AD-A103 951 BOEING AEROSPACE CO HOUSTON TX F/G 15/6

ELECTRICAL ANALYSIS OF B-52/FB-111 AMAC AND RELEASE CIRCUITRY U--ETC(U)

OCT 75 F29601-76-C-0017

UNCLASSIFIED D2-118576-1 NL

1 of 4

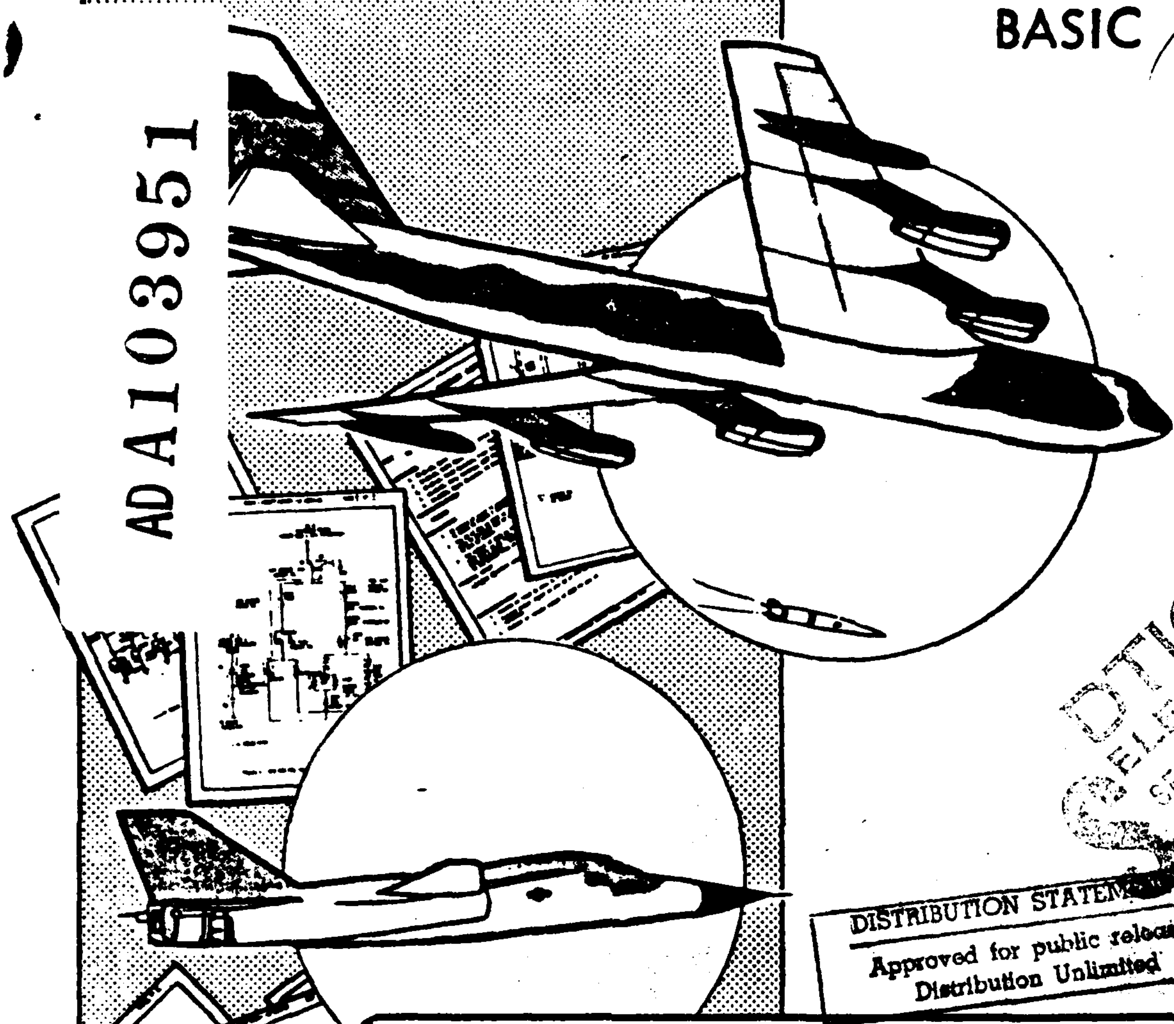
AD A103951

D2-118576-1

LEVEL II

VOLUME 1

BASIC



ELECTRICAL ANALYSIS OF B-52/FB-111 AMAC AND RELEASE CIRCUITRY UTILIZING SNEAK CIRCUIT ANALYSIS TECHNIQUE

—Final Report—

THE BOEING AEROSPACE COMPANY
HOUSTON, TEXAS
OCTOBER 31, 1975

REV LTR

THE BOEING COMPANY

CODE IDENT. NO. 81205

NUMBER D2-118576-1

TITLE: ELECTRICAL ANALYSIS OF B-52/FB-111 AMAC AND RELEASE CIRCUITRY UTILIZING SNEAK CIRCUIT ANALYSIS TECHNIQUES - FINAL REPORT.

MODEL B-52/FB-111 CONTRACT F29601-76-C-0017

ISSUE NO. 13 ISSUED TO:

PREPARED BY SNEAK CIRCUIT ANALYSIS GROUP ORG. 5-2932

SUPERVISED BY E. J. Hill, Jr.

APPROVED BY D. A. Heuer

Accession For
NTIS
DTIC
By
Dist
A

SHEET

U3 4802 1430 ORIG. 4/65

REVISIONS

REV. SYM	DESCRIPTION	DATE	APPROVED

HOU-3M-1116 (LSB) Approved 11 67 AJT

ABSTRACT

This report summarizes the results of an electrical circuitry analysis of B-52G and FB-111A aircraft monitor and control (AMAC) interfaces with nuclear weapons. The B-52G interface with the AGM-69A missile was also analyzed. Sneak circuit analysis techniques were used to produce network trees. The network trees provided necessary circuit topology for power and load analysis to identify feasible power sources to nuclear weapon interfaces in normal and abnormal environments. Preliminary results were presented to Air Force Weapons Laboratory/SEC, Kirtland AFB, on 1 October 1975 for use in a nuclear safety evaluation study.

KEY WORDS

Air Force Weapons Laboratory/SEC
AGM-69A Missile
Aircraft Monitor and Control (AMAC)
B-52G Aircraft
Electrical Circuitry Analysis
FB-111A Aircraft
Network Trees
Nuclear Safety Evaluation
Power and Load Analysis
Sneak Circuit Analysis
Topology

ARRANGEMENT

Document Number	Title	Subject
D2-1185761-1	Final Report	Electrical Analysis of B-52/FB-111 AMAC and Release Circuitry Utilizing Sneak Circuit Analysis Techniques
D2-1185761-2	B-52 Network Trees	B-52 AMAC and Release Circuitry
D2-1185761-3	FB-111 Network Trees	FB-111 AMAC and Release Circuitry

CONTENTS

CONTENTS (Continued)

CONTENTS (Continued)

CONTENTS (Continued)

LIST OF FIGURES

LIST OF FIGURES (Continued)

LIST OF FIGURES (Continued)

LIST OF TABLES

1.0 SUMMARY

This report documents the electrical circuitry analysis performed by Boeing Aerospace Company - Houston on Air Force contract F29601-76-C-0017. The study contributed to the AFWL/SE nuclear safety evaluation of B-52 and FB-111 aircraft directed by a joint ERDA/DOD steering group. The effort primarily involved evaluation of aircraft monitor and control (AMAC) circuitry for possible sneak circuits, and for currents or voltages to weapon interface connectors in normal and abnormal environments. Necessary data and documentation tasks were also performed. This report summarizes the study approach and results. Analysis packages and network trees are provided for possible use in a combined evaluation of the aircraft and weapons.

1.1 OBJECTIVE

The primary objective of the analysis was to identify latent electrical circuit paths and conditions that can cause unwanted functions to occur or which could inhibit desired functions with or without component damage due to normal or abnormal environments.

1.2 SIGNIFICANT FINDINGS

The most significant sneak circuit found is a bus-to-bus tie on the FB-111A. This condition will exist when stores jettison relays are energized, causing loss of both MAU Fire 1 and 2 commands to all pivot pylons. The sneak circuit analysis provided baseline data for the power and load analysis. Network trees developed by this task are documented in Volumes 2 and 3 of the report. Section 3 contains thirteen reports of sneak circuits, design concerns and drawing errors.

The most significant finding of the power and load analysis is that most weapon interface pins can be exposed to either 24/28VDC or 118VAC power when electrical elements have been damaged under crash and fire environments. These are the maximum voltages found in adjacent circuitry. No unlimited power sources were found. Results are documented in Section 4 of this report. Table 1.2-1 summarizes normal and worst-case fault analysis results.

TABLE 1.2-1 Power and Load Analysis Results - B-52/Gravity Weapons Interface (Sheet 1 of 4)

WEAPON INTERFACE		ENVIRONMENT ANALYSIS RESULTS						
		NORMAL			ABNORMAL - WORST CASE			ANALYSIS PACKAGE
DESIGNATOR	FUNCTION	V	I	t	V	I	t	Section 4.1.6
A114, J11, J12, J13 and J14	Forward Bomb Bay Clip-In Connectors	Note: Power is DC unless otherwise noted. AC current is 400 Hz unless otherwise noted.						
Pin A	IFC SAFING PWR	24V	75A	3.5s	24V	109A	1.4s	4.1.6.7
B	TESTER SW GND	0	0	-	24V	152A	.8s	4.1.6.7
C	TESTER SW OFF/SAFE	0	0	-	24V	110A	1.1s	4.1.6.4
D	TESTER SW AIR	0	0	-	24V	152A	.8s	4.1.6.7
E	IFC SAFING PWR	24V	131A	1.0s	24V	211A	.8s	4.1.6.7
F	TESTER SW SAFE	0	0	-	24V	109A	1.2s	4.1.6.6
G	INFLIGHT TEST	0	0	-	24V	152A	.8s	4.1.6.7
H	TESTER SW, READY	0	0	-	24V	150A	.8s	4.1.6.6
J	TESTER SW, AIR	0	0	-	24V	109A	1.2s	4.1.6.6
L	INFLIGHT TEST	0	0	-	24V	152A		4.1.6.7
O	WPN GROUND	GROUND						
P	IFC SAFING PWR	24V	152A	0.8s	24V	258A	.8s	4.1.6.7
R	INFLIGHT TEST	0	0	-	24V	152A	.8s	4.1.6.7
S	WPN GROUND	GROUND						
J11,12T	FWD IFI PWR, 25A	0	0	-	28V	1170A	.8s	4.1.6.3 (LH WPNS)
J13,14T	AFT IFI PWR, 25A	0	0	-	28V	1000A	.8s	4.1.6.2 (RH WPNS)
U	WPN GROUND	GROUND						
V	WPN GROUND	GROUND						
W	FWD IFI PWR, 15A	0	0	-	28V	800A	.8s	4.1.6.3
X	(OPEN)	0	0	-	24V	152A	.8s	4.1.6.8
Y	FWD IFI PWR, 15A	0	0	-	28V	800A	.8s	4.1.6.3
Z	TESTER SW, AIR	0	0	-	24V	110A	1.1s	4.1.6.4
a	TESTER SW, GND	0	0	-	24V	110A	1.1s	4.1.6.4
c	TESTER SW, GND	0	0	-	24V	109A	1.2s	4.1.6.6
d	IFC RELAY (FWD)	0	0	-	24V	152A	.8s	4.1.6.1
f	TESTER SW, READY	0	0	-	24V	218A	.8s	4.1.6.4
h	FWD BOMB BAY SAFE	0	0	-	24V	152A	.8s	4.1.6.5

TABLE 1.2-1 Power and Load Analysis Results - B-52/AGM-69 Interfaces (Sheet 2 of 4)

WEAPON INTERFACE		ENVIRONMENT ANALYSIS RESULTS						
		NORMAL			ABNORMAL - WORST CASE			ANALYSIS PACKAGE
DESIGNATOR	FUNCTION	V	I	t	V	I	t	Section 4.1.7
J1	Missile Connector							
Pin 2	BATTERY ACTIVATE							
	PYLON	0V	0A	-	118VAC	983A	.125s	4.1.7.4
	LAUNCHER	0V	0A	-	118VAC	900A	.125s	4.1.7.4
10	ACCUMULATOR ACT.							
	PYLON	0V	0A	-	118VAC	983A	.125s	4.1.7.4
	LAUNCHER	0V	0A	-	118VAC	900A	.125s	4.1.7.4
20	SAF CLASS III A CMD.							
	PYLON	0V	0A	-	118VAC	983A	.125s	4.1.7.8
	LAUNCHER	0V	0A	-	118VAC	900A	.13s	4.1.7.8
26	FIN UNLOCK							
	PYLON	0V	0A	-	118VAC	983A	.125s	4.1.7.4
	LAUNCHER	0V	0A	-	118VAC	900A	.125s	4.1.7.4
57	PROPULSION SAFE							
	PYLON	0V	0A	-	28V	1115A	1.5s	4.1.7.5
	LAUNCHER	0V	0A	-	28V	411A	2.0s	4.1.7.3
60	SAF CLASS III B CMD.							
	PYLON	0V	0A	-	118VAC	983A	.125s	4.1.7.8
	LAUNCHER	0V	0A	-	118VAC	900A	.13s	4.1.7.8
82, 92, 96	MISSILE ELECTRONIC POWER							
	PYLON SYS. ON	28V	254A	.45s	28V	1115A	1.5s	4.1.7.6
	SYS. OFF	0V	0A	-	28V	1115A	1.5s	4.1.7.6
	LAUNCHER SYS. ON	28V	368A	.2s	28V	1220A	1.5s	4.1.7.2
	SYS. OFF	0V	0A	-	28V	1220A	1.5s	4.1.7.2
97	SAF PREARM CMD.							
	PYLON	0V	0A	-	118VAC	983A	.125s	4.1.7.1
	LAUNCHER	0V	0A	-	118VAC	900A	.13s	4.1.7.1
J1	Ejector Connector							
Pin r	ARM SOLENOID							
	PYLON	0V	0A	-	27V	37A	1.1s	4.1.7.7
	LAUNCHER	0V	0A	-	27V	54A	1.1s	4.1.7.7

TABLE 1.2-1 Power and Load Analysis Results - B-52/AGM-69 Interfaces
(Sheet 2 of 4)

WEAPON INTERFACE		ENVIRONMENT ANALYSIS RESULTS						
		NORMAL			ABNORMAL - WORST CASE			ANALYSIS PACKAGE
DESIGNATOR	FUNCTION	V	I	t	V	I	t	Section 4.1.7
J1	Missile Connector							
Pin 2	BATTERY ACTIVATE							
	PYLON	0V	0A	-	118VAC	983A	.125s	4.1.7.4
	LAUNCHER	0V	0A	-	118VAC	900A	.125s	4.1.7.4
10	ACCUMULATOR ACT.							
	PYLON	0V	0A	-	118VAC	983A	.125s	4.1.7.4
	LAUNCHER	0V	0A	-	118VAC	900A	.125s	4.1.7.4
20	SAF CLASS III A CMD.							
	PYLON	0V	0A	-	118VAC	983A	.125s	4.1.7.8
	LAUNCHER	0V	0A	-	118VAC	900A	.13s	4.1.7.8
26	FIN UNLOCK							
	PYLON	0V	0A	-	118VAC	983A	.125s	4.1.7.4
	LAUNCHER	0V	0A	-	118VAC	900A	.125s	4.1.7.4
57	PROPULSION SAFE							
	PYLON	0V	0A	-	28V	1115A	1.5s	4.1.7.5
	LAUNCHER	0V	0A	-	28V	411A	2.0s	4.1.7.3
60	SAF CLASS III B CMD.							
	PYLON	0V	0A	-	118VAC	983A	.125s	4.1.7.8
	LAUNCHER	0V	0A	-	118VAC	900A	.13s	4.1.7.8
82, 92, 96	MISSILE ELECTRONIC POWER							
	PYLON SYS. ON	28V	254A	.45s	28V	1115A	1.5s	4.1.7.6
	SYS. OFF	0V	0A	-	28V	1115A	1.5s	4.1.7.6
	LAUNCHER SYS. ON	28V	368A	.2s	28V	1220A	1.5s	4.1.7.2
	SYS. OFF	0V	0A	-	28V	1220A	1.5s	4.1.7.2
97	SAF PREARM CMD.							
	PYLON	0V	0A	-	118VAC	983A	.125s	4.1.7.1
	LAUNCHER	0V	0A	-	118VAC	900A	.13s	4.1.7.1
J1	Ejector Connector							
Pin r	ARM SOLENOID							
	PYLON	0V	0A	-	27V	37A	1.1s	4.1.7.7
	LAUNCHER	0V	0A	-	27V	54A	1.1s	4.1.7.7

TABLE 1.2-1 Power and Load Analysis Results - FB-111/Station 3 (Sheet 3 of 4)

DESIGNATOR	WEAPON INTERFACE FUNCTION	NORMAL V	NORMAL I	NORMAL t	ABNORMAL - WORST CASE V	ABNORMAL - WORST CASE I	ABNORMAL - WORST CASE t	ANALYSIS PACKAGE Section 4.2.6
J479013-3	WPN STATION 3							
Pin A	SAFE INPUT	28V	608A	.6s	28V 115VAC	608A 1983A	.6s .6s	4.2.6.2
B	(NONE)							
C	SAFE INDICATION	28V	48mA		28V 115VAC	608A 198mA	.6s/-*	4.2.6.5
D	(NONE)							
E	GROUNDED	0	-					
F	GROUNDED	0	-					
G	WPN PRESENT (GROUND)	28V	48mA		28V 115VAC	608A 198mA	.6s/-*	4.2.6.5
H	ARM INPUT	0	0		28V	608A	.6s	4.2.6.2
J	ARM INPUT	0	0		28V	608A	.6s	4.2.6.2
K	(NONE)							
L	(UNUSED)	0	0		28V 115VAC	608A 451A	.6s/.6s	4.2.6.3
M	(NONE)							
N	(UNUSED)	0	0		28V 115VAC	608A 451A	.6s/.6s	4.2.6.3
P	PAL MONITOR	28V	48mA		28V 115VAC	608A 451A	.6s/.6s	4.2.6.1
R	ARM INDICATION	28V	48mA		28V 115VAC	608A 198mA	.6s/-*	4.2.6.5
S	SWITCHED TO GROUND	0	0		28V	608A	.6s	4.2.6.6
T	(NONE)							
U	(NONE)							
V	PYLON CONTINUITY	0	0		28V	608A	.6s	4.2.6.6
W	PYLON CONTINUITY	0	0		28V	608A	.6s	4.2.6.6
X	WPN DROP CONFIG. RETARD	0	0		28V	608A	.6s	4.2.6.2
Y	(FUTURE CAPABILITY)	0	0		28V	608A	.6s	4.2.6.2
Z	BURST OPTION-AIR	0	0		28V	608A	.6s	4.2.6.2
a	(SRAM ONLY)	28V	48mA		28V	608A	.6s	4.2.6.3
b	SAFE PROVISION	28V	48mA		28V 115VAC	608A 198mA	.6s/-*	4.2.6.4
c	(SRAM ONLY)	0	0		28V	608A	.6s	4.2.6.3
d	WPN DROP CONFIG. FREE FALL	0	0		28V	608A	.6s	4.2.6.2
e	(FUTURE CAPABILITY)	0	0		28V	608A	.6s	4.2.6.2
f	BURST OPTION-GND	0	0		28V	608A	.6s	4.2.6.2

*Indefinite

TABLE 1.2-1 Power and Load Analysis Results - FB-111/Station -R
Weapon Interface (Sheet 4 of 4)

WEAPON INTERFACE		ENVIRONMENT ANALYSIS RESULTS						ANALYSIS PACKAGE
		NORMAL			ABNORMAL - WORST CASE			
DESIGNATOR	FUNCTION	V	I	t	V	I	t	Section 4.2.6
J479013-R	RH WPNS BAY							
Pin A	SAFE INPUT	28V	1333A	.6s	28V 115VAC	1333A 3286A	.6s .6s	4.2.6.2
B	(NONE)							
C	SAFE INDICATION	28V	48mA	--	28V 115VAC	1333A 198mA	.6s indefinite	4.2.6.5
D	(NONE)							
E	GROUNDED							
F	GROUNDED							
G	WPN PRESENT (GND)	28V	48mA	--	28V 115VAC	1333A 198mA	.6s indefinite	4.2.6.5
H	ARM INPUT	0	0	--	28V	1333A	.6s	4.2.6.2
J	ARM INPUT	0	0	--	28V	1333A	.6s	4.2.6.2
K	(NONE)							
L	(UNUSED)	0	0	--	28V 115VAC	1333A 215A	.6s .6s	4.2.6.3
M	(NONE)							
N	(UNUSED)	0	0	--	28V 115VAC	1333A 215A	.6s .6s	4.2.6.3
P	PAL MONITOR	28V	48mA	--	28V	1333A	.6s	4.2.6.1
R	ARM INDICATION	28V	48mA	--	28V 115VAC	1333A 198mA	.6s indefinite	4.2.6.5
S	SWITCHED TO GND	0	0	--	28V	1333A	.6s	4.2.6.6
T	(NONE)							
U	(NONE)							
V	(UNUSED IN WPN BAY)							
W	(UNUSED IN WPN BAY)							
X	WPN DROP CONFIG. RET	0	0	--	28V	1333A	.6s	4.2.6.2
Y	(FUTURE CAPABILITY)	0	0	--	28V	1333A	.6s	4.2.6.2
Z	BURST OPTION-AIR	0	0	--	28V	1333A	.6s	4.2.6.2
a	(SRAM ONLY)	0	0	--	28V	1333A	.6s	4.2.6.3
b	SAFE PROVISION	0	0	--	28V 115VAC	1333A 198mA	.6s indefinite	4.2.6.4
c	(SRAM ONLY)	0	0	--	28V	1333A	.6s	4.2.6.3
d	WPN DROP CONFIG-FF	0	0	--	28V	1333A	.6s	4.2.6.2
e	(FUTURE CAPABILITY)	0	0	--	28V	1333A	.6s	4.2.6.2
f	BURST OPTION - GND	0	0	--	28V	1333A	.6s	4.2.6.2

1.3 CONCLUSIONS

The following conclusions were reached:

- o The probability of abnormal voltage/currents being supplied to nuclear weapon interfaces, is considered to be very low, even in fire or crash environment, except as shown in this report.
- o The reported sneak circuits are the only ones to exist in the nuclear weapons monitor, control and release systems, based on available data.
- o Sneak circuit analysis provides an excellent baseline for fault analysis while defining all normal environment paths.
- o Wire-to-wire short circuits within common cables and crushed components can be expected in a crash causing abnormal continuities.
- o Limiting the scope of aircraft wiring harness fault analysis to wires within shared cables or connectors is considered practical and valid.
- o Techniques used in this study provide a number of fringe benefits:
  - Design concerns identified.
  - Input documentation accuracy cross checked.
  - Good visibility of interfacing circuits.
  - System configuration defined for all nuclear weapons monitor, control and release circuits.
  - Electrical safety of these circuits examined.

1.4 RECOMMENDATIONS

Boeing recommends that AFWL/SEC

- o Continue with methods used for this analysis on other systems to be analyzed.
- o Provide access to input data as early as possible through cognizant ALC's.
- o Review findings from analysis to assess impact on weapon circuits.

2.0 ANALYSIS DESCRIPTION

This section describes the scope of the analysis, defines the tasks performed, and discusses the methods used.

2.1 SCOPE

The sneak circuit analyses performed on the B-52G and FB-111A aircraft were confined to circuitry pertaining to monitor, control and release of onboard nuclear weapons. The power and load analysis was confined to circuits which interface with the nuclear weapons and adjacent circuitry. Primary power, switched secondary power and control circuits were included as required.

Generalized aircraft damage modes and conditions under which they occur were studied to postulate circuit faults that could cause abnormal voltages and currents in wiring that interfaces with the nuclear weapon systems. For this analysis two operational modes were assumed: 1) Ground alert posture with power on and engines running, 2) flight (including taxi, takeoff and landing).

Sources that could possibly supply high voltage and current to wiring adjacent to direct nuclear weapon circuits were located and identified. Calculations were performed to determine voltage and current for each aircraft nuclear weapon system circuit at its interface with the weapon under both normal and faulted conditions. For these calculations each circuit was assumed grounded at the interface connector.

2.1.1 Configuration

The airplane configurations analyzed are as follows:

2.1.1.1 B-52G, Serial Number 59-2602, configured as follows:

Forward Bomb Bay - Multiple Weapon Clip-In Assembly, Type MHU-20A/C containing four bombs

Aft Bomb Bay - AGM-69A Launcher containing only Missile no. 1

Left Pylon - AGM-69A Ejector containing only Missile no. 1

Right Pylon - Identical to Left Pylon

2.1.1.2 FB-111A, Serial Number 69-6514, configured as follows:

Weapons Bay - Right-hand (Station -R) MAU-12B/A, Aircraft Bomb Ejector Rack Assemblies, each containing a bomb. (Left-hand station identical)

Left Pivot Pylon - Station -3, One MAU-12B/A, Aircraft Bomb Ejector Rack Assembly, containing a bomb.

Right Pivot Plyon - Identical to Left Pivot Pylon Station.

2.1.1.3 Analysis Assumptions and Exclusions

- o Interfaces with gravity bombs are the connectors shown in the aircraft wiring diagrams.
- o Interfaces with SRAMs are the connectors to the SRAM missile Internal SRAM missile circuits were excluded.
- o Aircraft circuits for SRAM guidance were excluded.
- o One SRAM weapons bay installation and one SRAM pylon station was analyzed in depth for the B-52G. The other similar SRAM installations were analyzed for impacts of detail differences.
- o Analyses of abnormal environments considered only one fault at a time.
- o Wiring faults within aircraft wiring harnesses were limited to those within shared cables and connectors. Cable-to-cable and bundle-to-bundle wiring faults were excluded.
- o Release circuits were not included as nuclear weapon interface circuits during load analysis for abnormal environments.
- o Short circuits in terminals and faults internal to components were not considered except in the worst-case abnormal environment analysis for each model.
- o The abnormal environments analysis of the FB-111A escape capsule disconnects were limited to circuits related to nuclear weapons.
- o Circuits to the "Hound Dog" AGM were excluded.
- o FB-111A SRAM interfaces were excluded.

2.1.2 Definitions

Some terms used in this study require specific definitions for clarity. The following definitions apply throughout this report:

Normal environments

These are the conditions present on an aircraft during ground alert operations with no faults postulated due to component damage, or abnormal temperature, forces, radiation or other out-of-tolerance influences from the aircraft surroundings.

Abnormal environments

For the purposes of the analysis, the abnormal environments that were considered were damaging temperatures and mechanical forces due to fuel-fed fire for aircraft on ground alert status and fuel-fed fire or crash for aircraft in flight.

Power and load analysis

This consisted of determining open circuit voltage and short circuit current on each weapon system interface wire under normal and faulted conditions.

Fire on ground alert

A fire fed by aircraft fuel such that damaging temperatures and forces reach the circuits of concern while power is still applied to them.

Fire and crash in flight

An intense fire in flight fed by fuel and slipstream. Inflight crash involves collision or structural breakup resulting in mechanical forces that cause damage and introduce abnormal current paths such as conductive structural debris in contact with circuits of concern.

2.1.2 (Continued)

High voltage and current

Any AC or DC voltage or current exceeding normal operating values, allowing for tolerances.

Electrical faults

These are the logical results from the damage modes. They are of the following types:

1. Open weapon system circuits in components and wiring.
2. Shorted wires in junction boxes, components, cables and connectors containing circuits that lead to nuclear weapon interfaces.

Damage

The physical result of fire or crash as defined above. Damage modes are generalized categories such as shear, rupture, collapse, melting, and perforation.

Worst-case conditions

Worst-case conditions assumed power on all systems, all engines running and fire on ground alert, or fire/crash in flight, as defined above.

Power profile

Plots of short circuit current versus time on each weapon system interface wire.

Interfacing circuits

Any circuit that can directly affect nuclear circuits.

Adjacent wiring

Wires that physically share the same cable or connector but do not electrically interface with the nuclear weapon system circuits.

2.1.2 (Continued)

Transient suppression

Components/circuits that will reduce voltages from inductive loads such as relays, motors or solenoids.

Direct nuclear circuit

Any circuit that has a current path into the nuclear weapon interface without an interrupting device. Resistors and relay coils are assumed to continue the current path. Switches, circuit breakers and relay contacts stop the current path.

2.2 TASK DESCRIPTIONS

The following tasks were performed:

2.2.1 Data Requirements and Handling - Task 1

Boeing received, catalogued and filed documents such as wiring diagrams, schematics, wire lists and other input data that defined electrical continuity, operation, and subsystem functions to be analyzed by aircraft model. Appendix A lists technical data utilized for the analysis.

2.2.2 Electrical Paths and Network Trees - Task 2

Boeing processed the input data to identify all continuity paths. Network trees were prepared for the sneak circuit analysis and power/load analysis efforts described below.

2.2.3 Sneak Circuit Analysis - Task 3

Boeing performed a sneak circuit analysis of each aircraft model in the ground alert and flight modes assuming a normal environment. The analysis used the network trees developed in Task 2. Boeing identified potential sneak circuit conditions such as:

- Sneak paths which may allow current or voltage to flow along an unexpected route to a nuclear weapon or SRAM interface.
- Sneak timing which may actuate or inhibit a function at an unexpected time.

2.2.3 (Continued)

- Sneak indications which may cause an ambiguous or false display of system operating conditions to the flight crew.
- Sneak labels which may cause incorrect stimuli to be initiated by the flight crew.

2.2.4 Power and Load Analysis - Task 4

Boeing performed a power and load analysis under worst-case environment conditions with the aircraft on ground alert. This assumed that power is on all circuits of concern and that all engines are running. Boeing calculated maximum power duration and profile in direct and interfacing circuits and in wiring adjacent to exposed nuclear weapon system circuits. Maximum currents were calculated for each circuit path assuming zero impedance to ground at the weapon interface. Sources were identified that could possibly supply high voltage or current on wiring that interface with nuclear weapon circuits. Expected failure modes resulting from abnormal environments (fire) were considered in this task to the extent that they could affect the voltage and current available to the weapons. Abnormal environment was limited to fire for ground alert and fire or crash for flight mode.

2.2.5 Documentation - Task 5

Boeing documented the analyses as described below.

2.2.5.1 Potential Sneak Circuit Conditions

Sneak circuit conditions found were described and documented. Sketches of the circuits are included when appropriate. Recommendations for appropriate corrective action are given along with references to supporting documentation.

2.2.5.2 Undesirable Circuit Conditions

Undesirable circuit conditions found during the analysis are described on design concern reports. Circuit paths that could deliver high power to nuclear weapon interfaces as a result of fire and crash environments are identified in Circuit Analysis Packages. During the performance of the analysis,

2.2.5.2 (Continued)

when the following conditions were apparent, they were also described and reported on Design Concern Reports:

- o Single failure points
- o Unnecessary circuitry or components
- o Improper implementation of redundancy
- o Lack of transient suppression or improper suppression for inductive loads
- o Improper application of components

2.2.5.3 Drawing Errors

Drawing errors and other discrepancies found in the input data for the analysis were identified and documented.

2.2.5.4 Analysis Effort Summary

The analysis effort was summarized to include: the Scope, Method, Conclusions and Recommendations at the completion of the analysis tasks.

2.3 METHODS

The chart in Figure 2.3-1 shows graphically how the total analysis was performed and the interaction between the sneak circuit portion and the power and loads analysis. The following paragraphs describe in detail how each analysis was performed.

2.3.1 Sneak Circuit Analysis Methods

The Sneak Circuit Analysis (SCA) techniques and associated computer programs developed by The Boeing Aerospace Company were designed to be applied to a broad range of electrical/electronic systems including the B-52G and FB-111A special weapons monitor, control and release systems. The methods described were applied directly.

Specifically, the methods used to conduct the analysis of these systems included an input phase, a processing phase and an analysis phase. Figure 2.3-2

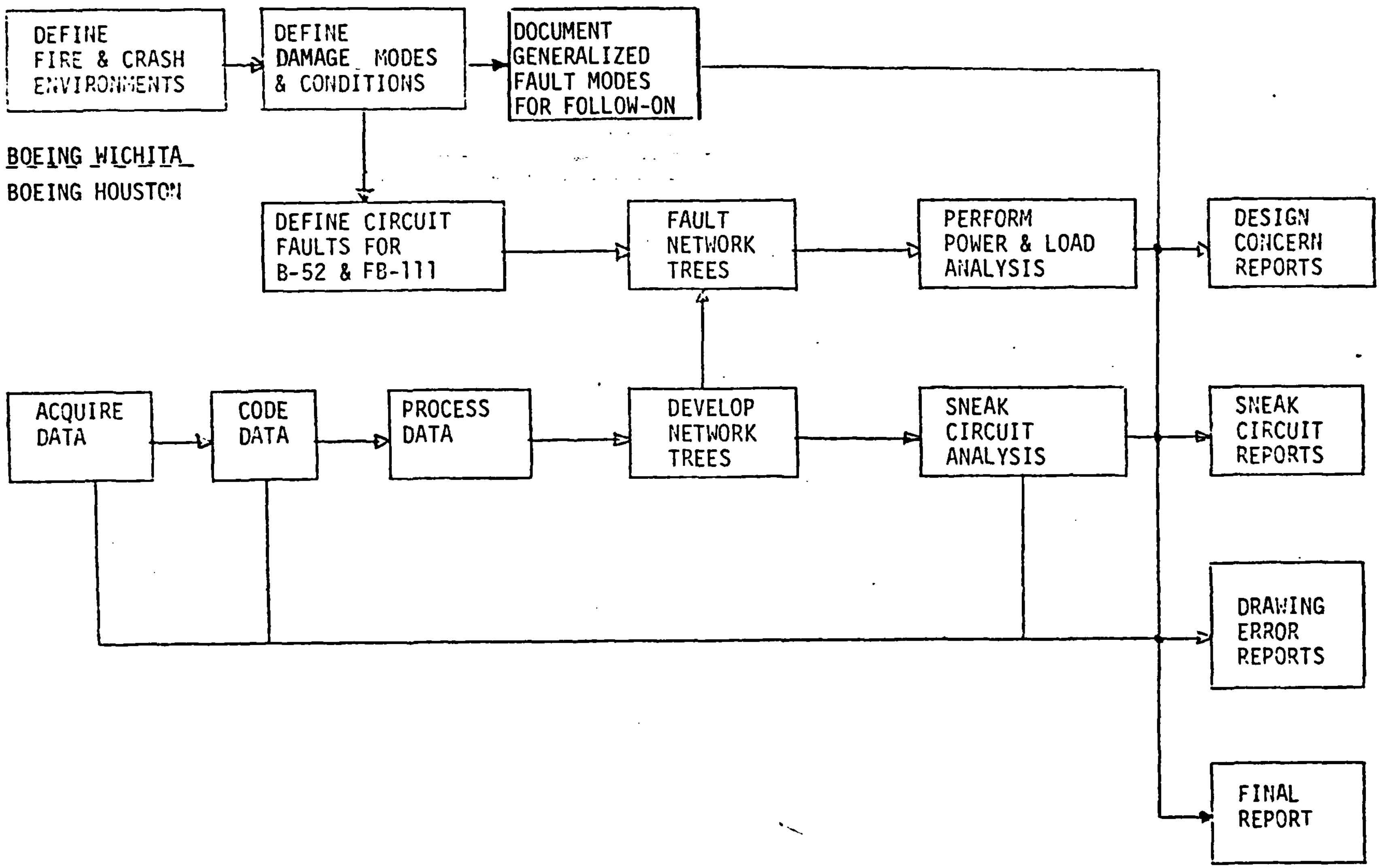


Figure 2.3-1 "B-52/FB-111 ANALYSIS WORK FLOW"

2.3.1 (Continued)

shows the steps involved in these phases and their relationship.

2.3.1.1 Input Phase

Data supplied by the Air Force Weapons Laboratory were converted into the proper format for use by the computer. Input data was manually encoded from the detail schematics and wiring diagrams. The computer generated a masterfile from this data. Several automatic audit and edit functions were performed while generating the masterfiles. The masterfiles were then verified by a second analyst. The masterfile was updated as necessary to correct any discrepancies noted. By using manufacturing level data and performing necessary audit and edit functions, an accurate data base was insured. Drawing errors discovered have been reported.

2.3.1.2 Computer Processing Phase

The masterfiles generated in the input phase formed the data base for the path search program. One of the outputs of the run was the Open End (O.E.) Report. This report identified all the path segments that are not connected to another segment, power or ground. All unintentional open ends were resolved and the masterfiles updated. The O.E. Report is one method of discovering drawing errors, i.e., mismatched connector numbers, connector pin numbers, etc.

The next major step was the path search which established all possible paths by stringing together all records with point to point continuity. All data input to the search program was accounted for in the Used and Unused Data Record indices. Matrix reports were generated identifying all paths, intersect nodes and path types. Several other reports (terminal branch, switch branch, special node cross reference, etc.) were produced at this time to present supplementary information used during the analysis phase.

2.3.1.3 Analysis Phase

The outputs of the computer processing phase were collated into nodal set

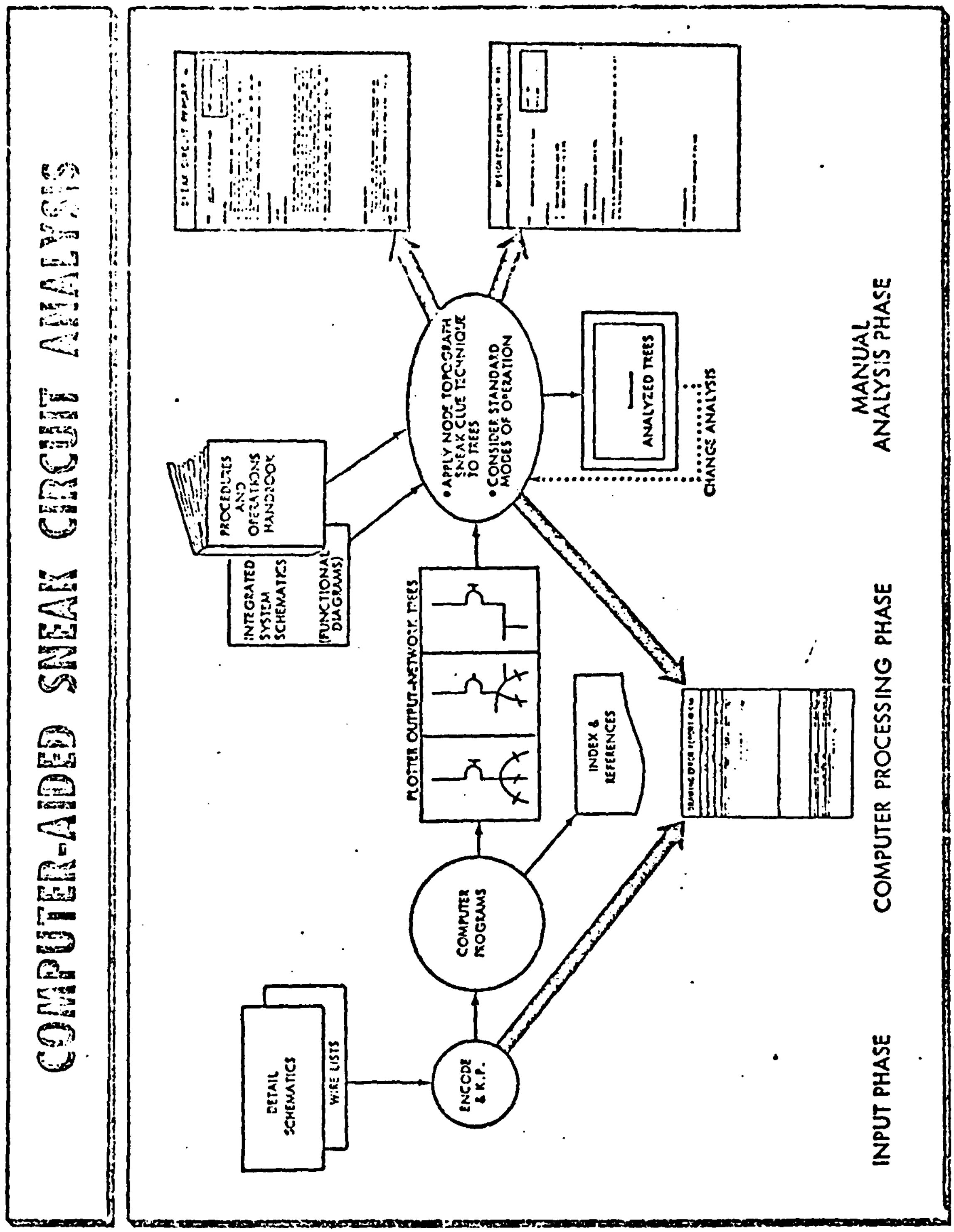


Figure 2.3-2. Sneak Circuit Analysis Work Flow

2.3.1.3 (Continued)

packages. These packages contained the network trees, matrix reports and the various reference reports peculiar to each nodal set. The analyst then prepared "node topographs" for the network trees. Topological network trees show the electrical power source (voltage input) at the top and the electrical return (ground) at the bottom of the figure. The only exception to this was a network tree with digital logic in which case the tree was drawn in a left to right manner. All nodes (intersection of three or more branches) were structured into levels between power and ground, and they were separated into levels or from one another by branches containing a switching device, a load (impedance), or a diode.

The use of topological network trees is a feature which greatly facilitates the analysis by clearly showing all connections at each electrical node. It also eliminates extraneous circuit routing detail and drafting line layout problems which can handicap an analysis to the extent of hiding sneak circuits. Therefore, topological network trees were essential to successful electrical Sneak Circuit Analysis.

Another key element in electrical Sneak Circuit Analysis development came with realization that the clues can be divided into groups with each group applying to an individual node topograph. Node topographs are the patterns which geometrically describe node connections in topological network trees. The node topographs recognized to exist in electrical network topology are presented in Figure 2.3-3. All electrical nodes in a topological network tree will fit one of these patterns. More complex patterns encountered can be broken into component parts represented by these basic patterns. The actual analysis was then performed by identifying all possible modes of operation, eliminating those that are not possible by switching or other restrictions and then determining if the remaining circuits perform as intended by the designer. The analyst applied a list of approximately forty "sneak circuit clues" to each nodal set. Potential "sneak" conditions and design concerns were reported along with the recommended corrective action.

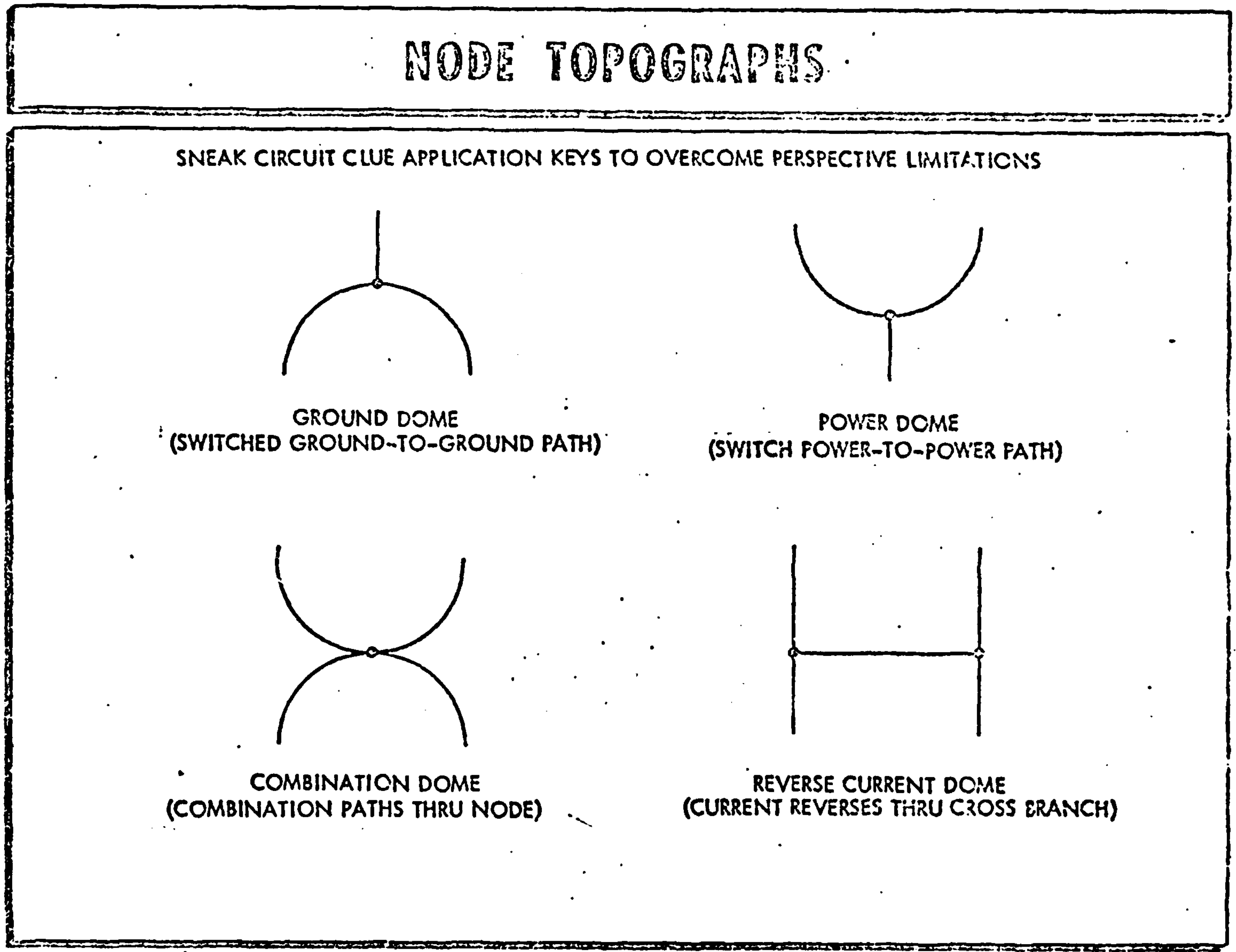


Figure 2.3-3. Electrical Network Node Topographs

2.3.2 Power and Load Analysis Method

The power and load analysis was performed for both normal and abnormal environment conditions.

2.3.2.1 Definition of Environments and Fault Modes

The power and load analysis involved normal and abnormal environments for nuclear-loaded ground alert and operational flight postures. Boeing defined the environments as shown in Table 2.3-1. There is very little difference in electrical effects between flight and ground alert. Perhaps the basic difference is ambient temperature which has a significant effect upon circuit breaker trip times.

TABLE 2.3-1 ENVIRONMENTS AND FAULT MODES

OPERATIONAL POSTURE	ENVIRONMENT DEFINITION: ENVIRONMENT	ENVIRONMENT DEFINITION: CONDITIONS	FEASIBLE FAULT MODES
GROUND ALERT	NORMAL	o AIRCRAFT PARKED o ALL ENGINES RUNNING o POWER ON ALL BUSSES o AMBIENT T = 25°C	NONE
	ABNORMAL	o AIRCRAFT PARKED o ALL ENGINES RUNNING o POWER ON ALL BUSSES o POWER ON ALL CIRCUITS OF CONCERN o FIRE LOCATED IN AREA OF CONCERN o AMBIENT T = 25°C	o ADJACENT WIRES/ADJACENT PINS SHORTED TOGETHER o WIRES IN COMMON CABLE FAULTED OPEN/ OR SHORTED TO GROUND o COMPONENTS/EQUIPMENT SHORTED TOGETHER OR TO GROUND o POWER LOSS FROM FAULTED COMPONENT
FLIGHT	NORMAL	o AIRCRAFT FLYING NORMAL MISSION PROFILE o ALL ENGINES, GENERATORS, TR'S, BATTERIES OPERATING o POWER ON ALL BUSSES o AMBIENT T = -54°C o CREW COMPARTMENT T = 25°C	NONE
	ABNORMAL	o ALL ENGINES RUNNING o POWER ON ALL BUSSES AND CIRCUITS OF CONCERN o CRASH DAMAGE IN AREA OF CONCERN o FIRE IN AREA OF CONCERN o AMBIENT T = -54°C	o ADJACENT WIRES/ADJACENT PINS SHORTED TOGETHER o WIRES IN COMMON CABLE FAULTED OPEN/ OR SHORTED TO GROUND o COMPONENTS/EQUIPMENT SHORTED TOGETHER OR TO GROUND o POWER LOSS FROM FAULTED COMPONENT

2.3.2.2 Normal Condition Calculations

The network trees that show the weapon interfaces and interfacing circuitry were analyzed as to voltage sources and current paths to the weapon interface. Path resistance was determined from the voltage source to the weapon interface where current paths were determined to be possible under ground alert or normal inflight checkout. This resistance was obtained from cable assembly drawings, wiring specifications, aircraft dimensions and cable routing. It was assumed for this analysis that arming functions and code switching were not normal conditions, but monitor, station select and safing functions might be performed. The current profile was then determined from the voltage source and path resistance assuming a ground at the weapon interface. Open circuit voltage was determined to be the source voltage assuming an open circuit at the weapon interface.

2.3.2.3 Fault Condition Calculations

The network trees that show the weapon interfaces and interfacing circuitry were analyzed as to possible voltage sources under fault conditions. The computer generated path reports were used to determine each connection and wire segment in the direct and interfacing circuitry. These were used with the computer generated output data index, technical orders, wiring diagrams, schematics and cable assembly drawings to determine powered circuitry in common cables, connectors or component assemblies. Under fault conditions it was assumed that any powered circuits could short into the direct or connected interfacing circuits where they exist in common cables, connectors or component assemblies. A sketch was prepared for each weapon interface pin to show the direct circuitry and adjacent circuitry. Potential points where faults could occur were identified on the sketches and on the network trees. The worst case path for each weapon interface was determined from examination of the above data considering the power source voltage, wire lengths and wire sizes. Resistance of the faulted path was determined from the cable assembly drawings, wiring specifications, aircraft dimensions and cable routing. The worst case path for each weapon interface was shown on a sketch that identifies

2.3.2.3 (Continued)

the fault area, resistance of the path and the voltage source. Maximum current was calculated assuming a ground at the weapon interface. Open circuit voltage was determined assuming an open circuit at the weapon interface. Time duration of the current was determined using manufacturer's data and governing specifications of the circuit breakers that supplied the circuits.

3.0 SNEAK CIRCUIT ANALYSIS OF B-52G & FB-111A

A Sneak Circuit Analysis of the Monitor & Control and Weapons Release systems of the B-52G and FB-111A aircraft was performed with the aid of a digital computer.

3.1 SUMMARY

The analyses of the systems of each aircraft were based on electrical wiring data from technical manuals. Circuit evaluation was limited to pertinent portions of the subsystems, and excluded circuitry internal to the weapons. The results of the B-52G analysis were three sneak-circuit reports describing erroneous indicator lights, two design concern reports describing unnecessary components and a single failure point, and one drawing error report. The FB-111A analysis resulted in two sneak circuit reports describing a sneak inhibit and a bus-to-bus tie, and five drawing error reports. Copies of all reports are included in Sections 3.4, 3.5 and 3.6 respectively.

3.2 CONDITIONS AND ASSUMPTIONS

The B-52G and FB-111A sneak circuit analyses were based on electrical wiring diagrams contained in technical manuals. The information shown on these drawings was of sufficient detail for component interconnections and generally sufficient for circuits internal to component "Boxes". Supplementary information was obtained from functional/integrated drawings and system descriptions from additional technical manuals.

Specifically, the circuitry of each aircraft that was analyzed was limited to the portions of the Weapons Release and Monitor and Control Systems for which electrical wiring data was available. Circuitry in other systems which interfaced with the aforementioned systems was considered out of scope. No circuitry internal to the gravity weapons or the AGM-69A was included in the analysis. Assumptions were made for components on which detail electrical data were not available, based on the supplementary information.

3.3 NETWORK TREES

The network trees derived from computer processed B-52G and FB-111A data were analyzed for sneak circuit conditions. The trees were uniquely identified according to aircraft, numbered, and titled for reference and cross-reference between trees. Copies of all network trees for B-52G and FB-111A aircraft are included as Volumes 2 and 3.

3.4 SNEAK CIRCUIT REPORTS

Five sneak circuit conditions were discovered during the analysis of aircraft systems. Three sneak circuit reports (SCR's) resulted from B-52G analysis, and two SCR's from FB-111A analysis. Copies of these SCR's are presented in the Figures listed below.

SCR Number	Subject	Figure
B-52G-1	DCU-9/A Warning Light	3.4-1
-2	Master Bomb Control Power Indicator	3.4-2
-3	AGM-69A Power Distribution Indicator	3.4-3
FB-111A-1	Tail Arming Solenoid	3.4-4
-2	Essential Bus to Main Bus Tie	3.4-5

SNEAK CIRCUIT REPORT B-52G-1

DATE 8-27-75

ENGINEER M. Garnett

jlc

TITLE DCU-9/A Warning Light Provides False Indication.

REFERENCES

1) USAF T.O. 11N-T5009-2 change 6, para. 4-1.2 Warning Indicator
2) USAF T.O. 1B-52B-2-31 change 32, page 3-83, figure 3-20
3) USAF T.O. 1B-52B-2-23, A8F.00 Rev JH
4) USAF T.O. 1B-52B-2-23, A8.14 Rev KM

MODULE/EQUIPMENT

DCU-9/A/B52-G

EXPLANATION

Per reference 1, the DCU-9/A Warning Indicator is used to indicate undesirable external conditions or to test certain external circuits for continuity. When the forward readiness switch S619 is in the SAFE position and the DCU-9/A rotary switch is in the GND or AIR position, relay K502 in the readiness panel will energize removing J11, J12, J13, and J14 pins G and L from the warning indicator circuit by opening the normally closed K502 contacts. Closure of the normally open K502 contacts will illuminate the warning indicator falsely implying an undesirable external circuit condition even though the indicator is not connected to an external circuit. Power is still present on J11/A through J14/A to "safe" the weapon. See figure 1.

POTENTIAL IMPACT

False indication of an undesirable external condition when an undesirable internal condition exists.

RECOMMENDATION

Change reference 1 and other documentation as necessary to show that the DCU-9/A warning light may also indicate an undesired switch configuration in addition to undesired external circuit conditions.

Figure 3.4.1, Page 1

SNEAK CIRCUIT REPORT B-528-1 PAGE 2 OF 2

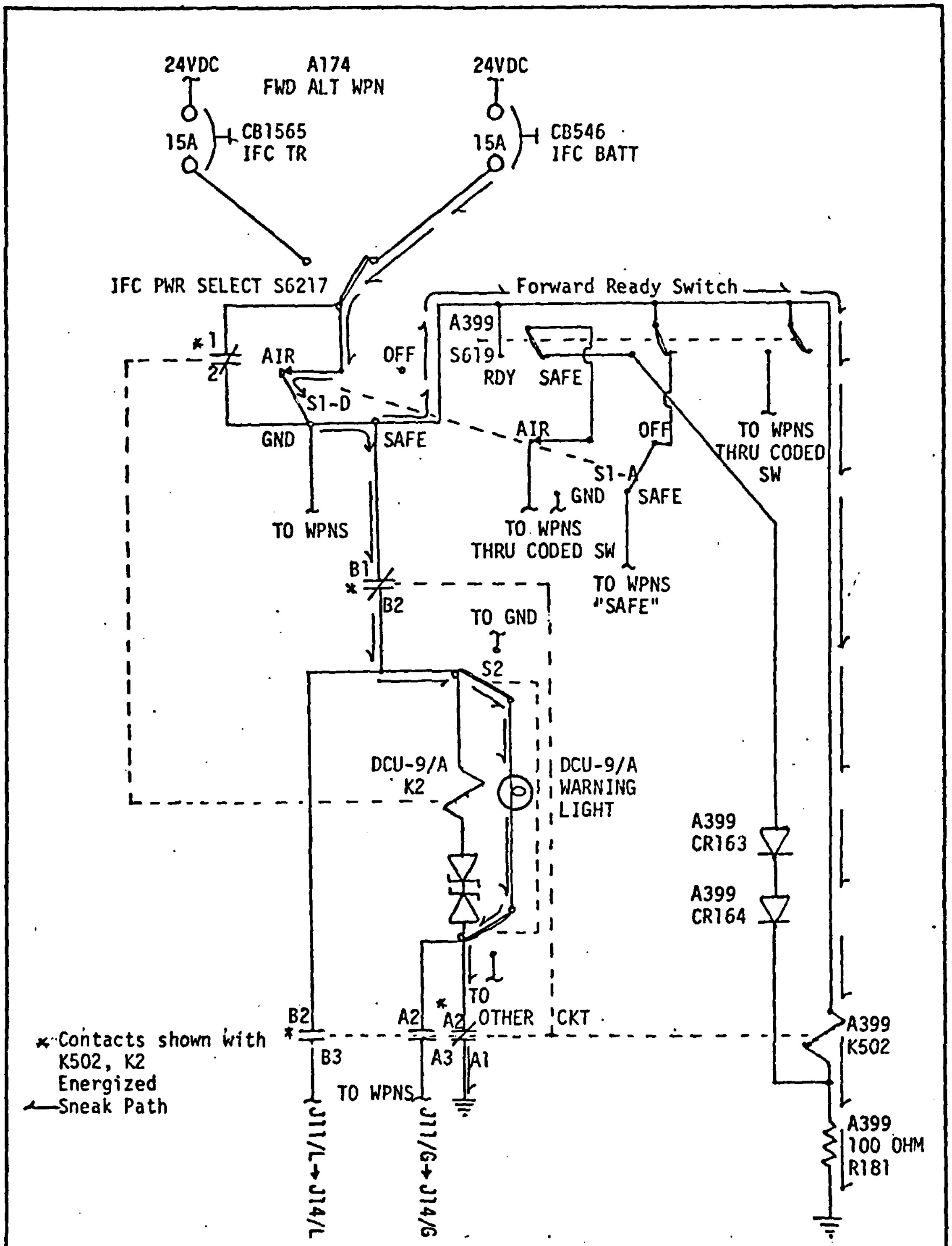


Figure 1 - DCU-9/A Warning Light Circuit

Figure 3.4.1, Page 2

SNEAK CIRCUIT REPORT B-52G-2

DATE 8-27-75

ENGINEER L. Bose

jle. L. Bose

TITLE Erroneous Master Bomb Control Power On Indicator

REFERENCES

1) T.O. 1B-52G-2-23, change 16, Electronic Wiring Diagrams and Data, Diagrams A6.02, A4.38, A3.32.
2) T.O. 1B-52G-2-31, change 38, Bomb Release Systems, pages 2-1, 2-3 & 3-1.

MODULE/EQUIPMENT

B-52G/A234

EXPLANATION

Figure 1 shows DS155, the "Power On" indicator in A234, Master Bomb Control Panel. This indicator is supplied power through CB411 (A174), S302 (A234) and S151 (A234), the Master Bomb Control Power On/Off switch. This indication shows only that power from CB411 and S302 has been switched through S151. It does not accurately indicate that the Master Bomb Control Power On function has been accomplished through S151 switching. Three other wafers of S151 switch control power from CB284 and CB409. The present configuration of DS155 cannot monitor that control power from CB284 and CB409 has been switched through S151.

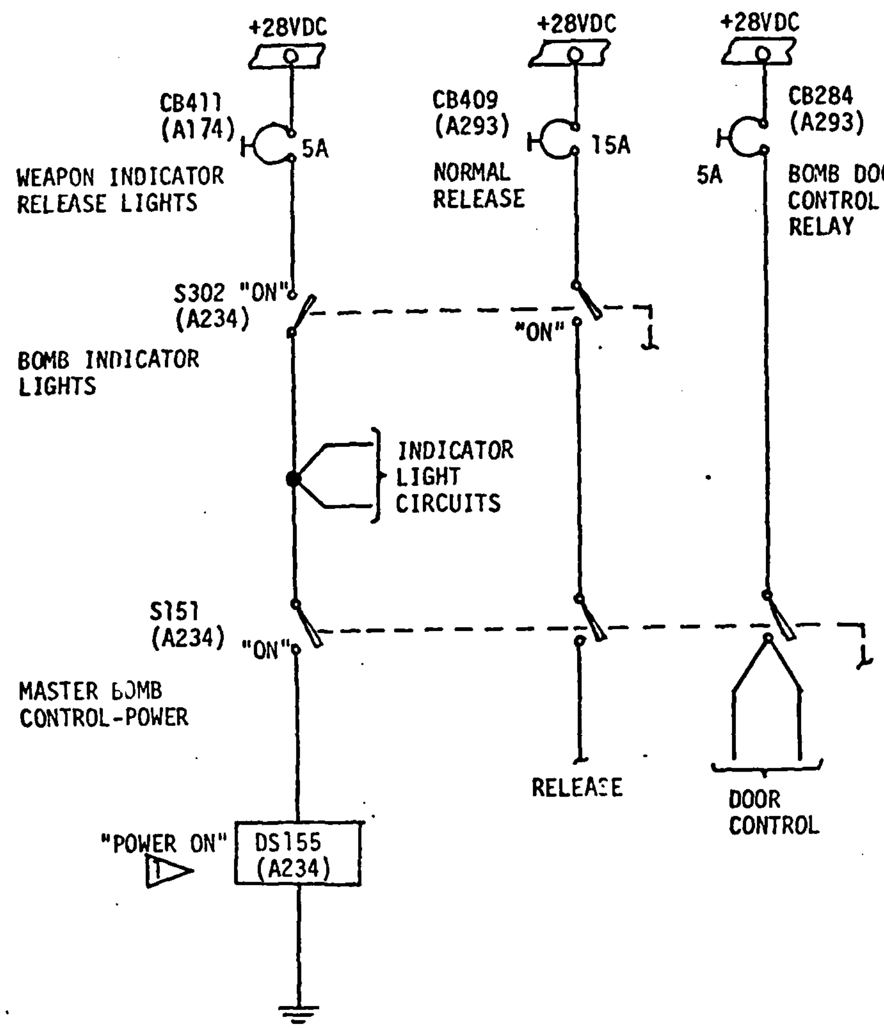
POTENTIAL IMPACT

DS155 could provide indication that power is on when it may be partially or totally interrupted by CB284 or CB409.

RECOMMENDATION

Change all applicable documentation to show that DS155 may not indicate power on function.

