE-CBCS EXTERNAL CABLE INSTALLATION**

**NOTE**

1. Some or all of the Early Comm ORUs may already be powered off because of Node 1 and Z1 Patch Panel Reconfig.

2. Do not perform step 1 until it is verified RPCM N1RS1C is receiving power or the Port Antenna Heater is already powered.

---

1. **POWERUP EARLY COMM PORT ANTENNA HEATER**

   **MCC**

   C&T: Early Comm Overview

   Early Comm Overview

   ‘RPCM N1RS1C’

   sel RPC 6

   **RPCM N1RS1_C_RPC_6**

   cmd RPC Position – Close (Verify – Cl)

2. **MCC-H**: CATO performs *(1.202  EARLY COMM POWERDOWN - PRE-CCS)*, steps 1 --- 7 (SODF: C&T: ACTIVATION AND CHECKOUT: ECS), then:

   **MCC-H** † ISS/STS: “Early Comm has been safed for EVA. Go for CBCS External Cable Installation.”

---

**CBCS EXTERNAL CABLE CHECKOUT**

---

**CAUTION**

Crewmembers should not reach inside the hole on the rear of the CBCS Camera Assembly with their hand or fingers due to elevated temperatures inside the unit.

---

**NOTE**

Once the CBCS External Cable is installed to the P5 Early Comm Starboard Antenna, OCA capability in the FGB is permanently lost.
ISS 3. ISS PREPARATIONS
Crew NOD1 Unstow from USOS Tool Kit:
D4_G2 Lid#1: Static wrist tether

If UOP  
√{NODE 1 FWD CBCS INSTALL}, all (SODF: ASSY OPS: ACTIVATION AND CHECKOUT: ON-ORBIT) has been performed

If no UOP  
√{NODE 1 FWD CBCS INSTALL WITH RPC POWER JUMPER}, all (SODF: ASSY OPS: ACTIVATION AND CHECKOUT: ON-ORBIT) has been performed

Verify SSC has been removed from VIU.

VIU (J1) ←|→ (VIU) VIU/CM Video Cable

4. ORBITER CCTV SYSTEM CONFIGURATION
STS AFD System configured per diagram, P/TV23 SETUP (PHOTO/TV, P/TV SCENES)
Crew

As required, perform ACTIVATION (Cue Card, TV).
As required, perform ACTIVATION, OPERATION (Cue Card, TV, 8mm VTR).

R12  √Green Jumper – ISS
√VPU Power – ON (LED – ON)

A7  VID OUT pb – MON 1
IN pb – PL2

VTR  √CNTL sw – STDBY

5. CBCS CONNECTION TO EARLY COMM RFPDB
ISS NOD1 Rotate down NOD1S4 RVCO (two PIP Pins).
Crew Don Static Wrist Tether by attaching to unpainted surface of standoff.

OCA Data Cable P18/JUMPER ←|→ J18 RFPDB Assembly
Tether to nearest unoccupied truss.
Unstow P18 of CBCS 5A Adapter Cable from temporarily stowed position near NOD1S4 Endcone Truss.
CBCS 5A ADAPTER CABLE →|← J18 RFPDB Assembly

√Ku-Band Power Supply Switch OUTPUT 28 V – OFF

Doff and stow Static Wrist Tether.
Rotate up NOD1S4 RVCO (two PIP Pins).

ISS ⇒ STS, “CBCS video configured to EARLY COMM RFPDB.”
6. **CBCS POWERUP VIA KU-BAND POWER SUPPLY**

STS $\Rightarrow$ ISS, “CBCS External Cable installed to Early Comm Starboard Antenna P5, EVA is clear of Early Comm Antennas…Go for CBCS Powerup.”

If UOP

- Enable UOP, depress Power Out Switch.
- $\sqrt{\text{ENABLED}}$ legend illuminates green
- $\sqrt{\text{OK}}$ legend illuminates green
- $\sqrt{\text{Ku-Band Power Switch OUTPUT 28 V → ON}}$

If no UOP

Node 1: EPS: RPCM N14B C: RPC 17

![RPCM N14B C RPC 17](image)

- **cmd** Close Cmd – Enable (Verify – Ena)
- **cmd** RPC Position – Close (Verify – Cl)

$\sqrt{\text{Ku-Band Power Switch OUTPUT 28 V → ON}}$

ISS $\Rightarrow$ STS, “CBCS is powered by Ku-Band power supply.”

7. **CBCS VIDEO VERIFICATION**

**STS**

Crew

**VTR**

CNTL sw – REC (lt – ON)

- A7 $\sqrt{\text{VID OUT pb – MON 1}}$
- $\sqrt{\text{IN pb – PL2}}$

**STS**

A3

Crew

Monitor Setup.

MON 1 XHAIR – White

If communication

- VID OUT pb – DNLK
- IN pb – PL2

Assess video quality.

Check general Quality.

Check if cross hairs are stationary.

After ~3 minutes

VTR

CNTL sw – STDBY (lt – ON)

Inform **MCC-H** of results.

STS $\Rightarrow$ ISS, “Video evaluation results…”, as required.

MON 1 – Crosshairs (as required)
8. **KU-BAND POWER SUPPLY POWERDOWN**

   
   **ISS**
   
   \[\sqrt{\text{Ku band Power Switch OUTPUT 28 V } \rightarrow \text{ OFF}}\]

   **Crew**
   
   If UOP
   
   Disable UOP, depress Power Out switch.
   
   \[\sqrt{\text{RESET legend illuminates white}}\]

   If no UOP
   
   Node 1: EPS: RPCM N14B C: RPC 17
   
   \[\text{RPCM N14B C RPC 17} \]

   \[\text{cmd Close Cmd – Inhibit (Verify – Inh)}\]

   \[\text{cmd RPC Position – Open (Verify – Op)}\]

   ISS ⇒ STS, “CBCS is unpowered.”

9. **EARLY COMM RFPDB RECONFIGURATION**

   **ISS NOD1**
   
   Rotate down NOD1S4 RVCO (two PIP Pins).
   
   Don Static Wrist Tether by attaching to unpainted surface of standoff.
   
   CBCS 5A Adapter Cable P18 \(\leftarrow\) J18 of RFPDB
   
   Temporarily stow by tethering to nearest unoccupied truss.
   
   OCA Data Cable P18 \(\rightarrow\) J18 RFPDB Assembly
   
   Doff and stow Static Wrist Tether.
   
   Rotate up NOD1S4 RVCO (two PIP Pins).
   
   ISS ⇒ STS, “Early Comm RFPDB configured to Node 1 OCA.”

10. STS performs a disconnect PCS CDS (Software Disconnect) on primary Orb bus N1-2 or N1-1.

    Inform **MCC-H** when complete.

**EARLY COMM CONFIGURATION POST CBCS EXTERNAL CABLE INSTALLATION**

11. **MCC-H**: CATO performs \{1.204 EARLY COMM POWERUP - PRE-CCS\}, steps 2 --- 8 (SODF: C&T: ACTIVATION AND CHECKOUT: ECS), then:

    12. STS performs a reconnect PCS CDS (Software Reconnect) on primary orb Bus N1-2 or N1-1 when **MCC-H** reports Early Comm CTP is powered on.
13. SETTING EARLY COMM MODE TO HIGH RATE

NOTE

MCC-H (ISS GC) will need to configure the ground for Early Comm High Data Rate after command is sent.

MCC

C&T: Early Comm Overview

‘Command Telemetry Processor’

sel System Mode

Early Comm System Mode

cmd High

Verify Mode – Hi

MCC-H ↑ ISS, “Early Comm and ground has been configured for Node 1 OCA.”
CAUTION

Crewmembers should not reach inside the hole on the rear of the CBCS Camera Assembly with their hand or fingers due to elevated temperatures inside the unit.

1. ISS PREPARATIONS

NOD1 Unstow from USOS Tool Kit:
D4_G2 Lid#1: Static Wrist Tether

If UOP
Verify {NODE 1 FWD CBCS INSTALL}, all (SODF: ASSY OPS: ACTIVATION AND CHECKOUT: ON-ORBIT) has been performed.

If no UOP
Verify {NODE 1 FWD CBCS INSTALL WITH RPC POWER JUMPER}, all (SODF: ASSY OPS: ACTIVATION AND CHECKOUT: ON-ORBIT) has been performed.

Verify SSC has been removed from VIU.
VIU (J1) ←|→ (VIU) VIU/CM Video Cable

ISS Unstow second set:
Crew Video Interface Unit Assembly (VIU) (P/N SEG33112646-301)
LED Control Unit Assembly (LCU) (P/N SEG33112643-301)

Unstow:
Primary CBCS Camera Assembly (P/N SEG33112576-301)

2. ORBITER CCTV SYSTEM CONFIGURATION

STS AFD Verify System configured per P/TV24 CBCS TEST Setup diagram, (PHOTO/TV SCENES).

As required, perform ACTIVATION (Cue Card, TV).
As required, perform ACTIVATION, OPERATION (Cue Card, TV, 8mm VTR).

ATU √PWR – AUD

A/G 1, A/G 2 Loops – T/R
VOL tw: 0
Other Loops – OFF

R12 √Green Jumper – ISS
√VPU Power – ON (LED – ON)

A7 √VID OUT pb – MON 1
√IN pb – PL2

VTR √CNTL sw – STDBY
3. EARLY COMM RFPDB POWERDOWN

√MCC for Pre or Post ECS Power Reconfig

If Pre ECS Power Reconfig

ISS PCS
Crew

C&T: Early Comm Overview
‘RPCM N1RS2A’

sel RPC 11

RPCM N1RS2_A_RPC_11

cmd RPC Position – Open Execute (Verify – Op)

If Post ECS Power Reconfig

Node 1: EPS: RPCM N14B B: RPC 14

RPCM N14B_B_RPC_14

cmd RPC Position – Open Execute (Verify – Op)

NOTE
EARLY COMM OCA capability will be inhibited when step 4, CBCS connection to RFPDB is performed.

4. CBCS CONNECTION TO EARLY COMM RFPDB

ISS NOD1
Crew

Retrieve a CBCS ECOMM RFPDB POWER ADAPTER CABLE (two) from CBCS Stowage Bag (P/N SEG33112640-301).

Rotate down NOD1S4 RVCO (two PIP Pins).

Ku-Band Power Supply SWITCH OUTPUT 28 V → OFF

Ku-Band Power Supply J2 ←|→ P2 of CBCS Electronics Cable (pink)

CBCS ECOMM RFPDB POWER ADAPTER CABLE P2 (pink) →|← P2 of CBCS Electronics Cable (pink)

J8 with protective cap installed

RFPDB

Figure 1.- Top of RFPDB with Protective Cap Installed on J8.
Remove Protective Cap from J8 of RFPDB. 
Stow on provided Velcro.  
Refer to Figure 1.

CBCS ECOMM RFPDB POWER ADAPTER CABLE P8 \rightarrow J8 of RFPDB 
OCA Data Cable P18 \rightarrow J18 RFPDB Assembly  
Tether to nearest unoccupied truss.

Retrieve CBCS Adapter Cable from stowage position on Node 1 Aft endcone truss. 
CBCS 5A ADAPTER CABLE P18 \rightarrow J18 RFPDB Assembly 
Rotate up NOD1S4 RVCO (two PIP Pins).

5. CBCS POWERUP VIA EARLY COMM RFPDB

**CAUTION**
After the RPC position has been taken to CLOSE, the CBCS system is energized.

If Pre ECS Power Reconfig
ISS PCS Crew
C&T: Early Comm Overview  
/'Early Comm Overview'  
‘RPCM N1RS2A’

sel RPC 11

RPCM N1RS2_A_RPC_11

**cmd** RPC Position – Close **Execute** (Verify – Cl)

If Post ECS Power Reconfig
Node 1: EPS: RPCM N14B B: RPC 14

RPCM N14B_B_RPC_14

**cmd** RPC Position – Close **Execute** (Verify – Cl)

√ LCU SYSTEM SELECT sw – SYS 1&2 
√ LCU LCD illumination level – Set to 6 
√ LCU MODE sw – STEADY 
√ LCU Sys 1&2 LED lights – On 

ISS ⇒ STS, “CBCS is powered by Early Comm RFPDB.”

6. CBCS VIDEO EVALUATION

**STS** VTR CNTL sw – REC (lt – ON) 
**Crew** A7 VID OUT pb – MON 1 
IN pb – PL2
NODE 1 FORWARD CBCS CHECKOUT

(ASSY OPS/4A/FIN) Page 4 of 10 pages

STS A3
Crew

Monitor Setup.

MON 1 XHAIR – White

If communication
VID OUT pb – DNLK
IN pb – PL2

Assess video quality (general quality, color, sync lines).

After ~3 minutes
VTR
CNTL sw – STDBY (lt – ON)

Inform MCC-H of results.

STS ⇒ ISS, “Video evaluation results (general quality, color, sync lines)...”

7. EARLY COMM RFPDB POWERDOWN

If Pre ECS Power Reconfig
ISS PCS
Crew

C&T: Early Comm Overview

Early Comm Overview

‘RPCM N1RS2A’

sel RPC 11

RPCM N1RS2_A_RPC_11

cmd RPC Position – Open Execute (Verify – Op)

If Post ECS Power Reconfig
Node1: EPS: RPCM N14B B: RPC 14

RPCM N14B_B_RPC_14

cmd RPC Position – Open Execute (Verify – Op)

ISS ⇒ STS, “CBCS is unpowered.”

8. REMOVAL OF LCU, VIU

ISS NOD1
Crew

CBCS Electronics Extension Cable P1 (green) ←|→ J1 of LCU (green)
CBCS Electronics Extension Cable P2 (light blue) ←|→ J2 of VIU (light blue)
CBCS Camera Cable P2 (gold) ←|→ J2 of LCU (gold)
CBCS Camera Cable P3 (violet) ←|→ J3 of VIU (violet)
Remove LCU/VIU assembly from Multi-use Bracket.
Detach LCU from VIU (Velcro).
Stow LCU, VIU in CBCS Stowage Bag.
9. INSTALLATION OF SECOND LCU, VIU

Attach second LCU to Multi-use Bracket.
Velcro second VIU to LCU.
CBCS Electronics Extension Cable P1 (green) →|← J1 of LCU (green)
CBCS Electronics Extension Cable P2 (light blue) →|← J2 of VIU (light blue)
CBCS Camera Cable P2 (gold) →|← J2 of LCU (gold)
CBCS Camera Cable P3 (violet) →|← J3 of VIU (violet)

√ LCU LCD illumination level – Set to 6
√ LCU MODE sw – STEADY
√ LCU SYSTEM SELECT sw – SYS 1&2

10. CBCS POWERUP VIA EARLY COMM RFPDB

CAUTION
After the RPC position has been taken to CLOSE, the CBCS system is energized.

If Pre ECS Power Reconfig
C&T: Early Comm Overview
Early Comm Overview
‘RPCM N1RS2A’

sel RPC 11

RPCM N1RS2_A_RPC_11

**cmd** RPC Position – Close **Execute** (Verify – Cl)

If Post ECS Power Reconfig
Node 1: EPS: RPCM N14B B: RPC 14

RPCM N14B_B_RPC_14

**cmd** RPC Position – Close **Execute** (Verify – Cl)

√ LCU SYSTEM SELECT sw – SYS 1&2
√ LCU LCD illumination level – Set to 6
√ LCU MODE sw – STEADY
√ LCU Sys 1&2 LED lights – On

ISS ⇒ STS, “CBCS is powered by Early Comm RFPDB.”
11. CBCS VIDEO EVALUATION

STS VTR CNTL sw – REC (lt – ON)

Crew

A7 VID OUT pb – MON 1
IN pb – PL2

If communication
VID OUT pb – DNLK
IN pb – PL2

Assess video quality (general quality, color, sync lines).

After ~3 minutes
VTR CNTL sw – STDBY (lt – ON)

Inform MCC-H of results.

STS ⇒ ISS, “Video evaluation results (general quality, color, sync lines)…”

12. EARLY COMM RFPDB POWERDOWN

If Pre ECS Power Reconfig
ISS PCS C&T: Early Comm Overview
Crew ‘RPCM N1RS2A’

sel RPC 11

RPCM N1RS2_A_RPC_11

cmd RPC Position – Open Execute (Verify – Op)

If Post ECS Power Reconfig
Node 1: EPS: RPCM N14B B: RPC 14

RPCM N14B_B_RPC_14

cmd RPC Position – Open Execute (Verify – Op)

ISS ⇒ STS, “CBCS is unpowered.”

13. REMOVAL OF CAMERA ASSEMBLY

CBCS Camera Cable P1 (orange) ←|→ J1 of CBCS Camera Assembly (orange)
Remove CBCS Camera Assembly from standoffs, 1/4 turn fasteners (four).
Stow CBCS Spare Camera in Camera cover and place in CBCS Stowage Bag.
14. INSTALLATION OF PRIMARY CAMERA ASSEMBLY
Mount Primary CBCS Camera Assembly to standoffs with camera protrusion pointing towards Deck, 1/4 turn fasteners (four).
CBCS Camera Cable P1 (orange) ➞ J1 of CBCS Camera Assembly (orange)

15. RECONFIGURATION OF POWER TO KU-BAND POWER SUPPLY
Rotate down NOD1S4 RVCO (two PIP Pins).
CBCS ECOMM RFPDB POWER ADAPTER CABLE P8 ➞ J8 of RFPDB
Install Protective Cap on J8 of RFPDB (stowed on provided Velcro).
CBCS ECOMM RFPDB POWER ADAPTER CABLE P2 (pink) ➞ P2 of CBCS Electronics Cable (pink)
Stow in ECOMM RFPDB ADAPTER CABLE in CBCS Stowage Bag.
Doff and stow Static Wrist Tether.
√ Ku-Band Power Supply Switch Output 28 V – OFF

CBCS Electronics Cable (pink) P2 ➞ J2 of Ku Band Power Supply
Rotate up NOD1S4 RVCO (two PIP Pins).

16. CBCS POWERUP VIA KU-BAND POWER SUPPLY AND UOP

CAUTION
Once UOP ENABLED, CBCS is energized.
√ DC illuminates (white)

NOD1SD4
Enable UOP, depress Power Out Switch.
√ Power Out Switch – ENABLED illuminated (green)
√ Fault/Test – OK illuminated (green)
√ Test Select – DC illuminated (white)
Ku-Band Power Supply Switch Output ➞ On 28 V
√ LCU SYSTEM SELECT sw – SYS 1&2
√ LCU LCD illumination level – Set to 6
√ LCU MODE sw – STEADY
√ LCU Sys 1&2 LED lights – On

If no UOP

ISS PCS Crew
Node 1: EPS: RPCM N14B C: RPC 17
RPCM N14B_C_RPC_17
NODE 1 FORWARD CBCS CHECKOUT
(assy ops/4a/fn) Page 8 of 10 pages

**cmd** Close Cmd – Enable (Verify – Ena)
**cmd** RPC Position – Close **Execute** (Verify – Cl)

Ku-Band Power Supply Switch OUTPUT 28 V → ON

√ LCU SYSTEM SELECT sw – SYS 1&2
√ LCU LCD illumination level – Set to 6
√ LCU MODE sw – STEADY
√ LCU Sys 1&2 LED lights – On

ISS ⇒ STS, “CBCS is powered by Ku-Band power supply.”

17. **CBCS LED AND VIDEO EVALUATION**

<table>
<thead>
<tr>
<th>STS</th>
<th>VTR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crew</td>
<td></td>
</tr>
<tr>
<td>A7</td>
<td>VID OUT pb – MON 1</td>
</tr>
<tr>
<td></td>
<td>IN pb – PL2</td>
</tr>
</tbody>
</table>

If communication
√ VID OUT pb – DNLK
√ IN pb – PL2

NOD1 On LCU

Set brightness level to [X] where [X] = [2 4 6 8 10]

ISS ⇒ STS, “LCD BRIGHTNESS SET TO [X]”

Wait for ~15 seconds.

Repeat

STs AFD Assess video quality (general quality, color, sync lines).

Crew

ISS 18. **SSC TO VIU CONNECTION**

Crew

VIIU/CM Camcorder Video Cable (VIU) →|← J1 of VIU
VIIU/CM Camcorder Video Cable (Camcorder) →|← Video In/Out Cable
Video In/Out Cable →|← SSC ((style)

√ SSC Power On

sel Station Apps (desktop icon), COSS Apps, Video Overlay

Confirm CBCS video via SSC.
Verify Camera Assembly LED illumination.
19. CBCS LED AND VIDEO EVALUATION
   Set brightness level to [X] where [X] = 2 4 6 8 10

   ISS ⇒ STS, “LCD BRIGHTNESS SET TO [X]”
   Wait for ~15 seconds.
   Repeat

20. SSC REMOVAL
   Exit SSC Video Viewer Application, depress “Q” key.
   If desired, power off SSC.

   VIU/CM Camcorder Video Cable (VIU) ←|→ J1 of VIU
   Video In/Out Cable ←|→ (Camcorder) VIU/CM Camcorder Video Cable
   Video In/Out Cable ←|→ ( ) SSC

   Stow VIU/CM Camcorder Video Cable, Video In/Out Cable in ISS
   Photo/TV Bag #1.

   STS VTR CNTL sw – STDBY (It – ON)
   Crew

   Inform MCC-H of results.

21. KU-BAND POWER SUPPLY POWERDOWN
   Ku-Band Power Supply Switch OUTPUT 28 V → OFF

   If UOP
   Disable UOP, depress Power Out Switch.

   √ Power Out Switch – RESET illuminated (white)
   √ Fault/Test – Dark
   √ Test Select – DC illuminated (white)

   If no UOP
   PCS
   Node 1: EPS: RPCM N14B C: RPC 17
   [RPCM N14B C RPC 17]
   cmd Close Cmd – Inhibit (Verify – Inh)
   cmd RPC Position – Open (Verify – Op)

   ISS ⇒ STS, “CBCS is unpowered.”
22. **EARLY COMM RFPDB RECONFIGURATION**

   **ISS NOD1**
   Rotate down NOD1S4 RVCO (two PIP Pins).
   Crew
   CBCS 5A Adapter Cable P18 left→right J18 of RFPDB
   Temporarily stow by tethering to nearest unoccupied truss.
   OCA Data Cable P18 right→left J18 RFPDB Assembly
   Rotate up NOD1S4 RVCO (two PIP Pins).

23. **EARLY COMM RFPDB POWERUP**

   If Pre ECS Power Reconfig
   **ISS PCS**
   C&T: Early Comm Overview
   Crew
   Early Comm Overview
   ‘RPCM N1RS2A’
   sel RPC 11
   **RPCM N1RS2_A_RPC_11**
   cmd RPC Position – Close **Execute** (Verify – Cl)

   If Post ECS Power Reconfig
   **ISS PCS**
   Node 1: EPS: RPCM N14B B: RPC 14
   Crew
   **RPCM N14B_B_RPC_14**
   cmd RPC Position – Close (Verify – Cl)

   ISS ⇒ STS, “Early Comm is reconfigured to Node 1 OCA and repowered.”

