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Westinghouse Astronuclear Laboratory

Operational Manual for LRE and ATE Console Panels

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Operational Manual for LRE and ATE Console
Panels.

DATE:

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1.0 GENERAL

1.1 Introduction

This operational manual covers the four instrumentation panels that are mounted on the face of the LRE Console and two instrumentation panels that are mounted on the left half of the ATE Console. The panels are as follows:

- a. Pulse and Linear Power Panel
- b. Startup Panel
- c. Log Power Panel
- d. Reactor Setup Panel
- e. Engine Temperature Panel
- f. Drums Panel

The four LRE panels contain displays and controls associated with the neutronic parameters for the engine and test stand control systems and the reactor safety system.

The two ATE panels contain displays and controls associated with the engine temperature and reactor control drums parameters.

1.2 Description

Each panel has a suitable number of 55 pin connectors located at the rear of the panel through which all the wiring is brought to the front mounted panel items.

1.2.1 Pulse and Linear Power Panel

The pulse and linear power panel consists of controls and displays as shown on assembly drawing 928F719. It provides for three Test Stand pulse channels and three Test Stand linear power channels of neutronics instrumentation.

Test Stand pulse channel No. 1 items consist of the following:

- a. A total count digital readout. This is a six (6) digit gas ionization type with integral BCD to decimal decoder modules.
- b. A log count rate analog panel meter.

- c. A scaler power ON/OFF switch light.
- d. An ATE channel selector switch light electrically interlocked with Channel Nos. 2 and 3.
- e. An AUTO/HOLD switch light.
- f. A four-button mechanically interlocked time interval selector switch light.

Test Stand Pulse Channel Nos. 2 and 3 items are identical to Channel No. 1 above.

Test Stand Linear Power Channel No. 1 items consist of the following:

- a. A linear power analog panel meter.
- b. A range digital readout. This is a one digit gas ionization type with integral BCD to decimal decoder module.
- c. A CTE channel selector switch light electrically interlocked with Channel Nos. 2 and 3.

Test Stand Linear Power Channel Nos. 2 and 3 items are identical to Channel No. 1 above.

1.2.2 Startup Panel

The startup panel consists of controls and displays as shown on assembly drawing 928F721 for power increase time, auto startup, nuclear instrumentation, and printer.

Power Increase time items consist of the following:

- a. A power increase time digital readout. This is a four digit gas ionization type without integral decoders.
- b. A three-button mechanically interlocked channel selector switch light.
- c. A three-button mechanically interlocked folding-time selector switch light.
- d. A power ON/OFF switch light.
- e. A RESET switch light.

The auto startup items consist of the following:

- a. A variable EXPONENTIAL multiturn pot with vernier dial.
- b. A variable RAMP multiturn pot with vernier dial.

The panel also includes a printer RUN/STOP switch light and a nuclear instrumentation CALIB switch light.

1.2.3 Log Power Panel

The log power panel consists of controls and displays as shown on assembly drawing 928F717, for the Test Stand log power and Engine log power.

The Test Stand log power items consist of the following:

- a. Three log power analog panel meters. One for each channel.
- b. Three ACTIVE/REJECT switch lights. One for each channel.
- c. Three INHIBIT switch lights. One for each channel.
- d. An average log power analog panel meter.
- e. An average period analog panel meter.
- f. Two average ACTIVE/REJECT switch lights. One for Channel A and one for Channel B.

The Engine log power items are identical to the Test Stand log power items above.

1.2.4 Reactor Setup Panel

The reactor setup panel consists of controls and displays as shown on assembly drawing 928F715, for the nuclear power control and the reactor safety system.

The nuclear power control items consist of the following:

- a. A nuclear power signal digital readout. This is a four-digit gas ionization type without integral decoders.
- b. A nine-position nuclear power rotary selector switch.
- c. A BF3 power ON/OFF switch light.
- d. A LRE READY/HOLD switch light.
- e. A power control T. S. LOG/ENG LOG switch light.
- f. A computed power analog panel meter.

The reactor safety system items consist of the following:

- a. A FIXED power scram indicator light and an associated ACTIVE/BYPASS switch light.
- b. A FLOATING power scram indicator light and an associated ACTIVE/BYPASS switch light.
- c. A PERIOD scram indicator light and an associated ACTIVE/BYPASS switch light.
- d. A SPARE indicator light and an associated SPARE switch light.
- e. A four-button mechanically interlocked PERIOD trip selector switch light.
- f. A four-button SAMPLE TIME selector switch light.
- g. A variable FIXED power scram multiturn pot with vernier dial.
- h. A variable FLOATING power scram multiturn pot with vernier dial.

The panel also includes a LAMP VERIFY switch light .

1.2.5 Engine Temperature Panel

The engine temperature panel consists of controls and displays as shown on assembly drawing 928F723 for the engine temperatures.

The panel items consist of the following:

- a. A computed temperature analog panel meter.
- b. A chamber temperature analog panel meter.
- c. An In-Core No. 1 temperature analog panel meter.
- d. An In-Core No. 2 temperature analog panel meter.
- e. A spare temperature analog panel meter.
- f. Nine alarm temperature analog vertical edgewise meters.
- g. Nine alarm temperature indicator lights.
- h. Three ACTIVE/BYPASS switch lights; one for each control temperature channel.

1.2.6 Drums Panel

The drums panel consists of controls and displays as shown on assembly drawing 928F725 for the control drums.

The panel items consist of the following:

- a. Twelve individual drum position analog vertical edgewise meters.
- b. An average drum position analog vertical edgewise meter.
- c. Twelve LOCKED/UNLOCKED switch lights.
- d. A drum control CP/TCB switch light.
- e. A two position (ENABLE/DISABLE) drum unlock rotary key switch.

2.0 INSTALLATION

2.1 Incoming Inspection

The equipment was carefully inspected both mechanically and electrically before shipment. It should be physically free of marks, dents, or scratches and should be in perfect electrical order upon receipt. To confirm this, the equipment should be inspected for physical damage from transit and tested for electrical performance using the procedure of Section 5. If there is damage or deficiency, repairs should be made before final use.

2.2 Mounting

CAUTION: Before installation of the panels make sure that all power and signals to the consoles are turned off to prevent possible damage to the equipment or injury to personnel.

The panels are to be mounted on the front display faces of the LRE and ATE Consoles. Each panel is mounted by means of 4 knurled screws located at the edges of the panels. The locations are as follows:

- a. Pulse and Linear Panel at the upper-left of the LRE Console face.
- b. Startup Panel at the lower-left of the LRE Console face.

- c. Log Power Panel at the upper-right of the LRE Console face.
- d. Reactor Setup Panel at the lower-right of the LRE Console face.
- e. Engine Temperature Panel at the upper-left of the ATE Console face.
- f. Drums Panel at the lower-left of the ATE Console face.

After mounting the panels, connect the appropriate console electrical cables to the proper panel connectors receptacles.

2.3 Power Requirements

All power requirements for the panels are supplied from the LRE Component Chassis located in the LRE Console. The following voltages are required:

- a. 28VDC to operate the various switch-indicators.
- b. 200VDC to operate the Nixie-tube digital readouts.

Fusing for these voltage supplies are located in the LRE Component Chassis. A 10 amp fuse is used in the +28VDC circuit. Three 1/8 amp fuses are used in the 200VDC circuits, one for each readout channel. Power is brought into the various panels through the 55-pin connectors located at the back of each panel.

3.0 PRINCIPLES OF OPERATION

The displays and controls mounted on the various panels are operated in conjunction with their associated instrumentation chassis that are located in the Control Room or the Test Cell Building. Refer to schematic drawing 937J848 to understand the operation of the various devices on the panels.

3.1 Analog Meters

The analog meters are conventional DC microammeters with 100 microampere movements. Each meter has an auxiliary printed circuit board mounted on the back side which holds limiting resistors and a trim potentiometer connected in series with the meter. The trim potentiometer

is adjusted to obtain the correct full-scale meter reading. All the meter circuits operate over a signal range of 0 to 10VDC except the Period meters on the Log Power Panel which operates over a signal range of -0.7 to 9VDC.

3.2 Digital Readouts

The digital readouts devices used are the gas-filled, cold-cathode, glow-discharge tube type. Each tube consists of a single anode and a number of separate cathode elements inside a glass envelope. The cathodes are in the shape of numerals so that application of a negative voltage automatically displays a number. These readouts require a relatively high voltage (150 to 200VDC) for operation. The readouts on the Pulse and Linear Panel are supplied from a 200VDC power supply located in the LRE Component Chassis. The other readouts are supplied from their associated driver units located elsewhere.

The readouts on the Pulse and Linear Panels also have a BCD decoder module mounted on the rear of each readout tube. The signals for the various readouts are supplied from their associated driver units located elsewhere in the equipment.

3.3 Switch-Indicators

Two types of switch-indicators are used on the panels; the Master Specialties Series 10E Twist-Lite and the Korry interlocking keyboard.

3.3.1 The Master Specialties Series 10E Twist-Lite is a flush-mounted, illuminated push-button switch. The combined capability of a word indicator and a push-button switch is provided within this unit. Depressing the front lens face actuates the switch contacts which are either momentary or alternate action. Holding coils, which provide for electrical interlock are used on the ATE Channel and CTE Channel selector switches on the Pulse and Linear Power Panel and the Control Temperature selector switches on the Engine Temperature Panel.

3.3.2 The Korry interlocking keyboard is a mechanically interlocked, illuminated push-button switch. When one push-button is depressed, making the switch, it remains in the depressed position until another push-button in the same switch group is depressed.

3.4 Selector Switches

A nine-position Nuclear Power Monitor selector switch is mounted on the Setup Panel. It is used to select the desired nuclear log power input to the Power Monitor Driver which, in turn, drives the Power Monitor digital readout. At the same time, it also supplies the corresponding BCD signal to the printer unit.

A two-position Drums Unlock selector key switch is mounted on the Drums Panel. When placed in the DISABLE (open) position it prevents the drums from being unlocked.

3.5 Adjustment Potentiometers

The adjustment potentiometers are used as voltage dividers to supply set point signals to their associated instrumentation chassis located elsewhere.

4.0 OPERATION

The panels are not intended to be operated independently of their associated equipments. After initial turn on of the panels has been accomplished, refer to the operating instructions of the various equipment interfacing the panels for proper operation.