Figure 3.4.2, Page 1



1 DS155 Cannot indicate the status of control power from CB409 or CB284.

Figure 1 - Erroneous Power On Indicator

HOU-331

Figure 3.4.2, Page 2

SNEAK CIRCUIT REPORT B-52G-3

DATE 9-4-75

ENGINEER L. Bose

TITLE Erroneous Indicator In AGM-69A Power Distribution

REFERENCES

1) T.O. 1B-52G-2-23, change 16, Electronic Wiring Diagrams and Data, pages Y6B1M.03 & Y6B1U.04.
2) T.O. 1B-52G-2-12, change 55, Electrical Systems, pages 3-51, 3-52, 3-53, & 3-54.

MODULE/EQUIPMENT

B52-G/AGM-69A PWR DIST. BOX

EXPLANATION

Indicator DS439 in A482, AGM-69A Power Distribution Box, does not indicate "Hydraulic Pump T. R. On" as its label suggests. DS439 shows only that K659 the Hydraulic Pump T. R. Ground Check Relay has been energized. A true "T.R. On" can be taken only at the output of the transformer-rectifier (T.R.). DS439 and the transformer-rectifier input circuits are shown in Figure 1.

POTENTIAL IMPACT:

The present configuration of DS439 cannot monitor loss of input or output of the transformer-rectifier.

RECOMMENDATION

1. Incorporate into applicable documentation that DS439 may not indicate the true "on-off" status of the hydraulic pumn T.K., or
2. If a true "on" indication is desired, place DS439 or control of DS439 in the transformer-rectifier output circuit.

Figure 3.4.3, Page 1

SNEAK CIRCUIT REPORT B52-G-3 PAGE 2 OF 2

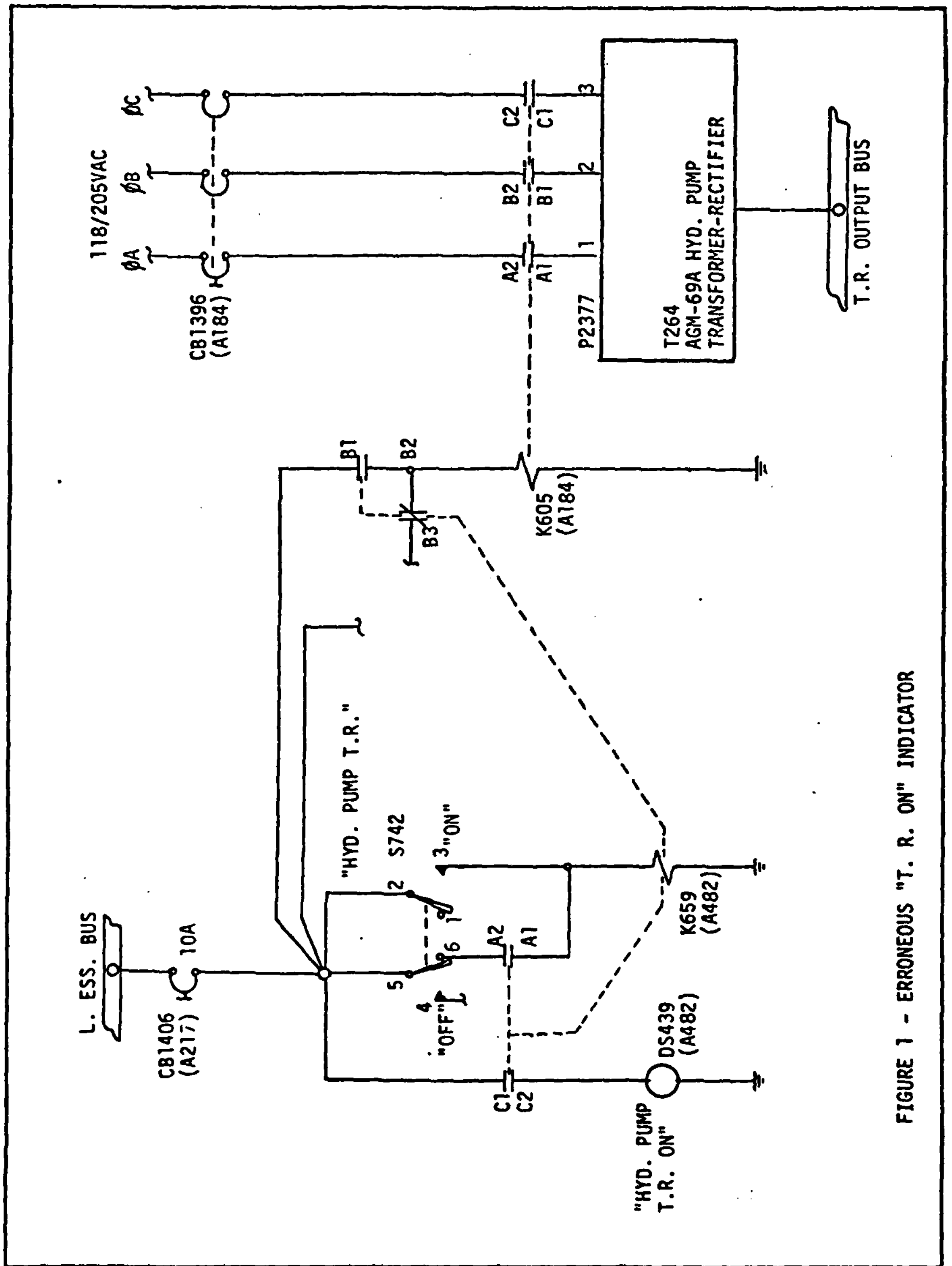


FIGURE 1 - ERRONEOUS "T. R. ON" INDICATOR

HOU-331

Figure 3.4.3, Page 2

SNEAK CIRCUIT REPORT FB-111A-1

DATE 9-17-75

ENGINEER M. Garnett

TITLE Tail Arming Solenoid Cannot be Energized

REFERENCES

1. T.O. 11N-T5055-2, Change 6, Station Program Unit, Figure 3-4.
2. T.O. 1F-111(B)A-2-11-1, Change 2, Figure 1-8, pg. 1-22

MODULE/EQUIPMENT

Pivot Pylon Conventional Station Program Unit/FB-111A

EXPLANATION

Reference 1 is excerpted in Figure 1. Note that no connection is made to pin 13 of relay K9. Normally open contact 3 of K9 connects to the "TAIL ARMING SOLENOID". Because of no connection to K9 pin 13, no means exists to energize the solenoid.

POTENTIAL IMPACT

Impossibility of tail arming a conventional weapon in this configuration.

RECOMMENDATION

Reference 2 implies that the dotted line connection shown in Figure 1 would resolve the problem.

Figure 3.4.4, Page 1

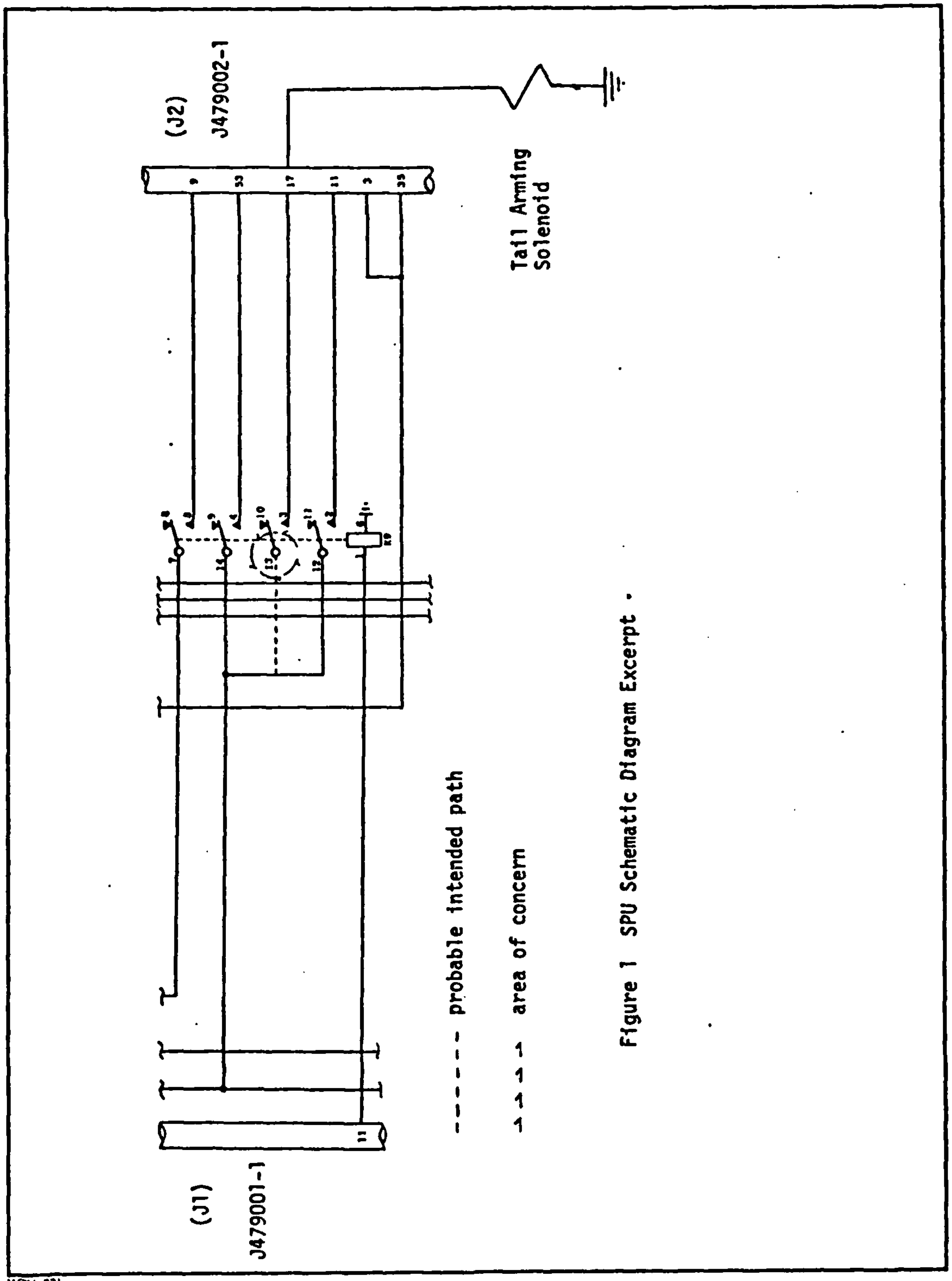


Figure 1 SPU Schematic Diagram Excerpt

HOU-331

Figure 3.4.4, Page 2

SNEAK CIRCUIT REPORT FB-111A-2 PAGE 1 OF 2

TITLE ESSENTIAL BUS TO MAIN BUS TIE

DATE 10-6-75

ENGINEER H. Holt

REFERENCES

1. T.O. 11F9-2-3 Technical Manual, Overhaul Instructions, Programmer Electronic Command Signals, Figure 12-1.
2. T.O. 1F-111(B)A-2-14 Technical Manual, Organizational Maintenance, Wiring Diagrams, Figure 3-28A & 3-41A.
3. T.O. 11N-T5055-2 Technical Manual Intermediate Maintenance, Station Program Unit Figure 3-4.

MODULE/EQUIPMENT

Weapon Release Circuitry/FB-111A

EXPLANATION

Figure 1 shows that when the Release Program Unit (RPU) issues a MAU Fire 2 command and K3 (Stores Jett) in the conventional SPU is energized a bus to bus tie exists between the 28VDC Ess bus in the DC Power Panel and the 28VDC Main bus in Weapons Bay DC Power Panel. This is typical for all four pylon weapons stations.

POTENTIAL IMPACT

When the bus to bus tie is made the 28VDC Ess bus can supply power to the 28VDC Main bus loads if the 28VDC Main bus is not powered for any reason. If the 28VDC Ess bus is at a higher potential than the 28VDC Main bus, CB5 in the DC Power Panel could trip causing loss of 28VDC power to the RPU MAU Fire circuits. Any fault that trips CB5 in the DC Power Panel will cause loss of both MAU Fire and 2 commands to all pivot pylons.

RECOMMENDATION

Revise the aircraft wiring such that RPU connector J230004 pin 2 is supplied power from the 28VDC Main bus and remove the internal connection in the RPU that ties the wiring from J230004 pins 1 and 2 together, and reverse MAU Fire 1 and 2 outputs for weapon station 3 at the RPU.

Figure 3.4-5, Page 1

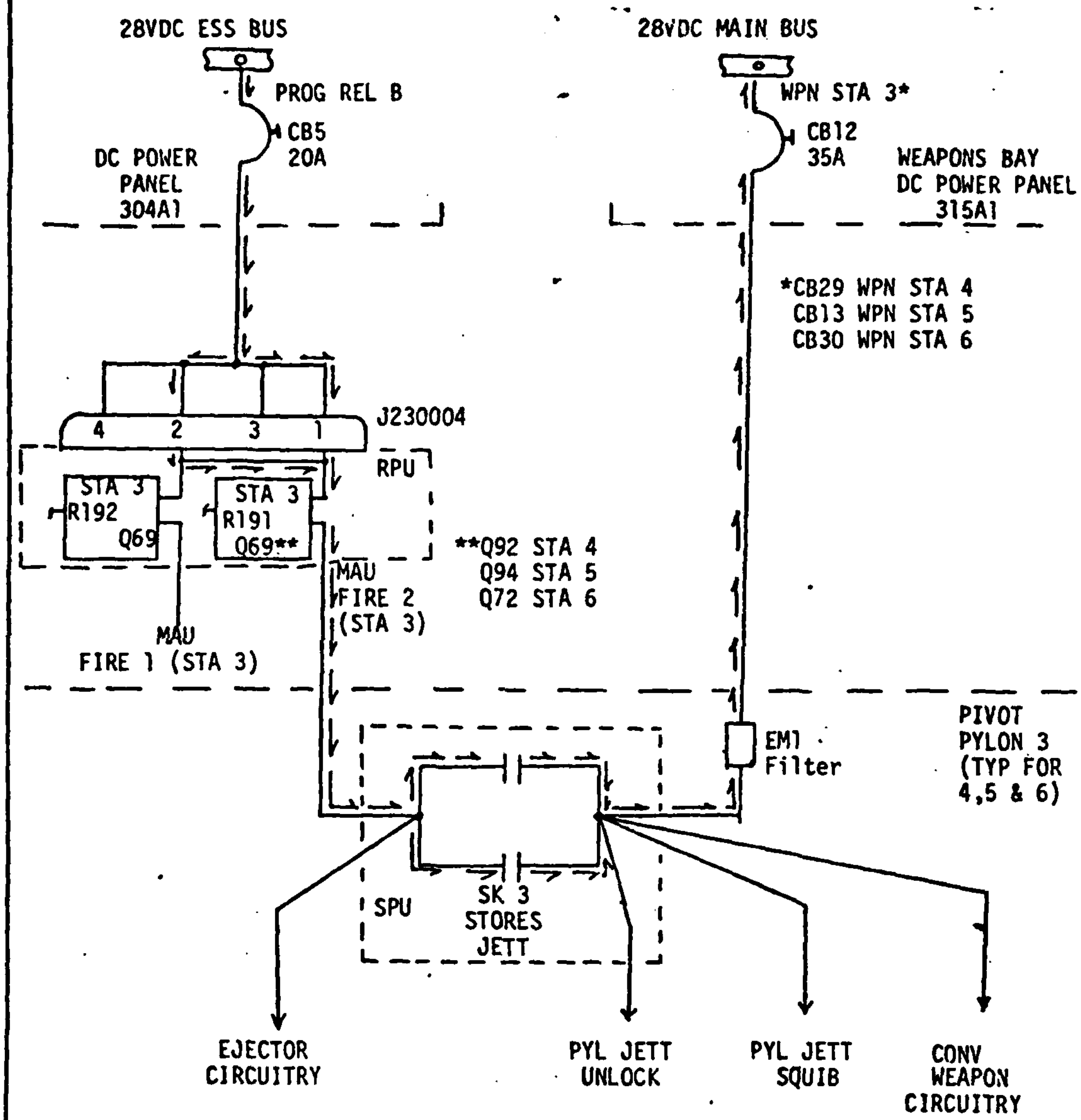


FIGURE 1

Figure 3.4-5, Page 2

3.5 DESIGN CONCERN REPORTS

Two design concern reports (DCR's) were written describing areas of concern in B-52G circuitry. No DCR's resulted from the FB-111A analysis. Copies of the two DCR's are presented in Figures listed below.

DCR Number	Subject	Figure
B-52G-1	Unnecessary Components	3.5-1
-2	Single Failure Point	3.5-2

DESIGN CONCERN REPORT B-52G-1

TITLE Unnecessary Components in Clip-In Subassembly and MB 3A Bomb Racks

DATE 9-2-75

ENGINEER M. Garnett

REFERENCES

1) USAF T.O. 11N-H5035-2, change 4, page 5-2, figure 5-1.

MODULE/EQUIPMENT

Clip-In Subassembly/B52-G

EXPLANATION

Figure 1 shows the forward right release schematic as it presently exists. Note that regardless of the state of salvo control relay K1, the lower and upper right release solenoids will energize with the BRML switches closed. A less complex circuit shown in figure 2 deletes K1, uses a single set of lower right BRML switch contacts, a single pair of lower right BOMB RACK RELEASE solenoid contacts, a single set of upper right BRML switch contacts, and a single pair of upper right BOMB RACK RELEASE solenoid contacts. A similar situation exists for the forward left release schematic.

RECOMMENDATION

The configuration shown in figure 2 requires fewer and less complex components. Removal of the salvo control relay K1 saves parts and improves reliability. It may be desired however, to leave the BRML switches and RELEASE solenoid contacts as is for redundancy.

Figure 3.5.1, Page 1

DESIGN CONCERN REPORT B-52G-1 PAGE 2 OF 3

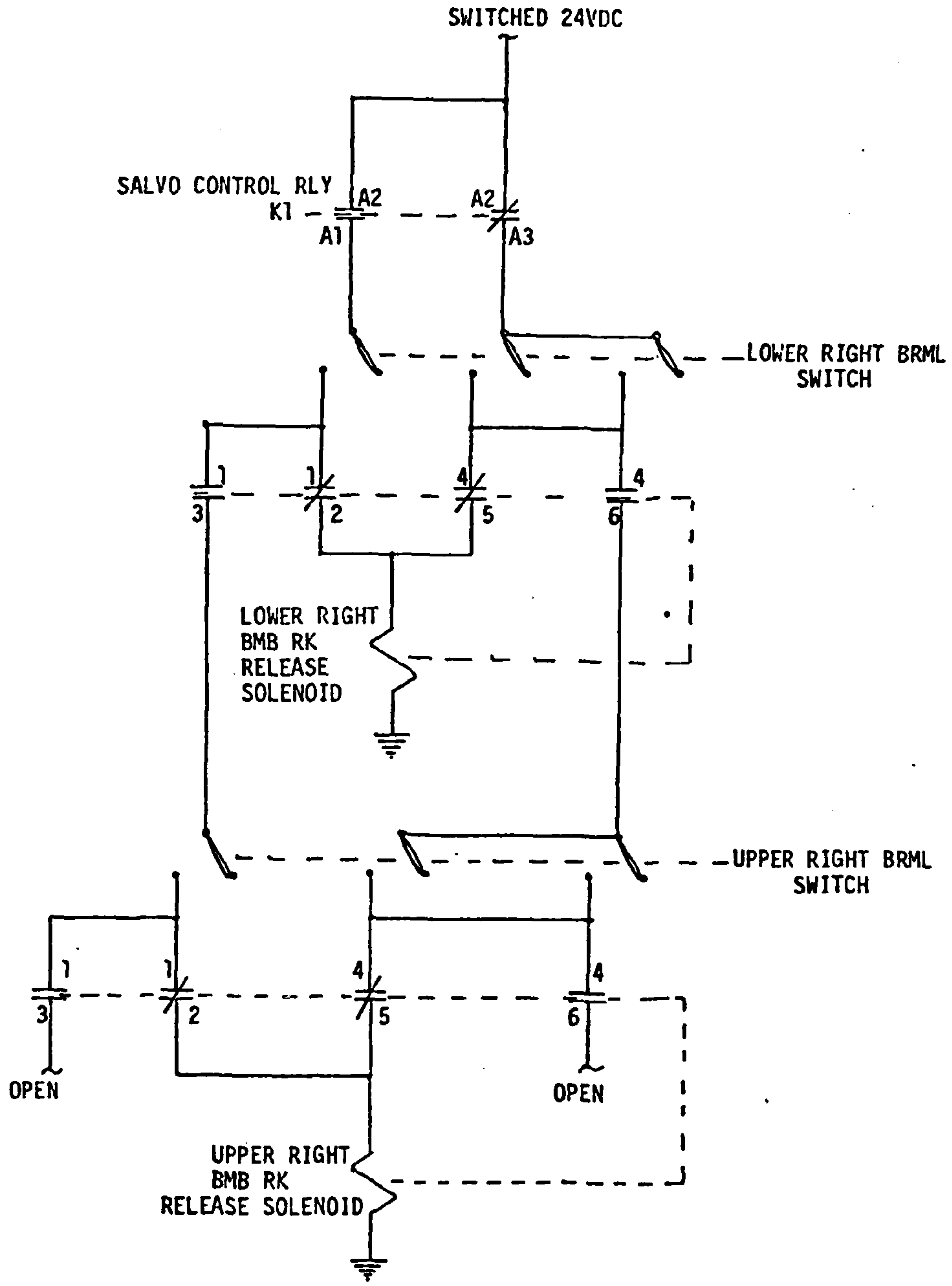


Figure 1 - Right Bomb Release Circuit

HOU-331

Figure 3.5.1, Page 2

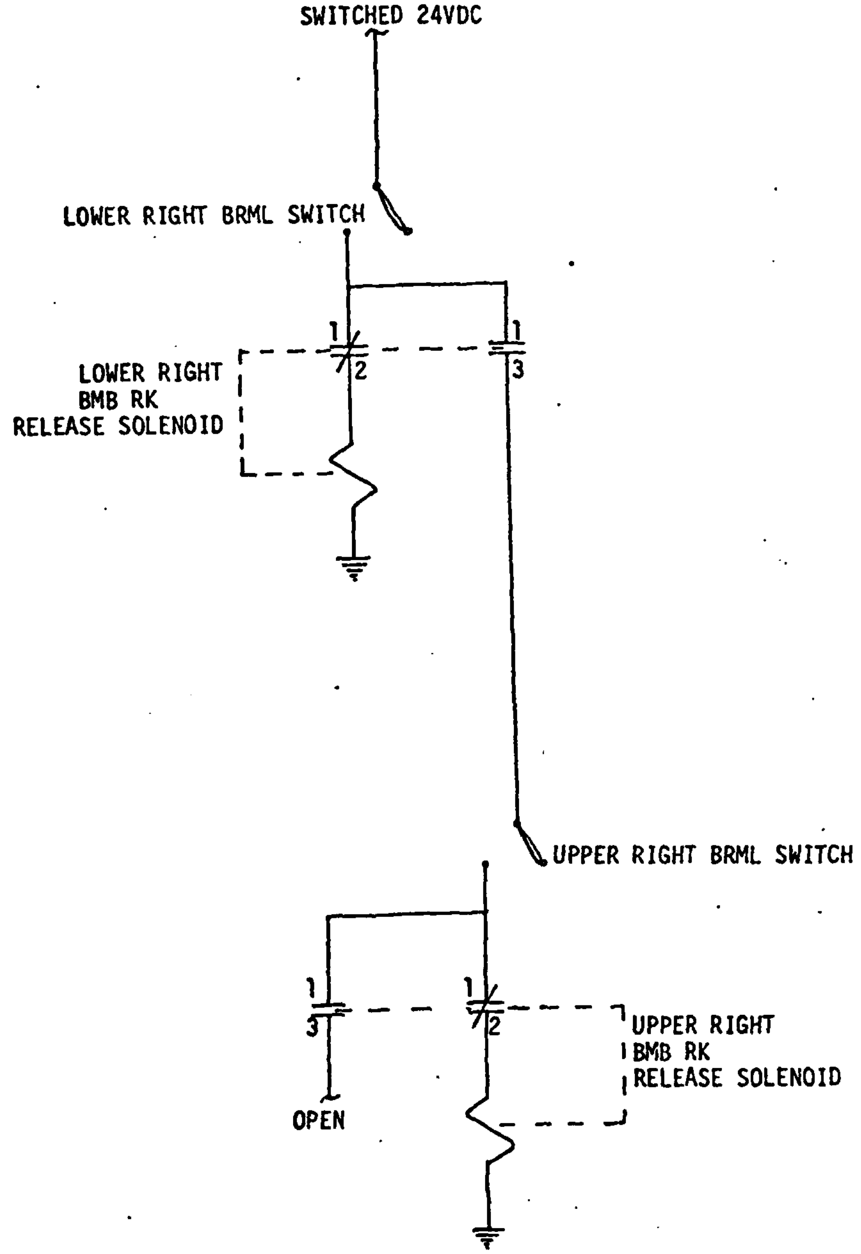


Figure 2 - Suggested Right Bomb Release Circuit

HOU-331

Figure 3.5.1, Page 3

DESIGN CONCERN REPORT B-52G-2

DATE 9-3-75

ENGINEER M. Garnett

TITLE Single Failure Point Ties Missile Critical & Non-Critical Electronic Power

REFERENCES

1) USAF T.O. 11LA12-2-3, page 5-40, figure 5-9, Schematic Diagram Relay Assembly
2) USAF T.O. 16W6-19-2, change 3, page 5-15, figure 5-7, Pylon Electrical Schematic

MODULE/EQUIPMENT

B-52G/AGM-69A

EXPLANATION

As shown in figure 1, pins Y and M on the missile connector (J9 for MSL 1, etc) are connected together in the relay assembly, reference 1. This connection ties the "ELECTRONIC POWER (NON-CRITICAL)" and the "ELECTRONIC POWER (CRITICAL)" supplied to the missiles per reference 2. A failure on the "NON-CRITICAL" bus will result in the loss of both "CRITICAL" and "NON-CRITICAL" ELECTRONIC POWER.

RECOMMENDATION

Supply separate paths including circuit breakers and relay switching for "CRITICAL" and "NON-CRITICAL" ELECTRONIC POWER or delete the distinction.

Figure 3.5.2, Page 1

DESIGN CONCERN REPORT B-52G-2 PAGE 2 OF 2

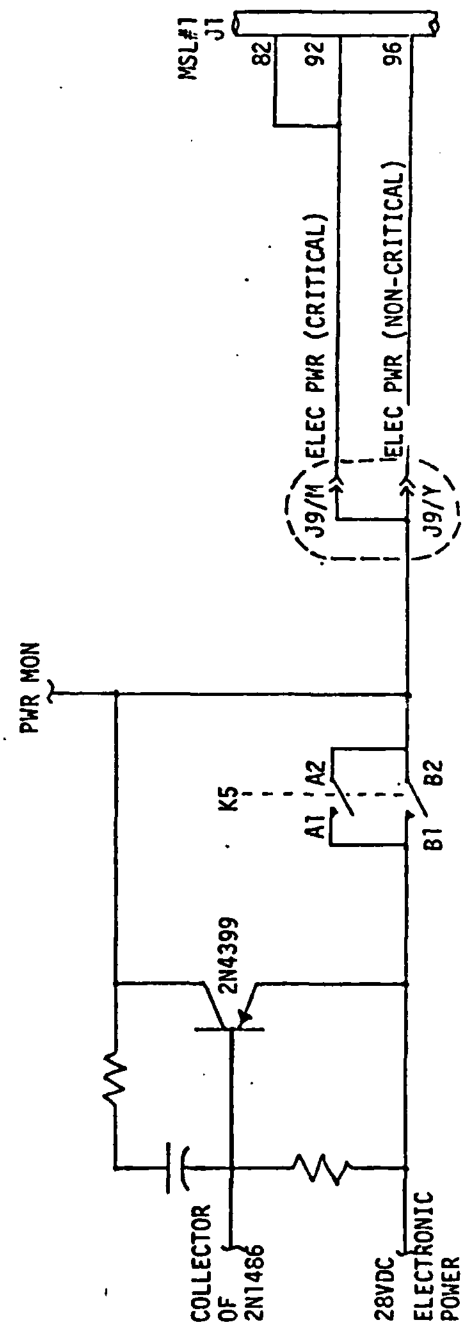


Figure 1 - Missile Electronic Power Circuit

HOU-331

Figure 3.5.2, Page 2

3.6 DRAWING ERROR REPORTS

A total of six drawing error reports (DER's) were written during the analysis. One DER resulted from the B-52G analysis, and five resulted from the FB-111A analysis. Copies of the DER's are presented in Figures listed below.

DER Number	Subject	Figure
B-52G-1	T.O. 1B-52G-2-23, p. A8.14, Change 10	3.6-1
FB-111A-1	T.O. 1F-111(B)A-2-14, p. 3-246H, Change 5	3.6-2
-2	T.O. 1F-111(B)A-2-145-1, p. 3-244, Change 5	3.6-3
-3	T.O. 1F-111(B) A-214, p. 3-246 E, Change 5-S10	3.6-4
-4	T.O. 16W6-23-2, p. 2-69, Change 9	3.6-5
-5	T.O. 1F-111(B)A-2-14, p. 3-762A, Change 10	3.6-6

DRAWING ERROR REPORT B-52G-1

TO: PROJECT:

OCUMENT NO.	REFERENCE DESIGNATOR	SUBSYSTEM
T.O. 1B-52G-2-23, A8.14 Change 10	A217	POWER

UNIT NOMENCLATURE

LH FWD DC LOAD BOX

DISCREPANCY:

CB550 has a rating of 5A shown on page A8.14 of T.O. 1B-52G-2-23. The part number shown in the index is BAC-C18J-15 which is a 15A rating.

ASSUMED CORRECTION:

Change the rating shown on page A8.14 to 15A.

REPORTED BY J. B. Campbell DATE 8-19-75

SNEAK CIRCUIT GROUP ACTION BY J. B. Campbell *jbc* DATE 8-19-75

CONTACT NAME ______ DATE ______

CONTRACTOR CONCURRENCE BY ______ DATE ______

Figure 3.6.1

HOU-227

THE BOEING COMPANY SPACE DIVISION HOUSTON

DRAWING ERROR REPORT FB-111A-1

TO: PROJECT: FB-111A

DOCUMENT NO.	REFERENCE DESIGNATOR	SUBSYSTEM
T.O. 1F-111(B)A-2-14	RPU (A2)	

UNIT NOMENCLATURE

RELEASE PROGRAM UNIT

DISCREPANCY:

Figure 3-28A, Sheet 9; Page 3-246H, Change 5

The following discrepancies exist in that portion of the circuit shown on the attached sheet:

1. Plug P13 is labeled incorrectly
2. Receptacle J23004 is labeled incorrectly
3. The function of P13-2,3,4 are shown incorrectly
4. Wire number A2403B12 is used twice

ASSUMED CORRECTION:

1. P13 will be labeled P230004.
2. The RPU receptacle will be labeled J230004.
3. All inputs to the RPU will be labeled ESS BUS.
4. One wire will be renumbered.

REPORTED BY P. Stokes P Stokes DATE 9-22-75

SNEAK CIRCUIT GROUP ACTION BY Julius B. Campbell DATE 9-23-75

CONTACT NAME ______ DATE ______

CONTRACTOR CONCURRENCE BY ______ DATE ______

Figure 3.6.2, Page 1

HOU-727

THE BOEING COMPANY SPACE DIVISION HOUSTON

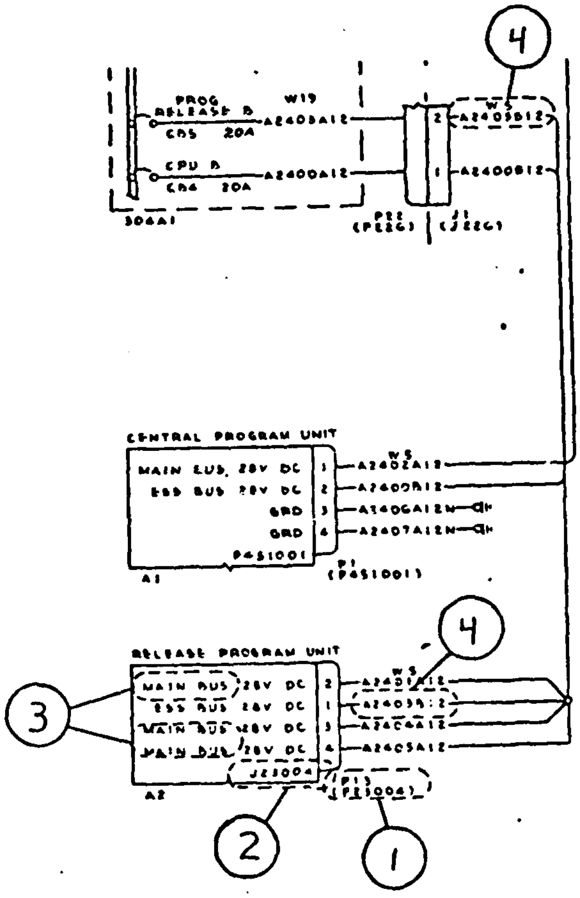


Figure 1 Release Program Unit

HOU-331

Figure 3.6.2, Page 2

DRAWING ERROR REPORT FB-111A-2

TO: PROJECT: FB-111A

DOCUMENT NO.	REFERENCE DESIGNATOR	SUBSYSTEM
USAF T.O. 1F-111(B)A-2-145-1, Change 5	SPU L and R	

UNIT NOMENCLATURE

Station Program Unit, part number 9346-8479-1

DISCREPANCY:

On Sheet 3-244, Figure 3-28 shows modules A3 and A4 which are the left and right SPU's. Note that J479002/28 is referenced to 12D2247. At this reference no J479002/28 can be located but J479002/41 (unwired on the document in question) is present. See Figure 1. It appears that J479002 pins 28 and 41 have been reversed.

ASSUMED CORRECTION:

Using USAF T.O. 1F-111(B)A-2-11-1, sheet 1-26, change 2 as supporting documentation, J479002/28 should be unwired and J479002/41 should be shown connected and referenced to 12D2247 in pin 28's place. Figure 2 excerpts the SPU on the aforementioned T.O.

REPORTED BY M. Garnett DATE 9-23-75

SNEAK CIRCUIT GROUP ACTION BY Julius B. Campbell DATE 9-24-75

CONTACT NAME ______ DATE ______

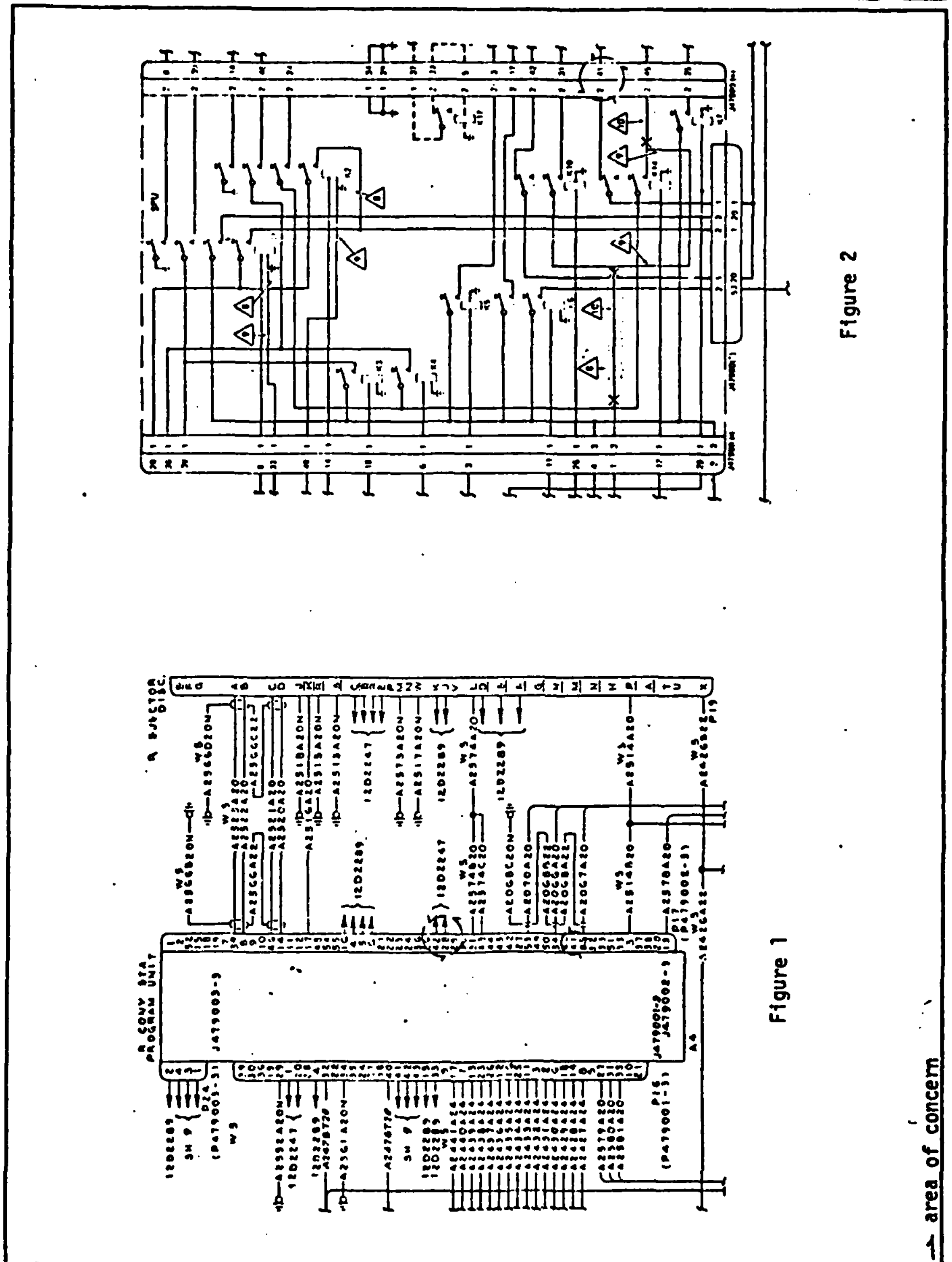
CONTRACTOR CONCURRENCE BY ______ DATE ______

Figure 3.6.3, Page 1

HOU-227

THE BOEING COMPANY SPACE DIVISION HOUSTON

DRAWING ERROR REPORT FB-111A-2 PAGE 2 OF 2



HOU-331

Figure 3.6.3, Page 2

DRAWING ERROR REPORT FB-111A-3

TO: PROJECT: FB-111A

DOCUMENT NO.	REFERENCE DESIGNATOR	SUBSYSTEM
T.O. 1F-111(B)A-2-14	003S10	

UNIT NOMENCLATURE

EXT STORES JETTISON

DISCREPANCY:

Figure 3-28A, Sheet 6, Page 3-246E, Change 5-S10 is labeled "EMER JETTISON SW". On the jettison panel, S10 is labeled "EXT STORES JETTISON" (Ref. T.O. 1F-111(B)A-2-11-1, Change 4, page 1-3 and 1-23)

ASSUMED CORRECTION:

Change figure 3-28A, Sheet 6 of T.O. 1F-111(B)A-2-14 to read "EXT STORES JETTISON" so that panel nomenclature and schematic nomenclature will agree.

REPORTED BY Jim Verges JV DATE 9-24-75

SNEAK CIRCUIT GROUP ACTION BY J. Burl Campbell DATE 10-7-75

CONTACT NAME ______ DATE ______

CONTRACTOR CONCURRENCE BY ______ DATE ______

Figure 3.6-4

HOU-177

THE BOEING COMPANY SPACE DIVISION HOUSTON

SNEAK CIRCUIT DRAWING ERROR REPORT FB-111A-4

TO: PROJECT:

DOCUMENT NO.	REFERENCE DESIGNATOR	SUBSYSTEM
T.O. 16W6-23-2, 2-69, Change 9	Pivot Pylon	Monitor & Control

UNIT NOMENCLATURE

Conventional Weapon Station Program Unit

DISCREPANCY:

T.O. 16W6-23-2 shows an electrical connection between Pins 1, 20, 21 of connector P47900-1.

T.O. 1F-111(B)A-2-14 and T.O. 1F-111(B)A-2-11-1 show an electrical connection between Pins 1, 20, 22 of connector P479001-1.

ASSUMED CORRECTION:

T.O. 16W6-23-2 should be changed to show electrical connection between Pins 1, 20, 22 of connector P479001-1.

REPORTED BY H. Holt H. Holt DATE 10-3-75

SNEAK CIRCUIT GROUP ACTION BY H. Holt H. Holt DATE 10-3-75

CONTACT NAME ______ DATE ______

CONTRACTOR CONCURRENCE BY ______ DATE ______

Figure 3.6-5

HOU-717 -1

THE BOEING COMPANY SPACE DIVISION HOUSTON

SNEAK CIRCUIT DRAWING ERROR REPORT FB-111A-5

TO: PROJECT:

DOCUMENT NO.	REFERENCE DESIGNATOR	SUBSYSTEM
T.O. 1F-111(B)A-2-14, Change 10	304A1	Weapon Release

UNIT NOMENCLATURE

Program Release B Circuit Breaker

DISCREPANCY:

T.O. 1F-111(B)A-2-14, Page 3-762A, Change 10 shows the Program Release B circuit breaker between wire A2403A12 and the essential bus rated at 5 amps.

T.O. 1F-111(B)A-2-14, Page 3-246H, Change 5 shows the Program Release B circuit breaker between wire A2403A12 and the essential bus rated at 20 amps.

ASSUMED CORRECTION:

T.O. 1F-111(B)A-2-14, Page 3-762A should be changed to show the Program Release B circuit breaker (between wire A2403A12 and essential bus) rated at 20 amps.

REPORTED BY H. Holt *H Holt* DATE 10-3-75

SNEAK CIRCUIT GROUP ACTION BY H. Holt *H. Holt* DATE 10-3-75

CONTACT NAME ______ DATE ______

CONTRACTOR CONCURRENCE BY ______ DATE ______

Figure 3.6-6

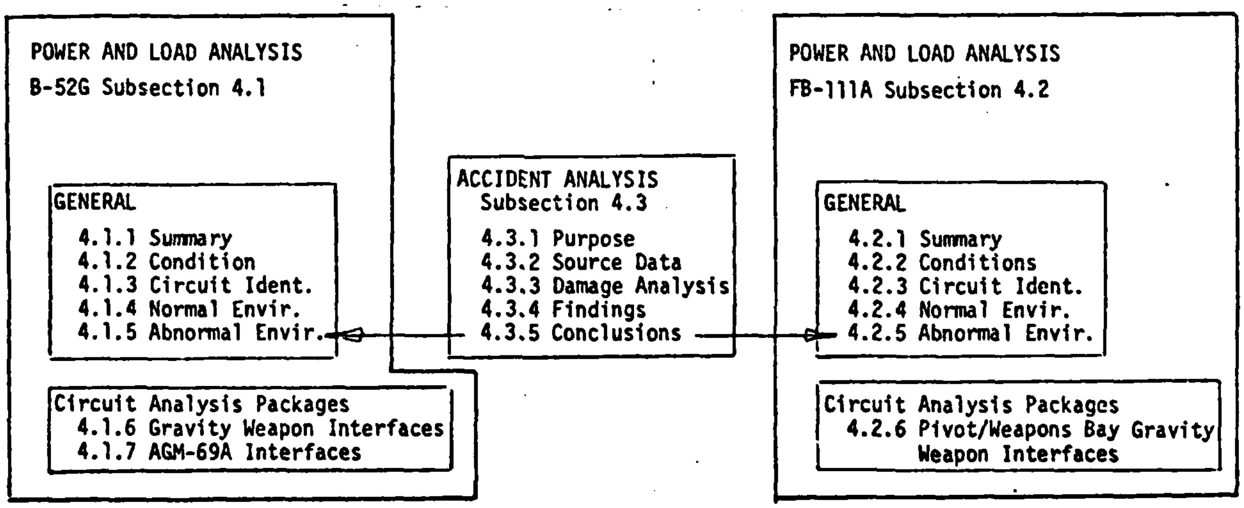
HOU-277-1

THE BOEING COMPANY SPACE DIVISION HOUSTON

4.0 POWER AND LOAD ANALYSIS

Boeing performed a power and load analysis of B-52 and FB-111 aircraft monitor and control (AMAC) circuitry to the nuclear weapon interfaces. Normal power and load analysis included direct and indirect interface circuits. Circuits adjacent to exposed nuclear weapon system circuitry sharing common cables, connectors and components were included in the fault analysis. The B-52 and FB-111 subsections are designed to stand alone in the event that they are separated from the rest of the report. The following diagram shows how the power and load analysis subsections are organized.

POWER AND LOAD ANALYSIS
SECTION 4



4.1 POWER AND LOAD ANALYSIS - B-52G

This section describes the power and load analysis of the B-52G monitor and control (AMAC) circuits leading to gravity weapons loaded on the forward bomb bay multiple carriage clip-in assembly and to AGM-69A missiles on the left pylon and the launcher in the aft bomb bay. Figures 4.1-A and 4.1-B are simplified schematic diagrams of gravity weapon circuits and AGM-69A arming circuits. Numbers opposite the AMAC connector pins refer to analysis packages in Sections 4.1.6 and 4.1.7 of this report.

4.1.1 Summary

The power and load analysis was performed on groups of interface circuits identified by sneak circuit network trees. Results are summarized in Table 4.1-A.

4.1.2 Conditions

The study was made according to the following ground-ruled conditions:

- Interfaces with gravity bombs are the connectors shown in the aircraft wiring diagrams.
- Interfaces with SRAM are the aircraft connectors to the SRAM missile. Internal SRAM missile circuits were excluded.
- Aircraft circuits for SRAM guidance were excluded.
- One SRAM weapons bay installation and one SRAM pylon station was analyzed in depth for the B-52G. The other similar SRAM installations were analyzed for impacts of detail differences.
- Analyses of abnormal environments considered only one fault at a time.
- Wiring faults within aircraft wiring harnesses were limited to those within shared cables and connectors. Cable-to-cable and bundle-to-bundle wiring faults were excluded.
- Release circuits were not included as nuclear weapon interface circuits during load analysis for abnormal environments.
- Short circuits in terminals and faults internal to components were considered only in the worst-case abnormal environment analysis for each model.

TABLE 4.1-A Power and Load Analysis Results - B-52/Gravity Weapons Interface (Sheet 1 of 2)

WEAPON INTERFACE		ENVIRONMENT ANALYSIS RESULTS						
		NORMAL			ABNORMAL - WORST CASE			ANALYSIS PACKAGE
DESIGNATOR	FUNCTION	V	I	t	V	I	t	Section 4.1.6
A114, J11, J12, J13 and J14	Forward Bomb Bay Clip-In Connectors	Note: Power is DC unless otherwise noted. AC current is 400 Hz unless otherwise noted.						
Pin A	IFC SAFING PWR	24V	75A	3.5s	24V	109A	1.4s	4.1.6.7
B	TESTER SW GND	0	0	-	24V	152A	.8s	4.1.6.7
C	TESTER SW OFF/SAFE	0	0	-	24V	110A	1.1s	4.1.6.4
D	TESTER SW AIR	0	0	-	24V	152A	.8s	4.1.6.7
E	IFC SAFING PWR	24V	131A	1.0s	24V	211A	.8s	4.1.6.7
F	TESTER SW SAFE	0	0	-	24V	109A	1.2s	4.1.6.6
G	INFLIGHT TEST	0	0	-	24V	152A	.8s	4.1.6.7
H	TESTER SW, READY	0	0	-	24V	150A	.8s	4.1.6.6
J	TESTER SW, AIR	0	0	-	24V	109A	1.2s	4.1.6.6
L	INFLIGHT TEST	0	0	-	24V	152A		4.1.6.7
O	WPN GROUND	GROUND						
P	IFC SAFING PWR	24V	152A	0.8s	24V	258A	.8s	4.1.6.7
R	INFLIGHT TEST	0	0	-	24V	152A	.8s	4.1.6.7
S	WPN GROUND	GROUND						
J11,12T	FWD IFI PWR, 25A	0	0	-	28V	1170A	.8s	4.1.6.3 (LH WPNS)
J13,14T	AFT IFI PWR, 25A	0	0	-	28V	1000A	.8s	4.1.6.2 (RH WPNS)
U	WPN GROUND	GROUND		-				
V	WPN GROUND	GROUND		-				
W	FWD IFI PWR, 15A	0	0	-	28V	800A	.8s	4.1.6.3
X	(OPEN)	0	0	-	24V	152A	.8s	4.1.6.7
Y	FWD IFI PWR, 15A	0	0	-	28V	800A	.8s	4.1.6.3
Z	TESTER SW, AIR	0	0	-	24V	110A	1.1s	4.1.6.4
a	TESTER SW, GND	0	0	-	24V	110A	1.1s	4.1.6.4
c	TESTER SW, GND	0	0	-	24V	109A	1.2s	4.1.6.6
d	IFC RELAY (FWD)	0	0	-	24V	152A	.8s	4.1.6.1
f	TESTER SW, READY	0	0	-	24V	218A	.8s	4.1.6.4
h	FWD BOMB BAY SAFE	0	0	-	24V	152A	.8s	4.1.6.5

TABLE 4.1A Power and Load Analysis Results - B-52/AGM-69 Interfaces
(Sheet 2 of 2)

WEAPON INTERFACE		ENVIRONMENT ANALYSIS RESULTS						
		NORMAL			ABNORMAL - WORST CASE			ANALYSIS PACKAGE
DESIGNATOR	FUNCTION	V	I	t	V	I	t	Section 4.1.7
J1	Missile Connector							
Pin 2	BATTERY ACTIVATE							
	PYLON	0V	0A	-	118VAC	983A	.125s	4.1.7.4
	LAUNCHER	0V	0A	-	118VAC	900A	.125s	4.1.7.4
10	ACCUMULATOR ACT.							
	PYLON	0V	0A	-	118VAC	983A	.125s	4.1.7.4
	LAUNCHER	0V	0A	-	118VAC	900A	.125s	4.1.7.4
20	SAF CLASS III A CMD.							
	PYLON	0V	0A	-	118VAC	983A	.125s	4.1.7.8
	LAUNCHER	0V	0A	-	118VAC	900A	.13s	4.1.7.8
26	FIN UNLOCK							
	PYLON	0V	0A	-	118VAC	983A	.125s	4.1.7.4
	LAUNCHER	0V	0A	-	118VAC	900A	.125s	4.1.7.4
57	PROPULSION SAFE							
	PYLON	0V	0A	-	28V	1115A	1.5s	4.1.7.5
	LAUNCHER	0V	0A	-	28V	411A	2.0s	4.1.7.3
60	SAF CLASS III B CMD.							
	PYLON	0V	0A	-	118VAC	983A	.125s	4.1.7.8
	LAUNCHER	0V	0A	-	118VAC	900A	.13s	4.1.7.8
82, 92, 96	MISSILE ELECTRONIC POWER							
	PYLON SYS. ON	28V	254A	.45s	28V	1115A	1.5s	4.1.7.6
	SYS. OFF	0V	0A	-	28V	1115A	1.5s	4.1.7.6
	LAUNCHER SYS. ON	28V	368A	.2s	28V	1220A	1.5s	4.1.7.2
	SYS. OFF	0V	0A	-	28V	1220A	1.5s	4.1.7.2
97	SAF PREARM CMD.							
	PYLON	0V	0A	-	118VAC	983A	.125s	4.1.7.1
	LAUNCHER	0V	0A	-	118VAC	900A	.13s	4.1.7.1
J1	Ejector Connector							
Pin r	ARM SOLENOID							
	PYLON	0V	0A	-	27V	37A	1.1s	4.1.7.7
	LAUNCHER	0V	0A	-	27V	54A	1.1s	4.1.7.7

4.1.3 Identification of Circuits

The analysis used Air Force technical manuals and other source documents to identify the interface circuits. The gravity bomb interfaces are shown in T.O. 11N-H5035-2, Figure 5-2, Change 4. (Reproduced in Figure 4.1-A of this report). The AMAC circuitry to the gravity weapons is shown in Figure 4.1-B, which is a reproduction of T.O. 1B-52B-2-31, Figure 3-10, Change 33. Analysis package numbers are shown opposite to the corresponding AMAC connector pins. AGM-69A missile interface is shown in Figure 4.1-C. Pertinent arming circuits are shown in Figure 4.1-D. The analysis used sneak circuit network trees and other source documents to identify adjacent and interrelated circuits for fault analysis. The applicable network trees are reproduced in the analysis packages.

4.1.4 Normal Environment

Power capability of the interfacing circuits was calculated by determining open circuit voltage and short circuit current at the weapon interfaces with the circuits grounded at that point.

4.1.5 Abnormal Environments

Each network tree was analyzed for postulated faults. Postulated faults were identified by numbered circles. The worst case for each interfacing circuit was identified and open circuit voltage, short circuit current and the duration of current flow was determined.

Several of the faults postulated receive power through the DCU-9/A Tester or SWK Box. Power from these sources can occur only twice during a mission according to T.O. 1B-52G-1, Radar Navigators Checklist (Nuclear), once during the Interior Inspection Checklist, before takeoff, and during the Before Descent Checklist. Power paths other than those through DCU-9/A Tester or SWK Box were used to determine worst case conditions whenever they existed. The reasons are that exposure to damage time during testing is minimal, and testing does not occur during landing, takeoff and air refueling when risk to damage is highest.

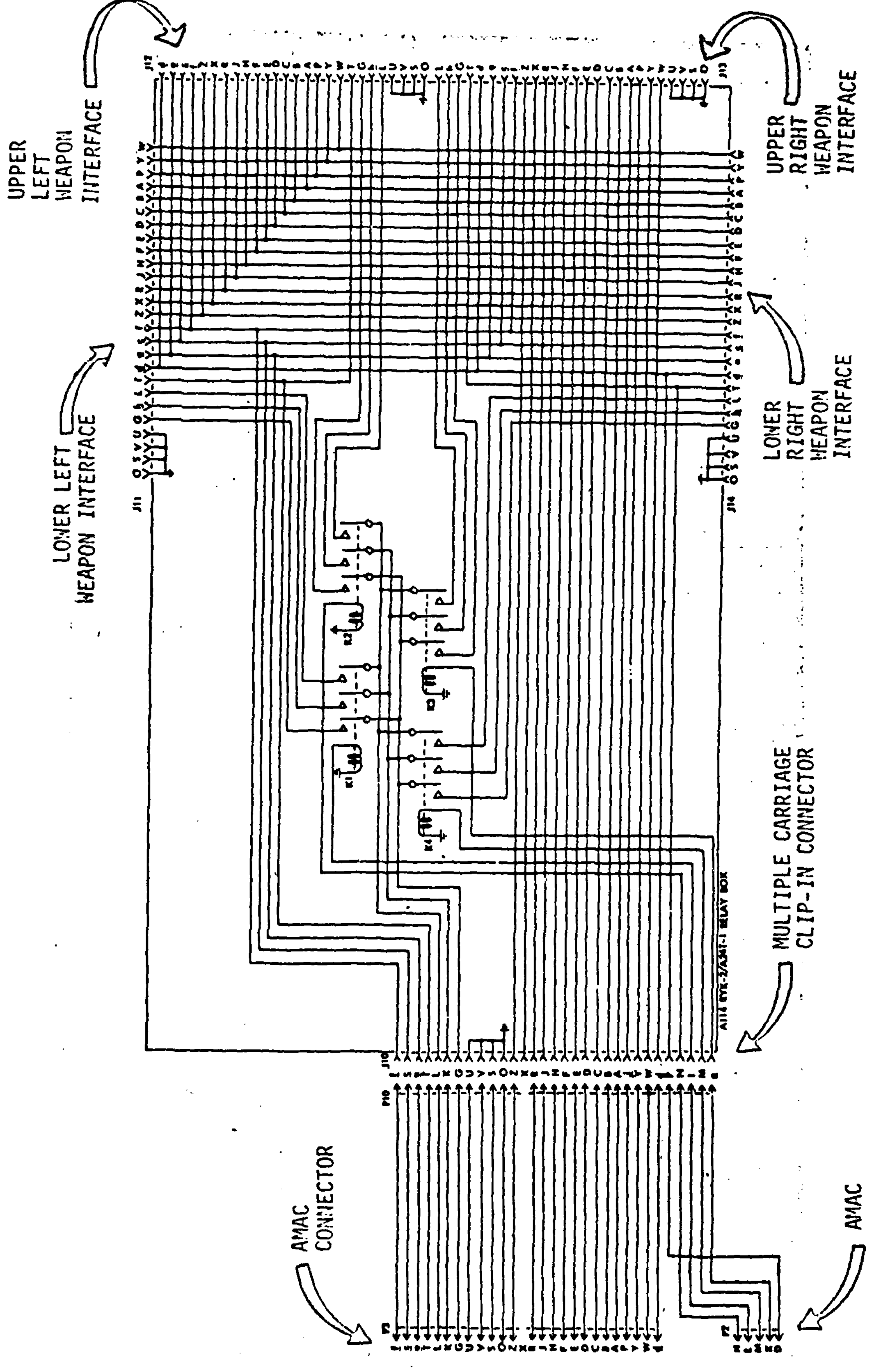
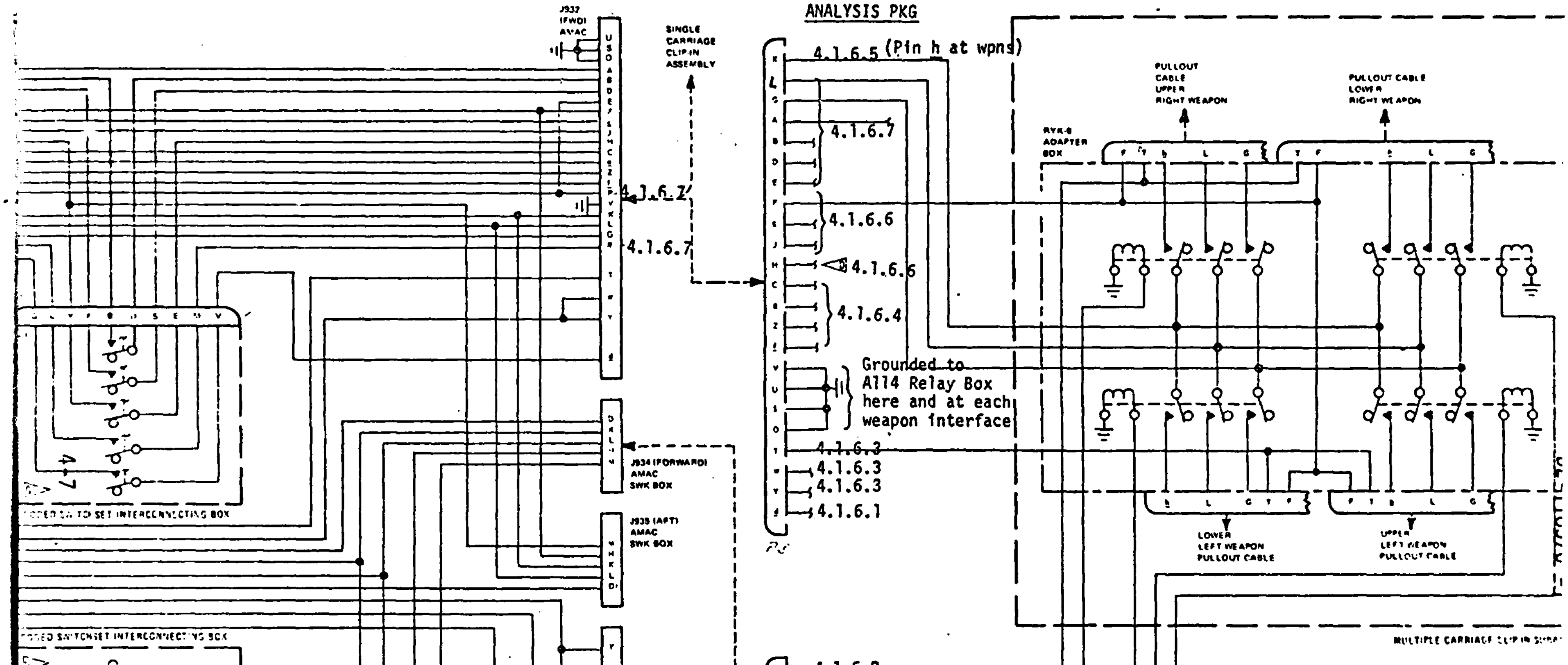


Figure 4.1-A Gravity Bomb Weapon Interfaces



NOTE

1. Not energized with multiple carriage in forward bay
2. When multiple carriage assembly is installed in aft bay location, SWK-2/A24T-1 switch box is installed in forward DCU 9/A tester position and DCU 9/A is installed in aft position. These testers are interchangeable.
3. When two single carriage assemblies are installed, use SWK-2/A24T-1 and install two DCU 9/A
4. All broken off wires shown are connected to the four pullout cable connectors in parallel as shown by circuit.
5. On B 52G aircraft.
6. On B 52H aircraft.
7. Circuits are controlled by enabling codes (Section XII).

