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Operational Manual for Component Chassis
LRE Console

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LRE Console

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1.0 GENERAL

1.1 Introduction

This operational manual covers the LRE Component Chassis that is mounted at the rear side of the LRE Console. This chassis contains the fuses and various components and modules that are associated with the LRE Console front panels and one-half of the ATE front panels.

1.2 Description

The unit consists of a drawer suitable for mounting in a standard 19" rack. Its overall dimensions are 19" wide, 22 1/2" deep, and 7" high.

1.2.1 Front Panel

The front panel of the LRE Component Chassis is 19" in width and 7" in height. A handle is mounted at each side of the panel. The left handle is equipped with a spring-operated mechanical latch to retain the chassis in the closed position in the rack. A button at the upper end of this handle releases the latch when pressed. The right handle is equipped with a key lock. The key is removable only when the lock is in the lock position. Nine Master Specialties Series 70E fuse-holders are located along the lower edge of the front panel.

1.2.2 Chassis

The chassis consists of a frame with chassis slides bolted to the sides. Inside the chassis is the component plate to which the printed circuit board guides and connectors, and components are mounted. On the left side of the component plate, provision is

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made for 2 rows of 11 printed circuit board cards. However, only the first 10 slots of each row are occupied with cards. The first row contains 6 Relay module cards and 4 Component module cards. The second row contains 9 Trigger module cards and 1 Relay module card. In place of the eleventh printed circuit board connector in the second row is a grounding module (E2). On the right side of the component plate are two 200VDC Power Supply modules and two associated stud-mounted silicon rectifiers.

On the rear of the chassis are two connector plates; each plate having two multi-pin connectors. One connector is a power connector with 16 pins, while the remaining three connectors have 55 pins.

1.2.3 Component Panel

Bolted across the top of the chassis at the front is the component panel. This panel contains 30 test point tip jacks arranged in 2 rows across the panel.

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 chassis 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 chassis is to be mounted at the lower-left corner of the rear side of the LRE Console. Mount the removable portion of the chassis slides at the desired level at the rear of the LRE Console and insert the LRE Component Chassis in the slides.

2.3 Power Requirements

Power is obtained from external sources and enters the unit through the rear mounted 16 pin connector. The following are the nominal voltage and current requirements:

- a. 115VAC at 4 amps
- b. 28VDC at 10 amps
- c. +15VDC (to I & C common) at 1 amp
- d. -15VDC (to I & C common) at 1/2 amp

3.0 PRINCIPLES OF OPERATION

The primary function of the LRE Component Chassis is to supply the power and also a location for the auxiliary equipment associated with the controls and displays on the LRE and ATE Consoles. Refer to schematic drawing 937J792 to understand the operation of the various components and modules in the chassis.

3.1 Fuseholders

The fuseholders used on the LRE Component Chassis are the Master Specialties Series 70E indicating type. These units contain a limiting resistor and lamps in parallel with the fuse, so that they are energized when the fuse opens. In addition, the fuseholders used in the +28VDC, +15VDC, and -15VDC circuits have been modified to include an encapsulated transistor-amplifier circuit attached to the back end of the holder to ensure proper indication of failure in cases where the circuit load is not heavy enough.

All the power required by the LRE Component Chassis, LRE Console Panels, ATE Drums Panel, and ATE Engine Temperature Panel is supplied through the fuses as follows:

F1 = 2 amps. 115VAC to operate Power Module No. 1.

F2 = 2 amps. 115VAC to operate Power Module No. 2.

F3 = 10 amps. 28VDC to operate relays and the various console switch-indicators.

F4 = 1/2 amp. -15VDC (with respect to I & C common) to operate the Trigger modules and for Printer signals from the console switches.

F5 = 1 amp. +15VDC (with respect to I & C common) to operate the Trigger modules.

F6 = 1/8 amp. 200VDC to operate the digital readouts for Pulse and Linear Power Channel No. 1.

F7 = 1/8 amp. 200VDC to operate the digital readouts for Pulse and Linear Power Channel No. 2.

F8 = 1/8 amp. 200VDC to operate the digital readouts for Pulse and Linear Power Channel No. 3.

F9 = 1/8 amp. 200VDC to operate the digital readouts for Pulse and Linear Power on the CTE Console.

