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BENDIX SYSTEMS DIVISION ANN ARBOR, MICH.
Test Procedure for CPLEE
Engineering Model

NO. ATM-630

REV.NO.

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R. Miley

SUBSYSTEM TEST PROCEDURE
FOR
ENGINEERING MODEL OF CPLEE
SUBSYSTEM OF APOLLO LUNAR SURFACE EXPERIMENT
PACKAGE

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Test Procedure for CPLEE
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TEST PROCEDURE FOR CPLEE ENGINEERING MODEL

1. PURPOSE OF TEST

This test procedure is designed to prove that the Charged Particle Experiment is operating satisfactorily and that the interfaces are compatible with the ALSEP central station.

2. SCOPE

The engineering model subsystem tests are electrical functional tests performed in a laboratory environment using the experiment test set. These tests must be performed before integrating the experiment with ALSEP.

3. APPLICABLE DOCUMENTS

- (a) IC-314107, Interface Control Specification for CPLEE.
- (b) AL-260000, Performance/Design and Product Configuration Requirements for CPLEE.
- (c) Handbook of Operating and Maintenance Instruction for CPLEE ETS (BRLD Report No. 3889).

4. EQUIPMENT AND POWER REQUIREMENTS4.1 Equipment

- (a) Charged Particle Experiment Test Set (ETS)
- (b) ALSEP/CPLEE Cable, BxA No. 2331190-7
- (c) Multirange Meter Triplet or Simpson
- (d) Oscilloscope Camera
- (e) Oscilloscope
- (f) Strip Chart Recorder

5. PROCEDURE5.1 Preliminary Requirements and Procedures Before Experiment Testing

- 5.1.1 Test Sequence - All tests will be performed in the order presented. Any deviation must be approved by the Project Engineer and/or BRLD representative.
- 5.1.2 Adjustments and Repairs - Should failures occur, the problem will be resolved by the P.E. or BRLD representative and continuation will be at their discretion.

5.2 Resistance Check of ETS Interface

CAUTION: Make certain that main power switches on the ETS are in the "OFF" position.

Connect the positive lead of a calibrated ohmmeter to the scope test panel terminal A. WARNING: Do not use the ohmmeter on X100 K or higher scale. This would feed +30V into the signal lines. Connect the negative lead to chassis ground. Measure the resistance of each ETS signal and power line by turning Selector "A" through all positions. On position 27 only throw the "EXP. ON" switch into a "Survival HTR PWR Line" to make the reading. Record all measured values in Table I.

5.3 Resistance Check of CPLEE Interface

- 5.3.1 Connect one lead of the ohmmeter to Pin S on connector P65B of jumper cable W65B.
WARNING: Do not use the ohmmeter on X100 K or higher scale. This would feed +30V into the lines.
Measure the resistance between each of the other connector pins and Pin S, and record all measured values in Table II.
- 5.3.2 Connect one lead of the ohmmeter to pin r on connector P65B of jumper cable W65B. Measure the resistance between each of the other pins and pin r and record all measured values in Table II.

5.4 Installation of CPLEE in ETS

1. Make certain that ETS Experiment and Main Power switches are in the OFF position.
2. Attach CPLEE to the mounting bracket assembly.
3. Bolt CPLEE and the mounting bracket into the ETS Vacuum Chamber.
4. Connect the 9 pin Cannon Connector on the GSE cable of the ETS to the 9 pin Cannon connector on CPLEE.
5. Connect the Experiment cable, W65, to the main connector in the ETS vacuum chamber.
6. Make certain that ETS and experiment are connected as shown in Figure 1.

Table I - ETS Isolation of Lines Check⁽¹⁾, ETS

ETS Selector SW Pos.		Resistance to Chassis Grnd			
		ETS Alone		ETS with CPLEE	
		Specified	Measured	Specified	Measured
A 2		30K Ω \pm (*)		1.5K (*)	
A 4		1800 Ω		1.3K	
A 6		1450 Ω		1.3K	
A 9		1800 Ω		1.3K	
A 19		∞		22K	
A 20		∞		7.3K	
A 21		∞		6.9K	
A 22		∞		320 Ω	
A 23		∞		5.5K	
A 24		∞		5.5K	
C-11		1700 Ω		1.3K	
C-12		1700 Ω		<div style="display: flex; align-items: center; justify-content: center;"> <div style="margin-right: 5px;">↑</div> <div style="border-left: 1px solid black; height: 100px; position: relative;"> <div style="position: absolute; top: 0; left: -5px;">↑</div> <div style="position: absolute; bottom: 0; left: -5px;">↓</div> </div> <div style="margin-left: 5px;">↓</div> </div>	
C-13		1700 Ω			
C-14		1700 Ω			
C-15		1700 Ω			
C-16		1700 Ω			
C-17		1700 Ω			
C-18		1700 Ω			
A 26		74 Ω		1.3K	
A 27 †		∞		70 Ω	
A 30		∞		70 Ω	
A 31		2800 Ω		380 Ω	
A 32		∞		1.2K	
A 33		∞		1.4K	
A 34		∞		1.0K	
A 35		∞		650 Ω	
A 36		∞		310 Ω	
A 37		∞ (*)		24K	
				300K	

(1) Refer to Fig. 1 for ETS Selector Switch Designation.

