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FM Deployment Switch Assembly Procedure



Date	Revision Number	Writer	Annotations
2024/03/04	1	Zamba Leonel	Initial Release
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1. Introduction

This document shall be used as a guide to facilitate the deployment switch screening for BIRDS-X Satellite Project (Dragonfly). The test criterion and the procedure for screening are illustrated with relevant images and a checklist of parts, tools and fasteners utilized.

2. Reference Documents


- [1] JX-ESPC-101133-D JEM Payload Accommodation Handbook. Vol 8.

3. Requirements




- A. The switch meets the JAXA requirements as stipulated on section 2.2.1 of **JX-ESPC-101133-D JEM Payload Accommodation Handbook. Vol 8.**
A satellite shall employ fault-tolerant design according to Section 1.3.1 (12) SSP51700, because a safety feature prevents the activation of the satellite while it is stored in the Satellite Install Case or Satellite Launch Case from launch to satellite deployment by J-SSOD
- B. It is also required that the switches have a zero Ohms at the point when the switch is depressed.
- C. During assembly of critical subsystem, at least one member of the critical sub-system must be present. A critical sub-system in this case shall refer to any sub-system that requires a separate assembly protocol other than indicated in this document.
- D. If you're unsure about any part of the procedure, ask the structure subsystem responsible. Do not proceed with assembly if you do not understand a step.
- E. Carefully read and observe every precaution documented for each stage of the test procedure (if any).

4. Tools used

Table 1: Tools for Switch Screening

Serial	Name	Picture
1	Vernier Caliper	

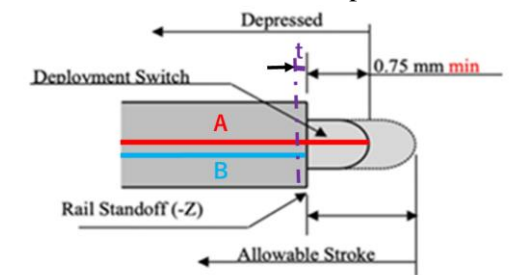
BIRDS-X_DEP_SWITCH SCREENING

2	Multimeter	 <p>A yellow and black Fluke digital multimeter is shown next to its test leads. The multimeter's LCD screen displays '02.98 DC'. The test leads consist of a black probe and a red probe, both with alligator clips at the ends.</p>
3	Digital Micro scale	 <p>A small, rectangular digital micro scale with a stainless steel body. It features a large, flat weighing platform on the left and a digital LCD display on the right showing '0.000'. Below the display are two circular buttons.</p>
4	Table mount vice clip	 <p>A heavy-duty metal table mount vice clip. It has a large, rectangular base with a threaded rod and a large nut at the bottom for securing it to a table. The main body of the clip is L-shaped, with a vertical section that holds a horizontal clamping arm. The clamping arm has a threaded rod with a conical end for gripping workpieces.</p>

5	Crocodile clips	
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5. Switch requirements

- 1) When one of the deployment switches remains depressed, its satellite shall not be activated. A switch is depressed if there is at least 0.75 mm from the end of the rail on



$$\text{Stroke} = A - (B + t)$$

Where, **A** = from the end of the switch case until the switch turns off, Depress length
B = switching case length
t = thickness of rail

Requirement

the -Z side, as shown in Figure 1.

Figure 5.1 Maximum Allowable Stroke of Deployment Switches

- 2) The total spring force of the separation spring and the deployment switches shall be 1.08 to 5.3 [N]. The spring force of one spring plunger (P/N 251D939002-1) is 0.6 ± 0.06 [N].
- 3) A satellite can have deployment switches located on the rail end surface (-Z plane) and/or the rail side surface (except for the W6U-size satellite) in order to prevent the operation of the satellite when it is stored in the Satellite Install Case.
- 4) The tip of a deployment switch on the side of the rail shall be R2.4 or more.
- 5) Deployment switches installed on the side of the rail shall not affect deployment conditions, such as significantly reducing the deploy velocity.
- 6) The deployment switches located on the end surface of the rail (-Z plane) are shown in Figure 2.