3.2 Power Modules

The 2 Power Modules are used to supply the 200VDC needed to operate the Pulse and Linear Power digital readouts on the consoles. To insure reliable operation, each Power Module is energized through a separate input fuse and both outputs are then auctioneered through 2 1N1198 silicon rectifiers. Hence, loss of either Power Module will not affect the digital readouts. The units are Technipower NP-80 Series unregulated AC-DC Power Modules with the following specifications:

Input - 115VAC nominal, 60 cps, 2 amps

Output - 200VDC nominal, 200 milliamps

Regulation - Line: proportional to input voltage

- Load: 10 per cent

Ripple - Less than 5 per cent RMS

Temperature - 80°C base temperature

Features - All silicon rectifiers

- Hermetically sealed

- Capacitive filtering

- Output isolated from ground

Dimensions - 4" x 4 11/16" x 6"

3.3 Trigger Modules

The Trigger Module consists of a plug-in printed circuit card composed of a Schmidt Trigger Amplifier and its associated input circuit components and output relay. (Drawing 978D828GO2). The relay is a Potter-Brumfield FC-11 DPDT 12VDC type. The input to the trigger is a 0 to 10VDC signal from the monitored alarm temperature. The output is a set of relay contacts through which 28VDC power is fed to actuate the Temperature Alarm indicator lights located on the Engine Temperature Panel of the ATE Console. The operating point of the trigger is selected by means of the set-point adjusting potentiometer (R1) mounted on the module. Another potentiometer (R7) is also provided on the module for adjusting the hysteresis of the trigger. There are 9 Trigger Modules available in the LRE Component Chassis.

3.4 Component Modules

The Component Module consists of a plug-in printed circuit card with 16 silicon diodes G-296. (Drawing 978D886GO1). The function of the circuit is to provide the auctioneering diodes needed for the Lamp Verify test of the Korry switch-indicators located on the LRE Console Panels. There are 4 Component Modules located in the LRE Component Chassis. Two are associated with the Time Interval switch-indicators, one with the Power Increase Time switch-indicators, and one with the Reactor Safety switch-indicators.

3.5 Relay Modules

The Relay Modules consist of one Phillips-Advance 64-07-J 4PDT relay with a protective G296 diode across the coil mounted on a plug-in printed circuit card. (Drawing 978D866GO2).

The relays are energized with 28VDC power which is controlled by the various switches on the consoles as indicated on the schematic drawing (937J792). There are 7 Relay Modules located in the LRE Component Chassis. Connections to the relay contacts vary depending upon their application as shown on the schematic drawing. Four of the relays are associated with the digital Range readout on the CTE Console, two with the Log Count Rate drivers and indicators, and one with the CTE Console Log Power Meter and ATE Console Period Meter.

4.0 OPERATION

After the chassis has been installed and tested in accordance with the applicable sections of the Test Specification and Procedure, no further procedures are required other than setting the adjustment potentiometers on the Trigger Modules to their desired set points. Refer to Paragraph 4.2.3 of the Test Procedure. Apply a DC signal corresponding to the desired alarm temperature and adjust potentiometer R1 to obtain the "ON" set point. If so desired, potentiometer R7 may be adjusted to obtain a selected hysteresis with in a limited range. Repeat the procedure for each of the Trigger Modules associated with a temperature alarm.

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

Major corrective maintenance is performed at the factory or by a Westinghouse field representative. Alignment and replacement of obviously faulty components may be performed locally by a skilled technician. There are no specially selected or matched components used, therefore, components may be replaced by locally available parts of identical value and tolerance.

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.

6.0 TEST SPECIFICATION AND PROCEDURE

The proper Test Specification and Procedure is:

T-711842 - Component Chassis - LRE Console

7.0 DRAWING LIST

937J907 - Component Chassis - LRE Console

937J792 - Schematic Diagram - Component Chassis

937J799 - Wiring Diagram - Component Chassis

978D828 - Amplifier, Relay Trigger Module

978D866 - Relay Module

978D886 - Component Module

979D442 - Fuseholder, Driven Indicator

TEST SPECIFICATION NUMBER T-711842

TITLE

Acceptance Test Specification and Procedure

COMPONENT CHASSIS-LRE CONSOLE ETS-1 TSCS

DATE: January, 1966

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ACCEPTANCE TEST SPECIFICATION COMPONENT CHASSIS-LRE CONSOLE

1.0 SCOPE

This document contains the requirements for the acceptance testing of the Component Chassis-LRE Console (WANL Drawing 937J907) 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 937J907 - Component Chassis-LRE Console
- 3.2 Drawing 937J792 - Schematic Diagram - Component Chassis-LRE Console
- 3.3 Drawing 937J799 - Wiring Diagram - Component Chassis-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 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 ± 15 VDC power source with $\pm 0.05\%$ regulation and ± 1 mv. ripple
- 4.6 Four (4) 5K ohm $\pm 20\%$, 10 watt resistors

