Westinghouse Astronuclear Laboratory

Operational Manual for LRE and ATE Console Panels

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TITLE: Operational Manual for LRE and ATE Console Panels

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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 multitum pot with vernier dial.
b. A variable RAMP multitum 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.
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

PREPARED BY: Harry Fowles
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Control Systems Engineering

APPROVED BY: R. A. Fergus
Control Systems Engineering

Quality Engineering

INFORMATION CATEGORY

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W. R. Murr 1-16-66
Authorised Classifier/Date
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, ±0.05% regulation and ±1 mv. ripple
4.4 28VDC±2VDC power source
4.5 200VDC±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±.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:
<table>
<thead>
<tr>
<th>Input Signal</th>
<th>Meter M1 Reading</th>
<th>Meter M2 Reading</th>
<th>Meter M3 Reading</th>
<th>Desired Reading</th>
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<td>COUNTS SEC</td>
<td>COUNTS SEC</td>
<td>COUNTS SEC</td>
<td>COUNTS SEC</td>
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<td></td>
<td></td>
<td></td>
<td>0.1 ± 0.1</td>
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<tr>
<td>1.667</td>
<td></td>
<td></td>
<td></td>
<td>1 ± 0.1</td>
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<tr>
<td>3.333</td>
<td></td>
<td></td>
<td></td>
<td>10 ± 1</td>
</tr>
<tr>
<td>5.000</td>
<td></td>
<td></td>
<td></td>
<td>10² ± 10</td>
</tr>
<tr>
<td>6.667</td>
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<td></td>
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<td>10⁵ ± 10⁴</td>
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<td>METER M11 READING</td>
<td>METER M12 READING</td>
<td>DESIRED READING</td>
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<td>------------------</td>
<td>------------------</td>
<td>------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Volts DC</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>0.000</td>
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<td></td>
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<td></td>
<td></td>
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<td>9 ± 0.1</td>
</tr>
<tr>
<td>10.000</td>
<td></td>
<td></td>
<td></td>
<td>10 ± 0.1</td>
</tr>
<tr>
<td>Meter</td>
<td>Connector Pins</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>----------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Log Count Rate #2 - M2</td>
<td>J1-c J1-d</td>
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<td></td>
</tr>
<tr>
<td>Log Count Rate #3 - M3</td>
<td>J1-e J1-f</td>
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<td></td>
</tr>
<tr>
<td>Linear Power #1 - M10</td>
<td>J1-g J1-h</td>
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</tr>
<tr>
<td>Linear Power #2 - M11</td>
<td>J1-h J1-u</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Linear Power #3 - M12</td>
<td>J1-v J1-FF</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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-i
" 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-V to J2-X
- J2-Z to J2-£
- J2-a to J2-d
- J2-£ to J2-g
- J2-i to J2-i
- J2-m to J2-n

**1 Switches OK**

4.9.6 Repeat Steps 4.9.2 through 4.9.4
**2 Switches OK**
**3 Switches OK**

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

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.

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-y are short-circuits when HOLD light is "on". Connector pins J2-p to J2-x and J2-s to J2-z are short-circuits when AUTO light is "on".

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-w to J2-y and J2-x to J2-A are short-circuits when HOLD light is "on". Connector pins J2-y to J2-A to J2-AA are short-circuits when AUTO light is "on".

4.9.9.6 Operate Auto/Hold Switch S21. HOLD light DS21B alternates "off" and "on". AUTO light DS21A alternates "on" and "off" in opposition to HOLD light. Connector pins J2-BF 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 VDC 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-v to J1-b and J1-FF to J1-HH are short-circuits.

+28 VDC 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 JL-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 BTS-1 TSCS

DATE: January, 1966

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

APPROVED BY: RA) Tann
Control Systems Engineering

Quality Engineering

INFORMATION CATEGORY
unclassified

W.R. Mais 1Jan 66
Authorised 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-116A NERVA Design Criteria ETS-1 TSC3 (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, ±0.05% regulation and ±1 mv. ripple
4.4 28VDC±2VDC power source
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.