ON AIRCRAFT INCORPORATING T.O. 1B-52-1970

Fig. 4.1-B. Simplified Diagram of Weapon Arming Circuit (Page 1 of 2)

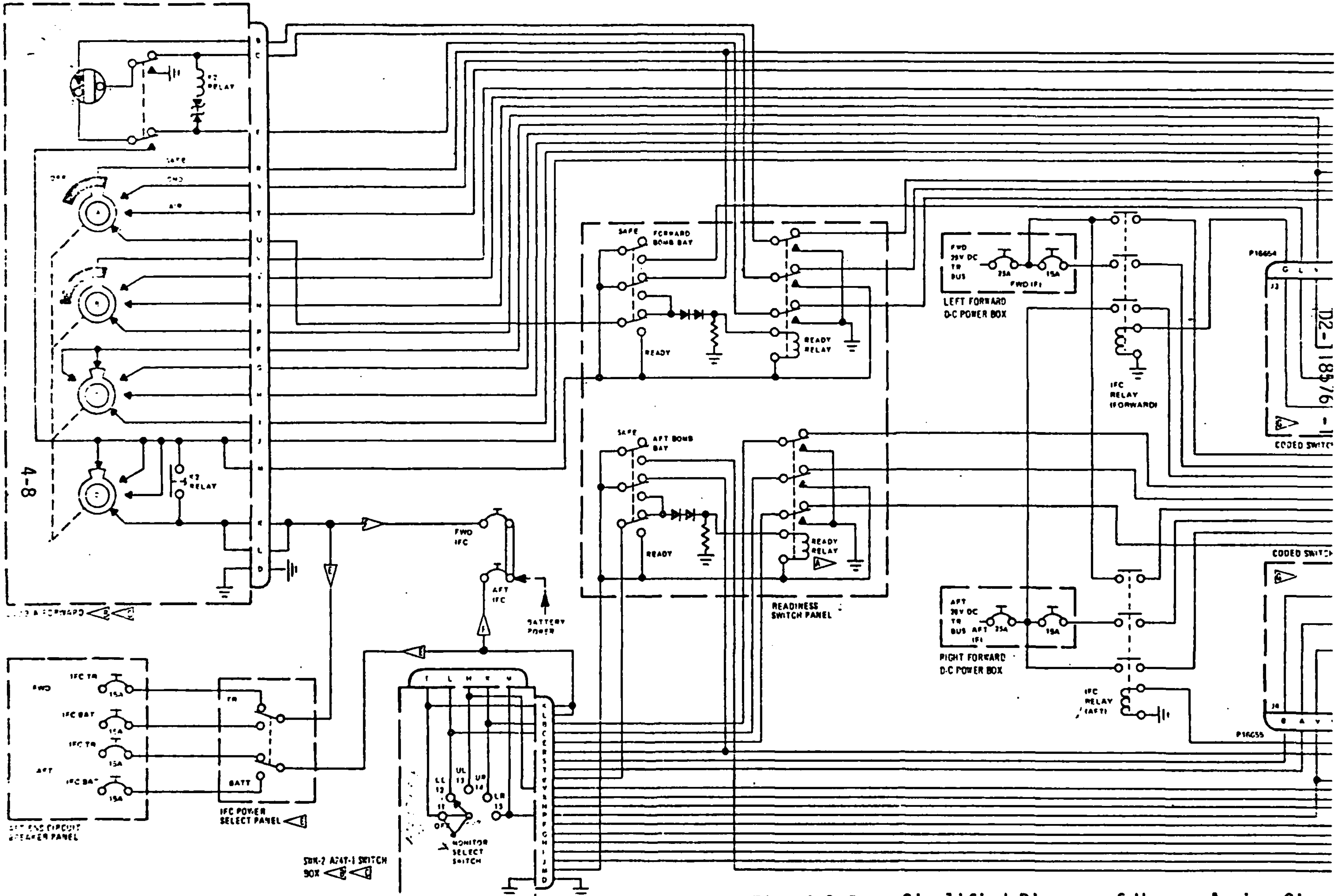


Figure 3-10. Weapon Arming Simplified Circuit (B-52G and H Aircraft) (Sheet 2 of 2)

Fig. 4.1-B. Simplified Diagram of Weapon Arming Circu
(Page 2 of 2)

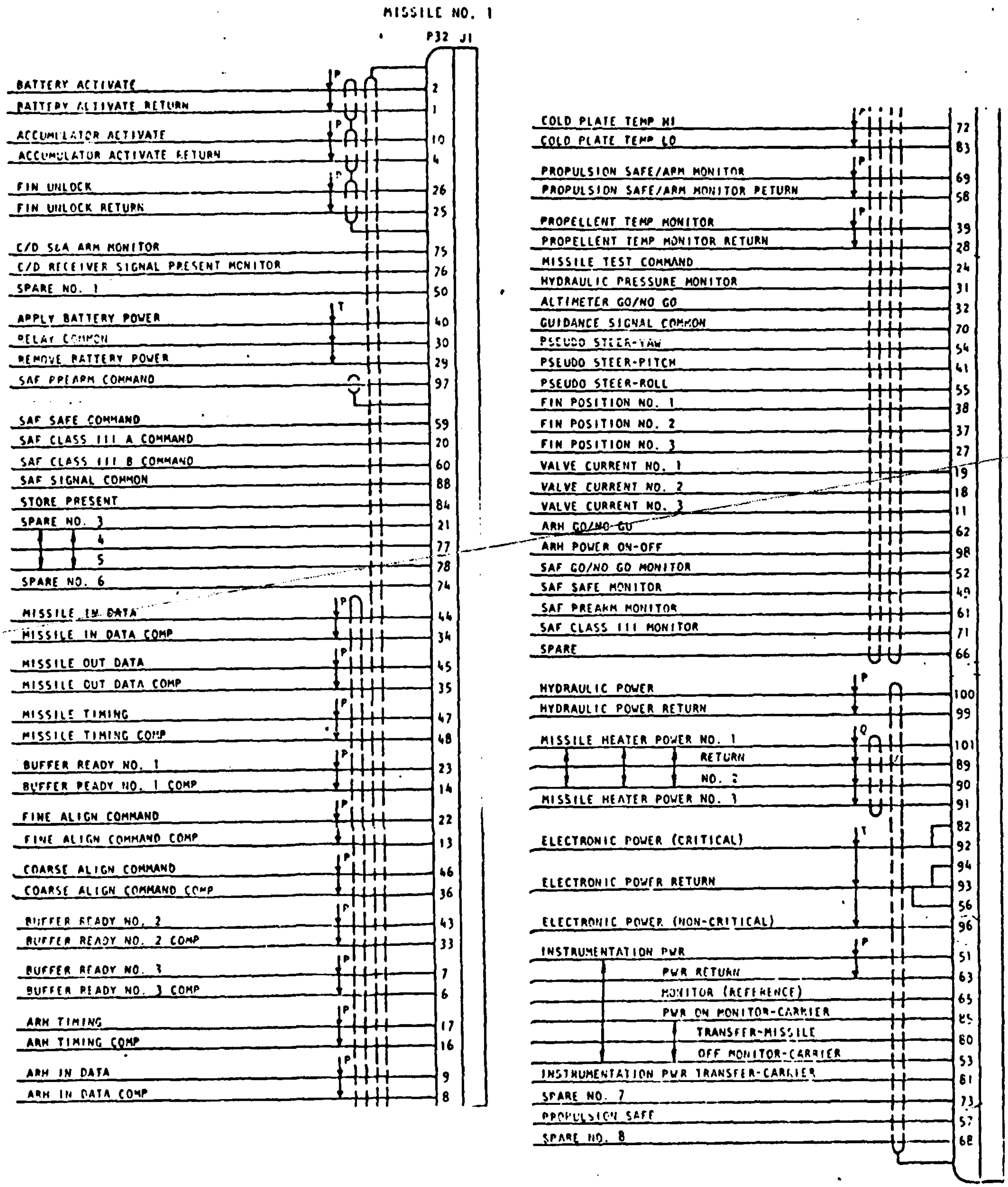


Figure 4.1-C AGM-69A Missile Interface

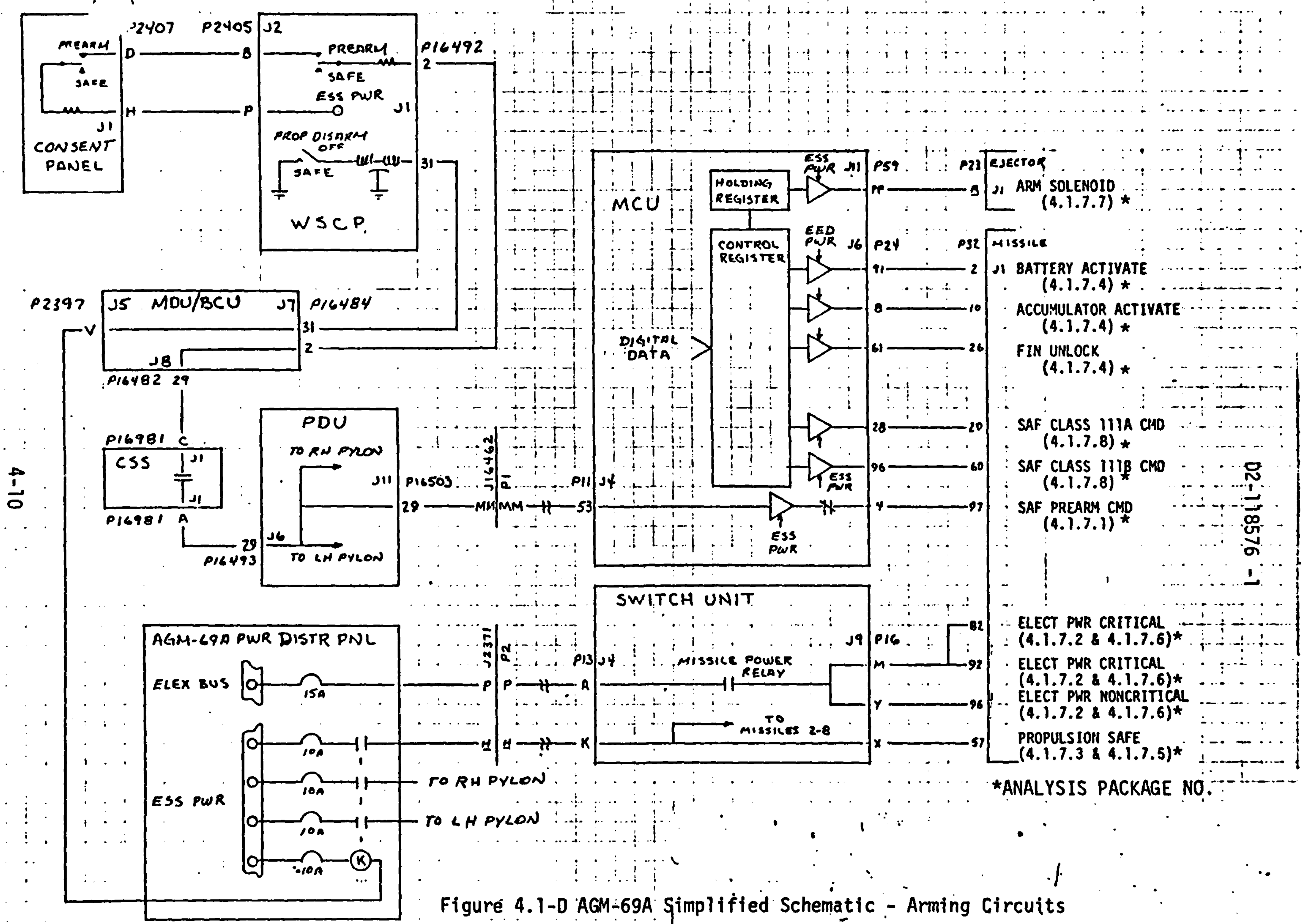
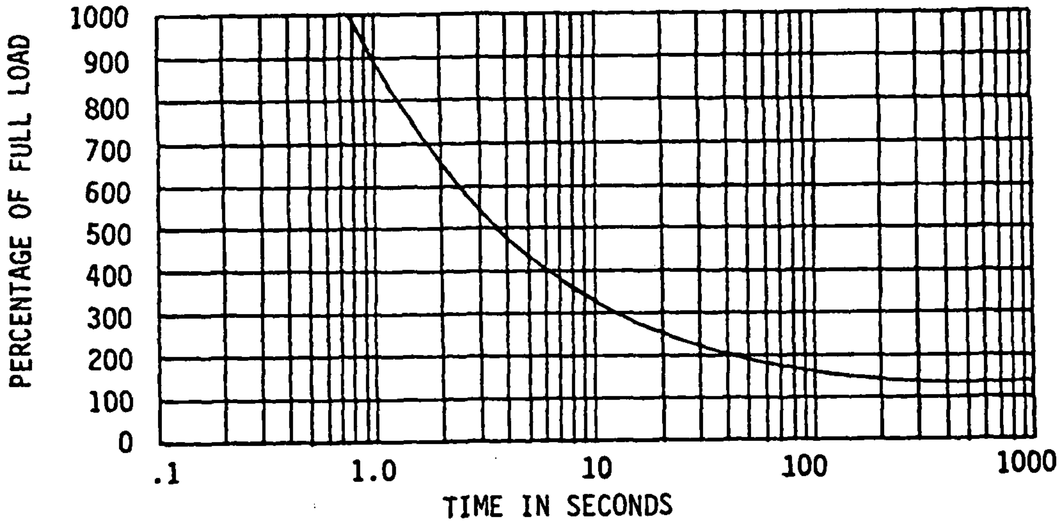


Figure 4.1-D AGM-69A Simplified Schematic - Arming Circuits

4.1.5.1 Ground Rules & Assumptions

Wire resistances and resistances across switches and relays were selected from parts specifications. Zero ohms resistance was assumed for cable connections and splices. Circuit breaker trip-times were determined from Figure 4.1-E, B-52 Gravity Bomb Circuit Breaker Trip Time V· Current Profile, and Figures 4.1-F, -G and -H, AGM-69A Circuit Breaker Trip Time Vs Current Profile. These curves were obtained from parts specifications. When applicable, standard temperature was used in determining characteristics.



CB TRIP TIME VS CURRENT PROFILE

Figure 4.1-E Gravity Bomb Circuit Breaker
Trip Time Vs Maximum Current

REV. 'E' 50

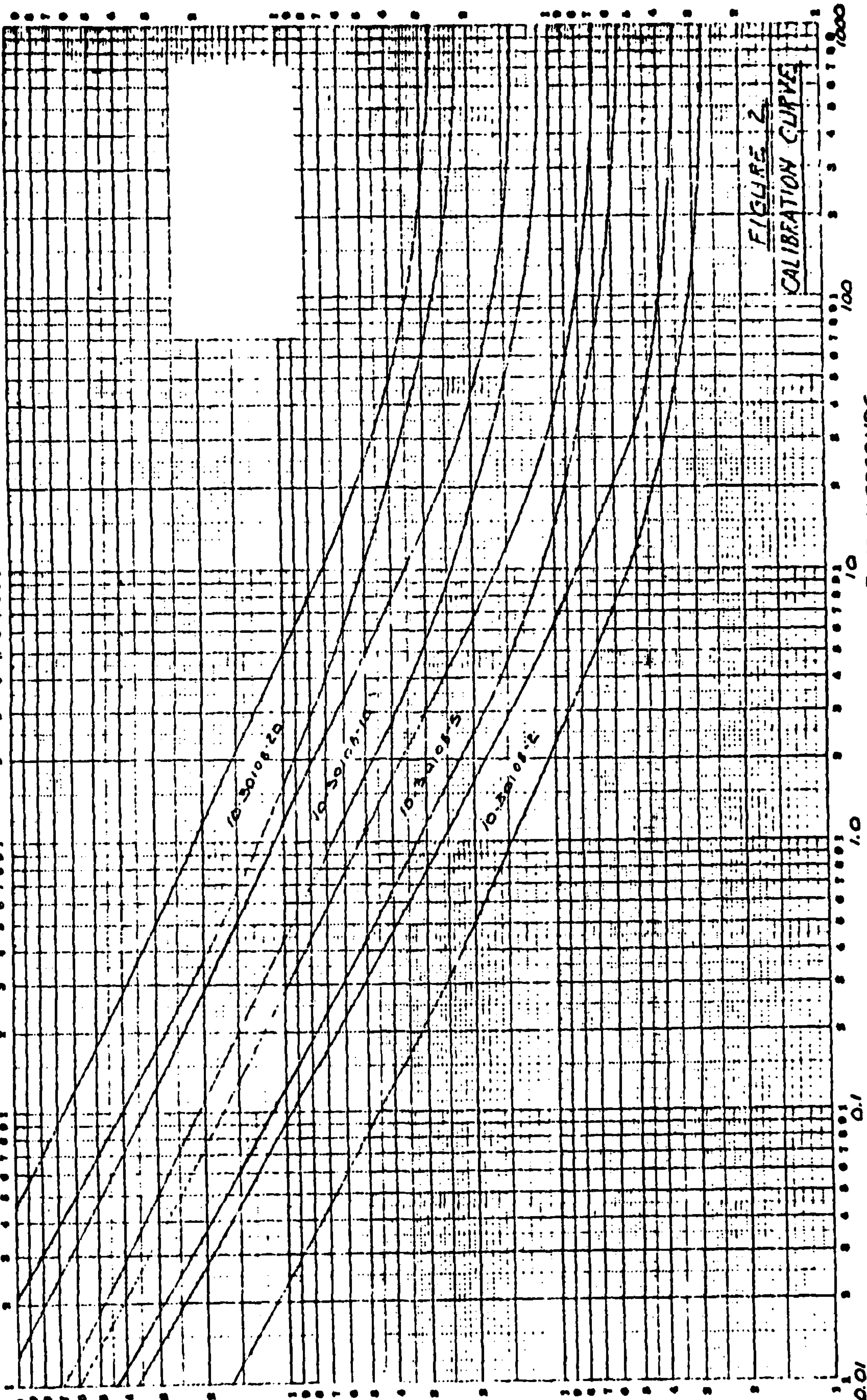


Fig. 4.1-F AGM-69A Circuit Breaker Trip Time Vs Current - 2, 5, 10 & 20 A Breakers

REV. E 51

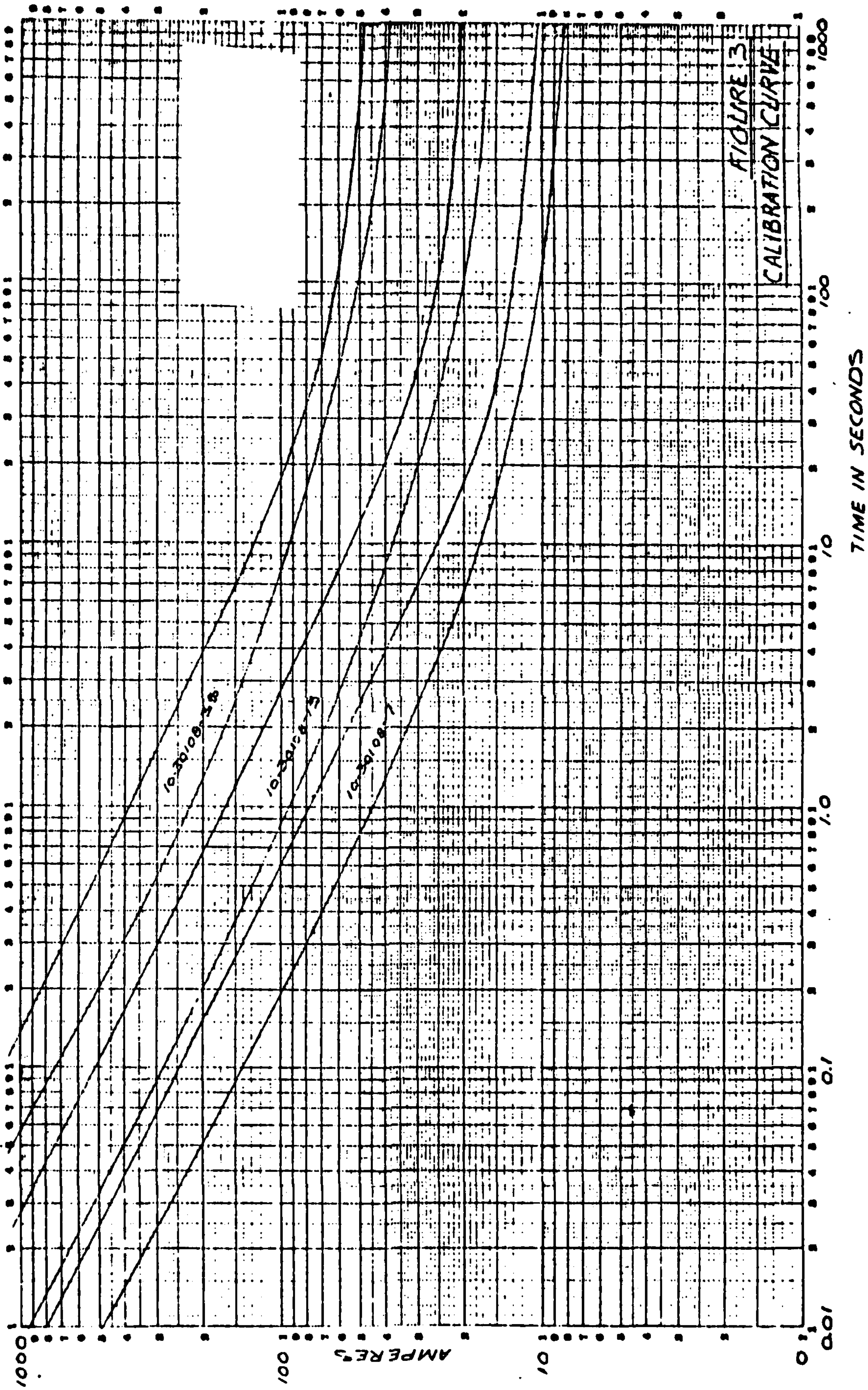


Fig. 4.1-G AGM-69A Circuit Breaker
Trip Time Vs Current -
7, 15, & 35 A Breakers

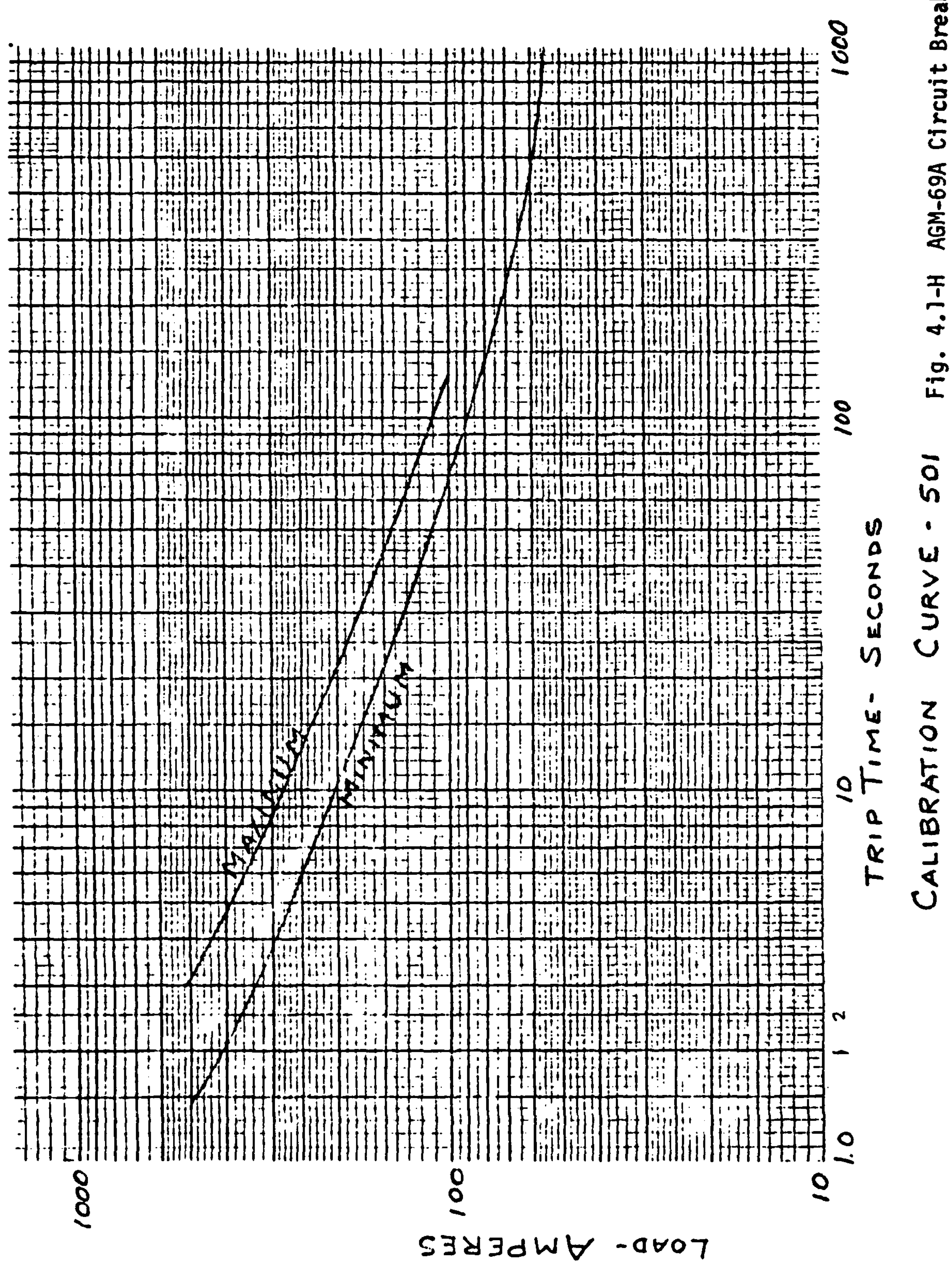


Fig. 4.1-H AGM-69A Circuit Breaker Trip Time Vs Current - 60 A Breaker

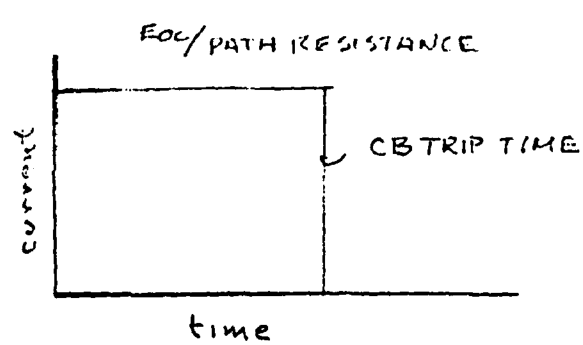
4.1.6 CIRCUIT ANALYSIS PACKAGES

Normal and fault analyses of each network tree are documented in individual packages. The following analysis packages cover all of the interface circuits to weapons carried in the forward bomb bay on the multiple carriage clip-in assembly:

4.1.6.1	Pin d	AMAC FWD SYS SECT III & IFC RELAY (Network Tree 0200)
4.1.6.2	Pin T	POWER FROM TR 4 (Network Tree 80)
4.1.6.3	Pins T, W & Y	POWER FROM TR 8 (Network Tree 83)
4.1.6.4	Pins C, f, Z & a	INFLIGHT CONTROL TESTER, DCU-9A (Network Tree 0198)
4.1.6.5	Pin h	FWD BOMB BAY SAFING (Network Tree 201, 248)
4.1.6.6	Pins c, J, H & F	INFLIGHT CONTROL TESTER, DCU-9A (Network Tree 0199)
4.1.6.7	Pins G. L, R, E,D,B,A & P	DCU-9A, INFLIGHT TEST (Network Tree 43B)
4.1.6.8	Pin X	UNUSED CIRCUITRY (Network Tree 202)

NOTE

Power Profiles - In all cases, short circuit current, caused by faults was found to be constant because of the absence of inductors and capacitors in the circuits investigated. Voltage source impedance was assumed to be zero ohms. A typical fault current Vs time profile is shown here:



FAULT CURRENT PROFILE

CLIP-IN ASSEMBLY PIN d
CIRCUIT ANALYSIS PACKAGE

4.1.6.1 Circuit Analysis Package, Weapon Interface Pin d of Connectors J11, J12, J13 and J14 on the A114 Clip-In Assembly and Cable In Forward Bomb Bay

These interfaces are shown in Figure 5-2, T.O. 11N-H5035-2 (Change 4) - copy attached below. Maximum current available to pin d in a normal environment is 0 amps. Worst case current at 24VDC in an abnormal (faulted) environment would be 152 amps assuming the pin d wires grounded at the weapon and shorted to power at J932 (AMAC).

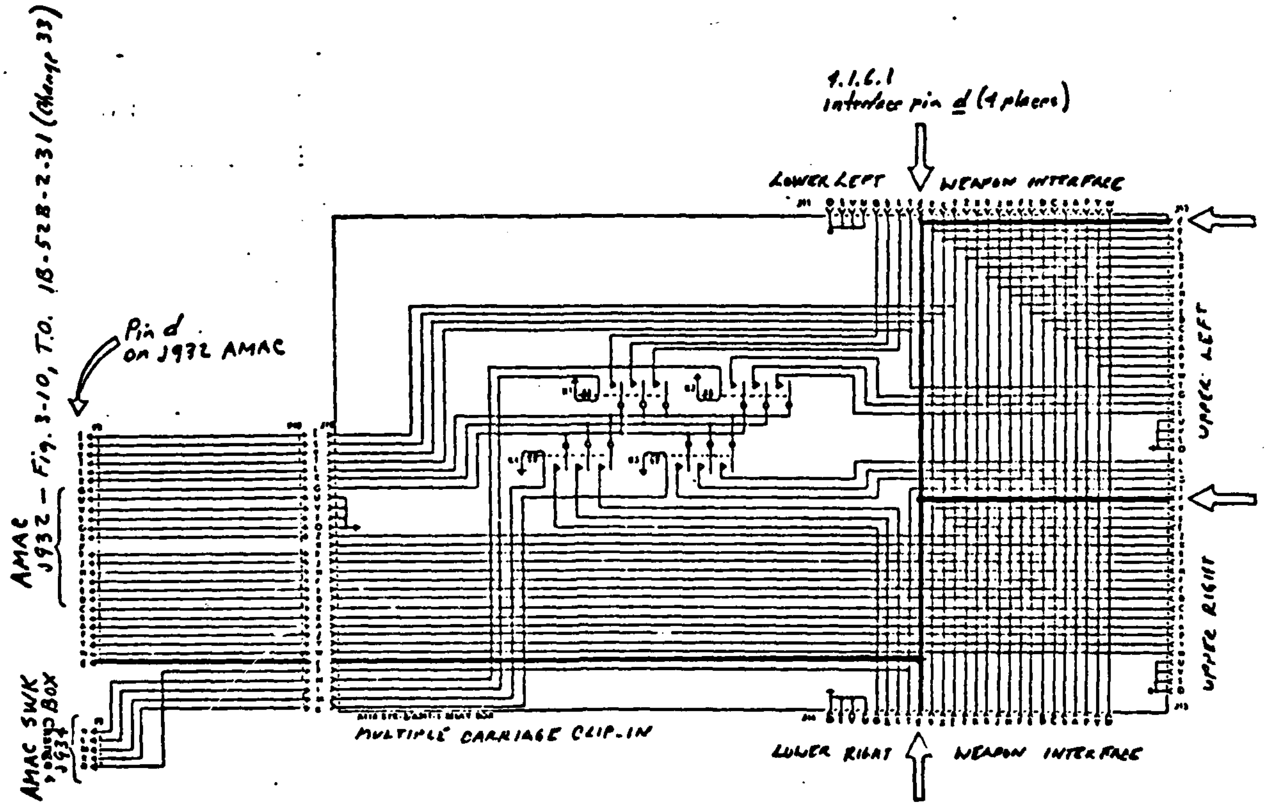


Figure 5-2. Control and Monitor Schematic

TO 11N-H5035-2

4.1.6.1 (Continued)

a. Normal Power and Load Analysis

From examination of Figure 4.1-1, Network Tree 0200, normal power environment is without voltage sources.
Open circuit voltage = 0V; Short circuit current = 0A.

b. Fault Analysis

The following postulated faults were analyzed using Network Tree 0200 and Figure 4.1-2, Cable Drawing:

① Clip-In Assembly or Connector Damaged

Wires to subject pins shorted to 24VDC from CB1565 or CB1566 during Radar Navigator testing using DCU-9/A and the SWK Box.

② Connector J932/P3 or Cable 31-3516-27 Damaged (Worst Case)

Wires to subject pins shorted to 24VDC from CB1565 during testing. See Figure 4.1-3 for source of voltage.

③ Cable 31-3516-1 Damaged

No voltages present. Cable runs between CSS interconnect box and weapons interface. The interconnect box opens all circuits.

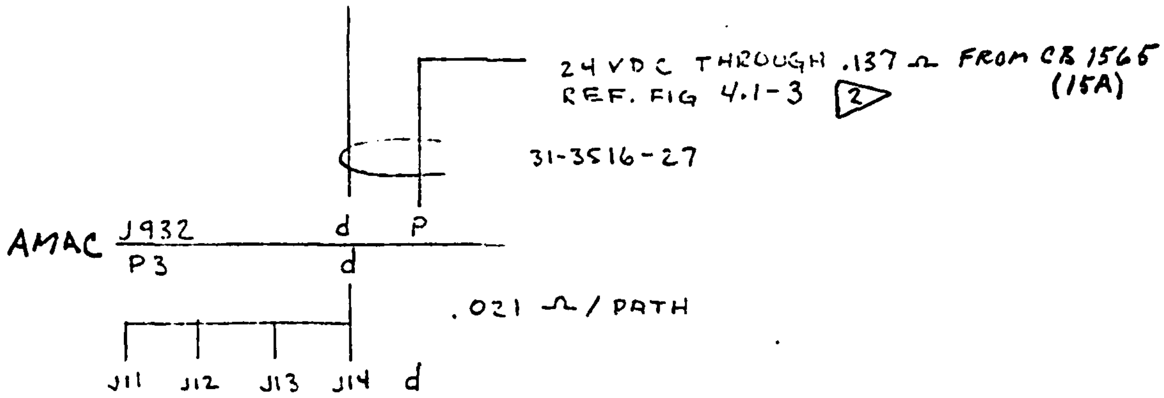
④ Interconnect Box or Connector Damaged

Wires to subject pins shorted to 24VDC from CB1566 during testing. See Figure 4.1-4 for source of voltage.

4.1.6.1 (Continued)

c. Worst Case Path and Calculations

REFERENCE PATH ② in paragraph b.



Total resistance of path = .187 Ω

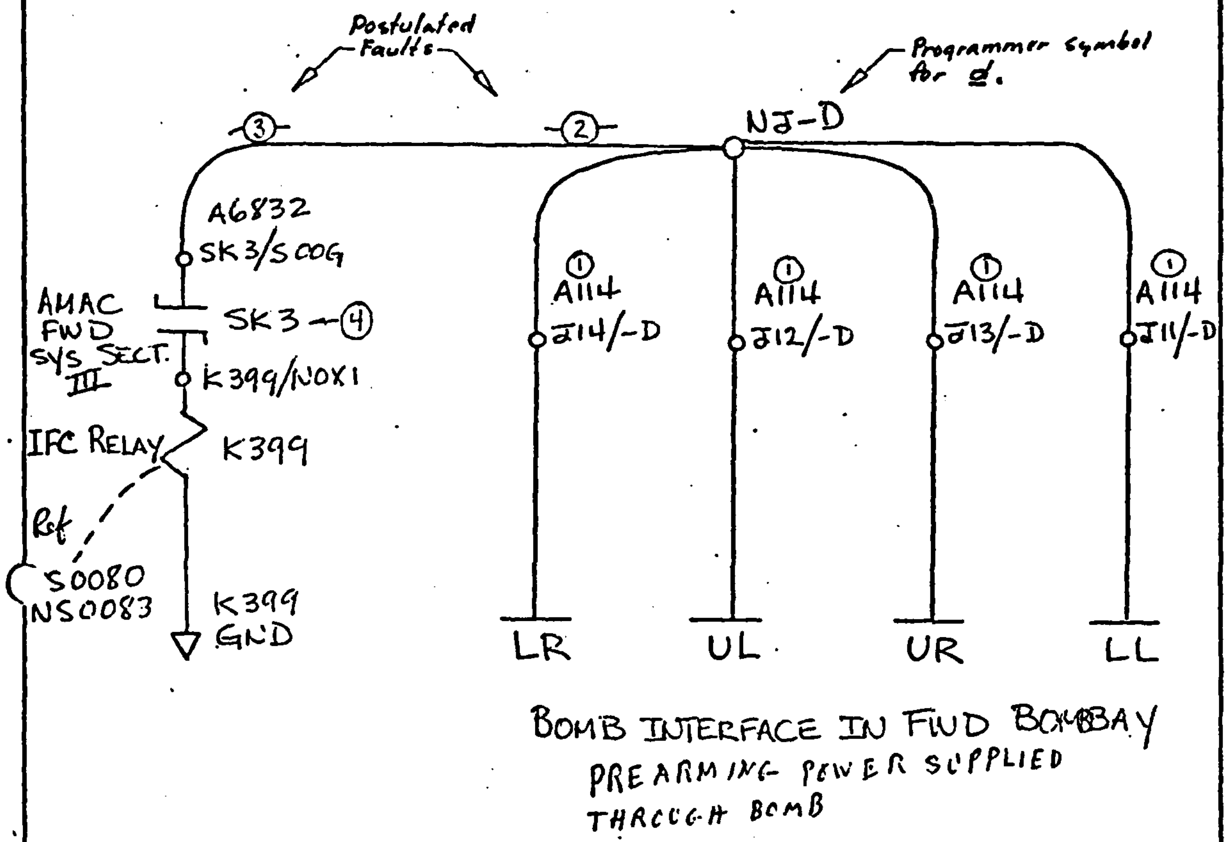
V_{OC} = 24VDC

$I_{SC} = \frac{24}{.158} = \underline{152}$ amps

Time = Less than 0.8 seconds. Current is greater than 1000% circuit breaker rating.

SNEAK CIRCUITS NETWORK TREE

REV



LR = LOWER RIGHT BOMB
UR = UPPER RIGHT BOMB
LL = LOWER LEFT BOMB
UL = UPPER LEFT BOMB

O FAULTS - SEE FAULT ANALYSIS, 9.4.1.6.1b

MONITOR & CONTROL SYS | DRAWING, TOIIN-H5035-2SL

PROJECT	TITLE
B52G	AMAC FWD SYS SECT III & IFC RELAY

QC	DATE	ANALYST	DATE	NODAL SET
jk	9-2-75	P.V.	8-19-75	0200

HOU 205 BOEING AEROSPACE COMPANY - HOUSTON, TEXAS

Figure 4.1.1 Network Tree No. 0200

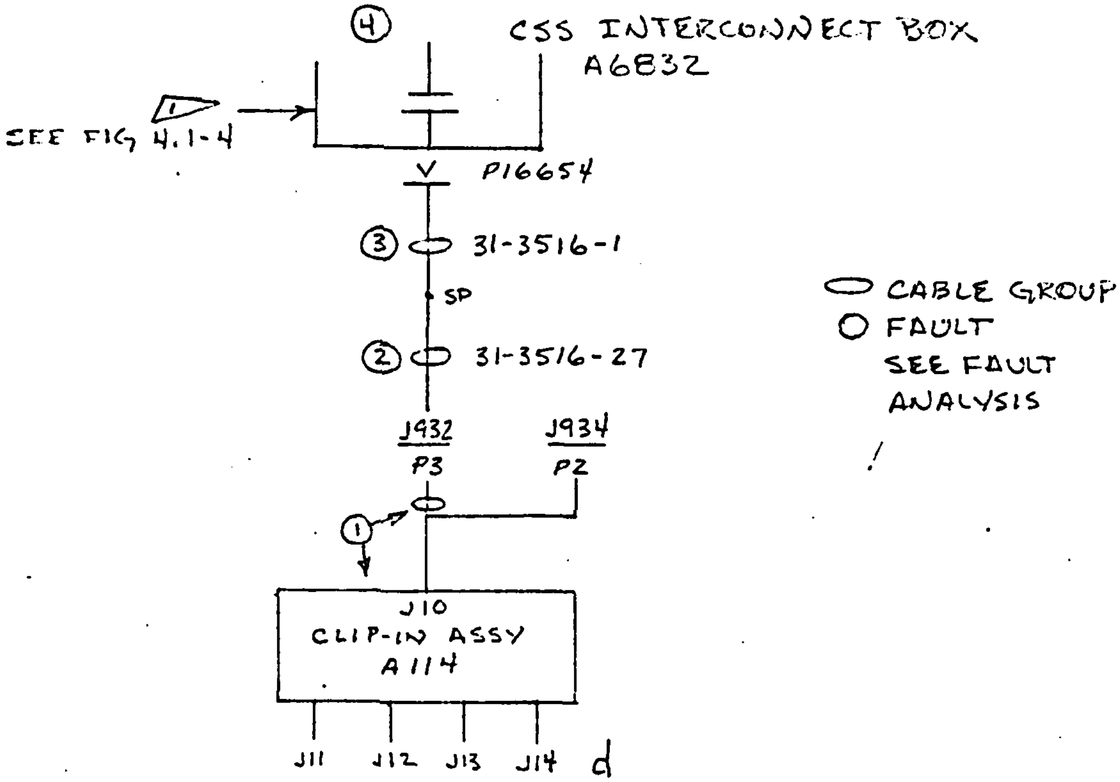


FIGURE 4.1-2

CABLE DRAWING

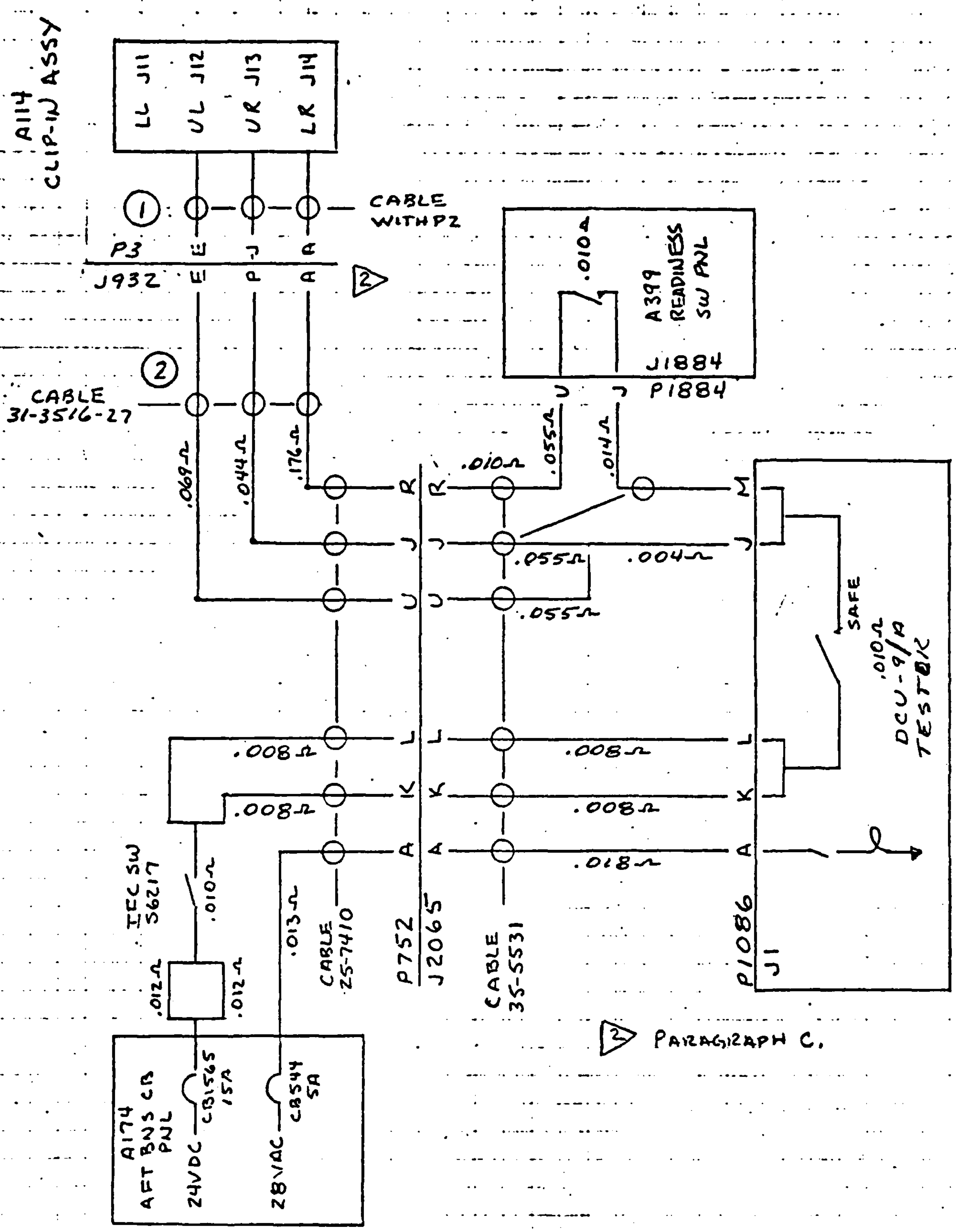


Figure 4.1-3 Power Paths Through DCU-9/A Tester

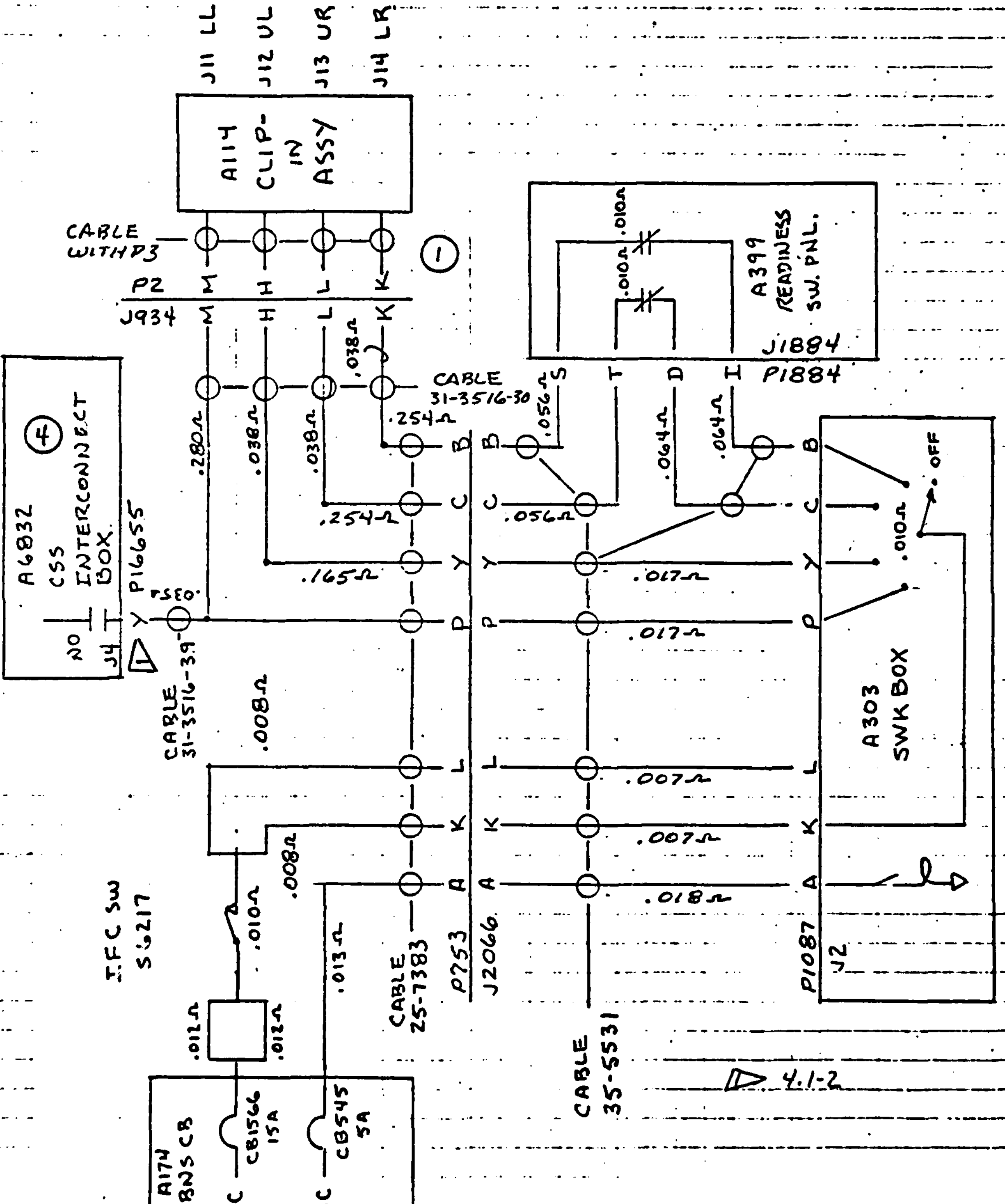


Figure 4.1-4 Power Paths Through SWK Box

CLIP-IN ASSEMBLY UPPER AND LOWER RIGHT WEAPON INTERFACE PINS T CIRCUIT ANALYSIS PACKAGE

4.1.6.2 Circuit Analysis Package, Weapon Interface Pins T of Connectors J13 and J14 on A114 Clip-In Assembly and Cable in Forward Bomb Bay

These interfaces are shown in Figure 5-2, T.O. 11N-H5035-2 (Change 4) - copy attached below. Maximum current available to pin T in a normal environment is <u>0</u> amps. Worst case current at 28VDC in an abnormal (faulted) environment would be <u>1000</u> amps, assuming the pins grounded at the weapon and shorted to power at IFC relay.

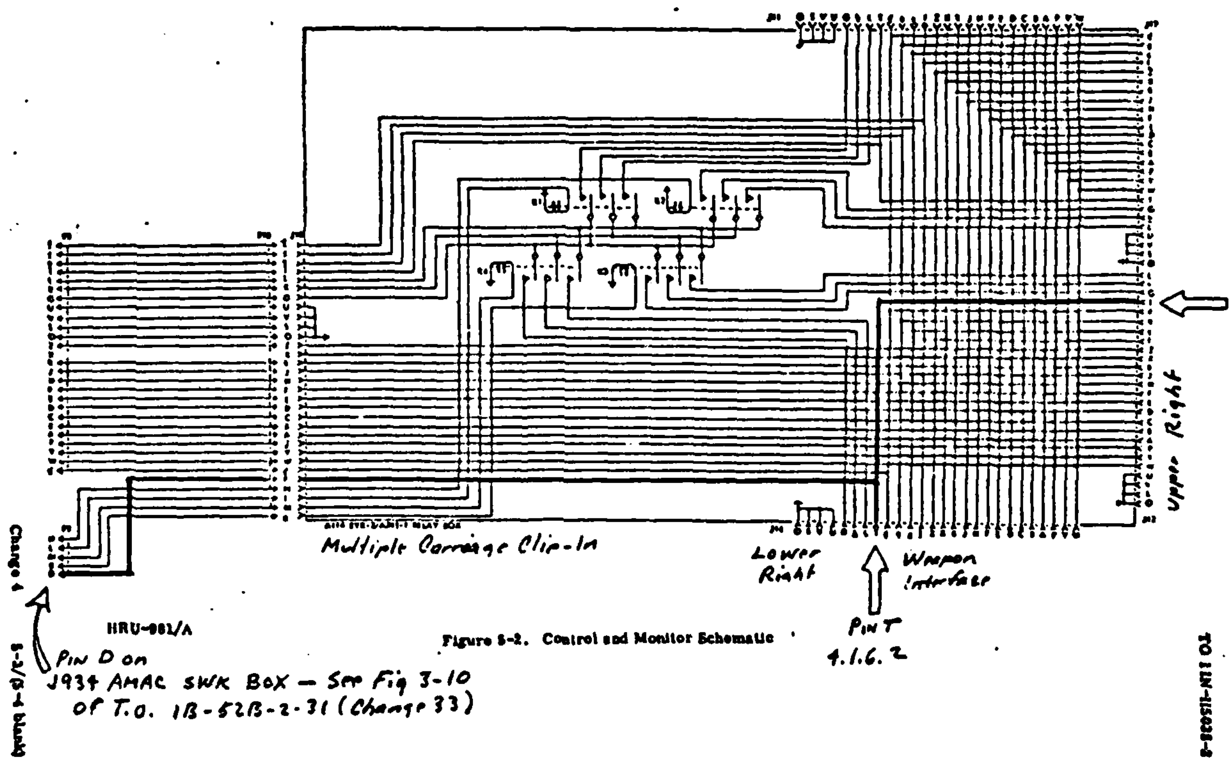


Figure 5-2. Control and Monitor Schematic

4.1.6.2 (Continued)

a. Normal Power and Load Analysis

From examination of Figure 4.1-5, Network Tree 80, normal power environment is with K399 open.

Open circuit voltage = 0V; Short circuit current = 0A.

b. Fault Analysis

The following postulated faults were analyzed using Network Tree 80 and Figure 4.1-6, Cable Drawing.

(1) Clip-In Assembly or Connector Damaged

Wires to subject pins shorted to 24VDC from CB1565 or CB1566 during Radar Navigator Testing with the DCU-9/A and SWK Box. See Figures 4.1-7 and 4.1-8 for voltage source.

(2) Cable 31-3516-30 or Connector J934/P2

Wires to subject pins shorted to 24VDC from CB1566 during testing. See Figure 4.1-8 for voltage source.

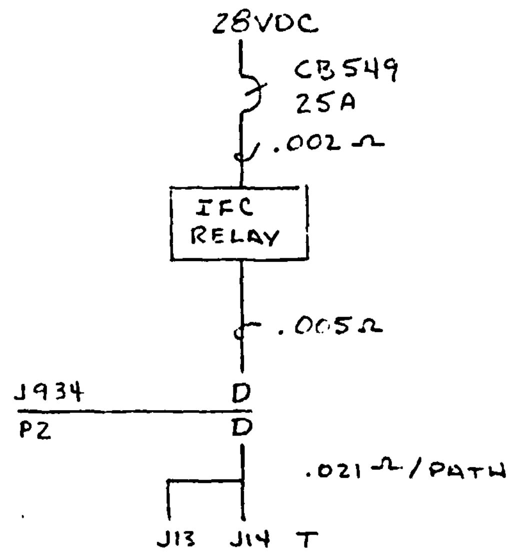
(3) IFC Relay K399 Damaged (Worst Case)

Pin L3 to T3 28VDC from CB549
L1 to T3 28VDC from CB548
L2 to T3 28VDC from CB550
See Figure 4.1.6 for voltage sources

4.1.6.2 (Continued)

c. Worst Case Path

Reference path (3) IFC Relay K399 Damaged (from paragraph b).



Total resistance of path .028 Ω

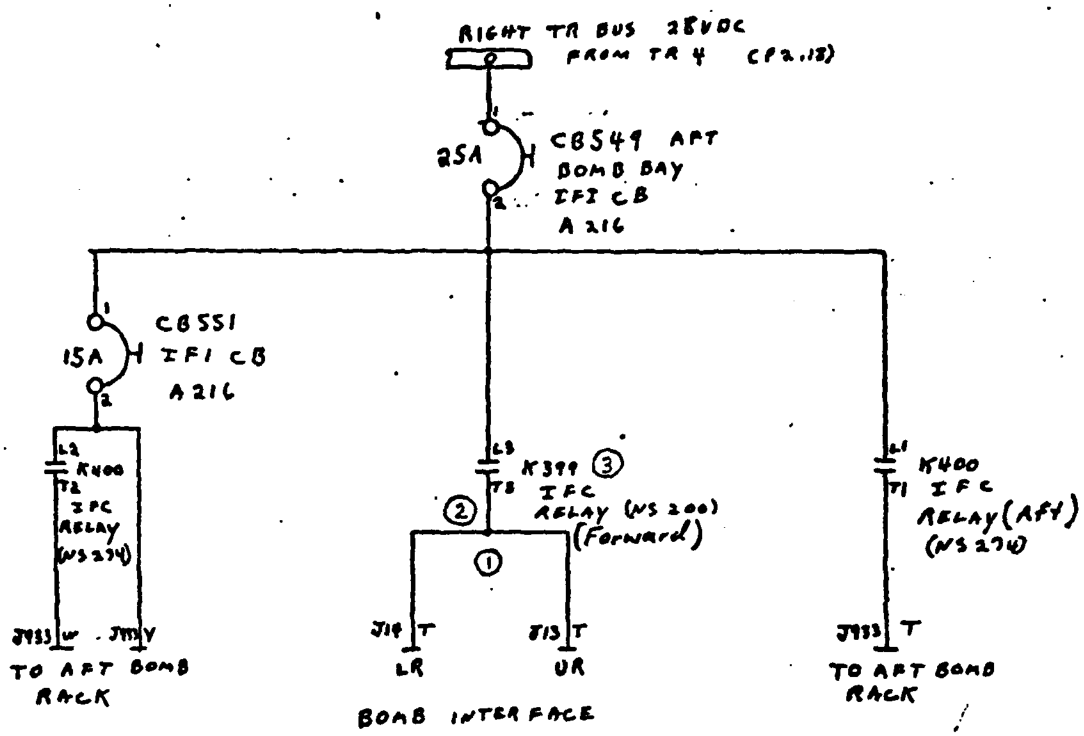
V_{OC} = 28VDC

$I_{SC} = \frac{28}{.028} = \underline{1000}$ Amps

Time = Less then 0.8 seconds for circuit breaker to open.

