

SPIRE

SUBJECT: SPIRE LPU ELECTRICAL INTEGRATION PROCEDURE

PREPARED BY: Douglas Griffin

DOCUMENT No: SPIRE-RAL-PRC-002972

ISSUE: 0.4 REDLINE

Date: 17-10-07

CHECKED BY: Dominique Poulliquen

Date:

APPROVED BY: Eric Sawyer

Date:

*AS
RUN PROCEDURE
18.10.2007*

ISSUE	DATE	
0.1	17-10-07	Initial release -
0.2	15-10-07	Inserted some TBD values
0.3	16-10-07	Added I/F check of P29/P30 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 !

Change Record



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

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

Spacecraft Power and Commands:

SPIRE Engineer
 EADS Engineer
 EADS PA

3. PERSONNEL

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

2. SCOPE AND INTRODUCTION

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

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	

1. APPLICABLE/REFERENCE DOCUMENTS



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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.

4.4 Notes

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

4.3 Test Equipment

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

4.2 End State

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 interlaces 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.

4.1 Prerequisites

4. DETAILED PROCEDURE

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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 ECU J43		✓
5	Prepare a 9-Way BOB as per §6 and mate to ECU 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 ECU J43 is less than 1 Ohm	Checks that the current for the MCU latch/un-latch commands passes through the LPU OK	350mΩ
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 ECU J43 and J44		✓
10	Send prime high-level command (HL #5)	DCT01170 (HLC5)	✓
11	Measure the voltage drop across contacts 4 and 5 of ECU J43 (4 positive wrt 2) and calculate current (Pass criteria 153mA < X < 185mA)	-1.655 V I = -165.5 mA	✓
12	Record the current being drawn by the prime LPU LCL (LCL #25) in the spacecraft TM	not pass, due to data base, DNS show	-
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 ECU J43 is greater than 5 MOhm	743 > 30 MΩ 344 > 20 MΩ	✓
15	Send prime high-level command (HL #6)	DCT01170 (HLC6)	✓

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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)	0V	✓
17	Un-power prime LPU LCL (LCL #25)	ZCA142999 (LCL#25 OPEN)	✓
18	Send redundant high-level command (HL #22) (make sure that it is isolated to start with)	DCT011170 (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)	DCT011170 (HLC21)	✓
22	Measure the voltage drop across contacts 4 and 2 of FCU J44 (4 positive wrt 2) and calculate current (Pass criteria $153 < X < 185$)	$V = -1.621$ $I = -162 mA$	✓
23	Record the current being drawn by the redundant LPU LCL (LCL # 26) in the spacecraft TM	not possible, see step 12	-
24	Verify that the resistance between contacts 7 and 8 of FCU J44 is greater than 5 MOhm	> 30 HΩ	✓
25	Send redundant high-level command (HL #22)	DCT011170 (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)	0V	✓
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)	✓

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No:	Activity	Remarks/Results	Sign off
38	Send Prime HL #5 (hold)	DCT01170 (HLC5)	✓
39	Send Red. HL #21 (hold)	DCT01170 (HLC21)	✓
40	Verify that the voltage on all contacts of FCU P29 is less than 0.1V	$PIN\ 26 = 28V$ $PIN\ 27 = 28V$ $PIN\ 28 = 28V$ $PIN\ 29 = 29V$ $PIN\ 30 = 28V$ $PIN\ 20 = 0.14V$ $PIN\ 21 = 0.14V$ $PIN\ 22 = 0.14V$ $PIN\ 23, 24, 25 = 0.14V$ $PIN\ 26, 27, 28, 29, 30 = 28V$	✓
41	Verify that the voltage on all contacts of FCU P30 is less than 0.1V	DCT01170 (HLC6)	✓
42	Send Prime HL #6 (release)	DCT01170 (HLC22)	✓
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 S5 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 (<i>92 = kat</i>)		✓
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) <i>Measure on PIN 93 (42)</i>	✓
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 (<i>92 = kat</i>)	$V = -1.65$	✓