5.0 MAINTENANCE

5.1 Preventive Maintenance

The equipment is designed so that no special maintenance procedures are required other than the normal good housekeeping rules used for similar type electronic equipment.

5.2 Corrective Maintenance

If there is any apparent or suspected failure or improper functioning

of the equipment, the equipment should be checked-out in accordance with the Test Specification and Procedure for the particular panel involved.

6.0 TEST SPECIFICATION AND PROCEDURE

The proper Test Specification and Procedure numbers are:

T-711840	Pulse and Linear Power Panel
T-711841	Log Power Panel
T-711843	Drums Panel
T-711844	Engine Temperature Panel
T-711848	Startup Panel
T-711849	Reactor Setup Panel

7.0 DRAWING LIST

937J848 - Schematic Diagram - LRE and ATE Consoles
928F715 - Reactor Setup Panel - LRE Console
937J846 - Wiring Diagram - Reactor Setup Panel
928F717 - Log Power Panel - LRE Console
909E489 - Wiring Diagram - Log Power Panel
928F719 - Pulse and Linear Power Panel - LRE Console
936J139 - Wiring Diagram - Pulse and Linear Power Panel
928F721 - Startup Panel - LRE Console
928F738 - Wiring Diagram - Startup Panel
928F723 - Engine Temperature Panel - ATE Console
928F756 - Wiring Diagram - Engine Temperature Panel
928F725 - Drums Panel - ATE Console
938J073 - Wiring Diagram - Drums Panel
928F804 - Meters - LRE and ATE Consoles
978D902 - Meter Calibrator, Edgewise
978D904 - Meter Calibrator, 4.5 inch
978D906 - Meter Calibrator, 2.5 inch

TEST SPECIFICATION NUMBER T-711840

TITLE

Acceptance Test Specification and Procedure

PULSE AND LINEAR POWER PANEL-LRE CONSOLE ETS-1 TSCS

DATE: January, 1966

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ACCEPTANCE TEST SPECIFICATION
PULSE AND LINEAR POWER PANEL-LRE CONSOLE

1.0 SCOPE

This document contains the requirements for the acceptance testing of the Pulse and Linear Power Panel-LRE Console (WANL Drawing 928F719) of the ETS-1 Test Stand Control System.

2.0 REQUIREMENTS

2.1 The acceptance test shall consist of the following:

2.2.1 Visual Examination-To be performed by Quality Control.

2.2.2 Weights and Dimensions-To be performed by Quality Control.

2.2.3 Functional Test-To be performed by Instrumentation and Control and witnessed by Quality Control.

2.2 The acceptance test shall be performed in the order of and as specified in the procedure. Discrepancies found during the visual examination shall be corrected and reinspected before performing the functional test. Failure or inability to obtain a required measurement during formal functional testing shall result in establishing a "hold" on the test. The failure or inadequacy shall be recorded by Quality Control and shall be reviewed by the WANL Engineering Review Board (ERB). The equipment shall be repaired and sections of the test repeated as determined by the ERB. Visual examination shall be performed on the reworked or repaired areas before resuming testing.

3.0 APPLICABLE DOCUMENTS

- 3.1 Drawing 928F719 - Pulse and Linear Power Panel-LRE Console
- 3.2 Drawing 937J848 - Schematic Diagram-LRE and ATE Consoles
- 3.3 Drawing 936J139 - Wiring Diagram Pulse and Linear Power Panel-LRE Console
- 3.4 Meter Calibration Drawing - LRE and ATE Consoles
- 3.5 NDC-118A NERVA Design Criteria ETS-1 TSCS (AGC)
- 3.6 Burroughs Technical Bulletin No. 1054B

4.0 EQUIPMENT REQUIRED

- 4.1 Multimeter (Simpson 269 or equivalent)
- 4.2 Digital Voltmeter (0.1% accuracy)
- 4.3 Variable 0 to 10VDC signal source, $\pm 0.05\%$ regulation and ± 1 mv. ripple
- 4.4 28VDC $\pm$ 2VDC power source
- 4.5 200VDC $\pm$ 20VDC power source
- 4.6 An 8-wire 8-4-2-1 BCD signal source with a positive logic level of +10VDC equal to a logic "1". (To drive a Burroughs type BIP-8211P Decoder.)

ACCEPTANCE TEST PROCEDURE
PULSE AND LINEAR POWER PANEL-LRE CONSOLE

1.0 SCOPE

This document contains the procedures for acceptance testing the Pulse and Linear Power Panel-LRE Console (WANL Drawing 928F719) of the ETS-1 Test Stand Control System in accordance with the Acceptance Test Specification.

2.0 VISUAL EXAMINATION

The equipment under test shall be presented in its final form together with the applicable schematic, wiring diagram, and assembly drawing. The visual examination shall consist of the following parts:

2.1 Workmanship, Assembly, and Fit

The inspector shall inspect the equipment for workmanship to NASA requirements, and to assure that the overall chassis is of the proper dimensions per the assembly drawing, Westinghouse Drawing Number 928F719.

Workmanship OK _____

2.2 Materials, Parts, and Finishes

The equipment shall be inspected to assure that the materials, parts, and finishes are in accordance with the applicable assembly drawings. Incoming inspection records on materials, parts, and finishes shall be utilized to determine conformance to the assembly drawings where possible.

Materials OK _____

2.3 Treatment for Prevention of Corrosion

The equipment shall be inspected to assure that the coatings for prevention of corrosion have not been impaired during the manufacturing cycle.

Treatment OK _____

2.4 Safety Requirements

The equipment shall be inspected to insure that no safety hazard, such as sharp edges, etc., exist on the equipment which are potential hazards to personnel operating or maintaining the equipment.

Safety OK _____

2.5 Marking

The markings on the equipment shall be inspected to ensure conformance to the applicable drawings and to assure that they are acceptable as to permanence and readability.

Marking OK _____

2.6 Visual Examination Review

After the visual examination of the equipment has been completed, all deficiencies shall be reviewed by WANL Engineering and Quality Control and corrected by one of the following methods:

- a. Drawing changes where drawing deficiencies are noted.
- b. Design changes if necessitated.
- c. Rework of the parts affected.

3.0 WEIGHTS AND DIMENSIONS

3.1 The unit shall be weighed and the weight shall be recorded.

Weight _____ lbs.

3.2 The unit shall be measured and the overall dimensions of width, height, and depth recorded.

Width _____ in.

Height _____ in.

Depth _____ in.

4.0 FUNCTIONAL TESTS

4.1 Log Count Rate #1 Meter M1

4.1.1 Adjust meter-zero screw to obtain the correct zero scale reading.

4.1.2 Apply 10 $\pm$.01VDC between connector pins J1-J (+) and J1-K (return). Adjust meter trim pot to obtain the correct full-scale reading.

4.1.3 Check the calibration of the meter by varying the signal voltage to obtain all of the major calibration points listed on the meter drawing. Record the meter readings.

4.1.4 Remove the 10VDC signal source.

4.2 Log Count Rate Meters M2 and M3 and Linear Power Meters M10, M11, and M12

Repeat Step 4.1 for each meter except using connector pins as follows:

LINEAR POWER METER CALIBRATION CHECK

	INPUT SIGNAL	METER M10 READING	METER M11 READING	METER M12 READING	DESIRED READING		
	VOLTS DC						
	0.000				0 ± .1		
	1.000				1 ± .1		
	2.000				2 ± .1		
	3.000				3 ± .1		
	4.000				4 ± .1		
	5.000				5 ± .1		
	6.000				6 ± .1		
	7.000				7 ± .1		
	8.000				8 ± .1		
	9.000				9 ± .1		
	10.000				10 ± .1		

<u>Meter</u>	<u>Connector Pins</u>	
	<u>(+)</u>	<u>(return)</u>
Log Count Rate #2 - M2	J1-c	J1-d
Log Count Rate #3 - M3	J1-e	J1-f
Linear Power #1 - M10	J1-S	J1-t
Linear Power #2 - M11	J1-h	J1-u
Linear Power #3 - M12	J1-v	J1-FF

4.3 Total Count #1 Readout M4

CAUTION

This test requires the use of a high voltage source (200VDC). Extreme care should be used to prevent bodily harm or equipment damage during the test.

4.3.1 Apply 200VDC between connector pins J1-N (+) and J1-A (return). Apply 28VDC between connector pins J1-L (+) and J1-M (return).

4.3.2 Operate Scaler Power Switch S1 to remove power from Readout M4. OFF light DS1B goes "on". ON light DS1A goes "off".

4.3.3 Connect 8-wire BCD signal source (8-4-2-1 BCD with a positive logic level of +10VDC for logic "1") to the first digit decoder of readout M4.

NOTE: All the decoder pin connections for readout M4 are brought out through connector J3. Refer to wiring diagram 936J139 and Burroughs Technical Bulletin No. 1054B to determine the corresponding J3 connector pin for each decoder pin.

4.3.4 Operate Scaler Power Switch S1 to apply power to the readout M4. OFF light DS1B goes "off". ON light DS1A goes "on".

4.3.5 Apply BCD signals sequentially from 0 to 9 and observe the first digit of the readout to verify that the correct reading occurs for each numeral.

4.3.6 Repeat procedures of Steps 4.3.2 through 4.3.5 for each digit of readout M4 in succession. Readout M4 OK _____

4.4 Range #1 Readout M7

4.4.1 Remove 200VDC and repeat procedures of Step 4.3.3 except using readout M7 in place of M4 and connector J1 in place of J3.

4.4.2 Reapply 200VDC and repeat Step 4.3.5.

Readout M7 OK _____

4.5 Total Count #2 Readout M5

4.5.1 Remove 200VDC from connector pins J1-N and J1-A. Apply 200VDC between connector pins J1-P (+) and J1-C (return).

4.5.2 Repeat procedures of Steps 4.3.2 through 4.3.6 except using Scaler Power Switch S2 in place of S1, lights DS2 in place of DS1, Readout M5 in place of M4, and connector J4 in place of J3.

Readout M5 OK _____

4.6 Range #2 Readout M8

4.6.1 Remove 200VDC and repeat procedures of Step 4.3.3 except using Readout M8 in place of M4 and connector J1 in place of J3.