24. Inform **MCC-H** of configuration.
TRANSFER
<table>
<thead>
<tr>
<th>Item #</th>
<th>Item Description</th>
<th>Qty</th>
<th>Tox</th>
<th>Shuttle Stowage</th>
<th>Station Stowage</th>
<th>Delta Stowage</th>
<th>Wt (lbs)</th>
<th>Constraints/Procedures Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SYSTEMS OPERATIONAL FLIGHT DATA FILE (SODF)</td>
<td>1</td>
<td>MF57G, MF57K</td>
<td>NOD1P4_B2</td>
<td></td>
<td>75.0</td>
<td>The books should have been removed from the Middeck Lockers and placed into a Middeck Floor bag in preparation for transfer to ISS.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>DOCKING MECHANISM ACCESSORY KIT</td>
<td>1</td>
<td>MA16L</td>
<td>PMA 3</td>
<td></td>
<td>3.0</td>
<td>Stowed per procedure during PMA3 INGRESS/EGRESS activities</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PORT MDDK FLR BAG</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>COLLAPSIBLE WATER CONTAINERS (CWCS)</td>
<td>7</td>
<td>PORT MDDK FLR BAG</td>
<td>FGB_109*</td>
<td></td>
<td>665.0</td>
<td>Three CWCs will be transferred on FD 03. The four remaining CWCs will be transferred on FD 07.</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>EPCS EQUIPMENT (CTB)</td>
<td>2</td>
<td>PORT MDDK FLR BAG</td>
<td>SM 310</td>
<td></td>
<td>7.2</td>
<td>This is replacement hardware for Return Item 105. Swap the Hardware with Items currently on ISS, and use the CTB as the return bag.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>XD Laptop Computer</td>
<td>5</td>
<td>PORT MDDK FLR BAG</td>
<td></td>
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<td></td>
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<tr>
<td></td>
<td>Writable CD-ROM, PCS</td>
<td>2</td>
<td>PORT MDDK FLR BAG</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>PCS 3.0 GB Hard Drive(760 XD)</td>
<td>2</td>
<td>PORT MDDK FLR BAG</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>IWIS BAG (CTB)</td>
<td>1</td>
<td>STBD MDDK FLR BAG</td>
<td>NOD1P4_L1</td>
<td></td>
<td>55.2</td>
<td>Components used during DTO 261. Expect one PCMCIA Card to return to shuttle at the completion of DTO 261 test. See Return Item 110.</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>1.5 in. WRENCH</td>
<td>1</td>
<td>PORT MDDK FLR BAG</td>
<td>PMA 3</td>
<td></td>
<td>0.5</td>
<td>Stowed per procedure during PMA3 INGRESS/EGRESS activities</td>
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<tr>
<td>7</td>
<td>STAND-OFF COVER BAG</td>
<td>1</td>
<td>PORT MDDK FLR BAG</td>
<td>PMA 3</td>
<td></td>
<td>0.2</td>
<td>Stowed in PMA 3 per procedure during PMA3 INGRESS/EGRESS activities</td>
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</tr>
<tr>
<td>8</td>
<td>TARGET BASE COVER ASSY</td>
<td>1</td>
<td>PORT MDDK FLR BAG</td>
<td>PMA 3</td>
<td></td>
<td>0.4</td>
<td>Stowed in PMA 3 per procedure during PMA3 INGRESS/EGRESS activities</td>
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<tr>
<td>9</td>
<td>HATCH COVER</td>
<td>1</td>
<td>PORT MDDK FLR BAG</td>
<td>PMA 3</td>
<td></td>
<td>2.0</td>
<td>Stowed in PMA 3 per procedure during EARLY PMA3 INGRESS/EGRESS activities</td>
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<tr>
<td>10</td>
<td>APAS HATCH STANDOFF ASSY</td>
<td>1</td>
<td>PORT MDDK FLR BAG</td>
<td>PMA 3(I)</td>
<td></td>
<td>3.0</td>
<td>Installed per procedure during EARLY PMA3 INGRESS/EGRESS activities</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>PMA/ODS INTERFACE(HALO BYPASS) DUCT</td>
<td>1</td>
<td>PORT MDDK FLR BAG</td>
<td>PMA 3(I)</td>
<td></td>
<td>15.0</td>
<td>Installed per procedure during EARLY PMA3 INGRESS/EGRESS activities</td>
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<tr>
<td>12</td>
<td>SURFACE SAMPLER KIT(SSK)</td>
<td>2</td>
<td>PORT MDDK FLR Bag</td>
<td>FGB_426/427</td>
<td></td>
<td>4.4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(I) - Indicates Installed hardware

* - Indicates stowage is on the front face of a panel

06 NOV 00
<table>
<thead>
<tr>
<th>Item #</th>
<th>Initial Item Qty</th>
<th>Tox</th>
<th>Shuttle Stowage</th>
<th>Station Stowage</th>
<th>Delta Stowage</th>
<th>Wt (lbs)</th>
<th>Constraints/Procedures</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>2</td>
<td>STBD MDDK FLR BAG</td>
<td>Temp Stowed in Node 1</td>
<td>IMAX3D BAG (CTB)</td>
<td>95.1</td>
<td>The IMAX equipment will be used on ISS during the 4A docked timeframe. The EXPOSED FILM Bag will be swapped out with the existing bag on orbit. Stow the “New” bag in XXXX. ALL remaining equipment contained in these two bags will be returned to shuttle after filming ops are complete. See Return Item 108.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>1</td>
<td>STBD MDDK FLR Bag</td>
<td>FGB_217*</td>
<td>AUDIO DOSIMETER BIOBAG</td>
<td>6.5</td>
<td>This is a swap with Return Item 101</td>
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<tr>
<td>15</td>
<td>1</td>
<td>STBD MDDK FLR Bag</td>
<td>FGB_426/427</td>
<td>CSA-CP RESUPPLY KIT</td>
<td>7.1</td>
<td>This is a swap with Return Item 103</td>
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<td>16</td>
<td>3</td>
<td>STBD MDDK FLR Bag</td>
<td>NOD1P4_B3</td>
<td>CREW CARE PACKAGE-2A.2</td>
<td>33.0</td>
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<tr>
<td>17</td>
<td>9</td>
<td>STBD MDDK FLR Bag</td>
<td>SM 411</td>
<td>GRAB SAMPLE CONTAINER</td>
<td>9.9</td>
<td>This is a swap with Return Item 107</td>
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<td>18</td>
<td>1</td>
<td>STBD MDDK FLR Bag</td>
<td>FGB_426/427</td>
<td>PCBA CARTRIDGE KIT (AMP)</td>
<td>1.3</td>
<td>This is a swap with Return Item 112</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>2</td>
<td>STBD MDDK FLR Bag</td>
<td>PMA 3(I)</td>
<td>GROUND STRAP Assy</td>
<td>0.5</td>
<td>Installed per procedure on FD 03.</td>
<td></td>
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<tr>
<td>20</td>
<td>1</td>
<td>STBD MDDK FLR Bag</td>
<td>NOD1O4_E2</td>
<td>SEED GROWTH KIT</td>
<td>4.2</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>21</td>
<td>1</td>
<td>PORT MDDK CEIL BAG</td>
<td>SM</td>
<td>CREW SUPPORT</td>
<td>TBD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>1</td>
<td>PORT MDDK CEIL BAG</td>
<td>NOD1(I)</td>
<td>METEROID/DEBRIS COVER ASSY(NODE NADIR)</td>
<td>38.0</td>
<td>This item will be swapped with the existing Meteoroid/Debris cover currently installed on the Node Nadir hatch. See Return Item 111.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>1</td>
<td>PORT MDDK CEIL BAG</td>
<td>SM 320</td>
<td>PHOTO/TV RESUPPLY ALLOCATION BAG</td>
<td>44.0</td>
<td>The contents of this bag will be swapped out with the existing Photo/TV Bag contents on ISS.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>1</td>
<td>PORT MDDK CEIL BAG</td>
<td>FGB_426/427</td>
<td>WATER MICROBIOLOGY KIT</td>
<td>19.3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
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06 NOV 00
| √ | Item # | Initial | Item | Qty | Tox | Shuttle Stowage | Station Stowage | Delta Stowage | Wt (lbs) | Constraints/Procedures | Comments |
|---|---|---|---|---|---|---|---|---|---|---|
|   |   |   |   |   |   |   |   |   |   |   |
|   |   |   |   |   |   |   |   |   |   |   |
|   |   |   |   |   |   |   |   |   |   |   |
|   |   |   |   |   |   |   |   |   |   |   |
|   |   |   |   |   |   |   |   |   |   |   |
|   |   |   |   |   |   |   |   |   |   |   |

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<table>
<thead>
<tr>
<th>IWIS BAG CONTENTS</th>
<th>IMAX BAG CONTENTS</th>
<th>PHOTO/TV BAG CONTENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>TIRAXIAL ACCELEROMETER W/ PIGTAIL(4)</td>
<td>EXPOSED FILM TAPE</td>
<td>Flash Cord Assy, Nikon/Hasselblad</td>
</tr>
<tr>
<td>ACCELEROMETER CABLE ASSY</td>
<td>DAT BOX</td>
<td>Film Load/Download Bag Assy (SM)</td>
</tr>
<tr>
<td>BATTERY PACK ASSY(6)</td>
<td>DIGITAL AUDIO TAPE(12)</td>
<td>Camera Body 70MM 203S</td>
</tr>
<tr>
<td>CABLE RESTRAINT(15)</td>
<td>OPERATIONS FILM CAN(4)</td>
<td>Battery 1.5v(20)</td>
</tr>
<tr>
<td>IWIS REMOTE SENSOR UNIT(RSU)(4)</td>
<td>ELECTRONIC CIRCUIT BOARDS</td>
<td>Battery AA, 1.5V(120)</td>
</tr>
<tr>
<td>WIS ANTENNA(6)</td>
<td>MAGAZINE ASSY</td>
<td>PCMCIA Hard Drive(10)</td>
</tr>
<tr>
<td>IWIS TRIAX ACCELEROMETER INTERFACE PLATE(4)</td>
<td>EXPOSED FILM BAG</td>
<td>Digital Video Tape(75)</td>
</tr>
<tr>
<td>PCMCIA HARD DRIVE(5)</td>
<td></td>
<td>Lg Capacity Film Container 70MM(20)</td>
</tr>
<tr>
<td>RACK SEAT TRACK STUD(6)</td>
<td></td>
<td>Film Cassette, 35mm(60)</td>
</tr>
<tr>
<td>STRAIN GAUGE EXTENSION CABLE 10’</td>
<td></td>
<td>Film Cassette Container(60)</td>
</tr>
<tr>
<td>WIS NETWORK CONTROL UNIT(2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PARALLEL PORT CABLE ASSY (2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ACCELEROMETER EXT CABLE – 6’(3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ACCELEROMETER MOUNTING PLATE – SM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ACCELEROMETER MOUNTING PLATE – FGB VELCRO STRAP(15)</td>
<td></td>
<td></td>
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<th>Delta Stowage</th>
<th>Wt (lbs)</th>
<th>Constraints/Procedures Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>101</td>
<td></td>
<td>AUDIO DOSIMETER BAG</td>
<td>1</td>
<td></td>
<td>FGB_217* PORT</td>
<td>MDDK FLR BAG</td>
<td>6.5</td>
<td></td>
<td>The ISS Crew used this during the 2R Stage.</td>
</tr>
<tr>
<td>102</td>
<td></td>
<td>CONTINGENCY WATER CONTAINER</td>
<td>6</td>
<td></td>
<td>FGB_109* STBD</td>
<td>MDDK FLR BAG</td>
<td>18.6</td>
<td></td>
<td>empty</td>
</tr>
<tr>
<td>103</td>
<td></td>
<td>CSA-CP RESUPPLY KIT</td>
<td>1</td>
<td></td>
<td>FGB_426/427 PORT</td>
<td>MDDK FLR BAG</td>
<td>7.1</td>
<td></td>
<td>The ISS Crew used this during the 2R Stage.</td>
</tr>
<tr>
<td>104</td>
<td></td>
<td>EXPEDITION 1 CREW CLOTHING</td>
<td>1 BAG</td>
<td></td>
<td>SM PORT</td>
<td>MDDK FLR BAG</td>
<td>25.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>105</td>
<td></td>
<td>EPCS RETURN EQUIPMENT</td>
<td>2</td>
<td>4</td>
<td>SM 310 STBD</td>
<td>MDDK FLR BAG</td>
<td>17.1</td>
<td></td>
<td>The Laptops, Hard Drives, and Diskette Assy were used during the 2R Stage and will return to shuttle.</td>
</tr>
<tr>
<td>106</td>
<td></td>
<td>FOOD RATIONS CONTAINERS</td>
<td>5</td>
<td></td>
<td>FGB_112* STBD</td>
<td>MDDK FLR BAG</td>
<td>11.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>107</td>
<td></td>
<td>GRAB SAMPLE CONTAINER</td>
<td>9</td>
<td></td>
<td>SM 411 PORT</td>
<td>MDDK FLR BAG</td>
<td>9.9</td>
<td></td>
<td>The ISS Crew used these bottles for air sample collection during the 2R Stage.</td>
</tr>
<tr>
<td>108</td>
<td></td>
<td>IMAX3D BAG</td>
<td>2</td>
<td></td>
<td>Temp Stowed PORT</td>
<td>MDDK FLR BAG</td>
<td>101.3</td>
<td></td>
<td>Once filming operations are complete, the IMAX3D equipment should be returned to shuttle. Unstow the &quot;old&quot; EXPOSED FILM Bag from XXX and stow three &quot;Dummy&quot; film rolls located in XXX. Stow bag/film in IMAX3D Bags for return to shuttle.</td>
</tr>
<tr>
<td>109</td>
<td></td>
<td>IMV Cap O Rings</td>
<td>1</td>
<td></td>
<td>PMA 3 MA16L</td>
<td></td>
<td>0.1</td>
<td></td>
<td>These were removed from the IMV cap on the Deck Aft Flange of PMA 3. They should be marked as &quot;Used O-Rings.&quot;</td>
</tr>
<tr>
<td>110</td>
<td></td>
<td>IWIS PCMCIA HARD DRIVE</td>
<td>1</td>
<td></td>
<td>NOD1P4_L1 MF14E</td>
<td></td>
<td>0.06</td>
<td></td>
<td>This hard drive contains IWIS data from the DTO 261 Test on FD 05. The hard drive will be labeled &quot;Flight 4A, DTO-261, IWIS Data&quot; per procedure; Assy Ops, IWIS SHUTDOWN</td>
</tr>
<tr>
<td>111</td>
<td></td>
<td>METEOROID/DEBRIS COVER ASSY</td>
<td>1</td>
<td></td>
<td>NOD1 PORT</td>
<td>MDDK CEIL BAG</td>
<td>38.0</td>
<td></td>
<td>Note: The tensioning bars for this cover are removed and used to install the New cover.</td>
</tr>
</tbody>
</table>

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<th>Wt (lbs)</th>
<th>Constraints/Procedures Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>112</td>
<td>PCBA CARTRIDGE KIT</td>
<td>1</td>
<td>SM</td>
<td>PORT MDDK FLIR BAG</td>
<td></td>
<td></td>
<td>1.3</td>
<td>The ISS Crew used this during the 2R Stage.</td>
</tr>
<tr>
<td>113</td>
<td>PHOTO/TV RESUPPLY ALLOCATION</td>
<td>1</td>
<td>SM 320</td>
<td>PORT MDDK CEIL BAG</td>
<td></td>
<td></td>
<td>44.0</td>
<td>Return all used Photo/TV consumables labeled 2A.2B. A 1/2 CTB from the 2A.2B flight may be used as the Return Photo/TV Bag.</td>
</tr>
<tr>
<td>114</td>
<td>ELECTRONIC STILL CAMERA 460C BODY</td>
<td>1</td>
<td>SM 320</td>
<td>PORT MDDK CEIL BAG</td>
<td></td>
<td></td>
<td>3.8</td>
<td>This item may be stowed with the returning Photo/TV equipment.</td>
</tr>
<tr>
<td>115</td>
<td>MULTI USE BRACKET ADAPTER (1/4 - 20)</td>
<td>1</td>
<td>SM 320</td>
<td>PORT MDDK CEIL BAG</td>
<td></td>
<td></td>
<td>0.1</td>
<td></td>
</tr>
<tr>
<td>115</td>
<td>SYSTEMS OPERATIONAL FLIGHT DATA FILE (SODF)ATSODF</td>
<td>1</td>
<td>NOD1P4_B2</td>
<td>MF57K</td>
<td></td>
<td></td>
<td>25.0</td>
<td></td>
</tr>
</tbody>
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06 NOV 00
DEORBIT PREP
NOTE
Expect ‘SM 200 APCU 1 TRIP’ and ‘SM 200 APCU 2 TRIP’ messages

1. DEACTIVATING PAYLOAD BUSES

R1
PL CAB – OFF
PRI MNC – OFF (tb-OFF)
AUX – OFF

SSP1
cb SW PWR 1, 2 – op
cb PDIP PWR 2/Ku BAND RLY – op
cb PDIP PWR 1 – op

SSP2
cb SW PWR 1, 2 – op
PAYLOAD REACTIVATION
(ASY OPS/4A/FIN)  Page 1 of 1 page

N/A
PAYLOAD ENTRY SWITCH LIST CONFIGURATION

TIG-1:55

PAYLOAD PWR CONFIG

R1
\[ \sqrt{\text{PL CAB}} \] - OFF
\[ \sqrt{\text{PRI MNC}} \] - OFF, hold 3 sec, (tb-bp)
\[ \sqrt{\text{MNB}} \] - ctr (tb-OFF)
\[ \sqrt{\text{FC3}} \] - ctr (tb-OFF)
\[ \sqrt{\text{AUX}} \] - OFF
\[ \sqrt{\text{AFT MNB}} \] - OFF
\[ \sqrt{\text{MNC}} \] - OFF

(SSP1)
\[ \sqrt{\text{APCU 1 CONV}} \] - OFF (tb-bp)
\[ \sqrt{\text{OUTPUT RLY}} \] - OFF (tb-bp)
\[ \sqrt{\text{cb SW PWR 1}} \] - OFF (tb-bp)
\[ \sqrt{\text{APCU 2 CONV}} \] - OFF (tb-bp)
\[ \sqrt{\text{OUTPUT RLY}} \] - OFF (tb-bp)
\[ \sqrt{\text{cb SW PWR 2}} \] - OFF (tb-bp)
\[ \sqrt{\text{TCS PWR}} \] - OFF (tb-bp)
\[ \sqrt{\text{PRI C/L CAM PWR}} \] - OFF (tb-bp)
\[ \sqrt{\text{SEC C/L CAM PWR}} \] - OFF (tb-bp)
\[ \sqrt{\text{cb PDIP PWR 2/Ku BAND RLY}} \] - OFF (tb-bp)
\[ \sqrt{\text{cb PDIP PWR 1}} \] - OFF (tb-bp)
\[ \sqrt{\text{ODS CONN MATE X1 TLM PWR}} \] - OFF (tb-bp)
\[ \sqrt{\text{X2 TLM PWR}} \] - OFF (tb-bp)
\[ \sqrt{\text{OIU PWR}} \] - OFF (tb-bp)

(SSP2)
\[ \sqrt{\text{ICBC3D PWR}} \] - OFF (tb-bp)
\[ \sqrt{\text{OVERRIDE}} \] - OFF (tb-bp)
\[ \sqrt{\text{cb SW PWR 1, 2}} \] - OFF (tb-bp)

(PDIP)
\[ \sqrt{\text{Ku BAND RATE}} \] - OFF
\[ \sqrt{\text{DC PWR 1,2 (two)}} \] - OFF (tb-bp)
1. **VERIFYING SOURCE POWER TO DDCU Z13B(Z14B)**

   CRT SM 200 APCU Status

   √APCU 2 (1)OUT VOLTS = 140 ± 4 V

2. **ESTABLISHING COMMUNICATION WITH DDCU Z13B(Z14B)**
   
   2.1 Enabling, Initializing NCS DDCU Control Software in Primary MDM
   
   Node 1: C&DH: Primary NCS MDM: Applications: EPS Apps
   
   Verify DDCU Control – INH

   **cmd** DDCU Control – Enable

   √DDCU Control – ENA

   2.2 Enabling DDCU Z13B(Z14B) RT and FDIR
   
   Node 1: C&DH: Primary NCS MDM: UB EPS N1-23(N1-14): RT Status
   
   Verify 15 DDCU Z1-3B(Z1-4B) RT Status – INH

   **cmd** 15 DDCU Z1-3B(Z1-4B) RT Status – Enable

   √15 DDCU Z1-3B(Z1-4B) RT Status – ENA

   √15 DDCU Z1-3B(Z1-4B) RT Failed Status – <blank>

   Verify 15 DDCU Z1-3B(Z1-4B) RT FDIR Status – INH

   **cmd** 15 DDCU Z1-3B(Z1-4B) RT FDIR Status – Enable FDIR

   √15 DDCU Z1-3B(Z1-4B) RT FDIR Status – ENA

3. **VERIFYING DDCU Z13B(Z14B) ACTIVE**

   Z1: EPS: DDCU Z13B(Z14B)

   **DDCU Z13B(Z14B)**

   √Integration Counter incrementing

   √Input Voltage: 132 --- 148 V

4. **CLEARING DDCU POWER ON RESET**

   sel Firmware

   **DDCU Z13B(Z14B) Firmware**

   **cmd** Clear Cmds – Common Clear

   √Power On Reset – <blank>
5. **TURNING ON DDCU CONVERTER**

   **DDCU Z13B(Z14B)**

   sel Converter

   **DDCU Z13B(Z14B) Converter**

   **cmd** On Arm
   **cmd** On

   \( \sqrt{\text{Output Voltage: 121 --- 128 V}} \)

6. **VERIFYING RPCM N13B(N14B) OPERATION**

   **DDCU Z13B(Z14B)**

   \( \sqrt{\text{RPCM N13B(N14B) A, B, C – Active}} \)

   sel RPCM N13B(N14B) [X] where [X] = \[A\] [B] [C]

   **RPCM N13B(N14B) [X]**

   \( \sqrt{\text{Intg Counter incrementing}} \)
   \( \sqrt{\text{RPCs (1 --- 18) – Open}} \)
   \( \sqrt{\text{Bus Voltage: 121 --- 128 V}} \)

   sel Firmware

   **RPCM N13B(N14B) [X] Firmware**

   **cmd** Clear Cmds – Common Clear

   \( \sqrt{\text{Power On Reset – <blank>}} \)

Repeat
MALFUNCTION
If the error message box in Figure 1 appears during operation of the IWIS, the most likely reason is that a required file in the c:\wis directory has been deleted or corrupted.

![Error 7 Message Box](image)

Figure 1.- Error 7 Message Box.

**NOTE**

1. Selection of ‘Continue’ may allow the software to perform temporarily. However, this will not correct the root cause of the problem and results are unpredictable.

2. The recommended action is selection of ‘Stop’. This will cause the standard IWIS software to terminate and enter a limited LabVIEW mode.

After receiving the error message in Figure 1, perform the following steps:

- **sel Stop** (This closes error message window and exits to LabVIEW mode.)

- **File: Exit** (This exits the LabVIEW software.)

**NOTE**

1. Use Windows Explorer to rename the WIS directory.

2. This will preserve any user-generated files that may not be a part of the standard IWIS load.

3. Any data files that have been downloaded will also be preserved.

- **sel Start: Programs: Windows Explorer**

  - **Exploring – (C:)**

  Right-click on the folder “c:\wis”.

- **sel Rename**

  input <wis_save> (name of new folder)

- **sel C:** (icon for the root directory of drive C)

- **sel File: New: Folder** (from Windows Explorer menu)
input <wis> (name of new folder)

sel View: Refresh

Insert IWIS CD-ROM into CD-ROM drive of SSC.
Copy all “wis” folders, subfolders, and files from the CD-ROM to the c:\wis folder on the SSC hard drive.
If any folders are present in c:\wis_save\data, then copy all of these folders to c:\wis\data.
1. **CHECKING FOR REQUIRED SUBFILES**
   Use Windows Explorer to check for required subfiles.

   sel Start: Programs: Windows Explorer

   **Exploring – (C:)**

   sel ‘c:\wis\subfiles’

   Verify that following files are in the folder:
   - RSU1_WARMUP
   - RSU2_WARMUP
   - RSU1_Node_Fwd_C1
   - RSU1_Node_Fwd_C2
   - RSU1_Node_Fwd_T1
   - RSU1_Node_Fwd_T2
   - RSU1_Node_Fwd_A1
   - RSU1_Node_Fwd_A2
   - RSU2_Node_Aft_C1
   - RSU2_Node_Aft_C2
   - RSU2_Node_Aft_T1
   - RSU2_Node_Aft_T2
   - RSU2_Node_Aft_A1
   - RSU2_Node_Aft_A2

   If all of the files are present, then proceed to step 2.

   If any of these files are missing
   - Reload the missing files from CD-ROM.
   - Return to the step that referenced this procedure and attempt to execute the command file.

2. **REBUILDING THE COMMAND FILE**
   If all of the designated files are present, rebuild the command file.

   **Commands: Init. For Data Collection**
   - **Initialize Network & Acquire Data**

   **cmd** RSU SCROLL (scroll down to RSU 1026)
   **cmd** Remove RSU (Repeat until RSU list is empty, windows gray out.)

   Left click mouse in ‘RSU S/N’ window under Command File Editor/Viewer.

   sel 1026
   **cmd** Select (gray button in Command File Editor/Viewer window next to ACQ Setup File window)
If command file is for ‘Warmup’
    sel RSU1_WARMUP

If command file is for ‘Checkout’
    sel RSU1_Node_Fwd_C1

If command file is for ‘DTO-261 Test 1 using VRCS’
    sel RSU1_Node_Fwd_T1

If command file is for ‘DTO-261 Test 2 using VRCS’
    sel RSU1_Node_Fwd_T2

If command file is for ‘DTO-261 Test 1 using ALT mode’
    sel RSU1_Node_Fwd_A1

If command file is for ‘DTO-261 Test 2 using ALT mode’
    sel RSU1_Node_Fwd_A2

**cmd** Open

Left click mouse in ‘RSU S/N’ window under Command File Editor/Viewer.

sel 1027

**cmd** Select (gray button in Command File Editor/Viewer window next to ACQ Setup File window)

If command file is for ‘Warmup’
    sel RSU2_WARMUP

If command file is for ‘Checkout’
    sel RSU2_Node_Aft_C1

If command file is for ‘DTO-261 Test 1 using VRCS’
    sel RSU2_Node_Aft_T1

If command file is for ‘DTO-261 Test 2 using VRCS’
    sel RSU2_Node_Aft_T2

If command file is for ‘DTO-261 Test 1 using ALT mode’
    sel RSU2_Node_Aft_A1

If command file is for ‘DTO-261 Test 2 using ALT mode’
    sel RSU2_Node_Aft_A2

**cmd** Open

Return to the step that referenced this procedure and attempt to execute the command file.
1. NCU is not responding to commands from SSC.
   Perform following corrective actions.

   √ Data cable →|← NCU Parallel Port
   √ Data cable →|← SSC LPT Port
   √ NCU pwr – On

   Utilities: Network Utility
   Network Utility

   **NOTE**
   1. Use mouse to click on window labeled “RSU S/N.”
   2. Input serial number using keyboard.

   input RSU S/N [X]   where [X] = 1032
   sel Action – Reset NCU

   **cmd** Configure
   **cmd** OK (Response to ‘Proceed Configure?’)
   **cmd** RETURN

2. Utilities: Node Status

   sel   Node ID – 1032 (NCU)  (left click in data window)
   **cmd** Get Status

   Verify Get Status button changes to gray Updating button.

   Wait ~1 minute.

   If button changes back to blue Get Status
   NCU is responding.

   √ Errors – None

   Return to beginning of step that referenced this procedure.

   If button remains gray Updating
   NCU is still not responding.

   **cmd** RETURN  (Close Node Status window.)
CHECKING ERROR LOG

3. Utilities: Error log
   - Error Log

   cmd Update

   Scroll to top of list.

   √Log entries

   √MCC-H (may require switch to backup NCU (S/N 1004))
In response to the error message ‘Node not configured in network’, perform the following corrective actions:

Utilities: Network Utility
Network Utility

NOTE
The following steps refer to inputs and buttons on the right side of the window in the section labeled “Network Configure.”

input [X] in RSU S/N box where [X] is serial number of unit not responding

Click mouse in box labeled “Action.”

sel ‘Add RSU to Network’
cmd Configure
cmd OK (Response to message ‘Proceed Configure?’.)
cmd Return
In response to the error message ‘Unable to contact target node’, perform the following corrective actions.

1. Verify that report unit is powered on.
   √RSU power – on (visually check switch, do not toggle off)

2. Check network status.

   Utilities: Node Status
   [Node Status]

   sel Node ID (click with mouse in Node ID window)
   sel xxxx (in dropdown window where xxxx = S/N of NCU)
   cmd Get Status (button changes to Updating)

   Wait for response windows to fill.

   √Errors – None

   Verify number of RSUs (typically two RSUs active in network).
   Verify Node ID Table (values should correspond to active RSUs).

   cmd RETURN

3. Modify network if RSUs are missing (or extra RSUs are present).

   Utilities: Network Utility
   [Network Utility]

   input RSU S/N (window on right-hand side under Network Configure)

   sel Add RSU (or Remove RSU)
   cmd Configure
   sel OK (response to ‘Proceed Configure?’)
   cmd RETURN

4. Check status of RSUs.

   Utilities: Node Status
   [Node Status]

   sel Node ID (click with mouse in Node ID window)
   sel xxxx (in dropdown window where xxxx = S/N of RSU)
   cmd Get Status (button changes to Updating)

   Wait for response windows to fill.
If Errors – None
   Return to calling point in nominal procedure.

If Errors – ‘Unable to contact target node’
   Proceed with next step.

5. Reposition RSU ~2 inches from current position.
   Move RSU in any direction that is convenient.
   Ensure that antenna points inboard (toward center of module if possible).