(*) All resistances are specified to \pm 25%.

(†) Throw switch on Main Power Panel to "Survival Htr Power Line" position for this measurement only.

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Table II - CPLEE Cable Isolation Measurements

No.* Line		Deutsch P65B	RESISTANCE				Remarks
			Line to Case Grnd (1)		Line to Signal Grnd(2)		
			Specified	Measured	Specified	Measured	
1	Shield	j			∞		
2	Digital Data	V			1.6K (3)		
3	Shield	s			∞		
4	Shift Pulse (Data Clock)	U			480K		
5	Shield	i			∞		
6	Even Frame Mark	T			16K		
7	Shield	t			∞		
8	Case Ground Return	S	0Ω		∞		
9	Demand Pulse	h					
10	Signal Return	r			0 Ω		
11	Therm.Cont. Bypass On	R			10 Meg		
12	Therm.Cont. Bypass Off	g			8.5 Meg		
13	Dust Cover Removal	q			120K		
14	Auto.Volt Level Seq. On	P			70K		
15	Step Voltage Level	f			500K		
16	Auto Volt Level Seq. Off	e			500K		
17	Chann.P.S.Volt INCR On	N			∞		
18	Chann.P.S. Volt INCR Off	M			∞		

Commands

- *These flat cable line numbers are the same as connector J65A-P65 (flight connector) numbers.
- (1) Connect one lead of the ohmmeter to line 8 (Deutsch Pin S).
 - (2) Connect one lead of the ohmmeter to line 10 (Deutsch Pin r).
 - (3) All resistances are specified to $\pm 25\%$.



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Table II (continued)

No.	Line	Deutsch P65B	RESISTANCE		Specified	Measured	Remarks
			Line to Case Grnd	Line to Signal Grnd			
			Specified	Measured			
Housekeeping	19	Switchable P.S. Volt	L		30K		
	20	Channeltron PS #1 volt	K		7.5K		
	21	Channeltron PS #2 volt	J		7.0K		
	22	DC-DC Converter volt	d		300 Ω		
	23	Temperature #1	c		5.7K		
	24	Temperature #2	H		5.7K		
	25	Spare	p				
	26	Operating & Heater Pwr	b				
	27		G				
	28		n				
	29		a				
	30	Power Return Line	F				
	31		m				
	32		k				
	33		Z				
	34	Survival Heater Power	E				
	35		Y				
	36		X				
	37		D				

Not Connected - $\left. \begin{array}{l} A \\ B \\ C \\ W \end{array} \right\}$

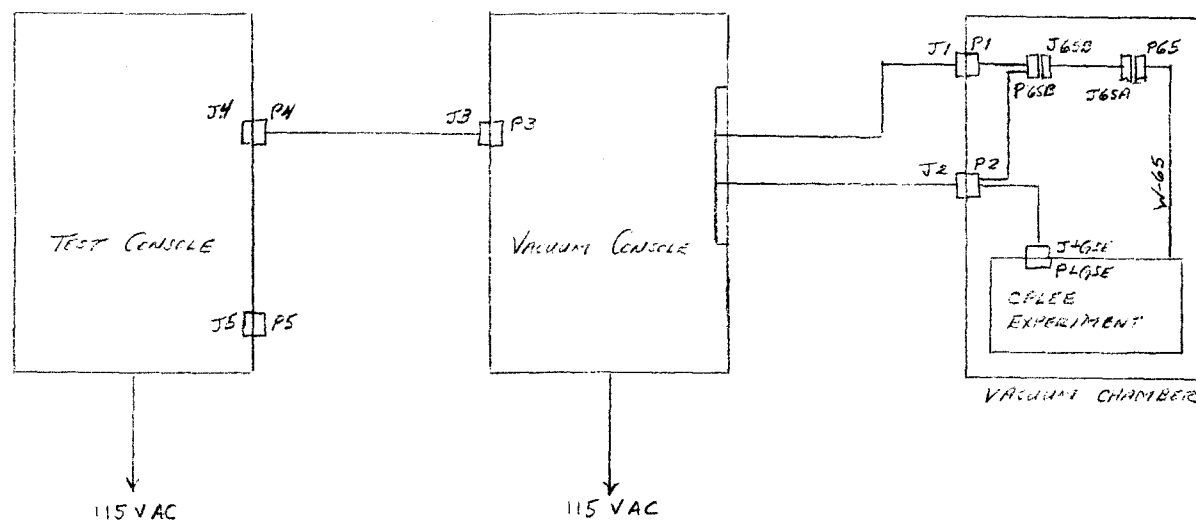


FIGURE 1 CPLEE EXPERIMENT AND ETS CABLING DIAGRAM

CONNECTOR	VENDOR	PART No.
P65	BXA	2332112-3
J65A	BXA	2332118-3
J65B	CANNON	MD81-518
P65B	CANNON	MD81-51P
P92E	CANNON	MD81-9P
J92E	CANNON	MD81-9S
P1	VARIAN	954-5013
J1	CANNON	MS-3106B-28-16S
P2	VARIAN	954-5013
J2	CANNON	MS-3106B-28-16S
P3	AMPHENOL	MS-3102A-36-7P
J3	"	MS-3106A-36-7S
P4	"	MS-3106A-26-7P
J4	"	MS-3102A-36-7S
P5	DEUTSCH	DTK-06-20-41PX-059
J5	"	DTK-01-20-41SX-059

