SPIRE

SUBJECT: **SPIRE LPU ELECTRICAL INTEGRATION PROCEDURE**

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DOCUMENT No: **SPIRE-RAL-PRC-002972**

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CHECKED BY: **Dominique Pouliquen** **Date:** **…….**

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Change Record

ISSUE	DATE	
0.1	17-10-07	Initial release -
0.2	15-10-07	Inserted some TBD values
		Added I/F check of P29/P30
0.3	16-10-07	Corrected pin allocations for 128-way Launch latch contacts (92 and 93)
		Added verifications that relays open as well as close
		Updated LCL and HL nomenclature to match the ASED denominations
		Removed steps which measure the polarity of the FCU Latch command current
0.4	17-10-07	Re-added steps which measure the polarity of the FCU Latch Command current
		Included SFT procedure cross referenced procedures for commanding SPIRE (also added RD 3)
		Removed references to the final mating of SIH-SS-11 and SIH-SS-13 as these steps can only be completed once the SPIRE SVM panel is closed !

Table of Contents

1. APPLICABLE/REFERENCE DOCUMENTS

Number	TITLE	Document Number	Issue
AD 1	LPU: Interface Control Document	LAM.PJT.SPI.DCI.070719_01	1.1
AD 2	Making SPIRE ESD Safe	SPIRE-RAL-NOT-002028	2
AD 3	LPU Mechanical Integration	TBW	

Number	TITLE	Document Number	Issue
RD1	Cryo Harness Interconnection Diagram SPIRE (PFM)	2547-121430-030-01-0B	B
RD2	SPIRE HARNESS DEFINITION DOCUMENT		
RD3	SPIRE FM SHORT FUNCTIONAL TEST PROCEDURES	SPIRE-RAL-PRC-2494	2.4

2. SCOPE AND INTRODUCTION

This document establishes the detailed procedure to be followed for the integration of the SPIRE LPU.

3. PERSONNEL

SPIRE Engineer
EADS Engineer
EADS PA

Spacecraft Power and Commands:

LCL #25: Prime LPU LCL
LCL #26: Red. LPU LCL

HL #5: Prime Latch hold command
HL #6: Prime Latch release command
HL #21: Red. Latch hold command
HL #22: Red. Latch release command

4. DETAILED PROCEDURE

4.1 Prerequisites

1. The black anodising has been removed from the designated area on the FCU in preparation for integration of the LPU
2. The SVM panel has been opened
3. The LPU has been delivered and has completed incoming inspection
4. The modifications to SIH-SS-11 and SIH-SS-13 (FCU P29/30) have been completed
5. All SIH-SS are mated to the DRCU (with the exception of LPU P43/44)
6. The electrical interfaces to the spacecraft (P41 and P42) carrying prime/redundant 28V power and the prime/redundant high level commands have been verified according to AD 1.

4.2 End State

The LPU has been integrated to the FCU
SPIRE is ready for the SVM panel to be closed for re-mating of the cryoharness

4.3 Test Equipment

One 128-Way Break-out Box
Two 9-Way DSub Break-out Boxes
Test leads for Break out Box
Three 10Ω ±5%, ½ W Resistance Bridge for Break-out Boxes
DVM
Isolated input Digital Storage oscilloscope

4.4 Notes

1. SPIRE is ESD sensitive. Handling of these units is to be carried out by personnel suitably trained and equipped. Prior to carrying out the mating operations detailed below, the Pxx and Jxx connectors are to put in an ionized air stream for > 30 sec to discharge the harness.

4.5 Detailed Procedure

No:	Activity	Remarks/Results	Sign off
	Spacecraft Interface Verification		
1	~~Provisional mechanical integration of LPU according to AD 3~~	Completed	
2	~~Mate FCU P41 to FCU J41 (prime spacecraft I/F)~~	Completed	
3	~~Mate FCU P42 to FCU J42 (redundant spacecraft I/F)~~	Completed	
	Initial Functional and State Test		
4	Prepare a 9-Way BOB as per §6 and mate to FCU J43		
5	Prepare a 9-Way BOB as per §6 and mate to FCU J44		
6	Send prime high-level command (HL #6) (make sure that it is isolated to start with)	DCT01170 (HLC6)	
7	Verify that the resistance between contacts 7 and 8 of FCU J43 is less than 1 Ohm	Checks that the current for the MCU latch/un-latch commands passes through the LPU OK	
8	Power on prime LPU LCL (LCL#25)	ZC102999 (LCL#25 CLOSE)	
9	Verify with a DVM that no power appears on contacts 1-9 of FCU J43 and J44		
10	Send prime high-level command (HL #5)	DCT01170 (HLC5)	
11	Measure the voltage drop across contacts 4 and 2 of FCU J43 (4 positive wrt 2) and calculate current (Pass criteria 153mA<X<185mA)		
12	Record the current being drawn by the prime LPU LCL (LCL #25) in the spacecraft TM		
13	Verify that contacts 1, 3, 5, 6, 7, 8 and 9 of J43 and J44 are unpowered		
14	Verify that the resistance between contacts 7 and 8 of FCU J43 is greater than 5 MOhm		
15	Send prime high-level command (HL #6)	DCT01170 (HLC6)	

