

CANISTERIZED SATELLITE DISPENSER

Operating and Integration Procedure | 3000257B

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NOTE: To avoid costly test failures and program delays, all users shall completely understand this document before attempting to operate the CSD for any purpose.

Customers are prohibited from operating the CSD without reading PSC Document 2002337 CSD Data Sheet and completing the CSD Training Course offered by PSC.

Program Name	
CSD Size	
CSD Assembly Number	
CSD Assembly Revision	
CSD Serial Number	
Technician Name	
Quality Assurance Name(s)	

This procedure does not involve any high-energy liquids, solid fuels, or any material with inherently hazardous physical or chemical properties.

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1. Revision History

Rev	Issued	Created By	Reviewed By	Change Description
-	23Sep14	RH	HM	Initial release.
A	29Dec15	CF	RH	Updated Cover Page Updated Section 2: Glossary Updated Section 3: Introduction Updated Section 4: Required Equipment Updated Steps 7.1.1 and 7.1.3 Added Steps 7.1.4 and 7.1.5 Updated Steps 8.1.1, 8.1.2, 8.1.3 and 8.1.4 Updated Steps 8.2.3, 8.2.4 and 8.2.6 Updated Steps 9.1.1, 9.1.8, 9.1.9 and 9.1.12 Updated Figure 9-3 Updated Deploy Electrical Verification Table 9-1 Updated Section 11: Final Integration Tasks
B	18Jan16	RH	RW	1) Removed voltage from deploy electrical verification in Figure 9-3 and Table 9-1.

2. Glossary

A (or Amps) – Ampere (SI unit of electric current)
 AR – As required
 CSD – Canisterized Satellite Dispenser
 DC – Direct current
 DMM – Digital multimeter
 ESD – Electrostatic discharge
 PS – Power supply
 PSC – Planetary Systems Corporation
 SHC – Socket head cap (type of screw)
 STP – Standard temperature and pressure
 UNC – Unified National Coarse (type of thread)
 UNF – Unified National Fine (type of thread)

3. Introduction

This document describes the steps required to handle, operate and integrate the Canisterized Satellite Dispenser (CSD). Training and certification by Planetary Systems Corp (PSC) are required to operate any CSD.

Read this entire document BEFORE attempting any procedures.

Electrical Verification (Table 9-1) and CSD Resistance Measurements (Table 10-1) apply only at standard temperature and pressure (STP).

Contact PSC to clarify any ambiguity or to answer any other questions.

3.1 CSD Description

The CSD is an aluminum box that encapsulates small payloads during launch. A pair of tabs on the payload are preloaded to the CSD. Closing the CSD's door automatically preloads the tabs and prevents movement of the payload during launch. The door initiator is a DC brush motor. There are no consumables and no items to reset between operations. For more information on the CSD see document *2002337 CSD Data Sheet*.

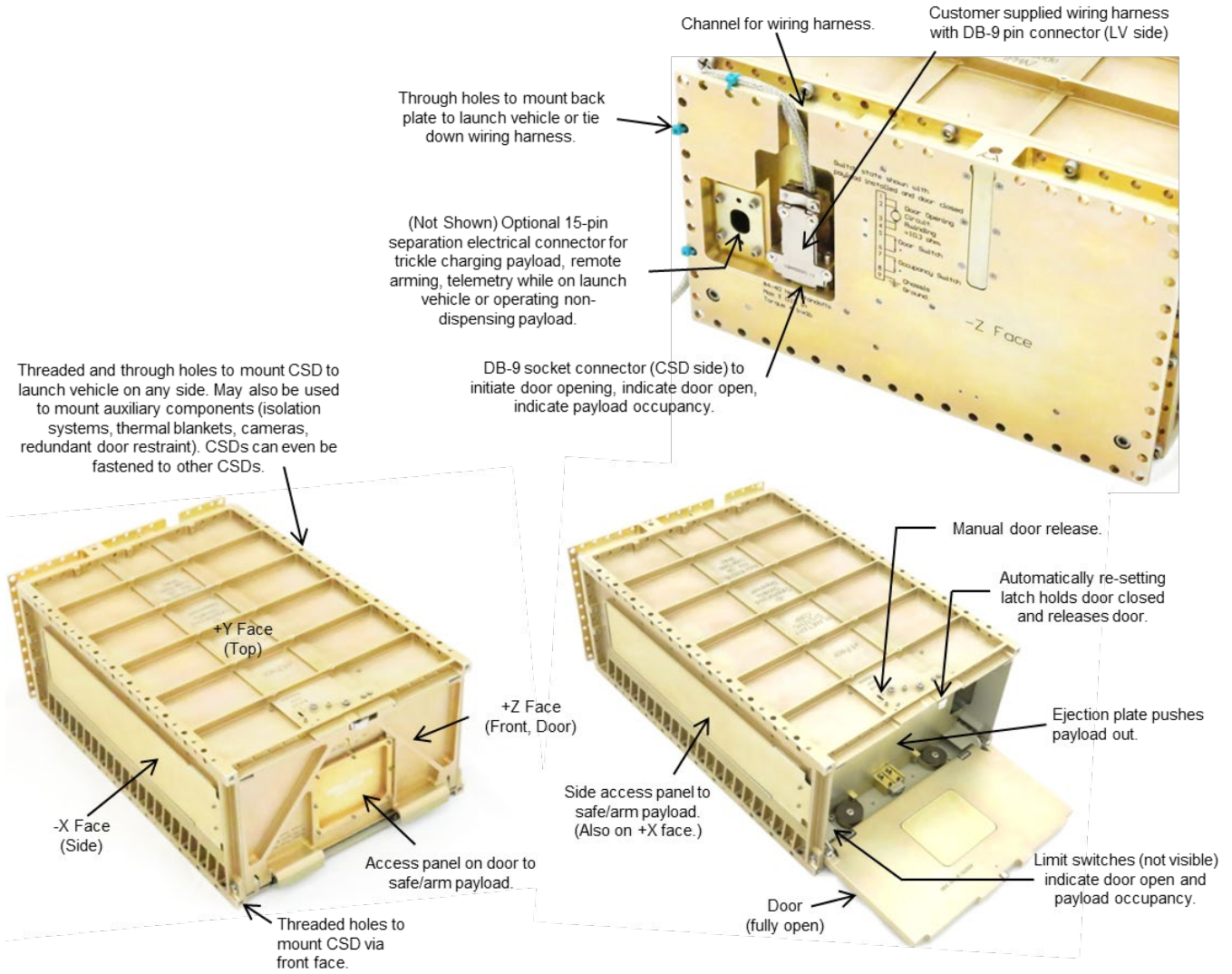
There are two CSD operations.

Stowing: Installing the payload (satellite) in the CSD and closing the Door.

Deploying (Separating): Powering the CSD initiator (motor) which opens the door and allows the payload to eject.

The CSD is not ESD sensitive.

Figure 3-1: CSD Features



3.2 References

Table 3-1: References

Document	Description
2002337	CSD Data Sheet
2002367	Payload Specification
2002404	CSD Inspection Report

4. Required Equipment

Table 4-1: Required Equipment

Qty	Item
For Operating CSD	
1	CSD
1	Power supply, min 22 VDC, min 5.0 A
AR	Cables and connectors necessary to create circuit in Figure 9-1
1	Oscilloscope, 4 channel, isolated channels preferred but not required
3	Voltage probes for oscilloscope
1	Current probe for oscilloscope, 4.0 A DC capability (Tektronix A622 has proven effective)
1	Adjustable timer relay with trigger, 0.10 sec duration in 0.01 sec increments (Macromatic TD-78122 has proven effective)
1	Trigger switch (minimum 7A & 34V)
1	10 ohm power resistor, ≥100 W, used to simulate CSD motor (Dale HL-100-06Z-10R00-J-J or similar)
2	>50 ohm resistor to measure CSD switch state
1	DMM with leads
1	DB-9 pin breakout cable to measure CSD resistances
1	5/64 inch hex key to attach Access Panels
1	3/32 inch hex key to install Separation Connector
1	Torque screwdriver with fitting for above hex keys, 4 in*lb capability
2	Small bag or pan to temporarily contain small fasteners
1	Conveyor to allow complete payload separation (optional)
1	Extension cord
1	Small tweezers to aide in screw handling
1	Storage device to save electrical profiles
For Attaching CSD to Adjoining Structure (all faces except +Z)	
AR	0.19-32 (#10) UNF SHC screws to attach CSD to adjoining structures, length and quantity will vary depending on mounting face
AR	Washers for #10 screws (McMaster-Carr PN 93574A438 or similar), max OD is 0.33 in
1	5/32 inch hex key (minimum 1.5 inch shank length)
1	Torque wrench w/ 3/32 inch ball drive hex key, 4 in*lb
1	Torque wrench w/ 5/32 inch ball drive hex key, 50 in*lb
1	Small tweezers to aide in screw handling
1	Feeler gauges to verify flatness of adjoining structure, 0.002-0.025 inch range suggested
1	Grease (vacuum compatible) for mounting screw threads

5. Warnings

Violating any of the below voids the warranty (PSC Doc 1001015).