REFERENCE: BXA DRAWING, 2331505
BRED DRAWING, 2158400

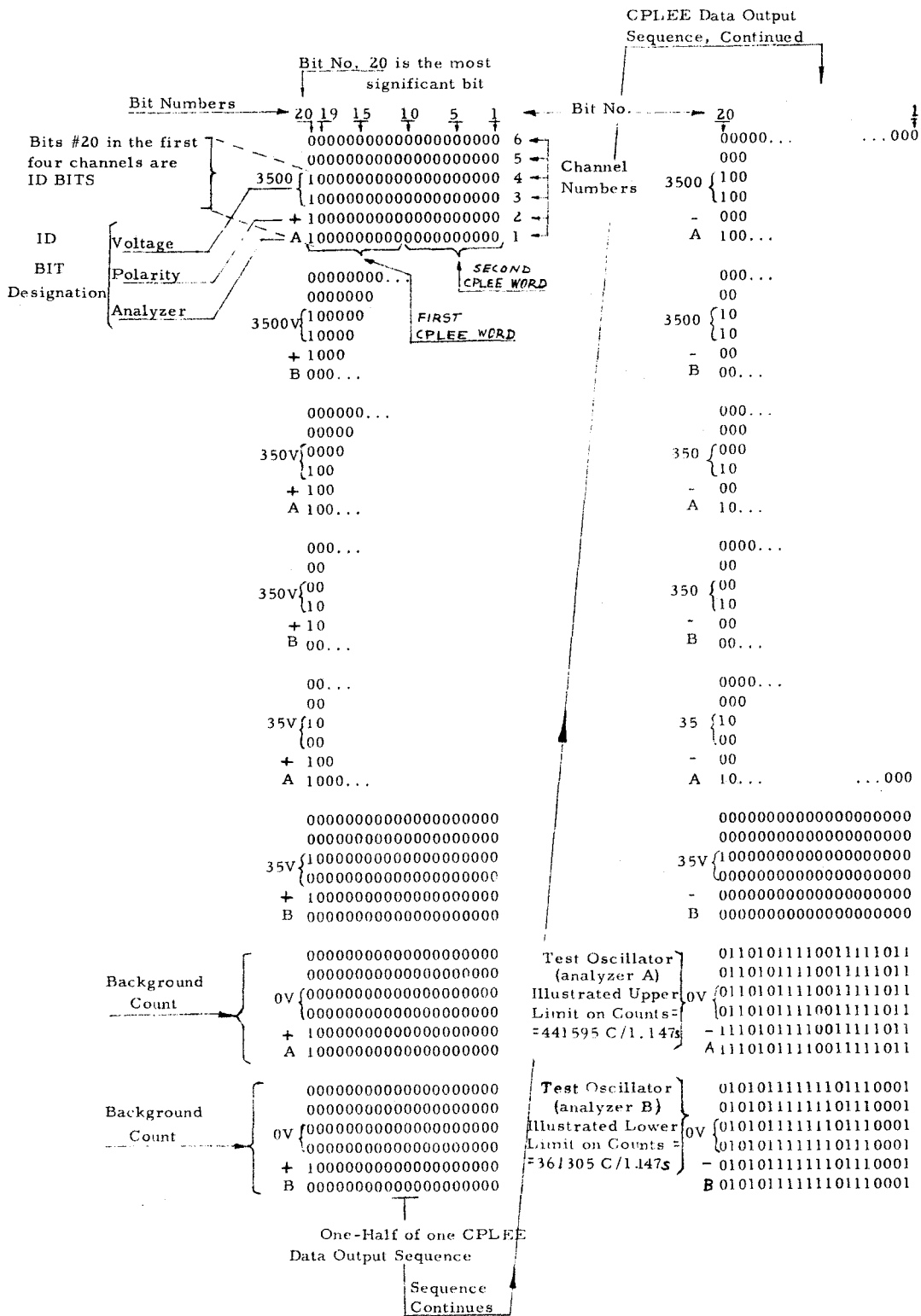


FIGURE 2 - One CPLEE Data Output Sequence



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5.6 Ambient Pressure Functional Tests

CAUTION: Make sure that the jumper cable from TP-8 to TP-7 on the Command Indicator Panel is disconnected. This is necessary to make the Switchable Power Supply and Channeltron Power Supplies inoperative during ambient pressure tests so that they are not damaged due to arcing.