6. Repeat status check of RSU (step 4).
   If Errors – None
      Return to calling point in nominal procedure.
   If Errors – ‘Unable to contact target node’
      Proceed with next step.

7. Check status of RSUs during powerup.

   Utilities: Node Status
   sel Node ID (click with mouse in Node ID window)
   sel xxxx (in dropdown window where xxxx = S/N of RSU)
   cmd Get Status (button changes to Updating)

   During update, toggle power off then back on for suspect RSU.

   Wait for response windows to fill.
   If Errors – None
      Return to calling point in nominal procedure.
   If Errors – ‘Unable to contact target node’
      \MCC-H
<table>
<thead>
<tr>
<th>ORBITER EPS BUSES</th>
<th>ESS</th>
<th>MNA DA1</th>
<th>MNB DA2</th>
<th>FC3</th>
<th>MNC DA3</th>
</tr>
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<tr>
<td></td>
<td>TBC</td>
<td>2CA</td>
<td>3AB</td>
<td>PNL O14</td>
<td>MPC 1</td>
</tr>
<tr>
<td></td>
<td>PNL AML</td>
<td>(R)</td>
<td>PNL AML</td>
<td>(R)</td>
<td>PNL AML</td>
</tr>
<tr>
<td></td>
<td>CABIN</td>
<td>PL1</td>
<td>PL2</td>
<td>PL3</td>
<td>CABIN</td>
</tr>
<tr>
<td>Orbiter equipment</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
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</tr>
<tr>
<td>OIU 1</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
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</tr>
<tr>
<td>OIU 2</td>
<td>X</td>
<td>X</td>
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<td>X</td>
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</tr>
<tr>
<td>APCU 1 (SSP 1B)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
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</tr>
<tr>
<td>APCU 2 (SSP 1B)</td>
<td>X</td>
<td>X</td>
<td>X</td>
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</tr>
<tr>
<td>ORB X1 CONN MATE TM PWR (SSP 1A)</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>ORB X2 CONN MATE TM PWR (SSP 1A)</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>TCS (SSP 1A)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
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</tr>
<tr>
<td>PRI C/L CAMERA (SSP 1A)</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<td>X</td>
</tr>
<tr>
<td>SEC C/L CAMERA (SSP 1A)</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<td>X</td>
</tr>
<tr>
<td>PDIP (L12) DC1</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
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</tr>
<tr>
<td>PDIP (L12) DC2</td>
<td>X</td>
<td>X</td>
<td>X</td>
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</tr>
<tr>
<td>PDIP KuSP RATE CNTL</td>
<td>X</td>
<td>X</td>
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<td>VIDEO PROCESSING UNIT</td>
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<tr>
<td>PAYLOAD TIMING BUFFER</td>
<td>X</td>
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<td>X</td>
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<td>ISS EQUIPMENT</td>
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</tr>
<tr>
<td>OSVS</td>
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<td>X</td>
<td>X</td>
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<td>ICBC3D ICB C3 D</td>
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<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>PMA 2/3 hooks - SYS A</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>PMA 2/3 hooks - SYS B</td>
<td>X</td>
<td>X</td>
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<td>X</td>
</tr>
<tr>
<td>PAYLOAD BUS CNTL PWR</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>CABIN PL BUS - MNA CNTL PWR</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>CABIN PL BUS - MNB CNTL PWR</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>AUX PL A BUS - MNA CNTL PWR</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>AUX PL B BUS - MNB CNTL PWR</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>PL PRI - MNB CNTL PWR</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>PL PRI - MNC CNTL PWR</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>PL PRI - FC 3 CNTL PWR</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>AFT PL B BUS - MNB CNTL PWR</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>AFT PL C BUS - MNC CNTL PWR</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

X = TOTAL LOSS OF OPERATIONAL PWR  
P = LOSS OF PRIMARY PWR SOURCE  
R = LOSS OF REDUNDANT PWR SOURCE  
(R) = REQUIRES ACTION TO USE REDUNDANT SOURCE  
XC = TOTAL LOSS OF CNTL PWR  
XRC = LOSS OF REDUNDANT CNTL PWR
FF1
  Uplink through NSP 1 (secondary)

FF3
  Uplink through NSP 2 (primary)

PF1
  ISS Primary command path (via PSP 1 – UMB 1/OIU 1)
  APCU-1 telemetry
  OIU 1 telemetry (PDI TLM 2)
  DIH Card 06 – CH 02
  DIH ODS X1/PMA-2 X2 connector mate tlm (input 15)
  DIH ODS X1/PMA-2 X1 connector mate tlm (input 08)

PF2
  ISS Redundant command path (via PSP 2 – UMB 1/OIU 2)
  APCU-2 telemetry
  OIU 2 telemetry (PDI TLM)
  OSVS Interface
  DIH Card 06 – CH 02
  DIH ODS X1/PMA-2 X1 connector mate tlm (input 14)
  DIH ODS X1/PMA-2 X2 connector mate tlm (input 09)

OF1
  PCMMU 1 – mode select
  PCMMU 1,2 – ON/OFF pwr select
  PCMMU 1,2 – RPC A tlm
  PCMMU 1,2 – BFS Auto TFL
  PL BAY MECH PWR SYS 1, 2 tlm
  PL RETEN LOGIC PWR SYS 1, 2 redundancy tlm
  MID MCA 3 OP STATUS 1 mon
  2 mon
  3 mon
  4 mon
  PL AUX A – RPC ON/OFF tlm

DSC OF1
  PCMMU 1 – mode select
  Ku-BAND GYRO TEMP tlm (FR 11-53)
  Ku-BAND ANT FEED TEMP tlm

OF2
  P/L INTRG 1,2 CHAN SEL tlm
  OP STATUS tlm
  PSP 1,2 – bit & frame sync
  PCMMU 2 – mode select
  PCMMU 2 RPC B tlm
  PCMMU 2 ON/OFF tlm
  PL AUX B – RPC ON/OFF tlm
DSC OF2
PCMMU 2 – mode select

OF3
Orbiter Comm system tlm (reference OI MDM/DSC Failure Impacts)
PL PRI (MNC, MNB, FC3, FC3 struct gnd) – ON/OFF tlm
Ku-BAND ALPHA, BETA-GIMBAL TEMP tlm
GCIL tlm (revert to panel)

DSC OF3
Ku-BAND ALPHA-GIMBAL TEMP tlm

OF4
PSP Command capability
If only one port is lost, command capability can be regained by switching
to opposite PCMMU
Ku-Band – RADAR mode and output pwr
S-Band, Ku-Band – PNL/CMD switch position
PSP, PI, GCIL, COMSEC – ON/OFF tlm
ORBITER COMM SYSTEM tlm (reference OI MDM/DSC Failure Impacts)
CAB PL (MNA, MNB), PL AUX – ON/OFF tlm
MPM STOW, LATCH cmd indication
RMS PWR SELECT tlm
RMS HTR A CONFIG tlm

DSC OF4
No payload impacts

OA1
ODS X4/PMA-2 X3 connector mate tlm
PMA-2 GRP 1 passive hooks (1,3,5) closed tlm
PMA-2 GRP 1 passive hooks (7,9,11) closed tlm

DSC OA1
ODS X4/PMA-2 X3 connector mate tlm pwr
PMA-2 GRP 2 passive hooks (1,3,5) closed tlm
PMA-2 GRP 2 passive hooks (7,9,11) closed tlm

OA2
ODS X3/PMA-2 X4 connector mate tlm
PMA-2 GRP 2 passive hooks (2,4,6) closed tlm
PMA-2 GRP 2 passive hooks (8,10,12) closed tlm

DSC OA2
ODS X3/PMA-2 X4 connector mate tlm pwr
PMA-2 GRP 2 passive hooks (2,4,6) closed tlm pwr
PMA-2 GRP 2 passive hooks (8,10,12) closed tlm pwr
Table A. Nominal Power Connectivity by Assembly Phase

Use in conjunction with Table C (end-item loads) to determine functionality lost after a failure.

Before Z1 CPP and N1 CPP reconfigurations, Y-Cable installed for N14B (planned 4A Pre-Assembly configuration).

<table>
<thead>
<tr>
<th>RACU 6</th>
<th>Power Bus N1RS1</th>
<th>Power Bus Z14B</th>
<th>Power Bus N14B</th>
</tr>
</thead>
<tbody>
<tr>
<td>RACU 5</td>
<td>Power Bus N1RS2</td>
<td>Power Bus Z13B</td>
<td></td>
</tr>
<tr>
<td>P6 Ch 4B</td>
<td>DCSU 4B RBI 6</td>
<td>DCCU Z14B</td>
<td>RPM 4B A</td>
</tr>
<tr>
<td></td>
<td>DCSU 4B RBI 5</td>
<td>DCCU 4B</td>
<td>RPM 4B B</td>
</tr>
<tr>
<td>P6 Ch 2B</td>
<td>DCSU 2B RBI 6</td>
<td>DCCU Z13B</td>
<td>Power Bus N13B</td>
</tr>
<tr>
<td></td>
<td>DCSU 2B RBI 5</td>
<td>DCCU 2B</td>
<td>RPM 2B A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>RPM 2B B</td>
</tr>
</tbody>
</table>

Post Z1 CPP and N1 CPP reconfigurations, Power Bus N1RS1 left on Russian power (planned Final 4A configuration).

<table>
<thead>
<tr>
<th>RACU 6</th>
<th>Power Bus N1RS1</th>
<th>Power Bus N14B</th>
</tr>
</thead>
<tbody>
<tr>
<td>RACU 5</td>
<td>No Loads</td>
<td></td>
</tr>
<tr>
<td>P6 Ch 4B</td>
<td>DCSU 4B RBI 6</td>
<td>DCCU Z14B</td>
</tr>
<tr>
<td></td>
<td>DCSU 4B RBI 5</td>
<td>DCCU 4B</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P6 Ch 2B</td>
<td>DCSU 2B RBI 6</td>
<td>DCCU Z13B</td>
</tr>
<tr>
<td></td>
<td>DCSU 2B RBI 5</td>
<td>DCCU 2B</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table B. Contingency Power Connectivity by Assembly Phase
Use in conjunction with Table C (end-item loads) to determine functionality lost after a failure.

Before Z1 CPP and N1 CPP reconfigurations, Y-Cable not installed (not a planned 4A configuration).

<table>
<thead>
<tr>
<th>RACU 6</th>
<th>Power Bus N1RS1</th>
<th>Power Bus Z14B</th>
</tr>
</thead>
<tbody>
<tr>
<td>RACU 5</td>
<td>Power Bus N1RS2</td>
<td>Power Bus Z13B</td>
</tr>
<tr>
<td></td>
<td>DCSU 4B RBI 6</td>
<td>DDCU Z14B</td>
</tr>
<tr>
<td></td>
<td>DCSU 4B RBI 5</td>
<td>DDCU 4B</td>
</tr>
<tr>
<td></td>
<td>Power Bus N14B</td>
<td>RPCM 4B A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RPCM 4B B</td>
</tr>
<tr>
<td>P6 Ch 4B</td>
<td>DCSU 2B RBI 6</td>
<td>DDCU Z13B</td>
</tr>
<tr>
<td></td>
<td>DCSU 2B RBI 5</td>
<td>DDCU 2B</td>
</tr>
<tr>
<td></td>
<td>Power Bus N13B</td>
<td>RPCM 2B A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RPCM 2B B</td>
</tr>
</tbody>
</table>

Before Z1 CPP and N1 CPP reconfigurations, Y-Cable installed for N13B (not a planned 4A configuration).

<table>
<thead>
<tr>
<th>RACU 6</th>
<th>Power Bus N1RS1</th>
<th>Power Bus Z14B</th>
</tr>
</thead>
<tbody>
<tr>
<td>RACU 5</td>
<td>Power Bus N1RS2</td>
<td>Power Bus Z13B</td>
</tr>
<tr>
<td></td>
<td>Power Bus N13B</td>
<td>Power Bus N13B</td>
</tr>
<tr>
<td></td>
<td>DCSU 4B RBI 6</td>
<td>DDCU Z14B</td>
</tr>
<tr>
<td></td>
<td>DCSU 4B RBI 5</td>
<td>DDCU 4B</td>
</tr>
<tr>
<td></td>
<td>Power Bus N14B</td>
<td>RPCM 4B A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RPCM 4B B</td>
</tr>
<tr>
<td>P6 Ch 4B</td>
<td>DCSU 2B RBI 6</td>
<td>DDCU Z13B</td>
</tr>
<tr>
<td></td>
<td>DCSU 2B RBI 5</td>
<td>DDCU 2B</td>
</tr>
<tr>
<td></td>
<td>Power Bus N13B</td>
<td>RPCM 2B A</td>
</tr>
<tr>
<td></td>
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<td>RPCM 2B B</td>
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Post Z1 CPP reconfiguration before N1 CPP reconfiguration, Y-Cable not installed (not a planned 4A configuration).

<table>
<thead>
<tr>
<th>RACU 6</th>
<th>Power Bus N1RS1</th>
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</thead>
<tbody>
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<tr>
<td>P6 Ch 4B</td>
<td>DCSU 4B RBI 6</td>
</tr>
<tr>
<td></td>
<td>DCSU 4B RBI 5</td>
</tr>
<tr>
<td></td>
<td>Power Bus N14B</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>P6 Ch 2B</td>
<td>DCSU 2B RBI 6</td>
</tr>
<tr>
<td></td>
<td>DCSU 2B RBI 5</td>
</tr>
<tr>
<td></td>
<td>Power Bus N13B</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Post Z1 CPP reconfiguration before N1 CPP reconfiguration, Y-Cable installed for N14B (not a planned 4A configuration)

<table>
<thead>
<tr>
<th>RACU 6</th>
<th>Power Bus N1RS1</th>
<th>Power Bus N14B</th>
</tr>
</thead>
<tbody>
<tr>
<td>RACU 5</td>
<td>Power Bus N1RS2</td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>P6 Ch 4B</th>
<th>DCSU 4B RBI 6</th>
<th>DDCU Z14B</th>
<th>Power Bus Z14B</th>
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</thead>
<tbody>
<tr>
<td>DCSU 4B RBI 5</td>
<td>DDCU 4B</td>
<td>RPCM 4B A</td>
<td>Power Bus Z14B</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>P6 Ch 2B</th>
<th>DCSU 2B RBI 6</th>
<th>DDCU Z13B</th>
<th>Power Bus Z13B</th>
</tr>
</thead>
<tbody>
<tr>
<td>DCSU 2B RBI 5</td>
<td>DDCU 2B</td>
<td>RPCM 2B A</td>
<td>Power Bus Z13B</td>
</tr>
</tbody>
</table>

Post Z1 CPP reconfiguration before N1 CPP reconfiguration, Y-Cable installed for N13B (not a planned 4A configuration)

<table>
<thead>
<tr>
<th>RACU 6</th>
<th>Power Bus N1RS1</th>
</tr>
</thead>
<tbody>
<tr>
<td>RACU 5</td>
<td>Power Bus N1RS2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>P6 Ch 4B</th>
<th>DCSU 4B RBI 6</th>
<th>DDCU Z14B</th>
<th>Power Bus N14B</th>
</tr>
</thead>
<tbody>
<tr>
<td>DCSU 4B RBI 5</td>
<td>DDCU 4B</td>
<td>RPCM 4B A</td>
<td>Power Bus Z14B</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>P6 Ch 2B</th>
<th>DCSU 2B RBI 6</th>
<th>DDCU Z13B</th>
<th>Power Bus Z13B</th>
</tr>
</thead>
<tbody>
<tr>
<td>DCSU 2B RBI 5</td>
<td>DDCU 2B</td>
<td>RPCM 2B A</td>
<td>Power Bus Z13B</td>
</tr>
</tbody>
</table>

Post Z1 CPP and N1 CPP reconfigurations, no busses left on Russian power (not a planned 4A configuration)

<table>
<thead>
<tr>
<th>RACU 6</th>
<th>No Loads</th>
</tr>
</thead>
<tbody>
<tr>
<td>RACU 5</td>
<td>No Loads</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>P6 Ch 4B</th>
<th>DCSU 4B RBI 6</th>
<th>DDCU Z14B</th>
<th>Power Bus N14B</th>
</tr>
</thead>
<tbody>
<tr>
<td>DCSU 4B RBI 5</td>
<td>DDCU 4B</td>
<td>RPCM 4B A</td>
<td>Power Bus Z14B</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>P6 Ch 2B</th>
<th>DCSU 2B RBI 6</th>
<th>DDCU Z13B</th>
<th>Power Bus Z13B</th>
</tr>
</thead>
<tbody>
<tr>
<td>DCSU 2B RBI 5</td>
<td>DDCU 2B</td>
<td>RPCM 2B A</td>
<td>Power Bus Z13B</td>
</tr>
</tbody>
</table>

Post Z1 CPP and N1 CPP reconfigurations, power bus N1RS2 left on Russian power (not a planned 4A configuration)

<table>
<thead>
<tr>
<th>RACU 6</th>
<th>No Loads</th>
<th>Power Bus N1RS2</th>
</tr>
</thead>
<tbody>
<tr>
<td>RACU 5</td>
<td>Power Bus N1RS2</td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>P6 Ch 4B</th>
<th>DCSU 4B RBI 6</th>
<th>DDCU Z14B</th>
<th>Power Bus N14B</th>
</tr>
</thead>
<tbody>
<tr>
<td>DCSU 4B RBI 5</td>
<td>DDCU 4B</td>
<td>RPCM 4B A</td>
<td>Power Bus Z14B</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>P6 Ch 2B</th>
<th>DCSU 2B RBI 6</th>
<th>DDCU Z13B</th>
<th>Power Bus Z13B</th>
</tr>
</thead>
<tbody>
<tr>
<td>DCSU 2B RBI 5</td>
<td>DDCU 2B</td>
<td>RPCM 2B A</td>
<td>Power Bus Z13B</td>
</tr>
<tr>
<td>BUS LOST</td>
<td>EQUIPMENT LOST</td>
<td>FUNCTION/EQUIPMENT LOST</td>
<td>CONTROL/INSTRUMENTATION LOST</td>
</tr>
<tr>
<td>-----------</td>
<td>-------------------------</td>
<td>-------------------------------------------------------------</td>
<td>------------------------------------------------------------------</td>
</tr>
<tr>
<td>RPDA N1RS1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RPCM N1RS1 A</td>
<td>RPC 1: N1 Htr 1A</td>
<td>1 of 2 Node 1 MDMs (N1-1)</td>
<td>Control of RPCM N14B A, B, and C</td>
</tr>
<tr>
<td></td>
<td>RPC 2: N1 Htr 2A</td>
<td>1 of 2 Node 1 Shell Heater Strings (N1 A Heaters)</td>
<td>Instrumentation from RPCM N14B A, B, and C</td>
</tr>
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RPC 2: Emer Lt N1 3B4B C  
RPC 3: CBM N1 Fwd Pri 1  
RPC 4: CBM N1 Fwd Pri 2  
RPC 5: CBM N1 Fwd Pri 3  
RPC 6: CBM N1 Fwd Pri 4  
RPC 13: IMV Fwd Stbd Vlv  
RPC 14: IMV Fwd Port Vlv  
RPC 16: IMV Port Fwd Fan | Power to Interior Lights  
1 of 2 Fwd CBM Power Sources | Refer to Table A for Upstream Power Source. |
| RPDA Z14B | RPC 1: FGB ARCU 3, 4  
RPC 3: SM CHTs 1, 2 | Power to CMG 2 and CMG 3 Heaters  
Power to PCU 2 Heater  
Power to S-Band ORU and Ku-Band ORU Heaters  
Power to EETCS Heater  
Power to 1 of 2 Heaters to all other Z1 Heater Loads  
Power to 1 of 2 Plasma Contactors | |
| RPCM Z14B A | RPC 1: S-Band SASA 2 Htr (Pre-4A relocation)  
RPC 2: S-Band SASA 2 Htr (Post 4A relocation)  
RPC 3: S-Band XPDR 2 Htr pwr (Post 4A relocation)  
RPC 4: S-Band BSP 2 Htr  
RPC 5: Ku-Band SGANT Htr  
RPC 6: Ku-Band SGTRC Htr  
RPC 7: EETCS Non-op Htr B-1  
RPC 8: SPDA Z13B Htr A  
RPC 9: SPDA Z14B Htr B  
RPC 10: CMG 2 Ext Htr  
RPC 11: DDCU Z14B Htr 1  
RPC 12: CMG 3 Ext Htr  
RPC 14: PCU 1 Htr  
RPC 15: PCU 2  
RPC 16: DDCU Z13B Htr 2  
RPC 17: CMG 4  
RPC 18: CMG 1 | Power to CMG 2 and CMG 3 Heaters  
Power to PCU 2 Heater  
Power to S-Band ORU and Ku-Band ORU Heaters  
Power to EETCS Heater  
Power to 1 of 2 Heaters to all other Z1 Heater Loads  
Power to 1 of 2 Plasma Contactors | |
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Refer to Table A for Upstream Power Source.

*Power to CMG 1 and CMG 4 Heaters*  
*Power to EETCS Heater*  
*Power to PCU 1 Heater*  
*Power to 1 of 2 Heaters to all other Z1 Heater Loads*  
*Power to 1 of 2 Plasma Contactors*
### Table C. Power Bus Connectivity (End-Item Loads) (Cont)

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| N1-1 | SDO 3     | 2       | HX Lab LT-A Inl V Byp Fl Cmd | Lab LTL IFHX NH3 Byp Vlv Byp cmd | X | Lab | 5A | 12A |
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## 5.403 N1-2 MDM CHANNEL ASSIGNMENTS

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## 5.403 N1-2 MDM CHANNEL ASSIGNMENTS

(C&DH/2R - ALL/FIN)  
Page 5 of 5 pages

<table>
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<th>MDM</th>
<th>Card Type</th>
<th>Channel</th>
<th>Eng Name</th>
<th>OPS NOM</th>
<th>SDO Cd 1A Pwr, RPCM N1 RS2-C RPC-3</th>
<th>SDO Cd 1B Pwr, RPCM N1 RS2-C RPC-4</th>
<th>ISS Element</th>
<th>Flight Activation</th>
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</table>
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**PROCEDURE** | **SECURE ACTION** | **RECOVERY ACTION** | **INFO**
--- | --- | --- | ---
PL 1(2) MDM I/O ERROR; PL 1(2) MDM OUTPUT (FDF, ORB PKT, DPS) | N/A | N/A | A
5.3c I/O ERROR PL 1(2); MDM OUTPUT PL 1(2) (FDF, MAL, DPS) | N/A | N/A | A
PASS SM GPC FAIL (FDF, ORB PKT, DPS) | N/A | D | B
GNC RECOVERY VIA G2FD (FDF, ORB PKT, DPS) | N/A | C, D | B
5.1a CS SPLIT (FDF, MAL, DPS) | N/A | C, D | B
5.3g BCE BYP PL1(2) (FDF, MAL, DPS) | N/A | N/A | A, B
GPC FRP-4 PASS RECOVERY AFTER BFS ENGAGE (ASCENT/ORBIT/ENTRY) (FDF, MAL, DPS) | N/A | C | N/A
GPC FRP-7 DPS RECONFIG FOR LOSS OF AV BAY COOLING (FDF, MAL, DPS) | N/A | N/A | N/A
DPS SSR-3 GNC REASSIGNMENT (FDF, MAL, DPS) | N/A | N/A | B
DPS SSR-4 SM REASSIGNMENT (FDF, MAL, DPS) | N/A | C, D | B
ECLSS SSR-10 H2O PUMP OPS VIA GPC (FDF, MAL, ECLS) | N/A | N/A | N/A

* Note: GPC FRP-4 does not call out PL/DPS RECONFIG Recovery.

**ACTION A**
If ‘I/O ERROR PL1’ message
- Loss of primary ground and crew interface to ISS via PSP 1/OIU 1.
- For additional impacts, refer to {ORBITER MDM LOSS IMPACTS} (SODF: ASSY OPS: MALFUNCTION).

If ‘I/O ERROR PL2’ message
- Loss of secondary ground and crew interface to ISS via PSP 2/OIU 2.
- For additional impacts, refer to {ORBITER MDM LOSS IMPACTS} (SODF: ASSY OPS: MALFUNCTION).

**ACTION B**
If affected GPC SM
- Note PL Commanding (onboard and ground) via SM GPC not possible until SM machine is restored and PF 1(2) MDM I/F is restored.

If affected GPC GNC
- Ground commanding not possible until GNC machine is restored.

**ACTION C**
If PSP 1(2) I/O reset not previously performed

```
SM 62 PCMMU/PL COMM
I/O RESET PSP 1(2) – ITEM 6(7) EXEC
```

- Notify MCC when complete.

**ACTION D**
Reload PDI DECOM FORMAT (FDF, ORB OPS FS, COMM/INST).
As required, reenable PDI DECOM FDA.
Resume SPEC 62.
MCC will determine cause of interruption of power or signal to the APCUs.

(APCU TEMP), block 1 (SODF: ASSY OPS: MALFUNCTION)
(APCU VOLTS), block 1 (SODF: ASSY OPS: MALFUNCTION)
(APCU AMPS), block 1 (SODF: ASSY OPS: MALFUNCTION)
Loss of APCU 1 causes the loss of P6 Channel 4B. Loss of APCU 2 causes the loss of P6 Channel 2B.

MCC will consider recovery actions. May activate downstream loads one at a time to find shorted load.
### Table 1. APCU TRIP STATUS

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<th>TRIP (STATUS VOLTAGE)</th>
<th>OV</th>
<th>OUV</th>
<th>OC</th>
<th>IUV</th>
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<td>-4.84 (no trip)</td>
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**NOTE**

OV: Output Overvoltage
OUV: Output Undervoltage
OC: Output Overcurrent
IUV: Input Undervoltage

Tolerance for all reported voltages is ± 0.20 volts.
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MCC will determine between a transducer shift and a real single converter failure.

Assumes DCSU RTs are enabled.

MCC will determine the cause of interruption of power or signal to the DCSUs.

Total output for each APCU must be maintained less than 14.7 amps and each conv output must be maintained less than 8.5 amps.
Loss of APCU 1 causes the loss of P6 Channel 4B. Loss of APCU 2 causes the loss of P6 Channel 2B.

Loss of APCU 1 causes the loss of P6 Channel 4B. Loss of APCU 2 causes the loss of P6 Channel 2B.

12

13
Is CONV A amps + CONV B amps still > 14.7 or single converter amps > 8.5?

No

14
Continue with current configuration.

Yes

15
(L12/SSP 1)
• APCU 1(2) CONV – OFF (tb-bp)
• APCU 1(2) OUTPUT RLY – OP (tb-bp)

Is APCU 2 affected and crew ingress?