ACCEPTANCE TEST PROCEDURE COMPONENT CHASSIS-LRE CONSOLE

1.0 SCOPE

This document contains the procedures for acceptance testing the Component Chassis-LRE Console (WANL Drawing 937J907) 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 937J907.

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

Before performing the functional tests, check all the fuses to insure that the proper fuses are installed in the fuseholders.

4.1 Power Supplies PS1 and PS2

CAUTION

This test involves 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 With all power removed connect four 5K ohm, 10 watt, load resistors between J3-J and J3-HH, J3-K and J3-HH, J3-L and J3-HH, J3-M and J3-HH.

4.1.2 Apply 115VAC between J1-C and J1-D.

4.1.3 Measure and verify the voltages at the following points:

<u>Voltage</u>		<u>Points</u>
<u>(Desired)</u>	<u>(Measured)</u>	
115VAC $\pm$ 5VAC	_____	TP10 to TP11
115VAC $\pm$ 5VAC	_____	TP12 to TP11
200 $\pm$ 20VDC	_____	TP13(+) to TP29
"	_____	TP14(+) to TP29

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<u>Voltage</u>		<u>Points</u>
(Desired)	(Measured)	
200+20VDC	_____	TP15(+) to TP29
"	_____	J3-J(+) to J3-HH
"	_____	J3-K(+) to J3-HH
"	_____	J3-L(+) to J3-HH
"	_____	J3-M(+) to J3-HH

- 4.1.4 Remove fuse F2 and measure and verify the voltages at the following points:

<u>Voltage</u>		<u>Points</u>
(Desired)	(Measured)	
115VAC+5VAC	_____	TP10 to TP11
0VAC+1VAC	_____	TP12 to TP11
200+20VDC	_____	TP13(+) to TP29
< 10VDC	_____	TP14 to TP29
200+20VDC	_____	TP15(+) to TP29

- 4.1.5 Replace fuse F2 and remove fuse F1. Measure and verify the voltages at the following points.

<u>Voltage</u>		<u>Points</u>
(Desired)	(Measured)	
0VAC+1VAC	_____	TP10 to TP11
115VAC+5VAC	_____	TP12 to TP11
< 10VDC	_____	TP13 to TP29
200+20VDC	_____	TP14(+) to TP29
200+20VDC	_____	TP15(+) to TP29

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- 4.1.6 Remove the 115VAC power source. Remove the four load resistors.
Replace fuse F1.

4.2 Trigger Amplifiers A1 through A9

- 4.2.1 Apply 28VDC between J1-A(+) and J1-B (return). Apply +15VDC to J1-L and -15VDC to J1-M using J1-F as return wire.
- 4.2.2 Measure and verify the voltages at the following points:

<u>Voltage</u>		<u>Points</u>
(Desired)	(Measured)	
28VDC+2VDC	_____	TP27(+) to TP28
28VDC+2VDC	_____	J1-J(+) to TP28
15+ 1VDC	_____	TP26(+) to TP30
15+ 1VDC	_____	TP25(-) to TP30
15+ 1VDC	_____	J22-t(+) to TP30
15+ 1VDC	_____	J22-u(-) to TP30

- 4.2.3 Check the operation of Trigger Amplifier A1 as follows:

- 4.2.3.1 Measure the output at TP1 (Temp. 1) and J2-y to TP28 (return). Output should be +28VDC+2VDC when trigger is "ON" and 0VDC+ 1VDC when trigger is "OFF".

- 4.2.3.2 Set pot R1 and pot R7 fully clockwise.
Slowly adjust pot R1 until trigger just comes "OFF" with no signal applied.

4.2.3.3 Apply a DC signal source between J2-A(+) and J1-F (return). Measure the signal input at TP16. Slowly increase the signal until the trigger just comes "ON".