5.6.1 On the Main Power Panel turn the top switch to "OP & HTR PWR Line" position, and turn the bottom switch to "EXPERIMENT ON" position. Read the current on the "+28.5 volts current" meter on the Command Select and High Voltage panel, and record values in Table III.

5.6.2 Measure the voltage ripple on the +28.5 volts power line by setting the scope selector switch A to position 26 and using the oscilloscope. Record the value in Table III.

5.6.3 CPLEE Digital Data Output Check

1. Depress the "RESET LOGIC" switch on the COMMAND SELECT AND HIGH VOLTAGE panel.
2. Turn the Ultraviolet lamp on the Monroe printer "ON". Set the speed on Slow Mode.
3. Start the printer and let it operate until about 12 feet of tape is printed.
4. Stop the printer and compare at least six complete cycles (96 lines) with the format shown in Figure 2, and record in Table III.
5. Figure 2 shows the correct sequence, and the proper digital count for the test oscillator sequence. The test oscillator count is shown in Figure 2 for both specification limits (361,305 and 441,595 counts for a 1.147 second period.) Any count between these limits is acceptable. The first three digits right of the ID bits (i.e., bits number 19, 18, and 17) can be used for a quick check as shown below:



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Bit Number

20	19	18	17	16	Oscillator Frequency
ID	1	1	1	0 ...	Too high
ID	0	1	1	1 ...	Too low
ID	1	1	0	...	May be correct - see Fig. 2 to check
ID	1	0	1	...	May be correct - see Fig. 2 to check

5.6.4 Command Response5.6.4.1 Thermal Control By-Pass On

1. Read the +28.5 volts current meter reading and record in Table III.
2. Set CommandSelector Switch on COMMAND INDICATOR panel to position 11 (Thermal Control By-Pass On)
3. Press the COMMAND INITIATE button.
4. Check that the THERMAL CONTROL BYPASS "ON" indicator light is lighted.
5. Check that the THERMAL CONTROL BYPASS "OFF" is not lighted.
6. Read the experiment current as indicated on the +28.V current meter and record in Table III.

CAUTION: The experiment must not be left in this condition for more than a few minutes as it may overheat and be damaged.



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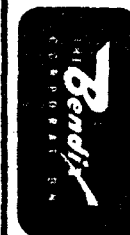
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Table III - Experiment Functional Tests

Ambient Pressure

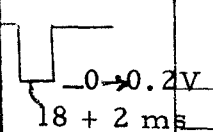
Paragraph Number	Test Parameter	Test Limit	Measured Value	Remarks
5.6.1	Experiment Current (Heater Off)	80 ± 5 ma		
5.6.2	Noise & Ripple	≤ 100 mv p-p		
5.6.3	Digital Data Sequence	Fig. 2	Correct <input type="checkbox"/> Incorrect <input type="checkbox"/>	
5.6.3	Test Oscillator Frequency	Fig. 2		
5.6.4.1	Experiment Current, Heater Off	80 ± 5 ma		
5.6.4.1	Command Indicator Lights			
	Thermal Control Bypass On	ON		
	Automatic Voltage Sequence On	ON		
	Channeltron P.S. Voltage Increase Off	ON		
	All other indicator lights	OFF		
5.6.4.1	Experiment Current (Heater On)	142 ± 5 ma		
5.6.4.2	Experiment Current (Heater Off)	80 ± 5 ma		
5.6.4.2	Command Indicator Lights			
	Thermal Control Bypass Off	ON		
	Automatic Voltage Sequence On	ON		
	Channeltron P.S. Voltage Increase Off	ON		
	All other indicators Off	OFF		



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Table III - Experiment Functional Tests

Ambient Pressure (continued)

Paragraph Number	Test Parameter	Test Limit	Measured Value	Remarks
5.6.4.3	Dust Cover Removal Signal Amplitude Duration	3.10V → ± 0.2V 		
5.6.4.3	Command Indicator Lights Thermal Control Bypass Off Automatic Voltage Sequence On Channeltron P.S. Voltage Increase Off Dust Cover Removal All other indicators	ON ON ON ON OFF		
5.6.4.4	Digital Data Sequence, AUTO SEQ.OFF Command Indicator Lights Thermal Control Bypass Off Automatic Voltage Sequence Off Channeltron P.S. Voltage Increase Off All other indicators	Fig. 2 ON ON ON OFF	ID Bit Check Correct Incorrect <input type="checkbox"/> <input type="checkbox"/>	
5.6.4.5	Digital Data Sequence, STEP VOLT.LEVEL	Fig.2	ID Bit Check 3,4 3,4 3,4 3,4 <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 3,4 3,4 3,4 3,4 <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	

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Table III - Experiment Functional Tests
Ambient Pressure (continued)

Paragraph Number	Test Parameter	Test Limit	Measured Value	Remarks
5.6.4.5	Command Indicator Lights		Light Check	
	Thermal Control Bypass Off	ON		
	Automatic Voltage Sequence Off	ON		
	Channeltron P.S. Voltage Increase Off	ON		
5.6.4.6	All other indicators	OFF		
	Digital Data Sequence, AUTO SEQ. ON	Fig.2	Correct Incorrect <input type="checkbox"/> <input type="checkbox"/>	
	Command Indicator Lights			
	Thermal Control Bypass On	ON		
	Automatic Voltage Sequence On	ON		
	Channeltron P.S. Voltage Increase Off	ON		
	All other indicators	OFF		



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5.6.4.2 Thermal Control By-Pass OFF

1. Set the Command Selector Switch to Position 12 (Thermal Control Bypass OFF)
2. Press Command initiate button.
3. Read the experiment current on the +28.5 V current meter and record in Table III.
4. Check that the Thermal Control Bypass "OFF" indicator light is lighted.
5. Check that the Thermal Control Bypass "ON" indicator light is not lighted.