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No:	Activity	Remarks/Results	Sign off
56	Verify that the current across Latch Simulator resistor is $153 < X < 185 \text{mA}$	<i>I = 165 mA</i>	✓
57	Record current drawn by Prime LPU LCL (LCL #25) in S/C TM	<i>not possible, see App 12</i>	✓
58	Send prime High level command HL #6 and record voltage across contacts 92 and 93 on oscilloscope (10ms/div time base)	DCT01170 (HLC6) <i>V = -15.4 on DVH</i>	✓
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 $50 \pm 10 \text{ms}$)	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)	✓

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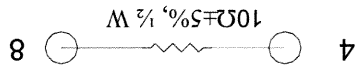
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No:	Activity	Remarks/Results	Sign off
69	Verify the polarity of the voltage drop across contacts 92 and 93 correspond to the polarity from the latch command	$V = -1.612$	✓
70	Verify that the current across Latch Simulator resistor is $153 < X < 185 \text{mA}$	$I = -162 \text{mA}$	✓
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) The following to be executed from SPIRE SFT procedure SPIRE-RAL-PRC-002494, issue 2.4 in the order below	✓
73	Power off SPIRE	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	Removed in Iss. 0.3 (Should have been completed already)	✓
75	Complete the final mechanical integration of the LPU to FCU	Deleted in 0.4 as this can only be carried out once the panel is closed	
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.		✓

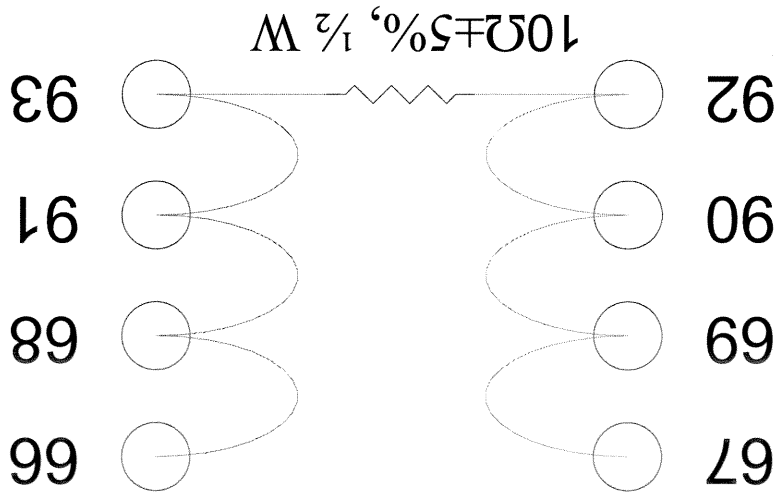
Contacts 4 and 8 bridged by a resistor as indicated above
 All other contacts left open circuit