Yes

16
• Turn on Portable Fans installed in NODE 1.

No

17
On MCC GO
• APCU 1(2) CONV – ON (tb-gray)
• □APCU AMPS

CONV A + CONV B amps > 14.7 or single converter amps > 8.5?

Yes

18
• APCU internal short.

No

19
Short downstream of APCU.

20
(L12/SSP 1)
• APCU 1(2) CONV – OFF (tb-bp)
• □MCC
Loss of APCU 1 causes the loss of P6 Channel 4B. Loss of APCU 2 causes the loss of P6 Channel 2B.

MCC will determine between a transducer shift and a real circuitry failure.

Nominal Config:
L12 (SSP 1)
cb SW PWR 1 – cl
APCU 1 CONV – ON (tb-gray)
APCU 1 OUTPUT RLY – CL (tb-gray)
APCU 2 CONV – ON (tb-gray)
APCU 2 OUTPUT RLY – CL (tb-gray)
(R1)
PRI PL MNC – ON (tb-ON)
PL CAB – MNB(MNA)
PL AUX – ON

1. Loss of APCU 1 causes the loss of P6 Channel 4B. Loss of APCU 2 causes the loss of P6 Channel 2B.

2. No

3. APCU 1(2) TRIP > -4.40

4. Any APCU 1(2) CONV A(B) AMPS > 8.5

5. APCU 1(2) VOLTS RES HIGH < 136 or > 144

6. All APCU 1,2 CONV A,B TEMPS (four) ≥ 130 and/or rising or ≤ 20

7. None of the above


10. Single APDU 1(2) CONV A(B) AMPS > 8.5

11. Single APDU 1(2) VOLTS RES HIGH < 136 or > 144

12. Single APDU 1(2) TEMPS (four) ≥ 130 and/or rising or ≤ 20

13. None of the above

14. MCC
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SPEC voltage for APCU in the 140 Volts mode is 136 to 144 volts. If APCU volts are outside this range but stable and usable for ISS loads, consideration will be given to continuing APCU operation.

APCU tripped but failed to set trip indicator (possible for a short circuit directly at the APCU output).

There is a single point failure which will cause both the HIGH and LOW RES VOLTS to read low (broken wire).

Loss of APCU 1 causes the loss of the P6 Channel 4B. Loss of APCU 2 causes the loss of the P6 Channel 2B.
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NOTE

A Russian segment reconfiguration is required to use the FGB MDM to UB ORB N1-1/2 C&T path.
OIU FAIL TO COMMAND

ASSY OPS/4A/FIN

Page 1 of 3 pages

Power cycle will place OIU in Format 255. OIU Station TLM will be lost until OIU CMD recovered. OIU H&S TLM will also be lost if PDI is not configured for OIU FMT 255.

No response to OIU Configuration or Routed Commands

Nominal Config:
(A1L)
S-BD PL CNTL – CMD
S-BD PL PWR SYS – 1
S-BD PL PWR SEL – PSP
S-BD PL PSP OUTPUT – PL UMB
(SSP1)
OIU PWR – OIU 1(2) ON (tb-UP(DN))
(R1)
PL CAB – MNB(MNA)
PL AUX – ON

1 Request PSP Dummy CMDs
• MCC will uplink PSP Dummy CMDs and verify telemetry.
• PSP Dummy CMD 2 (then 1)
• UMB #1
• No SM/PSP LOAD errors
• PSP I/F to OIU OFF(ON)

MCC CMD successful?

2 Power Cycle PSP 1(2)
(A1L)
• S-BD PL CNTL – CMD
• S-BD PL PWR SYS – OFF
• S-BD PL CNTL – PNL
• S-BD PL PWR SYS – 1(2)
• S-BD PL CNTL – CMD
• Expect ‘S62 BCE BYP’ message.

SM 62 PCMMU/PL COMM
• I/O RESET PSP 1(2) – ITEM 6(7) EXEC

3 OIU CMD

SM 212 OIU
• BUS 2 A – (*) ITEM 8
• BUS 2 B – ITEM 9 EXEC (*)

CMD successful?

4 Transient PSP 1(2) failure.

5 Determine Current OIU FMT

SM 212 OIU
• FMT (ITEM 1) and log

6 Return BUS 2 to Nominal Configuration

SM 212 OIU
• BUS 2 A – ITEM 8 EXEC (*)

7 Pwr Cycle OIU 1(2)

On MCC GO
(SSP1)
• OIU PWR– ctr, then
• OIU PWR – OIU 1(2) ON
• OIU PWR tb – UP(DN)
• Expect ‘S62 PDI DECOM FAIL’ message.

OIU FMT block 5 = 255?

8 Continue nominal operations.

9

10
Determine Affected DECOM

SM 62 PCMMU/PL COMM

DECOM indicating (↑) and log ______

OiU CMD

SM 212 OIU

BUS 2 B – ITEM 9 EXEC (*)

CMD successful?

Yes

Transient OIU 1(2) failure.

No

Return BUS 2 to Nominal Configuration

SM 212 OIU

BUS 2 A – ITEM 8 EXEC (*)

Continue nominal operations.

 transient OIU 1(2) failure.

Continue nominal operations.
Power cycle will place OIU in Format 255. OIU Station TLM will be lost until OIU CMD recovered. OIU H&S TLM will also be lost if PDI is not configured for OIU FMT 255.

17 Switch to OIU 2(1)

On MCC GO
(SSP1)
- OIU PWR – OIU 2(1) ON
- OIU PWR tb – DN(UP)
- Expect 'S62 PDI DECOM FAIL' message.
- Switch to PSP 2(1).

(A1L)
- S-BD PL CNTL – CMD
- S-BD PL PWR OUTPUT – PL UMB
- S-BD PL PWR SYS – 2(1)
- S-BD PL SEL – PSP
- S-BD PL CNTL – PNL.CMD
- Expect 'S62 BCE BYP PSP 1(2)' message.

SM 62 PCMMU/PL COMM
- I/O RESET PSP 2(1) – ITEM 7(6) EXEC (*)

- Config PDI for OIU 2(1).
- sel DECOM – ITEM 9 +X EXEC
- sel INPUT – ITEM 12 +2(1) EXEC
- LOAD – ITEM 13 EXEC

OIU FMT block 5 = 255?

18 SM 212 OIU
- BUS 2 B – ITEM 9 EXEC (*)

CMD successful?

19 PSP 1(2) to OIU 1(2)

interface failure.

20 Return BUS 2 to Nominal Configuration

SM 212 OIU
- BUS 2 A – ITEM 8 EXEC (*)

21 MCC

22 Continue nominal operations.

23 OIU CMD by Attempting to Load Original OIU FMT

SM 212 OIU
- ITEM 1 +X X X EXEC where X X X is original OIU FMT logged in block 5
- PDI DCM SYNC for affected DECOM

All three 'B', 'W', 'F' columns display an '*'?

24 MCC

25 PSP 1(2) to OIU 1(2)

interface failure.

26 Continue nominal operations.
SM 212 OIU TEMP

OIU message: OIU TEMP ≥ 212

Nominal Config:
- (R1)
- PL CAB – MNB
- (MNA)
- PL AUX – ON
- (SSP 1)
- OIU PWR – OIU 1(2) ON (tb – UP(DN))

OIU TEMP ↑ (ASSY OPS/4A/FIN)

1. [SM 212 OIU]
   OIU 1(2) TEMP?
   - No
   - Yes

2. AOS or LOS?
   - AOS
   - LOS

3. • √ MCC

4. • Select OIU 2(1)
   SSP1
   • OIU PWR – OIU 2(1) ON (tb-DN(UP))

5. Switch to PSP 2(1)
   (A1L)
   • √ S-BD PL CNTL – CMD
   • √ S-BD PSP CMD OUTPUT – PL UMB
   • S-BD PWR SYS – 2(1)
   • √ S-BD PWR SEL – PSP
   • S-BD PL CNTL – PNL.CMD
   • Expect ‘S62 BCE BYP PSP 1(2)’ message.
   SM 62 PCMMU/PL COMM
   • I/O RESET PSP 2(1) – ITEM 7(6) EXEC

6. Configure PDI for OIU 2(1)
   • sel DECOM – ITEM 9 +X EXEC
   • sel INPUT – ITEM 12 +2(1) EXEC
   • LOAD – ITEM 13 EXEC

7. Load OIU FMT and Configure if Required
   • √ MCC for correct OIU FMT/CONFIG
   • Perform LOAD OIU FMT/CONF (FDF: ORB OPS FS, COMM/INST), then:

8. • Continue nominal operations.
S212 OIU AD 1 NOLK/LOSS OF NODE MDM TELEMETRY

(assy ops/4A/Fin) Page 1 of 2 pages

Nominal Config:
(R1)
PL CAB – MNB(MNA)
PL AUX – ON
(SSP 1)
OIU PWR – OIU 1(2)
ON (tb – UP(DN))
One PCS connected to N1-2 MDM

Loss of Node Telemetry on MCDS Displays, Static Frame Counter

S212 OIU AD 1 NOLK

1

SM 62 PCMMU/PL COMM

•√ PDI DECOM for OIU is locked

OIU DECOM locked?

No

(S62 PDI DECOM FAIL), all (SODF: ASSY OPS: MALFUNCTION)

Yes

2

SM 212 OIU

•√ OIU SYNC

AD 1 LOCK – YES?

Yes

Momentary loss of node telemetry.

No

(S62 PDI DECOM FAIL), block 5 (SODF: ASSY OPS: MALFUNCTION)

3

•√ MDM status using PCS

PCS CDS Main Control Panel Window

• sel Connect To MDM icon

Is MDM connected status box green?

No

4

•√ Node MDM status

Yes

(3.601 LOSS OF PCS TELEMETRY), all (SODF: C&DH: MALFUNCTION: PCS) or (SODF: JNT OPS: MALFUNCTION)

5

Resynchronize OIU to Node MDM; Reload OIU FMT 002

•√ ITEM 1 +0 0 2 EXEC

AD1 LOCK – YES?

Yes

8

Momentary loss of node telemetry.

No

9

Cycle OIU Power

(SSP1)

• OIU PWR – ctr (tb-bp)

• OIU PWR– OIU 1(2) ON (tb-UP(DN))

• For NODE MDM, perform LOAD OIU FMT/CONF, all (FDF: ORB OPS FS, COMM/INST), then:

AD1 LOCK – YES?

Yes

Internal OIU logic lock up.

No

10

•√ OIU 1(2) BIA failure.

11

•√ Continue nominal operations.

No

13

12

621
13 Swap to OIU 2(1)
(SSP1)
• OIU PWR – OIU 2(1) ON (lb-DN(UP))

14 Switch to PSP2(1)
(A1L)
• S-BD PL CNTL – CMD
• S-BD PL PSP OUTPUT – PL UMB
• S-BD PL PWR SYS – 2(1)
• S-BD PL PWR SEL – PSP
• S-BD PL CNTL – PNL.CMD
• Error message, ‘S62 BCE BYP PSP 1(2)’

15 Configure PDI for OIU 2(1)
• sel DECOM – ITEM 9 +X EXEC
• sel INPUT – ITEM 12 +2(1) EXEC
• LOAD – ITEM 13 EXEC

16 Load OIU Format
• For Node MDM, perform LOAD OIU FMT/CONF (FDF: ORB OPS FS, COMM/INST), then:

17 SM 212 OIU
• OIU SYNC
AD1 LOCK – YES?

18 Yes
• Continue nominal operations.

19 No
• MCC
S212 OIU AD 1 NOLK/LOSS OF NODE MDM TELEMETRY or 2.4g ‘S62 PDI DECOM FAIL’ (FDF: MAL: COMM)

1. Message accompanied by ‘S62 BCE BYP PDI’? (FDF: MAL: COMM)
   - Yes: 2.4e ‘S62 BCE BYP PDI’ (FDF: MAL: COMM)
   - No: Continue nominal operations.

2. Determine which DECOM FDA indicated fail.
   - Yes: Continue nominal operations.
   - No: Determine which DECOM FDA indicated fail.

3. SM 62 OIU AD 1 LOCK – YES?
   - Yes: SM 212 OIU AD 1 NOLK/LOSS OF NODE MDM TELEMETRY, block 5 (SODF: ASSY OPS)
   - No: Continue nominal operations.

4. Transient PDI DECOM failure.
   - Yes: Continue nominal operations.
   - No: Transient PDI DECOM failure.

5. Reload DECOM Indicating Fail
   - Load – CPLT?
     - Yes: PDI DECOM failure.
     - No: Transient PDI DECOM memory failure.

6. If Required, Select B/U DECOM Configuration
   - For alt PDI configuration, perform LOAD PDI DECOM FORMAT, all (FDF: ORB OPS FS, COMM/INST), then:
     - Continue nominal operations.

7. PDI DECOM failure.
   - Yes: PDI DECOM failure.
   - No: PDI DECOM failure.

8. If Required, Select B/U DECOM Configuration
   - For alt PDI configuration, perform LOAD PDI DECOM FORMAT, all (FDF: ORB OPS FS, COMM/INST), then:
     - Continue nominal operations.

9. DECOM still indicating fail (↑)?
   - Yes: For alt PDI configuration, perform LOAD PDI DECOM FORMAT, all (FDF: ORB OPS FS, COMM/INST), then:
     - Continue nominal operations.
   - No: PDI DECOM failure.

10. Transient PDI DECOM memory failure.
    - Yes: PDI DECOM memory failure.
    - No: PDI DECOM failure.

11. If Required, Select B/U DECOM Configuration
    - For alt PDI configuration, perform LOAD PDI DECOM FORMAT, all (FDF: ORB OPS FS, COMM/INST), then:
      - Continue nominal operations.

12. Load ALT PDI and PCMMU Configuration
    - For alt PDI configuration, complete LOAD PDI DECOM FORMAT (FDF: ORB OPS FS, COMM/INST), then:
      - For alt TFL, perform LOAD PCMMU FORMAT, all (FDF: ORB OPS FS, COMM/INST).
TCS not addressed in malfunction. It is not enabled.

MCC may direct crew to confirm PL PRI receiving power.

Alternate (OIU 2) requires PSP 2.
FAILURE TO UNLATCH SABB REMOTELY
(ASSY OPS/4A/FIN) Page 1 of 21 pages

1. ECU SAW Communicating
    P6:EPS:SAW 4B(2B)
    SAW 4B(2B) 'ECU 4B(2B)' is Integ Cnt incrementing?
    Yes
    No

2. SAW Deploy Status
    Is other SAW 4B(2B) deployed?
    Yes
    No

3. ECU BGA Communicating
    P6:EPS:BGA 4B(2B)
    BGA 4B(2B) 'ECU 4B(2B)' is Integ Cnt incrementing?
    Yes
    No

Go to procedure (BGA 4B(2B) LOSS OF COMM), step 7 (SODF:
EPS:MALFUNCTION:PRIMARY POWER SYSTEMS)

4. ECU SAW Failure
    Possible ECU SAW Firmware Power Supply, or RT Failure. Possible fault on ECU SAW
    power string below ECU input power selector circuit breaker.

5. Check RPCM Trend Data for Increase in Current
    MCC-H Only
    Is a Current increase indicated in trend data for RPCM 4B(2B) A just before communication was
    lost with SAW
    Yes
    No

6. Check RPCM Current
    P6:EPS:RPCM 4B(2B) A
    RPCM 4B(2B) A is Current < 0.6 Amps
    Yes
    No

7. Power on Reset
    sel SAW Firmware
    SAW 4B(2B) Firmware
    Does Power On Reset = X
    Yes
    No

Go to procedure (P6 BGA 4B(2B) 1553/FWC ERRORS), all (SODF:
EPS:MALFUNCTION:PRIMARY POWER SYSTEMS)

8. Remove MDA Power
    P6:EPS:SAW 4B(2B)
    SAW 4B(2B) set RPCM 2B(4B) A RPC 02
    RPCM 2B(4B) A RPC 02
    cmd RPC Position - Open (Verify - Op)
    SAW 4B(2B) set RPCM 4B(2B) A RPC 01
    RPCM 2B(4B) A RPC 01
    cmd RPC Position - Open (Verify - Op)

9. Recover Heater Power
    Perform (P6 Ch 4B(2B) BGA Activation and SAW Deploy), Step 22 (SODF: ASSY OPS,
    Act and C/O)

10. Check RPCM Trend Data for Decrease in Current
    MCC-H Only
    Is a Current decrease indicated in trend data for RPCM 4B(2B) A just before communication was
    lost with SAW
    Yes
    No

11. Check RPCM Trend Data for Decrease in Current
    MCC-H Only
    Is a Current decrease indicated in trend data for RPCM 4B(2B) A just before communication was
    lost with SAW
    Yes
    No

12. ECU SAW Power Lost
    Possible ECU SAW Power Supply Failure or fault on ECU SAW power string below ECU input power
    selector circuit breaker. BGA operations are unaffected.
FAILURE TO UNLATCH SABB REMOTELY
(assy ops/4a/fin) Page 2 of 21 pages

10-Nov-00

7

8 LBB (RBB) Status
LBB (RBB) Partially Unlatched
LBB (RBB) Failed to Unlatch (No Hardware Response)

9 Verify Mast Telemetry
P6:EPS:SAW 4B(2B)
SAW 4B(2B)
SAW 4B(2B)

Verify telemetry Mast SW 01.02 Retracted= Yes
Mast SW 01.02 Deployed = No

13 MDA Status
Is LBB (RBB) MDA On?
MDA Voltage, V > 10 (+/-2.8)

14 MDA Driving Status
Is LBB (RBB) MDA Driving?
MDA Current, A > 0.2

15 MDA Temp Check
Is LBB (RBB) MDA Temp > 30 deg C?

16 Hi Temp Reject FI Status
sel SAW Software Inhibits
SAW 4B(2B) Software Inhibits

17 Command Check
Possible cmd error

18 Temp Limit set to Low
Command was rejected by the Hi Temp Reject function.
Temp limit is set to low for this function. Must load new firmware version to correct.

19 Override Hi Temp Reject
'Slow Temp Reject'
cmd Enable - Arm
cmd Enable
Verify Low Temp Reject - Ena

20

21

12 Continue SAW Deploy
Perform P6 Ch 4B(2B) BGA Activation and SAW Deploy,
Steps 16.2(17.2)--22
(SODF: ASSY OPS, Act and C/O)

1

2

SPN tbd (PR 15629) Enumerations are reversed on ePCS displays (5A fixed)
Must send enable cmd to inhibit function.

SPN tbd (PR 15629) Enumerations are reversed on ePCS displays (5A fixed)
Must send enable cmd to inhibit function. Also Low Temp Reject should be Hi Temp Reject.
13

21 MDA Off
Possible MDA H/W Failure,
MDA Over Current Trip,
MDA Over Temp Trip,
MDA Stall, Binding,
or sensor failure

20 MDA On and Driving
Possible Binding, or
Degraded MDA but not enough
to trigger FDIR. Monitor
for LBB(RBB) Unlatch completion

22 Over Current Detection

Yes

P6:EPS:SAW 4B(2B)
SAW 4B(2B)
"ECU 4B(2B)"

Does MDA Current Trip = X

No

23 Possible MDA Over Current
Possible MDA H/W Failure,
MDA Over Current Condition
MDA Stall, Binding,
or sensor failure

24

72 Over Temperature Detection

Yes

P6:EPS:SAW 4B(2B)
SAW 4B(2B)
"LBB(RBB) MDA"

Does Over Temp Trip = X

No

73 MDA Stall Status

MCC Only
Did MDA Slow Alert = Slow
prior to removal of MDA Power?

Yes

74 Possible MDA Stall Condition
Possible MDA H/W Failure,
MDA Stall, Binding,
or sensor failure

No

75 Clear MDA Indications

P6:EPS:SAW 4B(2B)
SAW 4B(2B)
SAW 4B(2B)
sel SAW LBB (RBB) Commands

cmd MDA Power - Off
Verify MDA Voltage, V < 10 (+/- 2.8)

76 Verify S/W Trip Temperature

Yes

P6:EPS:SAW 4B(2B)
SAW 4B(2B)

Is LBB, RBB or Mast MDA Temp >
74.4 deg C?

No

77 MDA Failure Unknown
Unknown MDA Failure

78 Continue SAW Deploy
Perform (P6 Ch 4B(2B) BGA
Activation and SAW Deploy),
Steps 16.1(17.1)--22
(SODF: ASSY OPS,
Act and C/O)

1

Disconnection are
present in the MDA
Over Temp FDIR.
S/W Trip level =
74.4 deg C. F/W
Trip level = 140
deg C. H/W
damage occurs
at 120 deg C. At
a minimum a 30
deg C Mast MDA
Temp increase
should be
protected
for
during mast
deployment.

2

MDA Over
Current Trip
occurs at
5.4 Amps.
FAILURE TO UNLATCH SABB REMOTELY
(ASY OPS/4A/FIN) Page 4 of 21 pages

23 Possible MDA fault, MDA Stall, or Binding

24 Clear MDA Indications

P6:EPS:SAW 4B(2B)
SAW 4B(2B)
"SAW 4B(2B)
set SAW LBB(RBB) Commands
SAW 4B(2B) LBB(RBB) Commands

cmd MDA Power - Off
Verify MDA Voltage, V < 10 (+/- 2.8)

25 Check MDA Trend Data for Increase in Current

MCC-H Only
Is a MDA Current increase, above expected levels, indicated in trend data just before MDA power was removed?

1
Yes
No

26 Check RPCM Trend Data for Increase in Current

MCC-H Only
Is a Current increase indicated in trend data for RPCM 4B(2B) A just before MDA power was removed?

1
Yes
No

27 Possible MDA fault, MDA Stall, or Binding

28 MDA Stall Status

MCC Only
Did MDA Slow Alert = Slow prior to removal of MDA Power?

2
Yes
No

29 MDA Stall indicated, binding.

30 BRS Pin Status

Have BRs pins(7) released?

2
Yes
No

31 Attempt to Latch LBB(RBB) then try to Unlatch again. May wish to wait for a different thermal condition before, this is attempted.

32 Dump SAW C&W Buffer

Is CW Stall Safing Failure Flag is set?

33 Clear CW Flag Indications

P6:EPS:EPS Software
EPS Software
set PVCU Software
PV_SW
set Cmd Resp Clear
PV Cmd Response Clear
'SAW Command Response Clear'
cmd Arm
cmd Clear

34

2

62

43

31

62

No

Yes

Yes

Re-attempt will be made at the end of insolation or end of eclipse, which ever case is opposite initial attempt.

2

Damage to SABB hardware when driving a MDA in the opposite direction from the initial cmded direction, in the sequence not completed case, applies only if the BRS pin(s) have not been released.

1

MDA Over Current Trip occurs at 5.4 Amps.
FAILURE TO UNLATCH SABB REMOTELY (ASSY OPS/4A/FIN) Page 5 of 21 pages

1. MDA Abort must be prevented from driving once power is reapplied. This is a single step cmd.

2. If Current sensor fails high > 5.4 A RPCs providing power to ECU will be opened. A new PPL with a higher Current limit must be uploaded before the ECU can be recovered.

3. Damage to SABB hardware when driving a MDA in the opposite direction from the initial cmded direction, in the sequence not completed case, applies only if the BRS pin(s) have not been released.

33. Set SAW LBB(RBB) Abort

34. P6:EPS:SAW 4B(2B)

35. Turn MDA On

36. Latch LBB (RBB)

37. Unlatch LBB(RBB)

38. Continue SAW Deploy

39. BRSP Status

40. Did BRS Pins Release?

41. Continue SAW Deploy

42. Perform (P6 Ch 4B(2B) BGA Activation and SAW Deploy), Steps 16.1(17.1)--22 (SODF: ASSY OPS, Act and C/O)

43. Update PPL

44. Upload new PV_PPL69 version with higher MDA Conv Current Limit

45. Inhibit Over Current Trip Fl

46. sel SAW Software Inhibits

47. SAW 4B(2B) Software Inhibits

48. SAW 4B(2B) Motor Stall Safing

49. SAW 4B(2B) Motor Stall Safing

50. ‘MDA Over Current Trip Function’

51. cmd Inhibit - Arm

52. cmd Inhibit

53. Verify MDA Over Current Trip Function= inh

54. MDA Current Sensor Failure

55. Erroneous BIT Flip

56. MDA Current Sensor Failure or Erroneous BIT Flip

57. Clear MDA Indications

58. MDA Over Current Trip Function= Inh

59. LBB(RBB) MDA

60. Does MDA Current, A = 0.00 (+/- 0.4)

61. Damage to SABB hardware when driving a MDA in the opposite direction from the initial cmded direction, in the sequence not completed case, applies only if the BRS pin(s) have not been released.

62. BRSP Status

63. Did BRS Pins Release?

64. Continue SAW Deploy

65. Perform (P6 Ch 4B(2B) BGA Activation and SAW Deploy), Steps 16.8(17.8)--22 (SODF: ASSY OPS, Act and C/O)

66. Continue SAW Deploy

67. Perform (P6 Ch 4B(2B) BGA Activation and SAW Deploy), Steps 16.1(17.1)--22 (SODF: ASSY OPS, Act and C/O)

68. Update PPL

69. Upload new PV_PPL69 version with higher MDA Conv Current Limit

70. Inhibit Over Current Trip Fl

71. sel SAW Software Inhibits

72. SAW 4B(2B) Software Inhibits

73. SAW 4B(2B) Motor Stall Safing

74. SAW 4B(2B) Motor Stall Safing

75. ‘MDA Over Current Trip Function’

76. cmd Inhibit - Arm

77. cmd Inhibit

78. Verify MDA Over Current Trip Function= inh

79. MDA Current Sensor Failure

80. Erroneous BIT Flip

81. MDA Current Sensor Failure or Erroneous BIT Flip

82. Clear MDA Indications

83. MDA Over Current Trip Function= Inh

84. LBB(RBB) MDA

85. Does MDA Current, A = 0.00 (+/- 0.4)

86. Damage to SABB hardware when driving a MDA in the opposite direction from the initial cmded direction, in the sequence not completed case, applies only if the BRS pin(s) have not been released.