1. ALL technicians completing this procedure shall be trained directly by PSC and given authority to operate their specific CSD (PN, revision and SN).
2. The CSD shall only be operated using this procedure. This procedure shall be filled out for every operation. Steps shall not be skipped or modified.
3. If a CSD ever fails to operate correctly, PSC shall be contacted immediately for recommendations and troubleshooting techniques. Subsequent operations shall not be attempted without first understanding the cause of the initial failure.

6. Handling Precautions

The CSD, while robust, is a precision space-flight mechanism and shall be treated with care. Special caution should be exercised around the following areas.

1. Do not impact the corners of the $-Z$ mounting flange against a table or floor as they may yield. This is especially true when a payload is installed as the CSD becomes quite heavy. See Figure 6-1.
2. Do not drop the payload into the CSD during vertical installation. Slowly lower the payload into the CSD until it is fully installed. See Figure 6-2.
3. Do not contact the sheet metal cover around the Latch mechanism. Yielding this cover may inhibit CSD operation. See Figure 6-3.
4. Do not contact the Ejection Springs or the precision guide rail. See Figure 6-4.

Figure 6-1: Corners of $-Z$ Mounting Flange may Yield from Impact.

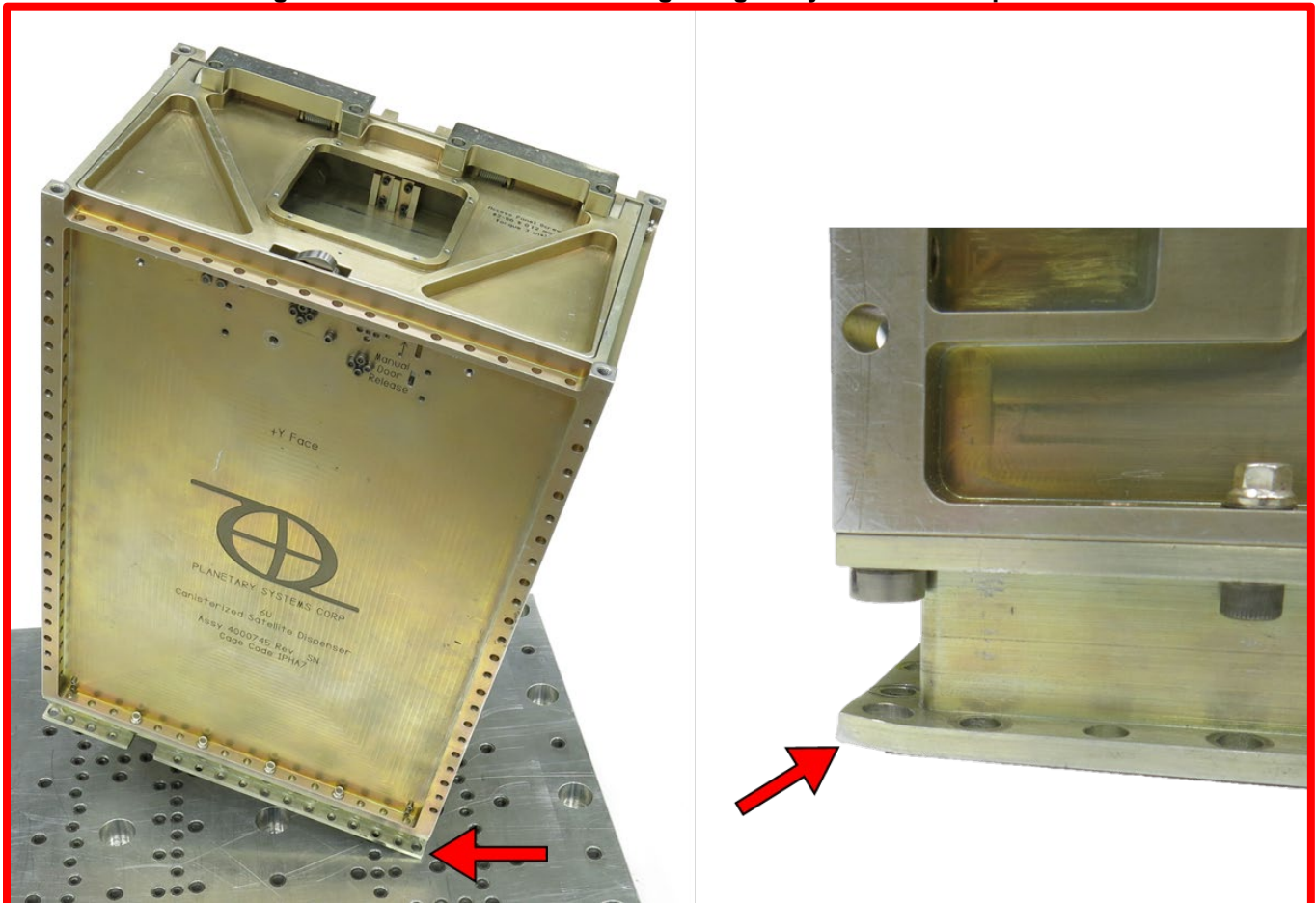


Figure 6-2: Do Not Drop the Payload into the CSD

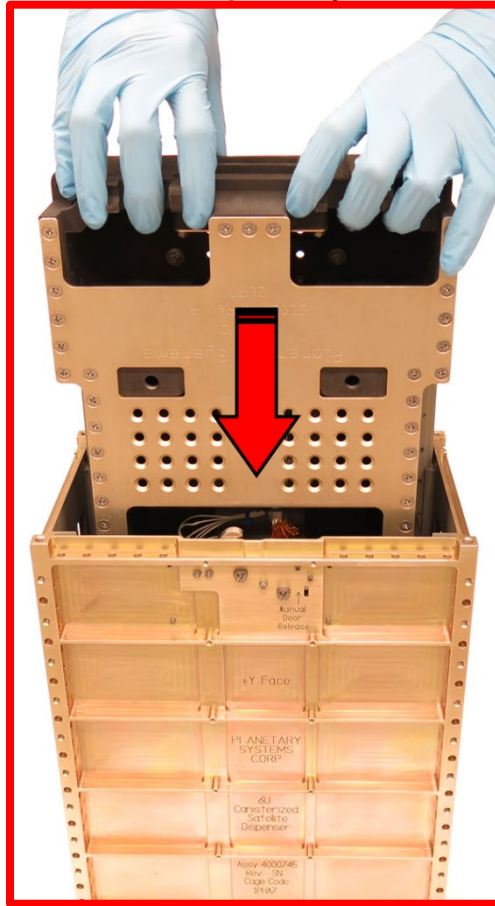
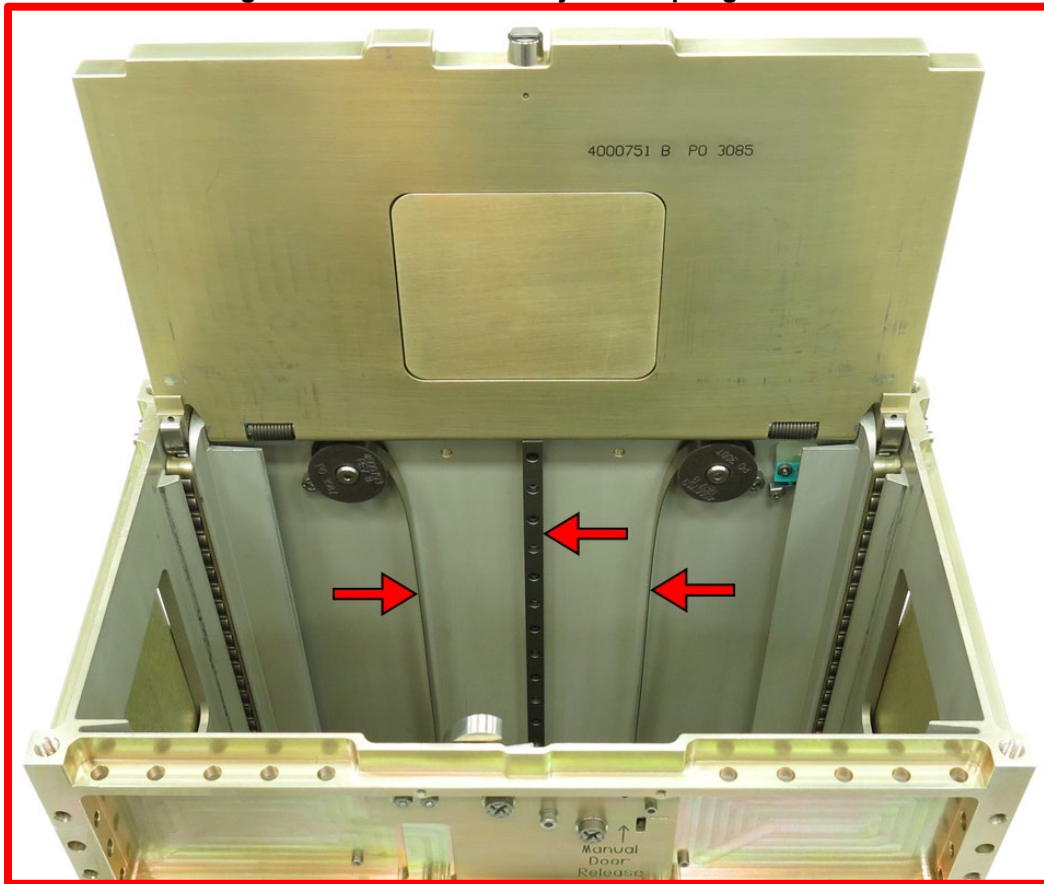