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

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

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



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

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

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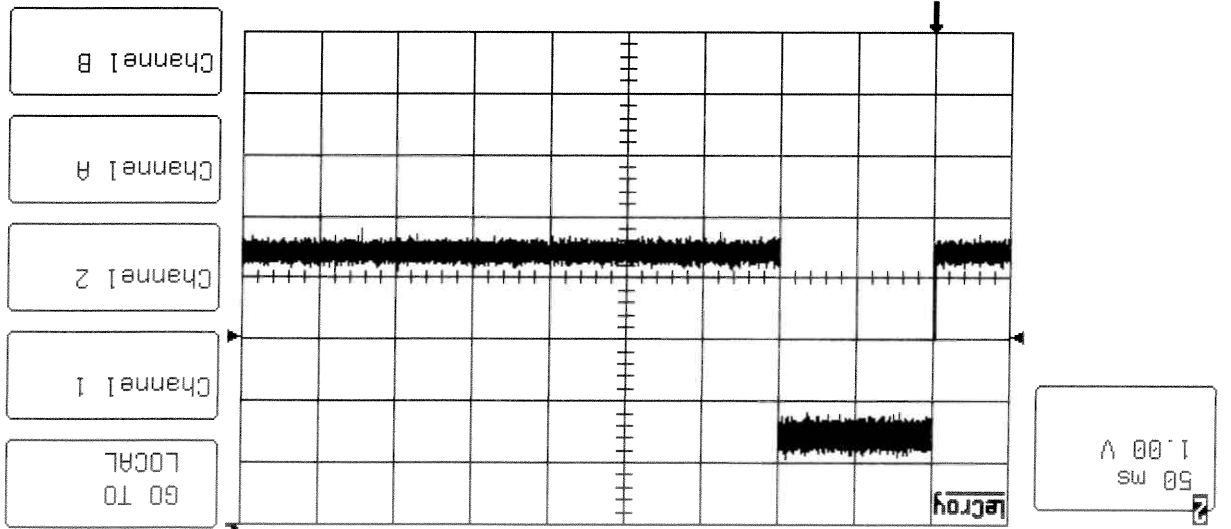
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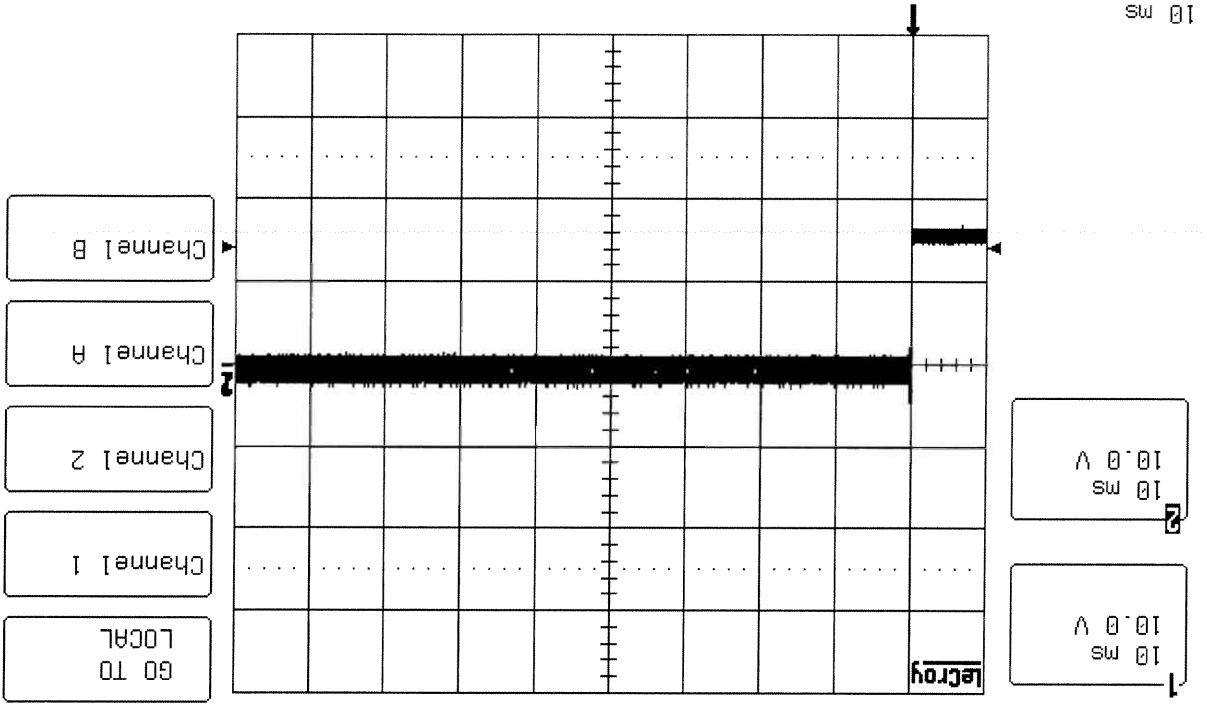
Measurement Records