SNEAK CIRCUITS NETWORK TREE

REV



LR - LOWER RIGHT BOMB

UR - UPPER RIGHT BOMB

0 Faults - See Fault Analysis

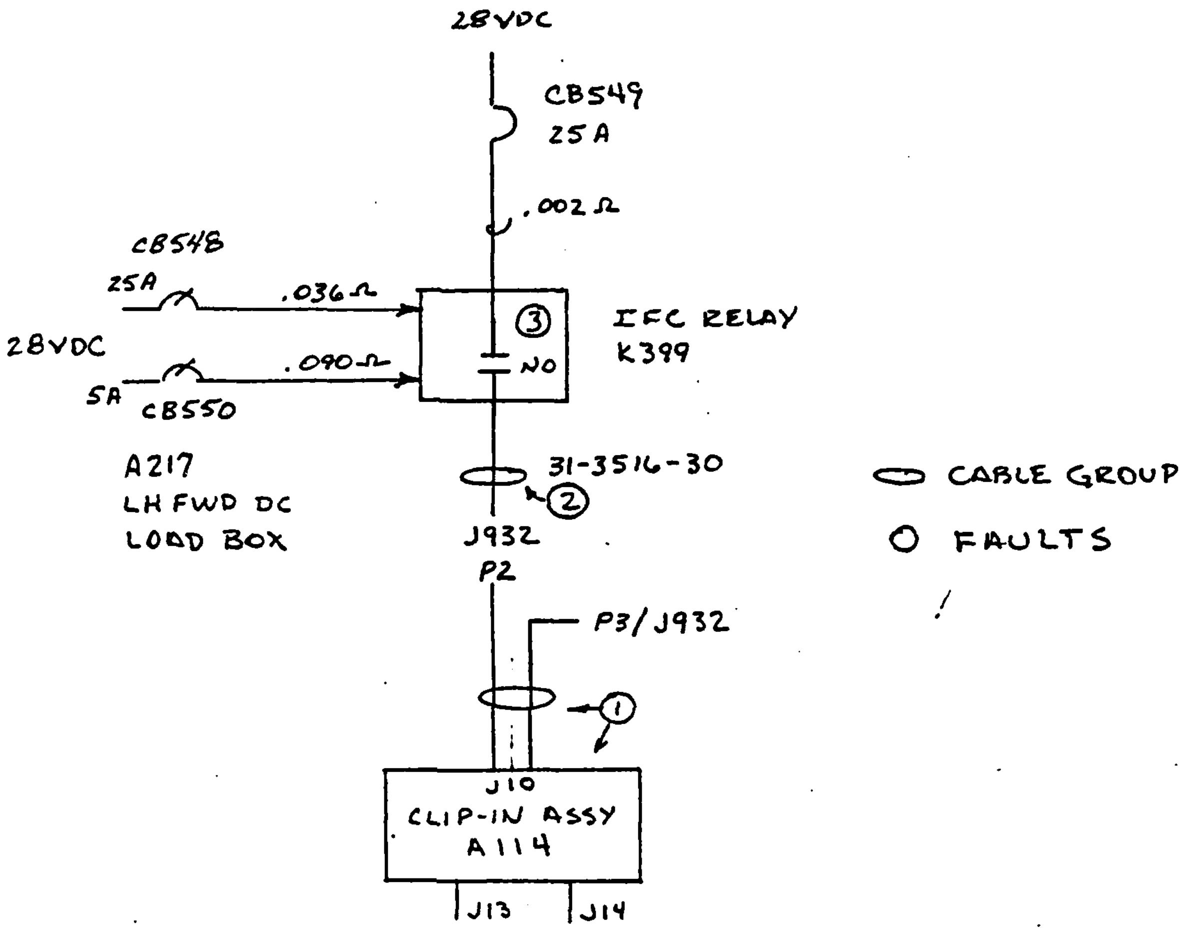
CONTROL MONITOR GROUP SYS. 2

PROJECT	TITLE	
B-52G	AFT BOMB BAY IFI POWER	
QC. [illegible] DATE 9-10-75	ANALYST A.B. CAMPBELL DATE 8-19-75	NODAL SET 80

HOU-705

BOEING AEROSPACE COMPANY - HOUSTON, TEXAS

Figure 4.1-5 Network Tree No. 80



CABLE DRAWING

FIGURE 4.1-6

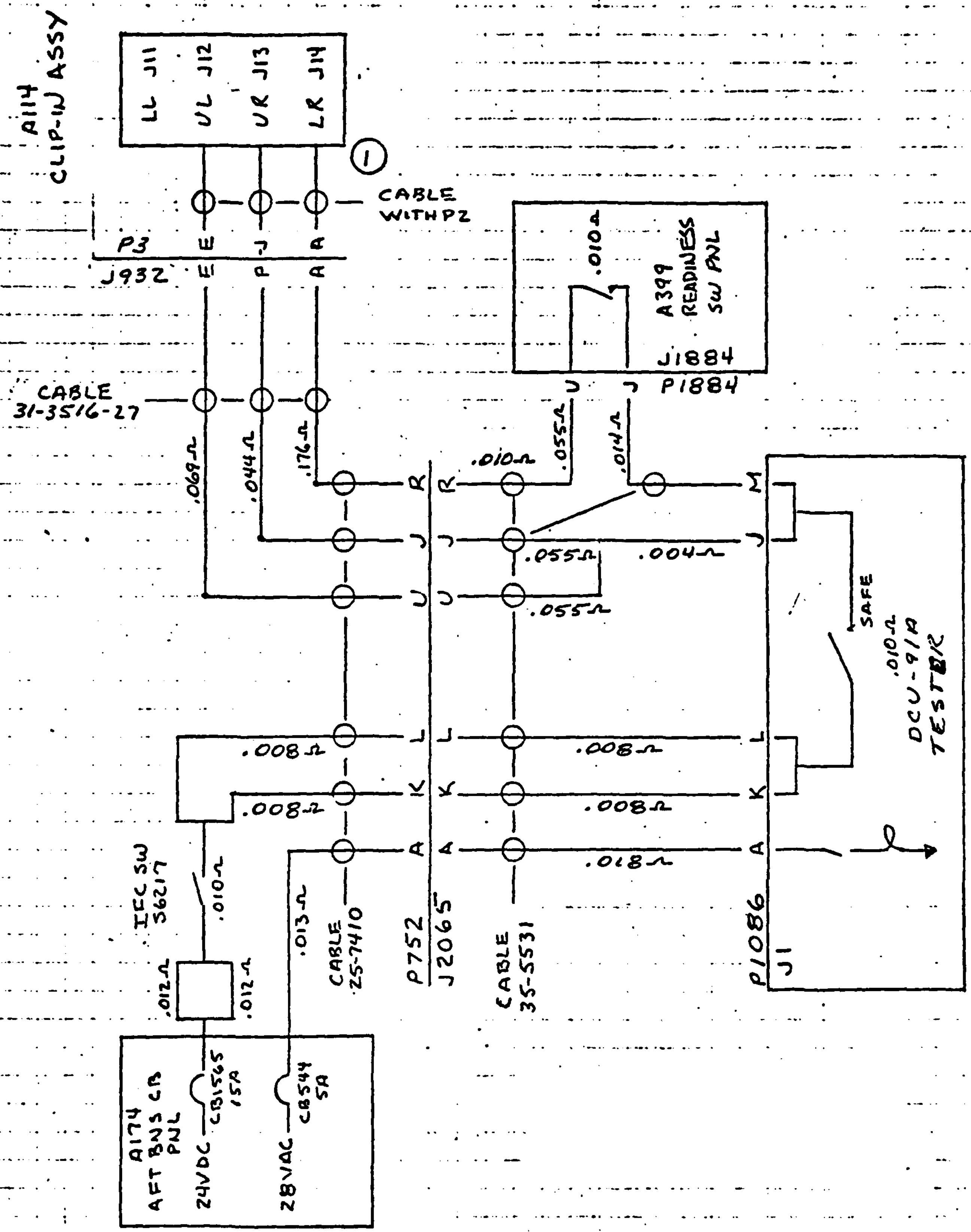


Figure 4.1-7 Power Paths Through DCU-9/A Tester

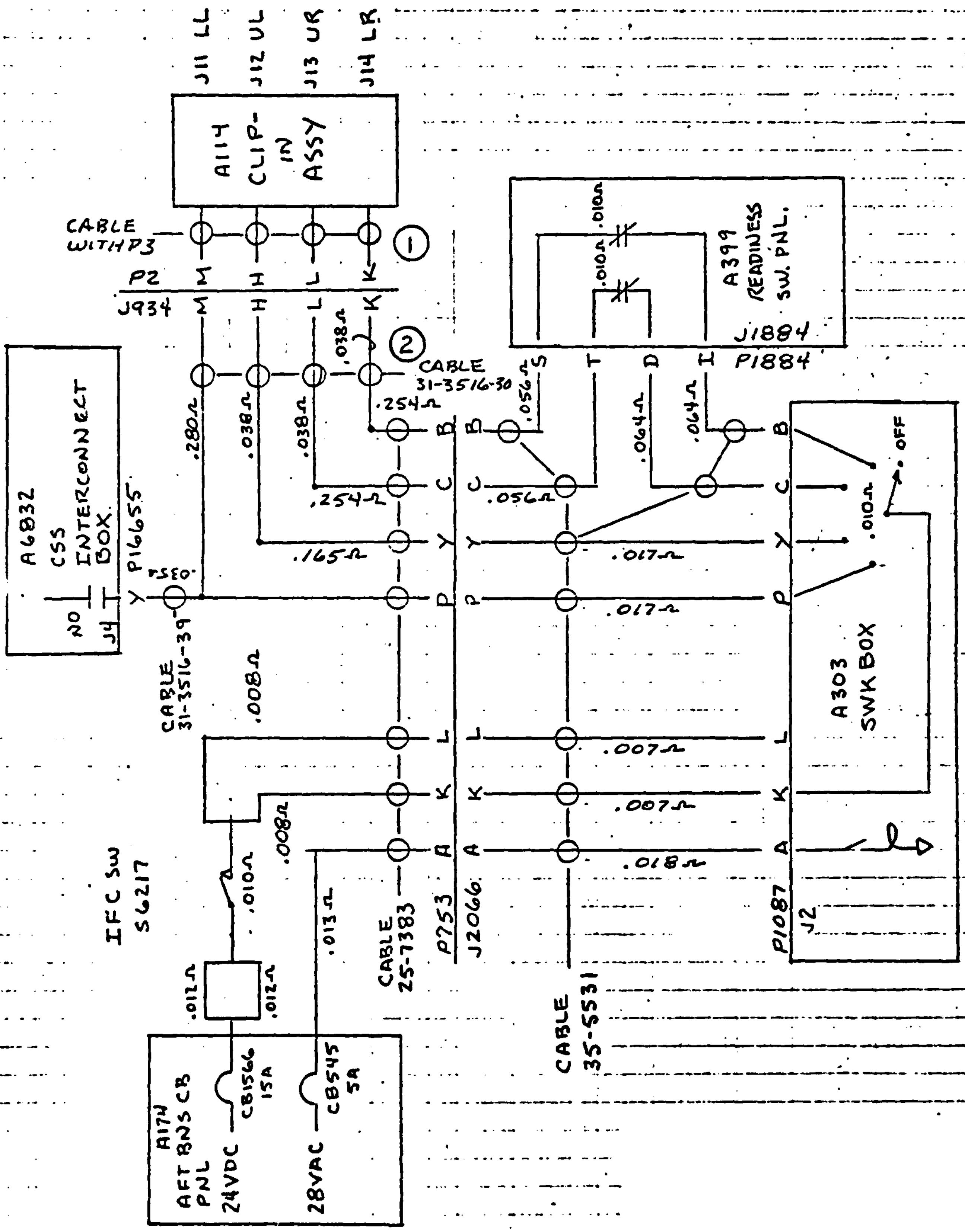
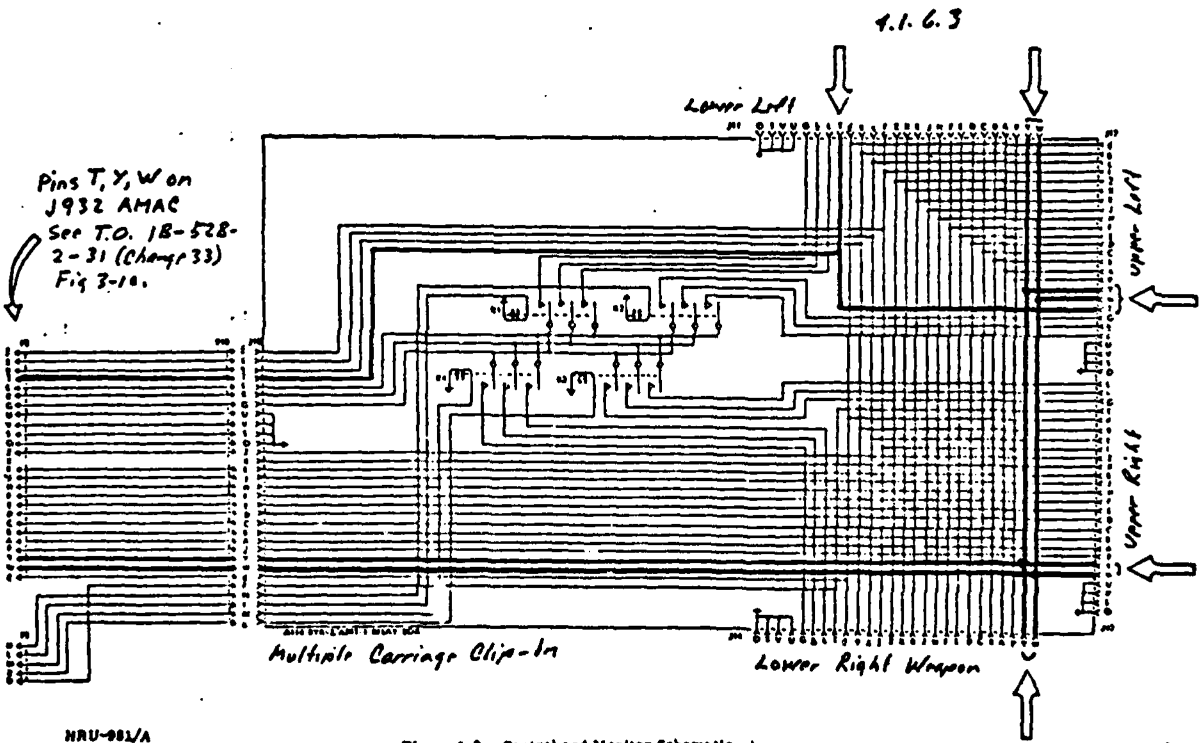


Figure 4.1-8 Power Paths Through SWK Box

CLIP-IN ASSEMBLY PINS T, W & Y
CIRCUIT ANALYSIS PACKAGE

4.1.6.3 Circuit Analysis Package, Weapon Interface Pins W & Y of Connectors J11, J12, J13 and J14; and Pin T of Connectors J11 and J12 on A114 Clip-In Assembly and Cable in Forward Bomb Bay

These interfaces are shown in Figure 5-2, T. O. 11N-H5035-2 (Change 4) - Copy attached below. Maximum current available to pins T, W and Y in a *normal environment* is <u>0</u> amps. Worst case current at 28VDC is an abnormal environment (faulted) would be <u>1170</u> amps for pins T and <u>800</u> amps for pins W and Y assuming the pins are grounded at the weapon and shorted to power through IFC relay.



HRU-981/A

Figure 5-2. Control and Monitor Schematic

Change 4 5-2/(5-4 blank) TO 11N-H5035-2

4.1.6.3 (Continued)

a. Normal Power and Load Analysis

From examination of Figure 4.1-9, Network Tree No. 83, normal power environment or all pins: Open circuit voltage = 0V; short circuit current = 0A, because K399 is normally open.

b. Fault Analysis

The following postulated faults were analyzed using Network Tree No. 83 and Figure 4.1-10, Cable Drawing:

① Clip-In Assembly or Connector Damaged

Wires to subject pins shorted to 24VDC from CB1565 or CB1566 during Radar Navigator testing. See Figures 4.1-11 and 4.1-12 for source of voltage.

② Cable 31-3516-27 or Connector J932/P3 Damaged

Wires to subject pins shorted to 24VDC from CB1565 during Radar Navigator testing. See Figure 4.1-12 for source of voltage.

③ IFC Relay K399 Damaged (Worst Case)

Reference Figure 4.1-10.
L2 to T2 28VDC from CB550
L1 to T1 28VDC from CB548
L1 to T2 28VDC from CB548
L2 to T1 28VDC from CB550
L3 to T1 or T2 28VDC from CB549

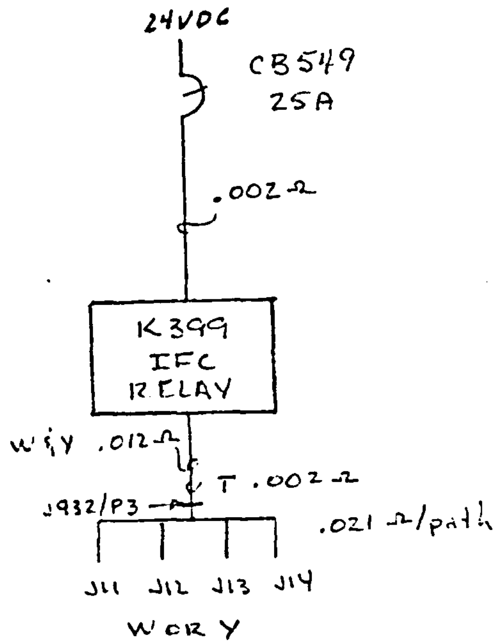
4.1.6.3 (Continued)

c. <u>Worst Case Path</u>

Reference Path (3) IFC Relay K399 Damaged.

J11, J12, J13 and J14 Y or W

J11 and J12T



Pin T

Total resistance = .024 Ω

V_{OC} = 28VDC

$I_{SC} = \frac{28}{.024} = \underline{1170}$ amps

Pins W & Y

Total resistance = .035 Ω

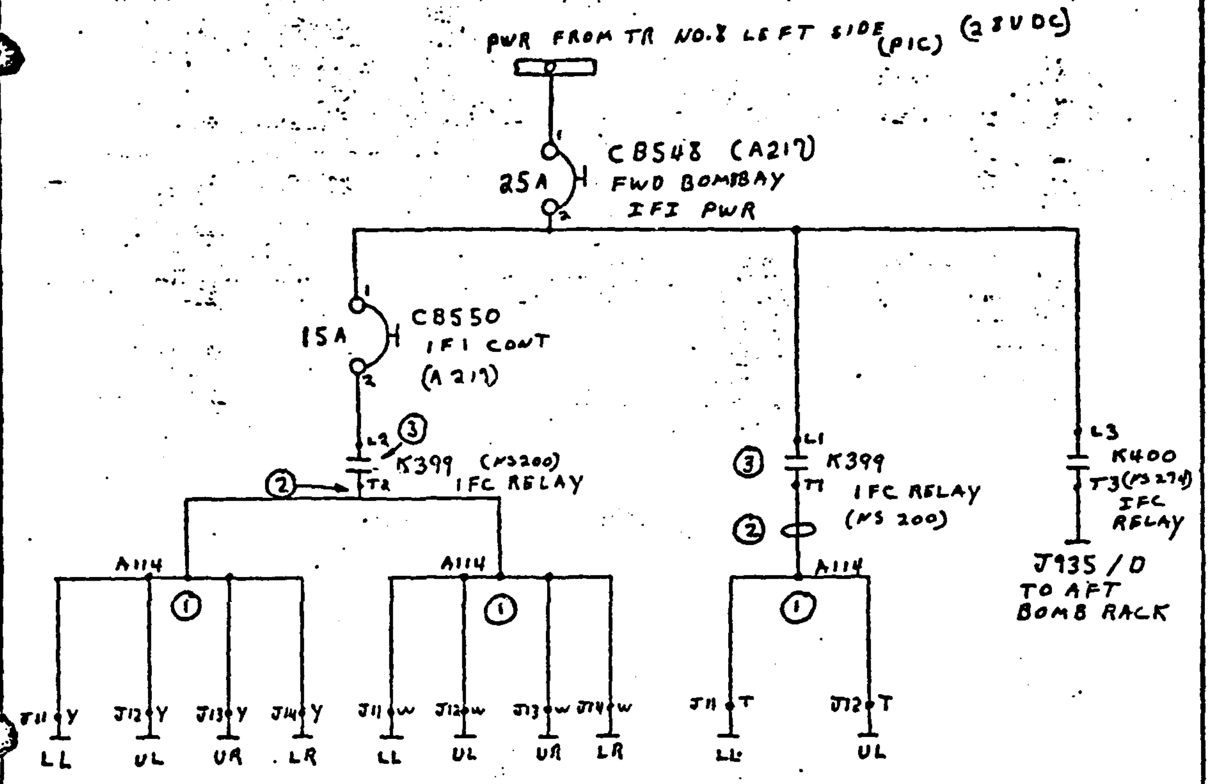
V_{OC} = 28VDC

$I_{SC} = \frac{28}{.035} = \underline{800}$ amps

Time - less then 0.8 seconds for circuit breaker to open.

SNEAK CIRCUITS NETWORK TREE

REV



BOMB INTERFACE IN FWD BOMBBAY

0 Faults

LL - LOWER LEFT BOMB
UL - UPPER LEFT BOMB
UR - UPPER RIGHT BOMB
LR - LOWER RIGHT BOMB

CONTROL MONITOR GROUP - SYS. I

DWG. A8.14

PROJECT	TITLE
B-52 G	FWD BOMB BAY IFI PWR

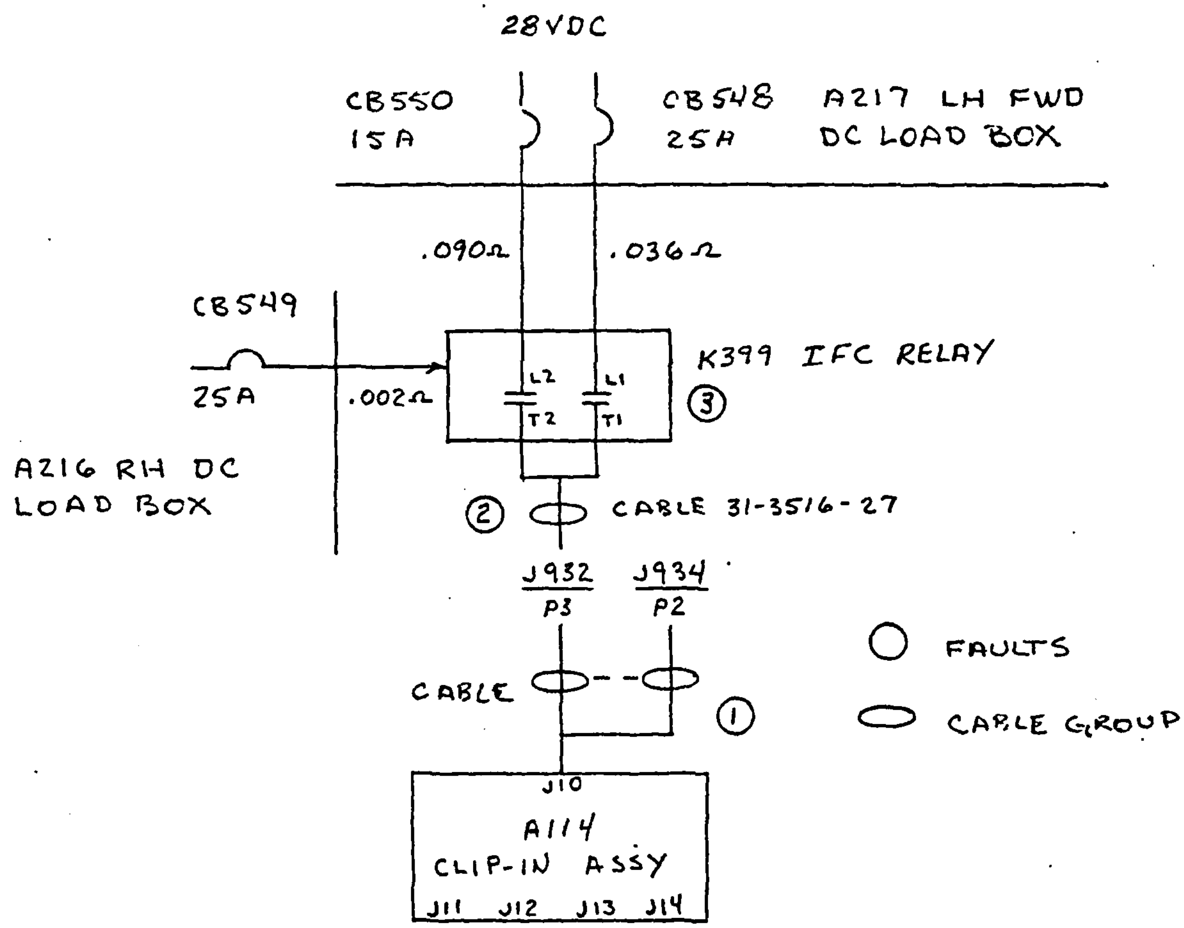
QC	DATE	ANALYST	DATE	NODAL SET
[illegible]	9-11-75	L.R. Campbell	8-19-75	83

HQU-205 BOEING AEROSPACE COMPANY - HOUSTON, TEXAS

Figure 4.1-9 Network Tree No. 83

AD-A103 951 BOEING AEROSPACE CO HOUSTON TX F/G 15/6
ELECTRICAL ANALYSIS OF B-52/FB-111 AMAC AND RELEASE CIRCUITRY U--ETC(U)
OCT 75 F29601-76-C-0017
UNCLASSIFIED D2-118576-1 NL

2 OF 4
AD
A103951



CABLE DRAWING

FIGURE 4.1-10

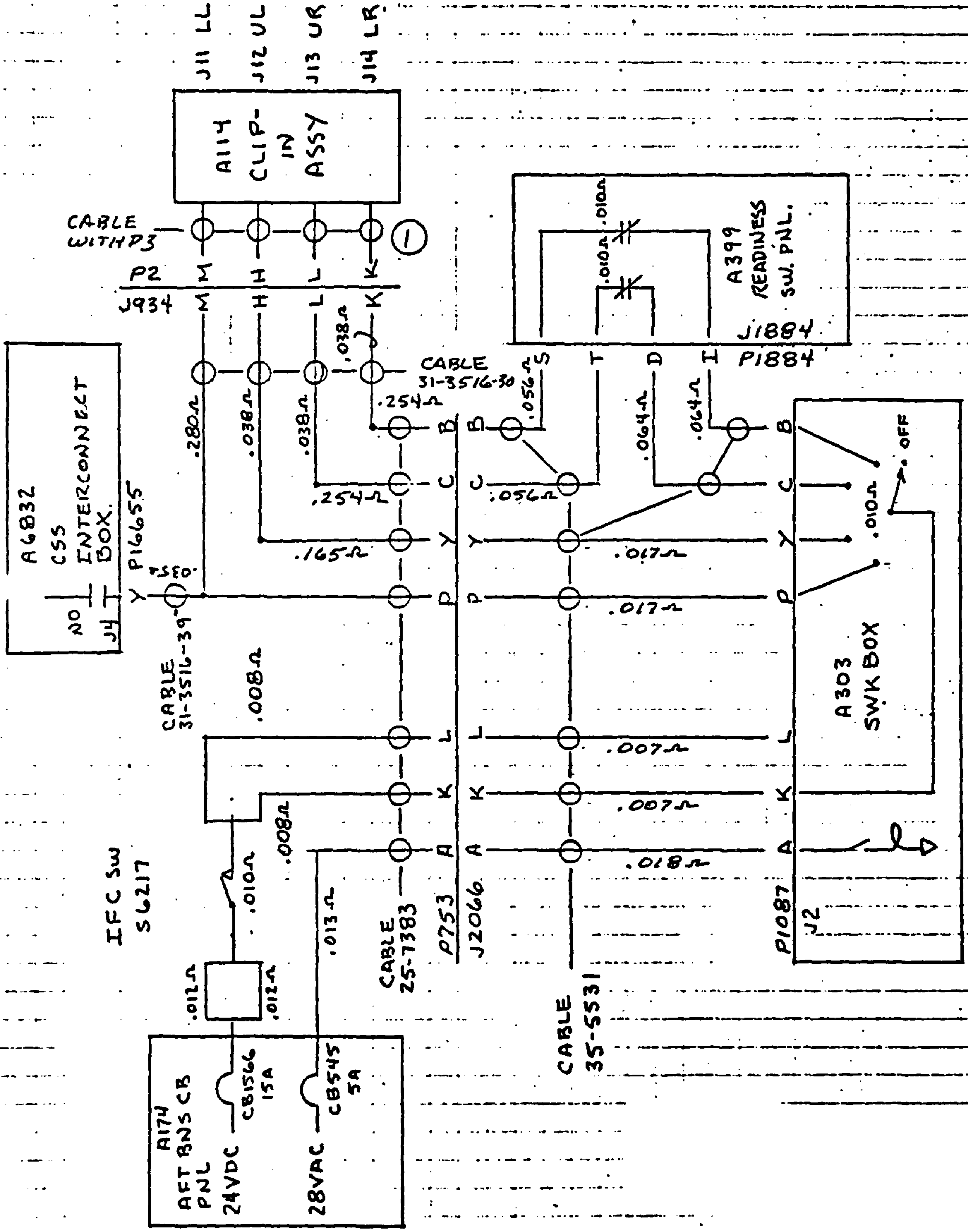


Figure 4.1-11 Power Paths Through SWK Box

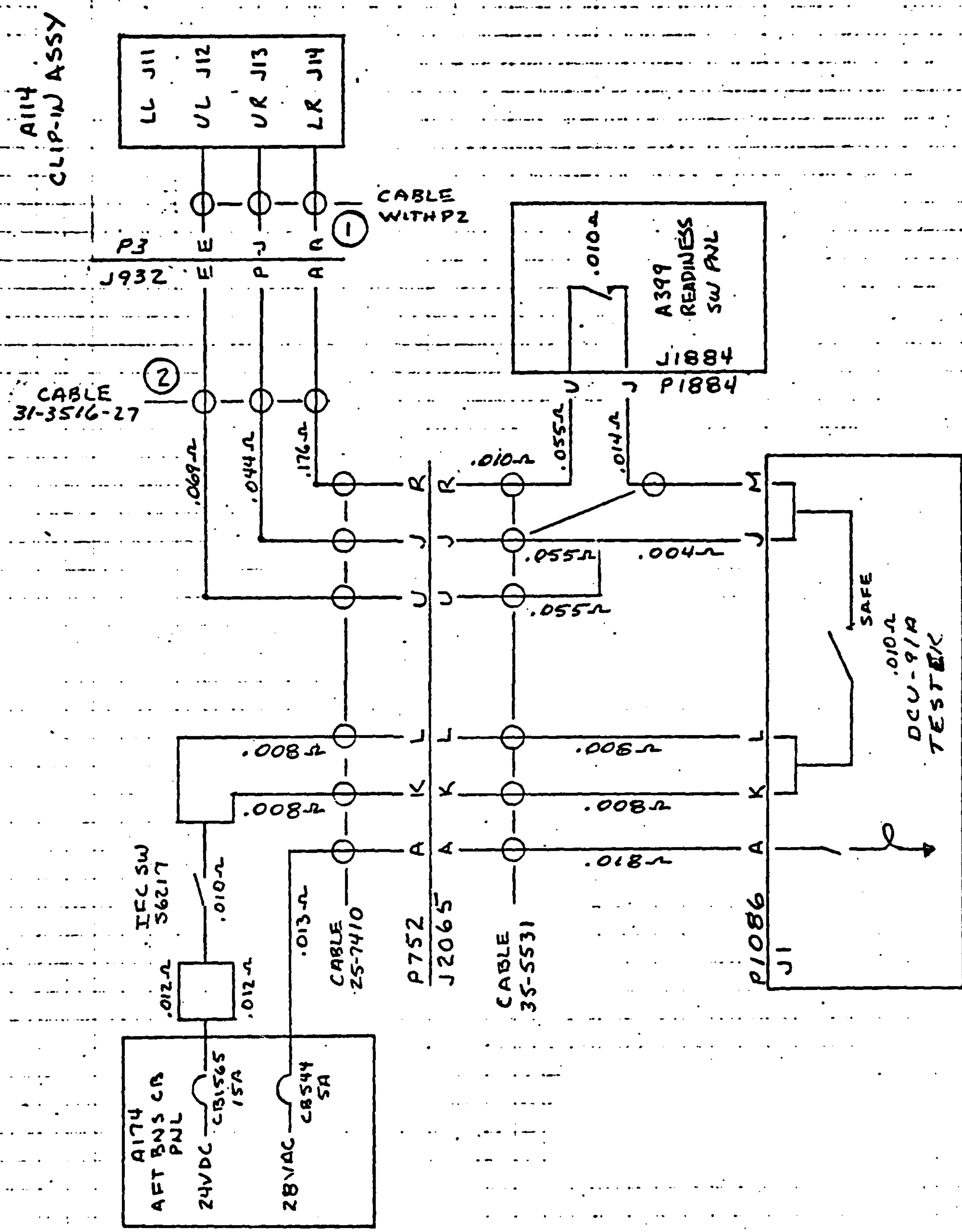


Figure 4.1.19 Power Paths Through DCU-9/A Tester

4.1.6.4 (Continued)

a. Normal Power and Load Analysis

From examination of Figure 4.1-13, Network Tree No. 0198, normal open circuit voltage = 0V; short circuit current = 0A.

b. Fault Analysis

The following postulated faults were analyzed using Network Tree No. 0198 and Figure 4.1-14, Cable Drawing.

(1) Clip-In Assembly or Connector Damaged

Wires to subject pins shorted to 24VDC during testing using DCU-9/A and the SWK box from CB1565 or CB1566. See Figure 4.1-15 and 4.1-16 for power paths.

(2) Cable 31-3516-27 or Connectors Damaged

Wires to subject pins shorted to 24VDC during testing from CB1565. See Figure 4.1-15 for power paths.

(3) Cable 25-7410 or Connectors Damaged (Worst Case)

Wires to subject pins shorted to 24VDC from CB1565 or 28VAC from CB544. See Figure 4.1-15 for power paths.

(4) Cable 35-5531 or Connectors Damaged

Wires to subject pins shorted to 24VDC from CB1565 or CB1566 on 28VDC from CB544 or CB585. See Figure 4.1-15 or 4.1-16 for power paths.

(5) DCU/9A Testor or Connector Damaged

Wires to subject pins shorted to 24VDC from CB1565 or 28VAC from CB544. See Figure 4.1-15 for power paths.

CLIP-IN ASSEMBLY PINS
C, f, Z & a
CIRCUIT ANALYSIS PACKAGE

4.1.6.4 Circuit Analysis Package, Weapons Interface Pins C, f, Z, a of Connectors J11, J12, J13 and J14 on A114 Clip-In Assembly and Cable in Forward Bomb Bay

These interfaces are shown in Figure 5-2, T.O. 11N-H5035-2 (change 4) Copy attached below. Maximum current available to pins C, f, Z and a in a normal environment is 0 amps. Worst case current at 24VDC in an abnormal (faulted) environment would be 218 amps for pin f and 110 amps for pin C, Z and a, assuming the pins grounded at the weapon and shorted to power at J2065/P752 connector.

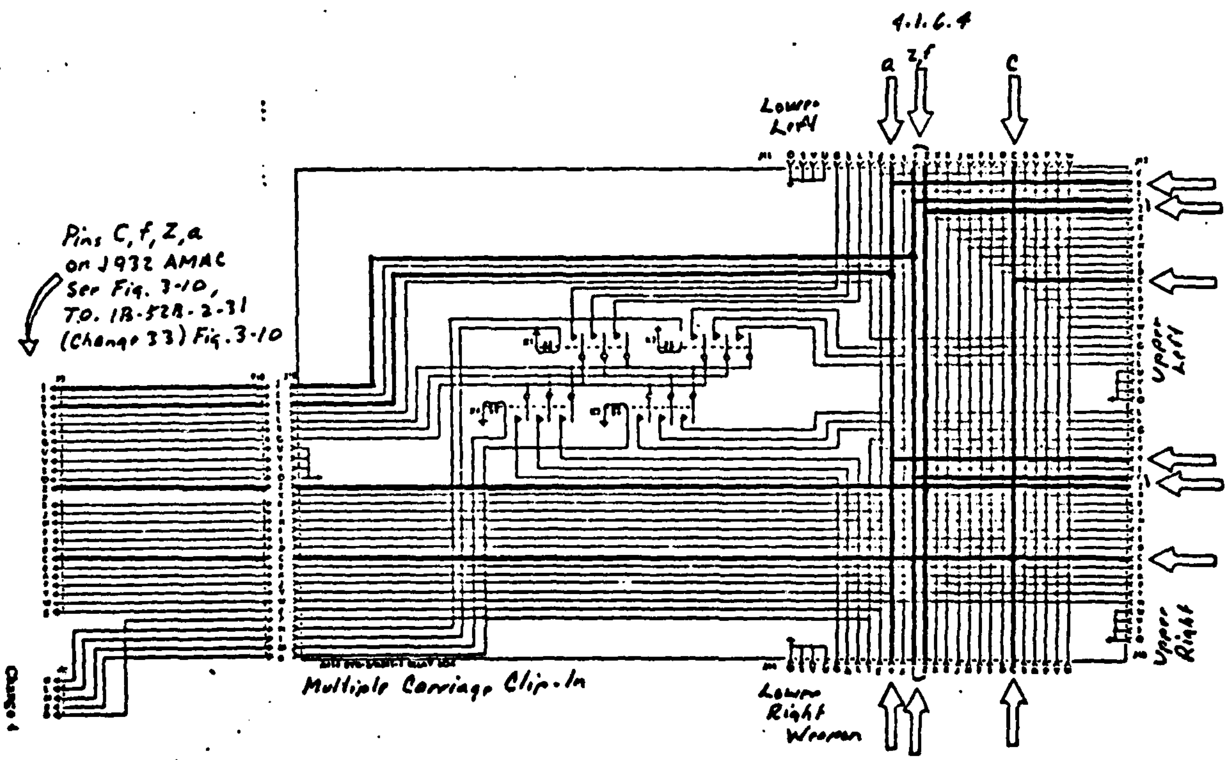


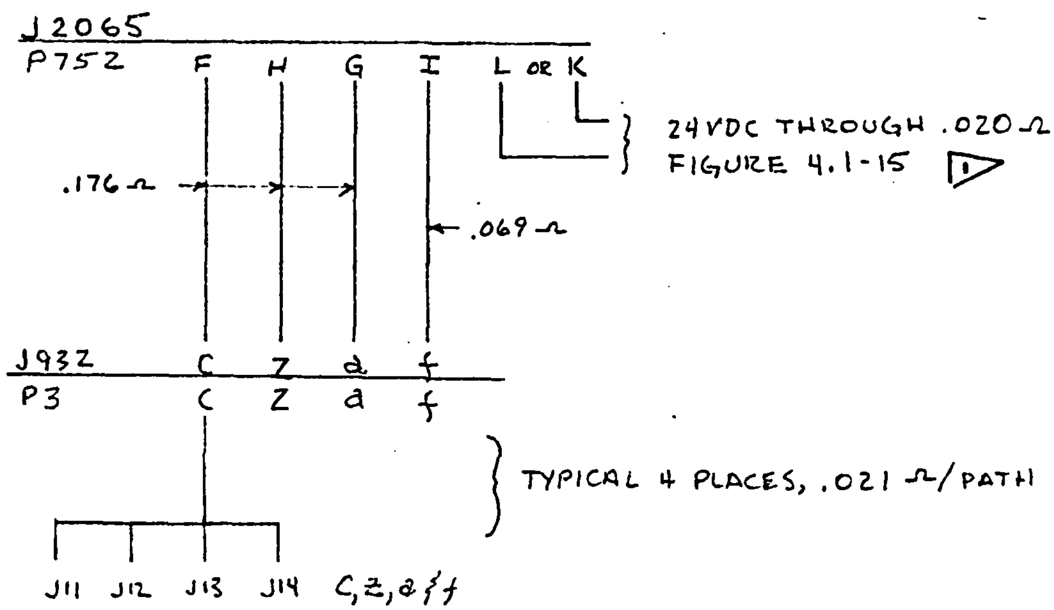
Figure 5-2. Control and Monitor Schematic

TO 11N-H5035-2

4.1.6.4 (Continued)

c. Worst Case Path and Calculations

Reference Path ③ Cable 25-7410 or Connectors Damaged.



Pin f — Total resistance = .110 Ω

V_{OC} = 24VDC

$I_{SC} = \frac{24}{.110} = \underline{218}$ Amps

Time = less than 0.8 seconds.

Pins C, Z, & a — Total resistance = .217 Ω

V_{OC} = 24VDC

$I_{SC} = \frac{24}{.217} = \underline{110}$ amps

Time = 1.1 seconds maximum.

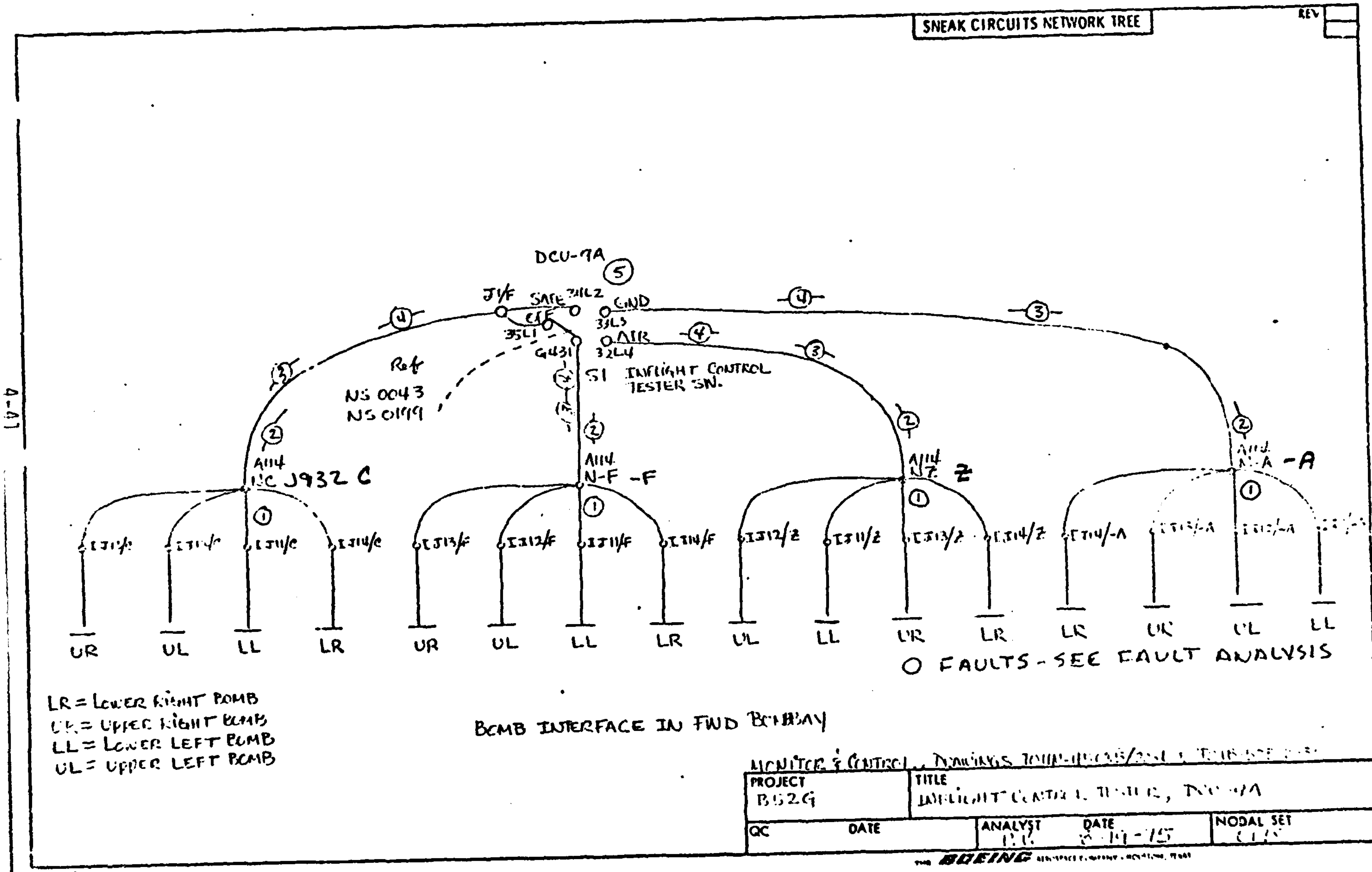
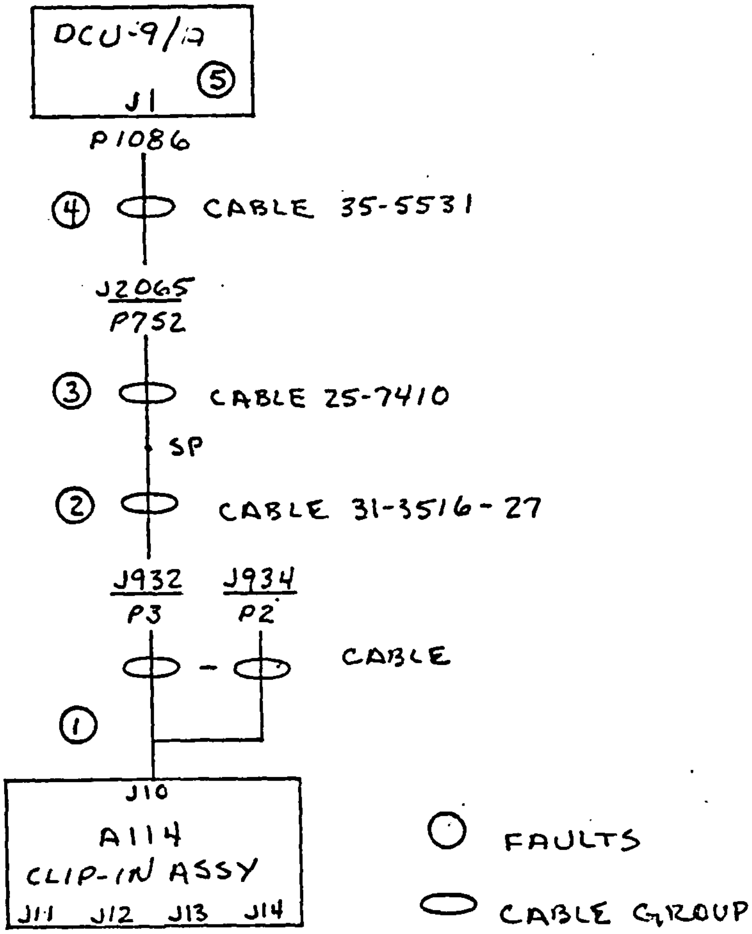


Figure 4.1-13 Network Tree No. 0198



CABLE DRAWING

FIGURE 4.1-14

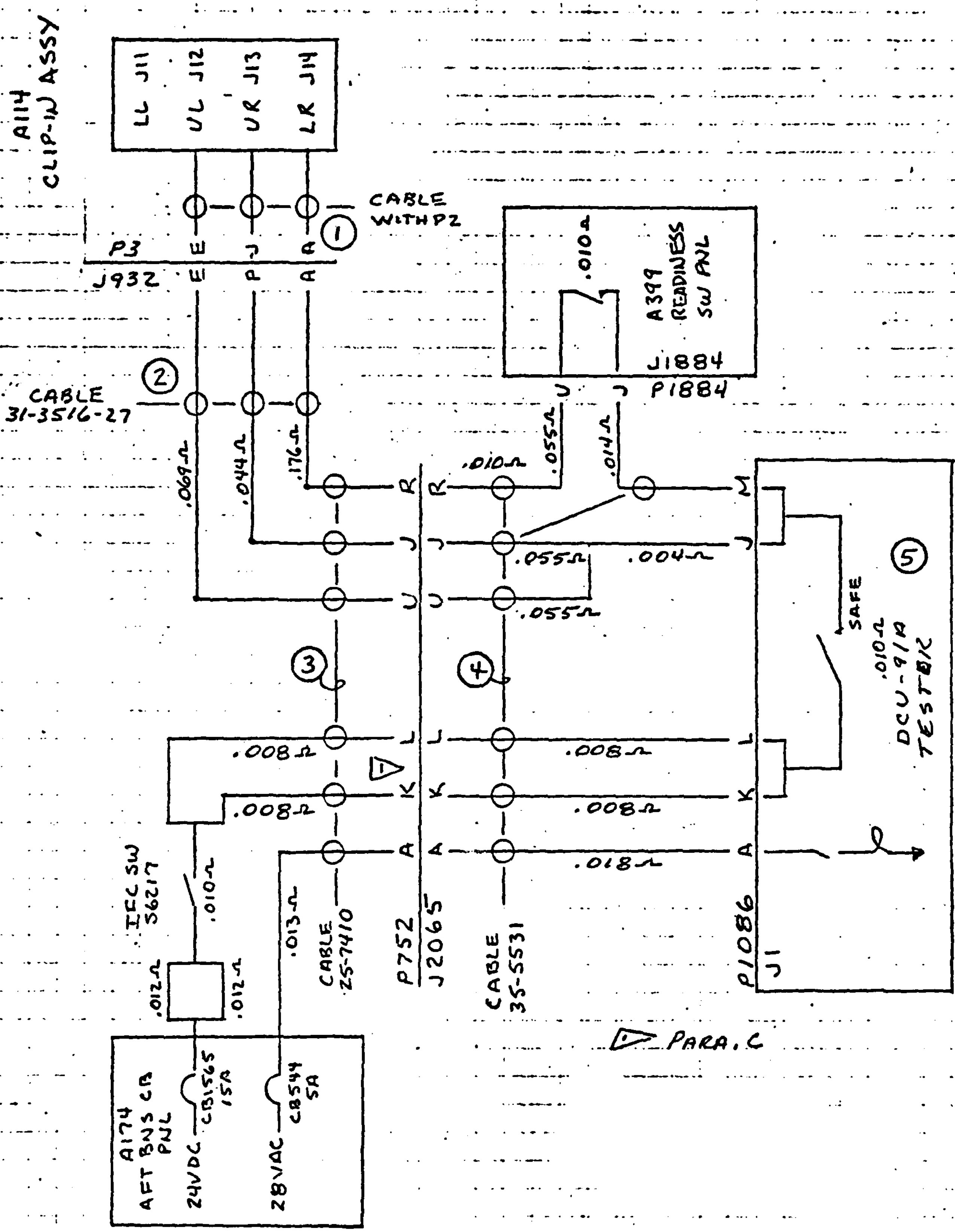


Figure 4.1-15, Power Paths Through DCU-9/A Tester

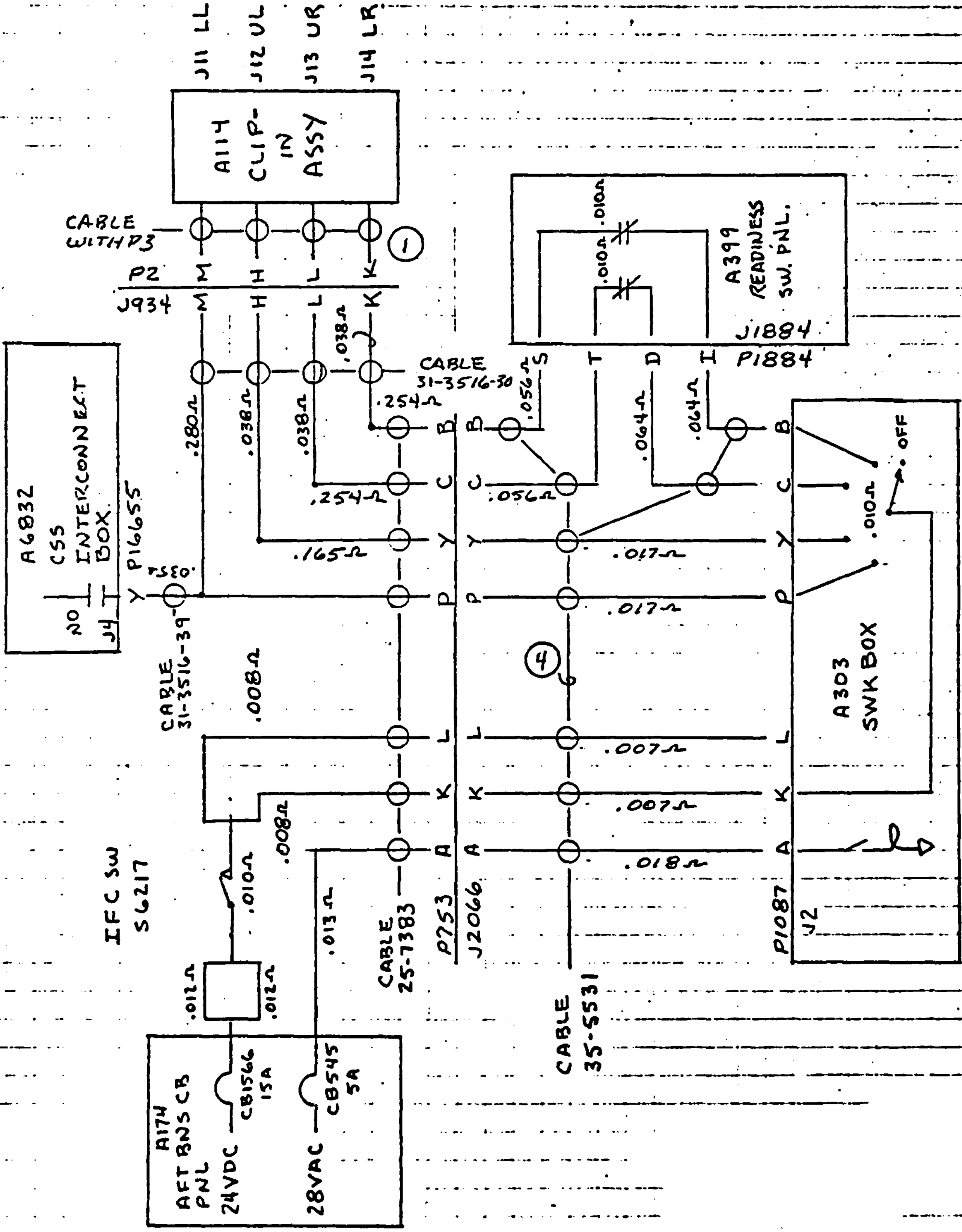
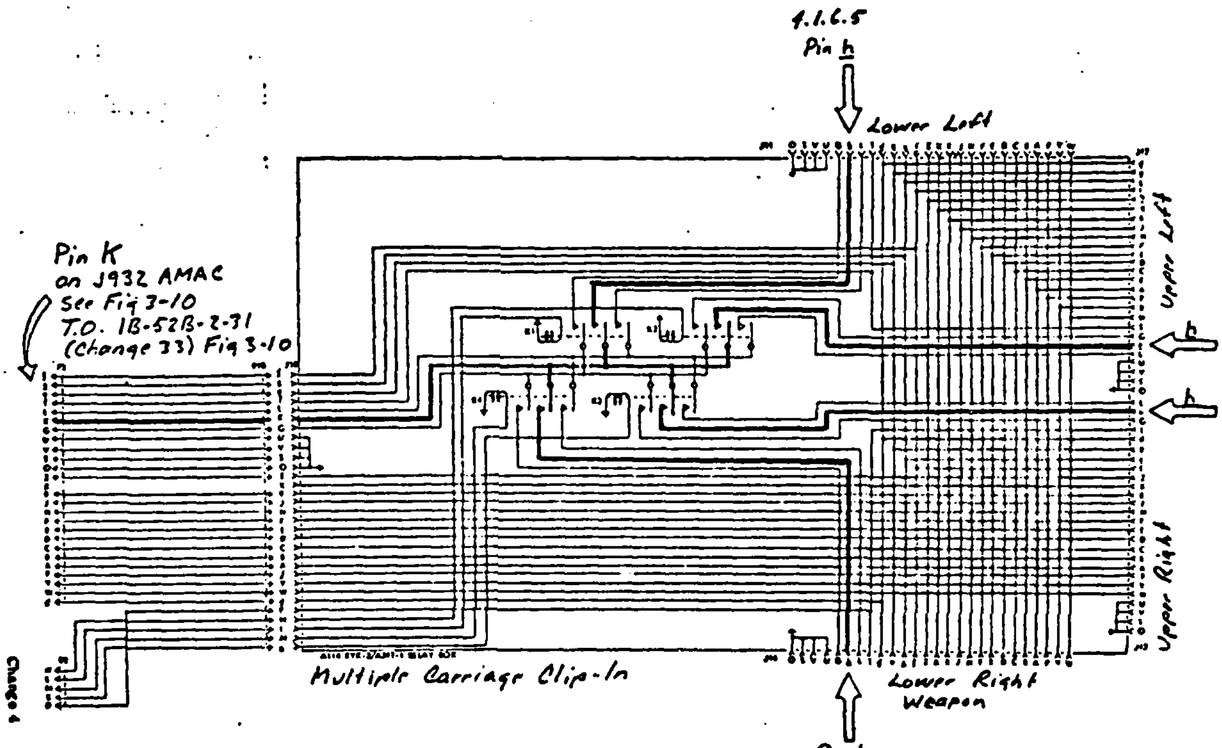


Figure 4.1-16, Power Paths Through DCU-9/A Tester

CLIP-IN ASSEMBLY PIN h
CIRCUIT ANALYSIS PACKAGE

4.1.6.5 Circuit Analysis Package, Weapon Interface Pin h of Connectors J11, J12, J13 and J14 on A114 Clip-In Assembly and Cable in Forward Bomb Bay

These interfaces are shown in Figure 5-2, T.O. 11N-H5035-2 (Change 4) - copy attached below. Note that Pin h connects to cable Pin K through relay contacts. Maximum current available to pin h in a normal environment is 0 amps. Worst case current at 24VDC in an abnormal (faulted) environment would be 152 amps assuming the pin grounded at the weapon and the SWK Box not switched "Off". With the SWK "off", the relay contacts in A114 would be open.



HRU-981/A

Figure 5-2. Control and Monitor Schematic

4.1.6.5 (Continued)

a. Normal Power and Load Analysis

From examination of Figure 4.1-17, Network Tree 201/248, normal open circuit voltage = 0V; short circuit current = 0A.

b. Fault Analysis

The following postulated faults were analyzed using Network Tree 201/248 and Figure 4.1-18, Cable Drawing.

(1) Clip-In Assembly or Connector Damaged

Wires to subject pins shorted to 24VDC from CB1565 or CB1566 during Radar Navigator testing using DCU-9/A and the SWK Box. Relay contacts (K1, K2, K3 and K4) in A114 are only closed during this period. Voltage sources are shown in Figures 4.1-19 or 4.1-20.

(2) Connector J932/P3 or Cable 31-3516-27 Damaged

Wires to subject pins shorted to 24VDC from CB1565 during testing. Voltage source is shown on Figure 4.1-19.

(3) Connector J935 or Cable 31-3516-28 Damaged

Connector is located in Aft Bomb Bay and is not connected and unpowered.

(4) Cable 31-3516-37 Damaged

Wires to subject pins shorted to 24VDC from CB1566 during testing. Voltage source is shown on Figure 4.1-20.

(5) Cable 25-7410 or Connector P 752/J2065

Wires to subject pins shorted to 24VDC from CB1565 or 28VAC from CB544 during testing. Voltage sources are shown on Figure 4.1-19.

(6) Cable 35-5531 Damaged

Wires to subject pins shorted to 24VDC from CB1565 or CB1566, or 28VAC from CB545. Voltage sources are shown on Figures 4.1-19 and 4.1-20.

4.1.6.5b (Continued)

(7) <u>Readiness Switch Panel(A399) or Connector Damaged</u>

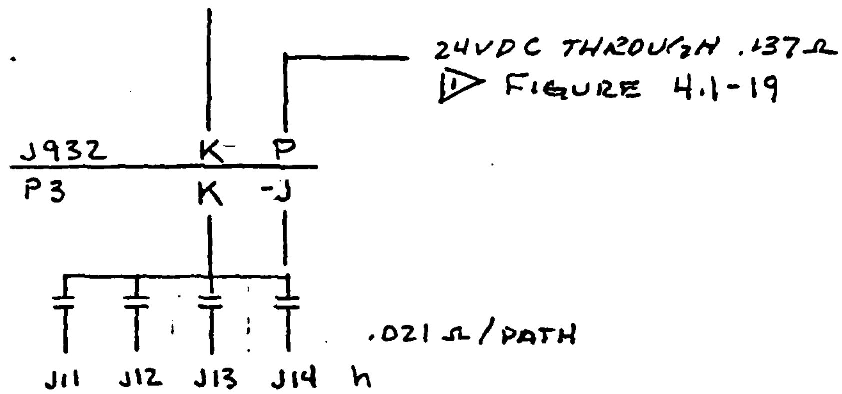
Wires to subject pins shorted to 24VDC from CB1565 or CB1566 during testing. Voltage sources are shown on Figures 4.1-19 and 4.1-20.

(8) <u>DCU/9A Tester or Connector Damaged</u>

Wires to subject pins shorted to 24VDC from CB1565 or 28VAC from CB544. Voltage sources are shown on Figure 4.1-19.

c. Worst Case Path and Calculations

Reference path (1), Clip-In Assy Damaged



Total Resistance of Path = .158 Ω

V_{OC} = 24VDC

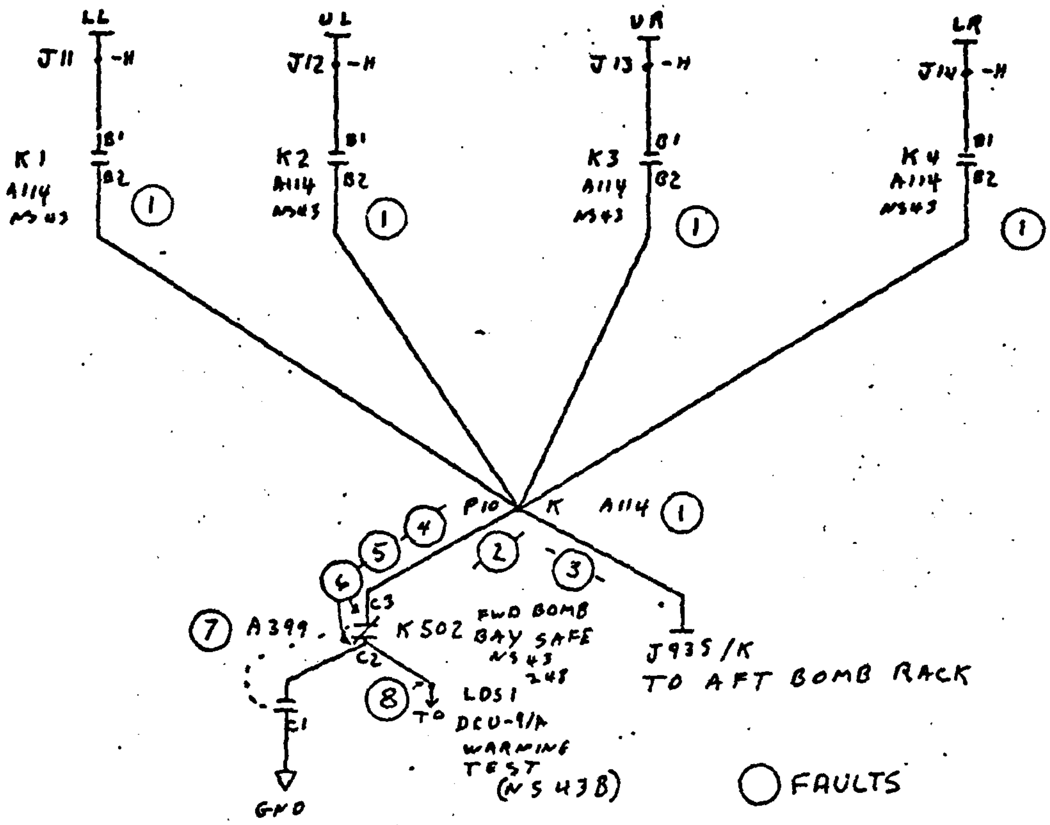
$I_{SC} = \frac{24}{.158}$ = 152 Amps

Time = Less than 0.8 seconds. Current is greater than 1000% circuit breaker rating.

SNEAK CIRCUITS NETWORK TREE

REV

BOMB INTERFACE



LL - LOWER LEFT BOMB
UL - UPPER LEFT BOMB
UR - UPPER RIGHT BOMB
LR - LOWER RIGHT BOMB

Note: Relay contacts shown in A114 closed only during testing.