Figure 6-3: Do Not Contact the Latch Cover.



Figure 6-4: Do Not Touch Ejection Springs or Rail



7. Fastening CSD to Adjoining Structure

This section details how to fasten the CSD to the adjoining structure. It may be completed before or after stowing the CSD.

Step	Procedure	Date, Time & Initials	
		Tech.	QA
7.1.1	<p>Determine via which face the CSD is being fastened. Gather the required screws, shims, and wrenches. Remember that normal washers do not fit in the CSD. Use shims as listed in Table 4-1 or custom reduced diameter washers. See Figure 7-1, Figure 7-2, and Section 12 for tips on torquing methods.</p> <p>Notes:</p> <ol style="list-style-type: none"> 1. If using the threaded holes on the CSD be cognizant of potential galling or seizing. Greasing the threads is recommended. 2. If attaching CSD via +Z (door) face, contact PSC to ensure proper Door clearance. 		
7.1.2	Place the CSD on the adjoining structure and apply a light normal force to the CSD. Verify flatness of the adjoining structure by using a feeler gauge. A 0.006 inch thick gage shall not fit under any portion of the CSD.		
7.1.3	Examine the gap between the Door and Walls of the CSD. Verify there is a gap (>0.002in) around all 3 sides of the Door. See Figure 7-3.		
7.1.4	Fasten the CSD to the adjoining structure. See Figure 7-1 and Figure 7-2		
7.1.5	Examine the gap between the Door and Walls of the CSD. Verify a gap (>0.002in) remains around all 3 sides of the Door. See Figure 7-3. An elimination of the clearance indicates warping of the CSD and the payload could hang-fire if this is not corrected.		

Figure 7-1: Using Ball Driver to Fasten CSD via -Y Face



Figure 7-2: Using Custom Wrenches to Fasten CSD via -Z Face

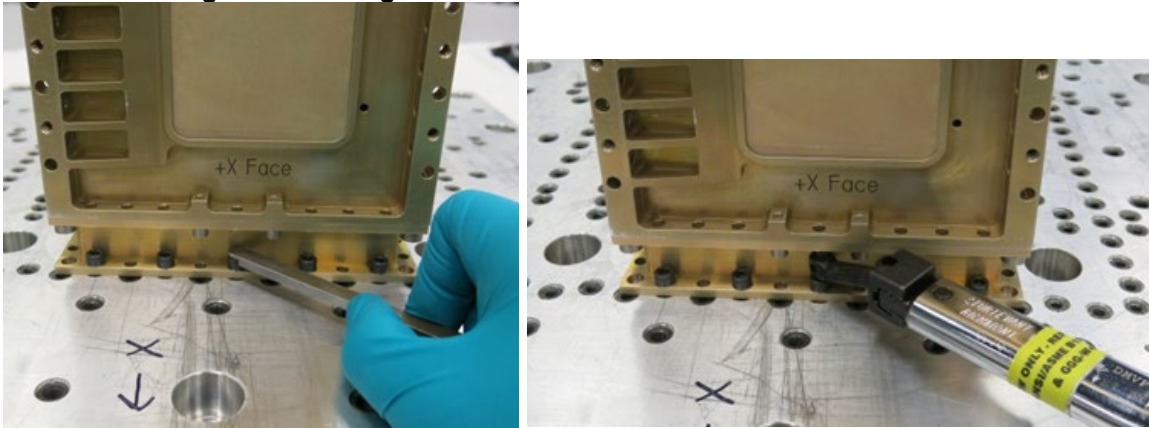
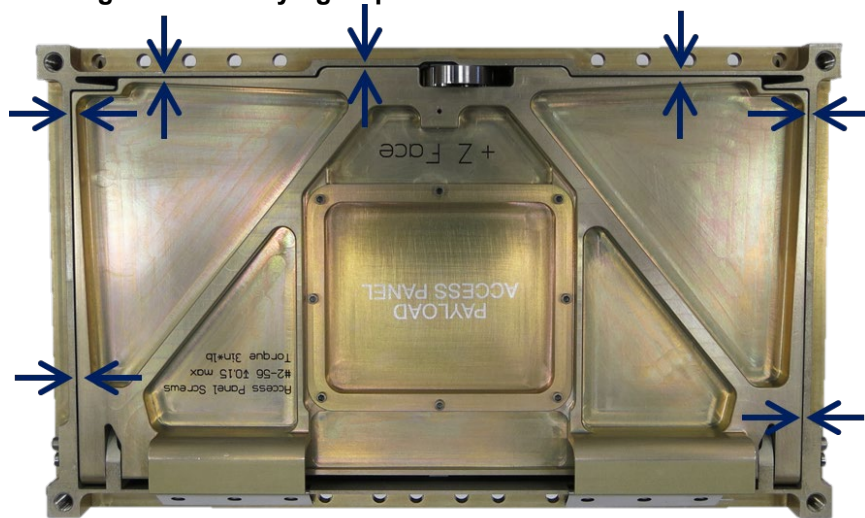


Figure 7-3: Verifying Gap Between Door and Walls of CSD



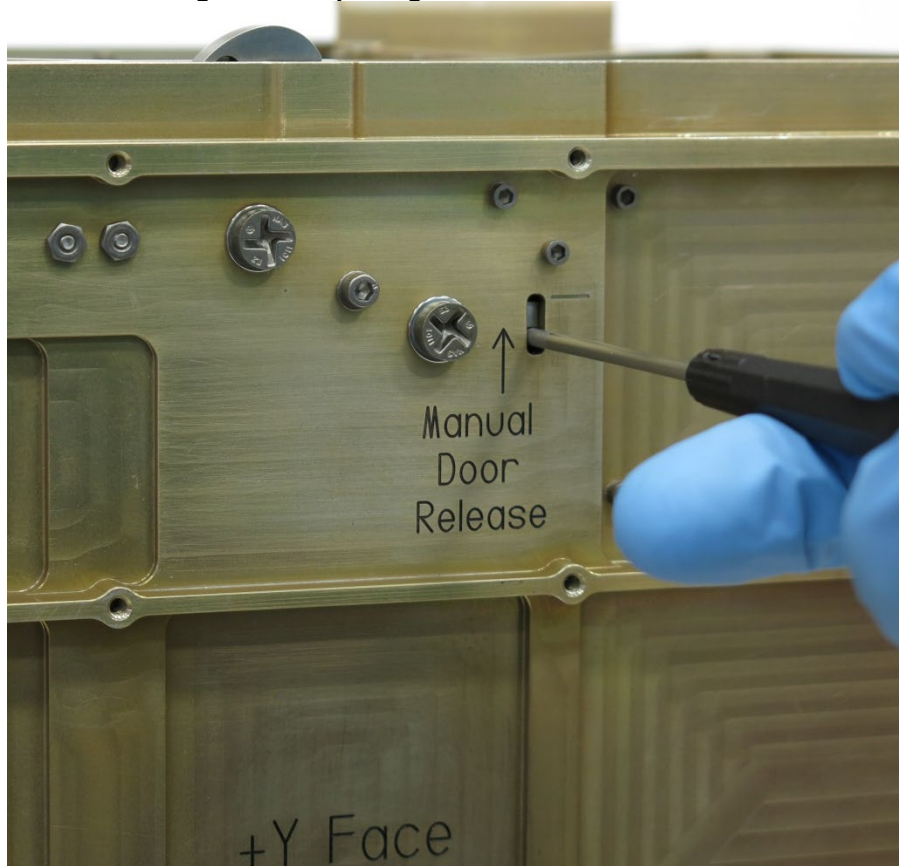
8. Stowing the CSD

This section lists the steps required to install a payload in the CSD and close the Door. The CSD need not be fastened to adjoining structures to install payload.