5.6.4.3 Dust Cover Removal

1. Set A selector on the SCOPE TEST panel to position 35.
2. Set Command Select switch on the COMMAND SELECT AND HIGH VOLTAGE panel to Position 13 (Dust Cover Removal).
3. First push in and hold the Dust Cover interlock button, then press the Command Initiate button.
4. Observe dust cover removal signal on oscilloscope.
5. Record dust cover removal pulse characteristics in Table III.

5.6.4.4 Automatic Voltage Level Sequence OFF

1. Set Command Selector Switch to position 16 (Automatic Voltage Level Sequence OFF)
2. Press COMMAND INITIATE button.
3. Check that Automatic Voltage Level Sequence "ON" indicator light is not lighted.



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5.6.4.4 (continued)

4. Check that Automatic Voltage Level Sequence "OFF" indicator light is lighted.
5. Turn on Ultraviolet lamp on Monroe printer.
6. Start printer and let it operate until 18 lines are printed. Check ID bits to make certain that automatic sequence has stopped. Record results in Table III. (Note that Analyzer or 2 ID bit continues to switch every 1.2 seconds (EFMP)).

5.6.4.5 Step Voltage Level

1. Set Command Selector Switch to position 15 (Step Voltage Level).
2. Press COMMAND INITIATE button.
3. Observe that Automatic Voltage Level Sequence "OFF" indicator light and thermal control bypass "OFF" indicator lights are both lighted.
4. Start printer and let it operate until 18 lines are printed. Check the ID bits to make certain that deflection voltage sequence has advanced one step.
5. Repeat steps 2, 3, and 4 until all eight deflection voltage operating points have been checked.
6. Record results in Table III.

5.6.4.6 Automatic Voltage Level Sequence "ON"

1. Set Command Selector Switch to position 14 (Automatic Voltage Level Sequence "ON")
2. Press COMMAND INITIATE button.
3. Observe that Automatic Voltage Level Sequence "ON" indicator light is lighted. Record indicator reading in Table III.



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5.6.4.6 (continued)

4. Observe that Thermal Control Bypass "OFF" indicator is lighted and that all other command indicators are not lighted.
5. Start the printer and let it operate until 40 lines are printed. Check the digital data output with Figure 2 and print-out from 5.6.3 to verify proper operation. Record results in Table III.

5.6.4.7 Channeltron P.S. Voltage Increase - "ON" & "OFF"

These two commands cannot be checked on the engineering model.

5.6.5 Analog Housekeeping Data Check

1. Turn the Voltage Selector Switch on the ANALOG TEST panel through positions HK-1 to HK-6 and read the values for each position on the panel meter.
2. Record the value for each reading in Table IV.

5.6.6 Check of GSE Test Points

1. Turn the A selector on the SCOPE PANEL through switch position 30 to 37 and measure the signals on the GSE connector with the oscilloscope.
2. Record the value for each GSE signal in Table V.



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Table IV - Analog Housekeeping Data

Ambient Pressure Condition

Voltage Selector Switch	Title	Analog T/M Signals		Measured
		Nominal	Tolerance	
HK-1	Switchable P.S.			
	+3500	0V	+ 0.2V	
	350	0V	+ 0.2V	
	35	0V	+ 0.2V	
	+0	0V	+ 0.1V	
	-3500	0V	+ 0.2V	
	-350	0V	+ 0.2V	
	-35	0V	+ 0.2V	
	-0	0V	+ 0.1V	
HK-2	Channeltron P.S.#1	0V	+ 0.2V	
HK-3	Channeltron P.S.#2	0V	+ 0.2 V	
HK-4	DC-DC Converter	3.10V	+ 0.2V	
HK-5	Temp. of Logic Module Standoff	1.78V (=25°C)	Note 1	
HK-6	Temp of Low Voltage P.S.	1.70V(=24°C)	Note 1	

NOTE: Maximum safe operating temperature in vacuum is 45°C.
See attached curves for conversion data.