CONTROL MONITOR SYS

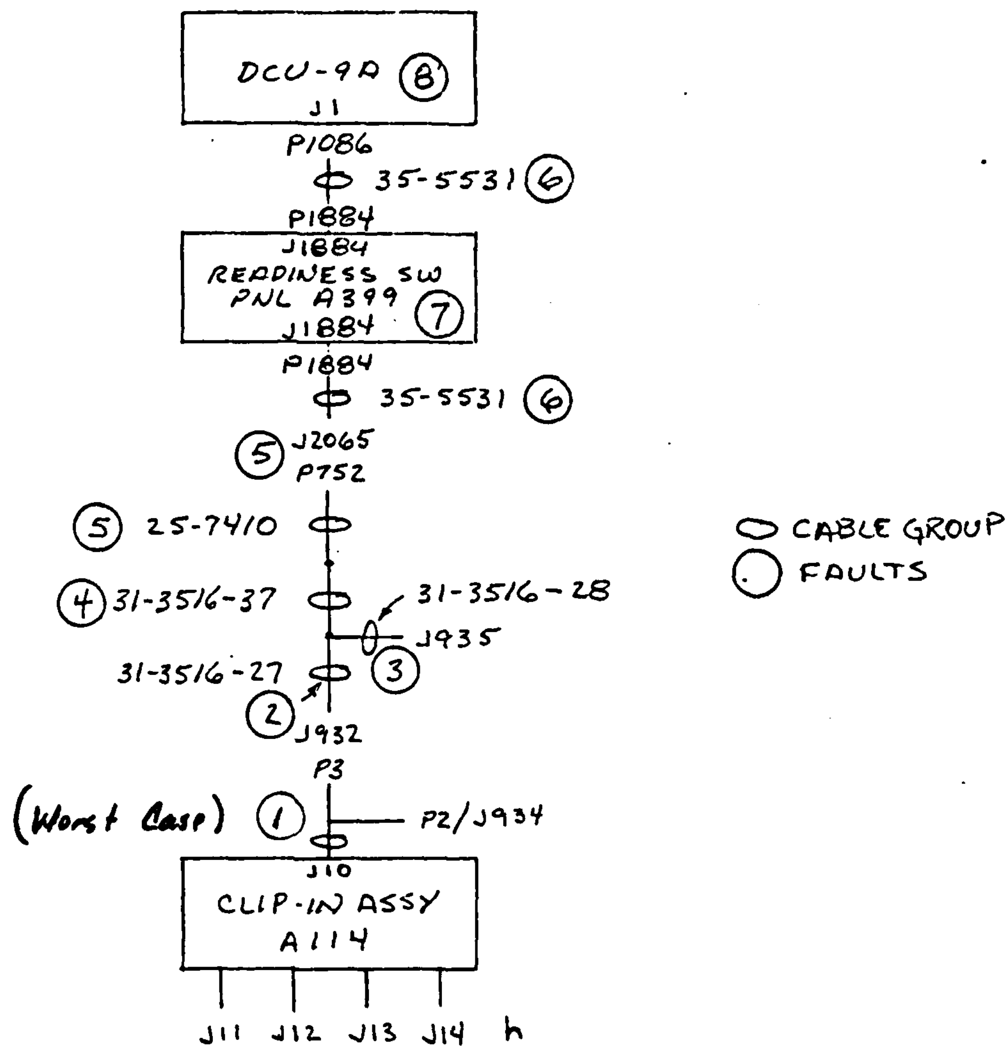
DWG A8F00

PROJECT	TITLE		
B-52 G	FWD BOMB BAY SAFING		
QC	DATE ?-??-75	ANALYST C. P. ?????? DATE 8-19-75	NODAL SET 201 248

HOU-205

AEROSPACE COMPANY - HOUSTON, TEXAS

Figure 4.1-17 Network Tree No. 201/248



CABLE DRAWING

FIGURE 4.1-18

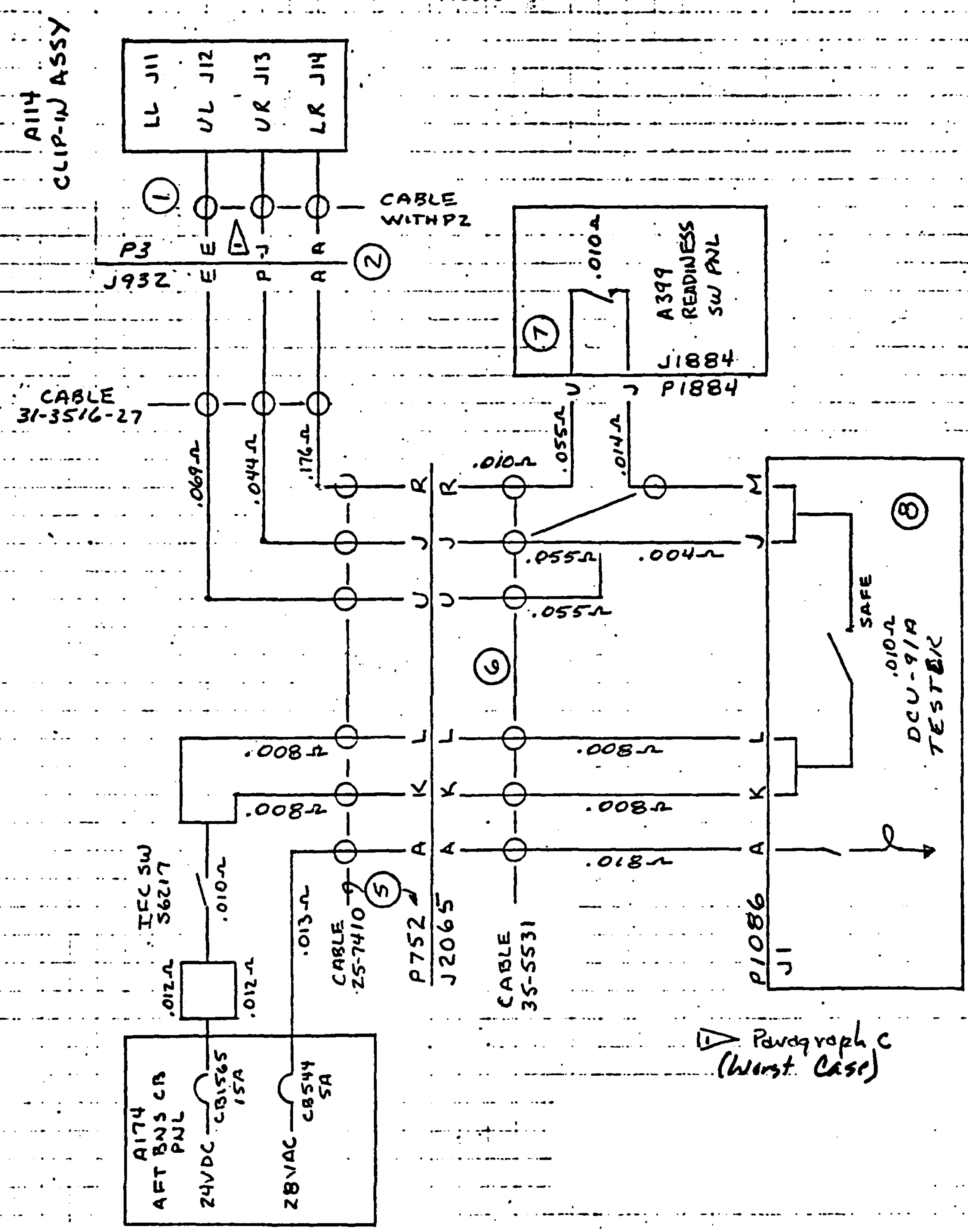


Figure 4.1-19 Power Paths Through DCU-9/A Tester

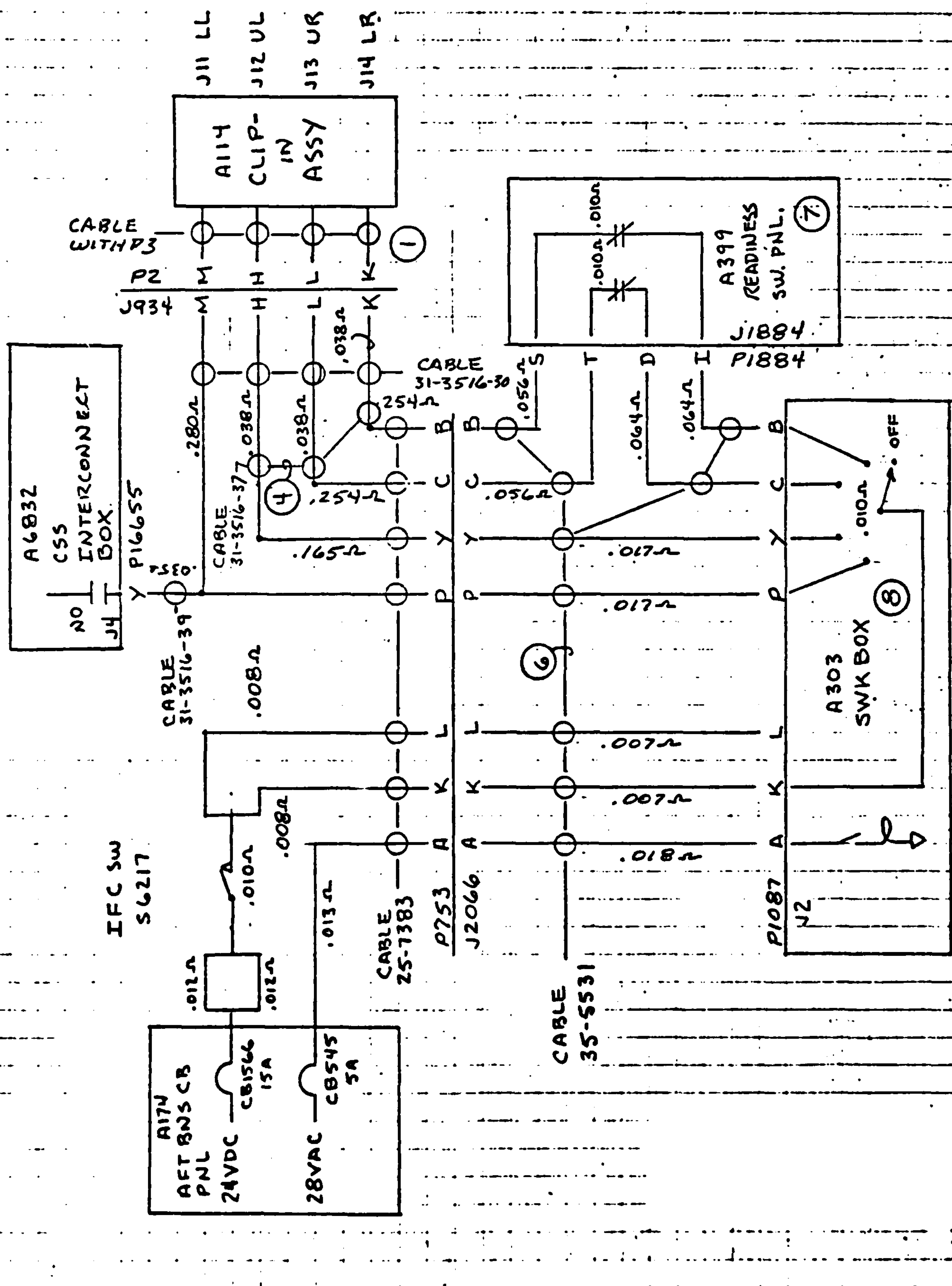


Figure 4.1-20 Power Paths Through SWK Box

CLIP-IN ASSEMBLY PINS
F, H, J & c
CIRCUIT ANALYSIS PACKAGE

4.1.6.6 Circuit Analysis Package, Weapon Interface Pins F, H, J & c of Connectors J11, J12, J13 and J14 on A114 Clip-In Assembly and Cable in Forward Bomb Bay

These interfaces are shown in Figure 5-2, T.O. 11N-H5035-2 (Change 4) - copy attached below. Maximum current available to these pins in a normal environment is 0 amps. Worst case current at 24VDC in an abnormal (faulted) environment assuming the pins grounded at the weapon interface would be 109 amps for pins F, J & c and 0 amps on pin H. The only fault that can supply current to pin H occurs during Radar Navigator Testing using the DCU-9/A. In this case 150 amps could be supplied but only for a brief period. This may result when the Clip-In Assembly is damaged.

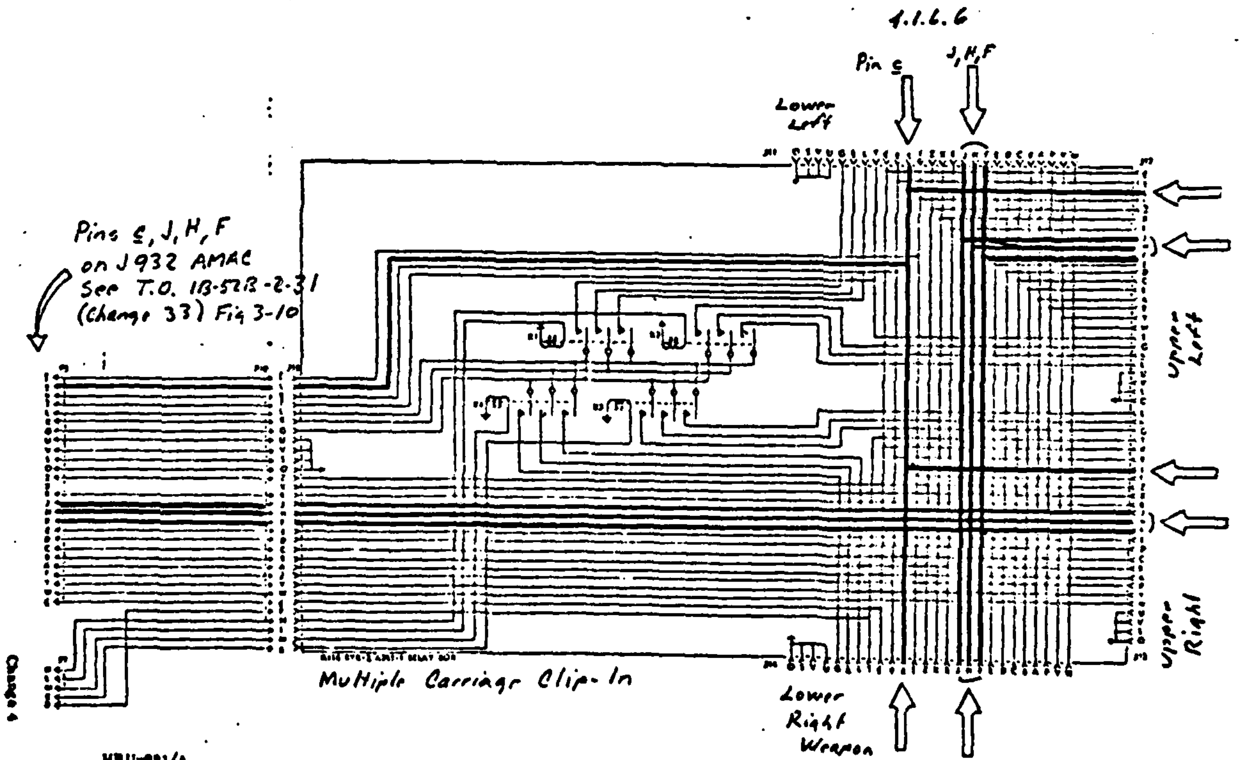


Figure 5-2. Control and Monitor Schematic

Change 4

5-3/(5-4 blank)

T.O. 11N-H5035-2

4.1.6.6 (Continued)

a. Normal Power and Load Analysis

From examination of Figure 4.1-21, Network Tree 0199, normal open circuit voltage = 0V; Short circuit current = 0A.

b. Fault Analysis

The following postulated faults were analyzed using Network Tree 0199 and Figure 4.1-22, Cable Drawing.

(1) Clip-In Assembly or Connector Damaged

Wires to subject pins shorted to 24VDC from CB1565 or CB1566 during testing using DCU-9/A and SWK Box. Voltage sources are shown on Figures 4.1-23 and 4.1-24.

(2) Connector J932/P3 or Cable 31-3516-27 Damaged

Wires to subject pins shorted to 24VDC from CB1565 during testing. Voltage source is shown on Figure 4.1-23.

(3) Cable 25-7410 or Connector P752/J2065 Damaged

Wires to subject pins shorted to 24VDC from CB1565 or 28VAC from CB544. Voltage sources are shown on Figure 4.1-23.

(4) Cable 35-5531 Damaged

Wires to pins F, J & c shorted to 24VDC prom CB1565 or CB1566 or 28VAC from CB544 and CB545. Voltage sources are shown on Figures 4.1-23 and 4.1-24.

(5) DCU-9/A Testor or Connector Damaged

Wires to pins F, J & c shorted to 24VDC from CB1565 or 28VAC from CB544. Voltage sources are shown on Figure 4.1-23.

(6) Cable 31-3516-28 or Connector J935 Damaged

Cable to Aft Bomb Bay is not connected and unpowered, (common with wire to Pin F).

4.1.6.6 (Continued)

(7) Cable 31-3516-37 Damaged

Wire to pin F shorted to 24VDC from CB1566 during testing. Voltage source is shown in Figure 4.1-24.

(8) Cable 31-3516-35 Damaged

Cable to CSS Interconnect Box does not normally contain voltage sources, (common with wires to pins F & H).

(9) Cable 31-3516-1

Cable from CSS Interconnect Box to Bomb Bay connectors does not normally contain voltage sources. (Common with wires to Pins F&H)

(10) CSS Interconnect Box Damaged

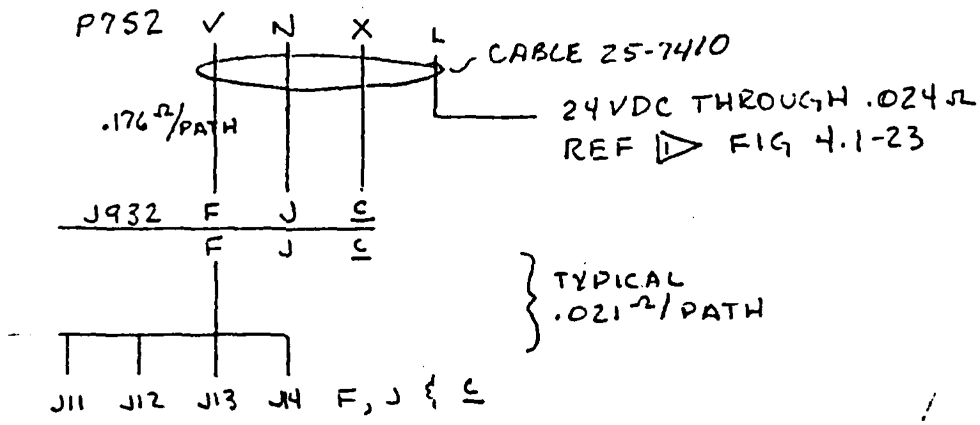
Wire to pins F & H shorted to 24VDC from CB1566. Voltage source is shown in Figure 4.1-24.

4.1.6.6 (Continued)

c. Worst Case Paths

Pins F, J & c

Reference Path③, Cable 25-7410 or Connector P752/J2065 Damaged.



Total resistance of path = .221Ω

V_{OC} = 24VDC

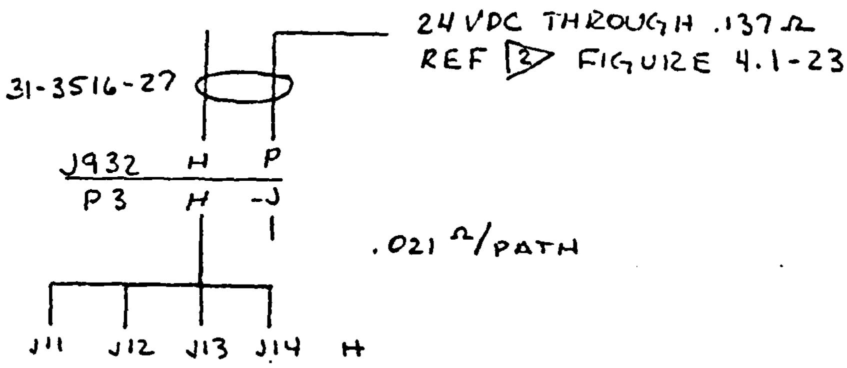
$I_{SC} = \frac{24}{.221} = \underline{109}$ A

Time = 1.2 seconds maximum for CB to open.

4.1.6.6c (Continued)

Pin H

Reference Path (1), Clip-In Assembly or Connectors Damaged.



Total Resistance of Path .158 Ω

V_{OC} = 24VDC*

I_{SC}*= $\frac{24}{.158}$ = 150 A

Time = 0.8 seconds maximum for CB to open.

* Voltage present when DCU-9/A in "SAFE"

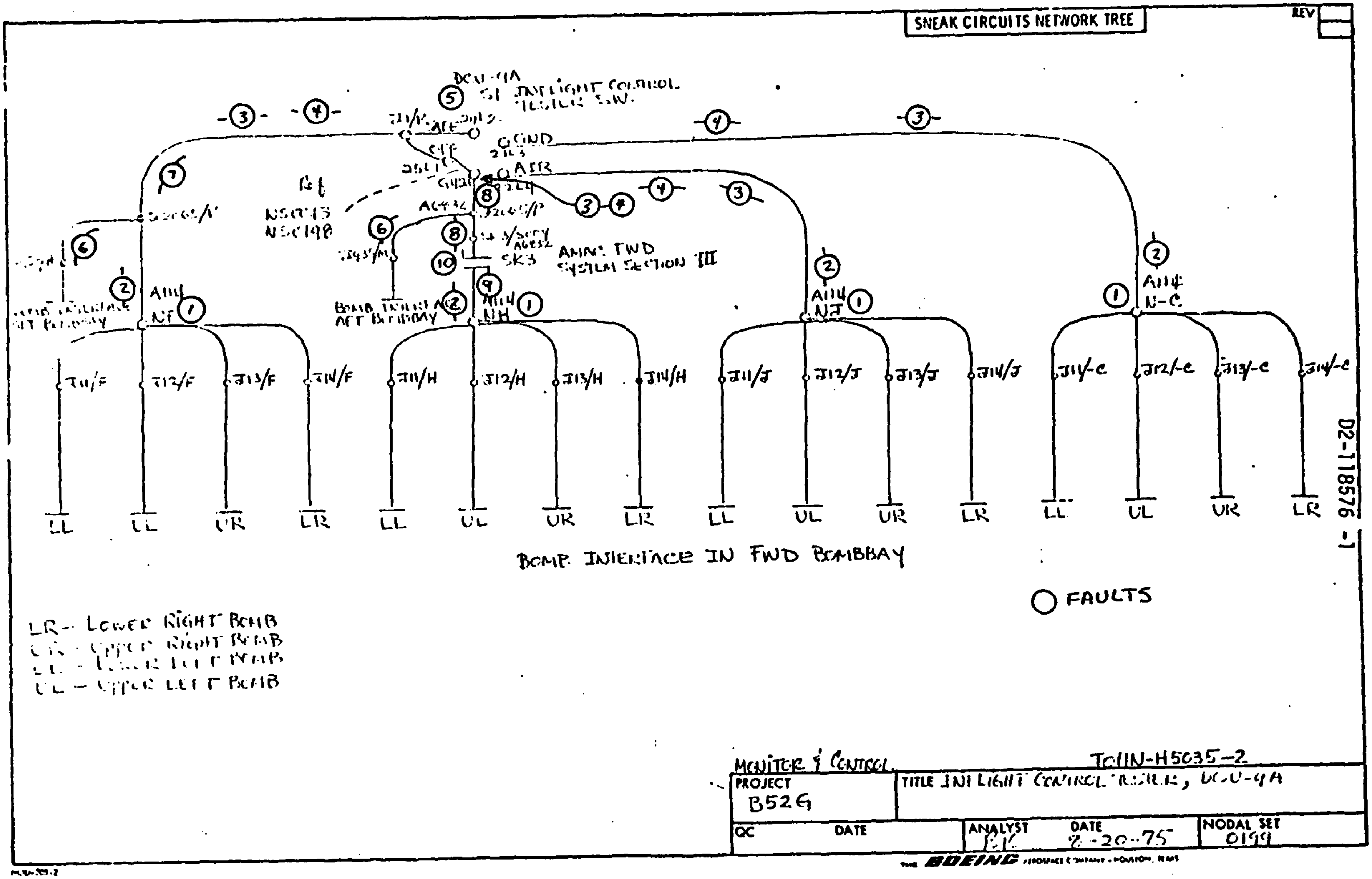


Figure 4.1-21 Network Tree No. 0199

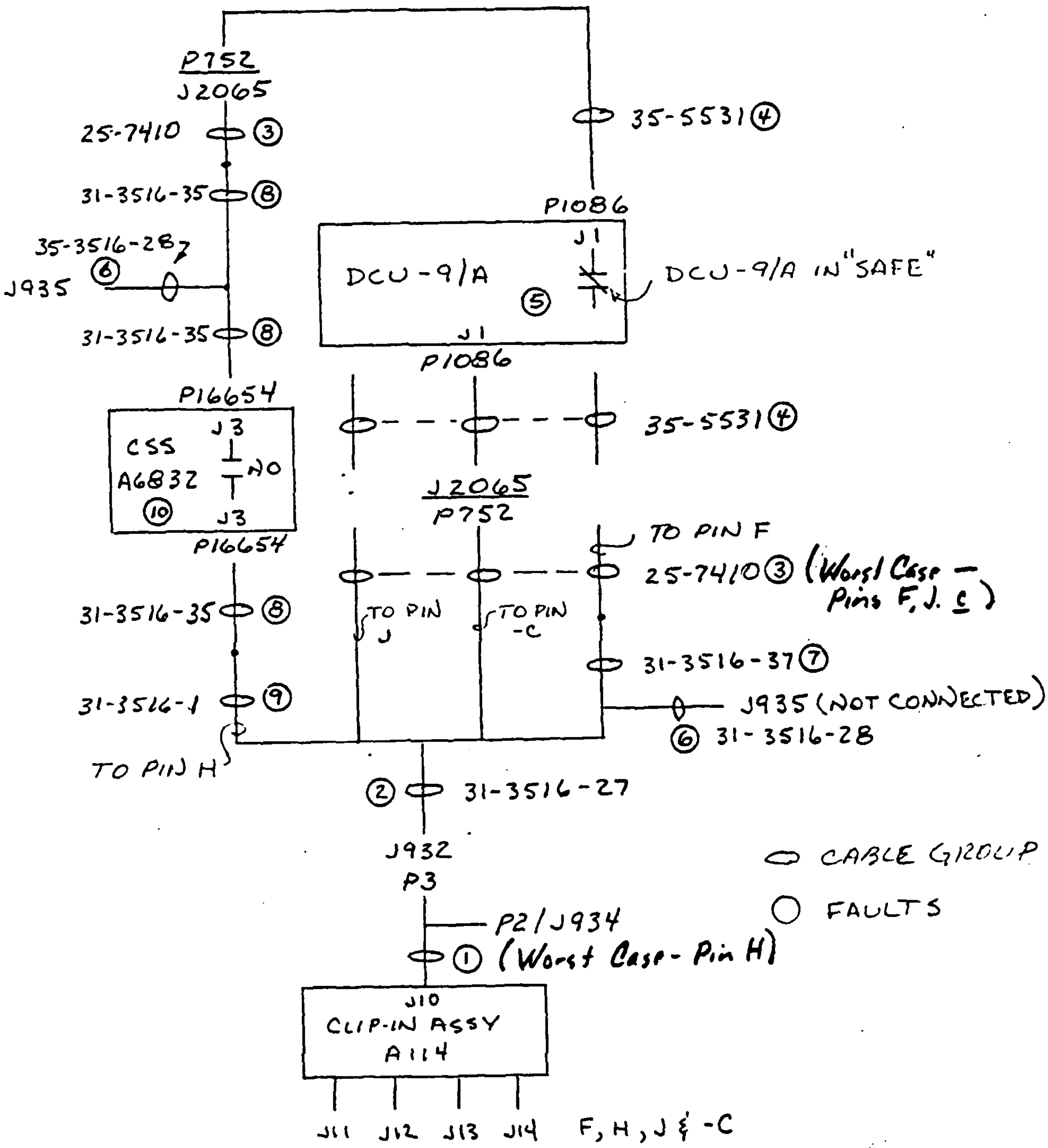


FIGURE 4.1-22

CABLE DRAWING

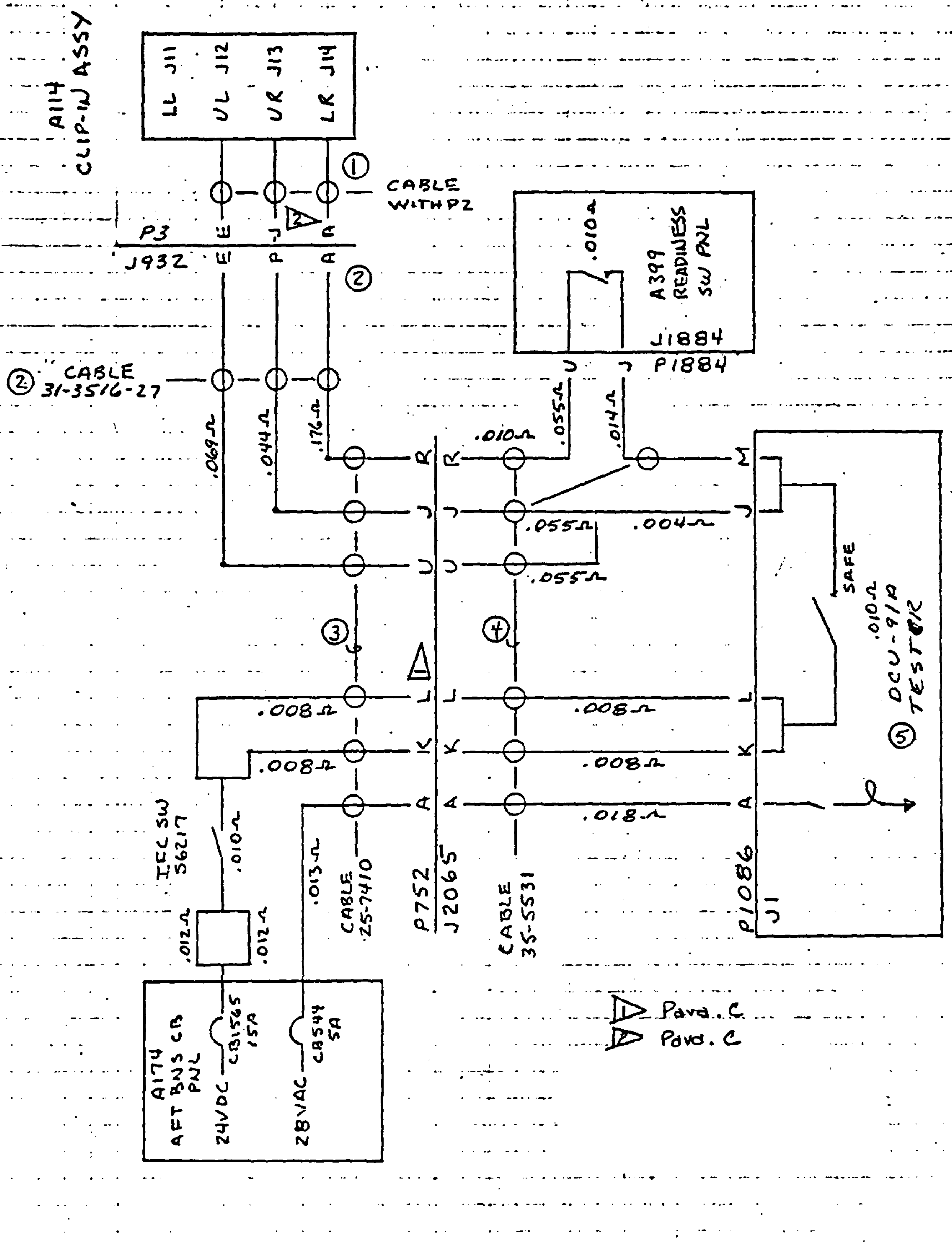


Figure 4.1-23 Power Paths Through DCU-9/A Tester

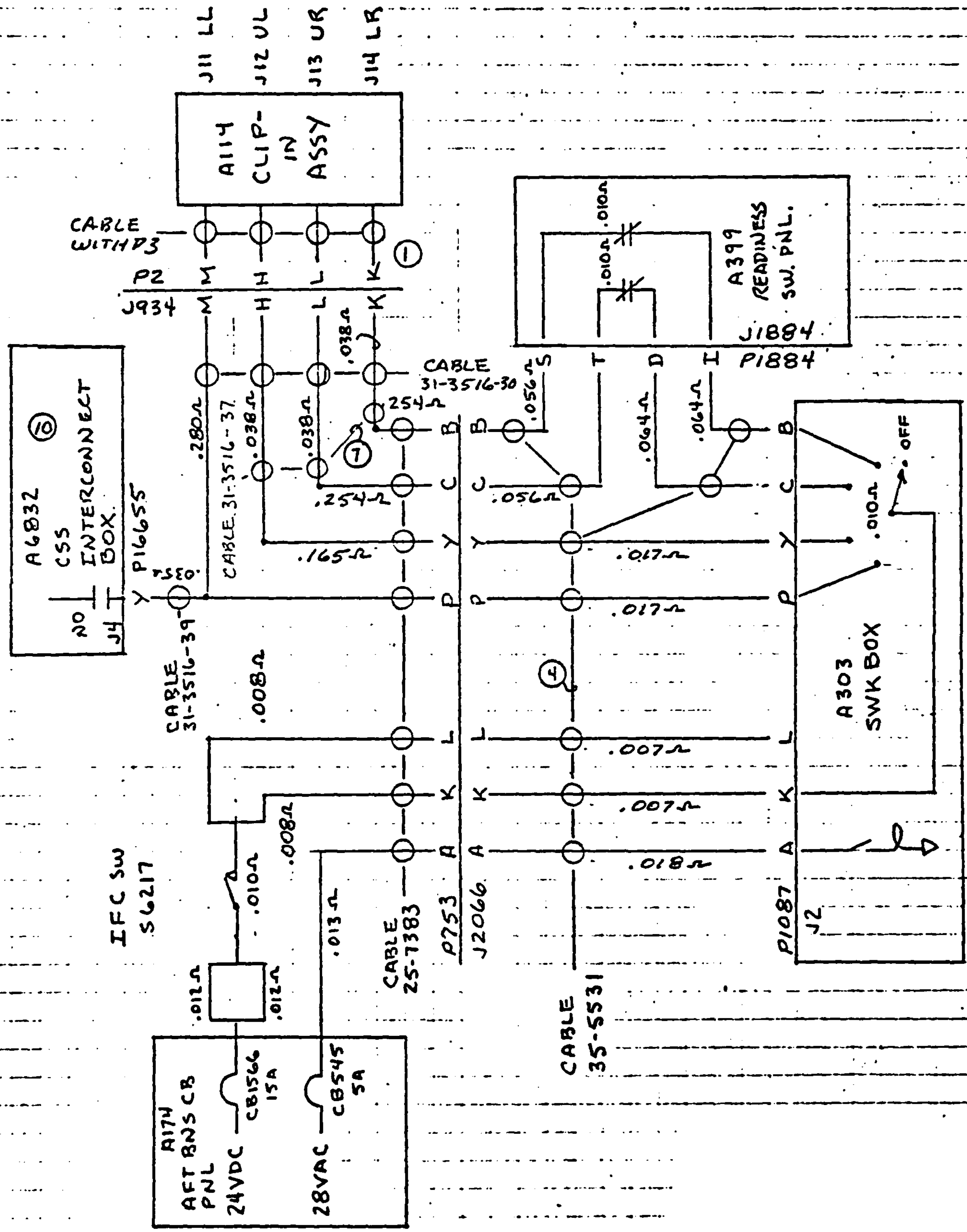
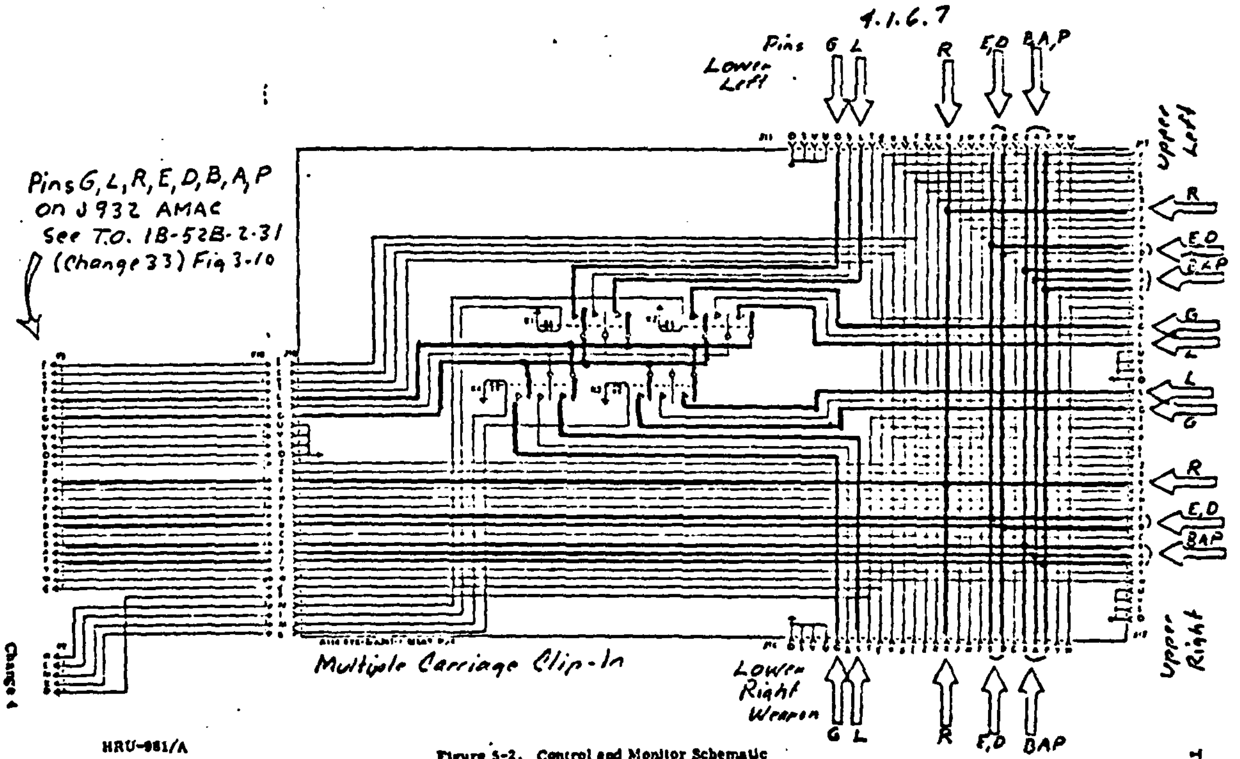


Figure 4.1-24 Power Paths Through SWK Box

CLIP-IN ASSEMBLY PINS
P, E, G, L, D, B, A & R
CIRCUIT ANALYSIS PACKAGE

4.1.6.7 Circuit Analysis Package, Weapon Interface Pins P, E, G, L, D, B, A & R of Connectors J11, J12, J13 and J14 on A114 Clip-In Assembly and Cable in Forward Bomb Bay

These interfaces are shown in Figure 5-2, T.O. 11N-H5035-2 (Change 4) - copy attached below. Maximum short circuit current available to these pins in a normal environment is 0 amps. When the DCU-9/A is switched to "SAFE", a test mode, short circuit current to Pin P is 152 amps, Pin E is 131 amps and Pin A is 75 amps at 24VDC. Worst case current at 24V in an abnormal environment to Pin P would be 258 amps, Pin E would be 211 amps, and Pin A would be 109 amps. Worst case fault current for Pins G, L, D, B & R would be 152 amps at 24V.



HRU-981/A

Figure 5-2. Control and Monitor Schematic

Change 4

5-3/(5-4 blank)

TO 11N-H5035-2

4.1.6.7 (Continued)

Worst case current at 24VDC in an abnormal (faulted) environment assuming the pins grounded would be:

Pin P - 258 Amps
E - 211 Amps
A - 109 Amps
G - 152 Amps - current available only when DCU-9/A is in "SAFE"
L - 152 Amps - current available only when DCU-9/A is in "SAFE"
D - 152 Amps - current available only when DCU-9/A is in "SAFE"
B - 152 Amps - current available only when DCU-9/A is in "SAFE"
R - 152 Amps - current available only when DCU-9/A is in "SAFE"

a. Normal Power and Load Analysis

From examination of Figure 4.1-25, Network Tree 43B, open circuit voltage for all subject pins would be = 0 amps. Short circuit current = 0A. With DCU-9/A switched to "SAFE", a test mode, a power path is established as shown in Figure 4.1-27, open circuit voltage and short circuit current for pins P, E and A in this mode would be:

Pin P

Total Resistance of path = .158Ω
V_{OC} = 24VDC
$I_{SC} = \frac{24}{.158} = 152$ A

Pin E

Total Resistance of path = .183Ω
V_{OC} = 24VDC
$I_{SC} = \frac{24}{.183} = 131$ A

Pin A

Total Resistance of path = .320Ω
V_{OC} = 24VDC
$I_{SC} = \frac{24}{.320} = 75$ A

b. Fault Analysis

The following postulated faults were analyzed using Network Tree 43B and Figure 4.1-26, Cable Drawing.

4.1.6.7b (Continued)

(1) Clip-In Assembly or Cable Damaged (Worst Case - Pins G & L)

Wires to subject pins shorted to 24VDC from CB1565 or CB1566 during testing with DCU-9/A tester and SWK Box. Voltage sources are shown on Figures 4.1-27 and 4.1-28.

(2) Cable 31-3516-27 or Connector J932/P3 (Worst Case - Pins D, B &R) Damaged

Wires to subject pins shorted to 24VDC from CB1565 during testing. Voltage source is shown on Figure 4.1-27.

(3) Cable 31-3516-1 Damaged

Cable runs between CSS and weapons interface. The CSS is normally open therefore no voltage potentials are present. This cable is common with wires to pins B, D & R.

(4) CSS Interconnect Box (A6832) or Connectors Damaged

Wires to pins B, D & R shorted to 24VDC from CB1566 during testing. Voltage source is shown on Figure 4.1-28.

(5) Cable 31-3516-35 Damaged

Cable to CSS Interconnect Box (A6832) does not normally contain voltage sources (common with wire to pin R).

(6) Cable 31-3516-28 Damaged

Cable to Aft Bomb Bay is open and does not contain voltage sources (common with wire to pin L).

(7) Cable 31-3516-37 Damaged

Wire to pin L shorted to 24VDC from CB1566 during testing. Voltage source is shown on Figure 4.1-28.

(8) Cable 25-7410 or Connector P752/J2065 Damaged (Worst Case-pins P,E & A)

Wires to pins A, E, G, L & P shorted to 24VDC from CB1565 or 28VAC from Voltage sources are shown on Figure 4.1-27.

(9) Cable 35-5531 Damaged

Wires to pins A, E, G, L & P shorted to 24VDC from CB1565 or CB1566, or 28VAC from CB544 or CB545. Voltage sources are shown on Figures 4.1-27 or 4.1-28.

(10) DCU-9/A Tester or Connector Damaged

Wires to pins A, E, G, L & P shorted to 24VDC from CB1565 or 28VAC from CB544. Voltage sources are shown on Figure 4.1-27.

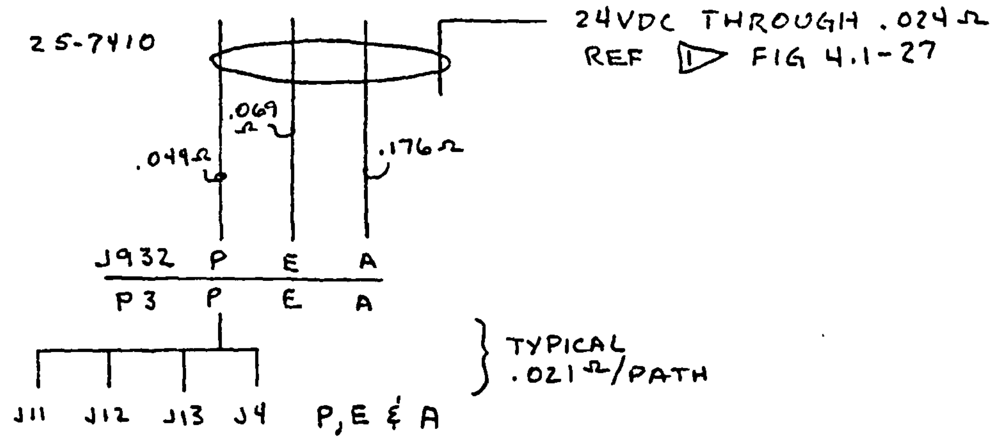
(11) Readiness Switch Panel (A399) or Connector Damaged

Wires to pins G, L & A shorted to 24VDC from CB1565 or CB1566 during testing. Voltage sources are shown on Figures 4.1-27 and 4.1-28.

4.1.6.7 (Continued)

c. Worst Case Paths

Pins P, E & A Reference Path ⑧ Cable 25-7410 Damaged.



Pin P Total resistance of path = .089 Ω

V_{OC} = 24VDC

$I_{SC} = \frac{24}{.089} = \underline{258}$ A

Time = Less than 0.8 seconds. Current exceeds 1000% rating of CB.

Pin E Total resistance of path = .114 Ω

V_{OC} = 24VDC

$I_{SC} = \frac{24}{.114} = \underline{211}$ A

Time = Less than 0.8 seconds. Current exceeds 1000% rating of CB.

Pin A Total resistance of path = .221 Ω

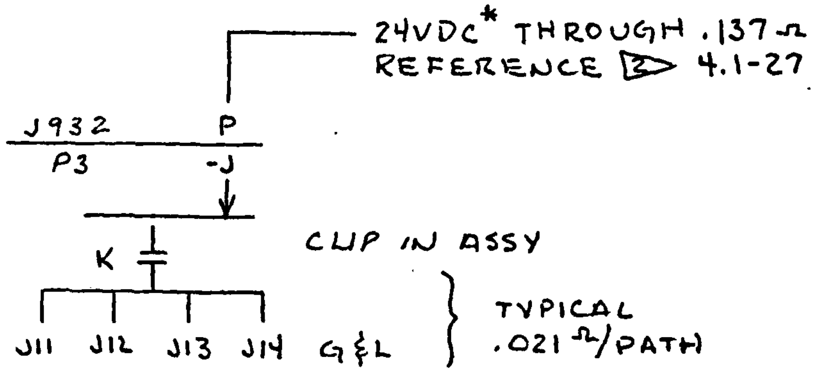
V_{OC} = 24VDC

$I_{SC} = \frac{24}{.221} = \underline{109}$ A

Time = Less than 1.4 seconds.

4.1.6.7c (Continued)

Pins G & L Reference Path (1) Clip-In Assembly Damaged



Total Resistance of Path = .158 Ω

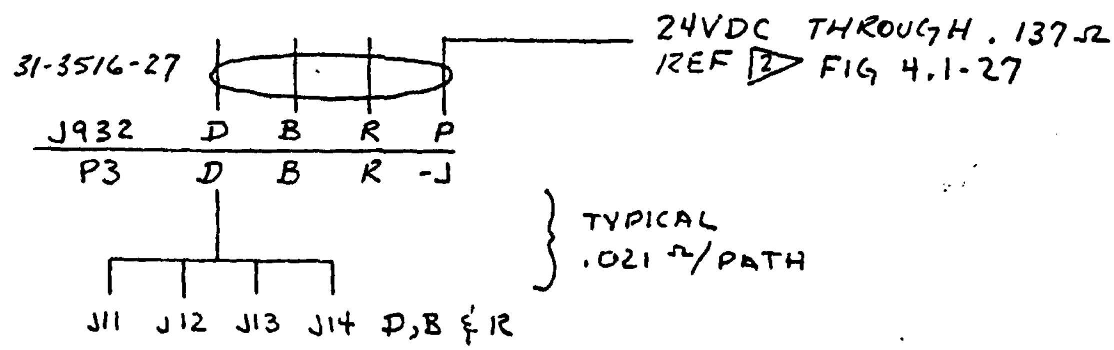
V_{OC} = 24VDC

$I_{SC} = \frac{24}{.158} = \underline{152}$ A

Time = Less than 0.8 seconds. Current exceeds 1000% rating of CB.

Note: Relay K closed only when SWK Box is in "UL", "LL", "UR" or "LR".

Pins D, B & R Reference Path (2) Cable 31-3516-27 or Connector J932/P3 Damaged.



4.1.6.7c (Continued)

Total Resistance of Path = .158 Ω

V_{OC} = 24VDC

I_{SC} = 152 A

Time = Less than 0.8 seconds. Current exceeds 1000% rating of CB.

* Voltage source is present only when DCU-9/A is in "SAFE" during Radar Navigator Testing.

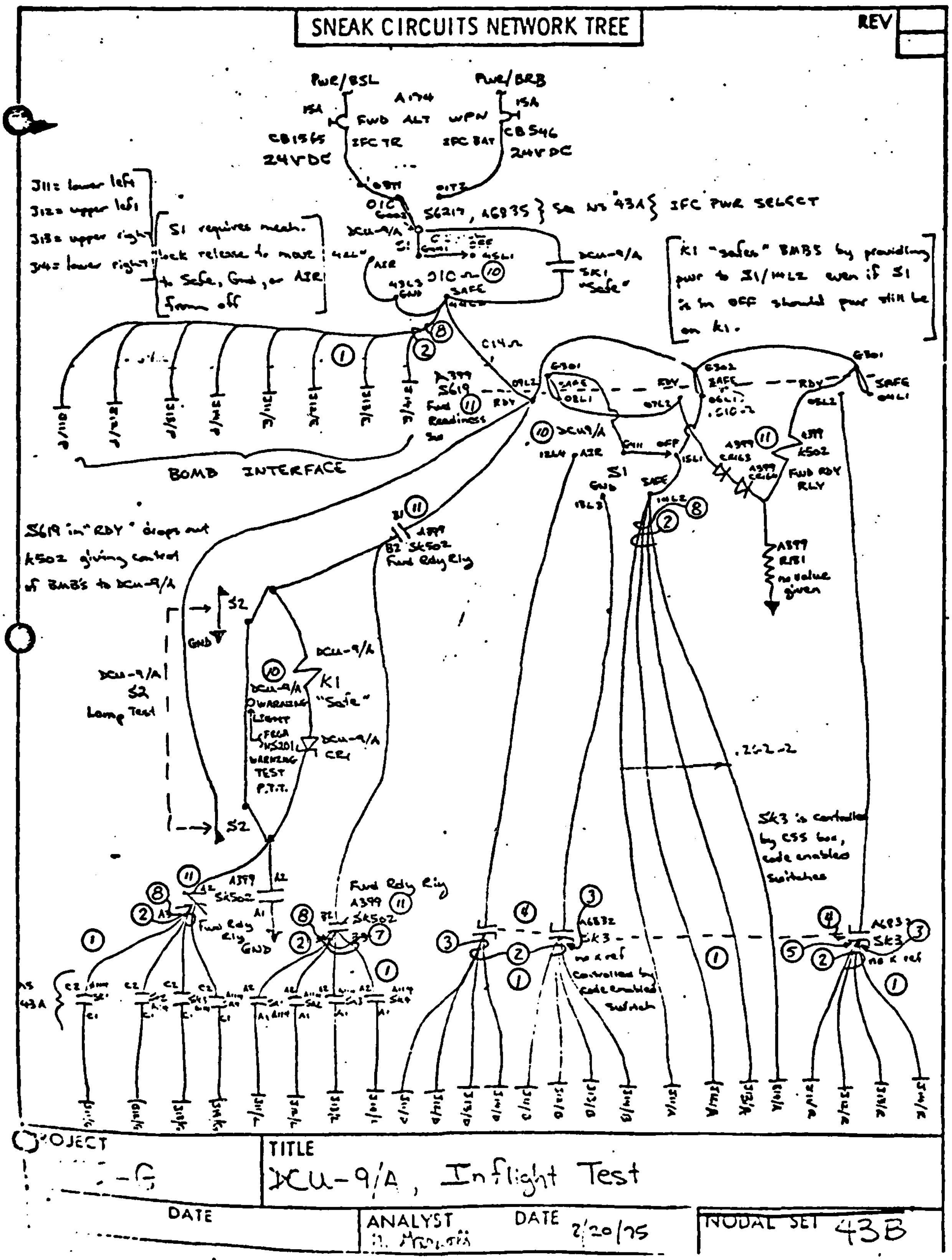
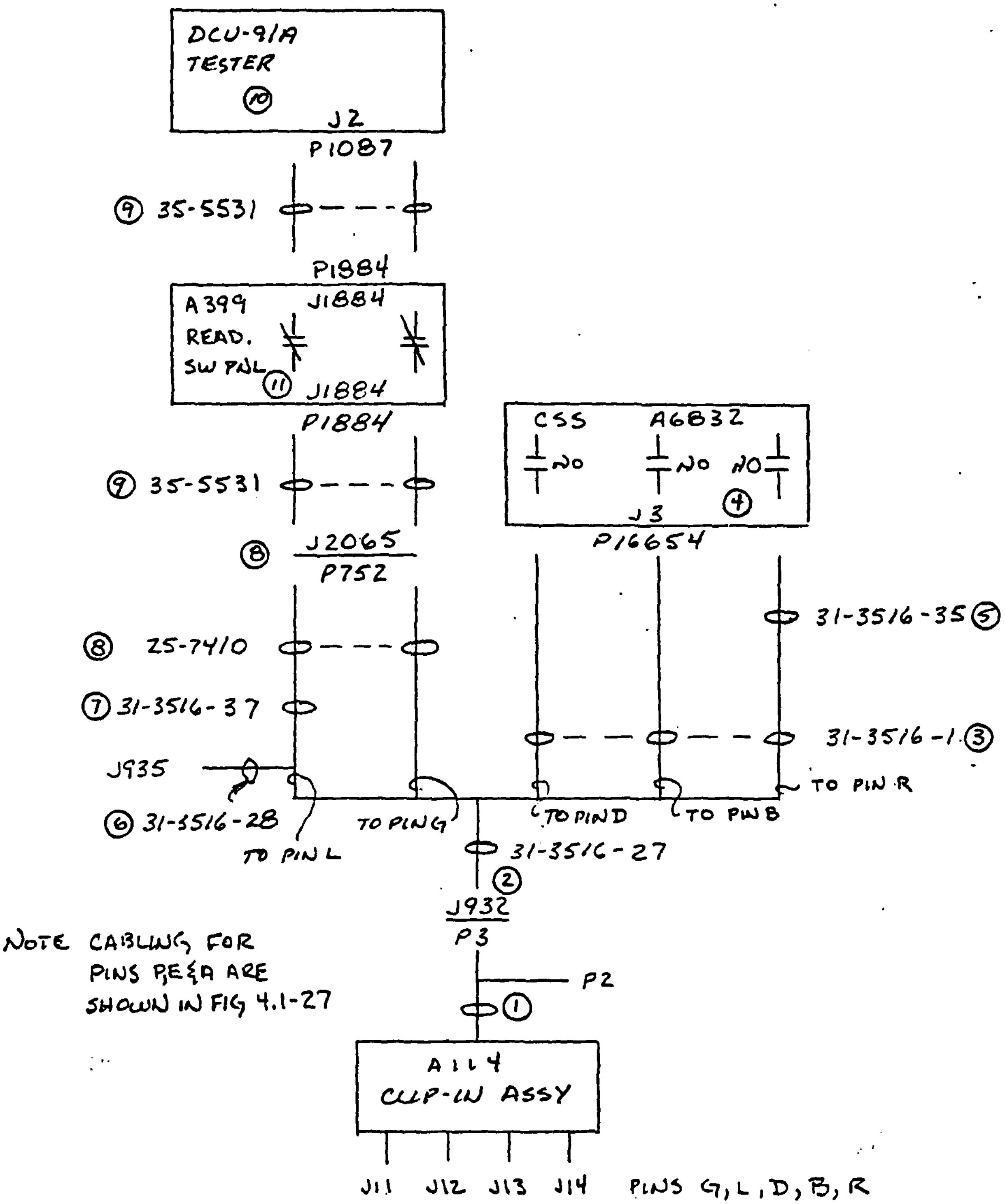


Figure 4.1-25 Network Tree No. 43B



CABLE DRAWING

FIGURE 4.1-26

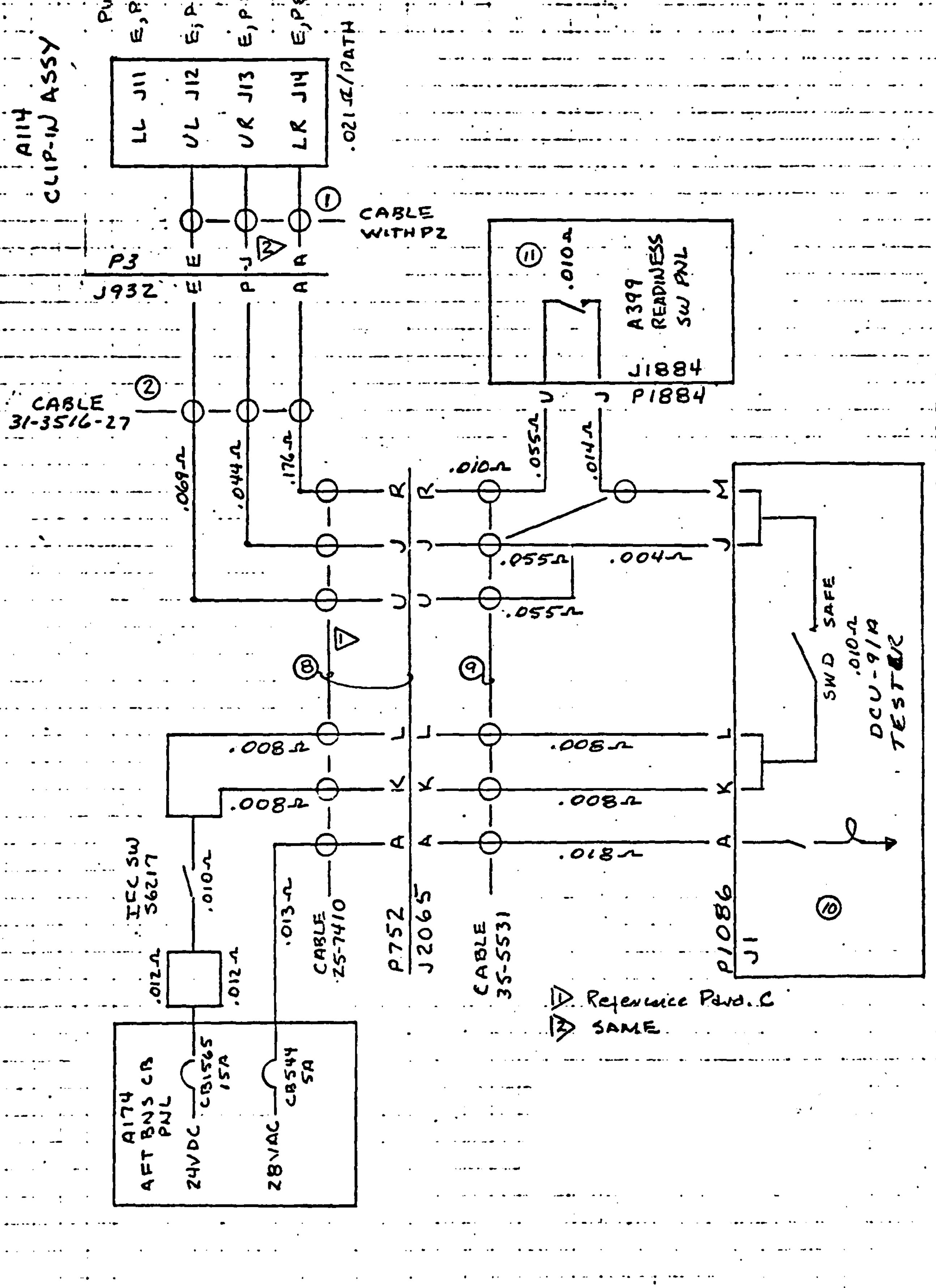


Figure 4.1-27 Power Paths Through DCU-9/A Tester

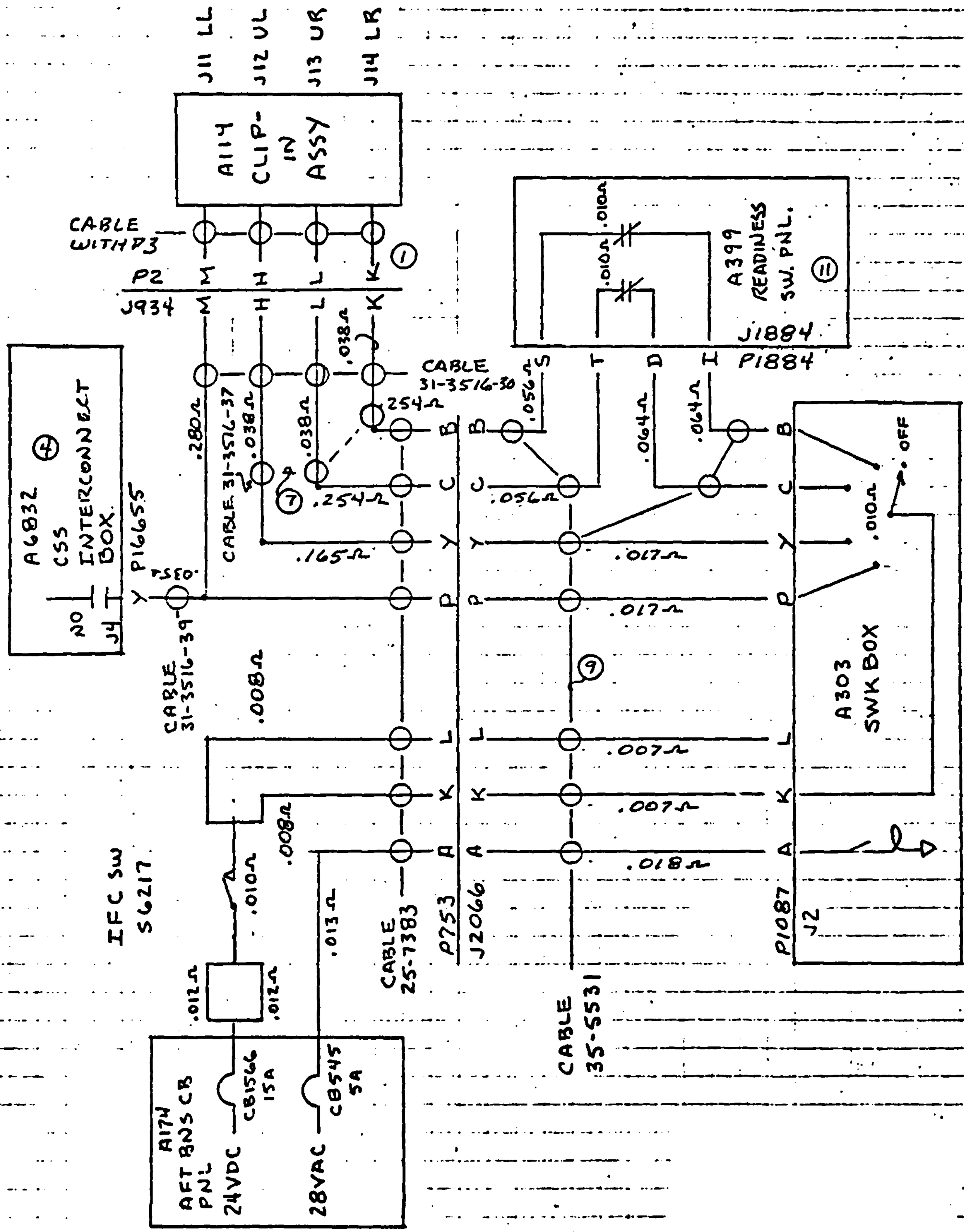


Figure 4.1-28 Power Path Through SWK Box

CLIP-IN ASSEMBLY PIN X
CIRCUIT ANALYSIS PACKAGE

4.1.6.8 Circuit Analysis Package, Weapon Interface Pin X on Connectors J11, J12, J13 and J14 of the Clip-In Assembly and Cable in the Forward Bomb Bay

These interfaces are shown in Figure 5-2, T.O. 11N-H5035-2, (Change 4) - copy attached below. Maximum current available to pin X in a normal environment is 0 amps. Worst case current in an abnormal (faulted) environment would be 152 amps assuming the pins grounded at the weapon interfaces when current is available through the DCU-9/A tester (a test mode).