Readout M8 OK _____

4.6.2 Reapply 200VDC and repeat Step 4.3.5.

4.7 Total Count #3 Readout M6

4.7.1 Remove 200VDC from connector pins J1-P and J1-C. Apply 200VDC between connector pins J1-R (+) and J1-B (return).

4.7.2 Repeat procedures of Steps 4.3.2 through 4.3.6 except using Scaler Power Switch S3 in place of S1, lights DS3 in place of DS1, readout M6 in place of M4, and connector J5 in place of J3.

Readout M6 OK _____

4.8 Range #3 Readout M9

4.8.1 Remove 200VDC and repeat procedures of Step 4.3.3 except using Readout M9 in place of M4 and connector J1 in place of J3.

4.8.2 Reapply 200VDC and repeat Step 4.3.5.

4.8.3 Remove 200VDC from connector pins J1-R and J1-B. Remove 28VDC from connector pins J1-L and J1-M.

Readout M9 OK _____

4.9 Switch-Indicator S1 through S24 and DS1 through DS24

4.9.1 Connect jumper wires as follows:

from J2-A to J2-C
" J2-D to J2-F
" J2-G to J2-J
" J2-K to J2-M
" J2-N to J2-R
" J2-S to J2-U
" J2-V to J2-X
" J2-Y to J2-a
" J2-b to J2-d
" J2-e to J2-g
" J2-h to J2-j
" J2-k to J2-n

4.9.2 Apply 28VDC between connector pins J1-L (+) and J1-M (return).

4.9.3 Verify the following conditions:

4.9.3.1 Press #1 Time Interval Select Switches S4, S5, S6, and S7 in succession. Each respective push-button light should go "on" when pressed. The other three push-button lights should be "off".

#1 Switches OK _____

4.9.3.2 Press #2 Time Interval Select Switches S8, S9, S10, and S11 in succession. Each respective push-button light should go "on" when pressed. The other three push-button lights should be "off".

#2 Switches OK _____

4.9.3.3 Press #3 Time Interval Select Switches S12, S13, S14, and S15 in succession. Each respective push-button light should go "on" when pressed. The other three push-button lights should be "off".

#3 Switches OK _____

4.9.4 Remove 28VDC from connector pins J1-L and J1-M.

4.9.5 Remove jumper wires connected in Step 4.9.1 and connect as follows:

from J2-B to J2-C
" J2-E to J2-F
" J2-H to J2-J
" J2-L to J2-M
" J2-P to J2-R
" J2-T to J2-U
" J2-W to J2-X
" J2-Z to J2-a
" J2-c to J2-d
" J2-f to J2-g
" J2-i to J2-j
" J2-m to J2-n

#1 Switches OK _____
#2 Switches OK _____
#3 Switches OK _____

4.9.6 Repeat Steps 4.9.2 through 4.9.4

4.9.7 Remove jumper wires connected in Step 4.9.5

4.9.8 Repeat Step 4.9.2

4.9.9 Verify the following conditions:

4.9.9.1 Press ATE #1 Switch S16. ATE #1 light DS16 should go "on". Switches S17 and S18 should be in "not depressed" position. Lights DS17 and DS18 should be "off". Connector pins J1-J to J1-F and J1-K to J1-D are short-circuits.

#1 Switch OK _____

4.9.9.2 Press ATE #2 Switch S17. ATE #2 light DS17 should go "on". Switches S16 and S18 should be in "not depressed" position. Lights DS16

and DS18 should be "off". Connector pins

J1-c to J1-F and J1-d to J1-D are short-circuits.

#2 Switch OK

4.9.9.3 Press ATE #3 Switch S18. ATE #3 light DS18

should go "on". Switches S16 and DS17 should

be in "not depressed" position. Lights DS16

and DS17 should be "off". Connector pins J1-e

to J1-F and J1-f to J1-D are short-circuits.

#3 Switch OK

4.9.9.4 Operate Auto/Hold #1 Switch S19. HOLD light

DS19B alternates "off" and "on". AUTO light

DS19A alternates "on" and "off", in opposition

to HOLD light. Connector pins J2-p to J2-q and

J2-s to J2-u are short-circuits when HOLD light

is "on". Connector pins J2-p to J2-r and

J2-s to J2-t are short-circuits when AUTO light

is "on".

#1 Switch OK

4.9.9.5 Operate Auto/Hold #2 Switch S20. HOLD light

DS20B alternates "off" and "on". AUTO light

DS20A alternates "on" and "off", in opposition

to HOLD light. Connector pins J2-v to J2-w and

J2-y to J2-z are short-circuits when HOLD light

is "on". Connector pins J2-v to J2-x and J2-y

to J2-AA are short-circuits when AUTO light is "on".

#2 Switch OK

4.9.9.6 Operate Auto/Hold^{#3} Switch S21. HOLD light DS21B

alternates "off" and "on". AUTO light DS21A

alternates "on" and "off" in opposition to HOLD

light. Connector pins J2-BE to J2-CC and J2-EE

to J2-FF are short-circuits when HOLD light is "on".

Connector pins J2-BB to J2-DD and J2-EE to J2-GG are short-circuits when AUTO light is "on". #3 Switch OK _____

4.9.9.7 Press CTE #1 Switch S22. CTE #1 light DS22 should go "on". Switches S23 and S24 should be in "not depressed" position. Lights DS23 and DS24 should be "off". Connector pins J1-S to J1-b and J1-t to J1-HH are short-circuits.

#1 Switch OK _____

4.9.9.8 Press CTE #2 Switch S23. CTE #2 light DS23 should go "on". Switches S22 and S24 should be in "not depressed" position. Lights DS22 and DS24 should be "off". Connector pins J1-h to J1-b and J1-u to J1-HH are short-circuits. +28+2VDC should appear at connector pin J1-s.

#2 Switch OK _____

4.9.9.9 Press CTE #3 Switch S24. CTE #3 light DS24 should be "on". Switches S22 and S23 should be in "not depressed" position. Lights DS22 and DS23 should be "off". Connector pins J1-y to J1-b and J1-FF to J1-HH are short-circuits. +28+2VDC should appear at connector pin J1-EE.

#3 Switch OK _____

4.9.10 Apply +28VDC to connector pin J1-G and verify that lights DS1A through DS3B and DS16 through DS24 go "on" regardless of the position of the switches.

Lamp Verify OK _____

4.9.11 Remove the 28VDC power.

4.10 Safety Ground

Use an ohmmeter from connector pin J1-H to the chassis to verify that it is a short-circuit. Ground OK _____

4.11 Isolation Test

Use an ohmmeter to measure the resistance between each connector pin and chassis ground to verify that the resistance is >10 megohms. Isolation OK _____

TEST SPECIFICATION NUMBER T-711841

TITLE

Acceptance Test Specification and Procedure

ENGINE TEMPERATURE PANEL-ATE CONSOLE ETS-1 TSCS

DATE: January, 1966

PREPARED BY:

Harry Kowalski
Control Equipment Design and Fabrication
Control Systems Engineering

APPROVED BY:

R. A. Fonger
Control Systems Engineering

R. J. Kelly 1-10-66
Quality Engineering

INFORMATION CATEGORY

unclassified
W. B. Morris 1/11/66
Authorized Classifier/Date

ACCEPTANCE TEST SPECIFICATION
ENGINE TEMPERATURE PANEL-ATE CONSOLE

1.0 SCOPE

This document contains the requirements for the acceptance testing of the Engine Temperature Panel-ATE Console (WANL Drawing 928F723) of the ETS-1 Test Stand Control System.

2.0 REQUIREMENTS

2.1 The acceptance test shall consist of the following:

2.2.1 Visual Examination-To be performed by Quality Control.

2.2.2 Weights and Dimensions-To be performed by Quality Control.

2.2.3 Functional Test-To be performed by Instrumentation and Control and witnessed by Quality Control.

2.2 The acceptance test shall be performed in the order of and as specified in the procedure. Discrepancies found during the visual examination shall be corrected and reinspected before performing the functional test. Failure or inability to obtain a required measurement during formal functional testing shall result in establishing a "hold" on the test. The failure or inadequacy shall be recorded by Quality Control and shall be reviewed by the WANL Engineering Review Board (ERB). The equipment shall be repaired and sections of the test repeated as determined by the ERB. Visual examination shall be performed on the reworked or repaired areas before resuming testing.

3.0 APPLICABLE DOCUMENTS

- 3.1 Drawing 928F723 - Engine Temperature Panel-ATE Console
- 3.2 Drawing 937J848 - Schematic Diagram-LRE and ATE Console
- 3.3 Drawing 928F756 - Wiring Diagram Engine Temperature Panel - ATE Console
- 3.4 Meter Calibration Drawing - LRE and ATE Consoles
- 3.5 NDC-118A NERVA Design Criteria ETS-1 TSCS (AGC)

4.0 EQUIPMENT REQUIRED

- 4.1 Multimeter (Simpson 269 or equivalent)
- 4.2 Digital Voltmeter (0.1% accuracy)
- 4.3 Variable 0 to 10VDC signal source, $\pm 0.05\%$ regulation and ± 1 mv.
ripple
- 4.4 28VDC $\pm$ 2VDC power source

ACCEPTANCE TEST PROCEDURE
ENGINE TEMPERATURE PANEL-ATE CONSOLE

1.0 SCOPE

This document contains the procedures for acceptance testing the Engine Temperature Panel-ATE Console (WANL Drawing 928F723) of the ETS-1 Test Stand Control System in accordance with the Acceptance Test Specification.

2.0 VISUAL EXAMINATION

The equipment under test shall be presented in its final form together with the applicable schematic, wiring diagram, and assembly drawing. The visual examination shall consist of the following parts:

2.1 Workmanship, Assembly, and Fit

The inspector shall inspect the equipment for workmanship to NASA requirements, and to assure that the overall chassis is of the proper dimensions per the assembly drawing, Westinghouse Drawing Number 928F723.

Workmanship OK _____

2.2 Materials, Parts, and Finishes

The equipment shall be inspected to assure that the materials, parts, and finishes are in accordance with the applicable assembly drawings. Incoming inspection records on materials, parts, and finishes shall be utilized to determine conformance to the assembly drawings where possible.

Materials OK _____

2.3 Treatment for Prevention of Corrosion

The equipment shall be inspected to assure that the coatings for prevention of corrosion have not been impaired during the manufacturing cycle.