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Table V - GSE Connector Signals

Ambient Pressure Condition

CPLEE GSE Connector (9 Pins)	Position of ETS Selector Switch "A"	SIGNAL		Remarks
		Specified	Measured	
TP1 Test Osc. Output	30	Freq.: 315KC to 385KC		Should be zero unless external VFO signal is applied.
TP2 VFO Input	31	See remarks		
TP3 Low Voltage 34V	32	+34VDC (± 1.0)		
TP4 Power 29V	33	+29VDC (± 0.5)		
TP5 Supply 6V	34	+ 8VDC (± 1.0)		
TP6 Dust Cover Removal Signal to Squibs	35 13	3.10 (± 0.2) VDC		See Note 1
TP7 Channeltron P.S. Low Voltage	36	28.8 (± 0.5) volts DC		
TP8 Channeltron P.S. Return	37	0V		

Note 1 This point measures the voltage applied to the collector of a transistor. When the dust cover removal command is transmitted, the transistor is turned "ON", and this voltage drops to about +0.5 volts for 20 millisecond.



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5.7 Functional Tests to be Performed Under Vacuum5.7.1 Vacuum Operation

Prior to starting this portion of the test procedure, CPLEE must be installed in the ETS vacuum chamber and connected in accordance with the requirements of paragraph 5.4.

CAUTION: Make certain that experiment power is turned "OFF" prior to starting pumping operation on the vacuum chamber.

When the vacuum chamber pressure is 5×10^{-5} torr, or less, electrical power may be applied to the experiment.

5.7.2 Experiment Turn-On

1. Make certain that the operating mode switch on the MAIN POWER power panel is in the "OP & HTR POWER LINE" position.
2. Make certain that the Experiment Power Switch is in the "OFF" position.
3. Turn 115 volts AC power switch to "ON" position.
4. Turn experiment power switch to "ON" position.
5. Read +28V current meter to measure current to experiment. Record reading in Table VIII.
6. Connect jumper from TP-8 to TP-7 on COMMAND INDICATOR PANEL.
7. Read 28.5V current. Record reading in Table VIII.
8. Check to see that "Thermal Control Bypass Off," "Automatic Voltage Level Sequence On" and "Channeltron P.S. Voltage Increase Off" indicator lights are lighted. All other command indicator lights must not be lighted.



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Table VI - Analog Housekeeping Data

Vacuum Condition

Voltage Selector Switch	Title	Analog T/M Signals		Measured
		Nominal	Tolerance	
HK-1	Switchable P.S.			
	+3500	3.30V	+ 0.2V	
	350	4.30V	+ 0.2V	
	35	4.15V	+ 0.2V	
	+0	0.25V	+ 0.1V	
	-3500	4.05	+ 0.2V	
	-350	4.30V	+ 0.2V	
	-35	4.15V	+ 0.2V	
HK-2		0.25V	+ 0.1V	
	Channeltron P.S.#1	3.75V	+ 0.2V	
	Channeltron P.S.#2	3.38V	+ 0.2V	
		(no load)		
	DC-DC Converter	3.10V	+ 0.2V	
HK-5	Temp. of Logic Module	1.78V'(=25°C)	Note 1	
HK-6	Temp of	1.70V(=24°C)	Note 1	
	Low Voltage P.S.			

NOTE: Maximum safe operating temperature in vacuum is 45°C.
See attached curves for conversion data.



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9. Check operating status of experiment (and to confirm command indicator lights) by
 - a. Check switchable P.S. analog voltage on HK-1 and verify switching sequence.
 - b. Check Channeltron P.S. #1 voltage on HK-2
 - c. Check Channeltron P.S. #2 voltage on HK-3

5.7.3 Analog Housekeeping Data Check

1. Turn the Voltage Selector Switch on the ANALOG TEST panel through positions HK-1 to HK-6 and read the values for each position on the panel meter.
2. Record the value for each reading in Table VI.

5.7.4 Check of GSE Test Points

1. Turn the A selector on the SCOPE PANEL through switch position 30 to 37 and measure the signals on the GSE connector with the oscilloscope.
2. Record the value for each GSE signal in Table VII.

5.7.5 Digital Data Output

1. Depress the "RESET LOGIC" switch on the COMMAND SELECT AND HIGH VOLTAGE panel.
2. Turn the Ultraviolet lamp on the Monroe printer "ON".
3. Start the printer and let it operate until about 12 feet of tape is printed
4. Stop the printer and compare at least six complete cycles (96 lines) with the format shown in Figure 2, and record in Table VIII.



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Table VII - GSE Connector Signals
Vacuum Condition

CPLEE GSE Connector (9 Pins)	Position of ETS Selector Switch "A"	SIGNAL		Remarks
		Specified	Measured	
TP1 Test Osc. Output	30	Freq.: 315KC to 385KC		Should be zero unless external VFO signal is applied.
TP2 VFO Input	31	See remarks		
TP3 Low Voltage 34V	32	+34VDC (± 1.0)		
TP4 Power 29V	33	+29VDC (± 0.5)		
TP5 Supply 6V	34	+ 8VDC (± 1.0)		
TP6 Dust Cover Removal Signal to Squibs	35 13	3.10 (± 0.2) VDC		See Note 1
TP7 Channeltron P.S. Low Voltage	36	28.8 (± 0.5) volts DC		When TP-7 is jumped to TP-8 on Com- mand Indicator Panel, TP-8 will read 28.8 (± 0.5) volts.
TP8 Channeltron P.S. Return	37	0 VDC		

Note 1 This point measures the voltage applied to the collector of a transistor. When the dust cover removal command is transmitted, the transistor is turned "ON" and this voltage drops to about +0.2 volts for 20 milliseconds.