8.1 Preparing the CSD to be Stowed

Step	Procedure	Date, Time & Initials	
		Tech.	QA
8.1.1	Only PSC trained personnel may operate the CSD. Verify that training is complete and authorizes the operation of this specific CSD assembly number, revision and serial number.		
8.1.2	<p>The CSD Door shall be open. If not, open it using one of the following methods:</p> <ul style="list-style-type: none"> a) Carefully insert a hex key or screwdriver <0.10 inch wide in manual release slot and pull up on Latch Lock with approximately 5 lbf. See Figure 8-1 below. The tool can be inserted about 0.35 inches before stopping against an internal cover. b) Power CSD initiator via Section 9. <p>Caution: Check occupancy switch resistance to determine if payload is installed (See Section 10). If payload is installed be prepared to properly stop payload per Section 9.</p>		

Figure 8-1: Opening Door via Manual Release



Step	Procedure	Date, Time & Initials	
		Tech.	QA
8.1.3	With the Door open, measure and record the 'Deployed' resistances per Section Table 10-1. Contact PSC if any value exceeds allowables.		
8.1.4	Examine the Manual Door Release slot. The Latch Lock shall be completely below (on -Z side of) the indicator line per Figure 8-2. If it is not, power the CSD initiator per Section 9. Re-examine the Latch Lock position. If it still does not comply contact PSC.		

Figure 8-2: Latch Lock Position. Image on Left is Acceptable. Middle & Right are Not Acceptable.



Step	Procedure	Date, Time & Initials	
		Tech.	QA
8.1.5	<p>If desired, one or both Side Access Panels can be temporarily removed. It may be beneficial to see and/or hold the payload as it is being installed in the CSD.</p> <p>Remove the Side Access Panel(s) as follows:</p> <ol style="list-style-type: none"> 1. Remove the 2-56 SHC Screws, if present, with a 5/64 inch hex key. See Figure 8-3. Be careful not to drop washer if attached. Bag hardware and catalog. 2. Carefully bend end of Access Panel just until it clears flange on CSD, then pull Access Panel out of restraint groove. See Figure 8-4. 		
8.1.6	<p>If desired, the Door Access Panel may be temporarily removed. It may be beneficial to see the front of the payload and verify clearance after the Door is closed.</p> <p>Remove the Door Access Panel by removing the 2-56 SHC Screws with a 5/64 inch hex key. Be careful not to drop washers if attached. Bag hardware and catalog.</p>		

Figure 8-3: Removing Side Access Panel Screws

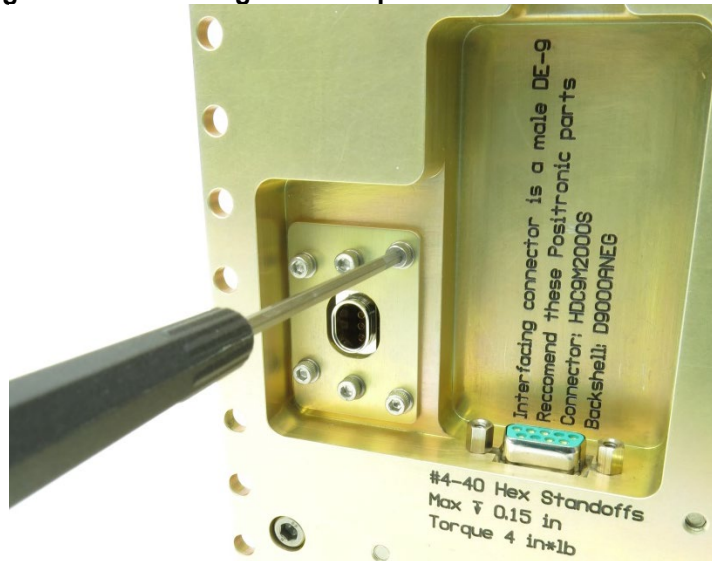


Figure 8-4: Removing Side Access Panel



Step	Procedure	Date, Time & Initials	
		Tech.	QA
8.1.7	<p>Remove the Separation Electrical Connector from the CSD. Use a 3/32 inch hex key to remove the four 4-40 SHC screws securing the connector plate to the -Z face. See Figure 8-5.</p> <p>Note: This step can be skipped if ALL of the following are true.</p> <ol style="list-style-type: none"> 1. This payload has been previously installed in this CSD with both Separation Connector halves installed. 2. The payload's Separation Connector has not been loosened or removed. 3. The CSD's Separation connector has not been loosened or removed. 		

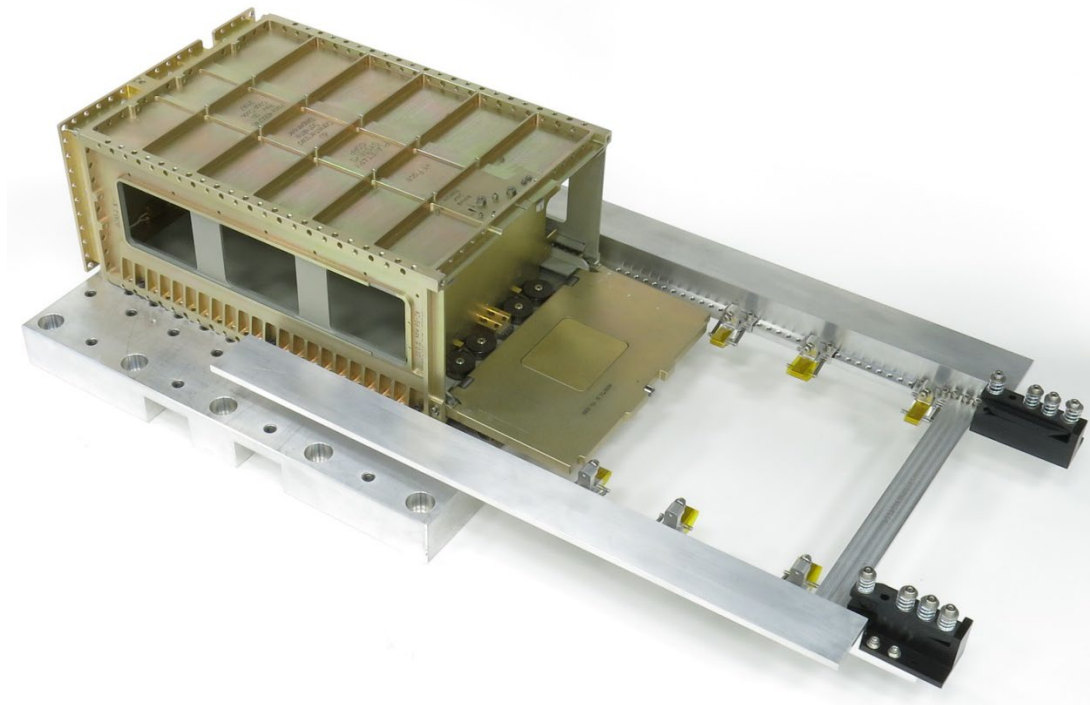
Figure 8-5: Removing Lower Separation Connector from CSD



8.2 Stowing the CSD

Step	Procedure	Date, Time & Initials	
		Tech.	QA
8.2.1	Record which revision of the Payload Specification, 2002367, the payload being installed complies with. Payload Complies with 2002367 Rev ____ Verify the CSD complies with that revision. If unsure contact PSC.		
8.2.2	Determine if the payload will be installed with the CSD oriented horizontally or vertically. If vertically, ensure there are features to grab the payload until it is completely installed. Grabbing the outside of the payload usually does not work as the installer's fingers will contact the CSD prior to the payload being fully installed.		
8.2.3	Determine if a conveyer will be used when the CSD is deployed. If so, attach the conveyer to the CSD now. See Figure 8-6 for an example. Place the payload on the conveyer and ensure the payload slides smoothly into the CSD. This ensures the payload will properly deploy from the CSD. Improperly setting the conveyer height or angle may prevent full payload ejection or damage the payload's tabs.		