No:	Activity	Remarks/Results	Sign off
16	Measure the voltage drop across contacts 4 and 2 of FCU J43 (4 positive wrt 2) and calculate current (Pass criteria X = 0mA)		
17	Un-power prime LPU LCL (LCL #25)	ZC142999 (LCL#25 OPEN)	
18	Send redundant high-level command (HL #22) (make sure that it is isolated to start with)	DCT01170 (HLC22)	
19	Power on redundant LPU LCL (LCL #26)	ZCA02999 (LCL#26 CLOSE)	
20	Verify with a DVM that no power appears on contacts 1-9 of FCU J43 and J44		
21	Send redundant high-level command (HL #21)	DCT01170 (HLC21)	
22	Measure the voltage drop across contacts 4 and 2 of FCU J44 (4 positive wrt 2) and calculate current (Pass criteria 153<X<185)		
23	Record the current being drawn by the redundant LPU LCL (LCL # 26)in the spacecraft TM		
24	Verify that the resistance between contacts 7 and 8 of FCU J44 is greater than 5 MOhm		
25	Send redundant high-level command (HL #22)	DCT01170 (HLC22)	
26	Measure the voltage drop across contacts 4 and 2 of FCU J44 (4 positive wrt 2) and calculate current (Pass criteria X = 0mA)		
27	Unpower Redundant LPU LCL (LCL #26)	ZCA42999 (LCL#26 OPEN)	
28	Remove 9-way BOB from FCU J43		
29	Remove 9-way BOB from FCU J44		
30	Mate LPU P43 to J43 (Final mating)		
31	Mate LPU P44 to J44 (Final mating)		
32	Demate FCU P29		
33	Demate FCU P30		
34	Mate 37-Way BOB to FCU P29		
35	Mate 38-Way BOB to FCU P30		
36	Power on Prime LPU LCL (LCL #25)	ZC102999 (LCL#25 CLOSE)	
37	Power on Red. LPU LCL (LCL # 26)	ZCA02999 (LCL#26 CLOSE)	
38	Send Prime HL #5 (hold)	DCT01170 (HLC5)	

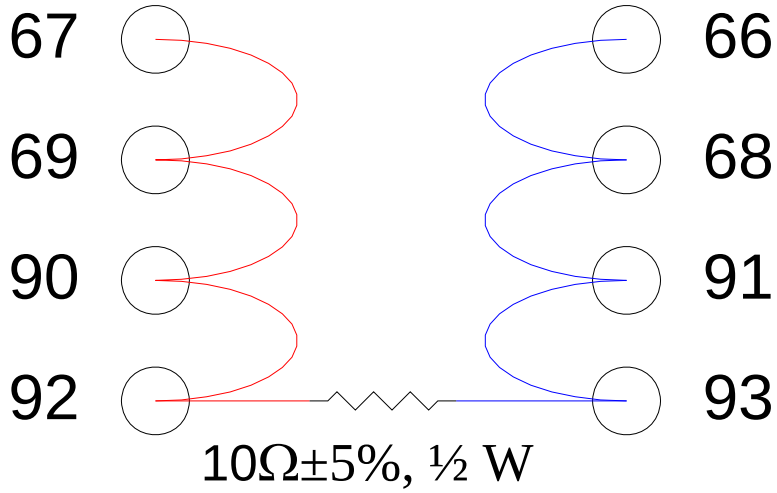
No:	Activity	Remarks/Results	Sign off
39	Send Red. HL #21 (hold)	DCT01170 (HLC21)	
40	Verify that the voltage on all contacts of FCU P29 is less than 0.1V		
41	Verify that the voltage on all contacts of FCU P30 is less than 0.1V		
42	Send Prime HL #6 (release)	DCT01170 (HLC6)	
43	Send Red. HL #22 (release)	DCT01170 (HLC22)	
44	Power off Prime LPU LCL (LCL #25)	ZC142999 (LCL#25 OPEN)	
45	Power off Red. LPU LCL (LCL #26)	ZCA42999 (LCL#26 OPEN)	
46	Mate FCU P29 to J29		
47	Mate FCU P30 to J30		
48	Prepare 128-way SMEC Launch Latch Coil Simulator according to §5 and mate to 312300 P04		
49	Power on SPIRE in prime mode	The following to be executed from SPIRE SFT procedure SPIRE-RAL-PRC-002494, issue 2.4 SPIRE-FM-SFT-DPU-ON-P SPIRE-FM-SFT-DRCU-ON-P	
50	Set SPIRE to REDY mode	The following to be executed from SPIRE SFT procedure SPIRE-RAL-PRC-002494, issue 2.4 SPIRE-FM-SFT-FUNC-MCU-01-P	
51	Connect an isolated input Digital Storage Oscilloscope to contacts 92 and 93 of the Launch Latch Simulator		
52	Send a latch command and record voltage across contacts 92 and 93 on oscilloscope (note: pulse duration 50±10 ms)	SEND_DRU_COMMAND (0x90430001,0)	
53	Power on Prime LPU LCL (LCL #25)	ZC102999 (LCL#25 CLOSE)	
54	Send prime High level command HL #5 and record voltage across contacts 92 and 93 on oscilloscope (10ms/div time base)	DCT01170 (HLC5)	
55	Verify the polarity of the voltage drop across contacts 92 and 93 is positive		
56	Verify that the current across Latch Simulator resistor is 153<X<185mA		
57	Record current drawn by Prime LPU LCL (LCL #25) in S/C TM		