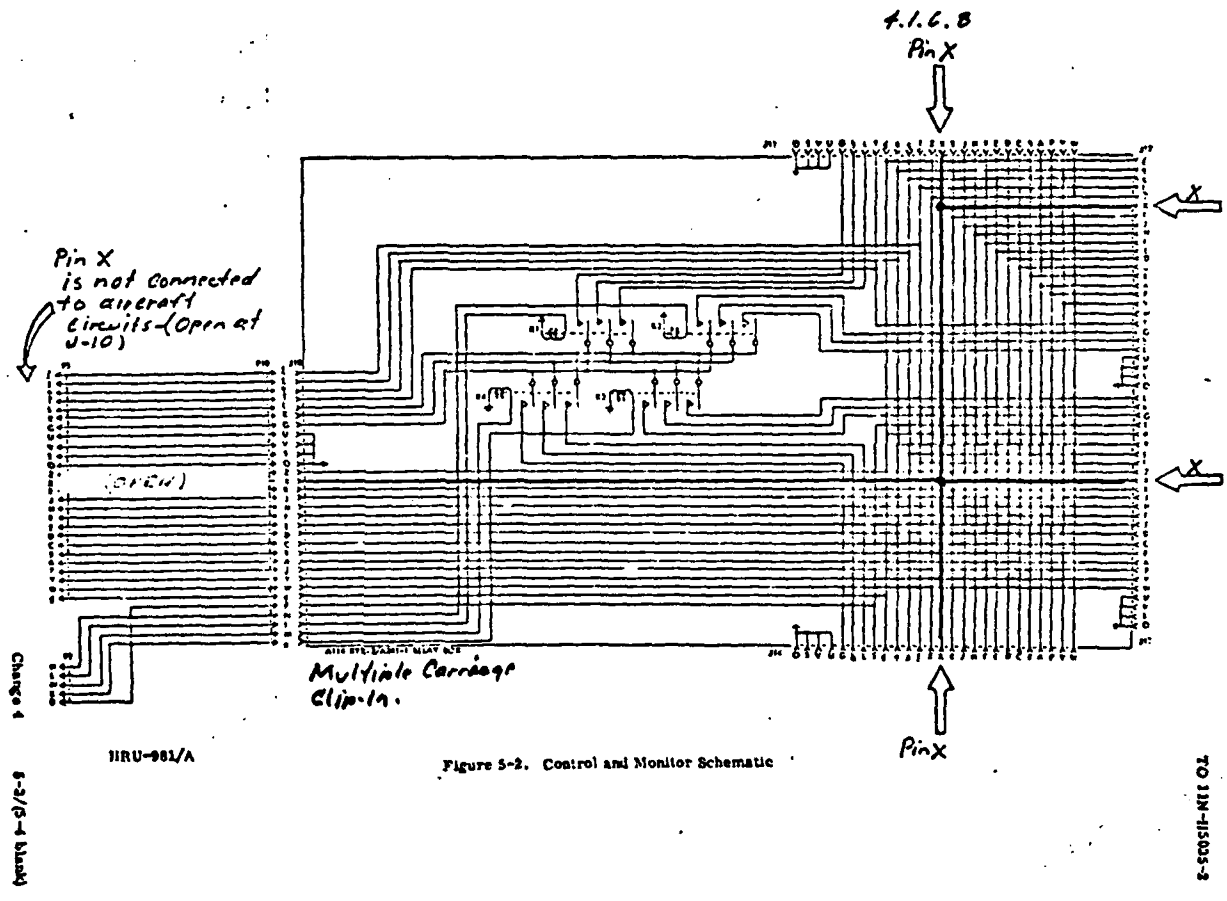


Figure 5-2. Control and Monitor Schematic

4.1.6.8 (Continued)

a. Normal Power and Load Analysis

From examination of Figure 4.1-29, Network Tree 202, open circuit voltage for pin X is = 0V. Short circuit current = 0A. This circuit is not connected to the aircraft. The cable between A114 Clip-In Relay Box and J932 AMAC has no wire to pin X.

b. Fault Analysis

The following postulated fault was analyzed using Network Tree 202.

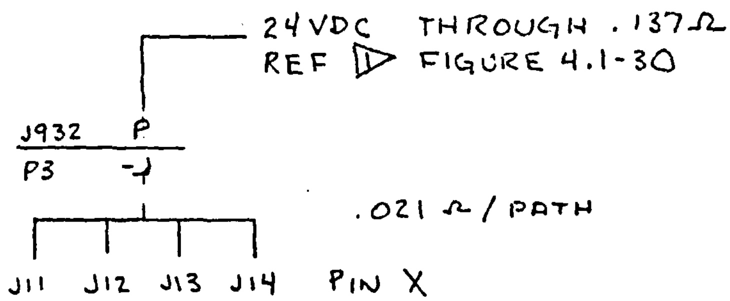
(1) Clip-In Assembly Damaged (Worst Case)

Wires to pin X shorted to 24VDC from CB1565 or CB1566 during testing using the DCU-9/A and the SWK Box. Voltage sources as shown in Figures 4.1-30 and 4.1-31.

4.1.6.8 (Continued)

c. Worst Case Fault

① Clip-In Assembly Damaged



Total Resistance of Path = .158 Ω

V_{OC} = 24VDC

I_{SC} = 152 A

Time = Less than 0.8 seconds. Current exceeds 1000% CB rating.

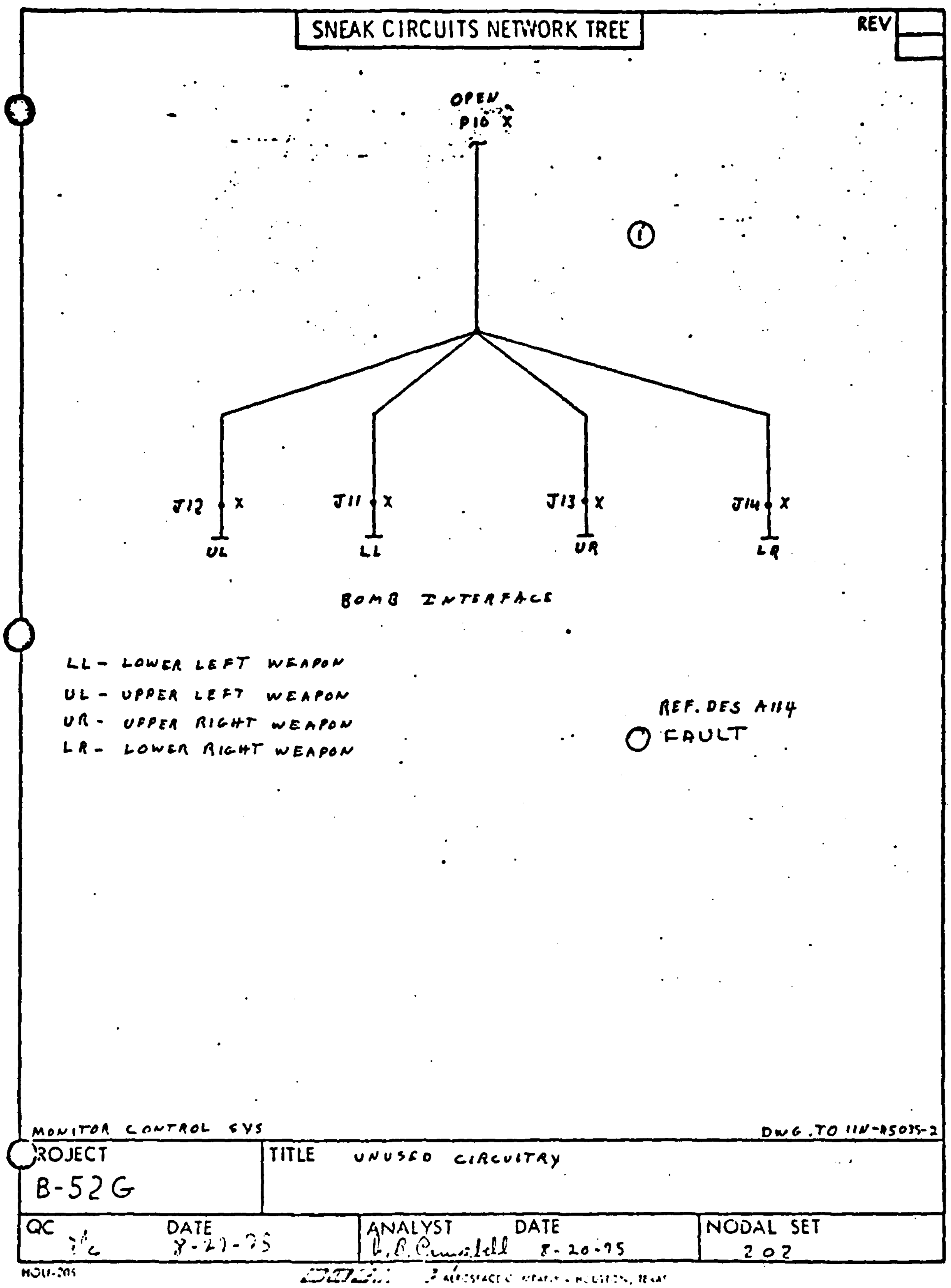


Figure 4.1-29 Network Tree 202

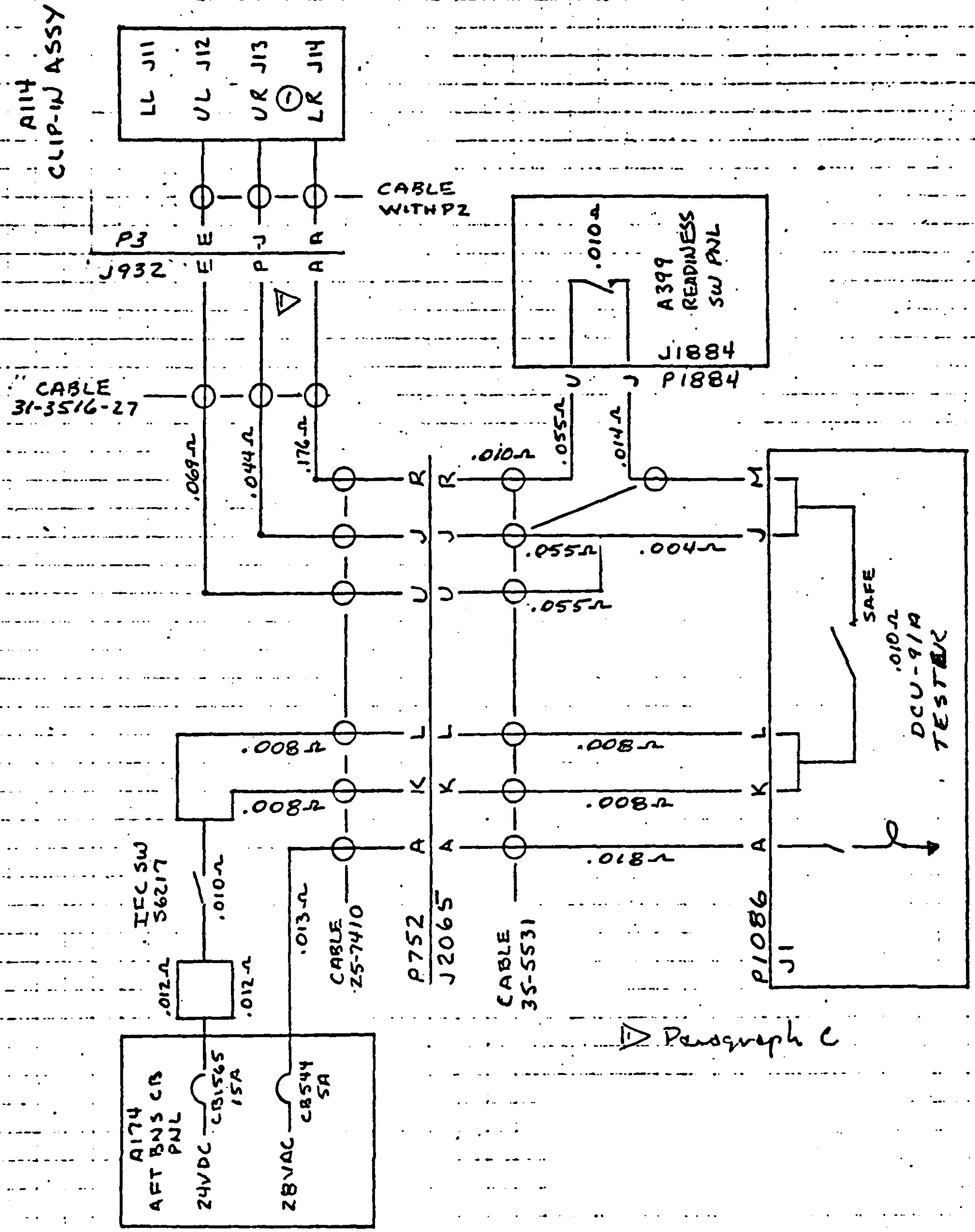


Figure 4.1-30 Power Paths Through DCU-9/A Tester

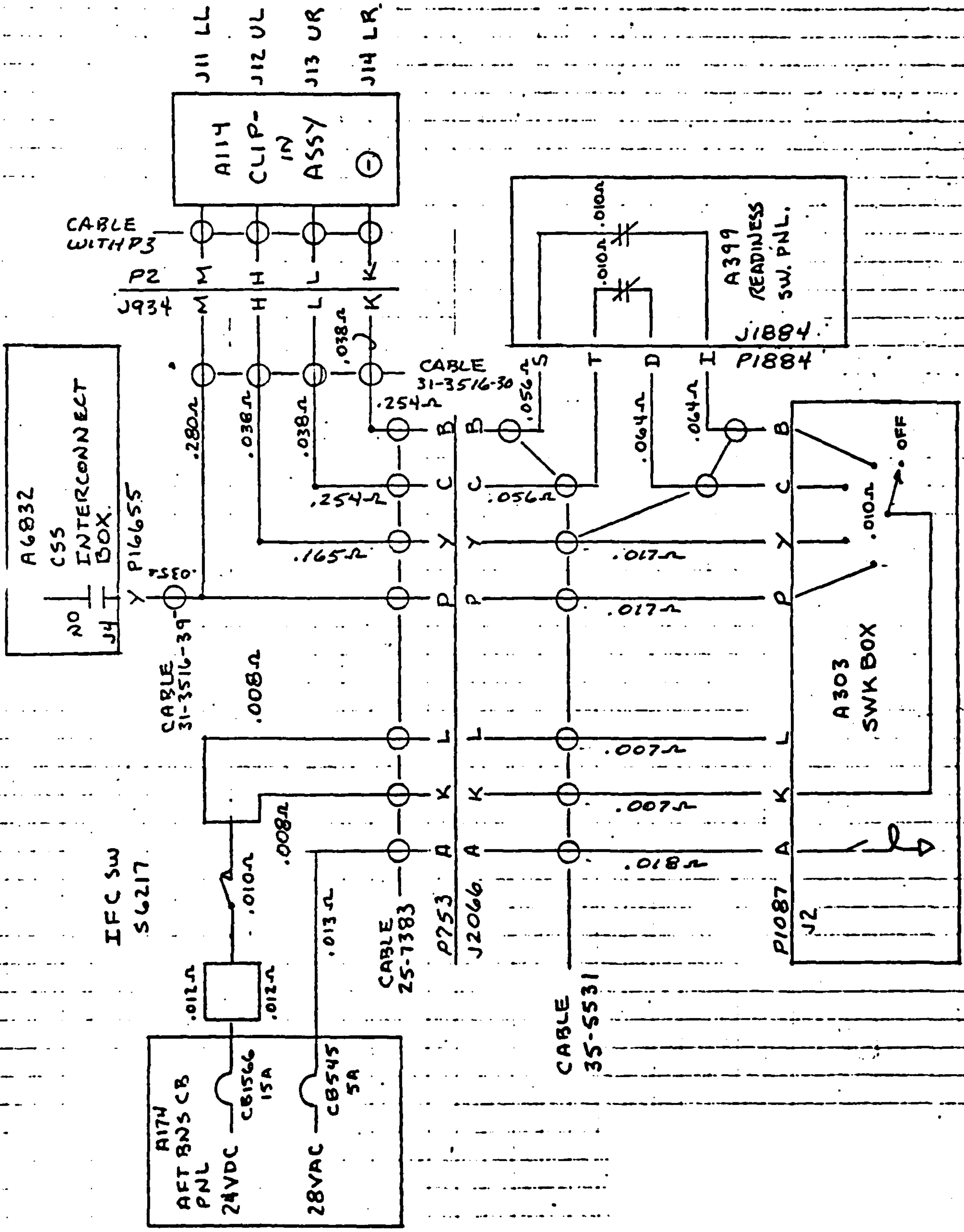


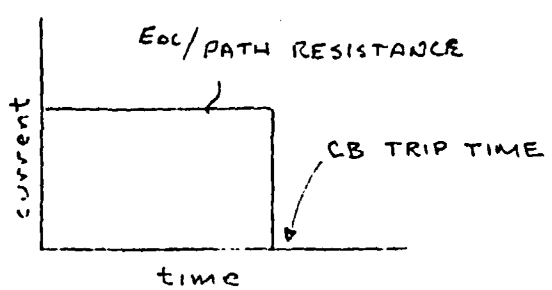
Figure 4.1-31 Power Paths Through SWK Box

4.1.7 Circuit Analysis Packages - B52/AGM-69A

The following packages present the power and load analyses of AGM-69A arming circuits on the launcher or pylon. Some packages describe the circuit for both the launcher and pylon while other packages describe separate circuits.

Analysis	Interface	Function
4.1.7.1	J1 Pin 97	SAF Prearm Command
4.1.7.2	J1 Pin 82	Missile Electronic Power
	Pin 92	Missile Electronic Power
	Pin 96	Missile Electronic Power
4.1.7.3	J1 Pin 57	Propulsion Safe (Launcher)
4.1.7.4	J1 Pin 2	Battery Activate
	Pin 10	Accumulator Activate
	Pin 26	Fin Unlock
4.1.7.5	J1 Pin 57	Propulsion Safe (Pylon)
4.1.7.6	J1 Pin 82	Missile Electronic Power (Pylon)
	Pin 92	Missile Electronic Power (Pylon)
	Pin 96	Missile Electronic Power (Pylon)
4.1.7.7	J1 Pin	(Ejector) Arm Solenoid
4.1.7.8	J1 Pin 20	SAF Class III A Command
	J Pin 60	SAF Class III B Command

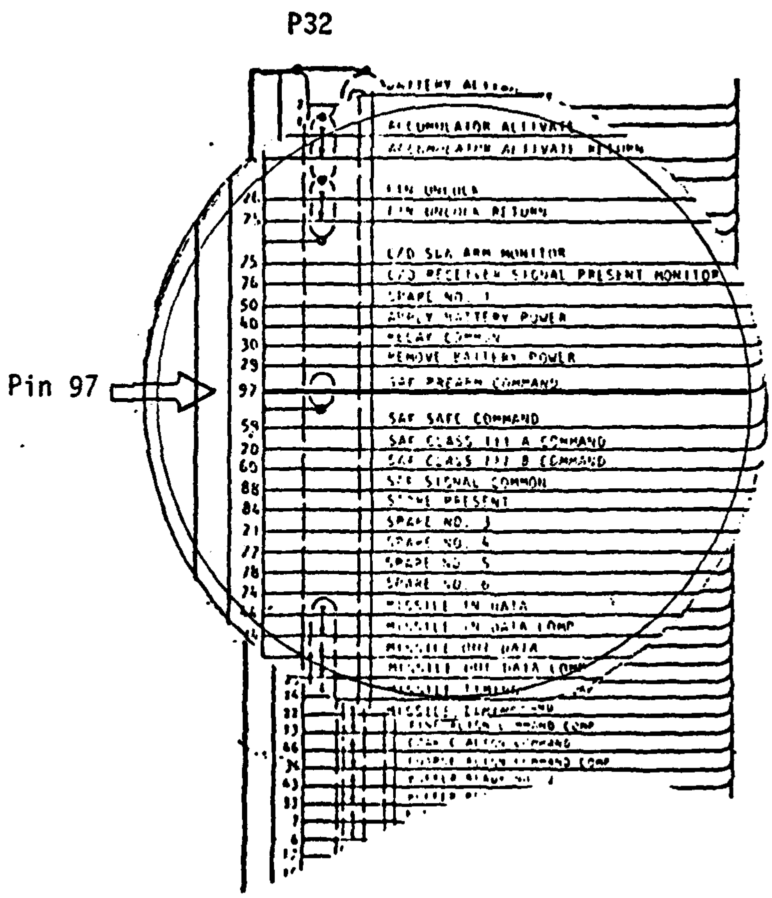
NOTE: Power Profiles - In all cases, short circuit current, caused by faults was found to be constant because of the absence of inductors and capacitors in the circuits investigated. Voltage source impedance was assumed to be zero ohms. A typical fault current versus time profile is shown here.



FAULT CURRENT PROFILE

4.1.7.1 Circuit Analysis Package, AGM 69A Interface Pin 97, Connector J1, Missile #1 on the Launcher & Left Pylon

This interface is shown in Figure 5-7, T.O. 11L1-2-8-2, (Change 12) and T.O. 16W6-19-2 (Change 3). Maximum current available to pin 97 in a normal environment is 0 amps. Worst case current at 118VAC in an abnormal (faulted) environment would be 900 amps for the missile on the launcher and 983 amps for the missile on the pylon assuming the pins grounded.



Refer to Figure 2-38 of T.O. 1B-52G-2-39GA-1 For Circuit Details

4.1.7.1 (Continued)

a. Normal Power & Load Analysis

From an examination of Figure 4.1-52, Cable Drawing - showing applicable circuits in the MCU, open circuit voltage for pin 97 is 0 VDC (the electronic switch is off) and short circuit current is 0A.

b. Fault Analysis

The following postulated faults were analyzed using Network Tree 99B and 99C, and Figure 4.1-52, Cable Drawing.

Pin 97, J1 Missile #1 Launcher

(1) Cable W1 Damaged

Wire to pin 97 shorted to 28VDC from CB1411, 118VAC from CB1395 if heater power is on, or to guidance and logic signals.

CB1411 (15A) 28VDC Missile Electronic Power

Resistance of wire from CB to missile interface

55 ft of #10 wire = .06 Ω

switch = .01 Ω

Maximum current available = 400 A

CB1395 (15A) 118VAC Missile Heater Power

Resistance of wire from CB to missile interface

47 ft of #12 wire = .095 Ω

6 ft of #16 wire = .027 Ω

switch = .01 Ω

Maximum current available = 900 A

Guidance and Logic Signals

Current output from these sources is device limited to less than other sources listed.

4.1.7.1 (Continued)

(2) <u>Launcher MCU Damaged</u>

Wire to pin 97 shorted to 27VDC from CB1484, ±22VDC from power supply in the switch unit, or guidance/logic signals.

CB1484 (5A) 27VDC Essential Power

Resistance of wire from CB to MCU

44 ft of #20 wire = .405 Ω

Maximum current available = 66 A

Power Supply in Switch Unit

Current output is less than other source listed. The magnitude is unknown. The specification is not available.

Guidance and Logic Signals

Current output from these sources is device limited to less than other sources listed.

(3) <u>Cable W13, W22 or W19 Damaged</u>

Wire to electronic switch shorted to 27VDC from CB1484 (Essential Bus) or to guidance and logic signals in the same cable. This may cause the electronic switch to turn on supplying 300 mA at 27VDC to pin 97.

(4) <u>Connector J16462/P1 or Cable 31-3564-119 Damaged</u>

Wire to electronic switch shorted to 27VDC from CB1484 (Essential Bus) or to guidance and logic signals in the same cable. This may cause the electronic switch to turn on supplying 300 mA at 27VDC to pin 97.

Pin 97, J1 Missile #1 Left Pylon

(5) <u>Cable W6 Damaged</u>

Wire to pin 97 shorted to 28VDC from CB1444 (ELEX Bus), 118VAC from CB1394 if heater power is on, or to guidance and logic signals.

4.1.7.1b (Continued)

(5) (Continued)

CB1444 (15A) 28VDC Missile Electronic Power

Resistance of wire from CB to missile interface

58 ft of #20 wire = .11 Ω

switch = .01 Ω

Maximum current available = 233 A

CB1394 (10A) 118VAC Heater Power

Resistance of wire from CB to missile interface

58 ft of #12 wire = .11 Ω

switch = .01 Ω

Maximum current available = 938 A

Guidance and Logic Signals

The current output of these sources is device limited to less than other sources listed.

(6) Left Pylon MCU Damaged

Wire to pin 97 shorted to 27VDC from CB1483 (Essential Bus), ± 22VDC from power supply in the switch unit, or to guidance and logic signals.

CB1483 (5A) 27VDC Essential Power

Resistance of wire from CB to MCU

50 ft of #20 wire = .619 Ω

Maximum current available = 43.5 A

Power Supply in Switch Unit

Current output is less than other listed source. The magnitude is unknown. The specification is not available.

Guidance and Logic Signals

Current output from these sources is device limited to less than other sources listed.

4.1.7.1b (Continued)

(7) Cable W1 Left Pylon, Connector J16460/P1, Cable 31-3564-114, Connector P16539/J16539 or Cable 31-3564-117 Damaged

Wire to electronic switch shorted to 28VDC from CB1411, 27VDC from CB1483 or guidance and logic signals in the same cable. This may cause the switch to turn on supplying 300 mA at 27VDC to pin 97.

Pin 97, J1 Missile #1 Launcher or Left Pylon

(8) PDU Damaged

Wire to electronic switch of both MCU's shorted to 118VAC from CB1487 (AC Bus), 118VAC-3Φ(AC Bus) from CB1422, 27VDC from CB1486, or guidance and logic signals. This may cause the switches to to turn on supplying 300 mA at 27VDC to pin 97 of both missiles.

(9) Cabling from PDU to Right Pylon MCU Damaged

Wire to electronic switch of both MCU's shorted to 27VDC from CB1485 (Essential Bus) or guidance and logic signals. This may cause the switches to turn on supplying 300 mA at 27VDC to pin 97 of both missiles.

(10) Right Pylon MCU Damaged

Wire to electronic switch of both MCU's shorted to 27VDC from CB1485 (Essential Bus), ±22VDC from Power Supply in the Switch Unit, or guidance and logic signals. This may cause the switches to turn on supplying 300 mA at 27VDC to pin 97 of both missiles.

(11) Cable 31-3564-52 Damaged

Wire to electronic switches in both MCU's are cabled with wires running between the PDU and MDU/BCU. These wires primarily carry guidance, digital information and other low level signals. A short to them may cause the switches to turn on supplying 300 mA at 27VDC to pin 97 of both missiles.

4.1.7.1b (Continued)

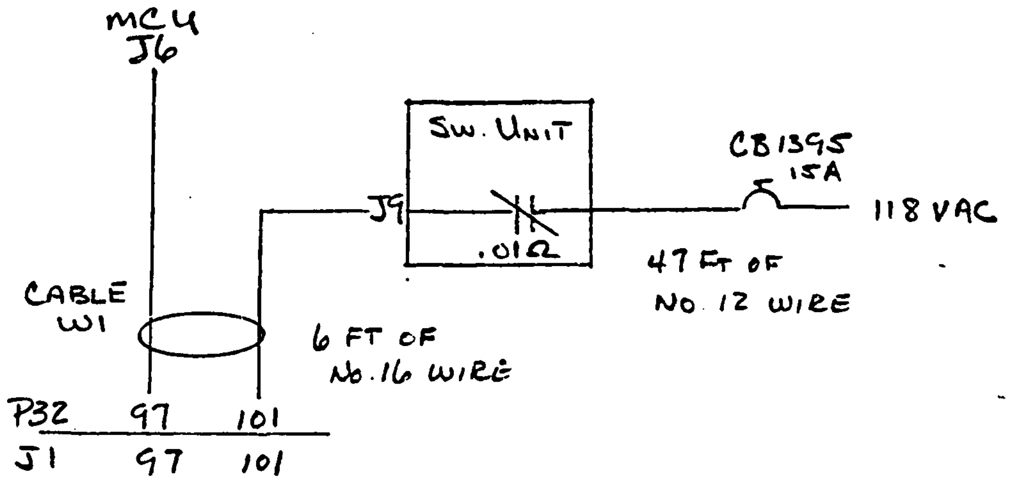
(12) CSS Interconnect Box Damaged

Wires to electronic switch of both MCU's shorted to 24VDC from CB1566. This may cause the electronic switches to turn on supplying 27VDC at 300 mA to both missiles. The 24 VDC is available only when the SWK Box is switched to "LL".

Note: All circuit breakers or located in the AGM-69A Power Distribution Box, A482 except CB1566 which is located in the Aft BNS CB PNL, A174.

c. Worst Case Paths

Launcher Missile pin 97: Reference path (1) Cable W1 Damaged.



Total resistance of path = .122 Ω

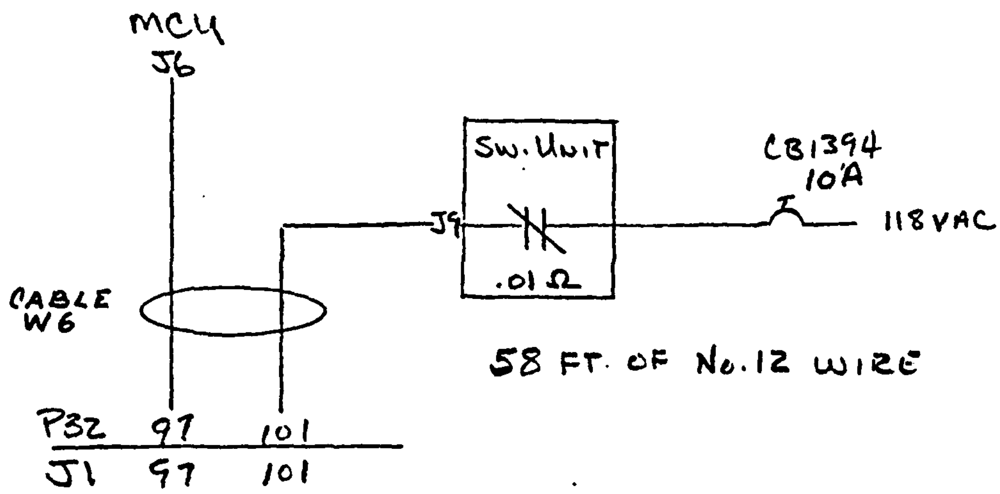
V_{OC} = 118VAC

$I_{SC} = \frac{118}{.122} = \underline{900}$ A

Time = current exceeds 6000% rating of CB. The time will be less than .13 sec (3000% rating).

4.1.7.1c (Continued)

Left Pylon Missile pin 97: Reference path ⑤ Cable W6 Damaged.



Total resistance of path = .12 Ω

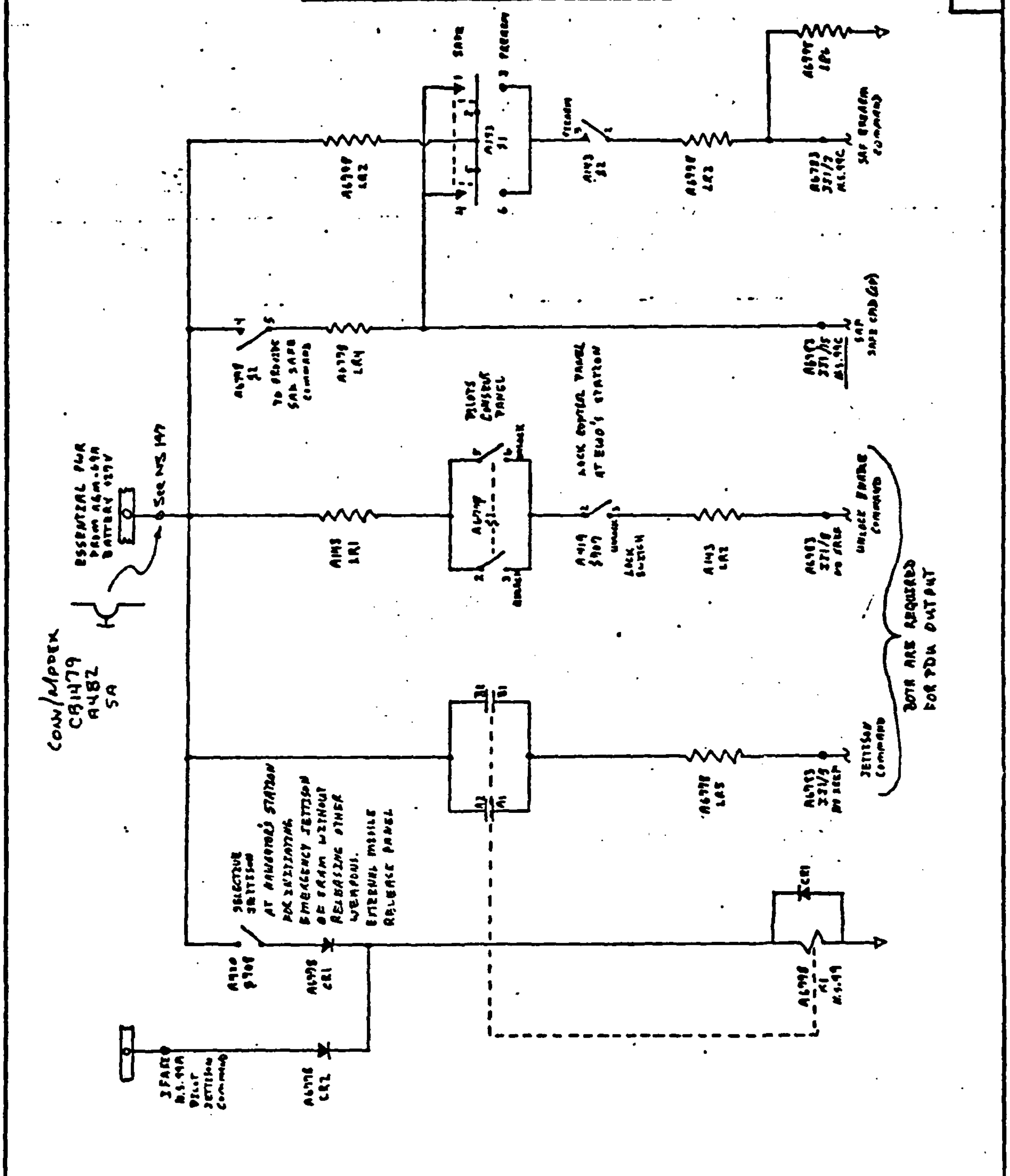
V_{OC} = 118VAC

$I_{SC} = \frac{118}{.12} = \underline{983}$ A

Time = current exceeds 9000% rating of CB. The time will be less than .125 Sec (3000% rating). Reference CB Spec D10-30108.

SNEAK CIRCUITS NETWORK TREE

REV



PROJECT	TITLE
B52G	JETTISON RELEASE SYSTEM

QC	DATE	ANALYST	DATE	NODAL SET
		[illegible] B. Buckley	4-25-75	99B

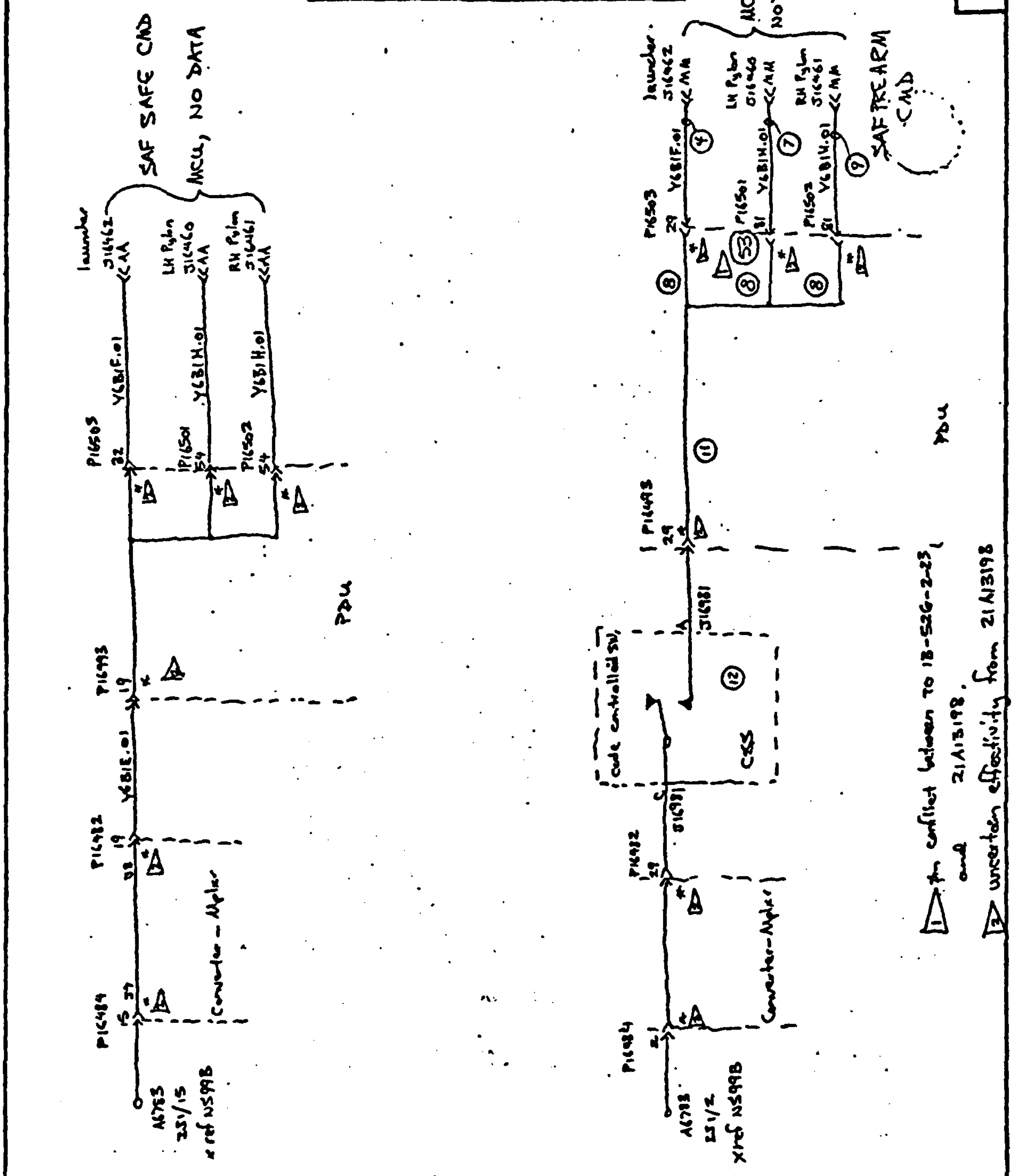
HOU-205

BOEING AEROSPACE COMPANY - HOUSTON, TEXAS

Figure 4.1-51 Network Tree No. 99B-99C (Sheet 1 of 2)

SNEAK CIRCUITS NETWORK TREE

REV



PROJECT	TITLE
B52-G	SAF SAFE CMD, SAF PREARM CMD

QC	DATE	ANALYST	DATE	NODAL SET
		M Barrett	9/9/75	99C

HOU-205 BOEING AEROSPACE COMPANY - HOUSTON, TEXAS

Figure 4.1-51 Network Tree No. 99B-99C (Sheet 2 of 2)

Notes:

Shorts to wires above MCU will cause switch in MCU to turn on applying normal power to missiles.

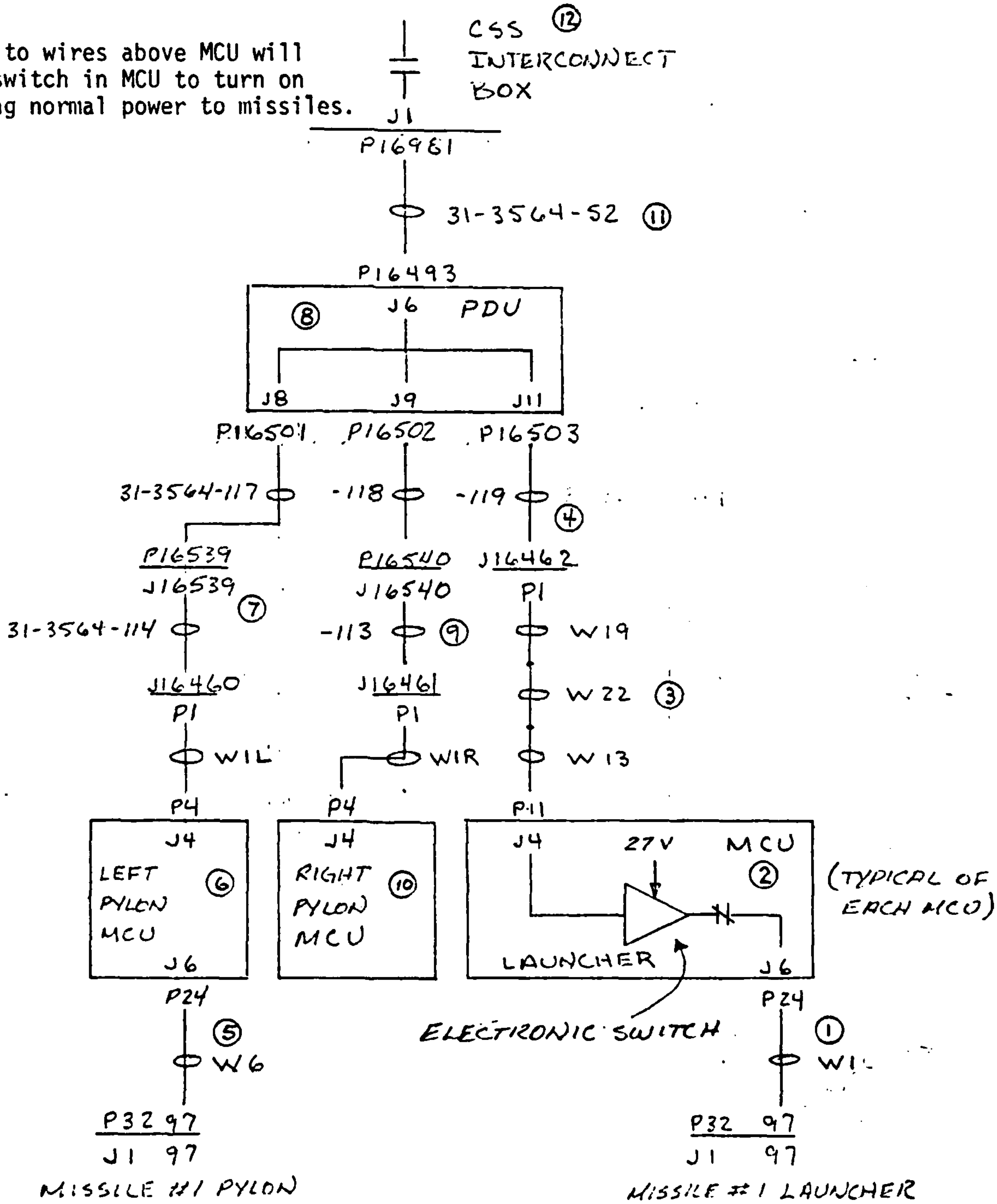


FIGURE 4.1-52. CABLE DRAWING

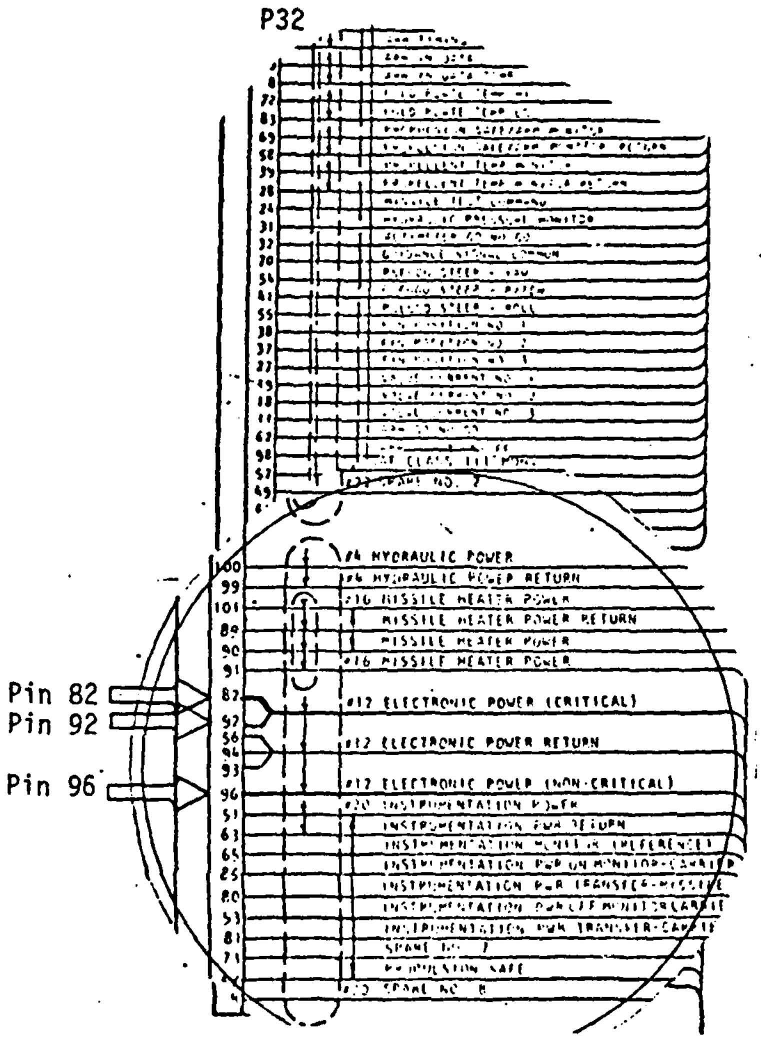
4.1.7.2 Circuit Analysis Package, AGM-69A Interface Pins 82, 92, and 96, Connector J1, Missile #1 on the Launcher

This interface is shown in Figure 5-7 of T.O. 11L1-2-8-2, Change 12. Maximum current available to the pins in a normal environment with the pins grounded would be:

System Off: Voc = 0V; Isc = 0 A

System On: Voc = 28 VDC; Isc = 368 A

Worst case current at 28VDC in an abnormal environment would be 1220 A with the pins grounded.



Refer to Figure 2-40 of T.O. 1B-52G-2-39GA-1 For Circuit Details

4.1.7.2 (Continued)

a. Normal Power and Load Analysis

From examination of Figure 4.1-53, Network Tree 118 and Figure 4.1-54, Cable Drawing, open circuit voltage and short circuit voltage is as follows:

Ground, System Off: Voc = 0V; Isc = 0A

Airborn, System On: Current to pins is supplied by CB1411, 28VDC ELEX Bus, through 37 ft. of #10 wire (.044Ω) and 17 ft. of #12 wire (.0323Ω). Total resistance of path = .076Ω.

Therefore:

Voc = 28 VDC

$$Isc = \frac{28}{.026} = \underline{368}\ A$$

b. Fault Analysis

The following postulated faults were analyzed using Figures 4.1.53 and 4.1.54:

(1) Cable WI Damaged

Wires subject pins shorted to 118 VAC from CB 1395 if heater power is on.

CB1395 (15A) 118 VAC Missile Heater Power

Resistance of wire from CB to missile interface

47 ft. of #12 wire = .095Ω

6 ft. of #16 wire = .027Ω

Maximum current available at 118 VAC = 967 A

(2) Switch Unit Damaged

Wires to subject pins shorted to:

118 VAC from CB 1395, Heater Power

28 VDC from CB 1433, Hydraulic Power

28 VDC from CB 1412 through CB 1418, Missile 2-8 ELEX Power

118 VAC from CB 1427, Launcher AC

28 VDC from CB 1435, Missile Valve

4.1.7.2b (Fault 2 Continued)

CB 1395 (15A) 118 VAC Missile Heater Power

Resistance of wire from CB to switch unit

47 ft. of #12 wire = .095Ω

Maximum current available at 118 VAC = 1242 A

CB 1433 (60A) 28 VDC Hydraulic Power

Resistance of wire from CB to Switch Unit

48 ft. of #4 wire = .013Ω

Maximum current available at 28 VDC = 2154 A

CB 1412 - CB 1418 (15A) 28 VDC Missile ELEX Power

Resistance of wire from CB's to Switch Unit

37 ft. of #10 wire = .044Ω

10 ft. of #12 wire = .019Ω

Maximum current available at 28 VDC = 444 A

CB 1427 (5A) 118 VAC Launcher AC

Resistance of wire from CB to Switch Unit

37 ft. of #20 wire = .34Ω

10 ft. of #16 wire = .045Ω

Maximum current available at 118 VAC = 306 A

CB 1435 (7.5A) 28 VDC Missile Valve

Resistance of wire from CB to Switch Unit

47 ft. of #16 wire = .21Ω

Maximum current available at 28 VDC = 133 A

(3) Cable W10 Damaged

Same faults as given in (2) above omitting power from CB 1395, CB 1417, CB 1418, and CB 1433.

(4) Cable W23 or W17

Same faults as given in (2) above.

4.1.7.2b (Fault 5 Continued)

(5) Cable 31-3564-124 or Connector P2/J2371 Damaged

Wires to subject pins shorted to:

118 VAC from CB 1395, Heater Power

28 VDC from CB's 1412 through CB 1417, Missile 2-7, ELEX Power

118 VAC from CB 1427, Launcher AC

28 VDC from CB 1435, Missile valve

CB 1395 (15A) 118 VAC Missile Heater Power

Resistance of wire from CB to connector

37 ft. #12 wire = .07Ω

Maximum current available at 118 VAC = 1685 A

CB 1412 - CB 1417, (15A) 28 VDC, Missile 2-7 ELEX Power

Resistance of wire from CB to connector

37 ft. #10 wire = .044Ω

Maximum current available at 28 VDC = 636 A

CB 1427 (5A) 118 VAC Launcher AC

Resistance of wire from CB to connector

37 ft. #20 wire = .34Ω

Maximum current available at 118 VAC = 347 A

CB 1435 (7.5A) 28 VDC Missile Valve

Resistance of wire from CB to Switch Unit

37 ft. of #16 wire = .166Ω

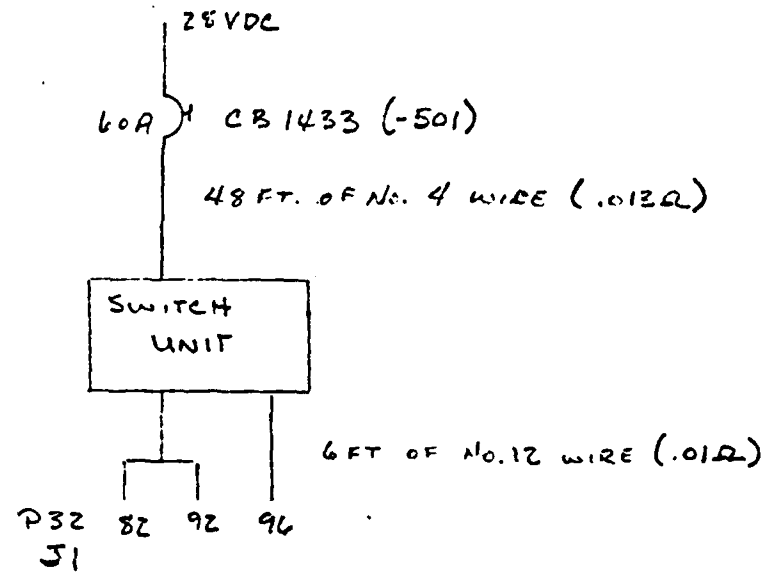
Maximum current available at 28 VDC = 168 A

Note: All circuit breakers are located in the AGM-69A Power Distribution Box.

4.1.7.2b (Fault 5 Continued)

c. <u>Worst Case Path</u>

Reference Path ② Switch Unit Damaged



Total Resistance of path = .023Ω

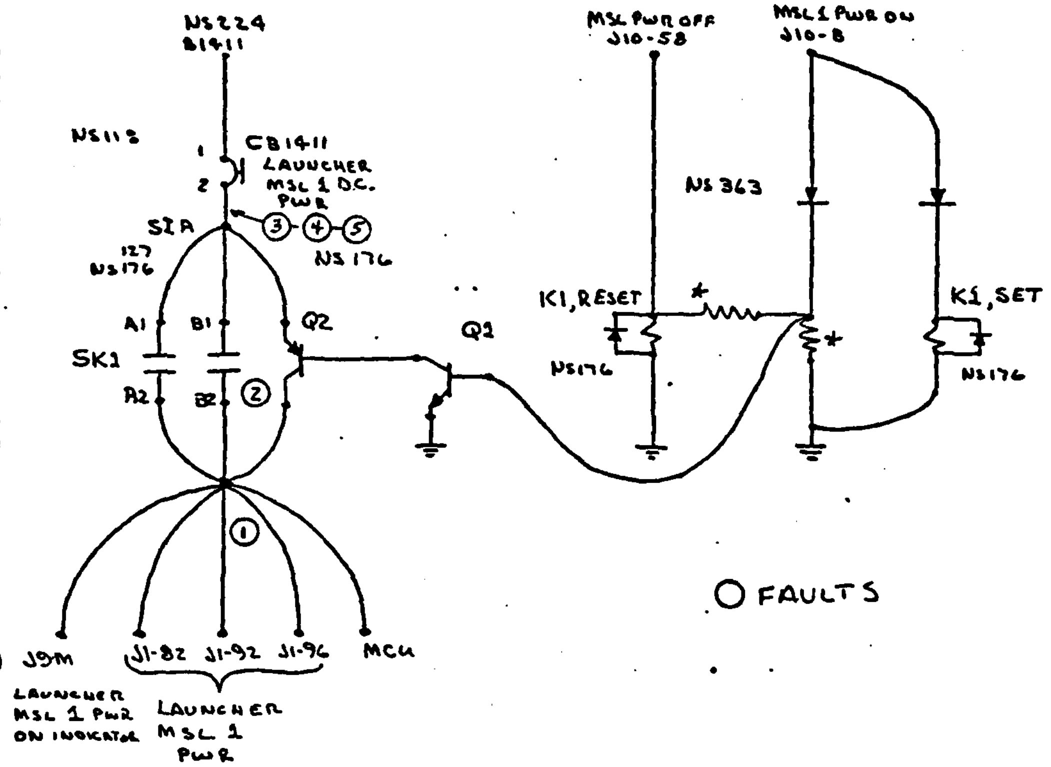
Voc = 28 VDC

Isc = $\frac{28}{.023}$ = 1220 A

Time = Minimum trip time shown on calibration curve is 1.5 seconds for 500 amps. Therefore the time for 1220 would be less than 1.5 seconds.

SNEAK CIRCUITS NETWORK TREE

REV



BOX REF: RELAY ASSY.
A482

NOTES: * RESISTANCE VALUES NOT SHOWN ON DRAWINGS

Q2; 2N4399
VCEO = -60V MAX
Ic = -7.5A CONT

SK1; 10A @ 28VDC RES.
6A @ 28VDC IND.

PROJECT	TITLE		
B52-G	MISSILE #1 DC.POWER - LAUNCHER		
QC	DATE	ANALYST J.D.C. / DATE 9 SEPT 1975	NODAL SET 118, 176, 363

HOU-705

BOEING AEROSPACE COMPANY - HOUSTON, TEXAS

Figure 4.1-53 Network Tree No. 118

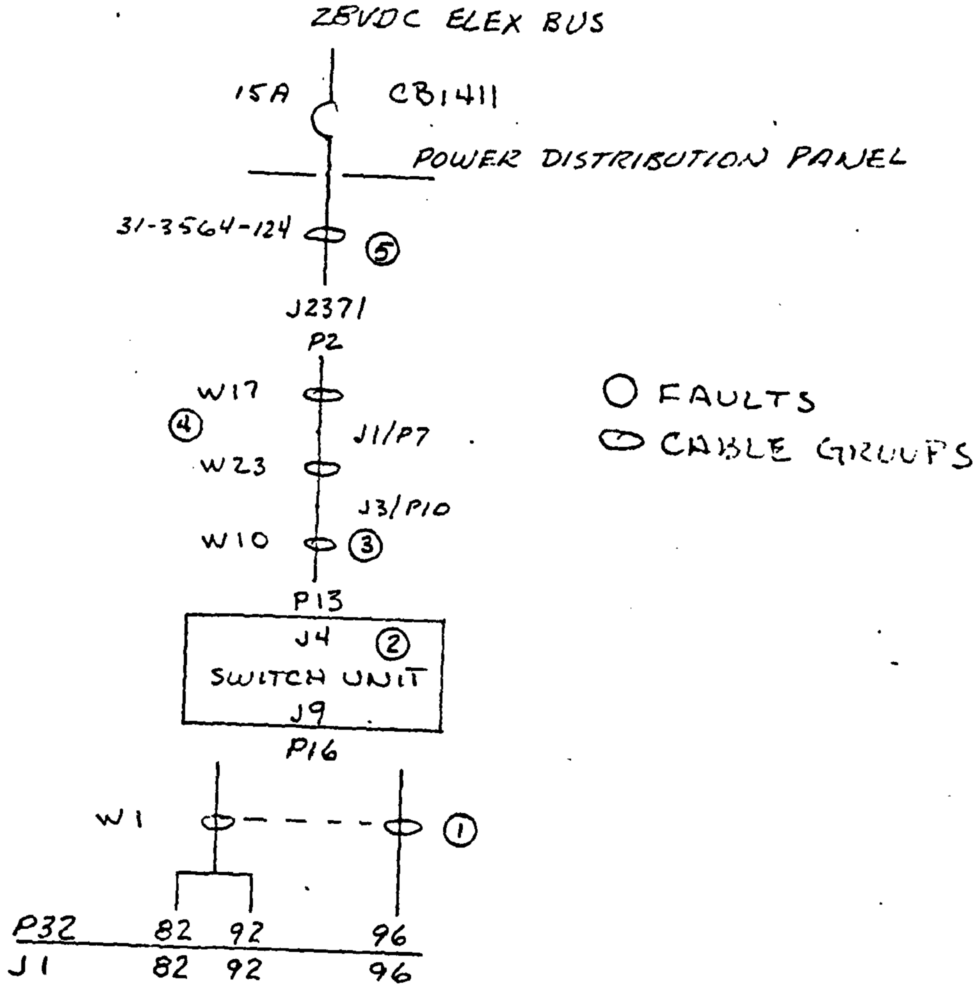
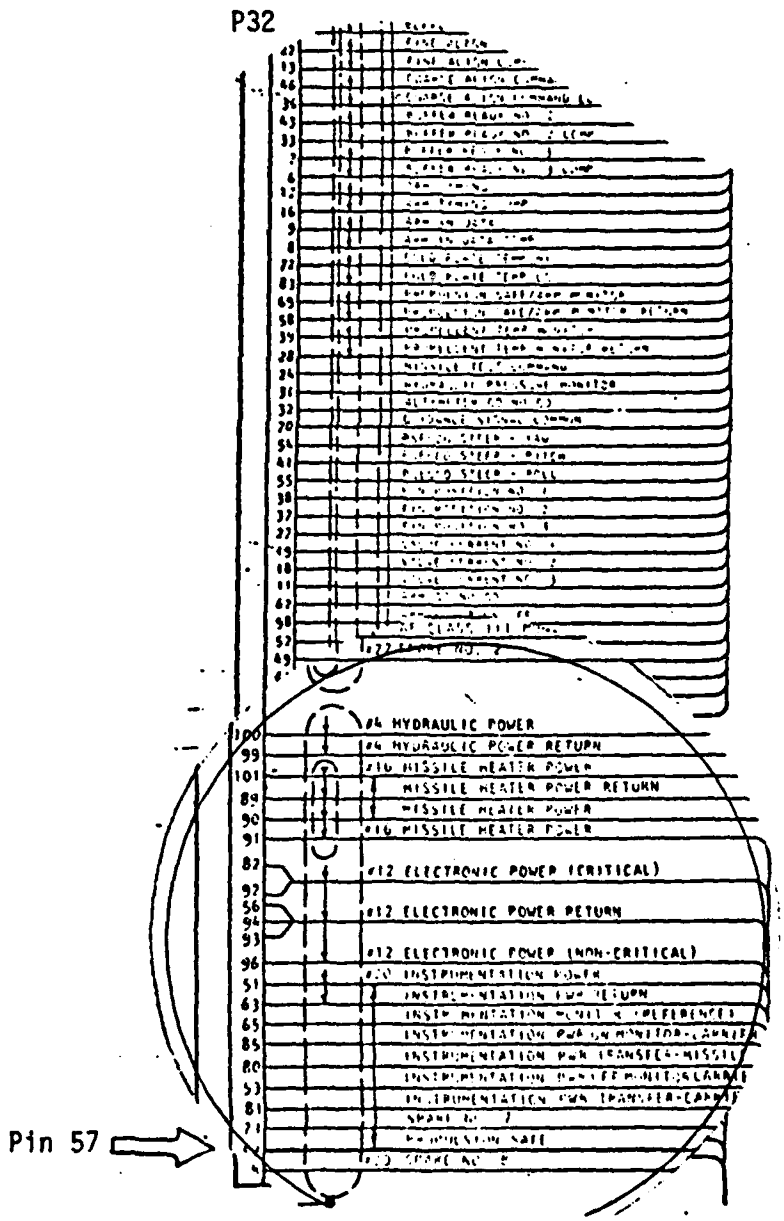


FIGURE 4.1-54. CABLE DRAWING

4.1.7.3 Circuit Analysis Package, SRAM, Interface Pin 57 of Connector J1, Missile 1 on the Launcher

This interface is shown in Figure 5-7, of T.O. 11L1-2-8-2, change 12. The current available to this pin in a normal environment is 0 amps. The worst-case current in an abnormal environment (faulted) is 411.76 A (assuming the pin is grounded).



Refer to Figure 2-38 of T.O. 1B-52G-2-39GA-1 For Circuit Details.

4.1.7.3 (Continued)

a. Normal Power and Load Analysis

From an examination of the Figure 4.1-55, Network Tree 151, the open circuit voltage is 0V and the short circuit current is 0A. The circuit passes through normally open relay contacts in the Power Distribution Panel.

b. Fault Analysis

The following postulated faults were analyzed using Network Tree 151 and the Cable Diagram, Figures 4.1-55 and 4.1-56.

(1) Damage to Connector J1 or Cable W1

Pin 57 may be shorted to 118 VAC through CB 1395, if heater power is on, or to 28 VDC through CB 1411.

CB 1395 (15A) 118 VAC Missile Heater Power

Resistance of wire from CB to missile

47 ft. of #12 wire = .095Ω

6 ft. of #16 wire = .027Ω

Maximum current available at 118 VAC = 967 A

CB 1411 (15A) 28 VDC Missile Electronic Power

Resistance of wire from CB to missile

37 ft. of #10 wire = .044Ω

17 ft. of #12 wire = .0323Ω

Maximum current available at 28 VDC = 3680 A

(2) Damage to Relay Assembly

The wires to the subject pins may be shorted to 28 VDC through CB 1433, CB 1435, CB 1411-CB 1418 or shorted to 118 VAC through CB 1395 or CB 1427.

CB 1433 (60A) 28 VDC Hydraulic Power

Resistance of wire from CB to Relay Assembly

48 ft. of #4 wire = .013Ω

Maximum current available at 28 VDC = 2154 A

4.1.7.3b (Fault 2 Continued)

CB 1435 (7.5A) 28 VDC Missile Bypass Valve

Resistance of wire from CB to Relay Assembly

47 ft. of #16 wire = .21Ω

Maximum current available at 28 VDC = 133 A

CB 1411 -CB 1418 (15A) 28 VDC Missile Electronic Power

Resistance of wire from CB's to Relay Assembly

37 ft. of #10 wire = .044Ω

10 ft. of #12 wire = .019Ω

Maximum current available at 28 VDC = 444 A

CB 1395 (15A) 118 VAC Missile Heater Power

Resistance of wire from CB to Relay Assembly

47 ft. of #12 wire = .095Ω

Maximum current available at 118 VAC = 1242 A

CB 1427 (5A) 118 VAC Launcher AC

Resistance of wire from CB to Relay Assembly

37 ft. of #20 wire = .34Ω

10 ft. of #16 wire = .045Ω

Maximum current available at 118 VAC = 306 A

(3) Cable W10 Damaged

Faults are the same as (2) except power from CB 1395, CB 1417, CB 1418, and CB 1433 is not available.