Treatment OK _____

2.4 Safety Requirements

The equipment shall be inspected to insure that no safety hazard, such as sharp edges, etc., exist on the equipment which are potential hazards to personnel operating or maintaining the equipment.

Safety OK _____

2.5 Marking

The markings on the equipment shall be inspected to ensure conformance to the applicable drawings and to assure that they are acceptable as to permanence and readability.

Marking OK _____

2.6 Visual Examination Review

After the visual examination of the equipment has been completed, all deficiencies shall be reviewed by WANL Engineering and Quality Control and corrected by one of the following methods:

- a. Drawing changes where drawing deficiencies are noted.
- b. Design changes if necessitated.
- c. Rework of the parts affected.

3.0 WEIGHTS AND DIMENSIONS

3.1 The unit shall be weighed and the weight shall be recorded.

Weight _____ lbs.

3.2 The unit shall be measured and the overall dimensions of width, height, and depth recorded.

Width _____ in.

Height _____ in.

Depth _____ in.

4.0 FUNCTIONAL TESTS

4.1 Computed Temperature Meter M1

4.1.1 Adjust meter-zero screw to obtain the correct zero scale reading.

4.1.2 Apply $10 \pm .01$ VDC between connector pins J1-P (+) and J1-GG (return). Adjust meter trim pot to obtain the correct full-scale reading.

4.1.3 Check the calibration of the meter by varying the signal voltage to obtain all of the major calibration points listed on the meter drawing. Record the meter readings.

4.1.4 Remove the 10VDC signal source.

4.2 Temperature Meters M2 through M14.

Repeat Step 4.1 for each meter except using connector pins as follows:

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TEMPERATURE METER CALIBRATION CHECK

INPUT SIGNAL	(IN-CORE 1) TEMP	(IN-CORE 2) TEMP	(STATION 32) TEMP	DESIRED READING		
	METER READING M3	METER READING M4	METER READING M9			
VOLTS DC.	OR	OR	OR	OR		
0.000				500 ±50		
0.450				1000 ±50		
1.450				1500 ±50		
2.750				2000 ±50		
4.210				2500 ±50		
5.670				3000 ±50		
7.070				3500 ±50		
8.350				4000 ±50		
9.470				4500 ±50		
10.000				4785 ±50		

TEMPERATURE METER CALIBRATION CHECK

INPUT SIGNAL	(SPARE) METER READING M7	(CORE INLET TEMP) METER READING M11	(OUTER REFLECTOR TEMP) METER READING M12	(SPARE) METER- READING M13	DESIRED READING
VOLTS DC.	(OK)	°R	°R	(OK)	°R
0.000					ZERO SCALE
0.000					35 ±5
0.330					100 ±5
1.260					200 ±5
2.590					300 ±5
4.290					400 ±5
6.300					500 ±5
8.600					600 ±5
10.000					656 ±5
10.000					FULL SCALE

TEMPERATURE METER CALIBRATION CHECK

INPUT SIGNAL	(SPARE) METER READING M5	(SPARE) METER READING M6	(TIE ROD TEMP) METER READING M8	(STATION 8 TEMP) METER READING M10	DESIRED READING
VOLTS DC.	(OK)	(OK)	°R	°R	°R
0.000			X	X	ZERO SCALE
0.000	X	X			137 ±20
0.170	X	X			200 ±20
0.980	X	X			400 ±20
2.070	X	X			600 ±20
3.210	X	X			800 ±20
4.330	X	X			1000 ±20
5.500	X	X			1200 ±20
6.680	X	X			1400 ±20
7.860	X	X			1600 ±20
9.030	X	X			1800 ±20
10.000	X	X			1970 ±20
10.000			X	X	FULL SCALE

<u>Meter</u>	<u>Connector Pins</u>	
	(+)	(return)
Chamber Temp. - M2	J1-R	J1-h
In-Core 1 Temp. - M3	J1-S	J1-f
In-Core 2 Temp. - M4	J1-T	J1-e
Monitoring Temp. - M5	J1-U	J1-d
" " - M6	J1-V	J1-c
" " - M7	J1-W	J1-b
" " - M8	J1-X	J1-N
" " - M9	J1-Y	J1-M
" " - M10	J1-Z	J1-L
" " - M11	J1-a	J1-F
" " - M12	J1-i	J1-G
" " - M13	J1-j	J1-m
Spare Temp. - M14	J1-k	J1-HH

4.3 Switch-Indicator S1 through S3 and DS1 through DS3

4.3.1 Connect jumper wires as follows:

from J1-q to J1-r
 " J1-t to J1-u

4.3.2 Apply 28VDC between connector pins J1-A (+) and J1-B (return).

4.3.3 Verify the following conditions:

4.3.3.1 Press Chamber Temp. Switch S1. All lights should be "off". Switches S2 and S3 should be in "not depressed" condition. Switch S1 OK _____

4.3.3.2 Press In-Core Temp. Switch S2. ACTIVE light DS2A should go "on". All other lights should remain "off". Switches S1 and S3 should be in "not depressed" condition. Switch S2 OK _____

4.3.3.3 Press In-Core Temp. Switch S3. ACTIVE light DS3A should go "on". All other lights should remain "off". Switches S1 and S2 should be in "not depressed" condition. Switch S3 OK _____

- 4.3.4 Apply +28VDC power to the following connector pins in succession and verify that the associated lights go "on".

Connector Pin	Light	(OK)
J1-n	Active DS1A (Chamber Temp.)	_____
J1-p	Bypass DS1B (Chamber Temp.)	_____
J1-s	Bypass DS2B (In-Core 1 Temp.)	_____
J1-v	Bypass DS3B (In-Core 2 Temp.)	_____
J1-w	#1 - DS4 (Monitoring Temp.)	_____
J1-x	#2 - DS5 " "	_____
J1-y	#3 - DS6 " "	_____
J1-z	#4 - DS7 " "	_____
J1-AA	#5 - DS8 " "	_____
J1-BB	#6 - DS9 " "	_____
J1-CC	#7 - DS10 " "	_____
J1-DD	#8 - DS11 " "	_____
J1-EE	#9 - DS12 " "	_____

- 4.3.5 Apply +28VDC to connector pin J1-E and verify that all lights go "on" regardless of the position of the switches.

- 4.3.6 Remove the 28VDC power and disconnect all the jumper wires. Lamp Verify OK _____

- 4.3.7 Use an ohmmeter between connector pins J1-B and J1-FF to verify that it is a short-circuit. Short OK _____

4.4 Safety Ground

Use an ohmmeter from connector pin J1-H to the chassis to verify that it is a short-circuit. Ground OK _____

4.5 Isolation Test

Use an ohmmeter to measure the resistance between each connector pin and chassis ground to verify that the resistance is >10 megohms. Isolation OK _____

TEST SPECIFICATION NUMBER T-711843

TITLE

Acceptance Test Specification and Procedure

DRUMS PANEL-ATE CONSOLE ETS-1 TSCS

DATE: January, 1966

PREPARED BY: Harry Kowalchuk
Control Equipment Design and Fabrication
Control Systems Engineering

APPROVED BY: R. A. Elmer
Control Systems Engineering

J. J. Kelly 1-10-66
Quality Engineering

INFORMATION CATEGORY

unclassified
W. B. Davis 1/11/66
Authorized Classifier/Date

ACCEPTANCE TEST SPECIFICATION

DRUMS PANEL-ATE CONSOLE

1.0 SCOPE

This document contains the requirements for the acceptance testing of the Drums Panel-ATE Console (WANL Drawing 928F725) of the ETS-1 Test Stand Control System.

2.0 REQUIREMENTS

2.1 The acceptance test shall consist of the following:

2.2.1 Visual Examination-To be performed by Quality Control.

2.2.2 Weights and Dimensions-To be performed by Quality Control.

2.2.3 Functional Test-To be performed by Instrumentation and Control and witnessed by Quality Control.

2.2 The acceptance test shall be performed in the order of and as specified in the procedure. Discrepancies found during the visual examination shall be corrected and reinspected before performing the functional test. Failure or inability to obtain a required measurement during formal functional testing shall result in establishing a "hold" on the test. The failure or inadequacy shall be recorded by Quality Control and shall be reviewed by the WANL Engineering Review Board (ERB). The equipment shall be repaired and sections of the test repeated as determined by the ERB. Visual examination shall be performed on the reworked or repaired areas before resuming testing.

3.0 APPLICABLE DOCUMENTS

- 3.1 Drawing 928F725 Drums Panel-ATE Console
- 3.2 Drawing 937J848 - Schematic Diagram LRE and ATE Consoles
- 3.3 Drawing 938J073 - Wiring Diagram-DRUMS Panel ATE Console
- 3.4 Meter Calibration Drawing-LRE and ATE Consoles
- 3.5 NDC-118A NERVA Design Criteria ETS-1 TSCS (AGC)

4.0 EQUIPMENT REQUIRED

- 4.1 Multimeter (Simpson 269 or equivalent)
- 4.2 Digital Voltmeter (0.1% accuracy)
- 4.3 Variable 0 to 10VDC signal source, $\pm 0.05\%$ regulation and ± 1 mv.
ripple
- 4.4 28VDC $\pm$ 2VDC power source

ACCEPTANCE TEST PROCEDURE

DRUMS PANEL-ATE CONSOLE

1.0. SCOPE

This document contains the procedures for acceptance testing the Drums Panel-ATE Console (WANL Drawing 928F725) of the ETS-1 Test Stand Control System in accordance with the Acceptance Test Specification.

2.0 VISUAL EXAMINATION

The equipment under test shall be presented in its final form together with the applicable schematic, wiring diagram, and assembly drawing. The visual examination shall consist of the following parts:

2.1 Workmanship, Assembly, and Fit

The inspector shall inspect the equipment for workmanship to NASA requirements, and to assure that the overall chassis is of the proper dimensions per the assembly drawing, Westinghouse Drawing Number 928F725.

Workmanship OK _____

2.2 Materials, Parts, and Finishes

The equipment shall be inspected to assure that the materials, parts, and finishes are in accordance with the applicable assembly drawings. Incoming inspection records on materials, parts, and finishes shall be utilized to determine conformance to the assembly drawings where possible.

Materials OK _____

2.3 Treatment for Prevention of Corrosion

The equipment shall be inspected to assure that the coatings for prevention of corrosion have not been impaired during the manufacturing cycle.