No:	Activity	Remarks/Results	Sign off
58	Send prime High level command HL #6 and record voltage across contacts 92 and 93 on oscilloscope (10ms/div time base)	DCT01170 (HLC6)	
59	Unpower Prime LPU LCL (LCL #25)	ZC142999 (LCL#25 OPEN)	
60	Power off SPIRE	**The following to be executed from SPIRE SFT procedure SPIRE-RAL-PRC-002494, issue 2.4 in the order below** **SPIRE-FM-SFT-FUNC-MCU-OFF-P** **SPIRE-FM-SFT-DRCU-OFF-P** **SPIRE-FM-SFT-DPU-OFF-P**	
61	Remove 128-way SMEC Launch Latch Coil Simulator from 312300 P04		
62	Mate 128-way SMEC Launch Latch Coil Simulator to 312300 P03		
63	Power on SPIRE in redundant mode	The following to be executed from SPIRE SFT procedure SPIRE-RAL-PRC-002494, issue 2.4 SPIRE-FM-SFT-DPU-ON-R SPIRE-FM-SFT-DRCU-ON-R	
64	Set SPIRE to REDY mode	The following to be executed from SPIRE SFT procedure SPIRE-RAL-PRC-002494, issue 2.4 SPIRE-FM-SFT-FUNC-MCU-01-R	
65	Connect an isolated input Digital Storage Oscilloscope to contacts 92 and 93 of the Launch Latch Simulator		
66	Send a latch command and record voltage across contacts 92 and 93 on oscilloscope (note: pulse duration 50±10 ms)	SEND_DRU_COMMAND (0x90430001,0)	
67	Power on Redundant LPU LCL (LCL #26)	ZCA02999 (LCL#26 CLOSE)	
68	Send redundant High level command HL #21 and record voltage across contacts 92 and 93 on oscilloscope (10ms/div time base)	DCT01170 (HLC21)	
69	Verify the polarity of the voltage drop across contacts 92 and 93 correspond to the polarity from the latch command		

No:	Activity	Remarks/Results	Sign off
70	Verify that the current across Latch Simulator resistor is 153<X<185mA		
71	Send redundant High level command HL #22 and record voltage across contacts 92 and 93 on oscilloscope (10ms/div time base)	DCT01170 (HLC22)	
72	Unpower redundant LPU LCL (LCL # 26)	ZCA42999 (LCL#26 OPEN)	
73	Power off SPIRE	**The following to be executed from SPIRE SFT procedure SPIRE-RAL-PRC-002494, issue 2.4 in the order below** **SPIRE-FM-SFT-FUNC-MCU-OFF-R** **SPIRE-FM-SFT-DRCU-OFF-R** **SPIRE-FM-SFT-DPU-OFF-R**	
74	Remove 128-way SMEC Launch Latch Coil Simulator from 312300 P03		
75	~~Complete the final mechanical integration of the LPU to FCU~~	Removed in Iss. 0.3 (Should have been completed already)	
76	~~Remove and store safing plugs from 312300 P04 and P03~~	**Deleted in 0.4 as this can only be carried out once the panel is closed**	
77	~~Mate 312300 J04 to P04~~	**Deleted in 0.4 as this can only be carried out once the panel is closed**	
78	~~Mate 312300 J03 to P03~~	**Deleted in 0.4 as this can only be carried out once the panel is closed**	
79	End of procedure.		

5. ANNEX 1 – 128-WAY SMEC LAUNCH LATCH COIL SIMULATOR

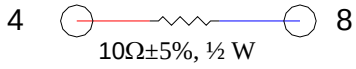
Simulator is a 128-Way Break-out Box prepared as follows:



Contacts 67, 69, 90 and 92 daisy chained as indicated above
Contacts 66, 68, 91 and 93 daisy chained as indicated above
Contacts 92 and 93 bridged by a resistor as indicated above
All other contacts left open circuit

6. ANNEX 1 – 9-WAY SMEC LAUNCH LATCH COIL SIMULATOR

Simulator is a 9-Way DEMA Break-out Box prepared as follows:



Contacts 4 and 8 bridged by a resistor as indicated above
All other contacts left open circuit