Figure 8-6: Separation Conveyor Attached to CSD



Step	Procedure	Date, Time & Initials	
		Tech.	QA
8.2.4	<p>Installing payload in CSD:</p> <ol style="list-style-type: none"> 1. Designate a 2nd person to stabilize the CSD while the payload is being installed. 2. Verify payload tabs are clean. 3. Verify proper payload orientation prior to installing. -Z end shall enter first. +Z end shall face CSD Door. Insert payload into CSD taking care to align tabs with flanges in CSD. Also ensure payload and CSD planes remain parallel to prevent damage to the payload's tabs. See Figure 8-7. 4. Push payload into the CSD until it is fully installed. <ol style="list-style-type: none"> a. If the CSD is oriented horizontally, force must be continually applied to counteract the CSD's ejection force. b. If the CSD Separation Connector is present, ensure sufficient force is applied to the payload to fully mate the Connector halves. c. If a handle was attached to the payload to aid vertical installation, remove the handle once the payload is fully installed. 5. Verify the payload and its tabs do not protrude beyond the flange on the CSD more than 0.01 inches in the +Z direction. See Figure 8-8. If the payload is too long or not fully installed the CSD will be damaged during Door closure. 6. While pressing on the payload, close the CSD Door approximately 45 deg. At this point the payload is clamped to the CSD and will not move. See Figure 8-9. 7. Completely close the Door. Using a thumb, push the Latch closed until a 'click' or 'ping' is heard. See Figure 8-10. 		

Figure 8-7: Ensure Payload is Aligned with CSD during Installation

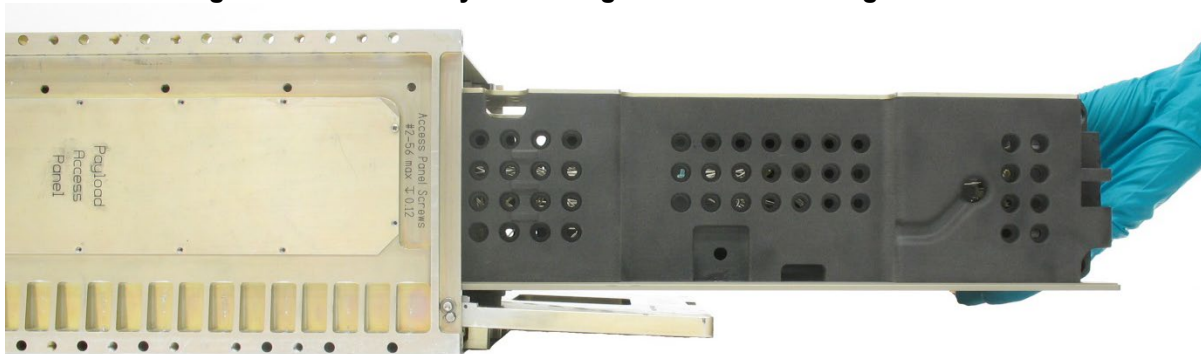


Figure 8-8: Verify Payload Tab Does Not Protrude Beyond CSD Flange More Than 0.01 inches

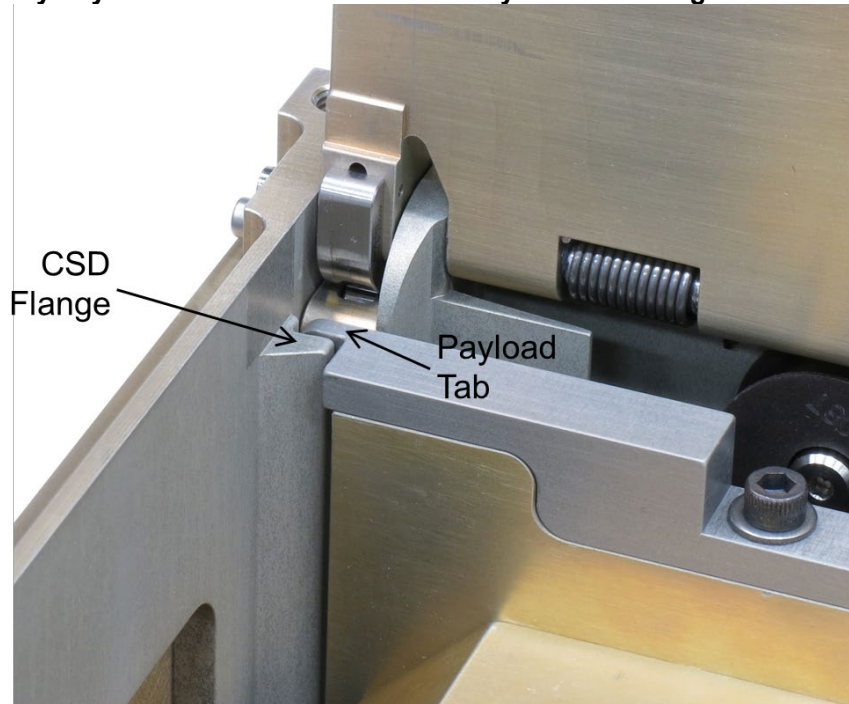


Figure 8-9: Press on Payload While Closing Door



Figure 8-10: Close Door Latch with Thumb



Step	Procedure	Date, Time & Initials	
		Tech.	QA
8.2.5	<p>Verify the payload is properly installed:</p> <ol style="list-style-type: none"> 1. Push the Door further closed. There shall be approximately 0.030 inches of movement even after the Latch is closed. A lack of movement signifies the payload is jammed against the Door. Contact PSC for troubleshooting. 2. Verify the Latch Lock is below the indicator line next to the manual door release cutout. See Figure 8-11. If above the line, the Door Latch is not properly closed. Contact PSC for troubleshooting. 		

Figure 8-11: Proper Latch Lock Position after Door Closure



Step	Procedure	Date, Time & Initials	
		Tech.	QA
8.2.6	Measure and record the 'Stowed' resistances per Section 10 record in Table 10-1. Contact PSC if any value exceeds allowables. Also verify all payload inhibit switches are open.		
8.2.7	<p>Separation Electrical Connector Installation:</p> <ol style="list-style-type: none"> 1. Attach Lower Separation Connector to Connector Plate with 4-40 X 0.31 UNC SHC screws and washers. Typically Connector should be oriented with PSC logo on side of Plate labeled 'Connector Logo Here'. See Figure 8-12. However examine Upper Connector on the payload to verify proper alignment. See Figure 8-13. It is acceptable to rotate the Lower Connector 180 deg (PSC logo away from engraving) if necessary. Tighten screws until they contact Plate and then back off ~1/4 turn to allow connector to translate on Plate. See Figure 8-14. 2. Insert Connector through cutout in CSD Back Plate and ensure Connectors align. Push only on Connector Plate and verify the following per Figure 8-15. If either is false the payload's Upper Connector is improperly located. <ol style="list-style-type: none"> a. Connector Plate makes flush contact with CSD Back Plate. b. All 4 threaded mounting holes on the CSD Back Plate are entirely visible through the Connector Plate clearance holes. 3. Loosely secure Connector Plate to CSD Back Plate with 4-40 X 0.31 SHC Screws and Washers. Screws shall go in easily without rubbing against Plate clearance holes. 4. Hand tighten Connector to Plate and Plate to CSD. Then torque all screws 3-4 in*lb. See Figure 8-16. 		