Treatment OK _____

2.4 Safety Requirements

The equipment shall be inspected to insure that no safety hazard, such as sharp edges, etc., exist on the equipment which are potential hazards to personnel operating or maintaining the equipment.

Safety OK _____

2.5 Marking

The markings on the equipment shall be inspected to ensure conformance to the applicable drawings and to assure that they are acceptable as to permanence and readability.

Marking OK _____

2.6 Visual Examination Review

After the visual examination of the equipment has been completed, all deficiencies shall be reviewed by WANL Engineering and Quality Control and corrected by one of the following methods:

- a. Drawing changes where drawing deficiencies are noted.
- b. Design changes if necessitated.
- c. Rework of the parts affected.

3.0 WEIGHTS AND DIMENSIONS

3.1 The unit shall be weighed and the weight shall be recorded.

Weight _____ lbs.

3.2 The unit shall be measured and the overall dimensions of width, height, and depth recorded.

Width _____ in.

Height _____ in.

Depth _____ in.

4.0 FUNCTIONAL TESTS

4.1 Drum Position Meter M1

4.1.1 Adjust meter-zero screw to obtain the correct zero scale reading.

4.1.2 Apply $10 \pm .01$ VDC between connector pins J2-A (+) and J2-HH (return). Adjust meter trim pot to obtain the correct full-scale reading.

4.1.3 Check the calibration of the meter by varying the signal voltage to obtain all of the major calibration points listed on the meter drawing. Record the meter readings.

4.1.4 Remove the 10VDC signal source.

4.2 Drum Position Meters M2 through M13

Repeat Step 4.1 for each meter except using connector pins as follows:

<u>Meter</u>	<u>Connector Pins</u>	
	(+)	(return)
#2-M2	J2-B	J2-GG
#3-M3	J2-C	J2-FF
#4-M4	J2-D	J2-EE
#5-M5	J2-E	J2-DD
#6-M6	J2-F	J2-CC
#7-M7	J2-G	J2-BB
#8-M8	J2-H	J2-AA
#9-M9	J2-J	J2- <u>g</u>
#10-M10	J2-K	J2- <u>y</u>
#11-M11	J2-L	J2- <u>x</u>
#12-M12	J2-M	J2- <u>w</u>
AVG.-M13	J2-N	J2-P

4.3 Switch-Indicators S1 through S12 and DS1 through DS13 and Key

Switch S13

4.3.1 Connect jumper wires as follows:

from J1-C to J1-D
 " J1-F to J1-G
 " J1-M to J1-N
 " J1-R to J1-S
 " J1-U to J1-V
 " J1-X to J1-Y
 " J1-a to J1-b
 " J1-d to J1-e
 " J1-g to J1-h
 " J1-i to J1-k
 " J1-n to J1-p
 " J1-r to J1-s

4.3.2 Apply 28VDC between connector pins J1-A (+) and J1-B (return)

4.3.3 Verify the following conditions:

4.3.3.1 Place Key Switch S13 in ENABLE position.
 Operate Lock/Unlock Switch S1.
 LOCKED light DS1A alternates "off" and "on".
 UNLOCKED light DS1B remains "off".

4.3.3.2 Place Key Switch S13 in DISABLE position
 Operate Lock/Unlock Switch S1
 Both lights DS1A, DS1B remain "off" S1 OK ____

4.3.3.3 Repeat Steps 4.3.3.1 and 4.3.3.2 for Lock/Unlock
 Switches S2 through S12 and LOCKED/UNLOCKED
 lights DS2 through DS12. S2 OK ____ S3 OK ____
 S4 OK ____ S5 OK ____ S6 OK ____ S7 OK ____
 S8 OK ____ S9 OK ____ S10 OK ____ S11 OK ____
 S12 OK ____

4.3.4 Apply +28VDC power to the following connector pins in succession and verify that the associated lights go "on".

Connector Pin	Light	(OK)
J1-E	Unlocked DS1B	_____
J1-L	" DS2B	_____
J1-P	" DS3B	_____
J1-T	" DS4B	_____
J1-W	" DS5B	_____
J1-Z	" DS6B	_____
J1-c	" DS7B	_____
J1-f	" DS8B	_____
J1-i	" DS9B	_____
J1-m	" DS10B	_____
J1-q	" DS11B	_____
J1-t	" DS12B	_____
J1-J	TCB DS13B	_____
J1-K	CP DS13A	_____

4.3.5 Apply +28VDC to connector pin J1-H and verify that all lights go "on" regardless of the position of the switches.

4.3.6 Remove the 28VDC power and disconnect all the jumper wires. Lamp Verify OK _____

4.4 Safety Ground

Use an ohmmeter from connector pin J1-H to the chassis to verify that it is a short-circuit. Ground OK _____

4.5 Isolation Test

Use an ohmmeter to measure the resistance between each connector pin and chassis ground to verify that the resistance is >10 megohms. Isolation OK _____

TEST SPECIFICATION NUMBER T-711844

TITLE

Acceptance Test Specification and Procedure

LOG POWER PANEL-LRE CONSOLE ETS-1 TSCS

DATE: January, 1966

PREPARED BY:

Harry Kowalski
Control Equipment Design and Fabrication
Control Systems Engineering

APPROVED BY:

V. A. Elmer
Control Systems Engineering

J. J. Kelly 1-10-66
Quality Engineering

INFORMATION CATEGORY

unclassified

W. B. Morris 1/11/66
Authorized Classifier/Date

ACCEPTANCE TEST SPECIFICATION

LOG POWER PANEL-LRE CONSOLE

1.0 SCOPE

This document contains the requirements for the acceptance testing of the Log Power Panel-LRE Console (WANL Drawing 928F717) of the ETS-1 Test Stand Control System.

2.0 REQUIREMENTS

2.1 The acceptance test shall consist of the following:

2.2.1 Visual Examination-To be performed by Quality Control.

2.2.2 Weights and Dimensions-To be performed by Quality Control.

2.2.3 Functional Test-To be performed by Instrumentation and Control and witnessed by Quality Control.

2.2 The acceptance test shall be performed in the order of and as specified in the procedure. Discrepancies found during the visual examination shall be corrected and reinspected before performing the functional test. Failure or inability to obtain a required measurement during formal functional testing shall result in establishing a "hold" on the test. The failure or inadequacy shall be recorded by Quality Control and shall be reviewed by the WANL Engineering Review Board (ERB). The equipment shall be repaired and sections of the test repeated as determined by the ERB. Visual examination shall be performed on the reworked or repaired areas before resuming testing.

3.0 APPLICABLE DOCUMENTS

- 3.1 Drawing 928F717 - Log Power Panel-LRE Console
- 3.2 Drawing 937J848 - Schematic Diagram-LRE and ATE Consoles
- 3.3 Drawing 909E489 - Wiring Diagram-Log Power Panel-LRE Console
- 3.4 Meter Calibration Drawing - LRE and ATE Consoles
- 3.5 NDC-118A NERVA Design Criteria ETS-1 TSCS (AGC)

4.0 EQUIPMENT REQUIRED

- 4.1 Multimeter (Simpson 269 or equivalent)
- 4.2 Digital Voltmeter (0.1% accuracy)
- 4.3 Variable 0 to 10VDC signal source, $\pm 0.05\%$ regulation and ± 1 mv. ripple
- 4.4 28VDC $\pm$ 2VDC power source

ACCEPTANCE TEST PROCEDURE
LOG POWER PANEL-LRE CONSOLE

1.0 SCOPE

This document contains the procedures for acceptance testing the Log Power Panel-LRE Console (WANL Drawing 928F717) of the ETS-1 Test Stand Control System in accordance with the Acceptance Test Specification.

2.0 VISUAL EXAMINATION

The equipment under test shall be presented in its final form together with the applicable schematic, wiring diagram, and assembly drawing. The visual examination shall consist of the following parts:

2.1 Workmanship, Assembly, and Fit

The inspector shall inspect the equipment for workmanship, to NASA requirements, and to assure that the overall chassis is of the proper dimensions per the assembly drawing, Westinghouse Drawing Number 928F717.

Workmanship OK _____

2.2 Materials, Parts, and Finishes

The equipment shall be inspected to assure that the materials, parts, and finishes are in accordance with the applicable assembly drawings. Incoming inspection records on materials, parts, and finishes shall be utilized to determine conformance to the assembly drawings where possible.

Materials OK _____

2.3 Treatment for Prevention of Corrosion

The equipment shall be inspected to assure that the coatings for prevention of corrosion have not been impaired during the manufacturing cycle.

Treatment OK _____

2.4 Safety Requirements

The equipment shall be inspected to insure that no safety hazard, such as sharp edges, etc., exist on the equipment which are potential hazards to personnel operating or maintaining the equipment.

Safety OK _____

2.5 Marking

The markings on the equipment shall be inspected to ensure conformance to the applicable drawings and to assure that they are acceptable as to permanence and readability.

Marking OK _____

2.6 Visual Examination Review

After the visual examination of the equipment has been completed, all deficiencies shall be reviewed by WANL Engineering and Quality Control and corrected by one of the following methods:

- a. Drawing changes where drawing deficiencies are noted.
- b. Design changes if necessitated.
- c. Rework of the parts affected.

3.0 WEIGHTS AND DIMENSIONS

3.1 The unit shall be weighed and the weight shall be recorded.

Weight _____ lbs.

3.2 The unit shall be measured and the overall dimensions of width, height, and depth recorded.

Width _____ in.

Height _____ in.

Depth _____ in.

4.0 FUNCTIONAL TESTS

4.1 TS Log Power 1 Meter M1

4.1.1 Adjust meter-zero screw to obtain the correct zero scale reading.

4.1.2 Apply 10 $\pm$.01VDC between connector pins J1-A (+) and J1-FF (return). Adjust meter trim pot to obtain the correct full-scale reading.

4.1.3 Check the calibration of the meter by varying the signal voltage to obtain all of the major calibration points listed on the meter drawing. Record the meter readings.