87. BRSP Status

88. Did BRS Pins Release?

89. Continue SAW Deploy

90. Perform (P6 Ch 4B(2B) BGA Activation and SAW Deploy), Steps 16.8(17.8)--22 (SODF: ASSY OPS, Act and C/O)

91. Update PPL

92. Upload new PV_PPL69 version with higher MDA Conv Current Limit

93. Inhibit Over Current Trip Fl

94. sel SAW Software Inhibits

95. SAW 4B(2B) Software Inhibits

96. SAW 4B(2B) Motor Stall Safing

97. SAW 4B(2B) Motor Stall Safing

98. ‘MDA Over Current Trip Function’

99. cmd Inhibit - Arm

100. cmd Inhibit

101. Verify MDA Over Current Trip Function= inh

102. MDA Current Sensor Failure

103. Erroneous BIT Flip

104. Update PPL

105. Upload new PV_PPL69 version with higher MDA Conv Current Limit

106. Inhibit Over Current Trip Fl

107. sel SAW Software Inhibits

108. SAW 4B(2B) Software Inhibits

109. SAW 4B(2B) Motor Stall Safing

110. SAW 4B(2B) Motor Stall Safing

111. ‘MDA Over Current Trip Function’

112. cmd Inhibit - Arm

113. cmd Inhibit

114. Verify MDA Over Current Trip Function= inh

115. MDA Current Sensor Failure

116. Erroneous BIT Flip

117. MDA Current Sensor Failure or Erroneous BIT Flip

118. Clear MDA Indications

119. MDA Over Current Trip Function= Inh

120. LBB(RBB) MDA

121. Does MDA Current, A = 0.00 (+/- 0.4)

122. Damage to SABB hardware when driving a MDA in the opposite direction from the initial cmded direction, in the sequence not completed case, applies only if the BRS pin(s) have not been released.
FAILURE TO UNLATCH SABB REMOTELY

ASSY OPS/4A/FIN

10 NOV 00

Disconnects are present in the MDA Over Temp FDIR.

S/W Trip level = 74.4 deg C. F/W Trip level = 140 deg C. H/W damage occurs at 120 deg C. At a minimum a 30 deg C Mast MDA Temp increase should be protected for during mast deployment.

Since S/W Temp limit is reached first and it does not set the MDA Over Temp Trip flag, a MDA Abort must be sent to prevent MDA from driving, once power is re-applied. This is a single step cmd.

Clear MDA Indications

P6:EPS:SAW 4B(2B)
SAW 4B(2B)
"SAW 4B(2B)
sel SAW LBB(RBB) Commands
SAW 4B(2B) LBB(RBB) Commands

cmd MDA Power - Off
Verify MDA Voltage, V < 10 (+/- 2.8)

Verify S/W Trip Temperature

P6:EPS:SAW 4B(2B)
SAW 4B(2B)
"SAW 4B(2B)

Is LBB, RBB or Mast MDA Temp > 74.4 deg C?

Check MDA Trend Data for Increase in Temperature

MCC-H Only

Is a steady MDA Temp increase over time indicated in trend data just before MDA power was removed?

MDA Temp Sensor Failure

Set SAW LBB(RBB) Abort

P6:EPS:SAW 4B(2B)
SAW 4B(2B)
"SAW 4B(2B)
sel SAW LBB(RBB) Commands
SAW 4B(2B) LBB(RBB) Commands

cmd LBB(RBB) - Abort

Clear MDA Indications

cmd MDA Power - Off
Verify MDA Voltage, V < 10 (+/- 2.8)

Assess Inhibit

Assess use of MDA based on last good Temp value.

Deploy opposite SAW

Perform (P6 Ch 4B(2B) BGA Activation and SAW Deploy), all (SODF: ASSY OPS, Act and C/O) for opposite SAW.

Deploy opposite SAW then return to step 6 of this procedure.

Continue SAW Deploy

Perform (P6 Ch 4B(2B) BGA Activation and SAW Deploy), Steps 1-7,9-15,16(17)-22 (SODF: ASSY OPS, Act and C/O) for failed SAW.

Erroneous BIT Flip

Set SAW LBB(RBB) Abort

P6:EPS:SAW 4B(2B)
SAW 4B(2B)
"SAW 4B(2B)
sel SAW LBB(RBB) Commands
SAW 4B(2B) LBB(RBB) Commands

cmd LBB(RBB) - Abort

Clear MDA Indications

cmd MDA Power - Off
Verify MDA Voltage, V < 10 (+/- 2.8)

Assess Inhibit

Check with MCC-H to determine if inhibiting the MDA Over Temp Safing FI is appropriate.
FAILURE TO UNLATCH SABB REMOTELY
(assy ops/4A/fin)  Page 7 of 21 pages

Disconnects are present in the MDA Over Temp FDIR. S/W Trip level = 74.4 deg C. F/W Trip level = 140 deg C. H/W damage occurs at 120 deg C. At a minimum a 30 deg C Mast MDA Temp increase should be protected for during mast deployment.

Inhibit Over Temp Safing

P6:EPS:SAW 4B(2B)
SAW 4B(2B) ECU 4B(2B)
 sel SAW Software Inhibits
SAW 4B(2B) Software Inhibits
 sel SAW 4B(2B) Temp Safing
SAW 4B(2B) Temp Safing
‘LBB(RBB) MDA’
‘Over Temp Safing’
‘Primary PVCU’
 cmd Inhibit - Arm
 cmd Inhibit
 Verify Over Temp Safing = Inh
‘Backup PVCU’
 cmd Inhibit - Arm
 cmd Inhibit
 Verify Over Temp Safing = Inh

Inhibit Over Temp Trip Function

If necessary
SAW 4B(2B) Temp Safing
‘Over Temp Trip Function’
 cmd Inhibit - Arm
 cmd Inhibit
 Verify Over Temp Trip Function = Inh

Continue SAW Deploy

Perform {P6 Ch 4B(2B) BGA Activation and SAW Deploy}, Steps 16.1(17.1)--22 (SODF: ASSY OPS, Act and C/O)

Let MDA Cool or Deploy Via EVA

Let MDA cool to < 44.4 deg C and re-attempt Unlatch or Unlatch via EVA

Unlatch Via EVA?

Yes
No

Let MDA Cool

Let MDA cool to < 44.4 deg C and re-attempt Unlatch.
Remove ECU Power

ECU SAW Power Supply remains powered but communication is lost. Possible fault in SAW Firmware controller. BGA operations are unaffected.

Communication Restored

Communication with the SAW has been restored. Confirm SAW and BGA configurations are as expected before continuing nominal procedure.

Verify LBB(RBB) Fully Unlatched

Verify telemetry
LBB(RBB) SW 01.02 Pin Released = Yes
LBB(RBB) SW 01.02 Latched = No
LBB(RBB) SW 01.02 Unlatched = Yes

Verify visually
BRS Pin Release (seven) - restraint pins released
Latch Position (four of eight) - Unlatched
Separation of BB top and bottom - Uniform

Is LBB(RBB) Fully Unlatched?

Continue SAW Deploy

Perform (P6 Ch 4B(2B) BGA Activation and SAW Deploy), Steps 4, 10-12, 16.8(17.8)-22
(SODF: ASSY OPS, Act and C/O)
FAILRE TO UNLATCH SABB REMOTELY
(ASY ONS/4A/FIN) Page 9 of 21 pages

117

118 Apply Power to ECU
P6:EPS:SAW 4B(2B)
SAW 4B(2B)
set RPCM 4B(2B) A RPC 01
RPCM 4B(2B) A RPC 01

119 ECU SAW Communication
P6:EPS:SAW 4B(2B)
SAW 4B(2B)
‘ECU 4B(2B)’

Is Integ Cnt incrementing?

120 Continue SAW Deploy
Yes
Perform (P6 Ch 4B(2B) BGA Activation and SAW Deploy), Steps 4, 6, 7, 10-12, 16(17)-22 (SODF: ASSY OPS, Act and C/O)

121 Communication Lost with SAW Firmware
Possible SAW RT or Firmware Controller failure. Mast Deploy, LBB and RBB Unlatching must be accomplished by EVA. BGA operations are unaffected.

122 ECU BGA Communication
P6:EPS:BGA 4B(2B)
BGA 4B(2B)
‘ECU 4B(2B)’

Verify Integ Cnt: < incrementing>

123 BGA Common Clear
BGA 4B(2B)
‘ECU 4B(2B)’
set BGA Firmware
BGA 4B(2B) Firmware
‘Clear Commands’

cmd Common Clear
Verify Power On Reset - < blank>

124 Override SAW Indications

125

126
FAILURE TO UNLATCH SABB REMOTELY
(ASSY OPS/4A/FIN)  Page 10 of 21 pages

71 96

43 LBB(RBB) MDA Failed
LBB(RBB) Unlatch and Tension must be accomplished by EVA.

40 LBB(RBB) Hardware Binding
LBB(RBB) Unlatch and Tension must be attempted via EVA.

41 Remove LBB(RBB) MDA Power

P6 EPS:SAW 4B(2B)
SAW 4B(2B)
SAW 4B(2B)

sel SAW LBB(RBB) Commands
SAW 4B(2B) LBB(RBB) Commands

cmd MDA Power - Off
Verify MDA Voltage, V < 10 (+/- 2.8)

42 Position SAW for LBB(RBB) Unlatch via EVA
Perform P6 Configure BGA 4B(2B) to Safe/Lock Mode (SODF: ISS EPS, Nominal Procedures)

Copy the following values into Step 10:
Cmded Angle, deg = 270 (+/-0.5) (LBB)
= 90 (+/-0.5) (RBB)
Latch Select = 1
These values apply for SAW 4B or SAW 2B

44 LBB(RBB) Unlatch via EVA

On MCC-H Go
Perform Manual Override to Unlatch SABB (EVA, Unsched/Cont)

45 Verify LBB(RBB) Fully Unlatched
P6 EPS:SAW 4B(2B)
SAW 4B(2B)
SAW 4B(2B)

Verify telemetry
LBB(RBB) SW 01.02 Pin Released = Yes
LBB(RBB) SW 01.02 Latched = No
LBB(RBB) SW 01.02 Unlatched = Yes

Verify visually
BRS Pin Release (seven) - restraint pins released
Latch Position (four of eight) - Unlatched Separation of BB top and bottom - Uniform

46 Return to Nominal Procedure
Continue (P6 Ch 4B(2B) BGA Activation and SAW Deploy), Steps 16.8(17.8) -19(20), 21 - 22
(SODF: ASSY OPS, Act and C/O)

48 LBB (RBB) Hardware Binding
Wait for better thermal conditions and re-attempt LBB(RBB) Unlatch via EVA.

47 EVA Unlatch Attempts
Is this the first attempt to Unlatch the LBB(RBB) via EVA?

No
Yes

49

44

1 2

This step can take up to 1 hr to complete. The Safe/Lock cmd can be sent when the BGA Actual Angle is within 1 deg of the commanded value in order to save time.

This step may be omitted if EVA crew can free float and drive the MDA. Wait for NBL test results 8/9/00.
Unlatching the SAW is ineffective if < 31.5 bays are visible.

1

**FAILURE TO UNLATCH SABB REMOTELY**

Unable to Deploy SAW

Unable to deploy the solar array, mast is 0% deployed. Primary power channel is lost, USOS power generation capability reduced by 50%.

Return to Nominal Procedure

Continue (P6 Ch 4B(2B) BGA Activation and SAW Deploy), Steps 21 - 22 (SODF: ASSY OPS, Act and C/O)
FAILURE TO UNLATCH SABB REMOTELY
(ASSY OPS/4A/FIN) Page 12 of 21 pages

146 Mast Failed to Extend
Is Mast partially deployed?

No

147 Mast is 0% Deployed
Primary Power Channel Lost

Yes

148 Percent Mast is Deployed
Record number of visible mast bays:

<table>
<thead>
<tr>
<th># of Bays</th>
<th>%Deployed</th>
</tr>
</thead>
<tbody>
<tr>
<td>31.5</td>
<td>100</td>
</tr>
<tr>
<td>28</td>
<td>90</td>
</tr>
<tr>
<td>25</td>
<td>80</td>
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<td>6</td>
<td>20</td>
</tr>
<tr>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Record Percent Deployed: ___________

149 Mast is Partially Deployed
Primary power generation capability degraded for affected channel.

Assess short term impacts:
1. Attitude control restrictions
2. Power generation capability
3. Departure restrictions
4. Crew exercise constraints
5. BGA operations

Assess long term impacts to:
1. Future rendezvous ops
2. SAW retract capability

55 SABB Failed to Tension
LBB(RBB) Failed to Tension?

Yes

57 Return to Nominal Procedure
Continue (P6 Ch 4B(2B) BGA Activation and SAW Deploy), Steps 21 - 22 (SODF: ASSY OPS, Act and C/O)

No

61 SAW Structurally Compromised
SAW structural load capability compromised.

Assess short term impacts:
1. Attitude control restrictions
2. Departure restrictions
3. Crew exercise constraints
4. BGA operations

Assess long term impacts to:
1. Future rendezvous ops

155

60 Return to Nominal Procedure
Continue (P6 Ch 4B(2B) BGA Activation and SAW Deploy), Steps 21 - 22 (SODF: ASSY OPS, Act and C/O)

58 SAW Ops Complete
Mast fully deployed, LBB and RBB fully tensioned.

59 Return to Nominal Procedure
Continue (P6 Ch 4B(2B) BGA Activation and SAW Deploy), Steps 21 - 22 (SODF: ASSY OPS, Act and C/O)
FAILURE TO UNLATCH SABB REMOTELY
(ASSY OPS/4A/FIN)  Page 13 of 21 pages

126 SAW PS, FWC or RT Lost
LBB and RBB Unlatching, Mast Deploy, LBB and RBB Tensioning must be accomplished by EVA.

127 Recover ECU
Perform (P6 Ch 4B(2B) BGA Activation and SAW Deploy), Steps 10 (for BGA only), 11 - 12, and 22 (SODF: ASSY OPS, Act and C/O)

128 One or Both SABBs Affected?
Is LBB Unlatched?

No

Yes

129

132

52 LBB(RBB) Tension via EVA
On MCC-H Go
Perform Manual Override to Tension SABB (EVA, Unsched/Cont)

53 Verify LBB(RBB) Fully Tensioned
P6:EPS:SAW 4B(2B)
“SAW 4B(2B)”
Verify telemetry
LBB(RBB) SW 01,02 Latched = Yes
LBB(RBB) SW 01,02 Unlatched = No
Verify visually
Latch Position (four of eight) - tensioned position
Tension Bar - Pulled toward blanket box
Solar Array Blanket - rigid and flat
Is LBB(RBB) Fully Tensioned?

No

Yes

55 EVA Tension Attempts
Is this the first attempt to tension the LBB(RBB) via EVA?

No

Yes

57

56 LBB Hardware Binding
Wait for better thermal conditions and re-attempt LBB(RBB) Tension via EVA

52

1

54 SAW Ops Complete
Mast fully deployed, LBB and RBB fully tensioned.

Re-attempt will be made at the end of insolation or end of eclipse, which ever case is opposite initial attempt.
129 Position SAW for LBB Unlatch via EVA

Perform P6 Configure BGA 4B(2B) to Safe/Lock Mode (SODF: ISS EPS, Nominal Procedures)

Copy the following values into Step 10:
Safe/Lock, Cmded Angle = 270 deg
Latch Select = 1
These values apply for SAW 4B or SAW 2B

131 LBB Unlatch via EVA

On MCC-H Go
Perform Manual Override to Unlatch SABB (EVA, Unsched/Cont)

133 RBB Unlatch via EVA

On MCC-H Go
Perform Manual Override to Unlatch SABB (EVA, Unsched/Cont)

137 LBB Hardware Binding
Wait for better thermal conditions and re-attempt LBB Unlatch via EVA.

139 RBB Hardware Binding
Wait for better thermal conditions and re-attempt RBB Unlatch via EVA.
FAILURE TO UNLATCH SABB REMOTELY
(assy ops/4a/fn)    Page 15 of 21 pages

From (BGA 4B(2B)
Loss of comm), Step Tbd

- **163** ECU Power Lost
  - LBB and RBB Unlatching, Mast Deploy, LBB and RBB Tensioning, and BGA ops must be accomplished by EVA.

- **161** ECU Loss of Comm
  - LBB and RBB Unlatching, Mast Deploy, LBB and RBB Tensioning, and BGA ops must be accomplished by EVA.

- **162** Remove MDA Power
  - P6:EPS:SAW 4B(2B)
    - SAW 4B(2B) sel RPCM 2B(4B) A RPC 02
    - cmd RPC Position - Open (Verify - Op)
    - SAW 4B(2B) sel RPCM 4B(2B) A RPC 01
    - cmd RPC Position - Open (Verify - Op)

- **164** Position SAW for SABB Unlatch via EVA
  - SAW and BGA insight and command capability lost. BGA rotation and latch capability lost, EVA access is restricted. BGA will remain locked at 0 deg with latch 1 engaged.

- **165** Attitude Control
  - Perform (P6 Ch 4B(2B) BGA Activation and SAW Deploy), Step 22 (sodf: assy ops, act and c/o)

- **166** One or Both SABBs Affected?
  - **Is LBB Unlatched?**
    - No
      - **167**
    - Yes
      - **169**

1 PVCU Loss or UB failures.
FAILURE TO UNLATCH SABB REMOTELY
(ASY OP4A/FIN) Page 16 of 21 pages

Re-attempt will be made at the end of insolation or end of eclipse, which ever case is opposite initial attempt.

166 LBB Unlatch via EVA
On MCC-H Go
Perform Manual Override to Unlatch SABB
(EVA, Unsched/Cont)

168 Verify LBB Fully Unlatched
P6:EPS:SAW 4B(2B)
SAW 4B(2B)
'SAW 4B(2B)
Verify visually
BRS Pin Release (seven) - restraint pins released
Latch Position (four of eight) - Unlatched
Separation of BB top and bottom - Uniform
Is LBB Fully Unlatched?

169 RBB Unlatch via EVA
On MCC-H Go
Perform Manual Override to Unlatch SABB
(EVA, Unsched/Cont)

170 Verify RBB Fully Unlatched
P6:EPS:SAW 4B(2B)
SAW 4B(2B)
'SAW 4B(2B)
Verify visually
BRS Pin Release (seven) - restraint pins released
Latch Position (four of eight) - Unlatched
Separation of BB top and bottom - Uniform
Is RBB Fully Unlatched?

172 EVA Unlatch Attempts
No
Yes
169
173 LBB Hardware Binding
Wait for better thermal conditions and re-attempt LBB Unlatch via EVA.
1

174 EVA Unlatch Attempts
No
Yes
49
175 RBB Hardware Binding
Wait for better thermal conditions and re-attempt RBB Unlatch via EVA.
1

LBB Hardware Binding
Wait for better thermal conditions and re-attempt LBB Unlatch via EVA.

RBB Hardware Binding
Wait for better thermal conditions and re-attempt RBB Unlatch via EVA.

10 NOV 00
640
7960
Position SAW for Mast Deploy via EVA

Perform P6 Configure BGA 4B(2B) to Safe/Lock Mode (SODF: ISS EPS, Nominal Procedures)

Copy the following values into Step 10:
- Safe/Lock, Cmded Angle = 180 deg
- Latch Select = 1

These values apply for SAW 4B or SAW 2B

This step can take up to 1 hr to complete. The Safe/Lock cmd can be sent when the BGA Actual Angle is within 1 deg of the commanded value in order to save time.

This step may be omitted if EVA crew can free float and drive the Mast MDA. Wait for NBL test results 8/9/00.

Re-attempt will be made at the end of insolation or end of eclipse, which ever case is opposite initial attempt.

On MCC-H Go
Perform Manual Override to Extend Mast (EVA, Unsched/Cont)

Verify Mast Fully Deployed
P6:EPS:SAW 4B(2B)
SAW 4B(2B)

Verify visually
- Tension Bar - Pulled away from blanket box (as last mast bay deploys)
- Number of visible mast bays = 31.5
- Guide rollers on final bay - visible (yellow flex batten)
- Solar Array blankets - flat

Is Mast Fully Deployed?

Config for Mast Deploy
Perform (P6 Ch 4B(2B) BGA Activation and SAW Deploy), Steps 18.3 and 18.5 (SODF: ASSY OPS, Act and C/O)

Mast Deploy via EVA

Config for Mast Deploy
Perform (P6 Ch 4B(2B) BGA Activation and SAW Deploy), Step 21 (SODF: ASSY OPS, Act and C/O)

EVA Deploy Attempts
Is this the first attempt to deploy the mast via EVA?

Wait for better thermal conditions and re-attempt Mast deploy via EVA.
FAILURE TO UNLATCH SABB REMOTELY
(ASSY OPS/4A/FIN) Page 18 of 21 pages

Position SAW for LBB Tension via EVA
Perform P6 Configure BGA 4B(2B) to Safe/Lock Mode (SODF: ISS EPS, Nominal Procedures)
Copy the following values into Step 10:
Safe/Lock, Cmded Angle = 270 deg
Latch Select = 1
These values apply for SAW 4B or SAW 2B

On MCC-H Go
Perform Manual Override to Tension SABB (EVA, Unsched/Cont)
Verify LBB Fully Tensioned

P6:EPS:SAW 4B(2B)
[SAW 4B(2B)]
[SAW 4B(2B)]
Verify visually
Latch Position (four of eight) - tensioned position
Tension Bar - Pulled toward blanket box
Solar Array Blanket - rigid and flat
Is LBB Fully Tensioned?

No
Yes
153

150
152
157

EVA Tension Attempts
Is this the first attempt to tension the LBB via EVA?
LBB Hardware Binding
Wait for better thermal conditions and re-attempt LBB Tension via EVA.

Wait for better thermal conditions and re-attempt RBB Tension via EVA.

Position SAW for RBB Tension via EVA
Perform P6 Configure BGA 4B(2B) to Safe/Lock Mode (SODF: ISS EPS, Nominal Procedures)
Copy the following values into Step 10:
Safe/Lock, Cmded Angle = 90 deg
Latch Select = 1
These values apply for SAW 4B or SAW 2B

On MCC-H Go
Perform Manual Override to Tension SABB (EVA, Unsched/Cont)
Verify RBB Fully Tensioned

P6:EPS:SAW 4B(2B)
[SAW 4B(2B)]
[SAW 4B(2B)]
Verify visually
Latch Position (four of eight) - tensioned position
Tension Bar - Pulled toward blanket box
Solar Array Blanket - rigid and flat
Is RBB Fully Tensioned?

No
Yes
153

154
155
159

EVA Tension Attempts
Is this the first attempt to tension the RBB via EVA?
RBB Hardware Binding
Wait for better thermal conditions and re-attempt RBB Tension via EVA.

Wait for better thermal conditions and re-attempt RBB Tension via EVA.

Re-attempt will be made at the end of insolation or end of eclipse, which ever case is opposite initial attempt.

Mast fully deployed, LBB and RBB fully tensioned.
FAILURE TO UNLATCH SABB REMOTELY
(ASSY OPS/4A/FIN) Page 19 of 21 pages

171 Config for Mast Deploy
Perform {P6 Ch 4B(2B) BGA Activation and SAW Deploy},
Steps 18.3 and 18.5
(SODF: ASSY OPS,
Act and C/O)

176 Mast Deploy via EVA
On MCC-H Go
Perform Manual Override to Extend Mast
(EVA, Unsched/Cont)

177 Verify Mast Fully Deployed
P6:EPS:SAW 4B(2B)
SAW 4B(2B)
Verify visually
Tension Bar - Pulled away from blanket box
(as last mast bay deploys)
Number of visible mast bays = 31.5
Guide rollers on final bay - visible
(yellow flex batten)
Solar Array blankets - flat
Is Mast Fully Deployed?

178 Attitude Control
Perform {P6 Ch 4B(2B) BGA Activation and SAW Deploy},
Step 21
(SODF: ASSY OPS,
Act and C/O)

179 EVA Deploy Attempts
Is this the first attempt to deploy the mast via EVA?

180 Mast Hardware Binding
Wait for better thermal conditions and re-attempt
Mast deploy via EVA.

Re-attempt will be made at the end of
insolation or end of eclipse, which
ever case is opposite initial
attempt.
FAILURE TO UNLATCH SABB REMOTELY
(ASSY OPS/4A/FIN) Page 20 of 21 pages

182. LBB Tension via EVA
On MCC-H Go
Perform Manual Override to Tension SABB
(EVA, Unsched/Cont)

183. Verify LBB Fully Tensioned
PS6:EPS:SAW 4B(2B)
[SAW 4B(2B) 'SAW 4B(2B)]
Verify visually
Latch Position (four of eight) - tensioned position
Tension Bar - Pulled toward blanket box
Solar Array Blanket - rigid and flat

Is LBB Fully Tensioned?

No Yes 184

187. EVA Tension Attempts
Is this the first attempt to tension the LBB via EVA?

Yes 188 LBB Hardware Binding
Wait for better thermal conditions and re-attempt LBB Tension via EVA.

182

184. RBB Tension via EVA
On MCC-H Go
Perform Manual Override to Tension SABB
(EVA, Unsched/Cont)

185. Verify RBB Fully Tensioned
PS6:EPS:SAW 4B(2B)
[SAW 4B(2B) 'SAW 4B(2B)]
Verify visually
Latch Position (four of eight) - tensioned position
Tension Bar - Pulled toward blanket box
Solar Array Blanket - rigid and flat

Is RBB Fully Tensioned?

No Yes 186

189. EVA Tension Attempts
Is this the first attempt to tension the RBB via EVA?

Yes 190 RBB Hardware Binding
Wait for better thermal conditions and re-attempt RBB Tension via EVA.

184

184. SAW Ops Complete
Mast Fully deployed, LBB and RBB fully tensioned.

186

Re-attempt will be made at the end of insolation or end of eclipse, whichever case is opposite initial attempt.
2

MDA Abort must be sent to prevent MDA from driving once power is reapplied. This is a single step cmd.

2

FAILUER TO UNLATCH SABB REMOTELY
(ASSY OPS/4A/FIN) Page 21 of 21 pages

1

Has full latch travel been confirmed, visually and by limit switch data?

No

Yes

32

30

62

Unlatch Sequence Verification

63

Identify Stuck BRS Pins

Record which BRS Pin(s) are stuck, and corresponding BGA position and Latch number, required for EVA access. Refer to procedure: (Manual Release of SABB Restraint Pins) for this data.

BRS Pin      Angle,deg   Latch
1            _______     ______
2            _______     ______
3            _______     ______
4            _______     ______
5            _______     ______
6            _______     ______
7            _______     ______

Copy values into the next step.

4

66

Release BRS Pins via EVA

On MCC-H Go
Perform Manual Release of SABB Restraint Pins (EVA, Unsched/Cont)

3

65

BRS Pin Status

Did BRS Pins release during BGA rotation?