Figure 8-12: Lower Connector Attached to Connector Plate



Figure 8-13: Typical Payload Separation Connector Orientation (PSC Logo Outward)

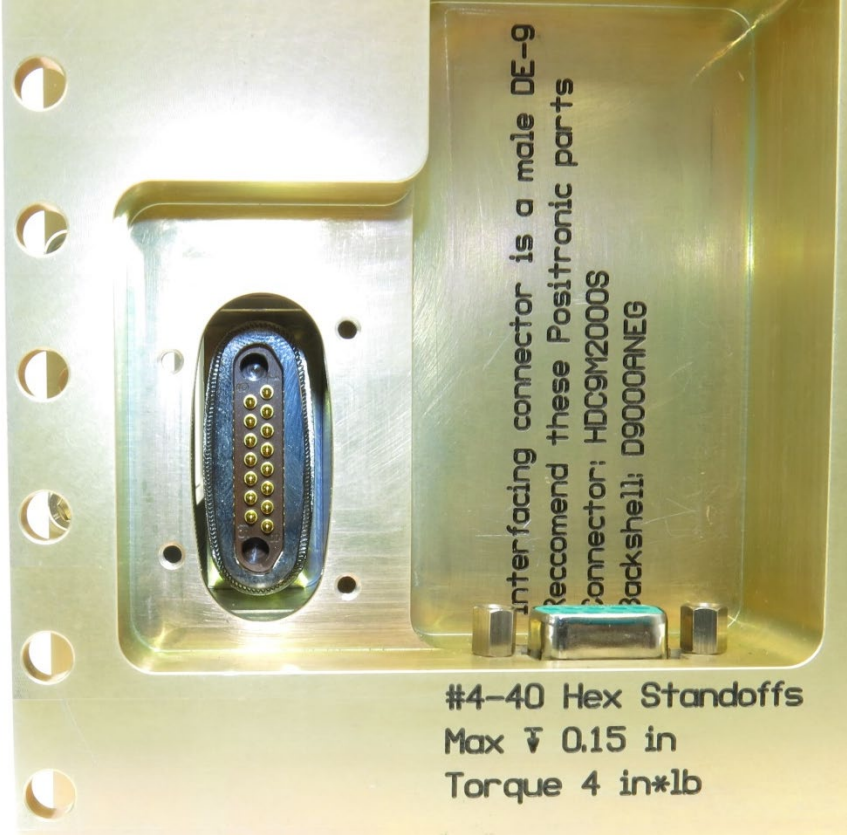


Figure 8-14: Loosely Attach Lower Connector to Plate

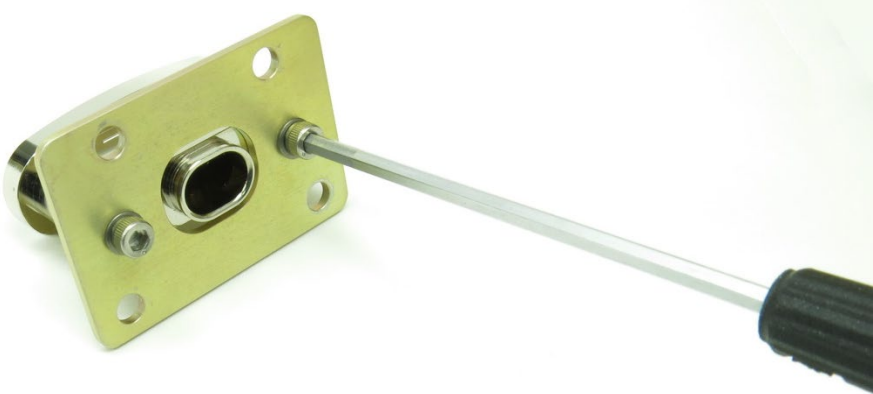
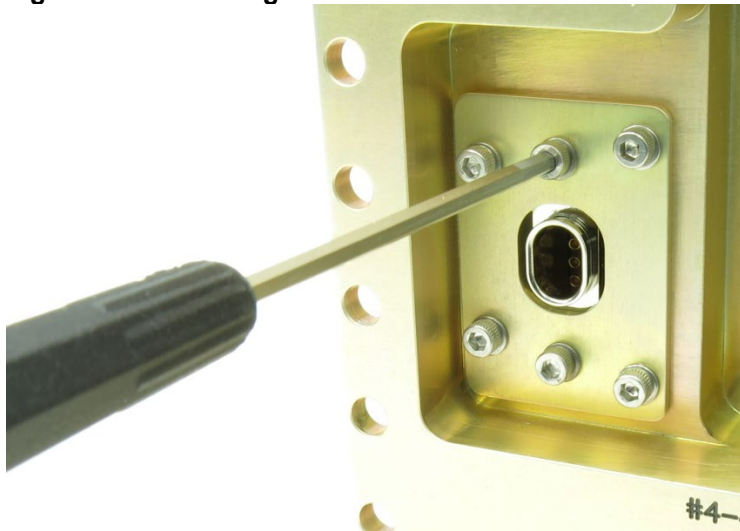


Figure 8-15: Ensuring Connector Alignment



Figure 8-16: Securing Connector to Plate and Plate to CSD



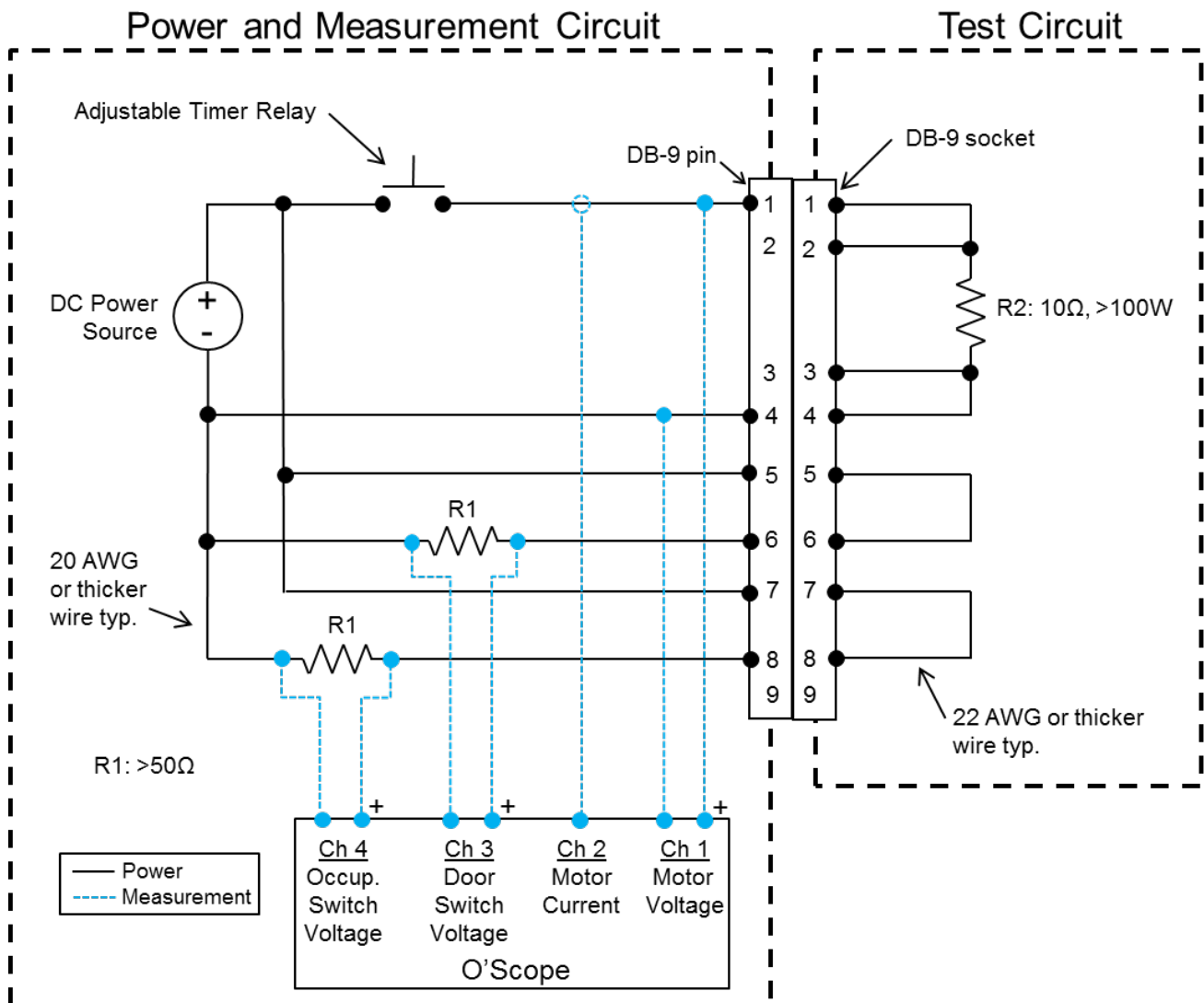
Step	Procedure	Date, Time & Initials	
		Tech.	QA
8.2.8	<p>Side Access Panel Attachment:</p> <ol style="list-style-type: none"> 1. Determine if optional restraint screws will be used to secure the Side Access Panel. If no, the small tab shall point inward. If yes, the tab may point inward or outward. 2. Slide Access Panel in restraint groove of CSD. Carefully bend the panel only enough to clear the flange on the CSD. Excessive bending will yield the Panel. 3. If Panel tab is pointed outward, secure Panel with at least one 2-56 X 0.19 SHC Screw and Washer using a 5/64 inch hex key (two holes are present in case one gets damaged). Torque 3 in*lb max. 		
8.2.9	<p>Door Access Panel Attachment:</p> <p>Secure Panel to Door with 2-56 X 0.19 SHC Screws using a 5/64 inch hex key. Washers are optional. Only 4 of the 8 Screws are required. All 8 can be used if desired (extra holes are available in case one is damaged). Torque 3 in*lb max.</p>		

9. Deploying the CSD

This section lists the steps required to deploy the CSD and eject the payload.