Record the result. Input _____ VDC

4.2.3.4 Increase the signal to $10 \pm .01$ VDC. Slowly adjust pot R1 until the trigger just comes "OFF". Record the result. Output OK _____

4.2.4 Check the operation of Trigger Amplifiers A2 through A9 in succession by repeating the procedures of Step 4.2.3 except using the following connector pins for signal and output measurements:

<u>Trigger</u>	<u>Signal</u>	<u>Input</u> (VDC)	<u>Output</u> (OK)
A2	J2-B, TP17	_____	J2-z, TP2 _____
A3	J2-C, TP18	_____	J2-AA, TP3 _____
A4	J2-D, TP19	_____	J2-BB, TP4 _____
A5	J2-E, TP20	_____	J2-CC, TP5 _____
A6	J2-F, TP21	_____	J2-DD, TP6 _____
A7	J2-G, TP22	_____	J2-EE, TP7 _____
A8	J2-M, TP23	_____	J2-FF, TP8 _____
A9	J2-N, TP24	_____	J2-GG, TP9 _____

4.2.5 Remove the power sources and the signal source.

4.3 Lamp Verify Diode Boards A10 through A13

4.3.1 Apply +28VDC+2VDC to the following input connector pins, in succession, and measure the voltage at the indicated output pins to verify that +28VDC+2VDC appears at each output.

Input (OK) Step 4.3.2	Output (OK) Step 4.3.1
J2-P _____	J3-A _____
J2-R _____	J3-B _____
J2-S _____	J3-C _____
J2-T _____	J3-D _____
J2-U _____	J3-E _____
J2-V _____	J3-F _____
J2-W _____	J3-G _____
J2-X _____	J3-H _____
J2-Y _____	J3-R _____
J2-Z _____	J3-S _____
J2-a _____	J3-N _____
J2-b _____	J3-P _____
J2-c _____	J3-V _____
J2-d _____	J3-U _____
J2-e _____	J3-T _____
J2-f _____	J3-Y _____
J2-g _____	J3-X _____

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Input (OK) Step 4.3.2	Output (OK) Step 4.3.1
J2-h _____	J3-W _____
J2-k _____	J2-K _____
J2-m _____	J2-L _____
J2-n _____	J2-i _____
J2-p _____	J2-j _____
J2-q _____	J2-v _____
J2-r _____	J2-w _____
J2-s _____	J2-x _____
J2-t _____	J2-HH _____
J2-u _____	All Output Pins _____

4.3.2 Reverse the procedure of Step 4.3.1. Apply +28VDC+2VDC at each output connector pin, in succession, and verify that no voltage appears at the input pins.

4.4 Relay Boards A14 through A19. Check the operation of the relay boards as follows:

4.4.1 With relays de-energized, use an ohmmeter between the following connector pins to verify the correct circuit conditions.

Open Circuit (OK)	Short-Circuit (OK)
J3-z to J3-r _____	J3-z to J3-Z _____
J3-z to J3-h _____	
J3-AA to J3-s _____	J3-AA to J3-a _____
J3-AA to J3-i _____	

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Open Circuit		Short-Circuit	
(OK)		(CK)	
J3-BB to J3- <u>t</u>	_____	J3-BB to J3- <u>b</u>	_____
J3-BB to J3- <u>i</u>	_____		
J3-CC to J3- <u>u</u>	_____	J3-CC to J3- <u>c</u>	_____
J3-CC to J3- <u>k</u>	_____		
J3-DD to J3- <u>v</u>	_____	J3-DD to J3- <u>d</u>	_____
J3-DD to J3- <u>m</u>	_____		
J3-EE to J3- <u>w</u>	_____	J3-EE to J3- <u>e</u>	_____
J3-EE to J3- <u>n</u>	_____		
J3-FF to J3- <u>x</u>	_____	J3-FF to J3- <u>f</u>	_____
J3-FF to J3- <u>p</u>	_____		
J3-GG to J3- <u>y</u>	_____	J3-GG to J3- <u>g</u>	_____
J3-GG to J3- <u>q</u>	_____		
J22-AA to J22- <u>a</u>	_____	J22-AA to J22- <u>w</u>	_____
J22-BB to J22- <u>z</u>	_____	J22-BB to J22- <u>v</u>	_____
J22-CC to J22- <u>y</u>	_____	J22-CC to J22-HH	_____
J22-DD to J22- <u>x</u>	_____	J22-DD to J22-GG	_____
J22-A to J22-N	_____	J22-A to J22-G	_____
J22-B to J22-P	_____	J22-B to J22-H	_____
J22-C to J22-N	_____	J22-C to J22-J	_____
J22-D to J22-P	_____	J22-D to J22-K	_____
J22-E to J22-N	_____	J22-E to J22-L	_____
J22-F to J22-P	_____	J22-F to J22-M	_____