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.
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 WAML 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±0.1VDC 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:
<table>
<thead>
<tr>
<th>Temperature Meter Calibration Check</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Computed Temp.)</td>
</tr>
<tr>
<td>Input Signal</td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>Volts DC. (OK)</td>
</tr>
<tr>
<td>0.000</td>
</tr>
<tr>
<td>0.000</td>
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<tr>
<td>1.200</td>
</tr>
<tr>
<td>2.600</td>
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<td>5.500</td>
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<tr>
<td>10.000</td>
</tr>
<tr>
<td>10.000</td>
</tr>
<tr>
<td>VOLTS DC</td>
</tr>
<tr>
<td>----------</td>
</tr>
<tr>
<td>0.000</td>
</tr>
<tr>
<td>0.450</td>
</tr>
<tr>
<td>1.450</td>
</tr>
<tr>
<td>2.750</td>
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<td>5.670</td>
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<tr>
<td>7.070</td>
</tr>
<tr>
<td>8.350</td>
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<tr>
<td>9.470</td>
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<tr>
<td>10.000</td>
</tr>
<tr>
<td>Input Signal</td>
</tr>
<tr>
<td>--------------</td>
</tr>
<tr>
<td>VOLTS DC.</td>
</tr>
<tr>
<td>0.000</td>
</tr>
<tr>
<td>0.000</td>
</tr>
<tr>
<td>0.330</td>
</tr>
<tr>
<td>1.260</td>
</tr>
<tr>
<td>2.590</td>
</tr>
<tr>
<td>4.290</td>
</tr>
<tr>
<td>6.300</td>
</tr>
<tr>
<td>8.600</td>
</tr>
<tr>
<td>10.000</td>
</tr>
<tr>
<td>10.000</td>
</tr>
<tr>
<td>Volts DC.</td>
</tr>
<tr>
<td>----------</td>
</tr>
<tr>
<td>M5</td>
</tr>
<tr>
<td>0.000</td>
</tr>
<tr>
<td>0.000</td>
</tr>
<tr>
<td>0.170</td>
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<tr>
<td>0.980</td>
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</tr>
</tbody>
</table>

**Zero Scale**
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".

<table>
<thead>
<tr>
<th>Connector Pin</th>
<th>Light</th>
</tr>
</thead>
<tbody>
<tr>
<td>JL- shy</td>
<td>Active DS1A (Chamber Temp.)</td>
</tr>
<tr>
<td>JL-sw</td>
<td>Bypass DSIB (Chamber Temp.)</td>
</tr>
<tr>
<td>JL-ky</td>
<td>Bypass DS2B (In-Core 1 Temp.)</td>
</tr>
<tr>
<td>JL-ky</td>
<td>Bypass DS3B (In-Core 2 Temp.)</td>
</tr>
<tr>
<td>JL-w</td>
<td>#1 - DS4 (Monitoring Temp.)</td>
</tr>
<tr>
<td>JL-x</td>
<td>#2 - DS5</td>
</tr>
<tr>
<td>JL-x</td>
<td>#3 - DS6</td>
</tr>
<tr>
<td>JL-x</td>
<td>#4 - DS7</td>
</tr>
<tr>
<td>JL-x</td>
<td>#5 - DS8</td>
</tr>
<tr>
<td>JL-x</td>
<td>#6 - DS9</td>
</tr>
<tr>
<td>JL-x</td>
<td>#7 - DS10</td>
</tr>
<tr>
<td>JL-x</td>
<td>#8 - DS11</td>
</tr>
<tr>
<td>JL-x</td>
<td>#9 - DS12</td>
</tr>
</tbody>
</table>

4.3.5 Apply +28VDC to connector pin JL-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.

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

4.4 Safety Ground

Use an ohmmeter from connector pin JL-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 Pavelscheck
Control Equipment Design and Fabrication
Control Systems Engineering

APPROVED BY: Quality Engineering

INFORMATION CATEGORY
Unclassified

W.B. Morris 1/10/66
Authorized Classifier/Date
1.0 Scope

This document contains the requirements for the acceptance testing of the Drums Panel-ATE Console (WANL Drawing 926F725) of the ETS-1 Test Stand Control System.