4.1.4 Remove the 10VDC signal source.

4.2 Log Power and Period Meters M2 through M10

4.2.1 Log Power Meters

Repeat Step 4.1 for each meter except using connector pins as follows:

LOG POWER METER CALIBRATION CHECK

INPUT SIGNAL	METER M1 READING	METER M2 READING	METER M3 READING	METER M6 READING	METER M7 READING	METER M8 READING	DESIRED READING
VOLTS DC	WATTS	WATTS	WATTS	WATTS	WATTS	WATTS	WATTS
0.000							55 ± 10
0.325							$10^2 \pm 20$
1.575							$10^3 \pm 2 \times 10^2$
2.825							$10^4 \pm 2 \times 10^3$
4.075							$10^5 \pm 2 \times 10^4$
5.325							$10^6 \pm 2 \times 10^5$
6.575							$10^7 \pm 2 \times 10^6$
7.825							$10^8 \pm 2 \times 10^7$
9.075							$10^9 \pm 2 \times 10^8$
10.000							$5.5 \times 10^9 \pm 10^9$

AVERAGE LOG POWER METER CALIBRATION CHECK

INPUT SIGNAL	METER M4 READING	METER M9 READING	DESIRED READING
VOLTS DC	WATTS	WATTS	WATTS
0.000			55 ± 10
0.325			$10^2 \pm 20$
1.575			$10^3 \pm 2 \times 10^2$
2.825			$10^4 \pm 2 \times 10^3$
4.075			$10^5 \pm 2 \times 10^4$
5.325			$10^6 \pm 2 \times 10^5$
6.575			$10^7 \pm 2 \times 10^6$
7.825			$10^8 \pm 2 \times 10^7$
9.075			$10^9 \pm 2 \times 10^8$
10.000			$5.5 \times 10^9 \pm 10^9$

AVERAGE PERIOD METER CALIBRATION CHECK

INPUT SIGNAL	METER M5 READING	METER M10 READING	DESIRED READING			
VOLTS DC	SECONDS	SECONDS	SECONDS			
- 0.700			-10 ± 2			
0.000			$\infty \pm 100$			
0.700			10 ± 2			
1.400			$5 \pm .5$			
1.750			$4 \pm .3$			
2.333			$3 \pm .2$			
3.500			$2 \pm .1$			
4.667			$1.5 \pm .05$			
5.833			$1.2 \pm .03$			
7.000			$1.0 \pm .2$			
7.222			$0.5 \pm .1$			
7.889			$0.2 \pm .05$			
9.000			$0.1 \pm .01$			

<u>METER</u>	<u>CONNECTOR PINS</u>	
	(+)	(return)
TS. Log Power 2 - M2	J1-B	J1-p
TS. Log Power 3 - M3	J1-C	J1-f
TS Avg. Log Power - M4	J1-D	J1-e
TS. Avg. Period - M5	J1-E	J1-a
Eng. Log Power 1 - M6	J1-V	J1-F
Eng. Log Power 2 - M7	J1-W	J1-M
Eng. Log Power 3 - M8	J1-X	J1-L
Eng. Avg. Log Power - M9	J1-Y	J1-K
Eng. Avg. Period - M10	J1-Z	J1-J

4.2.2 Average Period Meters

Repeat Step 4.1 for each meter except as follows:
Adjust meter-zero screw to obtain a scale reading of 00 instead of zero-scale. Apply a $9 \pm .01$ VDC signal instead of $10 \pm .01$ VDC for the correct full-scale reading. Use connector pins as listed above.

4.3 Switch-Indicator S1 through S16 and DS1 through DS16.

4.3.1 Connect jumper wires as follows:

From J1-N to J1-R	From J1-q to J1-s
" J1-P to J1-T	" J1-r to J1-u
" J1-b to J1-d	" J1-v to J1-x
" J1-c to J1-h	" J1-w to J1-z
" J1-i to J1-k	" J1-AA to J1-CC
" J1-j to J1-n	" J1-BB to J1-EE

4.3.2 Apply 28VDC between connector pins J1-GG (+) and J1-HH (return).

4.3.3 Verify the following conditions:

- 4.3.3.1 Operate Active/Reject Switch S1. ACTIVE light
DS1A alternates "off" and "on". REJECT light
DS1B remains "off". Switch S1 OK ____
- 4.3.3.2 Operate Inhibit Switch S2. INHIBIT light DS2
alternates "off" and "on". Switch S2 OK ____
- 4.3.3.3 Operate Active/Reject Switch S3. ACTIVE light
DS3A alternates "off" and "on". REJECT light
DS3B remains "off". Switch S3 OK ____
- 4.3.3.4 Operate Inhibit Switch S4. INHIBIT light DS4
alternates "off" and "on". Switch S4 OK ____
- 4.3.3.5 Operate Active/Reject Switch S5. ACTIVE light
DS5A alternates "off" and "on". REJECT light
DS5B remains "off". Switch S5 OK ____
- 4.3.3.6 Operate Inhibit Switch S6. INHIBIT light DS6
alternates "off" and "on". Switch S6 OK ____
- 4.3.3.7 Operate Active/Reject Switch S7. ACTIVE light
DS7A alternates "off" and "on". REJECT light
DS7B remains "off". Switch S7 OK ____
- 4.3.3.8 Operate Inhibit Switch S8. INHIBIT light DS8
alternates "off" and "on". Switch S8 OK ____
- 4.3.3.9 Operate Active/Reject Switch S9. ACTIVE light
DS9A alternates "off" and "on". REJECT light
DS9B remains "off". Switch S9 OK ____
- 4.3.3.10 Operate Inhibit Switch S10. INHIBIT light
DS10 alternates "off" and "on". Switch S10 OK ____
- 4.3.3.11 Operate Active/Reject Switch S11. ACTIVE light DS11A
alternates "off" and "on". REJECT light DS11B
remains "off". Switch S11 OK ____

- 4.3.3.12 Operate Inhibit Switch S12. INHIBIT light
DS12 alternates "off" and "on". Switch S12 OK _____
- 4.3.3.13 Operate Avg. A Reject Switch S13. Use
an ohmmeter between connector pins J2-G
and J2-H to verify it alternates between a
short-circuit and open-circuit. Switch S13 OK _____
- 4.3.3.14 Operate Avg. B Reject Switch S14. Use
an ohmmeter between connector pins J2-K
and J2-L to verify it alternates between a
short-circuit and open-circuit. Switch S14 OK _____
- 4.3.3.15 Operate Avg. A Reject Switch S15. Use
an ohmmeter between connector pins J2-c
and J2-d to verify it alternates between a
short-circuit and open-circuit. Switch S15 OK _____
- 4.3.3.16 Operate Avg. B Reject Switch S16. Use
an ohmmeter between connector pins J2-f
and J2-g to verify it alternates between a
short-circuit and open-circuit. Switch S16 OK _____

4.3.4 Apply +28VDC to the following connector pins in succession
and verify that the associated lights go "on".

<u>CONNECTOR PIN</u>		<u>LIGHTS (OK)</u>
J1-S	REJECT DS1B (TS . 1)	_____
J1- <u>g</u>	REJECT DS3B (TS. 2)	_____

<u>CONNECTOR PIN</u>	<u>LIGHTS (OK)</u>
J1-m	REJECT DS5B (TS. 3) _____
J1-t	REJECT DS7B (ENG. 1) _____
J1-y	REJECT DS9B (ENG. 2) _____
J1-DD	REJECT DS11B (ENG. 3) _____
J2-J	A. ACTIVE DS13A (TS.) _____
J2-b	A. REJECT DS13B (TS.) _____
J2-M	B. ACTIVE DS14A (TS.) _____
J2-h	B. REJECT DS14B (TS.) _____
J2-e	A. ACTIVE DS15A (ENG.) _____
J2-u	A. REJECT DS15B (ENG.) _____
J2-y	B. ACTIVE DS16A (ENG.) _____
J2-w	B. REJECT DS16B (ENG.) _____

4.3.5 Apply +28VDC to connector pin J1-U and verify that all lights go "on" regardless of the position of the switches.

LAMP VERIFY OK _____

4.3.6 Remove the 28VDC power and disconnect all the jumper wires.

4.4 Safety Ground

Use an ohmmeter from connector pin J1-H to the chassis to verify that it is a short-circuit.

GROUND OK _____

4.5 Isolation Test

Use an ohmmeter to measure the resistance between each connector pin and chassis ground to verify that the resistance is > 10 megohms.

ISOLATION OK _____

TEST SPECIFICATION NUMBER T-711848

TITLE

Acceptance Test Specification and Procedure

STARTUP PANEL-LRE CONSOLE ETS-1 TSCS

DATE: January, 1966

PREPARED BY:

Harry Kowalokuck
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APPROVED BY:

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INFORMATION CATEGORY

Unclassified
W.B. Mahis 1/11/66
Authorized Classifier/Date

ACCEPTANCE TEST SPECIFICATION

STARTUP PANEL-LRE CONSOLE

1.0 SCOPE

This document contains the requirements for the acceptance testing of the Startup Panel-LRE Console (WANL Drawing 928F721) of the ETS-1 Test Stand Control System.

2.0 REQUIREMENTS

2.1 The acceptance test shall consist of the following:

2.2.1 Visual Examination-To be performed by Quality Control.

2.2.2 Weights and Dimensions-To be performed by Quality Control.

2.2.3 Functional Test-To be performed by Instrumentation and Control and witnessed by Quality Control.

2.2 The acceptance test shall be performed in the order of and as specified in the procedure. Discrepancies found during the visual examination shall be corrected and reinspected before performing the functional test. Failure or inability to obtain a required measurement during formal functional testing shall result in establishing a "hold" on the test. The failure or inadequacy shall be recorded by Quality Control and shall be reviewed by the WANL Engineering Review Board (ERB). The equipment shall be repaired and sections of the test repeated as determined by the ERB. Visual examination shall be performed on the reworked or repaired areas before resuming testing.

3.0 APPLICABLE DOCUMENTS

- 3.1 Drawing 928F721 - Startup Panel-LRE Console
- 3.2 Drawing 937J848 - Schematic Diagram-LRE and ATE Consoles
- 3.3 Drawing 928F738 - Wiring Diagram Startup Panel-LRE Console
- 3.4 NDC-118A NERVA Design Criteria ETS-1 TSCS (AGC)

4.0 EQUIPMENT REQUIRED

- 4.1 Multimeter (Simpson 269 or equivalent)
- 4.2 28VDC $\pm$ 2VDC power source
- 4.3 200VDC $\pm$ 20VDC power source
- 4.4 20K ohm $\pm$ 20%, 1 watt resistor
- 4.5 68K ohm $\pm$ 20%, 1 watt resistor

ACCEPTANCE TEST PROCEDURE

STARTUP PANEL-LRE CONSOLE

1.0 SCOPE

This document contains the procedures for acceptance testing the Startup Panel-LRE Console (WANL Drawing 928F721) of the ETS-1 Test Stand Control System in accordance with the Acceptance Test Specification.