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<u>Open Circuit</u>	<u>Short-Circuit</u>
(OK)	(OK)

J22-W to J22-X	J22-W to J22-Y
----------------	----------------

- 4.4.2 Energize Relay Boards A15 and A17 by applying 28VDC between J2-J(+) and J1-B (return). Use an ohmmeter between the following connector pins to verify the correct circuit conditions:

<u>Open Circuit</u>	<u>Short-Circuit</u>
(OK)	(OK)

J3-z to J3-Z	J3-z to J3-h
J3-AA to J3-a	J3-AA to J3-i
J3-BB to J3-b	J3-BB to J3-j
J3-CC to J3-c	J3-CC to J3-k
J3-DD to J3-d	J3-DD to J3-m
J3-EE to J3-e	J3-EE to J3-n
J3-FF to J3-f	J3-FF to J3-p
J3-GG to J3-g	J3-GG to J3-q

- 4.4.3 De-energize Relay Boards A15 and A17 by removing +28VDC from J2-J. Energize Relay Boards A14 and A16 by applying +28VDC+2VDC to J2-H. Use an ohmmeter between the following connector pins to verify the correct circuit conditions:

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<u>Open Circuit</u>	<u>(OK)</u>	<u>Short-Circuit</u>	<u>(OK)</u>
J3- <u>z</u> to J3-Z	_____	J3- <u>z</u> to J3-r	_____
J3-AA to J3- <u>a</u>	_____	J3-AA to J3- <u>s</u>	_____
J3-BB to J3- <u>b</u>	_____	J3-BB to J3- <u>t</u>	_____
J3-CC to J3- <u>c</u>	_____	J3-CC to J3- <u>u</u>	_____
J3-DD to J3- <u>d</u>	_____	J3-DD to J3- <u>v</u>	_____
J3-EE to J3- <u>e</u>	_____	J3-EE to J3- <u>w</u>	_____
J3-FF to J3- <u>f</u>	_____	J3-FF to J3- <u>x</u>	_____
J3-GG to J3- <u>g</u>	_____	J3-GG to J3- <u>y</u>	_____

- 4.4.4 De-energize Relay Boards A14 and A16 by removing +28VDC +2VDC from J2-H. Energize Relay Board A18 by applying +28 VDC+2VDC to J22-FF. Use an ohmmeter between the following connector pins to verify the correct circuit conditions:

<u>Open Circuit</u>	<u>(OK)</u>	<u>Short-Circuit</u>	<u>(OK)</u>
J22-AA to J22- <u>w</u>	_____	J22-AA to <u>a</u>	_____
J22-BB to J22- <u>v</u>	_____	J22-BB to <u>z</u>	_____
J22-CC to J22-HH	_____	J22-CC to <u>y</u>	_____
J22-DD to J22-GG	_____	J22-DD to <u>x</u>	_____

- 4.4.5 De-energize Relay Board A18 by removing +28VDC+2VDC from J22-FF and 28VDC return from J1-B. Energize Relay Boards A19 and A20 by applying 28VDC+2VDC between J22-U(+) and J22-V(return). Use an ohmmeter between the following connector pins to verify the correct circuit conditions:

Open Circuit		Short-Circuit	
	(OK)		(OK)
J22-A to J22-G	_____	J22-A to J22-N	_____
J22-B to J22-H	_____	J22-B to J22-P	_____
J22-C to J22-J	_____	J22-C to J22-N	_____
J22-D to J22-K	_____	J22-D to J22-P	_____
J22-E to J22-L	_____	J22-E to J22-N	_____
J22-F to J22-M	_____	J22-F to J22-P	_____
J22-W to J22-Y	_____	J22-W to J22-X	_____

- 4.4.6 De-energize Relay Boards A19 and A20 by removing +28VDC+2VDC from J22-U and 28VDC return from J22-V.

4.5 Safety Ground

Use an ohmmeter from connector pin J1-E 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 _____