2.0 Requirements

2.1 The acceptance test shall consist of the following:

2.1.1 Visual Examination—To be performed by Quality Control.

2.1.2 Weights and Dimensions—To be performed by Quality Control.

2.1.3 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 TSGS (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, ±0.05% regulation and ±1 mv. ripple
4.4 28VDC±2VDC power source
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.

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.
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±0.01VDC 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:
## Drum Position Meter Calibration Check

<table>
<thead>
<tr>
<th>Input Signal</th>
<th>Meter Reading</th>
<th>Meter Reading</th>
<th>Meter Reading</th>
<th>Meter Reading</th>
<th>Meter Reading</th>
<th>Meter Reading</th>
<th>Meter Reading</th>
<th>Desired Reading</th>
</tr>
</thead>
<tbody>
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<td>0.000</td>
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<td></td>
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<td></td>
<td>0 ±3</td>
</tr>
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<td>1.111</td>
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<td></td>
<td></td>
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<td>20 ±3</td>
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<td>3.333</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>60 ±3</td>
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<td>4.444</td>
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<td>6.667</td>
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<td></td>
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<td>100 ±3</td>
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<td>7.778</td>
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<td>120 ±3</td>
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<td>8.889</td>
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<td></td>
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<td>140 ±3</td>
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<td></td>
<td></td>
<td>160 ±3</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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-q

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".

<table>
<thead>
<tr>
<th>Connector Pin</th>
<th>Light</th>
<th>(OK)</th>
</tr>
</thead>
<tbody>
<tr>
<td>JL-E</td>
<td>Unlocked DS1B</td>
<td></td>
</tr>
<tr>
<td>JL-L</td>
<td>&quot;</td>
<td>DS2B</td>
</tr>
<tr>
<td>JL-P</td>
<td>&quot;</td>
<td>DS3B</td>
</tr>
<tr>
<td>JL-T</td>
<td>&quot;</td>
<td>DS4B</td>
</tr>
<tr>
<td>JL-W</td>
<td>&quot;</td>
<td>DS5B</td>
</tr>
<tr>
<td>JL-Z</td>
<td>&quot;</td>
<td>DS6B</td>
</tr>
<tr>
<td>JL-G</td>
<td>&quot;</td>
<td>DS7B</td>
</tr>
<tr>
<td>JL-I</td>
<td>&quot;</td>
<td>DS8B</td>
</tr>
<tr>
<td>JL-A</td>
<td>&quot;</td>
<td>DS9B</td>
</tr>
<tr>
<td>JL-M</td>
<td>&quot;</td>
<td>DS10B</td>
</tr>
<tr>
<td>JL-Q</td>
<td>&quot;</td>
<td>DS11B</td>
</tr>
<tr>
<td>JL-T</td>
<td>&quot;</td>
<td>DS12B</td>
</tr>
<tr>
<td>JL-J</td>
<td>TCB</td>
<td>DS13B</td>
</tr>
<tr>
<td>JL-K</td>
<td>CP</td>
<td>DS13A</td>
</tr>
</tbody>
</table>

4.3.5 Apply ±28VDC to connector pin JL-H 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 JL-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 Kozak
Control Equipment Design and Fabrication
Control Systems Engineering