18-Oct-07 10:59:29 step52 latch cmd REMOTE ENABLE

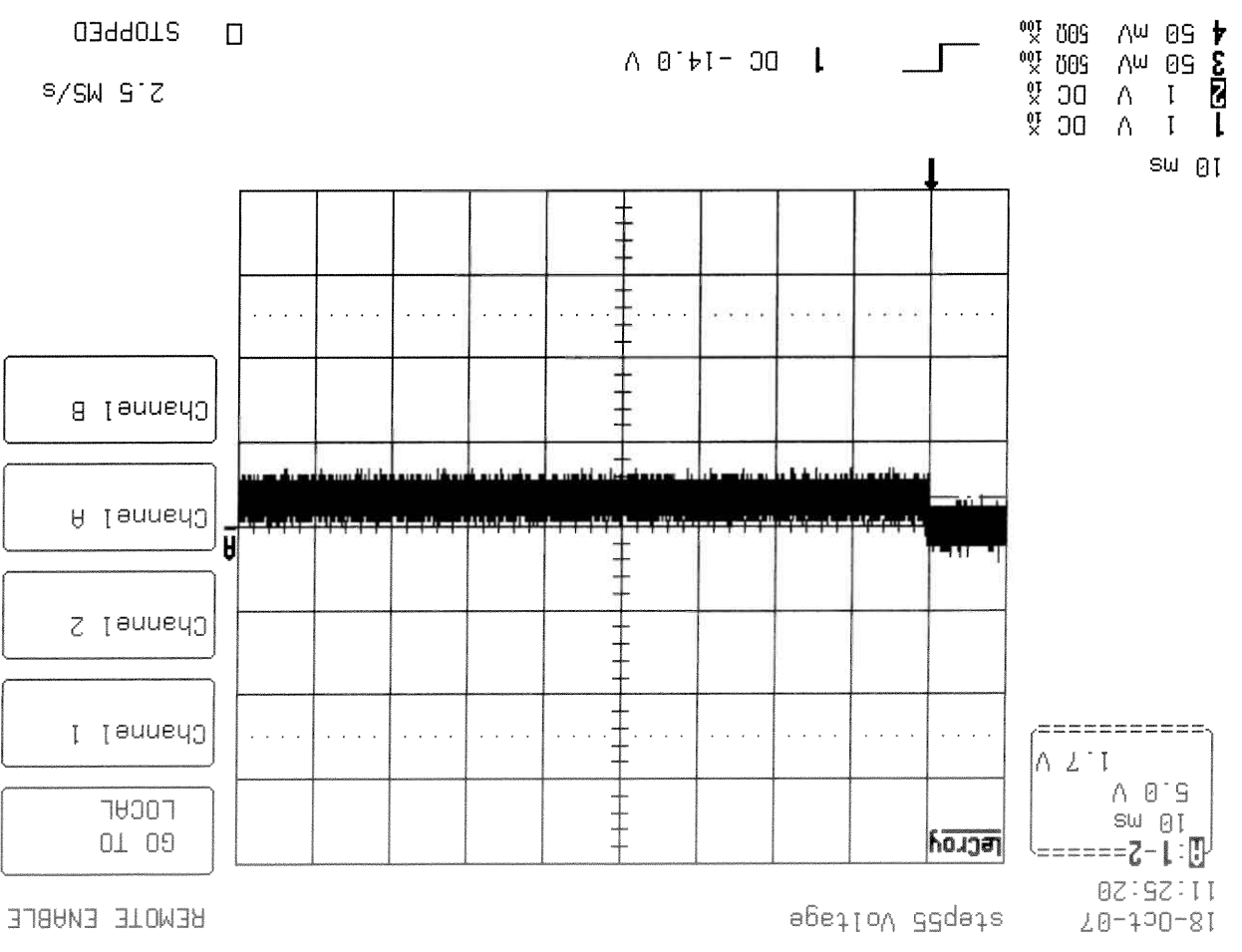
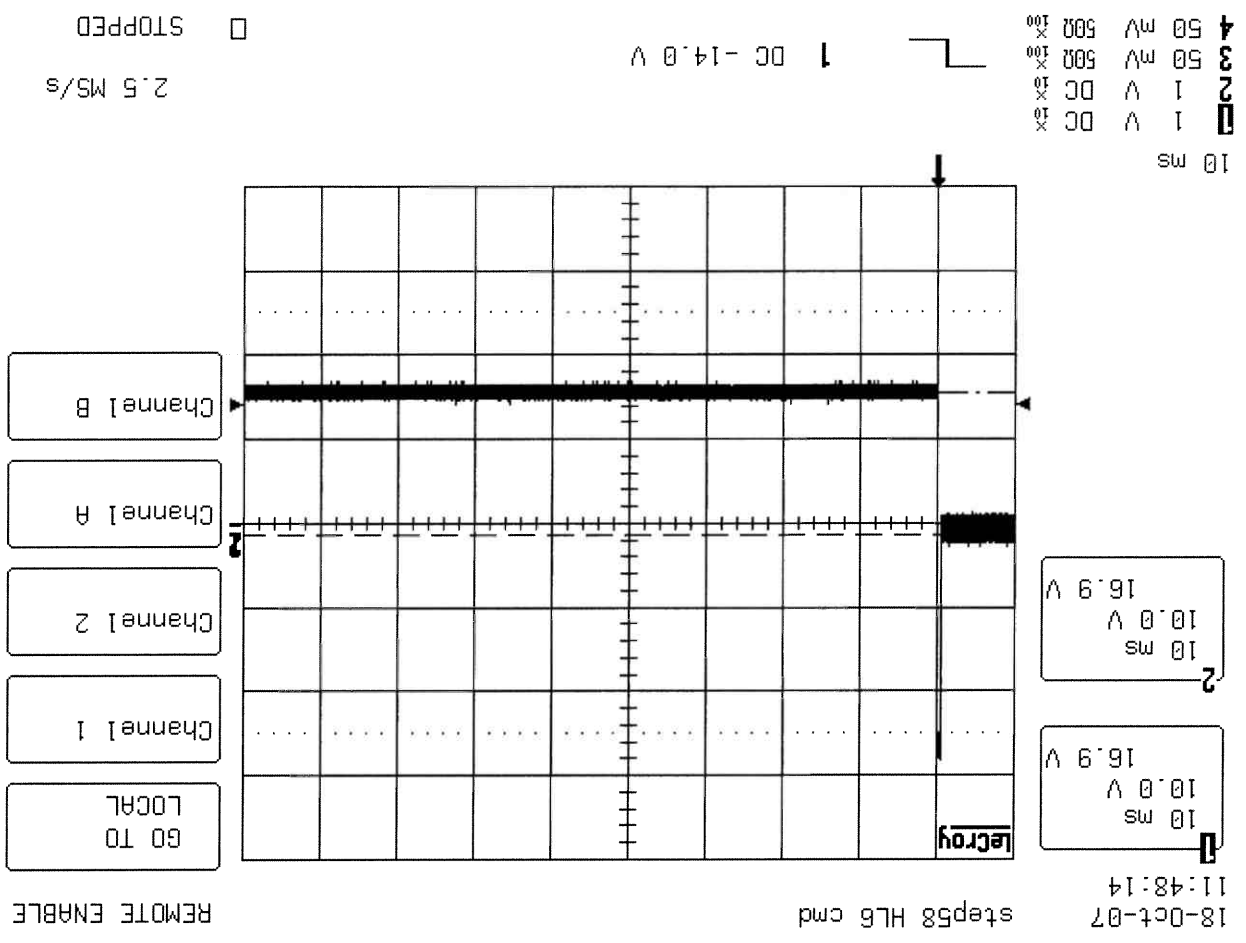