(4) Cable W23 or Cable W17 Damaged

Faults same as (3) above.

4.1.7.3b (Fault 5 Continued)

(5) Cable 31-3564-124 or Connector J2371 Damaged

Wires to subject pins may be shorted to 28 VDC through CB 1411-CB 1418 or through CB 1435. Wires may be shorted to 118 VAC through CB 1395 or CB 1427.

CB 1411 - CB 1418 (15A) 28 VDC Missile Electronic Power
Resistance of wire from CB to Connector
37 ft. of #12 wire = .07Ω
Maximum current available at 28 VDC = 1685 A

CB 1435 (7.5A) 28 VDC Missile Bypass Valve
Resistance of wire from CB to Connector
37 ft. of #16 wire = .166Ω
Maximum current available at 28 VDC = 168 A

CB 1395 (15A) 118 VAC Missile Heater Power
Resistance of wire from CB to Connector
37 ft. of #12 wire = .07Ω
Maximum current available at 118 VAC = 1685 A

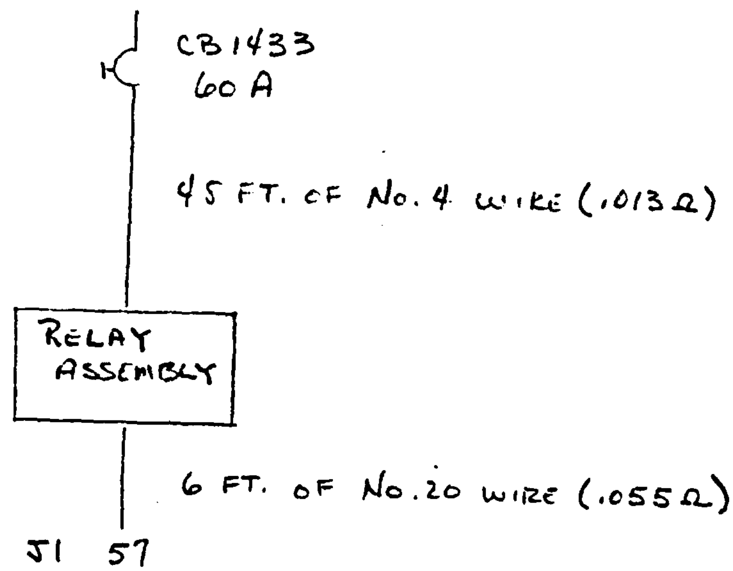
CB 1427 (5A) 118 VAC Launcher AC Power
Resistance of wire from CB to Connector
37 ft. of #20 wire = .34Ω
Maximum current available at 118 VAC = 347 A

Note: All circuit breakers are located in the AGM-69A Power Distribution Box.

4.1.7.3 (Continued)

c. Worst Case Path

Refer to Fault (2), Relay Assembly Damaged



Total Resistance of path = .068Ω

Voc = 28 VDC

$$Isc = \frac{28}{.068} = \underline{411.76}\ A$$

Time = 2.0 seconds

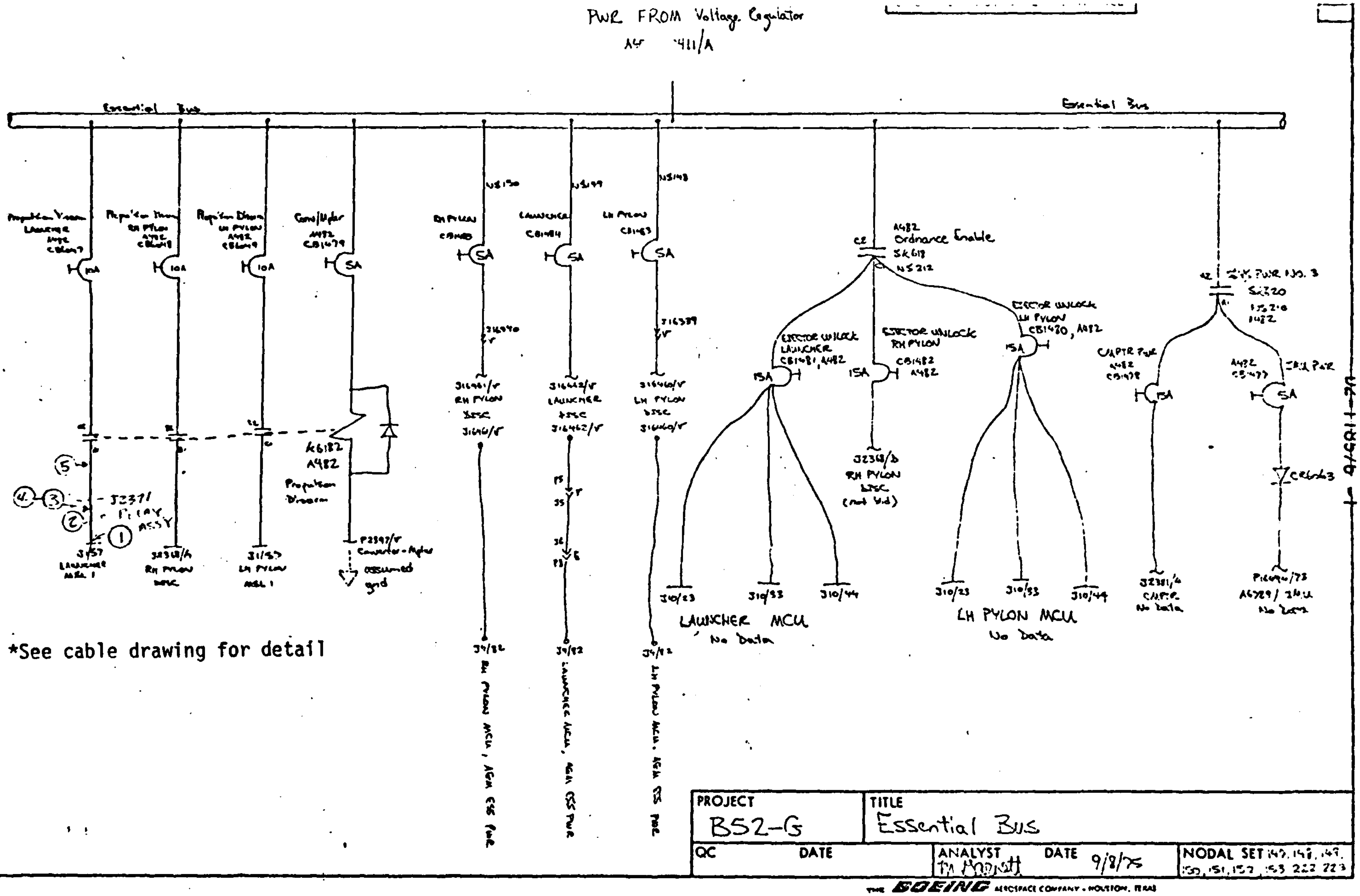


FIGURE 4.1-55. NETWORK TREE 151

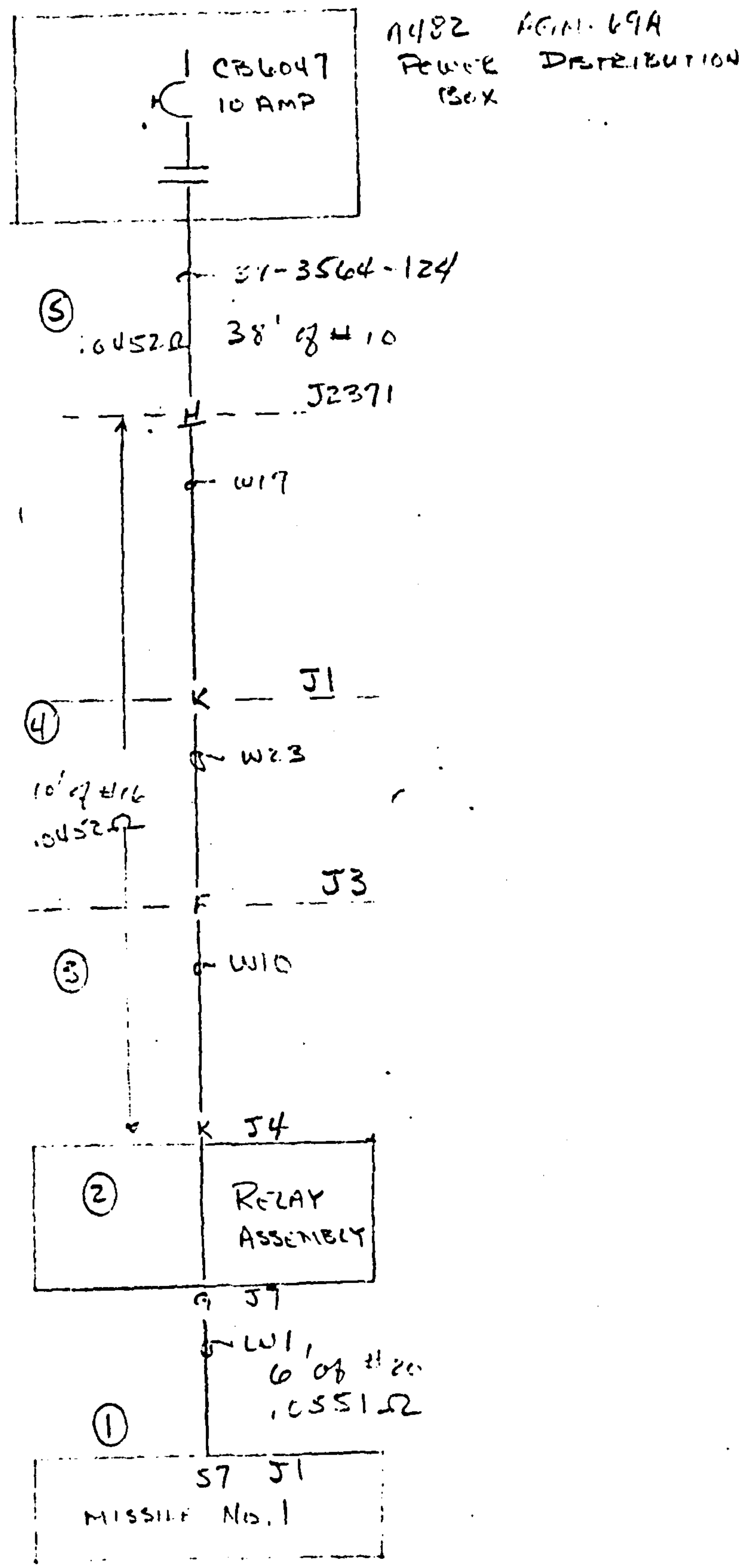
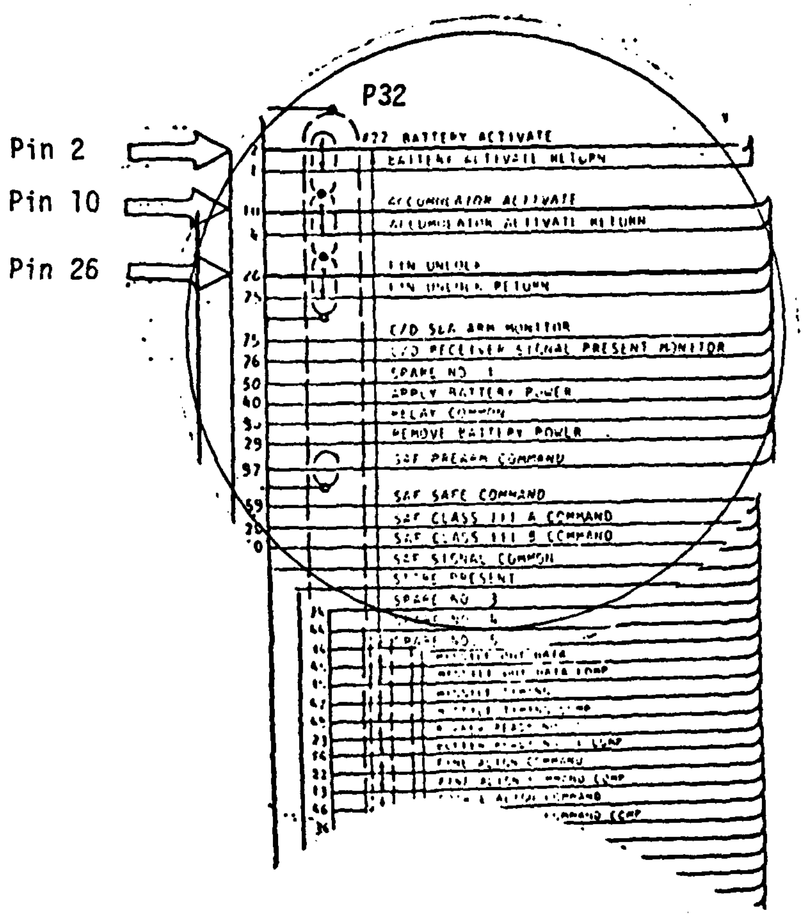


FIGURE 4.1-56. CABLE DRAWING

4.1.7.4 Circuit Analysis Package, AGM 69A Interface Pins 10, 26, and 2, Connector J1, Missile #1 on the Launcher and Left Pylon

This interface is shown in Figure 5-7 of T.O. 11L1-2-8-2, Change 12. Maximum current available to these pins in a normal environment is 0 amps. Worst case current at 118 VAC in an abnormal (faulted) environment with the pins grounded would be:

Launcher Missile 900 A
Pylon Missile 983 A



Refer to Figure 2-39 of T.O. 1B-52G-2-39GA-1 For Circuit Details.

4.1.7.4 (Continued)

a. Normal Power and Load Analysis

From an examination of Figure 4.1-58, Cable Drawing, open circuit voltage is 0V and the short circuit current is 0A. The electronic switches and EED power are normally off prior to launch.

b. Fault Analysis

The following postulated faults were analyzed using Network Tree 144-145 for Launcher Mounted Missile and Figure 4.1-58.

(1) Cable W1 Damaged

Wires to pins 10, 2 and 26 shorted to 28 VDC from CB 1411, to 118VAC from CB1395 (if heater power is on) or to guidance and logic signals.

CB 1411 (15A) 28 VDC Missile Electronic Power

Resistance of wire from CB to missile interface

55 ft. of #10 wire = .06Ω

Switch = .01Ω

Maximum current available = 400 A

CB 1395 (15A) 118 VAC Missile Heater Power

Resistance of wire from CB to missile interface

47 ft. of #12 wire = .095Ω

6 ft. of #16 wire = .027Ω

Maximum current available = 940 A

Guidance and Logic Signals

Current from these sources is device limited and is less than other sources listed.

4.1.7.4b (Continued)

(2) Launcher MCU Damaged

Wire to pins 10, 2 and 26 shorted to 27 VDC from CB 1484, ± 22VDC from Power Supply in the Switch Unit, or to guidance and logic signals.

CB 1484 (5A) 27 VDC Essential Power

Resistance of wire from CB to MCU

44 ft. of #20 wire = .405Ω

Maximum current available = 66 A

Power Supply in Switch Unit

Current output less than other source listed. The magnitude of the current is unknown since the part specification is not available.

Guidance and Logic Signals

Current output is device limited and is less than other sources listed.

For Pylon Mounted Missile

(1) Cable W6 Damaged

Wires to pins 10, 2 and 26 shorted to 28 VDC from CB 1444, 118VAC from CB1394, if heater power is on, or to guidance and logic signals.

CB 1444 (15A) 28 VDC Missile Electronic Power

Resistance of wire from CB to missile interface

58 ft of #20 wire = .11Ω

Switch = .01Ω

Maximum current available = 233 A

CB 1394 (10A) 118 VAC Heater Power

Resistance of wire from CB to missile interface

58 ft. of #12 wire = .11Ω

Switch = .01Ω

Maximum current available = 983 A

Guidance and Logic Signals

Current output from these sources is device limited and is less than other sources listed.

4.1.7.4b (Continued)

(2) Left Pylon MCU Damaged

Wires to pins 10, 2 and 26 shorted to 27 VDC from CB 1483, ± 22VDC from power supply in Switch Unit or guidance and logic signals.

CB 1483 (5A) 27 VDC Essential Power

Resistance of wire from CB to MCU

50 ft. of #20 wire = .619Ω

Maximum current available = 43.5 A

Power Supply in Switch Unit

Current output is less than other listed source. The magnitude is unknown since the specification is unavailable.

Guidance and Logic Signals

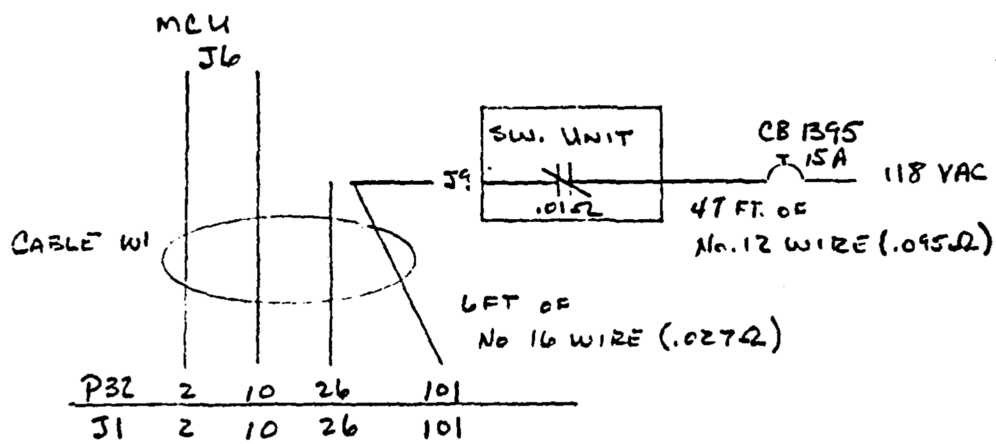
Current output from these sources is device limited and is less than other sources listed.

Note: Circuit Breakers are located in the AGM-69A Power Distribution Panel.

c. Worst Case Paths

For Launcher Mounted Missile

Reference Path (1) Cable W1 Damaged



Total Resistance of Path = .122Ω

Voc = 118 VAC

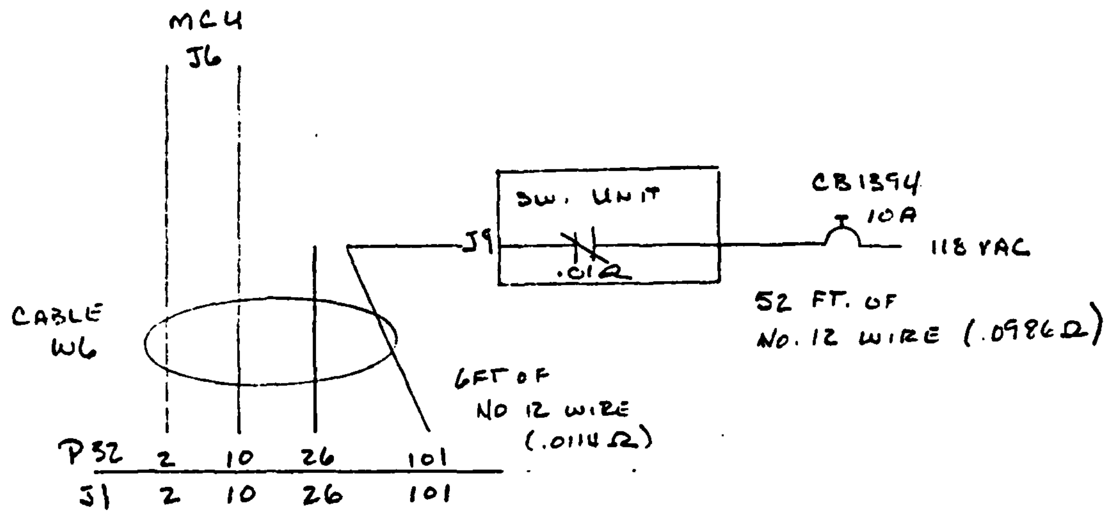
$$Isc = \frac{118}{.122} = 900 \text{ A}$$

Time - Current rating exceeds 6000% rating of CB. The time will be less than .13 sec. (3000% rated).

4.1.7.4c (Continued)

For Pylon Mounted Missile

Reference Path (1) Cable W6 Damaged



58 ft. of #12 wire total

Total resistance .12Ω

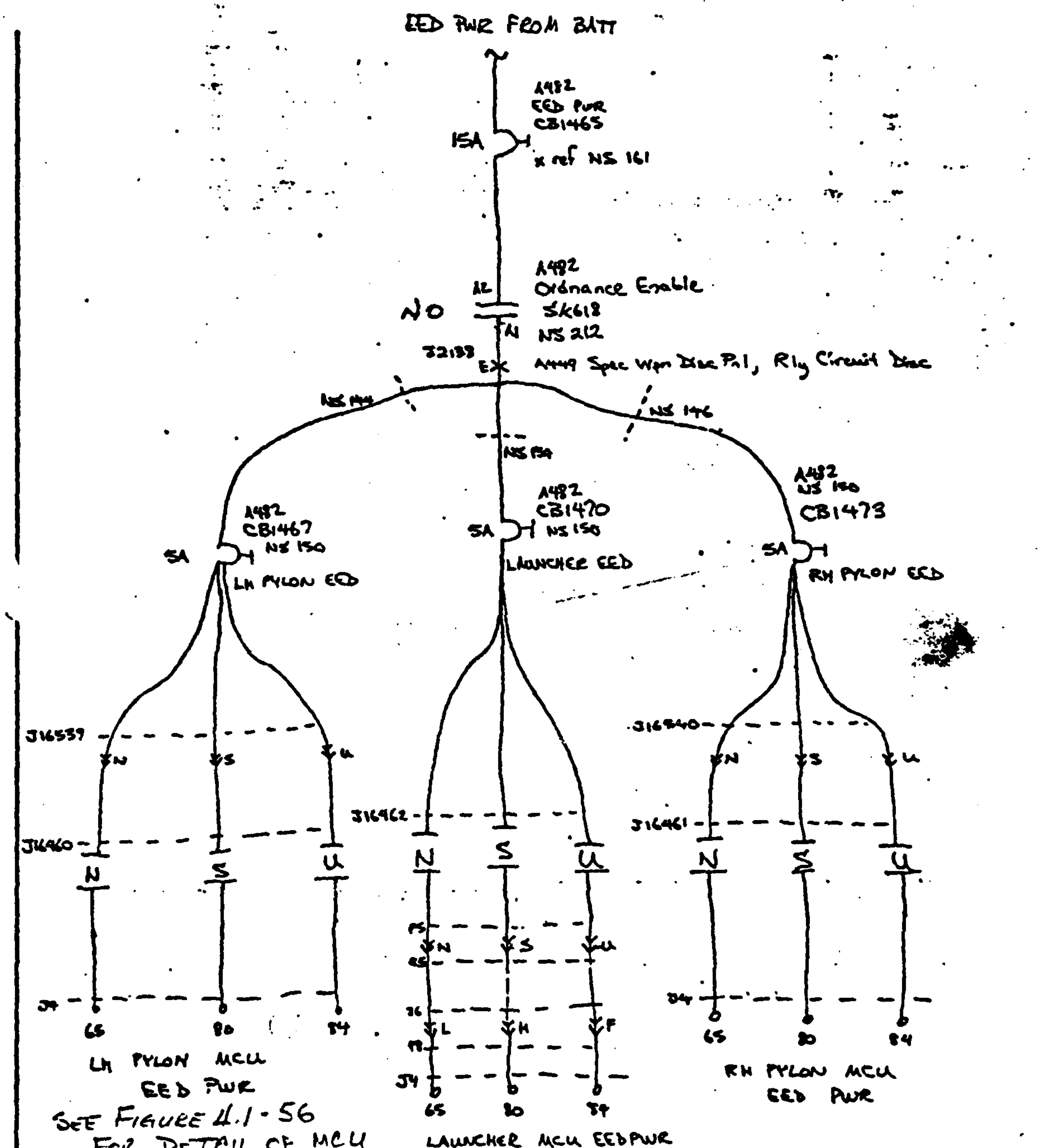
Voc = 118 VAC

$Isc = \frac{118}{.12} = \underline{983}$ A

Time - Current exceeds 9000% rating of CB. The time will be less than .125 sec. (3000% rated), Reference CB Spec. D10-30108.

SNEAK CIRCUITS NETWORK TREE

REV



PROJECT	TITLE		
B52-G	EED PWR		
QC ih	DATE 9-15-75	ANALYST M Barnett DATE 9/8/75	NODAL SET 144, 145, 146, 150

Figure 4.1-57 Network Tree No. 144-145

NOTE: CABLING AND CONNECTORS ARE SHOWN FOR MISSILE MOUNTED IN THE LAUNCHER. FOR MISSILE MOUNTED ON THE LEFT PYLON:

W1 IS W6
P24 IS P15
P32 IS P32
J1 IS J1

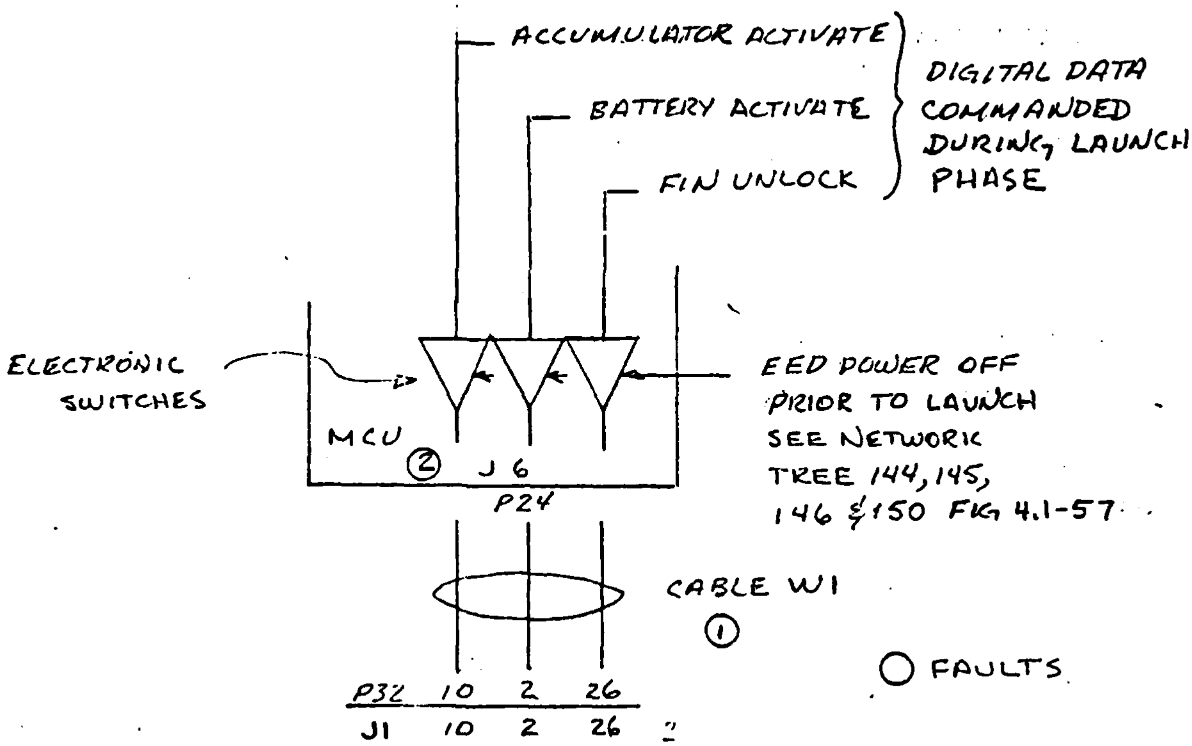
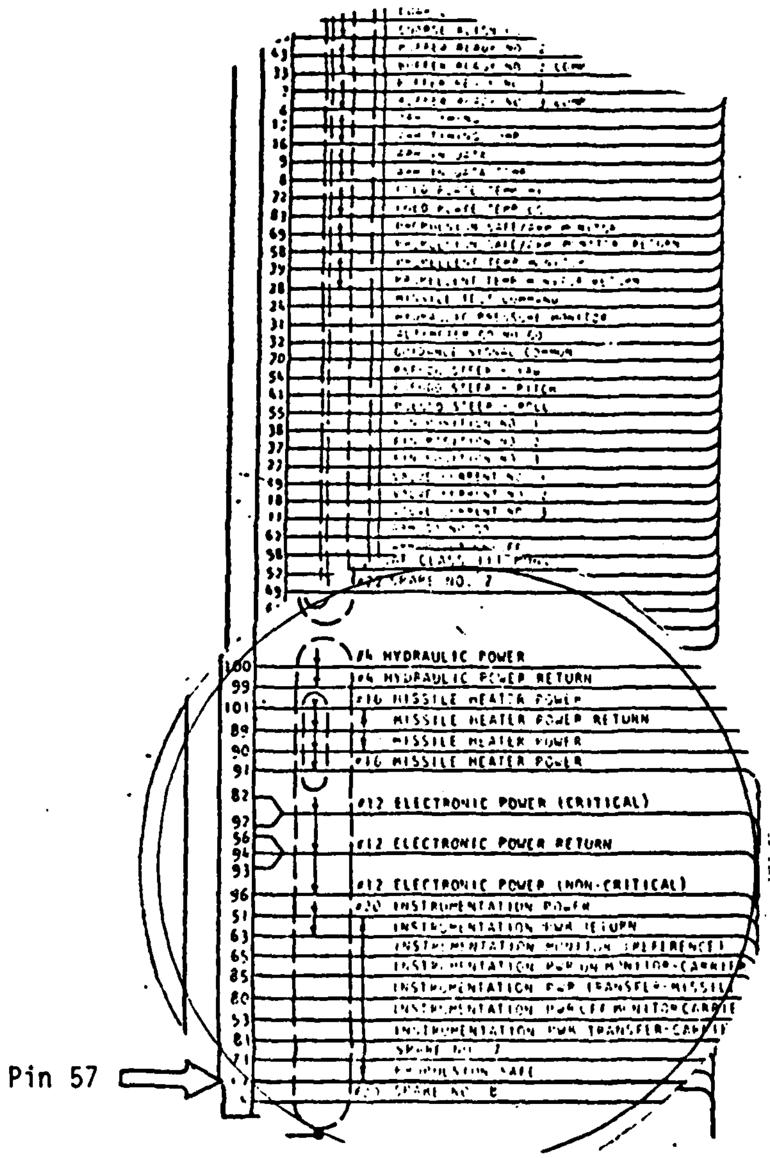


FIGURE 4.1-58. CABLE DRAWING

4.1.7.5 Circuit Analysis Package, SRAM, Interface Pin 57 of Connector J1, Missile 1 on the Left Pylon

This interface is shown in Figure 5-7 in T.O. 16W6-19-2, Change 3. The current available to this pin in a normal environment is 0 A. The worst case current in an abnormal environment (faulted) is 1115.5 A, assuming the pin is grounded.



Refer to Figure 2-38 of T.O. 1B-52G-2-39GA-1 For Circuit Details

4.1.7.5 (Continued)

a. Normal Power and Load Analysis

From an examination of Figure 4.1-59, Sneak Circuit Network Tree 153, the normal open circuit voltage is 0V and the short circuit current is 0A. The circuit passes through normally open relay contacts in the Power Distribution Panel.

b. Fault Analysis

The following postulated faults were analyzed using Figure 4.1-59, Network Tree 153 and Figure 4.1-60, Cable Drawing.

(1) Damage to Connector J1 or Cable W6

Pin 57 may be shorted to 28 VDC through CB 1444 or to 118 VAC through CB 1394.

CB 1444 (15A) 28 VDC Missile Electronic Power

Resistance of wire from CB to missile interface

58 ft. of #12 wire = .1102Ω

Relay Contact Resistance = .01Ω

Maximum current available at 28 VDC = 232 A

CB 1394 (10A) 118 VAC Missile Heater Power

Resistance of wire from CB to missile

58 ft. of #12 wire = .1102Ω

Relay contact resistance = .01Ω

Maximum current available at 118 VAC = 981.7 A

4.1.7.5b (Continued)

(2) Damage to the Relay Assembly or Cable W2

Wires to the subject pin may be shorted to 28 VDC through CB 1450, CB 1444, CB 1434, or shorted to 118 VAC through CB 1401 or CB 1394.

CB 1450 (7.5A) 28 VDC Bypass Valve Power

Resistance of wire from CB to Relay Assembly

52 ft. of #12 wire = .0988 Ω

Maximum current available at 28 VDC = 283.4 A

CB 1444 (15A) 28 VDC Missile Electronic Power

Resistance of wire from CB to Relay Assembly

52 ft. of #12 wire = .0988Ω

Maximum current available at 28 VDC = 283.4 A

CB 1434 (60A) 28 VDC Missile Hydraulic Power

Resistance of wire from CB to Relay Assembly

52 ft. of #4 wire = .0137Ω

Maximum current available at 28 VDC = 2043.8 A

CB 1401 (5A) 118 VAC AC Power

Resistance of wire from CB to Relay Assembly

52 ft. of #12 wire = .0988Ω

Maximum current available at 118 VAC = 1194.33A

CB 1394 (10A) 118 VAC Missile Heater Power

Resistance of wire from CB to Relay Assembly

52 ft. of #12 wire = .0988Ω

Maximum current available at 118 VAC = 1194.33A

(3) Damage to Connector J2367 or Cable 31-3564-121

The wire to pin 57 may be shorted to 28 VDC through CB 1450, CB 1444 or to 118 VAC through CB 1401 or CB 1394.

CB 1444 (15A) 28 VDC Missile Electronic Power

Resistance of wire from CB to Connector

44 ft. of #12 wire = .0836Ω

Maximum current available at 28 VDC = 334.9 A

4.1.7.5b (Continued)

(3) (Continued)

CB 1450 (7.5A) 28 VDC Bypass Valve Power

Resistance of wire from CB to Connector

44 ft. of #12 wire = .0836Ω

Maximum current available at 28 VDC = 334.9 A

CB 1401 (5A) 118 VAC AC Power

Resistance of wire from CB to Connector

44 ft. of #12 wire = .0836 Ω

Maximum current available at 118 VAC = 1141.5A

CB 1394 (10A) 118 VAC Missile Heater Power

Resistance of wire from CB to Connector

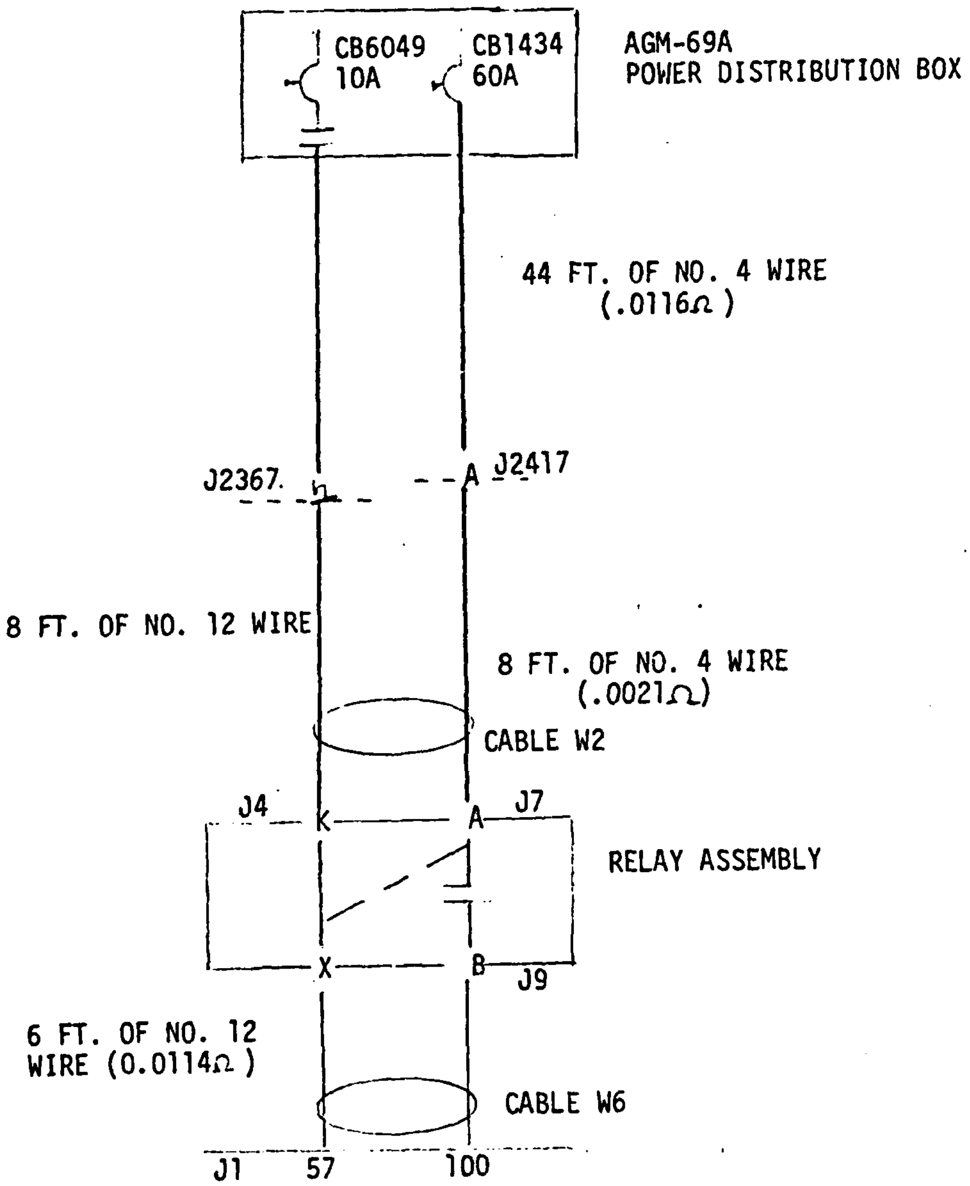
44 ft. of #12 wire = .0836 Ω

Maximum current available at 118 VAC = 1141.5A

4.1.7.5 (Continued)

c. Worst Case Path

(2) Damage to Relay Assembly



Interface Pin 57

Total wire Resistance = 0.0251Ω

Voc = 118 VAC

$$Isc = \frac{118}{.0251} = \underline{1115.5A}$$

Time - Minimum trip time shown on calibration curve is 1.5 seconds for 500 amps. Therefore the time for 1115.5 amps would be less than 1.5 sec.

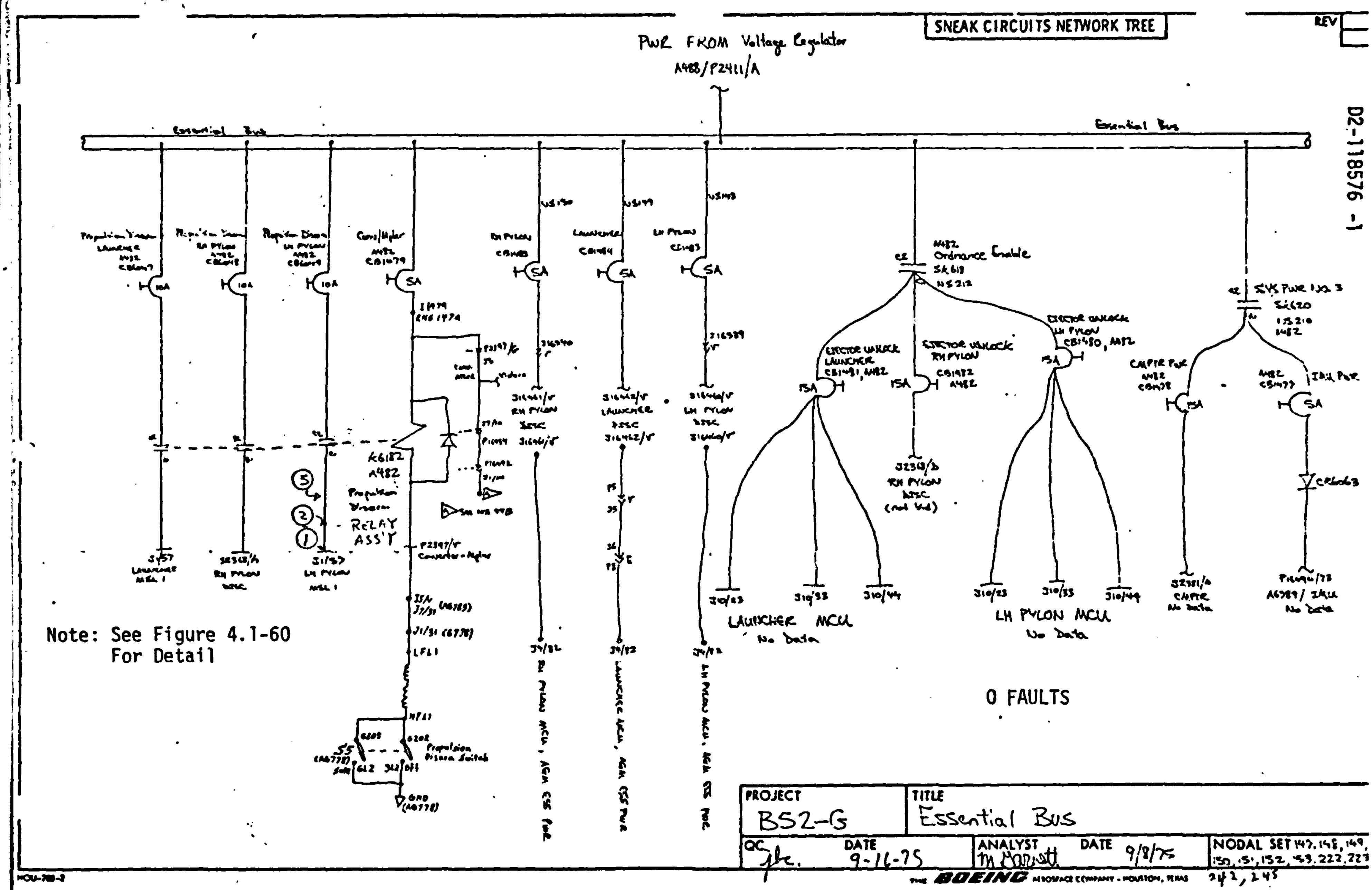
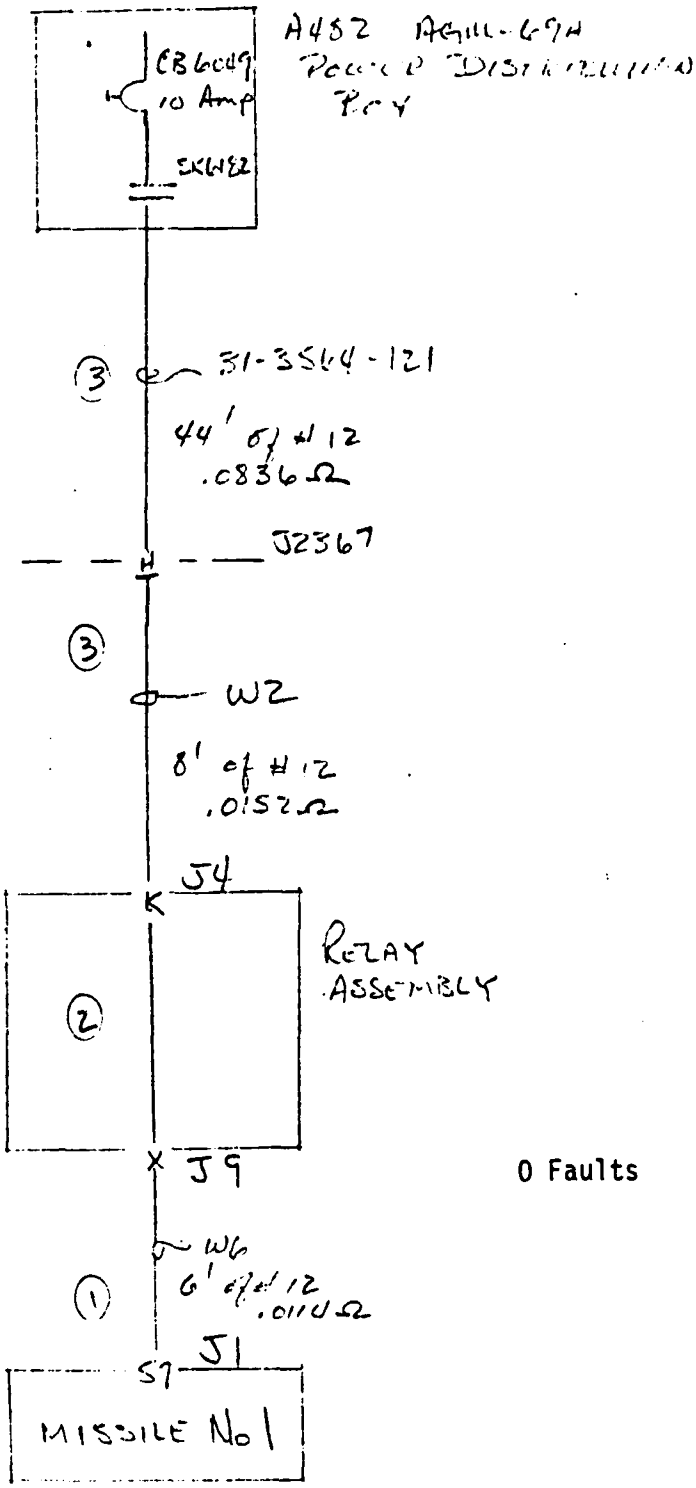


FIGURE 4.1-59. NETWORK TREE 153

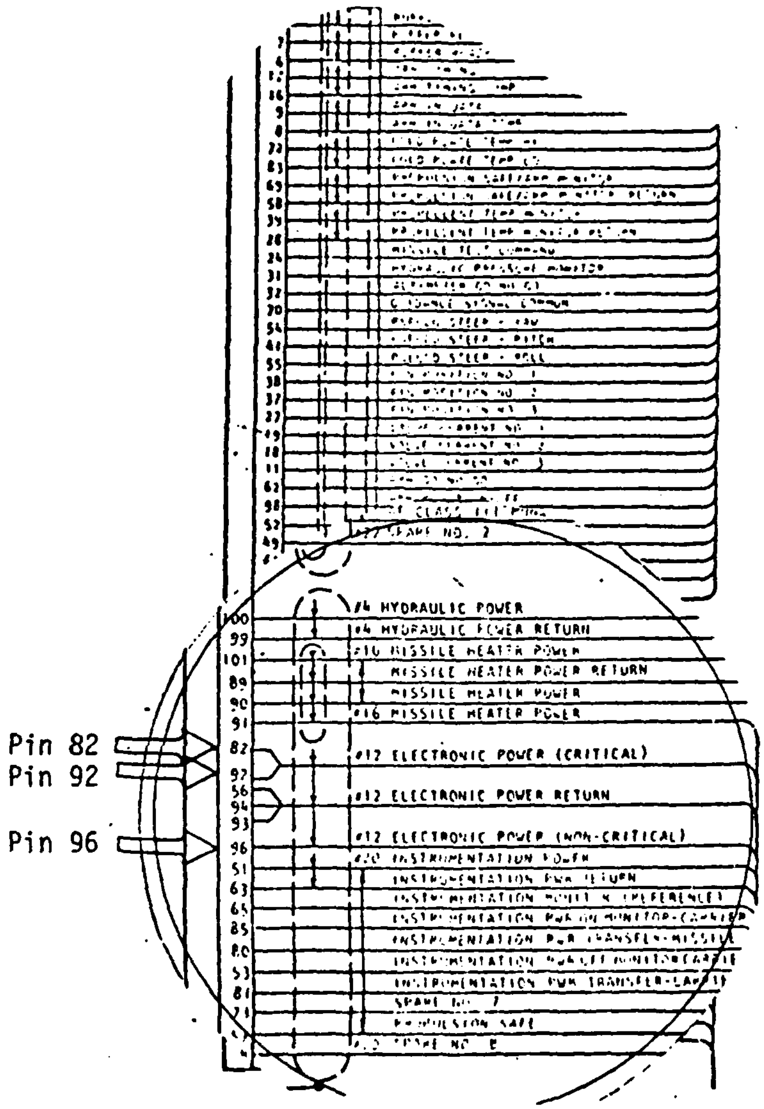


0 Faults

FIGURE 4.1-60. CABLE DRAWING

4.1.7.6 Circuit Analysis Package, AGM-69A Interface Pins 82, 92 & 96 of Connector J1, Missile 1 on the Left Pylon

These interfaces are shown in Figure 5-7 and T.O. 16W6-19-2, Change 3. The maximum current available to these pins in a normal environment is <u>0A</u> for ground alert and <u>254A</u> for airborne conditions. The worst case current at 28VDC in an abnormal (faulted) environment would be 1115.5A with the pins grounded.



Refer to Figure 2-40 of T.O. 1B-52G-2-39GA-1 For Circuit Details

4.1.7.6 (Continued)

a. Normal Power and Load Analysis

From examination of Figure 4.1-61, Network Tree 175, and Figure 4.1-62, open circuit voltage and short circuit current are:

Ground alert: (Missile OFF) V_{OC} = 0 VDC

I_{SC} = 0 A

Airborne: (Missile ON) V_{OC} = 28VDC

I_{SC} = 232A

b. Fault Analysis

The following postulated faults have been analyzed using Network Tree 175 and Cable Diagram, 4.1-61 and 4.1-62.

(1) Damage to Connector J1 or Cable W6

Pins 82, 92 and 96 may be shorted to 118VAC through CB1394 if missile heater power is on.

CB1394 (10A) 118VAC Missile Heater Power

Resistance of wire from CB to missile

58 ft of #12 wire = .1102

Resistance of relay contacts = .01

Maximum current available at 118VAC = 981.7A

(2) Damage to Relay Assembly or Cable W2

The wires to the subject pins may be shorted to 28VDC through CB1450, CB1444 and CB1434. The wires may also be shorted to 118VAC through CB1401 and CB1394.

4.1.7.6b (Continued)

CB1450 (7.5A) 28VDC Bypass Valve Power

Resistance of wire from CB to Relay Assembly

52 ft of #12 wire = .0988

Maximum current available at 28VDC = 283A

CB1444 (15A) 28VDC Missile Electronic Power

Resistance of wire from CB to Relay Assembly

52 ft of #12 wire = .0988

Maximum current available at 28VDC = 283A

CB1434 (60A) 28VDC Missile Hydraulic Power

Resistance of wire from CB to Relay Assembly

52 ft of #4 wire = .0137

Maximum current available at 28VDC = 2043A

CB1401(5A) 118VAC AC Power

Resistance of wire from CB to Relay Assembly

52 ft of #12 wire = .0988

Maximum current available at 118VAC = 1194A

CB1394 (10A) 118VAC Missile Heater Power

Resistance of wire from CB to Relay Assembly

52 ft of #12 wire = .0988

Maximum current available at 118VAC = 1194A

(3) Damage to Connector J2367 or Cable 31-3564-121

The wires to pins 82, 92, 96 may be shorted to 28VDC through CB1450 or to 118VAC through CB1401 or CB1394.

CB1450 (7.5A) 28VDC Bypass Valve Power

Resistance of wire from CB to Connector

44ft of #12 wire = .0836

Maximum current available at 28VDC = 334A

4.1.7.6b (Continued)

③ (Continued)

CB1401 (5A) 118VAC AC Power

Resistance of wire from CB to Connector

44 ft of #12 wire = .0836

Maximum current available at 118VAC = 1141A .

CB1394 (10A) 118VAC Missile Heater Power

Resistance of wire from CB to Connector

44 ft of #12 wire = .0836

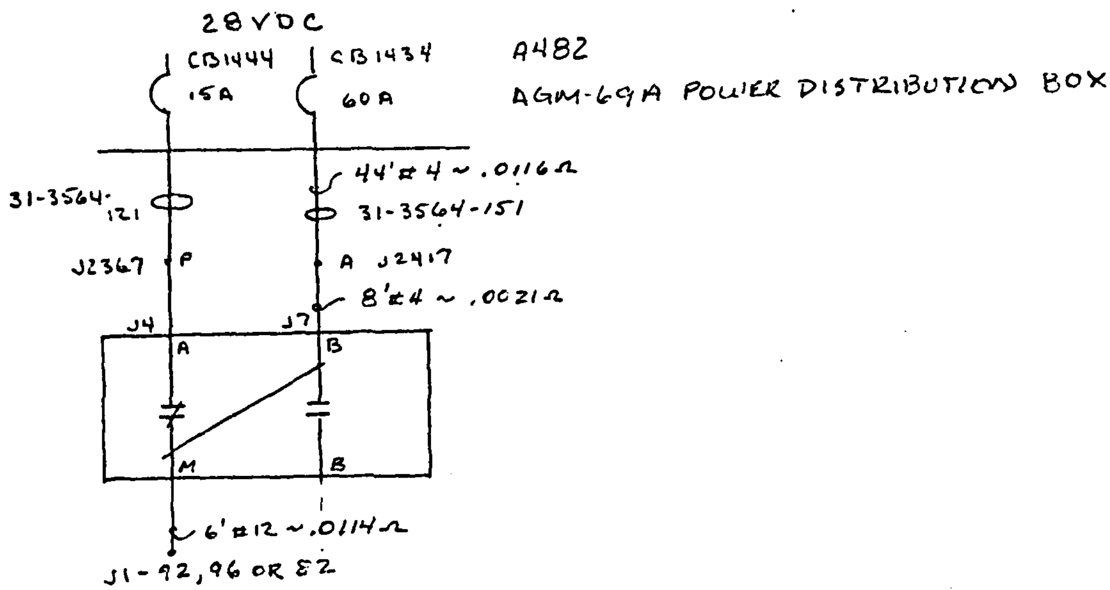
Maximum current available at 118VAC = 1141A

NOTE. All circuit breakers are located in the AGM-69A Power Distribution Box.

4.1.7.6 (Continued)

c. Worst Case Path

Reference path (2) Damage to Relay Assembly



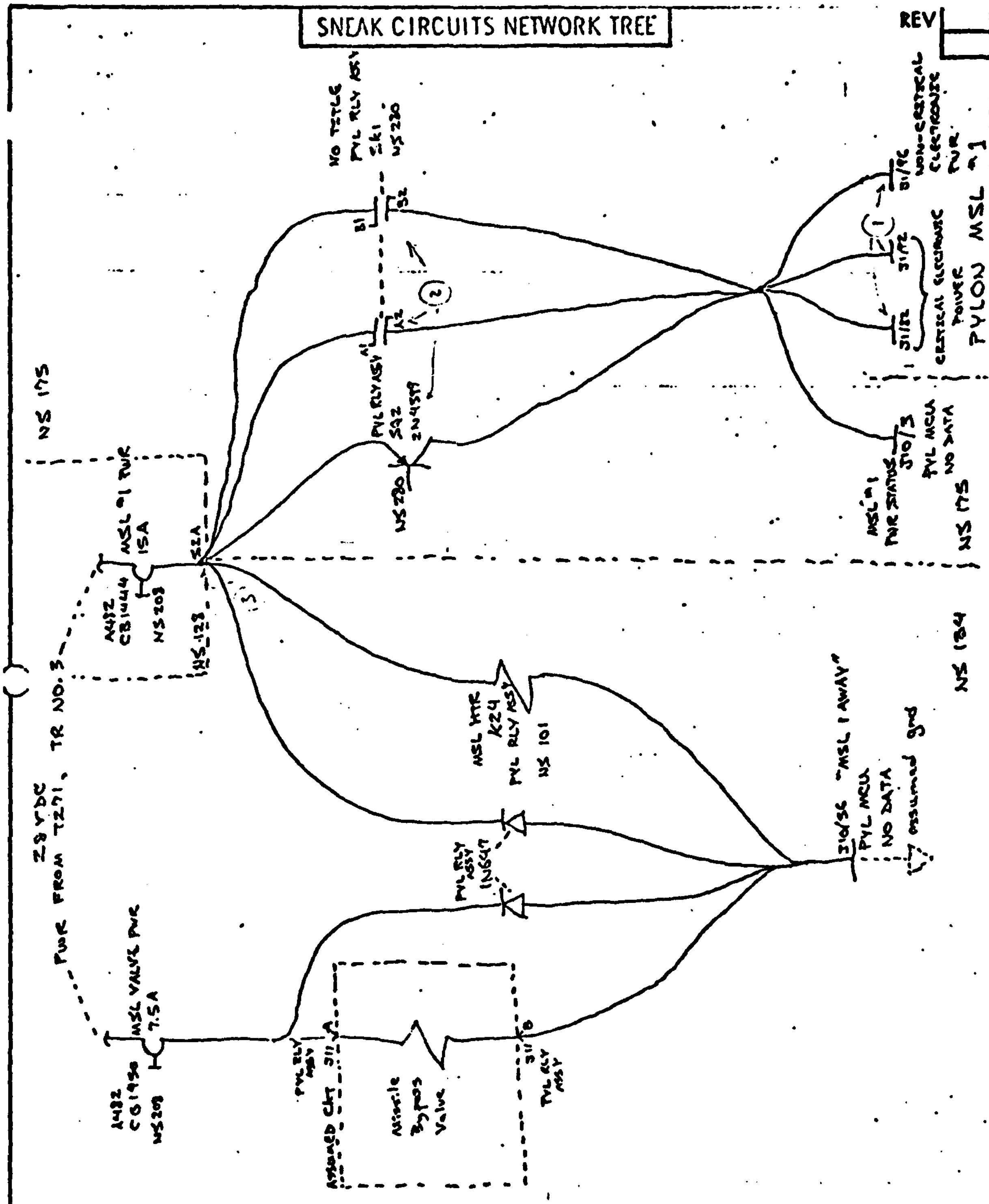
Pins 82, 92, 96

Total resistance = 0.0251Ω

V_{OC} = 28VDC

I_{SC} = 1115.5 A

Time = Minimum trip time shown in calibration curve is 1.5 seconds for 500 A. Trip time for 2413 A will be less than 1.5 seconds.



PROJECT	TITLE		
B52-G	MSL PWR & MSL VALVE PWR		
QC DATE	ANALYST M Barrett	DATE 9/3/75	NODAL SET 128, 134, 175

Figure 4.1 Network Tree No. 175

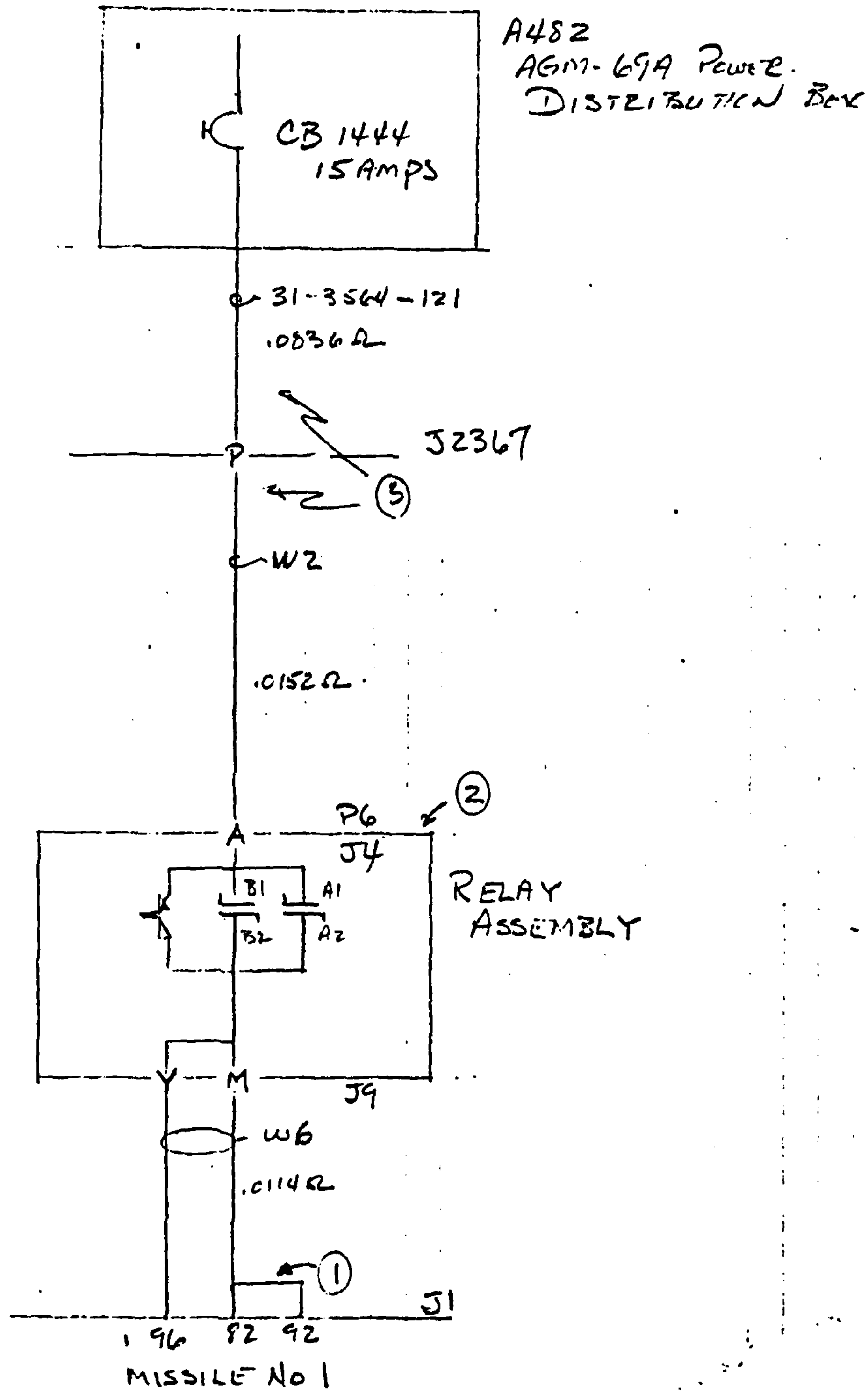
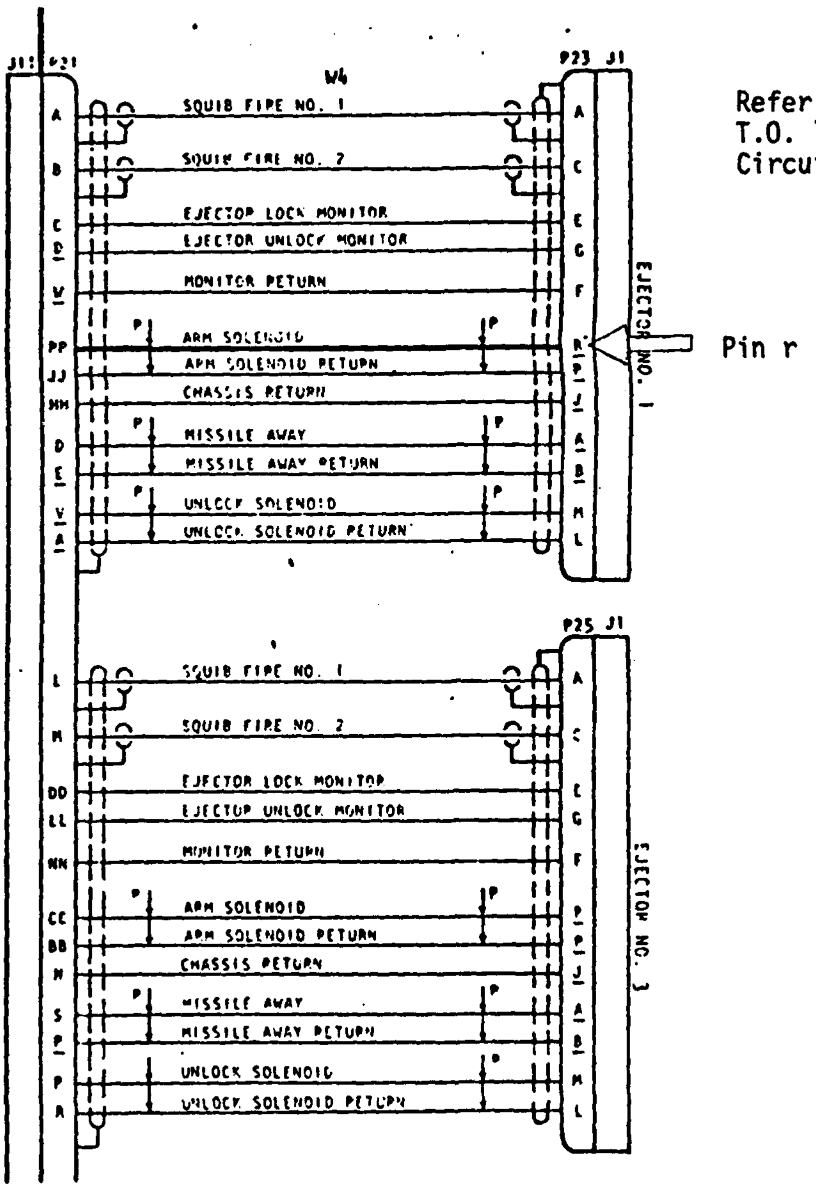


FIGURE 4.1-62. CABLE DRAWING

THIS PAGE INTENTIONALLY BLANK

4.1.7.7 Circuit Analysis Package, AGM-69A Ejector Interface pin r, Arm Solenoid, Launcher and Pylon

These interfaces are shown in Figure 5-7 of T.O. 11L1-2-8-2, Change 12. Maximum current available to this pin in a normal environment is 0 amps. Worst case current at 27VDC in an abnormal (faulted) environment for the launcher ejector pin is 54 amps and for the pylon ejector is 37 amps with the pins grounded.