APPROVED BY:
T. A. Elms
Control Systems Engineering

Quality Engineering 1-10-66

INFORMATION CATEGORY
unclassified
W. F. Miles 1/16/66
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, ±0.05% regulation and ±1 mv. ripple
4.4 28VDC±2VDC power source
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 WANNL 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±0.1VDC 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:
<table>
<thead>
<tr>
<th>Input Signal</th>
<th>Meter M1 Reading</th>
<th>Meter M2 Reading</th>
<th>Meter M3 Reading</th>
<th>Meter M4 Reading</th>
<th>Meter M5 Reading</th>
<th>Meter M6 Reading</th>
<th>Meter M7 Reading</th>
<th>Meter M8 Reading</th>
<th>Desired Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volts DC</td>
<td>Watts</td>
<td>Watts</td>
<td>Watts</td>
<td>Watts</td>
<td>Watts</td>
<td>Watts</td>
<td>Watts</td>
<td>Watts</td>
<td></td>
</tr>
<tr>
<td>0.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>55 ± 10</td>
</tr>
<tr>
<td>0.325</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10^2 ± 20</td>
</tr>
<tr>
<td>1.575</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10^3 ± 2 x 10^2</td>
</tr>
<tr>
<td>2.825</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10^4 ± 2 x 10^3</td>
</tr>
<tr>
<td>4.075</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10^5 ± 2 x 10^4</td>
</tr>
<tr>
<td>5.325</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10^6 ± 2 x 10^5</td>
</tr>
<tr>
<td>6.575</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10^7 ± 2 x 10^6</td>
</tr>
<tr>
<td>7.825</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10^8 ± 2 x 10^7</td>
</tr>
<tr>
<td>9.075</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10^9 ± 2 x 10^8</td>
</tr>
<tr>
<td>10.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5.5 x 10^9 ± 10^9</td>
</tr>
</tbody>
</table>
## Average Log Power Meter Calibration Check

<table>
<thead>
<tr>
<th>Input Signal</th>
<th>Meter M4 Reading</th>
<th>Meter M9 Reading</th>
<th>Desired Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volts DC</td>
<td>Watts</td>
<td>Watts</td>
<td>Watts</td>
</tr>
<tr>
<td>0.000</td>
<td></td>
<td></td>
<td>55 ± 10</td>
</tr>
<tr>
<td>0.325</td>
<td></td>
<td></td>
<td>10² ± 20</td>
</tr>
<tr>
<td>1.575</td>
<td></td>
<td></td>
<td>10³ ± 2 x 10²</td>
</tr>
<tr>
<td>2.825</td>
<td></td>
<td></td>
<td>10⁴ ± 2 x 10³</td>
</tr>
<tr>
<td>4.075</td>
<td></td>
<td></td>
<td>10⁵ ± 2 x 10⁴</td>
</tr>
<tr>
<td>5.325</td>
<td></td>
<td></td>
<td>10⁶ ± 2 x 10⁵</td>
</tr>
<tr>
<td>6.575</td>
<td></td>
<td></td>
<td>10⁷ ± 2 x 10⁶</td>
</tr>
<tr>
<td>7.825</td>
<td></td>
<td></td>
<td>10⁸ ± 2 x 10⁷</td>
</tr>
<tr>
<td>9.075</td>
<td></td>
<td></td>
<td>10⁹ ± 2 x 10⁸</td>
</tr>
<tr>
<td>10.000</td>
<td></td>
<td></td>
<td>5.5 x 10⁹ ± 10²</td>
</tr>
<tr>
<td>INPUT SIGNAL</td>
<td>METER M5 READING</td>
<td>METER MID READING</td>
<td>DESIRED READING</td>
</tr>
<tr>
<td>--------------</td>
<td>-----------------</td>
<td>-----------------</td>
<td>---------------</td>
</tr>
<tr>
<td>Volts DC</td>
<td>Seconds</td>
<td>Seconds</td>
<td>Seconds</td>
</tr>
<tr>
<td>-0.700</td>
<td></td>
<td></td>
<td>~10 ± 2</td>
</tr>
<tr>
<td>0.000</td>
<td></td>
<td></td>
<td>∞ ± 100</td>
</tr>
<tr>
<td>0.700</td>
<td></td>
<td></td>
<td>10 ± 2</td>
</tr>
<tr>
<td>1.400</td>
<td></td>
<td></td>
<td>5 ± 5</td>
</tr>
<tr>
<td>1.750</td>
<td></td>
<td></td>
<td>4 ± 0.3</td>
</tr>
<tr>
<td>2.333</td>
<td></td>
<td></td>
<td>3 ± 0.2</td>
</tr>
<tr>
<td>3.500</td>
<td></td>
<td></td>
<td>2 ± 0.1</td>
</tr>
<tr>
<td>4.667</td>
<td></td>
<td></td>
<td>1.5 ± 0.05</td>
</tr>
<tr>
<td>5.833</td>
<td></td>
<td></td>
<td>1.2 ± 0.03</td>
</tr>
<tr>
<td>7.000</td>
<td></td>
<td></td>
<td>1.0 ± 0.2</td>
</tr>
<tr>
<td>7.222</td>
<td></td>
<td></td>
<td>0.5 ± 0.1</td>
</tr>
<tr>
<td>7.889</td>
<td></td>
<td></td>
<td>0.2 ± 0.05</td>
</tr>
<tr>
<td>9.000</td>
<td></td>
<td></td>
<td>0.1 ± 0.01</td>
</tr>
</tbody>
</table>
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+.01VDC signal instead of 10+.01VDC 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
" J1-P to J1-T
" J1-b to J1-d
" J1-c to J1-h
" J1-i to J1-k
" J1-j to J1-n