No

Yes

5

67

Clear CW Flag Indications

P6.EPS.EPS Software
EPS Software
sel PVCU Software
PV SW
sel Cmd Resp Clear
PV Cmd Response Clear
'SAW Command Response Clear'

cmd Arm
cmd Clear

68

Set SAW LBB(RBB) Abort

P6.EPS.SAW 4B(2B)
'SAW 4B(2B)
.sel SAW LBB(RBB) Commands
SAW 4B(2B) LBB(RBB) Commands

cmd LBB(RBB) - Abort

2

69

Turn MDA On

cmd MDA Power - On Arm
cmd MDA Power - On
Verify MDA Voltage, V = 120 --- 125

3

2

Damage to SABB hardware when driving a MDA in the opposite direction from the initial cmded direction, in the sequence not completed case, applies only if the BRS pin(s) have not been released.

1

Identify Stuck BRS Pins

62

Has full latch travel been confirmed, visually and by limit switch data?

No

Yes

32

Position SAW for Mast Deploy via EVA

Perform P6 Configure BGA 4B(2B) to Safe/Lock Mode (SODF: ISS EPS, Nominal Procedures)

Copy the following values from previous step into Step 10 of the Safe/Lock procedure

Cmded Angle = _______deg
Latch Select = _______

Copy values into the next step.

4

66

Release BRS Pins via EVA

On MCC-H Go
Perform Manual Release of SABB Restraint Pins (EVA, Unsched/Cont)

2

65

BRS Pin Status

Did BRS Pins release during BGA rotation?

No

Yes

5

67

Clear CW Flag Indications

P6.EPS.EPS Software
EPS Software
sel PVCU Software
PV SW
sel Cmd Resp Clear
PV Cmd Response Clear
'SAW Command Response Clear'

cmd Arm
cmd Clear

68

Set SAW LBB(RBB) Abort

P6.EPS.SAW 4B(2B)
'SAW 4B(2B)
.sel SAW LBB(RBB) Commands
SAW 4B(2B) LBB(RBB) Commands

cmd LBB(RBB) - Abort

2

69

Turn MDA On

cmd MDA Power - On Arm
cmd MDA Power - On
Verify MDA Voltage, V = 120 --- 125

3
FAILURE TO EXTEND MAST REMOTELY
(ASSY OPS/4A/FIN)  Page 1 of 15 pages

1. ECU SAW Communicating
   P6:EPS:SAW 4B(2B)
   SAW 4B(2B) 'ECU 4B(2B)

   Is Integ Cnt incrementing?
   Yes
   No

2. SAW Deploy Status
   Is other SAW 4B(2B) deployed?
   Yes
   No

3. ECU BGA Communicating
   P6:EPS:BGA 4B(2B)
   BGA 4B(2B) 'ECU 4B(2B)

   Is Integ Cnt incrementing?
   Yes
   No

4. ECU SAW Failure
   Possible ECU SAW Firmware Power Supply, or RT. Failure. Possible fault on ECU SAW power string below ECU input power selector circuit breaker.

5. Check RPCM Trend Data for Increase in Current
   MCC-H Only
   Is a Current increase indicated in trend data for RPCM 4B(2B) A just before communication was lost with SAW
   Yes
   No

6. Check RPCM Current
   P6:EPS:RPCM 4B(2B) A
   RPCM 4B(2B) A

   Is Current < 0.6 Amps
   Yes
   No

7. Power on Reset
   sel SAW Firmware
   SAW 4B(2B) Firmware

   Does Power On Reset = X
   Yes
   No

8. Remove Mast MDA Power
   P6:EPS:SAW 4B(2B)
   SAW 4B(2B)
   RPCM 4B(2B) A RPC 02
   RPCM 2B(4B) A RPC 02

   cmd RPC Position - Open (Verify - Op)

9. Recover Heater Power
   Perform P6 Ch 4B(2B) BGA Activation and SAW Deploy, Step 22 (SODF: ASSY OPS, Act and C/O)

10. ECU SAW Power Lost
    Possible ECU SAW Power Supply Failure or fault on ECU SAW power string below ECU input power selector circuit breaker. BGA operations are unaffected.

11. Caution message BGA 4B(2B) 1553/FWC Errors- P6 may also be received if a Power on Reset has occurred.
Failure to Extend Mast Remotely

ASSY OPS/4A/FIN

Page 3 of 15 pages

1. Disconnects are present in the MDA Over Temp FDIR. S/W Trip level = 74.4 deg C. F/W Trip level = 140 deg C. H/W damage occurs at 120 deg C. At a minimum a 30 deg C Mast MDA Temp increase should be protected for during mast deployment.

2. MDA Over Current Trip occurs at 5.4 Amps.

MDA Off
- Possible MDA H/W Failure, MDA Over Current Trip, MDA Over Temp Trip, MDA Stall, Mast Binding, or sensor failure

MDA On and Driving
- Possible Mast Binding, or Degraded MDA but not enough to trigger FDIR. Monitor for Mast Deploy completion.

Over Current Detection
- P6:EPS:SAW 4B(2B)
  SAW 4B(2B)
  "ECU 4B(2B)"
  Does MDA Current Trip = X

Over Temperature Detection
- P6:EPS:SAW 4B(2B)
  SAW 4B(2B)
  "Mast MDA"
  Does Over Temp Trip = X

MDA Stall Status
- MCC Only
  Did MDA Slow Alert = Slow prior to removal of MDA Power?

Clear MDA Indications
- P6:EPS:SAW 4B(2B)
  SAW 4B(2B)
  sel SAW Mast Commands
  SAW 4B(2B) Mast Commands
  cmd MDA Power - Off
  Verify MDA Voltage, V < 10 (+/- 2.8)

Continue SAW Deploy
- Perform P6 Ch 4B(2B) BGA Activation and SAW Deploy, Steps 18.1--22 (SODF: ASSY OPS, Act and C/O)

MDA Failure Unknown
- Unknown MDA Failure
FAILURE TO EXTEND MAST REMOTELY
(assy ops/4A/FIN)  Page 4 of 15 pages

22

23 Clear MDA Indications

MDA Over Current Trip occurs at 5.4 Amps.

24 Check MDA Trend Data for Increase in Current

25 Check RPCM Trend Data for Increase in Current

MCC-H Only
Is a MDA Current increase, above expected levels, indicated in trend data just before MDA power was removed?

Yes

No

27 MDA Stall Status

MCC Only
Did MDA Slow Alert = Slow prior to removal of MDA Power?

Yes

No

28 MDA Stall indicated, Mast binding. Attempt to retract array a short distance then try to deploy again. May wish to wait for a different thermal condition before, this is attempted.

29 Dump SAW C&W Buffer

Is CW Stall Safing Failure Flag is set?

No

Yes

30 Clear CW Flag Indications

P6:EPS:EPS Software
EPS Software
Sel PVCU Software
PV_SW
Sel Cmd Resp Clear
PV Cmd Response Clear
'SAW Command Response Clear'
Cmd Arm
Cmd Clear

31

41

52 Erroneous data or BIT flip.

53 Possible short or fault in MDA.

41

52

53

52

53
FAILURE TO EXTEND MAST REMOTELY
(ASSY OPS/4A/FIN)  Page 5 of 15 pages

1 MDA Abort must sent to prevent MDA from driving once power is re-applied. This is a single step cmd.

2 If Current sensor fails high > 5.4 A RPCs providing power to ECU will be opened. A new PPL with a higher Current limit must be uploaded before the ECU can be recovered.

30

31 Set SAW Mast Abort
P6:EPS:SAW 4B(2B)
SAW 4B(2B)
'SAW 4B(2B)
Sel SAW Mast Commands
SAW 4B(2B) Mast Commands
cmd Mast - Abort

32 Turn MDA On
cmd MDA Power - On Arm
cmd MDA Power - On
Verify MDA Voltage, V = 120 --- 125

33 Retract Mast and Abort
Monitor mast retract with cameras.
cmd Mast - Retract Arm
cmd Mast - Retract
Retract at least 1 bay then Abort
cmd Mast- Abort

34 Clear MDA Indications
P6:EPS:SAW 4B(2B)
SAW 4B(2B)
'SAW 4B(2B)
Sel SAW Mast Commands
SAW 4B(2B) Mast Commands
cmd MDA Power - Off
Verify MDA Voltage, V < 10 (+/- 2.8)

35 Turn MDA On
cmd MDA Power - On Arm
cmd MDA Power - On
Verify MDA Voltage, V = 120 --- 125

36 Deploy Mast
Monitor mast deploy with cameras.
cmd Mast - Deploy Arm
cmd Mast - Deploy
Was deploy successful?

25

80 MDA Current Sensor Failure or Erroneous BIT Flip

81 Clear MDA Indications
P6:EPS:SAW 4B(2B)
SAW 4B(2B)
'SAW 4B(2B)
'Mast MDA
Does MDA Current, A = 0.00 (+/- 0.4)

82 Erroneous BIT Flip

84 MDA Current Sensor Failure

85 Inhibit Over Current Trip Fl
Sel SAW Software Inhibits
SAW 4B(2B) Software Inhibits
Sel SAW 4B(2B) Motor Stall Safing
SAW 4B(2B) Motor Stall Safing
'MDA Over Current Trip Function'
cmd Inhibit - Arm
cmd Inhibit
Verify MDA Over Current Trip Function= Inh

86 Update PPL
Upload new PV_PPL69 verison with higher MDA Conv Current Limit

83 Continue SAW Deploy
Perform (P6 Ch 4B(2B) BGA Activation and SAW Deploy), Steps 18.1--22
(SODF: ASSY OPS, Act and C/O)

83 Continue SAW Deploy
Perform (P6 Ch 4B(2B) BGA Activation and SAW Deploy), Steps 18.9--22
(SODF: ASSY OPS, Act and C/O)
### Failure to Extend Mast Remotely

1. **Disconnects are present in the MDA Over Temp FDIR.**
   - SW Trip level = 74.4 deg C.
   - F/W Trip level = 140 deg C.
   - H/W damage occurs at 120 deg C. At a minimum a 30 deg C Mast MDA Temp increase should be protected for during mast deployment.

2. **Since SW Temp limit is reached first and it does not set the MDA Over Temp flag, a MDA Abort must sent to prevent MDA from driving, once power is re-applied. This is a single step cmd.**

---

### Flowchart Description

**61** Clear MDA Indications
- **P6: EPS: SAW 4B(2B)**
- **SAW 4B(2B)**
- **SAW 4B(2B)**
- **sel SAW Mast Commands**
- **SAW 4B(2B) Mast Commands**
  - **cmd MDA Power - Off**
  - Verify MDA Voltage, V < 10 (+/- 2.8)

**62** Verify S/W Trip Temperature
- **P6: EPS: SAW 4B(2B)**
- **SAW 4B(2B)**
- **SAW 4B(2B)**
  - Is LBB, RBB or Mast MDA Temp > 74.4 deg C?
  - **Yes**
    - **Check MDA Trend Data for Increase in Temperature**
    - **MCC-H Only**
      - Is a steady MDA Temp increase over time indicated in trend data just before MDA power was removed?
  - **No**
    - **MDA Temp Sensor Failure**
  - **64** MDA Over Temp Condition
    - Yes
    - **72** Erroneous BIT Flip
      - **71** MDA Over Temp Condition
      - **74** Set SAW Mast Abort
        - **P6: EPS: SAW 4B(2B)**
        - **SAW 4B(2B)**
        - **SAW 4B(2B)**
        - **sel SAW Mast Commands**
        - **SAW 4B(2B) Mast Commands**
          - **cmd MDA Power - Off**
          - Verify MDA Voltage, V < 10 (+/- 2.8)
          - Assess Inhibit
            - **MCC-H Only**
              - Assess use of MDA based on last good Temp value.

**63** Continue SAW Deploy
- Perform (P6 Ch 4B(2B) BGA Activation and SAW Deploy), Steps 1-7-9-15-18-22 (SODF: ASSY OPS, Act and C/O) for failed SAW.

**65** Set SAW Mast Abort
- **P6: EPS: SAW 4B(2B)**
- **SAW 4B(2B)**
- **SAW 4B(2B)**
- **sel SAW Mast Commands**
- **SAW 4B(2B) Mast Commands**
  - **cmd MDA Power - Off**
  - Verify MDA Voltage, V < 10 (+/- 2.8)

**66** Assess Inhibit
- Check with MCC-H to determine if inhibiting the MDA Over Temp Safing FI is appropriate.
FAILURE TO EXTEND MAST REMOTELY
(ASY OPS/4A/FIN) Page 7 of 15 pages

Disconnects are present in the MDA Over Temp FDIR. S/W Trip level = 74.4 deg C. F/W Trip level = 140 deg C. H/W damage occurs at 120 deg C. At a minimum a 30 deg C Mast MDA Temp increase should be protected for during mast deployment.

1. Inhibit Over Temp Safing
   - P6:EPS:SAW 4B(2B)
   - SAW 4B(2B) ECU 4B(2B)
   - sel SAW Software Inhibits
   - SAW 4B(2B) Software Inhibits
   - sel SAW 4B(2B) Temp Safing
   - SAW 4B(2B) Temp Safing

   ‘Mast MDA’
   ‘Over Temp Safing’
   ‘Primary PVCU’
   cmd Inhibit - Arm
   cmd Inhibit
   Verify Over Temp Safing = Inh
   ‘Backup PVCU’
   cmd Inhibit - Arm
   cmd Inhibit
   Verify Over Temp Safing = Inh

2. Inhibit Over Temp Trip Function
   If necessary
   - SAW 4B(2B) Temp Safing

   ‘Over Temp Trip Function’
   cmd Inhibit - Arm
   cmd Inhibit
   Verify Over Temp Trip Function = Inh

3. Continue SAW Deploy
   Perform (P6 Ch 4B(2B) BGA Activation and SAW Deploy), Steps 18.1–22
   (SODF: ASSY OPS, Act and C/O)

4. Let MDA Cool or Deploy Via EVA
   - Let MDA cool to < 44.4 deg C and re-attempt deploy or Deploy via EVA.

5. Deploy Via EVA?
   Yes → 41
   No

6. Let MDA Cool
   - Let MDA cool to < 44.4 deg C and re-attempt deploy.
FAILRE TO EXTEND MAST REMOTELY
(ASSY OPS/4A/FIN) Page 8 of 15 pages

Remove Power from MDA. When power is re-applied to the ECU the MDA will be off.

MCC-H Only
Perform ECU SAW RT Reset from Ground:
CI PUI=
SPUI=
SAW 4B =
SAW 2B =

Is Integ Cnt incrementing?

Remove ECU Power

ECU SAW Communicating

Communication with the SAW has been restored. Confirm SAW and BGA configurations are as expected before continuing nominal procedure.

Verify Mast Fully Deployed

Is Mast Fully Deployed?

Continue SAW Deploy
FAILURE TO EXTEND MAST REMOTELY
(ASY OPS/4A/FIN)  Page 9 of 15 pages

1 Allows BGA to be operated when SAW Mast is in an undetermined state.

99 Allows BGA to be operated when SAW Mast is in an undetermined state.

100 Apply Power to ECU

P6:EPS:SAW 4B(2B)
SAW 4B(2B)
'SAW 4B(2B)' cmd RPC Position - Close (Verify - Cl)

101 ECU SAW Communication

P6:EPS:SAW 4B(2B)
SAW 4B(2B)
'ECU 4B(2B)' Is Integ Cnt incrementing?

102 Continue SAW Deploy

Perform (P6 Ch 4B(2B) BGA Activation and SAW Deploy), Steps 4, 6, 7, 10-12, 18-22 (SODF: ASSY OPS, Act and C/O)

103 Communication Lost with SAW Firmware

Possible SAW RT or Firmware Controller failure. Mast Deploy, LBB and RBB tensioning must be accomplished by EVA. BGA operations are unaffected

104 ECU BGA Communication

P6:EPS:BGA 4B(2B)
BGA 4B(2B)
'ECU 4B(2B)' Verify Integ Cnt: < incrementing>

105 BGA Common Clear

BGA 4B(2B)
'ECU 4B(2B)' cmd Enable - Arm

106 Override SAW Indications

BGA 4B(2B)
'ECU 4B(2B)' cmd Enable

107 Verify SAW Deployment - Ena

108 Common Clear

Verify Power On Reset - < blank>
Mast MDA Failed
- Mast deploy must be accomplished by EVA.

Mast Hardware Binding
- Mast deploy must be attempted via EVA.

Remove Mast MDA Power
- P6:EPS:SAW 4B(2B)
- SAW 4B(2B)
- "SAW 4B(2B)" Mast Commands
- cmd MDA Power - Off
- Verify MDA Voltage, V < 10 (+/- 2.8)

Position SAW for Mast Deploy via EVA
- Copy the following values into Step 8:
  - Safe/Lock, Cmded Angle = 180 deg
  - Latch Select = 1
- These values apply for SAW 4B or SAW 2B

Mast Deploy via EVA
- On MCC-H Go
- Perform Manual Override to Extend Mast (EVA, Unsched/Cont)

Verify Mast Fully Deployed
- P6:EPS:SAW 4B(2B)
- SAW 4B(2B)
- "SAW 4B(2B)" Mast Commands
- Verify telemetry
  - Mast SW 01,02 Retracted = No
  - Mast SW 01,02 Deployed = Yes
- Verify visually
  - Tension Bar - Pulled away from blanket box (as last mast bay deploys)
  - Number of visible mast bays = 31.5
  - Guide rollers on final bay - visible (yellow flex batten)
  - Solar Array blankets - flat
- Is Mast Fully Deployed?
Mast Failed to Extend

Is Mast partially deployed?

Percent Mast is Deployed

Record number of visible mast bays:

<table>
<thead>
<tr>
<th># of Bays</th>
<th>%Deployed</th>
</tr>
</thead>
<tbody>
<tr>
<td>31.5</td>
<td>100</td>
</tr>
<tr>
<td>28</td>
<td>90</td>
</tr>
<tr>
<td>25</td>
<td>80</td>
</tr>
<tr>
<td>22</td>
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<td>30</td>
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<tr>
<td>6</td>
<td>20</td>
</tr>
<tr>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Record Percent Deployed:

Mast is Partially Deployed

Primary power generation capability degraded for affected channel.

Assess short term impacts:
1. Attitude control restrictions
2. Power generation capability
3. Departure restrictions
4. Crew exercise constraints
5. BGA operations

Assess long term impacts to:
1. Future rendezvous ops
2. SAW retract capability

SAW Ops Complete

Mast fully deployed, LBB and RBB fully tensioned.

Return to Nominal Procedure

Continue (P6 Ch 4B(2B) BGA Activation and SAW Deploy), Steps 21 - 22 (SODF: ASSY OPS, Act and C/O)

SAW Structurally Compromised

SAW structural load capability compromised.

Assess short term impacts:
1. Attitude control restrictions
2. Departure restrictions
3. Crew exercise constraints
4. BGA operations

Assess long term impacts to:
1. Future rendezvous ops

Work ECU R&R opportunities.

Return to Nominal Procedure

Continue (P6 Ch 4B(2B) BGA Activation and SAW Deploy), Steps 21 - 22 (SODF: ASSY OPS, Act and C/O)
108 SAW PS, FWC or RT Lost
Mast deploy, LBB and RBB tensioning must be accomplished by EVA.

109 Recover ECU
Perform [P6 Ch 4B(2B)] BGA Activation and SAW Deploy, Steps 10 (for BGA only), 11 - 12 (SODF: ASSY OPS, Act and C/O)

110 Position SAW for Mast Deploy via EVA
Perform P6 Configure BGA 4B(2B) to Safe/Lock Mode (SODF: ISS EPS, Nominal Procedures)
Copy the following values into Step 8:
Safe/Lock, Cmded Angle = 180 deg
Latch Select = 1
These values apply for SAW 4B or SAW 2B

111 Mast Deploy via EVA
On MCC-H Go
Perform Manual Override to Extend Mast (EVA, Unsched/Cont)

112 Verify Mast Fully Deployed
P6/EPS:SAW 4B(2B)
SAW 4B(2B)
*SAW 4B(2B)*
Verify visually
Tension Bar - Pulled away from blanket box (as last mast bay deploys)
Number of visible mast bays = 31.5
Guide rollers on final bay - visible (yellow flex batten)
Solar Array blankets - flat
Is Mast Fully Deployed?

113 EVA Deploy Attempts
Is this the first attempt to deploy the mast via EVA?

114 Mast Hardware Binding
Wait for better thermal conditions and re-attempt Mast deploy via EVA.

This step can take up to 1 hr to complete. The Safe/Lock cmd can be sent when the BGA Actual Angle is within 1 deg of the commanded value in order to save time.

This step may be omitted if EVA crew can free float and drive the Mast MDA. Wait for NBL test results 8/9/00.
FAILURE TO EXTEND MAST REMOTELY
(ASSY OPS/4A/FIN)  Page 13 of 15 pages

114 Position SAW for LBB Tension via EVA
Perform P6 Configure BGA 4B(2B) to Safe/Lock Mode (SODF: ISS EPS, Nominal Procedures)
Copy the following values into Step 8:
  Safe/Lock, Cmded Angle = 270 deg
  Latch Select = 1
These values apply for SAW 4B or SAW 2B

115 LBB Tension via EVA
On MCC-H Go
Perform Manual Override to Tension SABB (EVA, Unsched/Cont)
Verify LBB Fully Tensioned

116 P6:EPS:SAW 4B(2B) [SAW 4B(2B)]
Verify telemetry
  LBB SW 01,02 Latched = Yes
  LBB SW 01,02 Unlatched = No
Verify visually
  Latch Position (four of eight) - tensioned position
  Tension Bar - Pulled toward blanket box
  Solar Array Blanket - rigid and flat
Is LBB Fully Tensioned?
  No  Yes

117 118
118 RBB Tension via EVA
Perform P6 Configure BGA 4B(2B) to Safe/Lock Mode (SODF: ISS EPS, Nominal Procedures)
Copy the following values into Step 8:
  Safe/Lock, Cmded Angle = 90 deg
  Latch Select = 1
These values apply for SAW 4B or SAW 2B

119 RBB Tension via EVA
On MCC-H Go
Perform Manual Override to Tension SABB (EVA, Unsched/Cont)
Verify RBB Fully Tensioned

120 P6:EPS:SAW 4B(2B) [SAW 4B(2B)]
Verify telemetry
  RBB SW 01,02 Latched = Yes
  RBB SW 01,02 Unlatched = No
Verify visually
  Latch Position (four of eight) - tensioned position
  Tension Bar - Pulled toward blanket box
  Solar Array Blanket - rigid and flat
Is RBB Fully Tensioned?
  No  Yes

121 125
124 LBB Hardware Binding
Wait for better thermal conditions and re-attempt LBB Tension via EVA.

125 EVA Tension Attempts
Is this the first attempt to tension the RBB via EVA?
  Yes

126 RBB Hardware Binding
Wait for better thermal conditions and re-attempt RBB Tension via EVA.

127
127
FAILURE TO EXTEND MAST REMOTELY

From (BGA 4B(2B) LOSS OF COMM), Step Tbd

133 ECU Power Lost

Mast deploy, LBB and RBB tensioning and BGA ops must be accomplished by EVA.

134 Position SAW for Mast Deploy via EVA

SAW and BGA insight and command capability lost. BGA rotation and latch capability lost, EVA access is restricted. BGA will remain locked at 0 deg with latch 1 engaged.

135 Mast Deploy via EVA

On MCC-H Go
Perform Manual Override to Extend Mast (EVA, Unsched/Cont)

136 Verify Mast Fully Deployed

P6:EPS:SAW 4B(2B)
SAW 4B(2B)
"SAW 4B(2B)"

Verify visually
Tension Bar - Pulled away from blanket box (as last mast bay deploys)
Number of visible mast bays = 31.5
Guide rollers on final bay - visible (yellow flex batten)
Solar Array blankets - flat

Is Mast Fully Deployed?

137 EVA Deploy Attempts

Is this the first attempt to deploy the mast via EVA?

138 Mast Hardware Binding

Wait for better thermal conditions and re-attempt Mast deploy via EVA.

1 PVCU Loss or UB failures.
FAILURE TO EXTEND MAST REMOTELY
(ASSY OPS/4A/FIN)     Page 15 of 15 pages

LBB Tension via EVA
On MCC-H Go
Perform Manual Override to Tension SABB
(EVA, Unsched/Cont)
Verify LBB Fully Tensioned
P6:EPS:SAW 4B(2B)
'sAW 4B(2B)
Verify visually
Latch Position (four of eight) - tensioned position
Tension Bar - Pulled toward blanket box
Solar Array Blanket - rigid and flat
Is LBB Fully Tensioned?

RBB Tension via EVA
On MCC-H Go
Perform Manual Override to Tension SABB
(EVA, Unsched/Cont)
Verify RBB Fully Tensioned
P6:EPS:SAW 4B(2B)
'SAW 4B(2B)
Verify visually
Latch Position (four of eight) - tensioned position
Tension Bar - Pulled toward blanket box
Solar Array Blanket - rigid and flat
Is RBB Fully Tensioned?

LBB Hardware Binding
Wait for better thermal conditions and re-attempt
LBB Tension via EVA.

RBB Hardware Binding
Wait for better thermal conditions and re-attempt
RBB Tension via EVA.
FAILURE TO TENSION SABB REMOTELY
(ASSY OPS/4A/FIN) Page 1 of 15 pages

1. ECU SAW Communicating
   P6:EPS:SAW 4B(2B)
   SAW 4B(2B) 'ECU 4B(2B)'
   Is Integ Cnt incrementing?
   No

2. SAW Deploy Status
   Is other SAW 4B(2B) deployed?
   Yes

3. ECU BGA Communicating
   P6:EPS:BGA 4B(2B)
   BGA 4B(2B) 'ECU 4B(2B)'
   Is Integ Cnt incrementing?
   No

4. ECU SAW Failure
   Possible ECU SAW Firmware
   Power Supply, or RT Failure. Possible fault on ECU SAW
   power string below ECU input power selector circuit breaker.

5. Check RPCM Trend Data
   for Increase in Current

6. Check RPCM Current
   P6:EPS:RPCM 4B(2B) A
   RPCM 4B(2B) A
   Is Current < 0.6 Amps
   No

7. Power on Reset
   sel SAW Firmware
   SAW 4B(2B) Firmware
   Does Power On Reset = X
   Yes

8. Remove MDA Power
   P6:EPS:SAW 4B(2B)
   SAW 4B(2B) RPCM 2B(4B) A RPC 02
   cmd RPC Position - Open (Verify - Op)

9. Check RPCM Trend Data
   for Decrease in Current

10. ECU SAW Power Lost
    Possible ECU SAW Power Supply Failure or fault
    on ECU SAW power string below ECU input power
    selector circuit breaker. BGA operations are unaffected.