2.0 VISUAL EXAMINATION

The equipment under test shall be presented in its final form together with the applicable schematic, wiring diagram, and assembly drawing. The visual examination shall consist of the following parts:

2.1 Workmanship, Assembly, and Fit

The inspector shall inspect the equipment for workmanship, to NASA requirements, and to assure that the overall chassis is of the proper dimensions per the assembly drawing, Westinghouse Drawing Number 928F721.

Workmanship OK _____

2.2 Materials, Parts, and Finishes

The equipment shall be inspected to assure that the materials, parts, and finishes are in accordance with the applicable assembly drawings. Incoming inspection records on materials, parts, and finishes shall be utilized to determine conformance to the assembly drawings where possible.

Materials OK _____

2.3 Treatment for Prevention of Corrosion

The equipment shall be inspected to assure that the coatings for prevention of corrosion have not been impaired during the manufacturing cycle.

Treatment OK _____

2.4 Safety Requirements

The equipment shall be inspected to insure that no safety hazard, such as sharp edges, etc., exist on the equipment which are potential hazards to personnel operating or maintaining the equipment.

Safety OK _____

2.5 Marking

The markings on the equipment shall be inspected to ensure conformance to the applicable drawings and to assure that they are acceptable as to permanence and readability.

Marking OK _____

2.6 Visual Examination Review

After the visual examination of the equipment has been completed, all deficiencies shall be reviewed by WANL Engineering and Quality Control and corrected by one of the following methods:

- a. Drawing changes where drawing deficiencies are noted.
- b. Design changes if necessitated.
- c. Rework of the parts affected.

3.0 WEIGHTS AND DIMENSIONS

3.1 The unit shall be weighed and the weight shall be recorded.

Weight _____ lbs.

3.2 The unit shall be measured and the overall dimensions of width, height, and depth recorded.

Width _____ in.

Height _____ in.

Depth _____ in.

4.0 FUNCTIONAL TESTS

4.1 Power Increase Time Readout MI .

CAUTION

This test requires the use of a high voltage source (200VDC).

Extreme care should be used to prevent bodily harm or equipment damage during the test.

4.1.1 Apply +200VDC in series with a 20K ohm (1W.) limiting resistor to the anode (pin 1) of the first digit Nixie readout tube.

NOTE: All the Nixie tube pin connections are brought through connector J2. Refer to Wiring Diagram 928F738 to determine the corresponding J2 connector pin for each Nixie tube connector pin.

4.1.2 Connect the first digit Nixie tube pins 2 through 11 sequentially to the return wire of the 200VDC supply and observe the readout to verify that the correct reading occurs as follows:

<u>Tube Pin No.</u>	<u>Readout Numeral</u>
2	0
3	9
4	8
5	7
6	6
7	5
8	4
9	3
10	2
11	1

4.1.3 Repeat steps 4.1.1 and 4.1.2 for each of the Nixie tube digits.

4.1.4 Remove the 200VDC supply from the Nixie tubes.

4.1.5 Apply 200VDC in series with a 68K ohm (1W) resistor across the two pins of each decimal light in succession to verify that each light operates correctly. Readout M1 OK _____

4.2 Switch Indicator S1 through S10 and DS1 through DS10.

4.2.1 Connect jumper wires as follows:

From J1-H to J1-L

" J1-J to J1-M

" J1-K to J1-R

" J1-c to J1-f

" J1-d to J1-g

" J1-e to J1-v

" J1-m to J1-n

" J1-z to J1-AA

4.2.2 Apply 28VDC between connector pins J1-u (+) and J1-w (return).

4.2.3 Verify the following conditions:

4.2.3.1 Press channel switches S1, S2, and S3 in succession.

Each respective push-button light should go "on" when pressed. The other two push-button lights should remain "off".

4.2.3.2 When S1 is pressed, the following connector pins should be shorted:

J1-A to J1-S

J1-B to J1-T

J1-G to J1-F

Switch S1 OK _____

4.2.3.3 When S2 is pressed, the following connector pins should be shorted:

J1-D to J1-S

J1-E to J1-T

J1-G to J1-C

Switch S2 OK _____

4.2.3.4 When S3 is pressed, the following connector pins should be shorted:

J1-N to J1-S

J1-P to J1-T

Switch S3 OK _____

4.2.3.5 Press E-Fold Time Switches S4, S5, and S6 in succession. Each respective push-button light should go "on" when pressed. The other two push-button lights should remain "off".

4.2.3.6 When S4 is pressed, the following connector pins should be shorted:

J1-S to J1-U

J1-G to J1-Z

J1-G to J1-j

Switch S4 OK _____

4.2.3.7 When S5 is pressed, the following connector pins should be shorted:

J1-S to J1-X

J1-k to J1-Y

J1-G to J1-W

J1-G to J1-j

Switch S5 OK _____

4.2.3.8 When S6 is pressed, the following connector pins should be shorted:

J1-S to J1-h

J1-k to J1-i

J1-G to J1-W

J1-G to J1-Z

Switch S6 OK _____

4.2.3.9 Operate Power Switch S7. ON light DS7A alternates "off" and "on". OFF light DS7B remains "off".

Switch S7 OK _____

4.2.3.10 Press RESET Switch S8. RESET light DS8 goes "on"

and connector pins J1-a to J1-b are shorted

whenever Switch S8 is pressed.

Switch S8 OK _____

4.2.3.11 Operate PRINT Switch S9. RUN light DS9A alternates "off" and "on". STOP light DS9B alternates "on" and "off" in opposition to RUN light. Connector pins J1-q to J1-s should be shorted whenever RUN light is "on". Switch S9 OK _____

4.2.3.12 Press NUCLEAR INST. Switch S10. CALIB light DS10 goes "on", whenever Switch S10 is pressed. Switch S10 OK _____

4.2.3.13 Apply +28VDC to connector pin J1-p and verify that OFF light DS7B goes "on". DS7B OK _____

4.2.3.14 Apply +28VDC to connector pin J1-x . Lights DS7A, DS7B, DS8, DS9A, DS9B, and DS10 should go "on", regardless of the position of the switches. Lamp Verify OK _____

4.3 Exponential Set R1

4.3.1 Measure the resistance between connector pins J1-CC and J1-EE. The value should be $20K \pm 5\%$ ohms. Record the result. Resistance R1 _____ ohms.

4.3.2 Measure the resistance between connector pins J1-CC and J1-DD while rotating the potentiometer from end to end. The value should vary smoothly from zero to $20K \pm 5\%$ ohms. R1 OK _____

4.4 Ramp Set R2

4.4.1 Measure the resistance between connector pins J1-FF and J1-HH. The value should be $10K \pm 5\%$ ohms. Record the result. Resistance R2 _____ ohms.

4.4.2 Measure the resistance between connector pins J1-FF and J1-GG while rotating the potentiometer from end to end. The value should vary smoothly from zero to $10K \pm 5\%$ ohms.

R2 OK _____

4.5 Safety Ground

Use an ohmmeter from connector pin J1-V to the chassis to verify that it is a short-circuit. Ground OK _____

4.6 Isolation Test

Use an ohmmeter to measure the resistance between each connector pin and chassis ground to verify that the resistance is >10 megohms. Isolation OK _____

TEST SPECIFICATION NUMBER T-711849

TITLE

Acceptance Test Specification and Procedure

REACTOR SETUP PANEL-LRE CONSOLE ETS-1 TSCS

DATE: January, 1966

PREPARED BY:

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INFORMATION CATEGORY

unclassified
W. B. Morris 1/11/66
Authorized Classifier/Date

ACCEPTANCE TEST SPECIFICATION
REACTOR SETUP PANEL-LRE CONSOLE

1.0 SCOPE

This document contains the requirements for the acceptance testing of the Reactor Setup Panel-LRE Console (WANL Drawing 928F715) of the ETS-1 Test Stand Control System.

2.0 REQUIREMENTS

2.1 The acceptance test shall consist of the following:

2.2.1 Visual Examination-To be performed by Quality Control.

2.2.2 Weights and Dimensions-To be performed by Quality Control.

2.2.3 Functional Test-To be performed by Instrumentation and Control and witnessed by Quality Control.

2.2 The acceptance test shall be performed in the order of and as specified in the procedure. Discrepancies found during the visual examination shall be corrected and reinspected before performing the functional test. Failure or inability to obtain a required measurement during formal functional testing shall result in establishing a "hold" on the test. The failure or inadequacy shall be recorded by Quality Control and shall be reviewed by the WANL Engineering Review Board (ERB). The equipment shall be repaired and sections of the test repeated as determined by the ERB. Visual examination shall be performed on the reworked or repaired areas before resuming testing.

3.0 APPLICABLE DOCUMENTS

- 3.1 Drawing 928F715-Reactor Setup Panel-LRE Console
- 3.2 Drawing 937J848-Schematic Diagram-LRE and ATE Consoles
- 3.3 Drawing 937J846-Wiring Diagram-Reactor Setup Panel-LRE Console
- 3.4 Meter Calibration Drawing-LRE and ATE Consoles
- 3.5 NDC-118A NERVA Design Criteria ETS-1 TSCS (AGC)

4.0 EQUIPMENT REQUIRED

- 4.1 Multimeter (Simpson 269 or equivalent)
- 4.2 Digital Voltmeter (0.1% accuracy)
- 4.3 Variable 0 to 10VDC signal source, $\pm 0.05\%$ regulation and ± 1 mv. ripple
- 4.4 28VDC ± 2 VDC power source
- 4.5 200VDC ± 20 VDC power source
- 4.6 20K ohm $\pm 20\%$, 1 watt resistor
- 4.7 68K ohm $\pm 20\%$, 1 watt resistor

ACCEPTANCE TEST PROCEDURE
REACTOR SETUP PANEL-LRE CONSOLE

1.0 SCOPE

This document contains the procedures for acceptance testing the Reactor Setup Panel-LRE Console (WANL Drawing 928F715) of the ETS-1 Test Stand Control System in accordance with the Acceptance Test Specification.