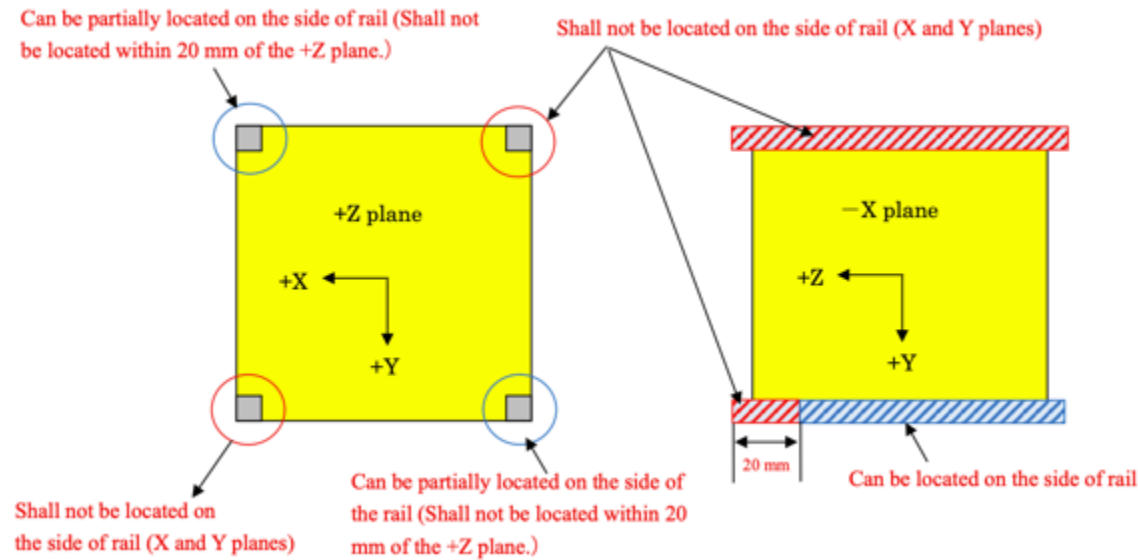


Figure 5.2 Deployment Switch position on the Rail

6 Deployment switch overview

The axonometric view of the switch is shown below (Figure 6.1)



Figure 6.1 Deployment switch (SDS002R)

5. Switch specifications

Table 2: Switch Specifications

TYPE	PRODUCT SUMMARY
Category	switch
	Snap action, limit switch
Supplier	C & K
series	SDS
Packaging	Cut tape (CT)
Parts status	Active

circuit	SPST-NC
Switch function	On-momentary
Rated current (A)	100mA (DC)
Rated voltage-DC	12V
Actuator type	Overtravel plunger
Mounting type	Surface mounting, right angle
Termination style	SMD (SMT) tab
Working force	75gf
Overtravel	0.079 inch (2.0 mm)
Operating temperature	-40 ° C to 85 ° C
Electrical life	50,000 cycles
Mechanical life	50,000 cycles

7. Stroke screening

The stroke screening was conducted in the following procedure,

- 1) Functional check: the functional check was done by checking continuity using a multimeter when the switch is depressed and when the switch is undepressed position as show in the figure 7.1 below:

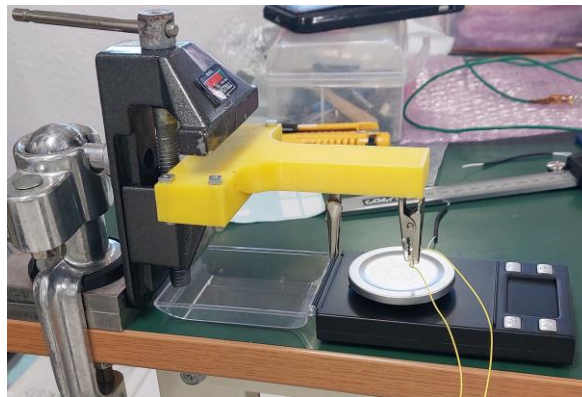


Figure 7.1: Switch Screening Setup



Figure 7.2: Screened Switches



Figure 7.3: Switch functional check

- 2) Depressed dimension measurement: the switch was connected to a multimeter while being depressed by a Vernier clippers and the point where the switch turns on and off was measured as shown in figure below:



Figure 7.4: Switch depressed position measurement

- 3) The resistance for the switch during in the depressed position was also measured

7 Measurement results

Table 3: Switch Measurements

Switch	Resistance	Depressed Length A (mm)	B the case with rail thickness	Maximum Allowable Stroke [A – (B+t)]
1	0	7.81	5.71	0.80
2	0	7.78	5.7	0.78
3	0	7.74	5.7	0.74
4	0	7.78	5.69	0.79
5	0	7.81	5.72	0.79
6	0	7.77	5.7	0.77
7	0	7.77	5.71	0.76
8	0	7.8	5.69	0.81
9	0	7.75	5.69	0.76
10	0	7.8	5.69	0.81
11	0	7.79	5.7	0.79
12	0	7.86	5.7	0.86
13	0	7.84	5.7	0.84
14	0	7.76	5.71	0.75
15	0	7.79	5.71	0.78

8 Switch Spring force measurement

The switch force was measured using a digital micro scale as shown in the figure below:



Figure 8.1: Switch functional check

The weight was measured during depression and releasing the spring to get the both activation and deactivation weight. The results are as follows:

Calculation of spring force from weight measurements:

$$l_{gf} = 0.00980665 \text{ N}$$

$$g = 9.81 \text{ ms}^{-2}$$

$$F = \text{weight} \times 0.00980665 \text{ N}$$

Here,

Total spring force is =1.08N

One spring plunger force= 0.35N

Deployment switches force= 0.73N

One deployment switch force =0.24 minimum

Table4: For FM and FM(back up) switches force test result

Switch	Resistance	Pressing Force (N)
1	0	0.42
2	0	0.5
3	0	0.47
4	0	0.52
5	0	0.46
6	0	0.49
7	0	0.56
8	1	0.51
9	2	0.5
10	3	0.48
11	4	0.49
12	5	0.53
13	6	0.51
14	7	0.49
15	8	0.45

9 Switch Selection

Table5: Best 6 selected Switches

Switch	Resistance	Releasing Force
1	0	0.10
4	0	0.14
5	0	0.14
8	1	0.18
12	5	0.16
13	6	0.19

Requirements Verification

Deployment switch release force measurement

The total spring force of the separation spring and the deployment switch on the -Z side shall be 1.08 to 5.3 [N].

※ The spring force of one spring plunger (P/N 251D939002-1) is 0.6 ± 0.06 [N].

Table6: Final selected Switches

Switch	Dragonfly	Resistance	Releasing Force
8	DepSW1	1	0.18
12	DepSW2	5	0.16
13	DepSW3	6	0.19

Total Force = $0.18 + 0.16 + 0.19 + 0.6 = 1.13$ N

Deployment switch stroke measurement

Satellite shall not be activated when either of two switches remains depressed, i.e. 0.75mm min. from the rail standoff surface.

In this test, it was confirmed that the satellite will not turn on in all conditions if the switch is released from the rail end face with the following values.

Switch stroke Measurements	1st	2nd	3rd	4th	5th
DepSW1&2	0.84mm	0.85mm	0.84mm	0.83mm	0.84mm
DepSW3	0.90mm	0.90mm	0.91mm	0.92mm	0.90mm
DepSW4	0.82mm	0.82mm	0.81mm	0.83mm	0.82mm

Conclusion

Fifteen deployment switches were tested, all passed the stroke requirements and the force requirements.