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5. Figure 2 shows the correct sequence, and the proper digital count for the test oscillator sequence. The test oscillator count is shown in Figure 2 for both specification limits (361, 305 and 441, 595 counts for a 1.147 second period.) Any count between these limits is acceptable.

5.7.6 Response to Commands

5.7.6.1 Thermal Control By-Pass On

1. Read the +28.5 volts current meter reading and record in Table VIII
2. Set Command Selector Switch on COMMAND INDICATOR Panel to position 11 (Thermal Control By-Pass On).
3. Press the COMMAND INITIATE button.
4. Check that the THERMAL CONTROL BYPASS "ON" indicator light is lighted.
5. Check that the THERMAL CONTROL BYPASS "OFF" is not lighted.
6. Read the experiment current as indicated on the +28.V current meter and record in Table VIII

CAUTION: The experiment must not be left in this condition as it may overheat and be damaged.

5.7.6.2 Thermal Control By-Pass OFF

1. Set the Command Selector Switch to Position 12 (Thermal Control Bypass OFF).
2. Press Command initiate button.
3. Read the experiment current on the +28.5V current meter and record in Table VIII



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4. Check that the Thermal Control Bypass "OFF" indicator light is lighted.
5. Check that the Thermal Control Bypass "ON" indicator light is not lighted.

5.7.6.3 Dust Cover Removal

1. Set A selector on the SCOPE TEST panel to position 35.
2. Set Command Select switch on the COMMAND SELECT AND HIGH VOLTAGE panel to Position 13 (Dust Cover Removal).
3. Simultaneously press the Command Initiate and Dust Cover Interlock Switches.
4. Observe dust cover removal command on oscilloscope.
5. Record dust cover removal pulse characteristics in Table VIII

5.7.6.4 Automatic Voltage Level Sequence OFF

1. Set Command Selector Switch to position 16 (Automatic Voltage Level Sequence OFF).
2. Press COMMAND INITIATE button.
3. Check that Automatic Voltage Level Sequence "ON" indicator light is not lighted.
4. Check that Automatic Voltage Level Sequence "OFF" indicator light is lighted.
5. Turn on Ultraviolet lamp on Monroe printer.
6. Start printer and let it operate until 18 lines are printed. Check ID bits to make certain that automatic sequence has stopped.



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Table VIII - Experiment Functional Tests

Vacuum Operation

Paragraph Number	Test Parameter	Test Limit	Measured Value	Remarks
5.7.2 a.	Experiment Current (Heater Off), HV supplies OFF	$90 \pm 5\text{ma}$	a. _____	
b.	Experiment Current (Heater Off, HV P.S. On)	$98 \pm 5\text{ma}$	b. _____	
c.	Noise & Ripple		c. _____	
d.	Noise & Ripple		d. _____	
5.7.5	Digital Data Sequence	Fig. 2	{ Correct <input type="checkbox"/> Incorrect <input type="checkbox"/>	
5.7.5	Test Oscillator Frequency	Fig. 2		
5.7.6.1	Experiment Current, Heater Off	$98 \pm 5\text{ma}$		
5.7.6.1	Command Indicator Lights			
	Thermal Control Bypass On	ON		
	Automatic Voltage Sequence On	ON		
	Channeltron P.S. Voltage Increase Off	ON		
	All other indicator lights	OFF		
5.7.6.1	Experiment Current (Heater On)	$160 \pm 5\text{ma}$		
5.7.6.2	Experiment Current (Heater Off)	$98 \pm 5\text{ma}$		
5.7.6.2	Command Indicator Lights			
	Thermal Control Bypass Off	ON		
	Automatic Voltage Sequence On	ON		
	Channeltron P.S. Voltage Increase Off	ON		
	All other indicators Off	OFF		



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Table VIII (continued)

Paragraph Number	Test Parameter	Test Limit	Measured Value	Remarks
5.7.6.3	Dust Cover Removal Signal			
	Amplitude		$3.10 \pm 0.2V$	
	Duration		18 ± 2 msec	
5.7.6.3	Command Indicator Lights			
	Thermal Control Bypass Off	ON		
	Automatic Voltage Sequence On	ON		
	Channeltron P.S. Voltage Increase Off	ON		
	Dust Cover Removal	ON		
	All other indicators	OFF		
5.7.6.4	Digital Data Sequence, AUTO SEQ.OFF	Fig. 2	ID Bit Check Correct <input type="checkbox"/> Incorrect <input type="checkbox"/>	
	Command Indicator Lights			
	Thermal Control Bypass Off	ON		
	Automatic Voltage Sequence Off	ON		
	Channeltron P.S. Voltage Increase Off	ON		
	All other indicators	OFF		
5.7.6.5	Digital Data Sequence, STEP VOLT. LEVEL	Fig. 2	ID Bit Check 3, 4 3, 4 3, 4 3, 4 <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 3, 4 3, 4 3, 4 3, 4 <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	