2.0 VISUAL EXAMINATION

The equipment under test shall be presented in its final form together with the applicable schematic, wiring diagram, and assembly drawing. The visual examination shall consist of the following parts:

2.1 Workmanship, Assembly, and Fit

The inspector shall inspect the equipment for workmanship to NASA requirements, and to assure that the overall chassis is of the proper dimensions per the assembly drawing, Westinghouse Drawing Number 928F715.

Workmanship OK _____

2.2 Materials, Parts, and Finishes

The equipment shall be inspected to assure that the materials, parts, and finishes are in accordance with the applicable assembly drawings. Incoming inspection records on materials, parts, and finishes shall be utilized to determine conformance to the assembly drawings where possible.

Materials OK _____

2.3 Treatment for Prevention of Corrosion

The equipment shall be inspected to assure that the coatings for prevention of corrosion have not been impaired during the manufacturing cycle.

Treatment OK _____

2.4 Safety Requirements

The equipment shall be inspected to insure that no safety hazard, such as sharp edges, etc., exist on the equipment which are potential hazards to personnel operating or maintaining the equipment.

Safety OK _____

2.5 Marking

The markings on the equipment shall be inspected to ensure conformance to the applicable drawings and to assure that they are acceptable as to permanence and readability.

Marking OK _____

2.6 Visual Examination Review

After the visual examination of the equipment has been completed, all deficiencies shall be reviewed by WANL Engineering and Quality Control and corrected by one of the following methods:

- a. Drawing changes where drawing deficiencies are noted.
- b. Design changes if necessitated.
- c. Rework of the parts affected.

3.0 WEIGHTS AND DIMENSIONS

3.1 The unit shall be weighed and the weight shall be recorded,

Weight _____ lbs.

3.2 The unit shall be measured and the overall dimensions of
width, height, and depth recorded.

Width _____ in.

Height _____ in.

Depth _____ in.

4.0 FUNCTIONAL TESTS

4.1 Computed Power Meter M1

4.1.1 Adjust meter-zero screw to obtain the correct zero
scale reading.

4.1.2 Apply 10±.01VDC between connector pins J2-P(+) and J2-h
(return). Adjust meter trim pot to obtain the

correct full-scale reading.

4.1.3 Check the calibration of the meter by varying the signal
voltage to obtain all of the major calibration points
listed on the meter drawing. Record the meter readings.

4.1.4 Remove the 10VDC signal source.

4.2 Power Monitor Readout M2

CAUTION

This test requires the use of a high voltage source.(200VDC).

Extreme care should be used to prevent bodily harm or equipment
damage during the test.

4.2.1 Apply +200VDC in series with a 20K ohm (1W) limiting
resistor to the anode (pin 1) of the first digit Nixie
readout tube.

COMPUTED POWER METER CALIBRATION CHECK

INPUT SIGNAL	METER READING MI	DESIRED READING				
VOLTS DC	%	%				
0.000		0 ± 1.5				
1.000		15 ± 1.5				
2.000		30 ± 1.5				
3.000		45 ± 1.5				
4.000		60 ± 1.5				
5.000		75 ± 1.5				
6.000		90 ± 1.5				
7.000		105 ± 1.5				
8.000		120 ± 1.5				
9.000		135 ± 1.5				
10.000		150 ± 1.5				

4.2.1 Continued

NOTE: All the Nixie tube pin connections are brought through connector J3. Refer to Wiring Diagram 937J846 to determine the corresponding J3 connector pin for each Nixie tube connector pin.

4.2.2 Connect the first digit Nixie tube pins 2 through 11 sequentially to the return wire of the 200VDC supply and observe the readout to verify that the correct reading occurs as follows:

<u>Tube Pin No.</u>	<u>Readout Numeral</u>
2	0
3	9
4	8
5	7
6	6
7	5
8	4
9	3
10	2
11	1

4.2.3 Repeat steps 4.2.1 and 4.2.2 for each of the Nixie tube digits.

4.2.4 Remove the 200VDC supply from the Nixie tubes.

4.2.5 Apply 200VDC in series with a 68K ohm (1W) resistor across the two pins of each decimal light in succession to verify that each light operates correctly. Readout M2 OK —

4.3 Switch-Indicators S1 through S15 and DS1 through DS17.

4.3.1 Connect jumper wires as follows:

From J2-s to J2-t

" J2-v to J2-w

" J1-B to J1-C

" J1-F to J1-G

" J1-R to J1-S

" J1-s to J1-t

" J1-u to J1-v

" J1-w to J1-x

" J1-y to J1-z

" J1-AA to J1-BB

" J1-CC to J1-DD

" J1-EE to J1-FF

" J1-GG to J1-HH

4.3.2 Apply 28VDC between connector pins J1-A (+) to J1-V (return).

4.3.3 Verify the following conditions:

4.3.3.1 Operate Power Control Switch S1.

TEST STAND light DS1A alternates "off" and "on".

ENGINE light DS1B remains "off". Switch S1 OK _____

4.3.3.2 Operate BF3 Power Switch S2.

ON light DS2A alternates "off" and "on".

OFF light DS2B remains "off". Switch S2 OK _____

4.3.3.3 Operate LRE Switch S4.

READY light DS4A alternates "off" and "on".

HOLD light DS4A alternates "off" and "on" in opposition to READY light.

4.3.3.3.1 Measure the voltage at connector pins

J2-f and J2-y. +28VDC appears at J2-f when
HOLD light is on. +28VDC appears at J2-y
when READY light is on.

Switch S4 OK ____

4.3.3.4 Operate Fixed Power Switch S5.

ACTIVE light DS6A alternates "off" and "on".

BYPASS light DS6B remains "off". Switch S5 OK ____

4.3.3.5 Operate Period Switch S6.

ACTIVE light DS8A alternates "off" and "on".

BYPASS light DS8B remains "off". Switch S6 OK ____

4.3.3.6 Operate Floating Power Switch S7.

ACTIVE light DS10A alternates "off" and "on".

BYPASS light DS10B remains "off". Switch S7 OK ____

4.3.3.7 Press Lamp Verify Switch S3. All lights DS1A through
DS10B except DS3 should go on whenever Switch S3 is
pressed regardless of the position of the other switches.

4.3.3.7.1 Measure the voltage at connector pin J2-i.

+28VDC should appear at J2-i whenever Switch

S3 is pressed. Switch S3 OK ____

4.3.3.8 Press Period Trip Switches S8, S9, S10, and S11 in
succession. Each respective push-button light should
go on when pressed. The other three push-button lights
should remain off.

Period Trip Switches OK ____

4.3.3.9 Press Trip Sensitivity Switches S12, S13, S14, and S15
in succession. Each respective push-button light should
go on when pressed. The other three push-button lights
should remain off.

Trip Sensitivity Switches OK ____

4.3.4 Apply +28VDC power to the following connector pins in succession
and verify that the associated lights go on.

4.3.4 Continued

<u>Connector Pin</u>	<u>Light</u>	<u>(OK)</u>
J2-u	ENGINE (Power Control)	_____
J2-x	OFF (BF3 Power)	_____
J1-E	SCRAM (Fixed Power)	_____
J1-D	BYPASS (Fixed Power)	_____
J1-J	SCRAM (Period)	_____
J1-H	BYPASS (Period)	_____
J1-U	SCRAM (Floating Power)	_____
J1-T	BYPASS (Floating Power)	_____

4.3.5 Remove the 28VDC power and disconnect all the jumper wires.

4.4 Log Power Selector Switch S16

Use an ohmmeter

~~Measure resistance~~ between the connector pins listed

below. Rotate the selector switch through the various positions and verify that the pins are shorted in the correct positions and only in these positions as listed below:

<u>Pins Shorted</u>	<u>(OK)</u>	<u>Switch S16 Positions</u>
J3-A to J3-B	_____	Off
" J2-W	_____	T.S. AVG.
" J2-T	_____	T.S. 1
" J2-U	_____	T.S. 2
" J2-V	_____	T.S. 3
" J2-a	_____	ENG. AVG.
" J2-X	_____	ENG. 1
" J2-Y	_____	ENG. 2
" J2-Z	_____	ENG. 3

<u>Pins Shorted</u>	<u>Switch S16 Positions</u>
J3-B to J2-DD	T.S. AVG.
" J2-CC	T.S. 1
" J2-BB	T.S. 2
" J2-AA	T.S. 3
" J2-EE	ENG. AVG.
" J2-FF	ENG. 1
" J2-GG	ENG. 2
" J2-HH	ENG. 3
J2-A to J2-B	OFF, T.S. AVG.
" J2-C	OFF, T.S. 2
" J2-D	OFF, T.S. AVG., T.S. 2
" J2-r	OFF, T.S. AVG., T.S. 2
J2-B to J2-C	OFF, T.S. 3, ENG. 3
" J2-D	OFF, T.S. AVG., T.S. 3, ENG. AVG.
" J2-r	OFF, T.S. AVG., T.S. 3, ENG. AVG., ENG. 3
J2-C to J2-D	OFF, T.S. 1, T.S. 2, T.S. 3
" J2-r	OFF, T.S. 1, T.S. 2, T.S. 3, ENG. 3
J2-D to J2-r	OFF, T.S. AVG, T.S. 1, T.S. 2, T.S. 3 ENG. AVG, ENG. 1, ENG. 2

4.5 Fixed Power Set R1

4.5.1 Measure the resistance between connector pins J2-j and

J2-m. The value should be $5K \pm 5\%$ ohms. Record the result.

Resistance R1 _____ s

4.5.2 Measure the resistance between connector pins J2-j and

J2-k while rotating the potentiometer from end to end.

The value should vary smoothly from zero to $5K \pm 5\%$ ohms.

R1 OK _____

4.6 Floating Power Set R2.

4.6.1 Measure the resistance between connector pins J2-n and J2-g. The value should be $2K \pm 5\%$ ohms. Record the results. Resistance R2 _____ ohms.

4.6.2 Measure the resistance between connector pins J2-n and J2-p while rotating the potentiometer from end to end. The value should vary smoothly from zero to $2K \pm 5\%$ ohms. R2 OK _____

4.7 Safety Ground

Use an ohmmeter from connector pin J2-H to the chassis to verify that it is a short-circuit. Ground OK _____

4.8 Isolation Test

Use an ohmmeter to measure the resistance between each connector pin and chassis ground to verify that the resistance is >10 megohms. Isolation OK _____