11. Caution message
    BGA 4B(2B) 1553/FWC Errors- P6
    may also be received if a
    Power on Reset
    has occurred.

Nominal Config:
ECU SAW 4B:
RPCM 4B A
RPC 1 - Cl
RPCM 2B A
RPC 2 - Cl

ECU SAW 2B:
RPCM 2B A
RPC 1 - Cl
RPCM 4B A
RPC 2 - Cl

10 NOV 00
**FAILURE TO TENSION SABB REMOTELY**

**(ASSY OPS/4A/FIN)**

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**Page 2 of 15 pages**

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**1.**

SPN tbd (PR 15629) Enumerations are reversed on ePCS displays (5A fixed)
Must send enable cmd to inhibit function.

**2.**

SPN tbd (PR 15629) Enumerations are reversed on ePCS displays (5A fixed)
Must send enable cmd to inhibit function. Also Low Temp Reject should be Hi Temp Reject.

---

**EPS**
FAILURE TO TENSION SABB REMOTELY
( Assy Ops/4A/FIN) Page 3 of 15 pages

1. Disconnects are present in the MDA Over Temp FDIR. S/W Trip level = 74.4 deg C. F/W Trip level = 140 deg C. H/W damage occurs at 120 deg C. At a minimum a 30 deg C Mast MDA Temp increase should be protected for during mast deployment.

2. MDA Over Current Trip occurs at 5.4 Amps.

MDA Stall Status

- MCC Only
  - Did MDA Slow Alert = Slow prior to removal of MDA Power?
  - Yes
    - Possible MDA Stall Condition
    - MDA Stall, Binding, or sensor failure
  - No
    - Possible MDA H/W Failure, MDA Stall, Binding, or sensor failure

Clear MDA Indications

- P6:EPS:SAW 4B(2B)
  - SAW 4B(2B)
  - 'ECU 4B(2B)'
  - sel SAW LBB (RBB) Commands
  - SAW 4B(2B) LBB (RBB) Commands
  - cmd MDA Power - Off
  - Verify MDA Voltage, V < 10 (+/- 2.8)

Continue SAW Deploy

- Perform (P6 Ch 4B(2B) BGA Activation and SAW Deploy), Steps 19.1(20.1), 22
  - ( SODF: Assy Ops, Act and C/O)

MDA On and Driving

- Possible Binding, or Degraded MDA but not enough to trigger FDIR. Monitor for LBB(RBB) tension completion

Possible MDA H/W Failure, MDA Over Current Condition
MDA Stall, Binding, or sensor failure

Possible MDA Stall Condition
Possible MDA H/W Failure, MDA Stall, Binding, or sensor failure

Verify S/W Trip Temperature

- P6:EPS:SAW 4B(2B)
  - SAW 4B(2B)
  - 'SAW 4B(2B)'
  - Is LBB, RBB, or Mast MDA Temp > 74.4 deg C?
  - Yes
    - Possible MDA Over Temp
    - MDA Stall, Binding, or sensor failure
  - No
    - No
      - Unknown MDA Failure

Possible MDA Over Temp
Possible MDA Over Temp Condition
or sensor failure

Clear MDA Indications

- P6:EPS:SAW 4B(2B)
  - SAW 4B(2B)
  - 'ECU 4B(2B)'
  - sel SAW LBB (RBB) Commands
  - SAW 4B(2B) LBB (RBB) Commands
  - cmd MDA Power - Off
  - Verify MDA Voltage, V < 10 (+/- 2.8)

Possible MDA Over Temp
Possible MDA H/W Failure, MDA Over Temp Condition
or sensor failure

Possible MDA Over Current
Possible MDA H/W Failure, MDA Over Current Condition
MDA Stall, Binding, or sensor failure

MDA Stall Status

- MCC Only
  - Did MDA Slow Alert = Slow prior to removal of MDA Power?
  - Yes
    - Possible MDA Stall Condition
    - MDA Stall, Binding, or sensor failure
  - No
    - Possible MDA H/W Failure, MDA Stall, Binding, or sensor failure

MDA On and Driving

- Possible Binding, or Degraded MDA but not enough to trigger FDIR. Monitor for LBB(RBB) tension completion

Possible MDA H/W Failure, MDA Over Current Condition
MDA Stall, Binding, or sensor failure

Possible MDA Over Temp
Possible MDA H/W Failure, MDA Over Temp Condition
or sensor failure

Clear MDA Indications

- P6:EPS:SAW 4B(2B)
  - SAW 4B(2B)
  - 'ECU 4B(2B)'
  - sel SAW LBB (RBB) Commands
  - SAW 4B(2B) LBB (RBB) Commands
  - cmd MDA Power - Off
  - Verify MDA Voltage, V < 10 (+/- 2.8)

Possible MDA Over Temp
Possible MDA H/W Failure, MDA Over Temp Condition
or sensor failure

Clear MDA Indications

- P6:EPS:SAW 4B(2B)
  - SAW 4B(2B)
  - 'ECU 4B(2B)'
  - sel SAW LBB (RBB) Commands
  - SAW 4B(2B) LBB (RBB) Commands
  - cmd MDA Power - Off
  - Verify MDA Voltage, V < 10 (+/- 2.8)

Possible MDA Over Temp
Possible MDA H/W Failure, MDA Over Temp Condition
or sensor failure

Clear MDA Indications

- P6:EPS:SAW 4B(2B)
  - SAW 4B(2B)
  - 'ECU 4B(2B)'
  - sel SAW LBB (RBB) Commands
  - SAW 4B(2B) LBB (RBB) Commands
  - cmd MDA Power - Off
  - Verify MDA Voltage, V < 10 (+/- 2.8)

Possible MDA Over Temp
Possible MDA H/W Failure, MDA Over Temp Condition
or sensor failure

Clear MDA Indications

- P6:EPS:SAW 4B(2B)
  - SAW 4B(2B)
  - 'ECU 4B(2B)'
  - sel SAW LBB (RBB) Commands
  - SAW 4B(2B) LBB (RBB) Commands
  - cmd MDA Power - Off
  - Verify MDA Voltage, V < 10 (+/- 2.8)

Possible MDA Over Temp
Possible MDA H/W Failure, MDA Over Temp Condition
or sensor failure

Clear MDA Indications

- P6:EPS:SAW 4B(2B)
  - SAW 4B(2B)
  - 'ECU 4B(2B)'
  - sel SAW LBB (RBB) Commands
  - SAW 4B(2B) LBB (RBB) Commands
  - cmd MDA Power - Off
  - Verify MDA Voltage, V < 10 (+/- 2.8)

Possible MDA Over Temp
Possible MDA H/W Failure, MDA Over Temp Condition
or sensor failure

Clear MDA Indications

- P6:EPS:SAW 4B(2B)
  - SAW 4B(2B)
  - 'ECU 4B(2B)'
  - sel SAW LBB (RBB) Commands
  - SAW 4B(2B) LBB (RBB) Commands
  - cmd MDA Power - Off
  - Verify MDA Voltage, V < 10 (+/- 2.8)

Possible MDA Over Temp
Possible MDA H/W Failure, MDA Over Temp Condition
or sensor failure

Clear MDA Indications

- P6:EPS:SAW 4B(2B)
  - SAW 4B(2B)
  - 'ECU 4B(2B)'
  - sel SAW LBB (RBB) Commands
  - SAW 4B(2B) LBB (RBB) Commands
  - cmd MDA Power - Off
  - Verify MDA Voltage, V < 10 (+/- 2.8)

Possible MDA Over Temp
Possible MDA H/W Failure, MDA Over Temp Condition
or sensor failure

Clear MDA Indications

- P6:EPS:SAW 4B(2B)
  - SAW 4B(2B)
  - 'ECU 4B(2B)'
  - sel SAW LBB (RBB) Commands
  - SAW 4B(2B) LBB (RBB) Commands
  - cmd MDA Power - Off
  - Verify MDA Voltage, V < 10 (+/- 2.8)
FAILURE TO TENSION SABB REMOTELY  
(ASSY OPS/4A/FIN)  

23 Possible MDA fault, MDA Stall, or Binding

MDA Stall Status

MCC Only
Did MDA Slow Alert = Slow prior to removal of MDA Power?

24 Clear MDA Indications

P6:EPS:SAW 4B(2B)  
SAW 4B(2B)  
'SAW 4B(2B)  
'SAW LBB(RBB) Commands  
'SAW 4B(2B) LBB(RBB) Commands  

cmd MDA Power - Off  
Verify MDA Voltage, V < 10 (+/- 2.8)

25 Check MDA Trend Data for Increase in Current

MCC-H Only
Is a MDA Current increase, above expected levels, indicated in trend data just before MDA power was removed?

26 Check RPCM Trend Data for Increase in Current

MCC-H Only
Is a Current increase indicated in trend data for RPCM 4B(2B) A just before MDA power was removed?

27 Possible MDA fault, MDA Stall, or Binding

MCC-H Only

MDA Stall indicated, binding. Attempt to unlatch LBB(RBB) then try to tension(latch) again. May wish to wait for a different thermal condition before, this is attempted.

28 MDA Stall Status

MCC Only

29 No

30 Dump SAW C&W Buffer

31 Clear CW Flag Indications

P6:EPS:EPS Software  
EPS Software  
'Sel PVCU Software  
'Sel PV SW  
'Sel Cmd Resp Clear  
'SPV Cmd Response Clear  
'SAW Command Response Clear'  

cmd Arm  

cmd Clear

Yes

Yes

40

49 Erroneous data or BIT flip.

50 Possible short or fault in MDA.

32

77

1 MDA Over Current Trip occurs at 5.4 Amps.
**FAILURES TO TENSION SABB REMOTELY**

**ASSY OPS/4A/FIN**

---

1. **MDA Abort**
   - MDA Abort must be sent to prevent MDA from driving once power is reapplied. This is a single step cmd.

2. **Current Sensor Failure or Erroneous BIT Flip**
   - If Current sensor fails high > 5.4 A, RPCs providing power to ECU will be opened.
   - A new PPL with a higher Current limit must be uploaded before the ECU can be recovered.

3. **Damage to SABB hardware**
   - Damage to SABB hardware when driving a MDA in the opposite direction from the initial cmded direction, in the sequence not completed case, applies only if the BRS pin(s) have not been released.

---

**EPS**

**FAILURES TO TENSION SABB REMOTELY**

**ASSY OPS/4A/FIN**

---

1. **MDA Abort**
   - MDA Abort must be sent to prevent MDA from driving once power is reapplied. This is a single step cmd.

2. **Current Sensor Failure or Erroneous BIT Flip**
   - If Current sensor fails high > 5.4 A, RPCs providing power to ECU will be opened.
   - A new PPL with a higher Current limit must be uploaded before the ECU can be recovered.

3. **Damage to SABB hardware**
   - Damage to SABB hardware when driving a MDA in the opposite direction from the initial cmded direction, in the sequence not completed case, applies only if the BRS pin(s) have not been released.
FAILURE TO TENSION SABB REMOTELY
(ASSY OPS/4A/FIN) Page 6 of 15 pages

58

59 Clear MDA Indications
P6:EPS:SAW 4B(2B)
SAW 4B(2B)
'SAW 4B(2B)
sel SAW LBB(RBB) Commands
SAW 4B(2B) LBB(RBB) Commands

cmd MDA Power - Off
Verify MDA Voltage, V < 10 (+/- 2.8)

60 Verify S/W Trip Temperature
P6:EPS:SAW 4B(2B)
SAW 4B(2B)
'SAW 4B(2B)
Is LBB, RBB or Mast MDA Temp > 74.4 deg C?

61 Check MDA Trend Data
MCC-H Only
for Increase in Temperature
Is a steady MDA Temp increase over time indicated in trend data just before MDA power was removed?

62 MDA Temp Sensor Failure

63 Set SAW LBB(RBB) Abort
P6:EPS:SAW 4B(2B)
SAW 4B(2B)
'SAW 4B(2B)
sel SAW LBB(RBB) Commands
SAW 4B(2B) LBB(RBB) Commands

cmd LBB(RBB) - Abort

64 Clear MDA Indications
cmd MDA Power - Off
Verify MDA Voltage, V < 10 (+/- 2.8)

65 Assess Inhibit
MCC-H Only
Assess use of MDA based on last good Temp value.

66

67 MDA Over Temp Condition

68

69 Erroneous BIT Flip

70

71 Set SAW LBB(RBB) Abort
P6:EPS:SAW 4B(2B)
SAW 4B(2B)
'SAW 4B(2B)
sel SAW LBB(RBB) Commands
SAW 4B(2B) LBB(RBB) Commands

cmd LBB(RBB) - Abort

72 Clear MDA Indications
cmd MDA Power - Off
Verify MDA Voltage, V < 10 (+/- 2.8)

73 Assess Inhibit
Check with MCC-H to determine if inhibiting the MDA Over Temp Safing FI is appropriate.

1

Disconnects are present in the MDA Over Temp FDIR. S/W Trip level = 74.4 deg C. F/W Trip level = 140 deg C. H/W damage occurs at 120 deg C. At a minimum a 30 deg C Mast MDA Temp increase should be protected for during mast deployment.

2

Since S/W Temp limit is reached first and it does not set the MDA Over Temp Trip flag, a MDA Abort must sent to prevent MDA from driving, once power is reapplied. This is a single step cmd.
FAILURE TO TENSION SABB REMOTELY  
(assy ops/4a/fiN)  

1. **Inhibit Over Temp Safing**
   - P6:EPS:SAW 4B(2B)
   - SAW 4B(2B)
   - ECU 4B(2B)
   - sel SAW Software Inhibits
   - SAW 4B(2B) Software Inhibits

2. **Inhibit Over Temp Trip Function**
   - If necessary
   - SAW 4B(2B) Temp Safing
   - 'Over Temp Trip Function'
   - cmd Inhibit - Arm
   - Verify Over Temp Trip Function = Inh

3. **Continue SAW Deploy**
   - Perform (P6 Ch 4B(2B) BGA Activation and SAW Deploy), Steps 19.1(20.1)–22
   - (SODF: ASSY OPS, Act and C/O)

4. **Let MDA Cool or Deploy Via EVA**
   - Let MDA cool to < 44.4 deg C and re-attempt tension or tension via EVA.

5. **Tension Via EVA?**
   - Yes
   - No

6. **Let MDA Cool**
   - Let MDA cool to < 44.4 deg C and re-attempt tension.

Discards are present in the MDA Over Temp FDIR. S/W Trip level = 74.4 deg C. F/W Trip level = 140 deg C. H/W damage occurs at 120 deg C. At a minimum a 30 deg C Mast MDA Temp increase should be protected for during mast deployment.
Removes Power from MDA. When power is re-applied to the ECU the MDA will be off.

ECU SAW Communicating

Is Integ Cnt incrementing?

Remove ECU Power

Communication Restored

Communication with the SAW has been restored. Confirm SAW and BGA configurations are as expected before continuing nominal procedure.

Verify LBB(RBB) Fully Tensioned

Is LBB(RBB) Fully Tensioned?

Continue SAW Deploy

Perform (P6 Ch 4B(2B) BGA Activation and SAW Deploy), Steps 4, 10-12, 19.2(20.2)-22 (SOD: ASSY OPS, Act and C/O)

Continue SAW Deploy

Perform (P6 Ch 4B(2B) BGA Activation and SAW Deploy), Steps 4, 10-12, 19.6(20.6)-22 (SOD: ASSY OPS, Act and C/O)
FAILUERE TO TENSION SABB REMOTELY

(assy ops/4A/FIN) Page 9 of 15 pages

1. Allows BGA to be operated when SAW Mast is in an undetermined state.

96. Allows BGA to be operated when SAW Mast is in an undetermined state.

97. Apply Power to ECU

- P6:EPS:SAW 4B(2B)
  - SAW 4B(2B)
    - sel RPCM 4B(2B) A RPC 01
  - RPCM 4B(2B) A RPC 01
- cmd RPC Position - Close (Verify - Cl)

98. ECU SAW Communication

- P6:EPS:SAW 4B(2B)
  - SAW 4B(2B)
    - "ECU 4B(2B)"
  - Is Integ Cnt incrementing?

99. Continue SAW Deploy

- Perform (P6 Ch 4B(2B) BGA Activation and SAW Deploy), Steps 4, 6, 7, 10-12, 19(20)-22
  - (SODF: ASSY OPS, Act and C/O)

100. Communication Lost with SAW Firmware

- Possible SAW RT or Firmware Controller failure. Mast Deploy, LBB and RBB tensioning must be accomplished by EVA. BGA operations are unaffected.

101. ECU BGA Communication

- P6:EPS:BGA 4B(2B)
  - BGA 4B(2B)
    - "ECU 4B(2B)"
  - Verify Integ Cnt: < incrementing>

102. BGA Common Clear

- BGA 4B(2B)
  - "ECU 4B(2B)"
  - sel BGA Firmware
  - BGA 4B(2B) Firmware
  - ‘Clear Commands’
  - cmd Common Clear
  - Verify Power On Reset - < blank>

103. Override SAW Indications

- BGA 4B(2B)
  - ECU 4B(2B)
    - sel BGA Software Inhibits
  - SAW 4B(2B) Software Inhibits
  - ‘SAW Deployment’
    - cmd Enable - Arm
    - cmd Enable
    - Verify SAW Deployment - Ena
FAILRE TO TENSION SABB REMOTELY
(assy ops/4a/FIN)    Page 10 of 15 pages

40 LBB(RBB) MDA Failed
LBB(RBB) tension must be accomplished by EVA.

37 LBB(RBB) Hardware Binding
LBB(RBB) tension must be attempted via EVA.

38 Remove LBB(RBB) MDA Power
P6:EPS:SAW 4B(2B)
[SAW 4B(2B)]
"SAW 4B(2B)"
Sel SAW LBB(RBB) Commands
[SAW 4B(2B) LBB(RBB) Commands]
Cmd MDA Power - Off
Verify MDA Voltage, V < 10 (+/- 2.8)

39 Position SAW for LBB(RBB) Tension via EVA
Perform P6 Configure BGA 4B(2B) to Safe/Lock Mode (SODF: ISS EPS, Nominal Procedures)
Copy the following values into Step 10:
Cmded Angle, deg = 270 (+/-0.5) (LBB)
or
= 90 (+/-0.5) (RBB)
Latch Select = 1
These values apply for SAW 4B or SAW 2B

41 LBB(RBB) Tension via EVA
On MCC-H Go
Perform Manual Override to Tension SABB (EVA, Unsched/Cont)

42 Verify LBB(RBB) Fully Tensioned
P6:EPS:SAW 4B(2B)
[SAW 4B(2B)]
"SAW 4B(2B)"
Verify telemetry
LBB(RBB) SW 01.02 Latched = No
LBB(RBB) SW 01.02 Unlatched = Yes
Verify visually
Latch Position (four of eight) - tensioned position
Tension Bar - Pulled toward blanket box
Solar Array Blanket - rigid and flat

Is LBB(RBB) Fully Tensioned?

43 Return to Nominal Procedure
Continue (P6 Ch 4B(2B) BGA Activation and SAW Deploy), Steps 19.6(20.6) - 22 (SODF: ASSY OPS, Act and C/O)

44 EVA Tension Attempts
Is this the first attempt to tension the LBB(RBB) via EVA?

45 LBB (RBB) Hardware Binding
Wait for better thermal conditions and re-attempt LBB(RBB) Tension via EVA.

Is LBB(RBB) Fully Tensioned?

1 This step can take up to 1 hr to complete. The Safe/Lock cmd can be sent when the BGA Actual Angle is within 1 deg of the commanded value in order to save time.

2 This step may be omitted if EVA crew can free float and drive the MDA. Wait for NBL test results 8/9/00.
Tensioning the SAW is ineffective if < 31.5 bays are visible.

**FAILURE TO TENSION SABB REMOTELY**

**SAW Failed to Tension**

**LBB(RBB) Failed to Tension?**

- **46**
  - **Yes**
    - **120 SAW Structurally Compromised**
      - SAW structural load capability compromised.
      - Assess short term impacts:
        1. Attitude control restrictions
        2. Departure restrictions
        3. Crew exercise constraints
        4. BGA operations
      - **MCC-H Only**
        - Assess long term impacts to:
          1. Future rendezvous ops & mnvs.
    - **121 Return to Nominal Procedure**
      - Continue (P6 Ch 4B(2B) BGA Activation and SAW Deploy), Steps 19(20) - 22 (SODF: ASSY OPS, Act and C/O)
  - **No**
    - **47**
      - **SAW Ops Complete**
        - Mast fully deployed, LBB and RBB fully tensioned.
    - **48**
      - **Return to Nominal Procedure**
        - Continue (P6 Ch 4B(2B) BGA Activation and SAW Deploy), Steps 21 - 22 (SODF: ASSY OPS, Act and C/O)
    - **113**
      - **Return to Nominal Procedure**
      - Continue (P6 Ch 4B(2B) BGA Activation and SAW Deploy), Steps 21 - 22 (SODF: ASSY OPS, Act and C/O)
    - **115**
      - **Assess ECU R&R**
        - **MCC-H Only**
        - Work ECU R&R opportunities.
FAILURE TO TENSION SABB REMOTELY
(ASSY OPS/4A/FIN) Page 12 of 15 pages

105 SAW PS, FWC or RT Lost
LBB and RBB
tensioning must be
accomplished by EVA.

106 Recover ECU
Perform (P6 Ch 4B(2B) BGA
Activation and SAW Deploy),
Steps 10 (for BGA only), 11 - 12
(SODF: ASSY OPS,
Act and C/O)

107 One or Both SABBs Affected?
Is LBB tensioned?

No

Yes

106

111
1. Position SAW for LBB Tension via EVA
   - Perform P6 Configure BGA 4B(2B) to Safe/Lock Mode (SODF: ISS EPS, Nominal Procedures)
   - Copy the following values into Step 8:
     Safe/Lock, Cmded Angle = 270 deg
     Latch Select = 1
   - These values apply for SAW 4B or SAW 2B

2. Position SAW for RBB Tension via EVA
   - Perform P6 Configure BGA 4B(2B) to Safe/Lock Mode (SODF: ISS EPS, Nominal Procedures)
   - Copy the following values into Step 8:
     Safe/Lock, Cmded Angle = 90 deg
     Latch Select = 1
   - These values apply for SAW 4B or SAW 2B

On MCC-H Go
   - Perform Manual Override to Tension SABB (EVA, Unsched/Cont)

Verify LBB Fully Tensioned
   - P6:EPS:SAW 4B(2B) [SAW 4B(2B)]
   - Verify telemetry
     LBB SW 01,02 Latched = Yes
     LBB SW 01,02 Unlatched = No
   - Verify visually
     Latch Position (four of eight) - tensioned position
     Tension Bar - Pulled toward blanket box
     Solar Array Blanket - rigid and flat
   - Is LBB Fully Tensioned?
     - No
     - Yes

EVA Tension Attempts
   - Is this the first attempt to tension the LBB via EVA?
     - No
     - Yes

LBB Hardware Binding
   - Wait for better thermal conditions and re-attempt LBB Tension via EVA.

Verify RBB Fully Tensioned
   - P6:EPS:SAW 4B(2B) [SAW 4B(2B)]
   - Verify telemetry
     RBB SW 01,02 Latched = Yes
     RBB SW 01,02 Unlatched = No
   - Verify visually
     Latch Position (four of eight) - tensioned position
     Tension Bar - Pulled toward blanket box
     Solar Array Blanket - rigid and flat
   - Is RBB Fully Tensioned?
     - No
     - Yes

EVA Tension Attempts
   - Is this the first attempt to tension the RBB via EVA?
     - No
     - Yes

RBB Hardware Binding
   - Wait for better thermal conditions and re-attempt RBB Tension via EVA.

This step can take up to 1 hr to complete. The Safe/Lock cmd can be sent when the BGA Actual Angle is within 1 deg of the commanded value in order to save time.

This step may be omitted if EVA crew can free float and drive the Mast MDA. Wait for NBL test results 8/9/00.
Failure to Tension SABB Remotely

From (BGA 4B(2B)
LOSS OF COMM), Step Tbd

124 ECU Power Lost
LBB and RBB
tensioning and BGA ops
must be accomplished by EVA.

122 ECU Loss of Comm
LBB and RBB
tensioning and BGA ops
must be accomplished by EVA.

123 Remove MDA Power
P6:EPS:SAW 4B(2B)
set RPCM 2B(4B) A RPC 02
RPCM 2B(4B) A RPC 02

125 Position SAW for SABB Tension via EVA
SAW and BGA insight and command
capability lost. BGA rotation and latch
capability lost, EVA access is restricted. BGA
will remain locked at 0 deg with latch 1
engaged.

126 One or Both SABBs Affected?
Is LBB tensioned?

No 127
Yes 129

1 PVCU Loss or UB failures.

From (BGA 4B(2B)
LOSS OF COMM), Step Tbd
FAILURE TO TENSION SABB REMOTELY
(ASY OP/4A/FIN) Page 15 of 15 pages

126

LBB Tension via EVA

On MCC-H Go
Perform Manual Override to Tension SABB
(EVA, Unsched/Cont)

127

Verify LBB Fully Tensioned

P6:EPS:SAW 4B(2B)
[SAW 4B(2B)]
'SAW 4B(2B)'

Verify visually
Latch Position (four of eight) - tensioned position
Tension Bar - Pulled toward blanket box
Solar Array Blanket - rigid and flat

Is LBB Fully Tensioned?

No

128

EVA Tension Attempts

Is this the first attempt to tension the LBB via EVA?

Yes

132

LBB Hardware Binding

Wait for better thermal conditions and re-attempt
LBB Tension via EVA.

No

129

RBB Tension via EVA

On MCC-H Go
Perform Manual Override to Tension SABB
(EVA, Unsched/Cont)

130

Verify RBB Fully Tensioned

P6:EPS:SAW 4B(2B)
[SAW 4B(2B)]
'SAW 4B(2B)'

Verify visually
Latch Position (four of eight) - tensioned position
Tension Bar - Pulled toward blanket box
Solar Array Blanket - rigid and flat

Is RBB Fully Tensioned?

No

133

EVA Tension Attempts

Is this the first attempt to tension the RBB via EVA?

Yes

134

RBB Hardware Binding

Wait for better thermal conditions and re-attempt
RBB Tension via EVA.

No

46

Yes
1. All displays in this procedure are on the PCS.

2. Because the FDIR did not properly execute, the 'EEATCS Loop A(B) TCR Config Complete Safing Failed – P6' advisory may have flagged.

3. By issuing these two commands, the error indicators generated by the firmware are cleared, allowing Deploy/Retract commands to be sent once again.