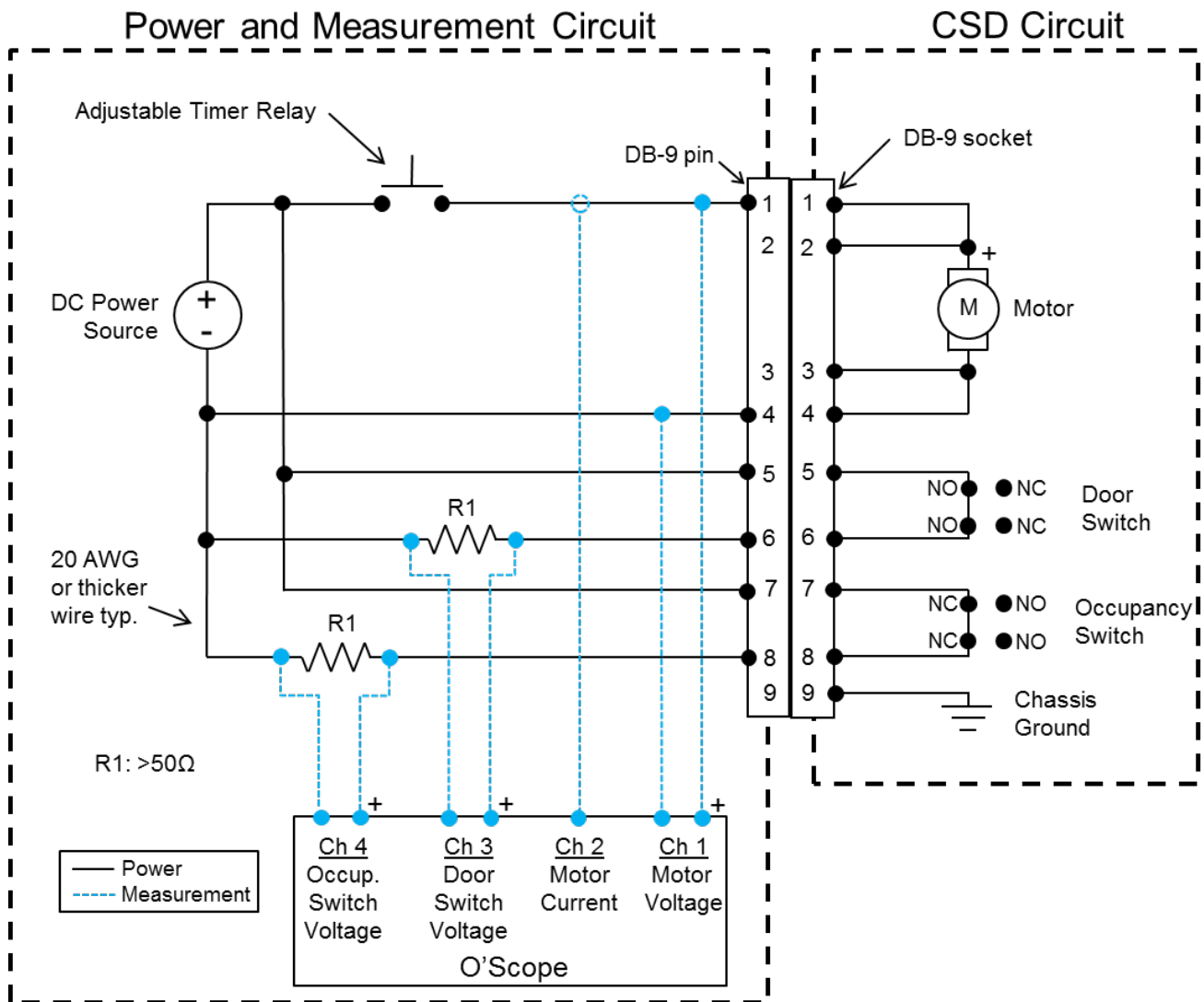
Step	Procedure	Date, Time & Initials	
		Tech.	QA
9.1.1	Verify data acquisition system can record voltage and current per the following requirements: <ol style="list-style-type: none"> 1. Sample rate: 1,000 Hz minimum 2. Voltage resolution: 0.2 V maximum 3. Current Resolution: 0.02 A maximum Caution: If oscilloscope or data acquisition (DAQ) measurement channels share common ground be cognizant of their effect on the circuit.		
9.1.2	Set up the 'Power and Measurement Circuit' portion of the Deploy Test Circuit per Figure 9-1. Ensure the test resistors, R1, have sufficient power capability.		
9.1.3	Verify the resistance between the power supply (PS) and CSD connector is less than 1.0 ohm for the motor circuit. This applies to the complete loop (PS to pin 1 and return from pin 4).		
9.1.4	Set up the 'Test Circuit' portion of the Deploy Test Circuit per Figure 9-1.		

Figure 9-1: Deploy Test Circuit



Step	Procedure	Date, Time & Initials	
		Tech.	QA
9.1.5	Set the timer relay to apply power for 0.10 ±0.02 sec.		
9.1.6	Set the power supply voltage at 22 to 34 Vdc. When possible use the minimum voltage as this maximizes the CSD's operating life.		
9.1.7	Set the current limit on the power supply to 5.5 ±0.5 A.		
9.1.8	Turn on the power supply output. Then activate the timer relay. Verify the following: <ol style="list-style-type: none"> 1. Voltage and current were recorded per step 9.1.1. 2. 'CSD motor' voltage meets requirements in step 9.1.6. 3. 'CSD motor' current is 1/10 of applied voltage. 4. Timer relay applies power per step 9.1.5. <p>If any parameters are not met, make the required changes and run the test circuit again.</p>		
9.1.9	Turn off power supply output. Then remove the Test Circuit and connect the CSD to the 'Power and Measurement Circuit' per Figure 9-2.		

Figure 9-2: Deploy CSD Circuit



Step	Procedure	Date, Time & Initials	
		Tech.	QA
9.1.10	Orient CSD for deploying. Designate one person to restrain CSD (if not bolted to structure) and another person to stop payload (if a payload conveyor brake is not used).		
9.1.11	Ensure timer relay is inactive then turn on the power supply output. This will send current through the CSD's limit switches.		
9.1.12	When ready activate the timer relay to deploy the CSD. If a conveyor is not utilized, stop the payload by hand prior to fully exiting the CSD to prevent damage to either item. After stopping, allow the payload to fully eject while supporting by hand to ensure it remains aligned with CSD (depending on payload mass and CSD orientation, payload may need to be pulled out of CSD to verify separation).		
9.1.13	Turn off the power supply.		
9.1.14	Save the voltage and current profiles. It is acceptable to take a picture of the oscilloscope screen; however raw data and high fidelity graphs are preferred. Verify picture focus prior to deleting/refreshing screen.		
9.1.15	Figure 9-3 shows a sample deploy electrical profile. Complete Table 9-1 to verify all parameters are within tolerance. Single data point exceedances are acceptable. Also, a slow sample rate may alias data. Contact PSC if a discrepancy is found.		
9.1.16	Figure 9-4 shows the deployed CSD switch state. Measure resistance directly at the CSD's DB-9 connector and complete Table 10-1. Contact PSC if a discrepancy is found.		