50 ms
 1 1 V DC 10 X
 2 1 V DC 10 X
 3 50 mV 500 X 100
 4 50 mV 500 X 100
 1 DC -14.00 V 2
 STOPPED 500 Ks/s

18-Oct-07 11:07:40 step54 HLS cmd REMOTE ENABLE



10 ms
 1 1 V DC 10 X
 2 1 V DC 10 X
 3 50 mV 500 X 100
 4 50 mV 500 X 100
 1 DC -14.00 V 1
 STOPPED 2.5 MS/s



18-Oct-07 12:26:12
 step68 HL21 cmd
 REMOTE ENABLE

Channel B
 Channel A
 Channel 2
 Channel 1
 GO TO LOCAL

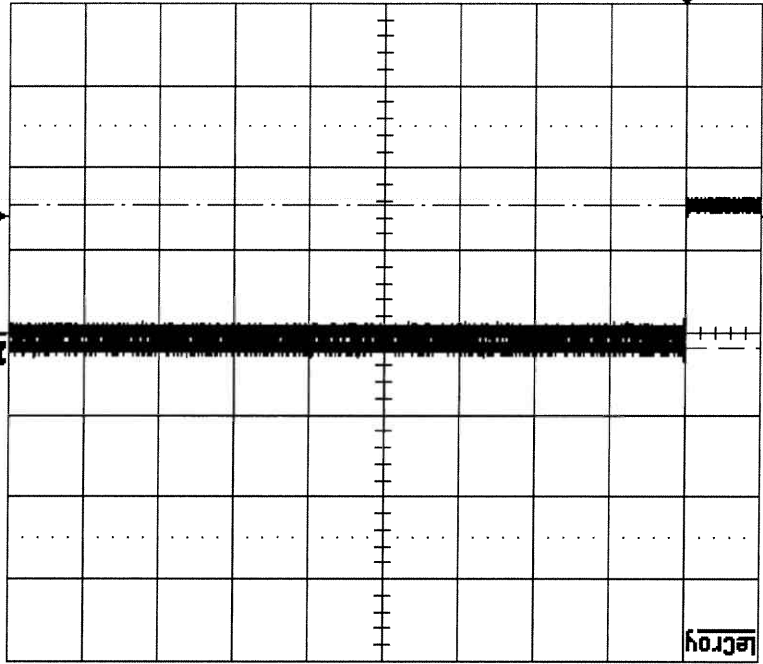
10 ms 10.0 V 17.3 V
 10 ms 10.0 V 17.3 V

1 V DC 10%
 1 V DC 10%
 50 mV 500 100
 50 mV 500 100
 1 V DC 10%
 1 V DC 10%

1 DC -14.00 V

2.5 MS/s

STOPPED



18-Oct-07 12:22:24
 step66 latch cmd
 REMOTE ENABLE

Channel B
 Channel A
 Channel 2
 Channel 1
 GO TO LOCAL

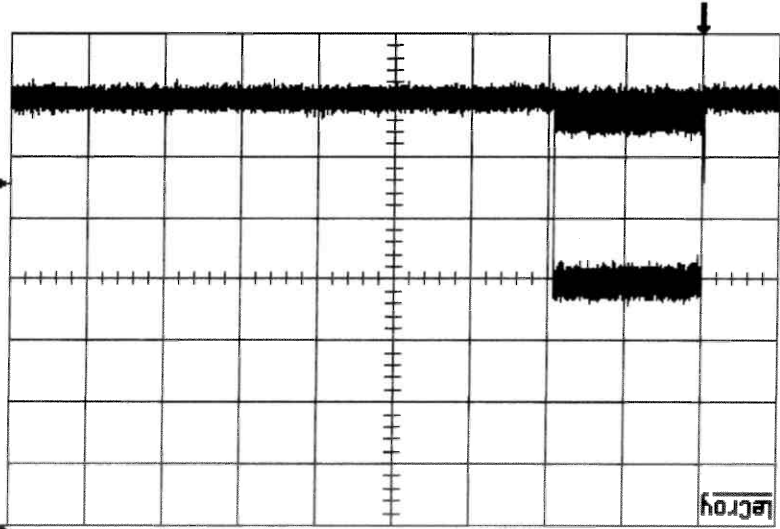
50 ms 1.00 V
 50 ms 1.00 V

1 V DC 10%
 1 V DC 10%
 50 mV 500 100
 50 mV 500 100
 0.1 V DC 10%
 0.1 V DC 10%

2 DC -14.00 V

500 KS/s

STOPPED



amp1(2) 2.98 V
 base(2) -15.43 V
 top(2) -12.45 V
 width(2) 97.3724 ms