4. It is not necessary to arm the Motor Power Off Command. It is a one step command. Inadvertently arming it will have no adverse effect. See SPN 16517.

5. Clearing Config Fail Flag

6. Perform a visual check for obstructions to radiator motion.

7. •√ MCC-H for steps to check the radiator pulley positions

8. •√ MCC-H for further troubleshooting


If Attitude adjustment is necessary, perform adjustment before continuing with block 14 or 15. Radiator motor must be stopped during any attitude maneuver. Docking, undocking and reboost can be performed with a partially deployed/retracted radiator if necessary. The Station must be in Free Drift mode before attempting block 14 or 15.
By issuing these two commands, the error indicators generated by the firmware are cleared, allowing Deploy/Retract commands to be sent once again.
RESISTIVE THERMAL DEVICE (RTD)

The RTDs are the temperature sensors for the Shuttle-based Wireless Instrumentation System (SWIS). Each RTD is a 1 inch square piece of resistive thermal material with resistance related to temperature. Each RTU has a cable attached that is routed to a Remote Sensing Unit. The RTD designations and locations are shown below.

### Z1 RTD Locations

<table>
<thead>
<tr>
<th>RSU Port Designation</th>
<th>RTD Filename</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z1-1A</td>
<td>Z1-1\accum-1a.wis</td>
<td>Inner PMA bulkhead inside accumulator housing (lower side)</td>
</tr>
<tr>
<td>Z1-1B</td>
<td>Z1-1\cmg3-1b.wis</td>
<td>CMG bulkhead, mounting post for CMG 3</td>
</tr>
<tr>
<td>Z1-1C</td>
<td>Z1-1\sasa-1j.wis</td>
<td>Starboard bulkhead, near SASA mounting bracket</td>
</tr>
<tr>
<td>Z1-1D</td>
<td>Z1-1\pcbm-1d.wis</td>
<td>CBM pressure dome</td>
</tr>
<tr>
<td>Z1-2H</td>
<td>Z1-2\rtas-1e.wis</td>
<td>Zenith bulkhead near P6 interface, PMA side</td>
</tr>
<tr>
<td>Z1-1F</td>
<td>Z1-1\rpda-1f.wis</td>
<td>Port trunion bulkhead, front side of RPCM coldplate</td>
</tr>
<tr>
<td>Z1-1G</td>
<td>Z1-1\sgant-1g.wis</td>
<td>Zenith bulkhead, attached to SGANT RIRS plate</td>
</tr>
<tr>
<td>Z1-1H</td>
<td>Z1-1\tray-1h.wis</td>
<td>Cable tray, attached to NH3 line bracket</td>
</tr>
<tr>
<td>Z1-1E</td>
<td>Z1-1\bsp-1i.wis</td>
<td>Starboard trunion bulkhead, front side of BSP coldplate</td>
</tr>
<tr>
<td>Z1-1C</td>
<td>Z1-1\sasa-1j.wis</td>
<td>Starboard bulkhead, on SASA mounting bracket</td>
</tr>
<tr>
<td>Z1-2A</td>
<td>Z1-2\accum-2a.wis</td>
<td>Inner PMA bulkhead inside accumulator housing (upper side)</td>
</tr>
<tr>
<td>Z1-2B</td>
<td>Z1-2\cmg1-2b.wis</td>
<td>CMG bulkhead, mounting post for CMG 1</td>
</tr>
<tr>
<td>Z1-2C*</td>
<td>Z1-2\tray-2d.wis</td>
<td>Ku-Boom SGTRC (under coldplate)</td>
</tr>
<tr>
<td>Z1-2D*</td>
<td>Z1-2\tray-2d.wis</td>
<td>Cable tray, attached to NH3 line bracket</td>
</tr>
<tr>
<td>Z1-2I</td>
<td>Z1-2\sasa-2f.wis</td>
<td>Starboard bulkhead, near SASA mounting bracket</td>
</tr>
<tr>
<td>Z1-2F</td>
<td>Z1-2\sgant-2g.wis</td>
<td>Zenith bulkhead, attached to SGANT RIRS plate</td>
</tr>
<tr>
<td>Z1-2H*</td>
<td>Z1-2\tray-2d.wis</td>
<td>Port bulkhead near Plasma Contactor mounting</td>
</tr>
<tr>
<td>Z1-2E</td>
<td>Z1-2\sasa-2f.wis</td>
<td>Starboard trunion bulkhead, front side of BSP coldplate</td>
</tr>
<tr>
<td>Z1-2J*</td>
<td>Z1-2\sasa-2f.wis</td>
<td>Ku-Boom, mounting flange for Ku-antenna</td>
</tr>
</tbody>
</table>

*RTD attached to structure and cable routed, but not connected to RSU.
# P6 RTD Locations

<table>
<thead>
<tr>
<th>RSU Port Designation</th>
<th>RTD Filename Location</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>P6-1A</td>
<td>RSU1\IEAupr-1A</td>
<td>Battery 2B31*</td>
</tr>
<tr>
<td>P6-1B</td>
<td>RSU1\IEAlwr-1B</td>
<td>Battery 4B21 / DCSU 4B*</td>
</tr>
<tr>
<td>P6-1C</td>
<td>RSU1\IEAupr-1C</td>
<td>Battery 3B32*</td>
</tr>
<tr>
<td>P6-1D</td>
<td>RSU1\IEAlwr-1D</td>
<td>PFCS 4B*</td>
</tr>
<tr>
<td>P6-1E</td>
<td>RSU1\PVRad-1E</td>
<td>IEA PV Radiator</td>
</tr>
<tr>
<td>P6-1F</td>
<td>RSU1\Norml-1F</td>
<td>EEATCS Normal Radiator</td>
</tr>
<tr>
<td>P6-1G</td>
<td>RSU1\Xpndr-1G</td>
<td>SASA Transponder Plate</td>
</tr>
<tr>
<td>P6-1H</td>
<td>RSU1\RTAS-1H</td>
<td>P6/Z1 Interface (starboard/forward corner)</td>
</tr>
<tr>
<td>P6-2A</td>
<td>RSU2\IEAlwr-2A</td>
<td>Battery 4B31*</td>
</tr>
<tr>
<td>P6-2B</td>
<td>RSU2\IEAupr-2B</td>
<td>Battery 2B11*</td>
</tr>
<tr>
<td>P6-2C</td>
<td>RSU2\IEAlwr-2C</td>
<td>Battery 4B32*</td>
</tr>
<tr>
<td>P6-2D</td>
<td>RSU2\MDMupr-2D</td>
<td>PVCU 2B MDM*</td>
</tr>
<tr>
<td>P6-2E</td>
<td>RSU2\PVRad-2E</td>
<td>IEA PV Radiator</td>
</tr>
<tr>
<td>P6-2F</td>
<td>RSU2\Nline-2F</td>
<td>EEATCS Trailing Radiator</td>
</tr>
<tr>
<td>P6-2G</td>
<td>RSU2\Xpndr-2G</td>
<td>SASA Transponder Plate</td>
</tr>
<tr>
<td>P6-2H</td>
<td>RSU2\RTAS-2H</td>
<td>P6/Z1 Interface (port/forward corner)</td>
</tr>
<tr>
<td>P6-3A</td>
<td>RSU3\IEAupr-3A</td>
<td>Battery 2B21 / DCSU 2B*</td>
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*Located on structure beneath ORU.
REMOTE SENSING UNITS (RSU)
The RSUs collect temperature data from the RTDs connected to it and store it until the Network Control Unit (NCU) sends a request for the data. There are two RSUs integrated on Z1, Z1-1 and Z1-2. They are located on the CMG bulkhead along the zenith edge. The Z1-1 antenna is located on the nadir bulkhead, the starboard CMG side, at the tip of the pool handle. The Z1-2 antenna is located on the nadir bulkhead, starboard PMA side. There are 5 RSUs integrated on P6. Three of them, P6-1, P6-2, and P6-3 are located on the long spacer near the interface with the IEA. The remaining two are located on the solar array canisters with P6-4 on the channel 4B canister and P6-5 on the channel 2B canister. There are three other RSUs, one on the orbiter aft port sill, one on the orbiter forward starboard sill, and one on the aft starboard sill. They are used to relay radio signals between the RSUs on Z1, P6, and the NCU.

NETWORK CONTROL UNIT (NCU)
The NCU is the only component of SWIS located within the orbiter. Two NCUs are flown, with one being used and the other as a backup. The NCU attached near the aft windows, behind the CRTs, so that the antenna is in the window. It is connected to a PGSC and communicates via radio frequency to the RSUs. The data it receives from the RSUs is stored on the PGSC for eventual downlink via OCA.
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<thead>
<tr>
<th>Message Text (Major)</th>
<th>Alarm Class</th>
<th>MSID</th>
<th>Event Driver</th>
<th>Analog Limit Low</th>
<th>Analog Limit High</th>
<th>Discrete Alarm State</th>
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<th>Inhibit During Sleep</th>
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08 NOV 00
The Multipurpose Crew Display System (MCDS) provides a crew interface to the ISS in addition to the EPCS.

The OIU converts ISS telemetry into a format that can be processed by the orbiter. It is displayed to the crew onboard and sent to the MCC.

Likewise, the OIU converts the MCDS commands into a format the ISS can understand.

The assembly related crew displays and their MSID references Mission 4A are provided in this section.

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Figure 1.- FGB Display - SPEC 224.
### Table1. FGB Display - SPEC 224

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Figure 2.- Node 1 Display - SPEC 220.
### Table 2. Node 1 Display - SPEC 220

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Figure 3.- Early Comm Display - SPEC 223.
## Table 3. Early Comm Display - SPEC 223

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<td>1 = ‘PASS’, 0 = ‘FAIL’</td>
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<tr>
<td>SYS MODE HI LO</td>
<td>P82K4018J, P82K4019J, P79X0589E</td>
<td>ITEM 20, ITEM 21, (*) 1 = H1, 0 = LO</td>
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<tr>
<td>LOCK</td>
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<tr>
<td>PORTCOM</td>
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<td>CTP FRM</td>
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<td>PTG MODE</td>
<td>MANUAL</td>
<td>ITEM 22</td>
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<td>AUTO</td>
<td>P82K4024J</td>
<td>ITEM 23</td>
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</table>
**PARAMETER** | **MSID** | **STATUS** | **DISPLAY VALUES (RANGE)**
--- | --- | --- | ---
ANT SEL | | | 
PORT OMNI | P82K4022J | ITEM 24 | 
STBD OMNI | P82K4023J | ITEM 25 | 
PORT ARRAY BEAM | P93J0150C | X | 
STBD ARRAY BEAM | P93J0151C | X | 
BEAM SEL | P79U0599D | XXX | 
SIG STR | P79U0600A | XXX | 
PORT ANT TEMP I/F | P79U0601A P79X0373E | XXX ‘ERR’ ‘OK’ | 
STBD ANT TEMP I/F | P79U0602A P79X0374E | XXX ‘ERR’ ‘OK’ | 
PORTCOM TEMP I/F | P79U0603A P79X0375E | XXX ‘ERR’ ‘OK’ | 
CTP TEMP | P79U0604A | XXX |
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<tr>
<th>ACTIVE DEVICES</th>
<th>PDI</th>
<th>STATUS</th>
<th>1 FORMAT XXX</th>
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<tr>
<td>AD PD BUS LOCK</td>
<td>DCM</td>
<td>SYNC</td>
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<td>1 XXXX X XXXXS</td>
<td>B W F</td>
<td></td>
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<tr>
<td>2 XXXX X XXXXS</td>
<td>A 4X</td>
<td></td>
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<td>3 XXXX X XXXXS</td>
<td>B 5X</td>
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<td>4 XXXX X XXXXS</td>
<td>BC 7X</td>
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<th>OIU CMD CTR XXX</th>
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<tr>
<td>PSP I/F XXX</td>
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<tr>
<td>FLOAT POINT XXX</td>
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<table>
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<tr>
<th>PRI FRM SYNC XXX</th>
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<td>PRI STATUS XXX</td>
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<td>B/U FRM SYNC XXX</td>
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Figure 4.- OIU Display - SPEC 212.
## Table 4. OIU Display - SPEC 212

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<tbody>
<tr>
<td>OIU 1 TEMP</td>
<td>P50T4000V</td>
<td>S (↓↑)</td>
<td>XXX.X</td>
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<tr>
<td>OIU 2 TEMP</td>
<td>P50T4001V</td>
<td>S (↓↑)</td>
<td>XXX.X</td>
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### ACTIVE DEVICES

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<tr>
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<th>BUS</th>
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<th>STATUS</th>
<th>DISPLAY VALUES (RANGE)</th>
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<tr>
<td>AD2 PD</td>
<td>BUS</td>
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<td>P50X4401E</td>
<td>P50U4055D</td>
<td>XXXX (OIU, N1-1(2), FG1(2))</td>
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<td>AD3 PD</td>
<td>BUS</td>
<td>LOCK</td>
<td>P50X4411E</td>
<td>P50U4065D</td>
<td>XXXX (OIU, N1-1(2), FG1(2))</td>
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<tr>
<td>AD4 PD</td>
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<td>LOCK</td>
<td>P50X4421E</td>
<td>P50U4075D</td>
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### PDI

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<tr>
<th>DCM 1 SYNC B</th>
<th>W</th>
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<th>BS</th>
<th>V75X6403D</th>
<th>V75X6402D</th>
<th>V75X6401D</th>
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<td>DCM 2 SYNC B</td>
<td>W</td>
<td>F</td>
<td>BS</td>
<td>V75X6407D</td>
<td>V75X6406D</td>
<td>V75X6405D</td>
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<td>DCM 3 SYNC B</td>
<td>W</td>
<td>F</td>
<td>BS</td>
<td>V75X6411D</td>
<td>V75X6410D</td>
<td>V75X6409D</td>
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<tr>
<td>DCM 4 SYNC B</td>
<td>W</td>
<td>F</td>
<td>BS</td>
<td>V75X6415D</td>
<td>V75X6414D</td>
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### PRI FRM SYNC

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<tr>
<th>BS</th>
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<tbody>
<tr>
<td>PRI STATUS</td>
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### OIU CMD CTR

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### FLOAT POINT

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<td>FLOAT POINT</td>
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### LAST CMD

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<td>PRI FRM SYNC</td>
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<td>(OK, REJ, INC)</td>
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### SSOR

<table>
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<tr>
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<tbody>
<tr>
<td>PRI FRM SYNC</td>
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### FORMAT

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<td>BUS 1 RT</td>
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<td>P50K5628J</td>
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<td>MSTR STAT</td>
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<td>5 FWD</td>
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Figure 5.- CBM Control Display - SPEC 221.
## Table 5. CBM Control Display - SPEC 221

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LAT 2 CMDST  
| ANG CAPSW  | P79X0097E P79H0053A P79X0178E P79X0179E | S (↓) S (↓) | XXXX XXX 1 = 'O' 1 = 'C' |

LAT 3 CMDST  
| ANG CAPSW  | P79X0101E P79H0055A P79X0187E P79X0188E | S (↓) S (↓) | XXXX XXX 1 = 'O' 1 = 'C' |

LAT 4 CMDST  
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Figure 6.- APCU Status Display - SPEC 200.
## Table 6. APCU Status Display - SPEC 200

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Figure 7: FGB/SM C&W Display - SPEC 206.
Table 7. FGB/SM C&W Display - SPEC 206

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|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 1   | 1   | 1X  | 2X  | S   | 25X | 26X | S   | 3X  | 4X  | S   | 27X | 28X | S   | 5X  | 6X  | S   | 29X | 30X | S   | 7X  | 8X  | S   | 31X | 32X | S   |
| 2   | 2   | 3X  | 4X  | S   | 27X | 28X | S   | 5X  | 6X  | S   | 29X | 30X | S   | 7X  | 8X  | S   | 31X | 32X | S   | 5X  | 6X  | S   | 29X | 30X | S   |
| 3   | 3   | 5X  | 6X  | S   | 29X | 30X | S   | 7X  | 8X  | S   | 31X | 32X | S   | 5X  | 6X  | S   | 29X | 30X | S   | 7X  | 8X  | S   | 31X | 32X | S   |
| 4   | 4   | 7X  | 8X  | S   | 31X | 32X | S   | 5X  | 6X  | S   | 29X | 30X | S   | 7X  | 8X  | S   | 31X | 32X | S   | 5X  | 6X  | S   | 29X | 30X | S   |

Figure 8.- CBM Power Display - SPEC 222.
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<td>P82K6596J</td>
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<td>SEC 1 ON</td>
<td>P82K6763J</td>
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<td>ITEM 73 1 = ON 0 = OFF</td>
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<td>P82K6746J</td>
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<td>ITEM 77 1 = ON 0 = OFF</td>
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<td>SEC 4 ON</td>
<td>P82K6766J</td>
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<td>ITEM 79 1 = ON 0 = OFF</td>
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<td>P82K7414J</td>
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</table>
### SSP1 Switch and Talkback Function

<table>
<thead>
<tr>
<th>ITEM</th>
<th>TYPE</th>
<th>DEVICE</th>
<th>FUNCTION</th>
<th>USAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>S3</td>
<td>Toggle switch, two positions:</td>
<td>APCU 1 CONV</td>
<td>Up – ON</td>
<td>Applies power to APCU 1 power converter.</td>
</tr>
<tr>
<td></td>
<td>(maintained-maintained)</td>
<td></td>
<td>Down – OFF</td>
<td>Removes power from APCU 1 power converter.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Converter must be off before output switch is opened or closed.</td>
<td></td>
</tr>
<tr>
<td>DS3</td>
<td>Event indicator, two positions:</td>
<td>APCU 1 CONV</td>
<td>GRAY</td>
<td>Indicates power to APCU 1 power converter.</td>
</tr>
<tr>
<td></td>
<td>GRAY - powered Barberpole (BP) - unpowered</td>
<td></td>
<td>BP</td>
<td>Indicates power is removed from APCU 1 power converter.</td>
</tr>
<tr>
<td>S4</td>
<td>Toggle switch, two positions:</td>
<td>APCU 1 OUTPUT RLY</td>
<td>Up – CLOSE</td>
<td>Closes power relay to send power to PMA 3.</td>
</tr>
<tr>
<td></td>
<td>(maintained-maintained)</td>
<td></td>
<td>Down – OPEN</td>
<td>Opens power relay sending power to PMA 3.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Output relay should never be commanded on while converters are on.</td>
<td></td>
</tr>
<tr>
<td>DS4</td>
<td>Event indicator, two positions:</td>
<td>APCU 1 OUTPUT RLY</td>
<td>GRAY</td>
<td>Indicates APCU 1 is outputting 28 VDC to PMA 3.</td>
</tr>
<tr>
<td></td>
<td>GRAY - powered BP - unpowered</td>
<td></td>
<td>BP</td>
<td>Indicates APCU 1 is not outputting power.</td>
</tr>
<tr>
<td>S6</td>
<td>Toggle switch, two positions:</td>
<td>APCU 2 CONV</td>
<td>Up – ON</td>
<td>Applies power to APCU 2 power converter.</td>
</tr>
<tr>
<td></td>
<td>(maintained-maintained)</td>
<td></td>
<td>Down – OFF</td>
<td>Removes power from APCU 2 power converter.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Converter must be off before output switch is opened or closed.</td>
<td></td>
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</table>
### SSP1 SWITCH AND TALKBACK FUNCTION

<table>
<thead>
<tr>
<th>ITEM</th>
<th>TYPE DEVICE</th>
<th>FUNCTION</th>
<th>USAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DS6</strong></td>
<td>APCU 2 CONV</td>
<td>Event indicator, two positions: GRAY - powered, BP - unpowered</td>
<td>GRAY Indicates power to APCU 2 power converter. BP Indicates power is removed from APCU 2 power converter.</td>
</tr>
<tr>
<td><strong>S7</strong></td>
<td>APCU 2 OUTPUT RLY</td>
<td>Toggle switch, two positions: (maintained-maintained)</td>
<td>Up – CLOSE Closes power relay to send power to PMA 3. Down – OPEN Opens power relay sending power to PMA 3. Output relay should never be commanded on while converters are on.</td>
</tr>
<tr>
<td><strong>DS7</strong></td>
<td>APCU 2 OUTPUT RLY</td>
<td>Event indicator, two positions: GRAY - powered, BP - unpowered</td>
<td>GRAY Indicates APCU 2 is outputting 28VDC to PMA 3. BP Indicates APCU 2 is not outputting power.</td>
</tr>
<tr>
<td><strong>S15</strong></td>
<td>TCS PWR</td>
<td>Toggle switch, two positions: (maintained-maintained) with wickets</td>
<td>Up – ON Applies power to TCS. Down – OFF Removes power from TCS.</td>
</tr>
<tr>
<td><strong>DS15</strong></td>
<td>TCS PWR (display)</td>
<td>Event indicator, two positions: GRAY BP</td>
<td>GRAY Indicates TCS is powered. BP Indicates TCS is NOT powered.</td>
</tr>
<tr>
<td><strong>S18</strong></td>
<td>PRI C/L CAM PWR</td>
<td>Toggle switch, two positions: (maintained-maintained) with wickets</td>
<td>Up – ON Applies power to PRI C/L Camera. Down – OFF Removes power to PRI C/L Camera.</td>
</tr>
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</table>
### SSP1 SWITCH AND TALKBACK FUNCTION

<table>
<thead>
<tr>
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<th>FUNCTION</th>
<th>USAGE (type and frequency)</th>
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<tr>
<td>S19</td>
<td>SEC C/L CAM PWR</td>
<td>Toggle switch, two positions: (maintained-maintained) with wickets</td>
<td>Up – ON Applies power to SEC C/L Camera. Down – OFF Removes power to SEC C/L Camera.</td>
</tr>
<tr>
<td>S20</td>
<td>ODS CONN MATE X1 TLM PWR</td>
<td>Toggle switch, two positions: (maintained-maintained)</td>
<td>Up – ON Applies power to PMA 3 X 1 CONN MATE TLM PWR. Down – OFF Removes power to PMA 3 X 1 CONN MATE TLM PWR.</td>
</tr>
<tr>
<td>S22</td>
<td>ODS CONN MATE X2 TLM PWR</td>
<td>Toggle switch, two positions: (maintained-maintained)</td>
<td>Up – ON Applies power to PMA 3 X 2 CONN MATE TLM PWR. Down – OFF Removes power to PMA 3 X 2 CONN MATE TLM PWR.</td>
</tr>
<tr>
<td>S24</td>
<td>OIU PWR</td>
<td>Toggle switch, three positions: (maintained-maintained-maintained) with wicket</td>
<td>Up – OIU 1 ON Provides 28 VDC power to OIU 1. Center – OFF Not wired. Down – OIU 2 ON Provides 28 VDC power to OIU 2.</td>
</tr>
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</table>
## SSP1 SWITCH AND TALKBACK FUNCTION

<table>
<thead>
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<th>FUNCTION</th>
<th>USAGE (type and frequency)</th>
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<tbody>
<tr>
<td>DS13</td>
<td>Event indicator, three positions: UP - powered BP - unpowered DN - powered</td>
<td>UP – OIU 1 ON Indicates 28 V has been supplied to OIU 1 by S24. BP – OFF Indicates power is removed from OIU 1 and OIU 2. DN – OIU 2 ON Indicates 28 V has been supplied to OIU 2 by S24.</td>
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</tr>
<tr>
<td>CB1</td>
<td>Circuit breaker, five ampere: IN - closed OUT - open with wickets</td>
<td>IN Applies orbiter power to the PDIP DC PWR 2 and Ku-Band relay. OUT Removes orbiter power to the PDIP DC PWR 2 and Ku-Band relay.</td>
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<tr>
<td>CB2</td>
<td>Circuit breaker, five ampere: IN - closed OUT - open with wickets</td>
<td>IN Applies orbiter power to S3 and S4 on SSP1. OUT Removes orbiter power from S3 and S4 on SSP1.</td>
<td></td>
</tr>
<tr>
<td>CB3</td>
<td>Circuit breaker, five ampere: IN - closed OUT - open with wickets</td>
<td>IN Applies orbiter power to PDIP DC PWR 1. OUT Removes orbiter power from PDIP DC PWR 1.</td>
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</tr>
<tr>
<td>CB4</td>
<td>Circuit breaker, five ampere: IN - closed OUT - open with wickets</td>
<td>IN Applies orbiter power to S18 on SSP1. OUT Removes power from S18 on SSP1.</td>
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## SSP2 SWITCH AND TALKBACK FUNCTION

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<td>S10</td>
<td>ICBC3D PWR</td>
<td>Toggle switch, two position: (maintained-maintained)</td>
<td>Up – ON Applies 28 VDC power to ICBC3D. Down – OFF Removes 28 VDC Power from ICBC3D.</td>
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<tr>
<td>DS10</td>
<td>ICBC3D PWR</td>
<td>Event indicator, two positions: GRAY - powered BP - unpowered</td>
<td>GRAY Indicates ICBC3B is powered. BP Indicates ICBC3D is unpowered.</td>
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<tr>
<td>S11</td>
<td>ICBC3D OVERRIDE</td>
<td>Toggle switch, two positions: (maintained-maintained)</td>
<td>Up – CAM RUN Applies orbiter power to ICBC3D OVERRIDE. Down – OFF Removes orbiter power to ICBC3D OVERRIDE.</td>
</tr>
<tr>
<td>DS11</td>
<td>ICBC3D OVERRIDE</td>
<td>Event indicator, two positions: GRAY - powered BP - unpowered</td>
<td>GRAY Indicates ICBC3D OVERRIDE camera run is powered. BP Indicates that ICBC3D OVERRIDE is unpowered.</td>
</tr>
<tr>
<td>CB1 SW PWR 1</td>
<td>Circuit breaker, five ampere: IN - closed OUT - open with wickets</td>
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<tr>
<td>CB2 SW PWR 2</td>
<td>Circuit breaker, five ampere: IN - closed OUT - open with wickets</td>
<td>IN Applies orbiter power to S10 and S11 on SSP2. OUT Removes orbiter power from S10 and S11 on SSP2.</td>
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</tr>
<tr>
<td>ITEM</td>
<td>TYPE DEVICE</td>
<td>FUNCTION</td>
<td>USAGE (type and frequency)</td>
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<tr>
<td>CB3</td>
<td>Circuit breaker, five ampere:</td>
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<tr>
<td>SW PWR 3</td>
<td>IN - closed</td>
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<td>OUT - open with wickets</td>
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<td>CB4 SW PWR 4</td>
<td>Circuit breaker, five ampere:</td>
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<tr>
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<td>OUT - open with wickets</td>
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