Figure 9-3: Sample Deploy Electrical Profile

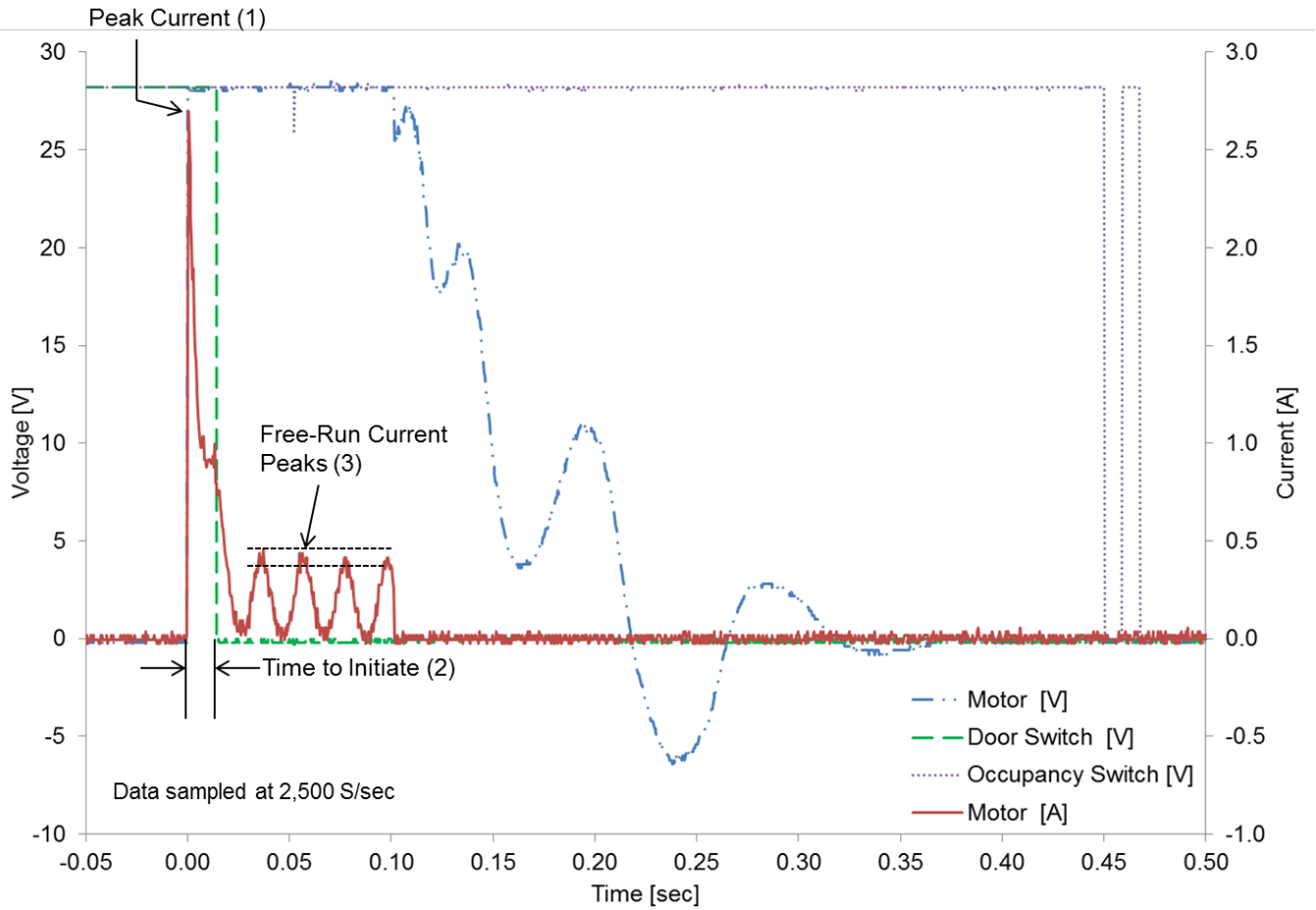
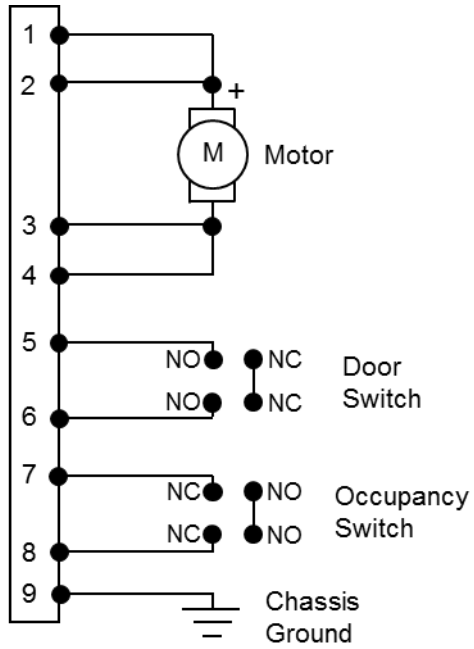


Table 9-1: Deploy Electrical Verification

Item	Description	Units	Allowable		Actual
			Min	Max	
1	Peak Current	A	2.0	3.9	
2	Time to Initiate	sec	0.010	0.025	
3	Free-Run Current Peaks*	A	0.30	0.80	

*Record range of Free-Run Current Peaks

Figure 9-4: Deployed CSD Switch State



10. CSD Electrical Verification

Measuring the electrical resistance of the CSD motor and switches helps verify functionality. Take the measurements directly at the CSD electrical interface (DB-9 socket connector). Contact PSC and do not operate the CSD if any value is out of spec. A DMM will not cause damage to or operate the CSD. Motor resistance may vary slightly depending on commutator position. If using a milliohm meter with a four wire Kelvin probe system ensure the applied current is ≤ 0.01 A. This ensures the Motor will not rotate and open the CSD Door.

Table 10-1: Resistance Measurement

CSD State	Object Being Measured	Pin Connections	Resistance [ohm]		Date & Initials
			Allowable	Measured	
Stowed	Motor	1 & 4	8.0 – 11.0		
	Motor	2 & 3	8.0 – 11.0		
	Door Switch	5 & 6	<0.3		
	Occupancy Switch	7 & 8	<0.3		
	CSD Ground	9 & CSD	<0.3		
Deployed	Motor	1 & 4	8.0 – 11.0		
	Motor	2 & 3	8.0 – 11.0		
	Door Switch	5 & 6	>1E6		
	Occupancy Switch	7 & 8	>1E6		
	CSD Ground	9 & CSD	< 0.3		

11. Final Integration Tasks



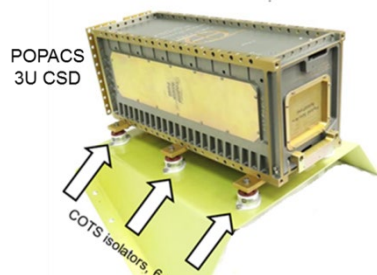
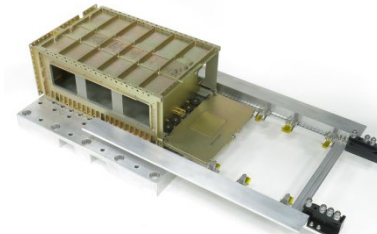
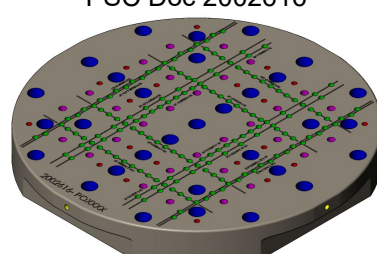
If the CSD is being integrated for flight the following tasks are recommended by PSC.

Take pictures of the following.

1. Latch position.
2. Latch Lock position in Manual Release slot.
3. Side Access Panels in restraint grooves and with restraint screws (if used).
4. Door Access Panel.
5. Separation Electrical Connector on Back Plate.
6. LV DB-9 connector secured to CSD with harness strain relief.

12. Best Practices and Lessons Learned

PSC has been operating and supporting CSDs for many years. During that time many valuable techniques have been implemented to make operating the CSD easier. The following is a table of best practices and lessons learned. These are not required for proper CSD operation. PSC will not directly supply any of the items listed below, however CAD models, production drawings, or reference part numbers may be available upon request.

Tip #	Step(s)	Best Practice / Lesson Learned	References
1	7.1.1	If attaching the CSD via the -Z face, custom wrenches are useful given the limited clearance. PSC uses one wrench to start the fastener and then a custom head on the torque wrench for final torquing.	<p>PSC Doc 2002399</p>  <p>PSC Doc 2002401</p> 
2	7.1.2	<p>Isolation systems are invaluable and serve the following benefits:</p> <ol style="list-style-type: none"> 1. Reduce shock and vibratory loading on CSD and payload. 2. Accommodate non-flat interfacing structures. <p>Contact PCS for recommendations on isolation systems.</p>	<p>POPACS 3U CSD</p>  <p>COTS Isolators, 6 x</p>
3	8.2.3	PSC uses a conveyor that enables complete payload separation and automatically restrains the payload. It is critical to verify complete deployment of the payload during environmental testing.	<p>PSC Doc 2002397</p> 
4	-	PSC recommends use of a precision interface plate during vibration testing. This ensures proper flatness and EDE control.	<p>PSC Doc 2002616</p> 

13. Setup Pictures

The picture below shows the typical equipment required to operate the CSD and record the electrical telemetry.

Figure 13-1: CSD Operating Equipment