From J1-q to J1-z
" J1-x to J1-y
" J1-y to J1-x
" J1-w to J1-z
" J1-aa to J1-cc
" 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".

<table>
<thead>
<tr>
<th>CONNECTOR PIN</th>
<th>LIGHTS (OK)</th>
</tr>
</thead>
<tbody>
<tr>
<td>J1-S</td>
<td>REJECT DS1B (TS. 1)</td>
</tr>
<tr>
<td>J1-g</td>
<td>REJECT DS3B (TS. 2)</td>
</tr>
<tr>
<td>CONNECTOR PIN</td>
<td>LIGHTS (OK)</td>
</tr>
<tr>
<td>---------------</td>
<td>-------------</td>
</tr>
<tr>
<td>J1-m</td>
<td>REJECT DS5B (TS. 3)</td>
</tr>
<tr>
<td>J1-t</td>
<td>REJECT DS7B (ENG. 1)</td>
</tr>
<tr>
<td>J1-y</td>
<td>REJECT DS9B (ENG. 2)</td>
</tr>
<tr>
<td>J1-DD</td>
<td>REJECT DS11B (ENG. 3)</td>
</tr>
<tr>
<td>J2-J</td>
<td>A. ACTIVE DS13A (TS.)</td>
</tr>
<tr>
<td>J2-b</td>
<td>B. REJECT DS13B (TS.)</td>
</tr>
<tr>
<td>J2-M</td>
<td>A. ACTIVE DS14A (TS.)</td>
</tr>
<tr>
<td>J2-h</td>
<td>B. REJECT DS14B (TS.)</td>
</tr>
<tr>
<td>J2-a</td>
<td>A. ACTIVE DS15A (ENG.)</td>
</tr>
<tr>
<td>J2-y</td>
<td>B. ACTIVE DS15B (ENG.)</td>
</tr>
<tr>
<td>J2-w</td>
<td>B. REJECT DS16A (ENG.)</td>
</tr>
</tbody>
</table>

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 Ponzolook
Control Equipment Design and Fabrication
Control Systems Engineering

APPROVED BY: R. A. Snape
Control Systems Engineering

Quality Engineering

INFORMATION CATEGORY

Unclassified

W.R. Madsie 1/4/66
Authorized Classifier/Date
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:

- **Visual Examination**—To be performed by Quality Control.
- **Weights and Dimensions**—To be performed by Quality Control.
- **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±2VDC power source
4.3 200VDC±20VDC power source
4.4 20K ohm ±20%, 1 watt resistor
4.5 68K ohm ±20%, 1 watt resistor
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 equip­
   ment 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
   928F736 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:

<table>
<thead>
<tr>
<th>Tube Pin No.</th>
<th>Readout Numeral</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>11</td>
<td>1</td>
</tr>
</tbody>
</table>

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:
- JL-S to JL-U
- JL-G to JL-Z
- JL-G to JL-i

4.2.3.7 When S5 is pressed, the following connector pins should be shorted:
- JL-S to JL-X
- JL-k to JL-Y
- JL-G to JL-W
- JL-G to JL-i

4.2.3.8 When S6 is pressed, the following connector pins should be shorted:
- JL-S to JL-h
- JL-k to JL-i
- JL-G to JL-W
- JL-G to JL-Z