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Table VIII continued

Paragraph Number	Test Parameter	Test Limit	Measured Value		Remarks
			Light Check		
5.7.6.5	Command Indicator Lights				
	Thermal Control Bypass Off	ON			
	Automatic Voltage Sequence Off	ON			
	Channeltron P.S. Voltage Increase Off	ON			
	All other indicators	OFF			
5.7.6.6	Digital Data Sequence, AUTO SEQ. ON	Fig.2	Correct	Incorrect	
			<input type="checkbox"/>	<input type="checkbox"/>	
5.7.6.6	Command Indicator Lights				
	Thermal Control Bypass On	ON			
	Automatic Voltage Sequence On	ON			
	Channeltron P.S. Voltage Increase Off	ON			
	All other indicators	OFF			
5.7.7	Turn-On Transient				
	Auto Volt. Sequence	ON			
	Channeltron P.S. Increase	OFF			
	Thermal Control Bypass	OFF			
5.7.8	Noise & Ripple on Power Lines	≤ 100 m V p-p			



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5.7.6.5 Step Voltage Level

1. Set Command Selector Switch to position 15 (Step Voltage Level).
2. Press COMMAND INITIATE button.
3. Observe that Automatic Voltage Level Sequence "OFF" indicator light and thermal control bypass "OFF" indicator lights are both lighted.
4. Start printer and let it operate until 18 lines are printed. Check the ID bits to make certain that deflection voltage sequence has advanced one step.
5. Repeat steps 2, 3, and 4 until all eight deflection voltage operating points have been checked.
6. Record proper operation in Table VIII

5.7.6.6 Automatic Voltage Level Sequence "ON"

1. Set Command Selector Switch to position 14 (Automatic Voltage Level Sequence "ON")
2. Press COMMAND INITIATE button.
3. Observe the Automatic Voltage Level Sequence "ON" indicator light is lighted. Record indicator reading in Table III.
4. Observe that Thermal Control Bypass "OFF" indicator is lighted and that all other command indicators are not lighted.
5. Start the printer and let it operate until 40 lines are printed. Check the digital data output with Figure 2 and printout from 5.6.3 to verify proper operation. Record results in Table VIII

5.7.6.7 Channeltron P.S. Voltage Increase - "ON" & "OFF"

These two commands cannot be checked on the engineering model.



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1. Turn experiment power switch to OFF position.
2. Turn ETS main power switch to OFF position.
3. Install a precision, two ohm, non-inductive resistor in the ground return cable of the +28.5 volt prime power circuit in the ETS,
4. Connect a Tektronix 545, or equivalent, oscilloscope across the two ohm resistor.
5. Adjust the oscilloscope for single sweep, internal positive slope trigger, 200 millivolts per centimeter vertical gain (with a X1 probe) and 5 milliseconds per centimeter sweep speed.
6. Turn ETS main power switch to "ON" position.
7. Turn on power to experiment, and make certain that experiment is operating in the following mode:
 - (a) Automatic Voltage Level Sequence ON
 - (b) Channeltron P.S. Voltage Increase OFF
 - (c) Thermal Control Bypass OFFby checking indicator lights on COMMAND INDICATOR panel, by checking current drain +28.5 volts supply and by observing analog voltages on HK-1, HK-2 and HK-3. Record results in Table VIII.
8. Turn experiment "OFF" and "ON" at least three times and photograph the turn-on transient with a Polaroid Oscilloscope Camera.

5.7.8 Noise and Ripple on Prime Power Lines

Use the same test set-up required for paragraph 5.7.7 and measure the noise and ripple on the +28.5 volts prime power lines. Record the results in Table VIII. Photograph any noise and ripple with the Polaroid oscilloscope camera.



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5.7.9 Power Profile

1. Turn experiment power switch to OFF position.
2. Turn ETS main power switch to OFF position.
3. Connect one channel of a Sanborn Model 7708, or equivalent, Recorder across the two ohm resistor in the ground return cable of +28.5 volts dc prime power for the experiment. Set recorder sensitivity to 50 mv/div.
4. Connect a second channel of the Sanborn Recorder to GND and HK-1 Terminal on Main Power panel of the ETS. Set recorder gain to 10 millivolts per millimeter.
5. Turn on main power to ETS.
6. Turn experiment power switch to ON position check experiment current.
7. Set recorder speed to 10 millimeter per second, and turn recorder "ON"
8. Make certain that experiment is operating in the following mode:
 - (a) Automatic Voltage Level Sequence ON
 - (b) Channeltron P.S. Voltage Increase OFF
 - (c) Thermal Control Bypass OFF
9. Let experiment and recorder operate for at least 20 seconds to record one complete CPLEE cycle.
10. Transmit Thermal Control Bypass ON Command Let experiment and recorder operate for at least 20 seconds.



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11. Transmit Dust Cover Removal Command
Let experiment and recorder operate at
least 10 seconds.