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

4.2.3.10 Press RESET Switch S8. RESET light DS8 goes "on" and connector pins JL-a to JL-b are shorted whenever Switch S8 is pressed.
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±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±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±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±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: Harry Kozloch
Control Equipment Design and Fabrication
Control Systems Engineering

APPROVED BY: R. A. Flury
Control Systems Engineering

Quality Engineering 1-10-66

INFORMATION CATEGORY
unclassified

W.R. Marion 1-1-66
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, ±0.05% regulation and ±1 mv. ripple
4.4 28VDC±2VDC power source
4.5 200VDC±20VDC power source
4.6 20K ohm ±20%, 1 watt resistor
4.7 68K ohm ±20%, 1 watt resistor
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+0.01VDC between connector pins J2-P(+) and J2-P

(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.
<table>
<thead>
<tr>
<th>INPUT SIGNAL</th>
<th>METER READING M1</th>
<th>DESIRED READING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volts DC.</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>0.000</td>
<td>0 ± 1.5</td>
<td></td>
</tr>
<tr>
<td>1.000</td>
<td>30 ± 1.5</td>
<td></td>
</tr>
<tr>
<td>2.000</td>
<td>45 ± 1.5</td>
<td></td>
</tr>
<tr>
<td>3.000</td>
<td>60 ± 1.5</td>
<td></td>
</tr>
<tr>
<td>4.000</td>
<td>75 ± 1.5</td>
<td></td>
</tr>
<tr>
<td>5.000</td>
<td>90 ± 1.5</td>
<td></td>
</tr>
<tr>
<td>6.000</td>
<td>105 ± 1.5</td>
<td></td>
</tr>
<tr>
<td>7.000</td>
<td>120 ± 1.5</td>
<td></td>
</tr>
<tr>
<td>8.000</td>
<td>135 ± 1.5</td>
<td></td>
</tr>
<tr>
<td>9.000</td>
<td>150 ± 1.5</td>
<td></td>
</tr>
<tr>
<td>10.000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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:

<table>
<thead>
<tr>
<th>Tube Pin No.</th>
<th>Readout Numeral</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>5</td>
<td>7</td>
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<tr>
<td>6</td>
<td>6</td>
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<td>7</td>
<td>5</td>
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<tr>
<td>8</td>
<td>4</td>
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<tr>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>11</td>
<td>1</td>
</tr>
</tbody>
</table>

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-a to J2-t

" J2-y to J2-m
" J1-B to J1-C
" J1-F to J1-G
" J1-R to J1-S
" J1-a to J1-t
" J1-u to J1-v
" J1-x 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". Switch S1 OK

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.
4.3.3.1 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-f.
+28VDC should appear at J2-f 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

<table>
<thead>
<tr>
<th>Connector Pin</th>
<th>Light</th>
</tr>
</thead>
<tbody>
<tr>
<td>J2-U</td>
<td>ENGINE (Power Control)</td>
</tr>
<tr>
<td>J2-X</td>
<td>OFF (BF3 Power)</td>
</tr>
<tr>
<td>J1-E</td>
<td>SCRAM (Fixed Power)</td>
</tr>
<tr>
<td>J1-D</td>
<td>BYPASS (Fixed Power)</td>
</tr>
<tr>
<td>J1-J</td>
<td>SCRAM (Period)</td>
</tr>
<tr>
<td>J1-H</td>
<td>BYPASS (Period)</td>
</tr>
<tr>
<td>J1-U</td>
<td>SCRAM (Floating Power)</td>
</tr>
<tr>
<td>J1-T</td>
<td>BYPASS (Floating Power)</td>
</tr>
</tbody>
</table>

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

4.4 Log Power Selector Switch Sl6

Use an ohmmeter 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:

<table>
<thead>
<tr>
<th>Pins Shorted</th>
<th>(OK)</th>
<th>Switch Sl6 Positions</th>
</tr>
</thead>
<tbody>
<tr>
<td>J3-A to J3-B</td>
<td></td>
<td>Off</td>
</tr>
<tr>
<td>&quot; J2-W</td>
<td></td>
<td>T.S. AVG.</td>
</tr>
<tr>
<td>&quot; J2-T</td>
<td></td>
<td>T.S. 1</td>
</tr>
<tr>
<td>&quot; J2-U</td>
<td></td>
<td>T.S. 2</td>
</tr>
<tr>
<td>&quot; J2-V</td>
<td></td>
<td>T.S. 3</td>
</tr>
<tr>
<td>&quot; J2-X</td>
<td></td>
<td>ENG. AVG.</td>
</tr>
<tr>
<td>&quot; J2-Y</td>
<td></td>
<td>ENG. 1</td>
</tr>
<tr>
<td>&quot; J2-Z</td>
<td></td>
<td>ENG. 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ENG. 3</td>
</tr>
</tbody>
</table>
### Pins Shorted (OK)

<table>
<thead>
<tr>
<th>Switch Sl6 Positions</th>
</tr>
</thead>
<tbody>
<tr>
<td>J3-B to J2-DD</td>
</tr>
<tr>
<td>&quot;</td>
</tr>
<tr>
<td>J2-CC</td>
</tr>
<tr>
<td>&quot;</td>
</tr>
<tr>
<td>J2-BB</td>
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<tr>
<td>&quot;</td>
</tr>
<tr>
<td>J2-AA</td>
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<tr>
<td>&quot;</td>
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<tr>
<td>J2-EE</td>
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<tr>
<td>&quot;</td>
</tr>
<tr>
<td>J2-FF</td>
</tr>
<tr>
<td>&quot;</td>
</tr>
<tr>
<td>J2-GG</td>
</tr>
<tr>
<td>&quot;</td>
</tr>
<tr>
<td>J2-HH</td>
</tr>
</tbody>
</table>

<p>| |</p>
<table>
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<th></th>
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</thead>
<tbody>
<tr>
<td>J2-A to J2-B</td>
</tr>
<tr>
<td>&quot;</td>
</tr>
<tr>
<td>J2-C</td>
</tr>
<tr>
<td>&quot;</td>
</tr>
<tr>
<td>J2-D</td>
</tr>
<tr>
<td>&quot;</td>
</tr>
<tr>
<td>J2-F</td>
</tr>
<tr>
<td>&quot;</td>
</tr>
<tr>
<td>J2-E</td>
</tr>
</tbody>
</table>

<p>| |</p>
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<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>J2-B to J2-C</td>
</tr>
<tr>
<td>&quot;</td>
</tr>
<tr>
<td>J2-D</td>
</tr>
<tr>
<td>&quot;</td>
</tr>
<tr>
<td>J2-F</td>
</tr>
<tr>
<td>&quot;</td>
</tr>
<tr>
<td>J2-G</td>
</tr>
</tbody>
</table>

<p>| |</p>
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<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>J2-C to J2-D</td>
</tr>
<tr>
<td>&quot;</td>
</tr>
<tr>
<td>J2-F</td>
</tr>
<tr>
<td>&quot;</td>
</tr>
<tr>
<td>J2-G</td>
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</tbody>
</table>

<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>J2-D to J2-F</td>
</tr>
<tr>
<td>&quot;</td>
</tr>
<tr>
<td>J2-H</td>
</tr>
<tr>
<td>&quot;</td>
</tr>
<tr>
<td>J2-G</td>
</tr>
</tbody>
</table>

### 4.5 Fixed Power Set RI

#### 4.5.1 Measure the resistance between connector pins J2-1 and J2-m. The value should be 5K±5% ohms. Record the result.

Resistance RI __________ ohms

#### 4.5.2 Measure the resistance between connector pins J2-1 and J2-k while rotating the potentiometer from end to end. The value should vary smoothly from zero to 5K±5% ohms.

RI __________ ok
4.6 Floating Power Set R2.

4.6.1 Measure the resistance between connector pins J2-7 and J2-2. The value should be 2K±5% ohms. Record the results. Resistance R2 ______ ohms.

4.6.2 Measure the resistance between connector pins J2-7 and J2-2 while rotating the potentiometer from end to end. The value should vary smoothly from zero to 2K±5% ohms. R2 OK ______

4.7 Safety Ground

Use an ohmmeter from connector pin J2-M 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 ______