Refer to Figure 2-39 of T.O. 1B-52G-39GA-1 for Circuit Details.

4.1.7.7 (Continued)

a. Normal Power and Load Analysis

From an examination of Figure 4.1-64, Cable Drawing, the open circuit voltage is 0V and the short circuit current is 0A. The electronic switch is normally off prior to launch.

b. Fault Analysis

The following faults were analyzed using Figure 4.1-64.

(1) Cable W11 Damaged or (2) W4 Damaged

Wire to pin r shorted to missile away monitor from pin a. Pin a is a ground path for the missile away monitor lamp located in the Weapon Release Indicator Panel, and a relay in the Switch Unit. Current available to the interface cannot be calculated since value of current limiting resistor and other components in the circuit is unknown (schematics in the MCU are not available).

Guidance and Logic Signals

Current output from these sources is device limited and is less than expected from the above fault.

(3) Launcher MCU Damaged

Wire to pin r shorted to 27VDC from CB1484, ± 22VDC from power supply in the switch unit or guidance and logic signals.

CB1484 (5A) 27VDC Essential Power

Resistance of wire from CB to MCU

44 ft of #20 wire = .405 ohms

Maximum current available = 66 amps

Power Supply in Switch Unit

Current output is less than above listed fault. Current magnitude is unknown since specification is not available.

Guidance and Logic Signals

Current from these sources is device limited to less than other sources listed.

4.1.7.7b (Continued)

④ Pylon MCU Damaged

Wire to pin r shorted to 27VDC from CB1483, ± 22VDC from power supply in Switch Unit or guidance and logic signals.

CB1485 (5A) 27VDC Essential Power

Resistance of wire from CB to MCU

50 ft of #20 wire .619 ohms

Maximum current available = 43.5 amps

Power supply in switch unit

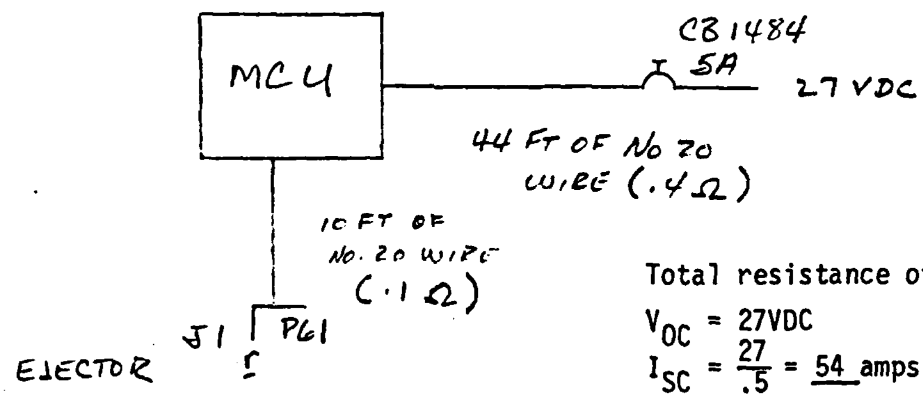
Current output is less than other listed fault circuit magnitude is unknown since specification is not available.

Guidance and Logic Signals

Current output from these sources is device limited to less than other sources listed.

c. Fault Analysis

For launch ejector reference path ② Launcher MCU Damaged.



Total resistance of path = .5 ohms

V_{OC} = 27VDC

$I_{SC} = \frac{27}{.5}$ = 54 amps

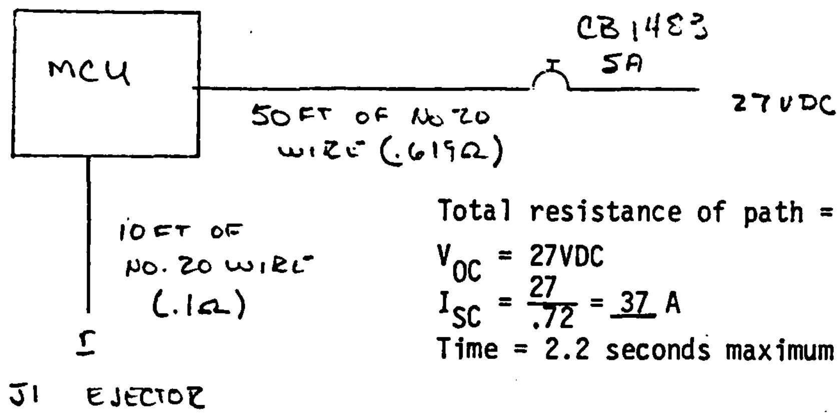
Time = 1.1 seconds maximum

NOTE: All circuit breakers are located in the AGM-69A Power Distribution Box.

4.1.7.7 (Continued)

c. (Continued)

For pylon ejector reference path (4) Pylon MCU Damaged.



Total resistance of path = .72 ohms

V_{OC} = 27VDC

$I_{SC} = \frac{27}{.72} = \underline{37}$ A

Time = 2.2 seconds maximum

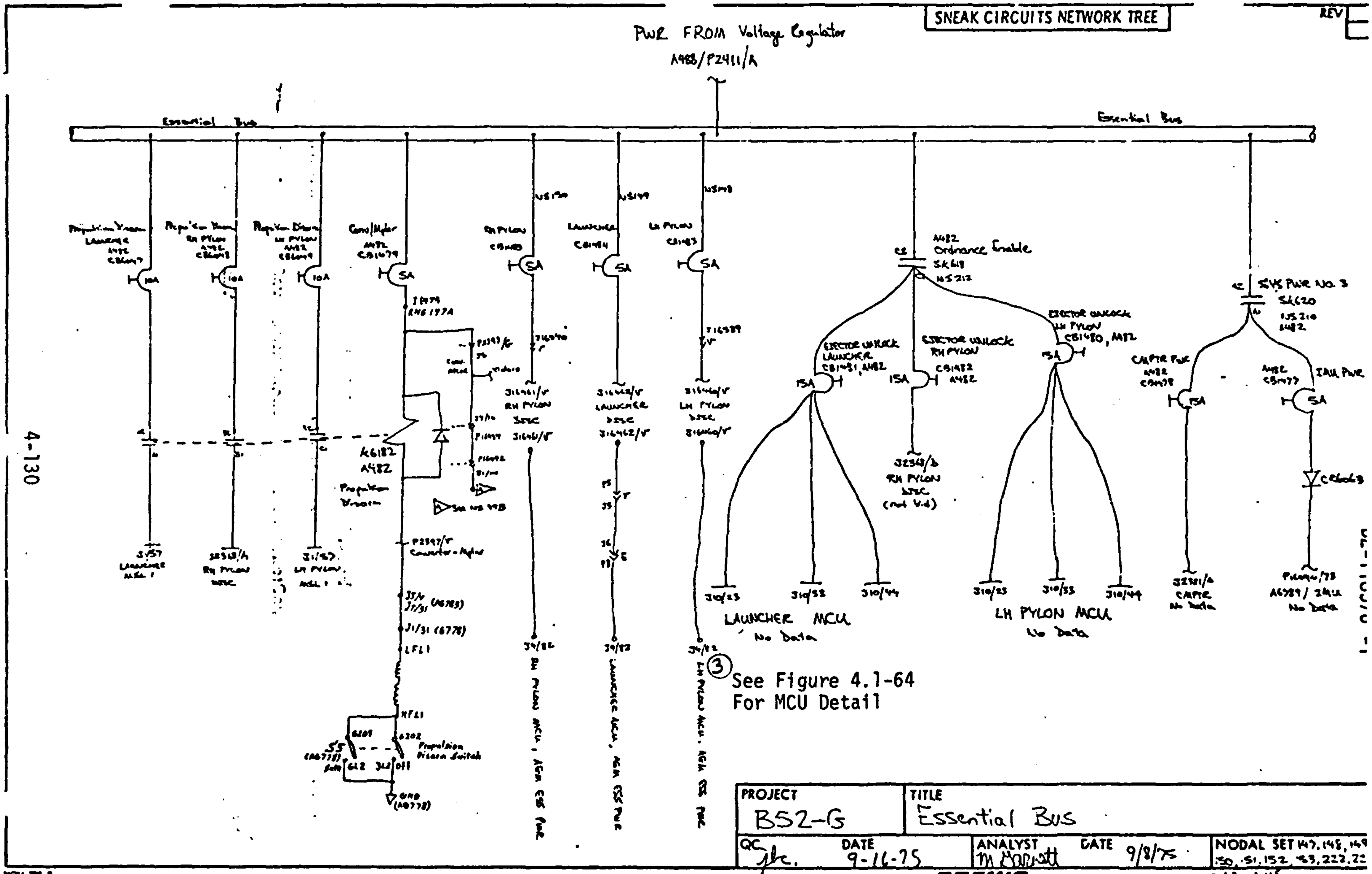


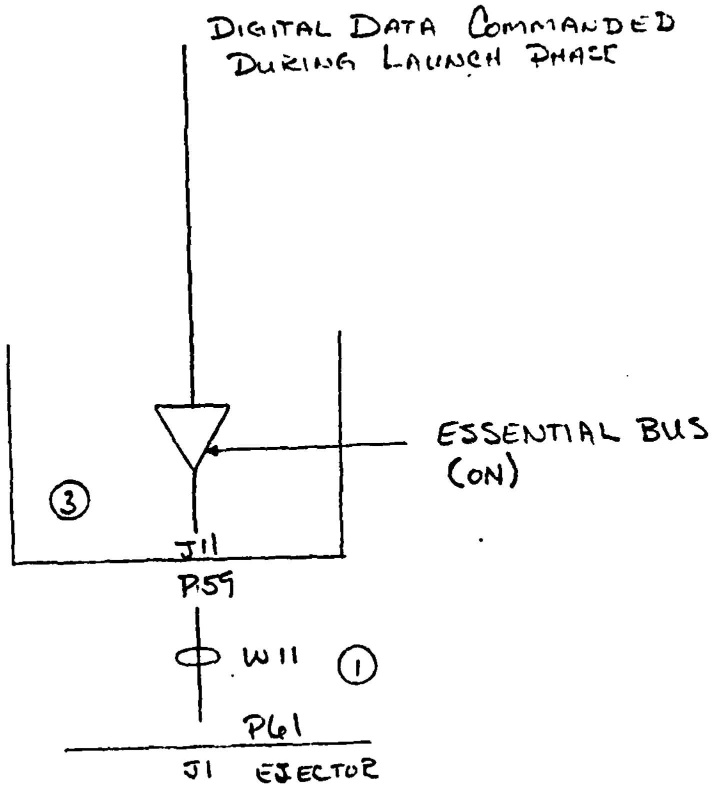
FIGURE 4.1-63. NETWORK TREE 148

AD-A103 951 BOEING AEROSPACE CO HOUSTON TX F/G 15/6
ELECTRICAL ANALYSIS OF B-52/FB-111 AMAC AND RELEASE CIRCUITRY U--ETC(U)
OCT 75 F29601-76-C-0017
UNCLASSIFIED D2-118576-1 NL

3 of 4
AD
A103951

4.1.7.7 (Continued)

Launcher Ejector shown
For pylon ejector:
J11 is J11
P59 is P21
W11 is W4
P61 is P23
J1 is J1
(1) is (2)
(3) is (4)



0 Faults

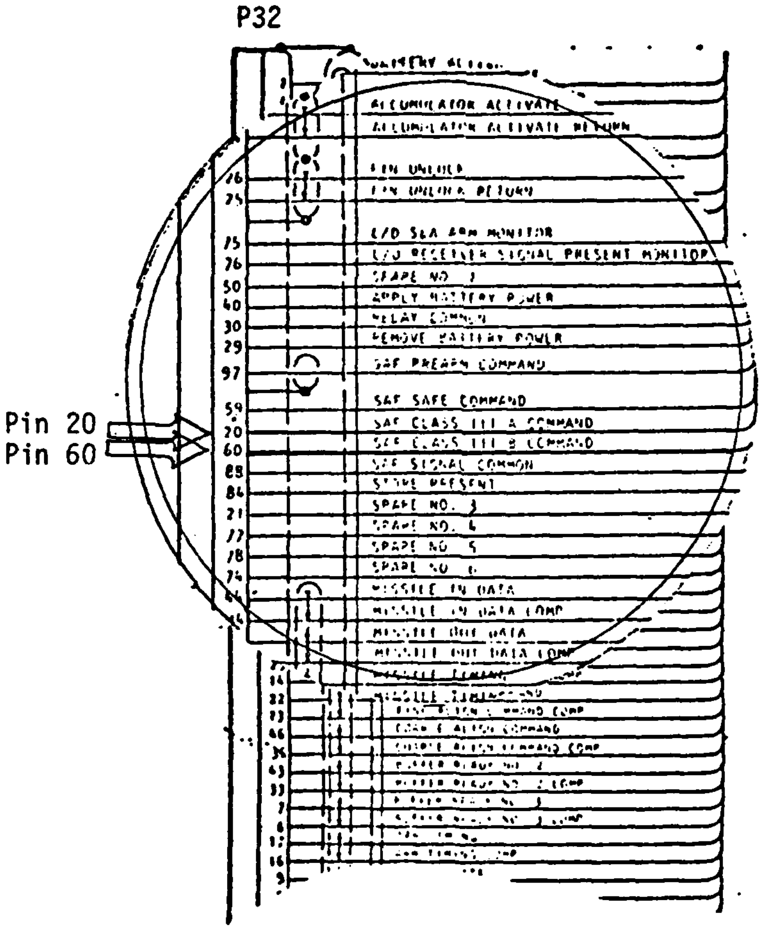
FIGURE 4.1-64 CABLE DIAGRAM

4.1.7.8 Circuit Analysis Package, AGM-69A Interface pins 20 and 60, Connector J1, Missile #1 On the Launcher and Left Pylon

This interface is shown in Figure 5-37 and T.O. 11L1-2-8-2, (Change 12). Maximum current available to these pins in a normal environment is 0A. Worst case current at 118VAC in an abnormal (faulted) environment assuming the pins grounded would be:

Launcher missile pins - 900A

Pylon missile pins - 983A



Refer to Figure 2-38 of T.O. 1B-52G-39GA-1 For Circuit Details

4.1.7.8 (Continued)

a. Normal Power and Load Analysis

From an examination of Figure 4.1-65, Cable Drawing, the open circuit voltage is 0V and the short circuit current is 0A. The electronic switches are normally off prior to the launch phase.

b. Fault Analysis

The following faults were analyzed using Figure 4.1-65.

For Launcher Mounted Missile

(1) Cable W1 Damaged

Wires to pins 20 and 60 shorted to 28VDC from CB1411, 118VAC from CB1395 if heater power is on, or to guidance and logic signals.

CB1411 (15A) 28VDC Missile Electronic Power

Resistance of wire from CB to missile interface

55 ft of #10 wire = .06 Ω

switch = .01 Ω

Maximum current available = 400A

CB1395 (15A) 118VAC Missile Heater Power

Resistance of wire from CB to missile interface

47 ft of #12 wire = .095 Ω

6 ft of #16 wire = .027 Ω

Maximum current available = 940A

Guidance and Logic Signals

Currently output of these sources is device limited to less than other sources listed.

4.1.7.8b (Continued)

(2) Launcher MCU Damaged

Wires to pins 20 and 60 shorted to 27VDC from CB1484, ± 22VDC from Power Supply in the Switch Unit, or guidance and logic signals.

CB1484 (5A) 27VDC Essential Power

Resistance of wire from CB to MCU

44 ft of #20 wire = .405 Ω

Maximum current available = 66A

Power Supply in Switch Unit

Current output is less than the other listed faults. Current magnitude unknown, specifications not available.

Guidance and Logic Signals

Current output from these sources is limited to less than other sources listed.

For Pylon Mounted Missile

(1) Cable W6 Damaged

Wires to pins 20 and 60 shorted to 28VDC from CB1444, 118VAC from CB1394 if heater power is on, or guidance and logic signals.

CB1444 (15A) 28VDC Missile Electronic Power

Resistance of wire from CB to missile interface

58 ft of #20 wire = .11 Ω

switch = .01 Ω

Maximum current available = 233A

CB1394 (10A) 118VAC Heater Power

Resistance of wire from CB to missile interface

58 ft of #12 wire = .11 Ω

switch = .01 Ω

Maximum current available = 983A

4.1.7.8b (Continued)

Guidance and Logic Signals

Current output from these sources is limited to less than other sources listed.

(2) <u>Left Pylon MCU Damaged</u>

Wires to pins 20 and 60 shorted to 27VDC from CB1483, ± 22VDC from power supply in switch unit, or guidance and logic signals.

CB1483 (5A) 27VDC Essential Power

Resistance of wire from CB to MCU

50 ft of #20 wire = .619 Ω

Maximum current available = <u>43.5</u>A

Power Supply in Switch Unit

Current output less than other listed fault. Current magnitude unknown, specifications not available.

Guidance and Logic Signals

Current output from these sources is limited to less than other sources listed.

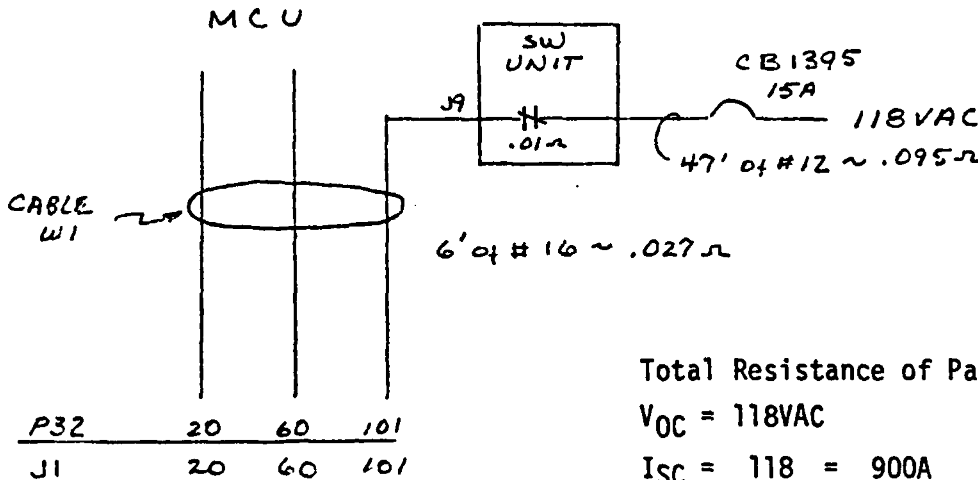
Note: All circuit breakers are located in the AGM-69A Power Distribution Box

4.1.7.8 (Continued)

c. <u>Worst Case Paths</u>

For Launcher Mounted Missile

Reference Path (1) Cable W1 Damaged



Total Resistance of Path .122 Ω

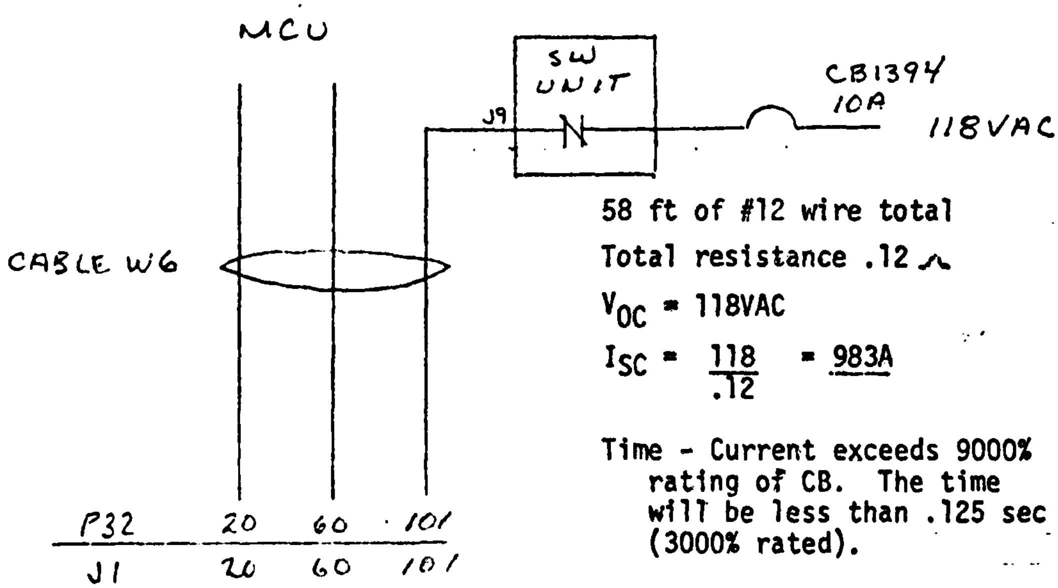
V_{OC} = 118VAC

$I_{SC} = \frac{118}{.122} = \underline{900A}$

Time - Current rating exceeds 6000% rating of CB. The time will be less than .13 sec (300% rated).

For Pylon Mounted Missile

Reference path (1) Cable W6 Damaged



58 ft of #12 wire total

Total resistance .12 Ω

V_{OC} = 118VAC

$I_{SC} = \frac{118}{.12} = \underline{983A}$

Time - Current exceeds 9000% rating of CB. The time will be less than .125 sec (3000% rated).

4.1.7.8c (Continued)

NOTE: CABLING AND CONNECTORS ARE SHOWN FOR MISSILE #1 MOUNTED IN THE LAUNCHER. FOR MISSILE MOUNTED ON THE LEFT PYLON:

W1 IS W6
P24 IS P15
P32 IS P32
J1 IS J1

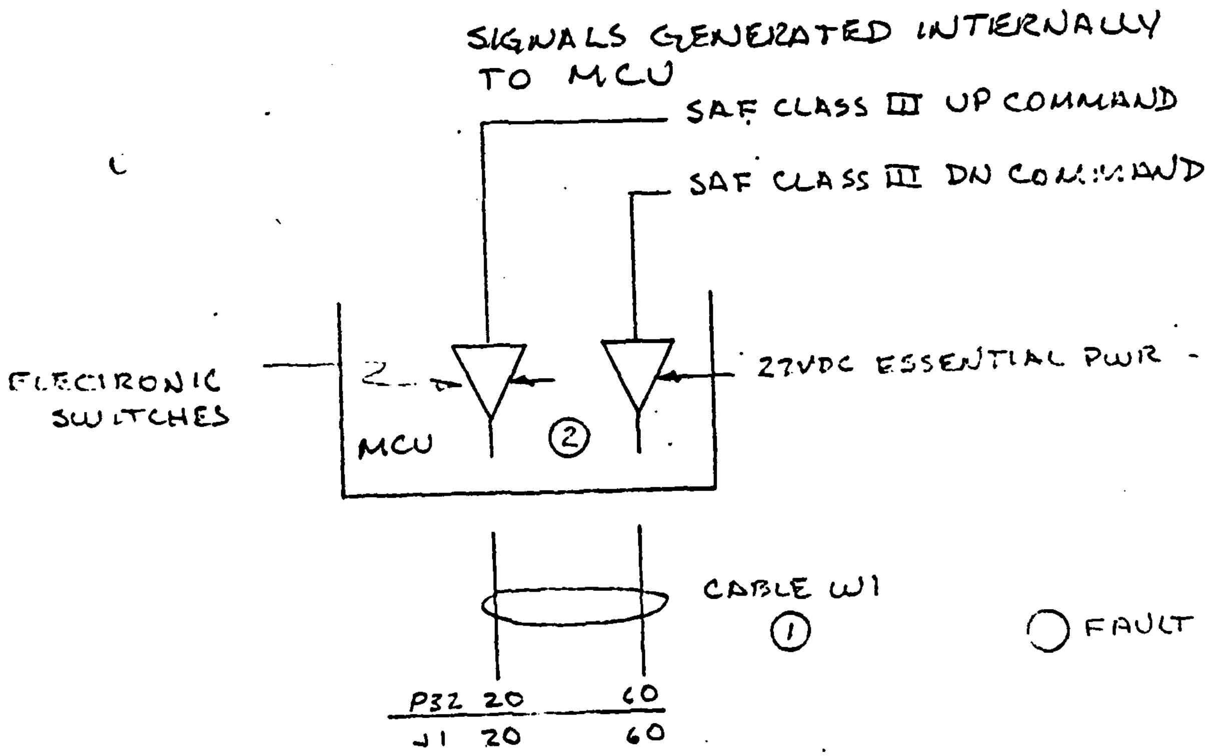


FIGURE 4.1-65. CABLE DRAWING

4.2 POWER AND LOAD ANALYSIS - FB-111A

This section describes the power and load analyses of monitor and control circuits leading to gravity weapons loaded on weapon station 3 pivot pylon and in RH weapons bay. These two weapons stations were picked as typical for all nuclear weapons stations and represent both the nearest and farthest station from the power sources. Potential worst case currents at weapon stations 4 and 5 would be slightly higher (approximately 12%) than those calculated for weapon station 3 due to differences in wire length. Figure 4.2-A is a simplified schematic diagram of the circuits to the Aircraft Monitor and Control - station program unit (AMAC SPU) interface connector. Numbers opposite the interface pins refer to circuit analysis packages in section 4.2.6 herein. Figure 4.2-B is an exploded view of an AMAC SPU, typical for all stations. Figure 4.2-C locates the pivot pylon weapon station AMAC SPU. Figure 4.2-D is a copy of Figure 1-8 from T.O. 1F-111(B)A-2-11-1 showing the circuitry to the pivot pylon weapons station. Note that the pins at the bottom of the diagram are the weapon interface pins. Figure 4.2-E locates the weapons bay AMAC SPU's.

Figure 4.2-F shows weapons bay interface circuitry. Note that the pins at the bottom of the diagram interface with the weapon. The main difference between the -3 pivot pylon interface and -R right hand weapons bay interface is the presence of interconnect pins V and W at the pylon. See Appendix A for a list of all technical data utilized for the FB-111A-Power and Load Analysis.

4.2.1 SUMMARY

Power and load analyses of network trees generated by sneak circuit analysis are documented in section 4.2.6 below. Table 4.2-1A, sheets 1 and 2, provide a summary of the results.

4.2.2 CONDITIONS

The following conditions and exclusions are applicable to the FB-111A Analysis.

TABLE 4.2-1A Power and Load Analysis Results - FB-111/Station 3
(Sheet 1 of 2)

WEAPON INTERFACE		ENVIRONMENT ANALYSIS RESULTS						ANALYSIS PACKAGE
		NORMAL			ABNORMAL - WORST CASE			
DESIGNATOR	FUNCTION	V	I	t	V	I	t	Section 4.2.6
J479013-3	WPN STATION 3							
Pin A	SAFE INPUT	28V	608A	.6s	28V 115VAC	608A 1983A	.6s .6s	4.2.6.2
B	(NONE)							
C	SAFE INDICATION	28V	48mA		28V 115VAC	608A 198mA	.6s/-*	4.2.6.5
D	(NONE)							
E	GROUNDED	0	-					
F	GROUNDED	0	-					
G	WPN PRESENT (GROUND)	28V	48mA		28V 115VAC	608A 198mA	.6s/-*	4.2.6.5
H	ARM INPUT	0	0		28V	608A	.6s	4.2.6.2
J	ARM INPUT	0	0		28V	608A	.6s	4.2.6.2
K	(NONE)							
L	(UNUSED)	0	0		28V 115VAC	608A 451A	.6s/.6s	4.2.6.3
M	(NONE)							
N	(UNUSED)	0	0		28V 115VAC	608A 451A	.6s/.6s	4.2.6.3
P	PAL MONITOR	28V	48mA		28V 115VAC	608A 451A	.6s/.6s	4.2.6.1
R	ARM INDICATION	28V	48mA		28V 115VAC	608A 198mA	.6s/-*	4.2.6.5
S	SWITCHED TO GROUND	0	0		28V	608A	.6s	4.2.6.6
T	(NONE)							
U	(NONE)							
V	PYLON CONTINUITY	0	0		28V	608A	.6s	4.2.6.6
W	PYLON CONTINUITY	0	0		28V	608A	.6s	4.2.6.6
X	WPN DROP CONFIG. RETARD	0	0		28V	608A	.6s	4.2.6.2
Y	(FUTURE CAPABILITY)	0	0		28V	608A	.6s	4.2.6.2
Z	BURST OPTION-AIR	0	0		28V	608A	.6s	4.2.6.2
a	(SRAM ONLY)	0	0		28V	608A	.6s	4.2.6.3
b	SAFE PROVISION	28V	48mA		28V 115VAC	608A 198mA	.6s/-*	4.2.6.4
c	(SRAM ONLY)	0	0		28V	608A	.6s	4.2.6.3
d	WPN DROP CONFIG. FREE FALL	0	0		28V	608A	.6s	4.2.6.2
e	(FUTURE CAPABILITY)	0	0		28V	608A	.6s	4.2.6.2
f	BURST OPTION-GND	0	0		28V	608A	.6s	4.2.6.2

*Indefinite

TABLE 4.2-1A Power and Load Analysis Results - FB-111/Station -R
Weapon Interface (Sheet 2 of 2)

WEAPON INTERFACE		ENVIRONMENT ANALYSIS RESULTS						
		NORMAL			ABNORMAL - WORST CASE			ANALYSIS PACKAGE
DESIGNATOR	FUNCTION	V	I	t	V	I	t	Section 4.2.6
J479013-R	RH WPNS BAY							
Pin A	SAFE INPUT	28V	1333A	.6s	28V 115VAC	1333A 3286A	.6s .6s	4.2.6.2
B	(NONE)							
C	SAFE INDICATION	28V	48mA	--	28V 115VAC	1333A 198mA	.6s indefinite	4.2.6.5
D	(NONE)							
E	GROUNDED							
F	GROUNDED							
G	WPN PRESENT (GND)	28V	48mA	--	28V 115VAC	1333A 198mA	.6s indefinite	4.2.6.5
H	ARM INPUT	0	0	--	28V	1333A	.6s	4.2.6.2
J	ARM INPUT	0	0	--	28V	1333A	.6s	4.2.6.2
K	(NONE)							
L	(UNUSED)	0	0	--	28V 115VAC	1333A 215A	.6s .6s	4.2.6.3
M	(NONE)							
N	(UNUSED)	0	0	--	28V 115VAC	1333A 215A	.6s .6s	4.2.6.3
P	PAL MONITOR	28V	48mA	--	28V	1333A	.6s	4.2.6.1
R	ARM INDICATION	28V	48mA	--	28V 115VAC	1333A 198mA	.6s indefinite	4.2.6.5
S	SWITCHED TO GND	0	0	--	28V	1333A	.6s	4.2.6.6
T	(NONE)							
U	(NONE)							
V	(UNUSED IN WPN BAY)							
W	(UNUSED IN WPN BAY)							
X	WPN DROP CONFIG. RET	0	0	--	28V	1333A	.6s	4.2.6.2
Y	(FUTURE CAPABILITY)	0	0	--	28V	1333A	.6s	4.2.6.2
Z	BURST OPTION-AIR	0	0	--	28V	1333A	.6s	4.2.6.2
a	(SRAM ONLY)	0	0	--	28V	1333A	.6s	4.2.6.3
b	SAFE PROVISION	28V	48mA	--	28V 115VAC	1333A 198mA	.6s indefinite	4.2.6.4
c	(SRAM ONLY)	0	0	--	28V	1333A	.6s	4.2.6.3
d	WPN DROP CONFIG-FF	0	0	--	28V	1333A	.6s	4.2.6.2
e	(FUTURE CAPABILITY)	0	0	--	28V	1333A	.6s	4.2.6.2
f	BURST OPTION - GND	0	0	--	28V	1333A	.6s	4.2.6.2

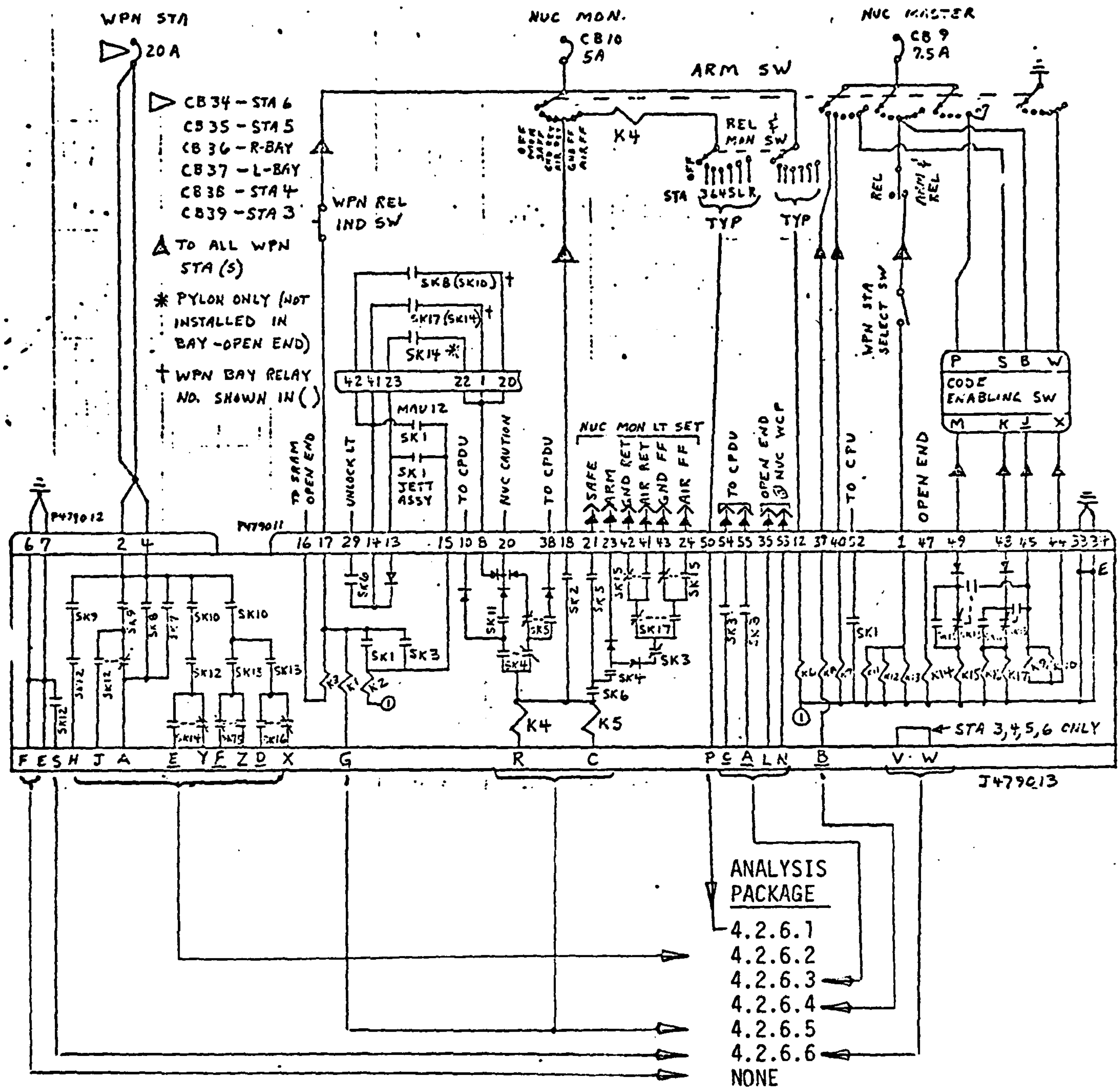
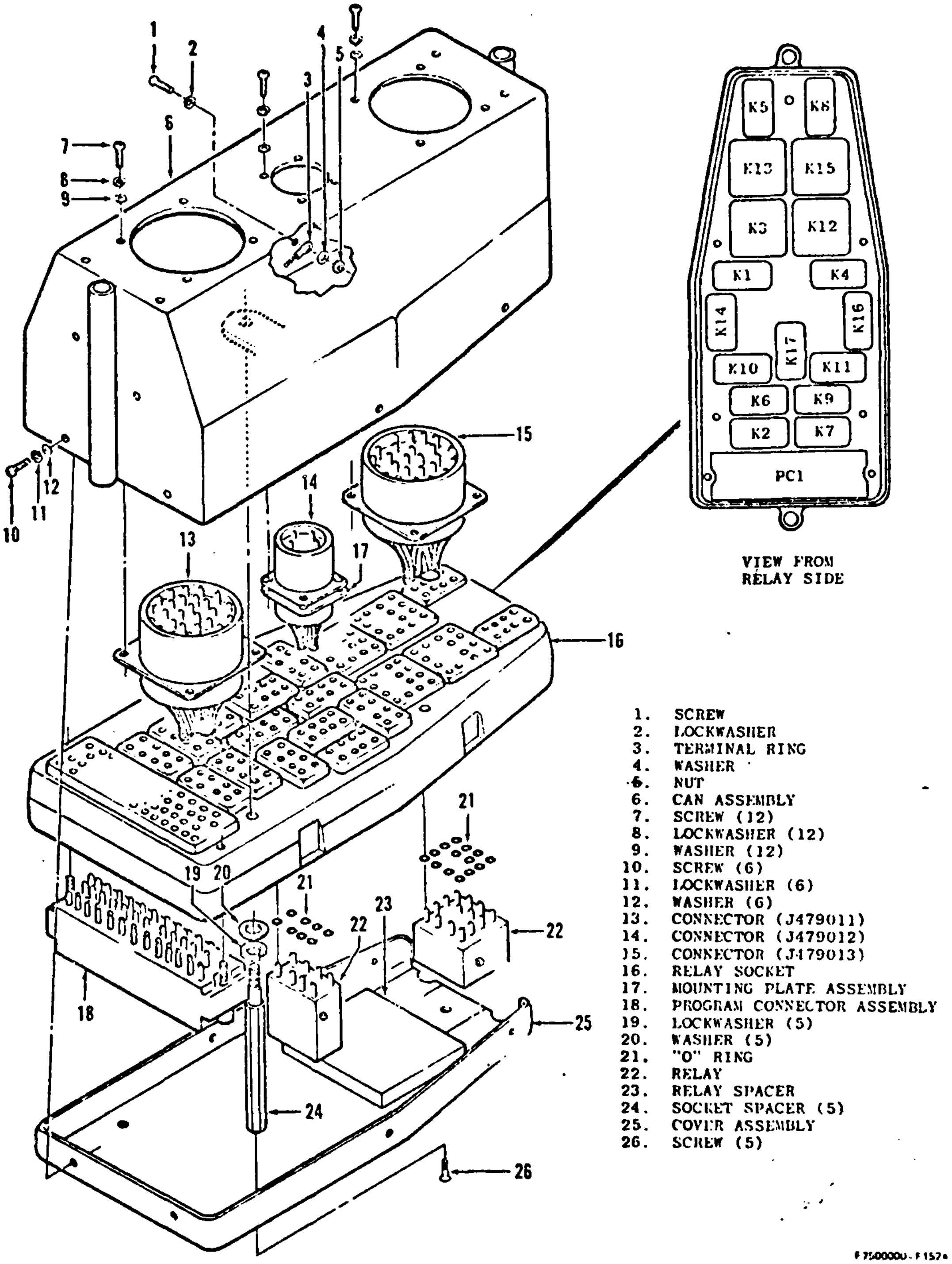


Figure 4.2-A Simplified Schematic - Circuits to AMAC SPU

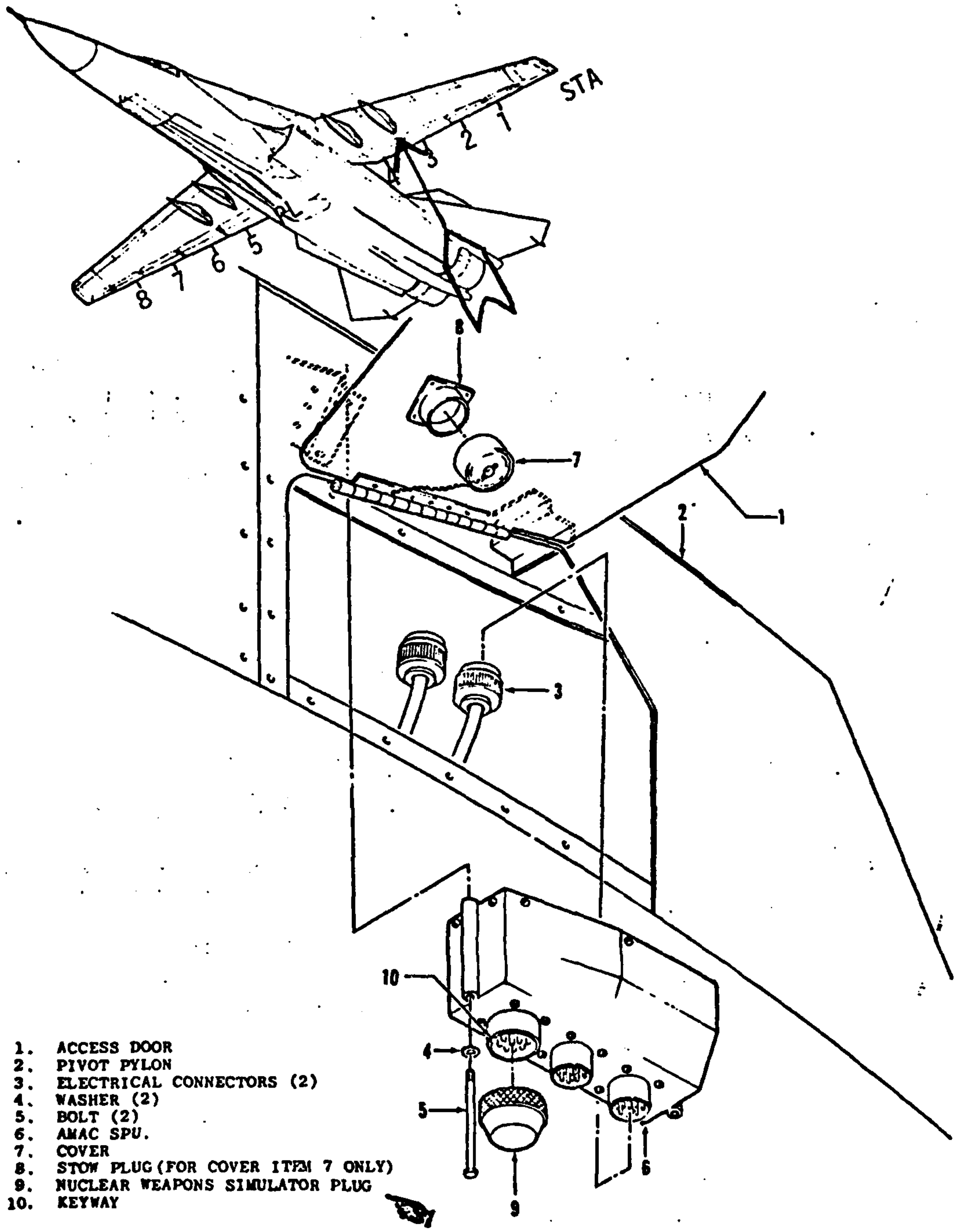


1. SCREW
2. LOCKWASHER
3. TERMINAL RING
4. WASHER
5. NUT
6. CAN ASSEMBLY
7. SCREW (12)
8. LOCKWASHER (12)
9. WASHER (12)
10. SCREW (6)
11. LOCKWASHER (6)
12. WASHER (6)
13. CONNECTOR (J479011)
14. CONNECTOR (J479012)
15. CONNECTOR (J479013)
16. RELAY SOCKET
17. MOUNTING PLATE ASSEMBLY
18. PROGRAM CONNECTOR ASSEMBLY
19. LOCKWASHER (5)
20. WASHER (5)
21. "O" RING
22. RELAY
23. RELAY SPACER
24. SOCKET SPACER (5)
25. COVER ASSEMBLY
26. SCREW (5)

F750000U-F157a

Figure 2-2. Station Program Unit Exploded View

Figure 4.2-B Typical AMAC SPU



1. ACCESS DOOR
2. PIVOT PYLON
3. ELECTRICAL CONNECTORS (2)
4. WASHER (2)
5. BOLT (2)
6. AMAC SPU.
7. COVER
8. STOW PLUG (FOR COVER ITEM 7 ONLY)
9. NUCLEAR WEAPONS SIMULATOR PLUG
10. KEYWAY

Figure 5-37. Pivot Pylon AMAC SPU and Nuclear Weapons Simulator Plug Removal and Installation

Figure 4.2-C Pivot Pylon AMAC SPU Location

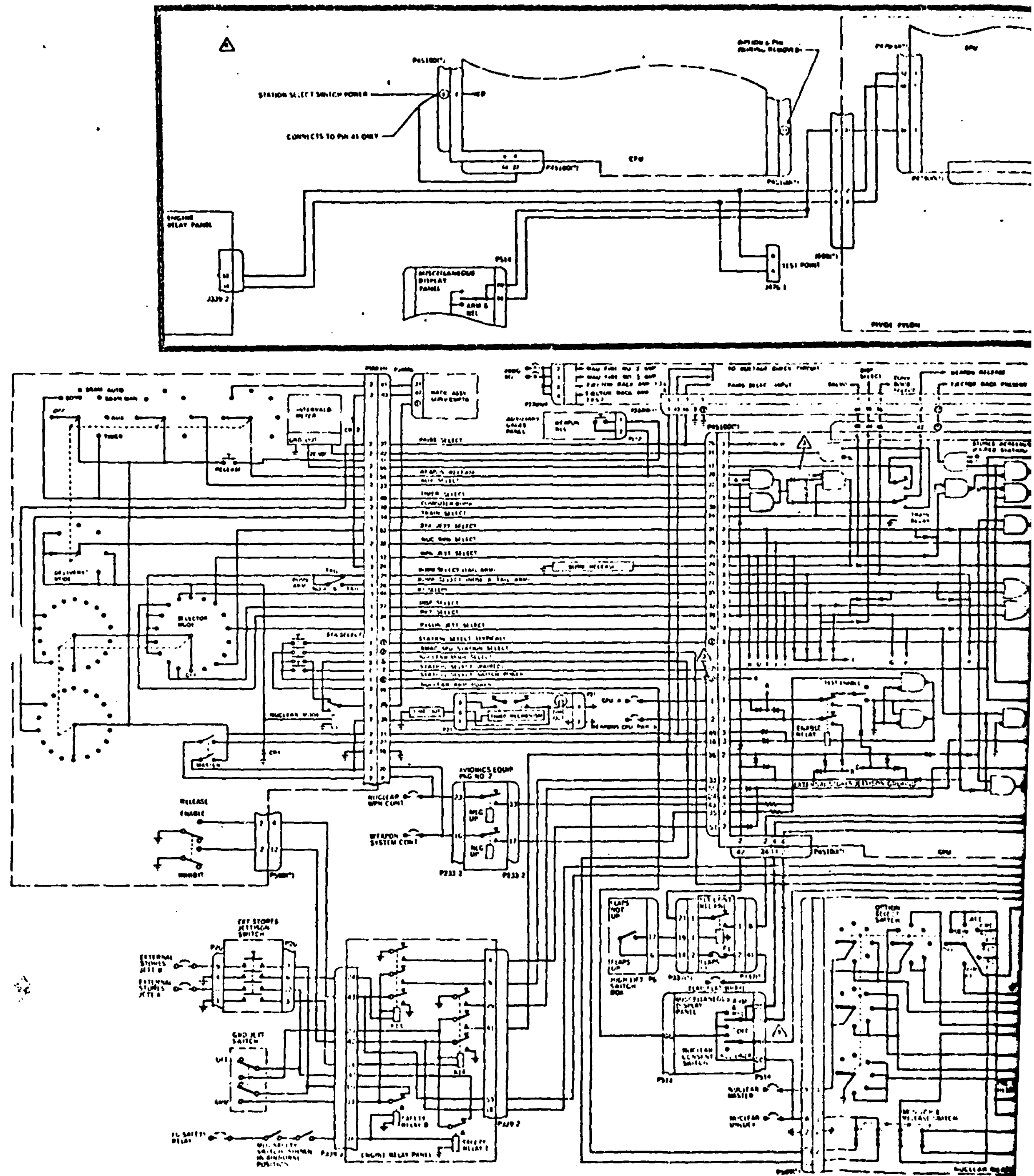


Figure 4.2-D Weapon Station 3 Circuitry
(Sheet 1 of 3)

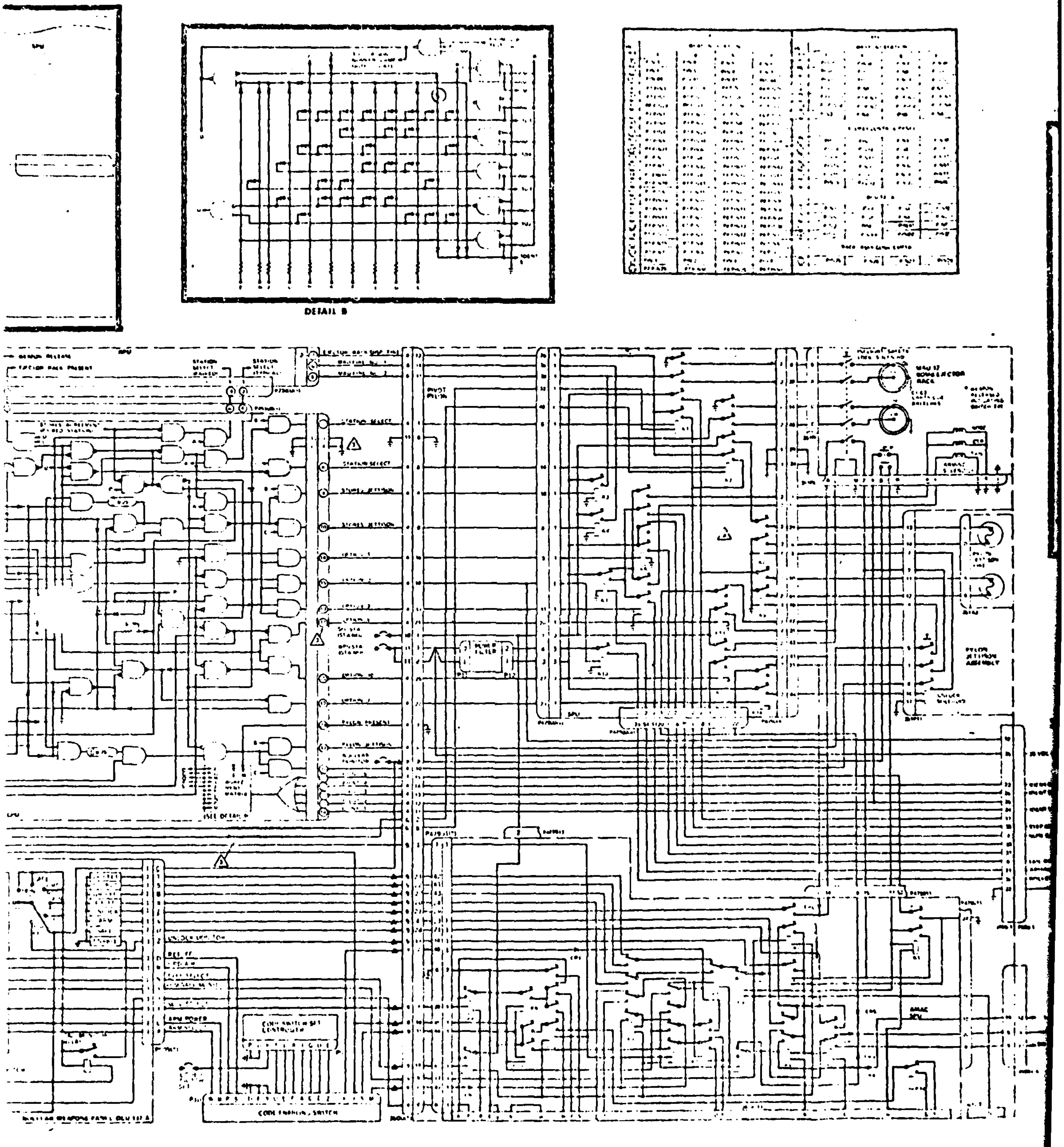


Figure 4.2-D Weapon Station 3 Circuitry
(Sheet 2 of 3)

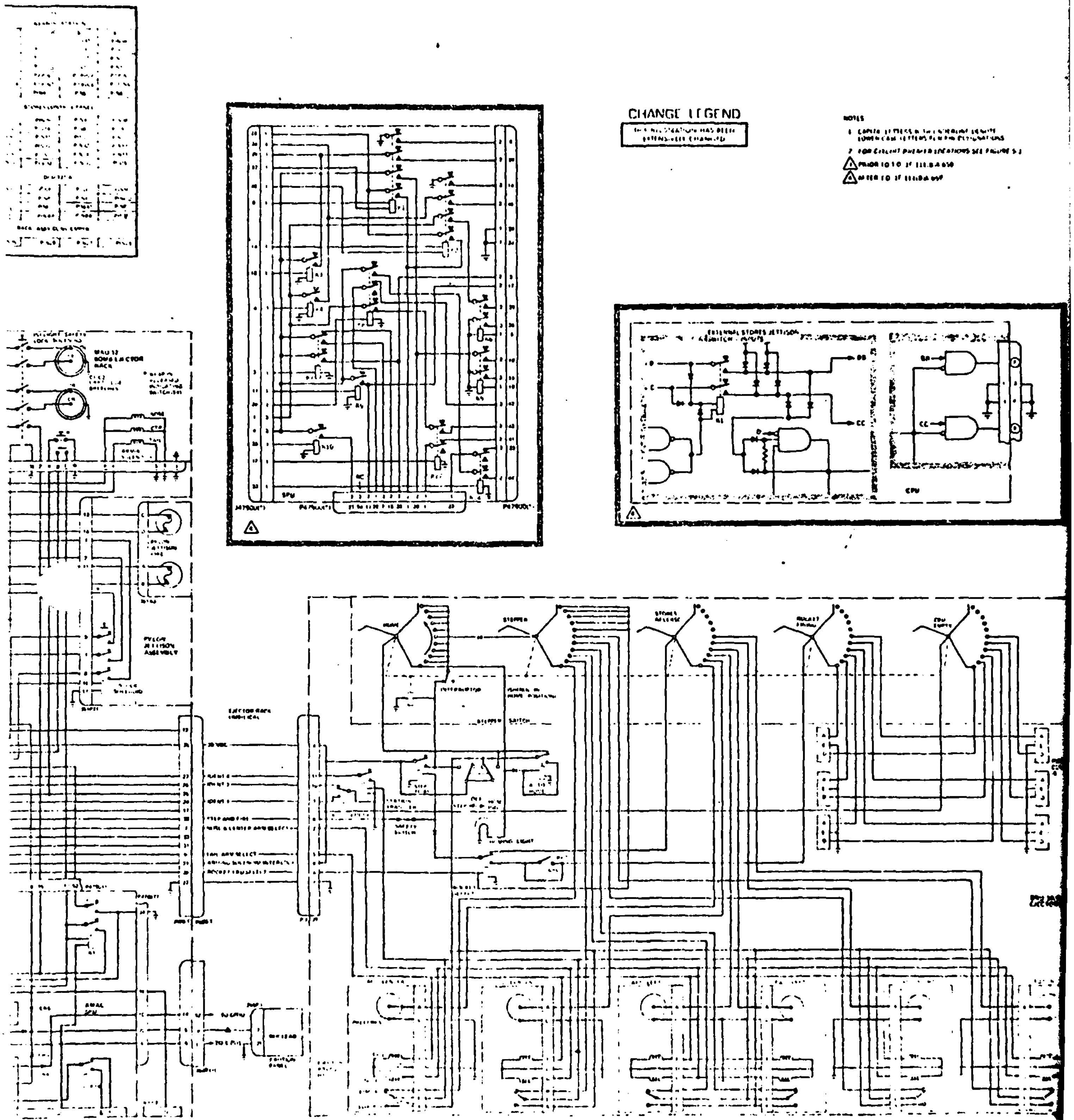


Figure 4.2-D Weapon Station 3 Circuitry
(Sheet 3 of 3)

ry

Figure 1-8. Stores Management System Pivot Pylon Integrated Schematic Diagram

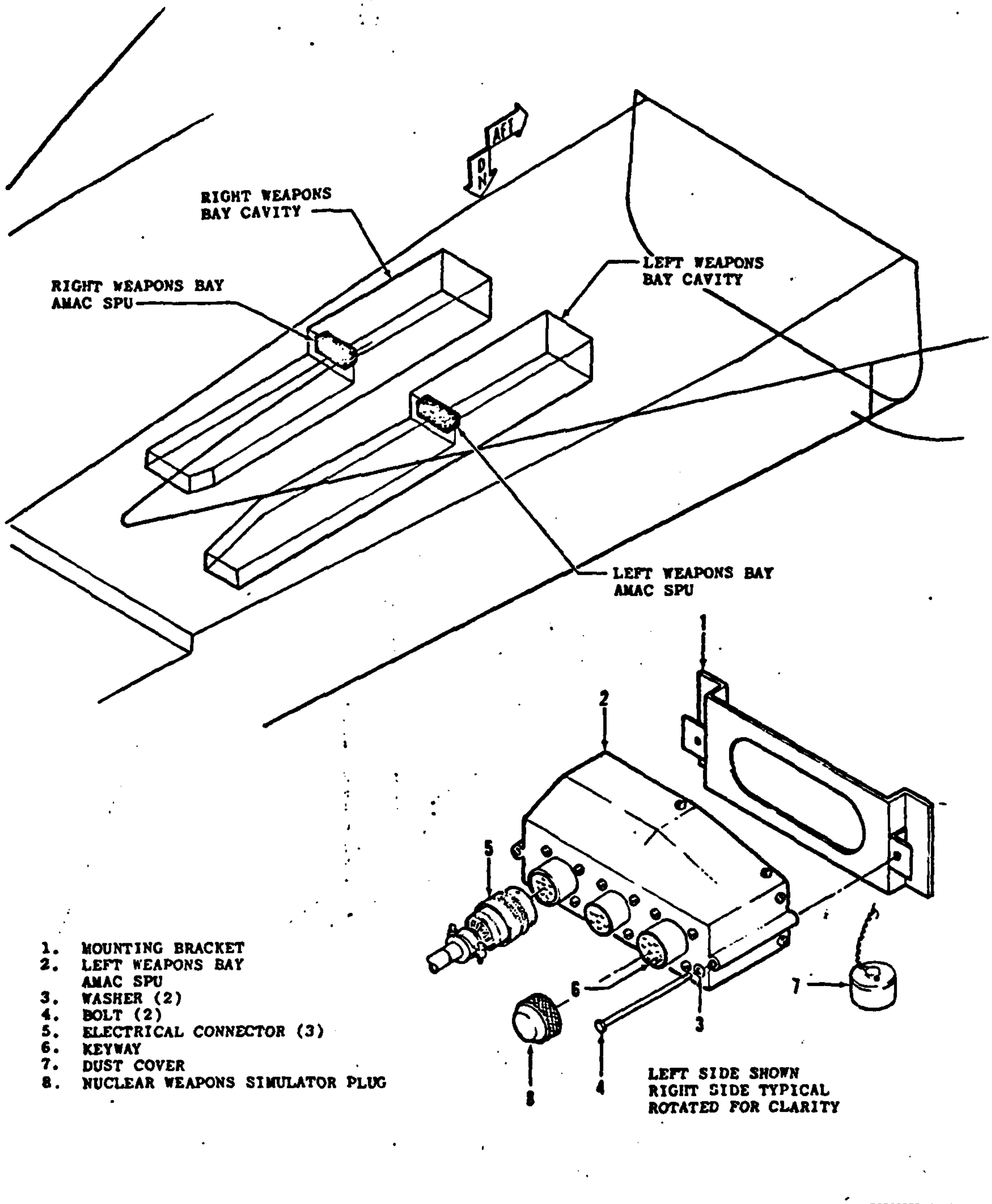
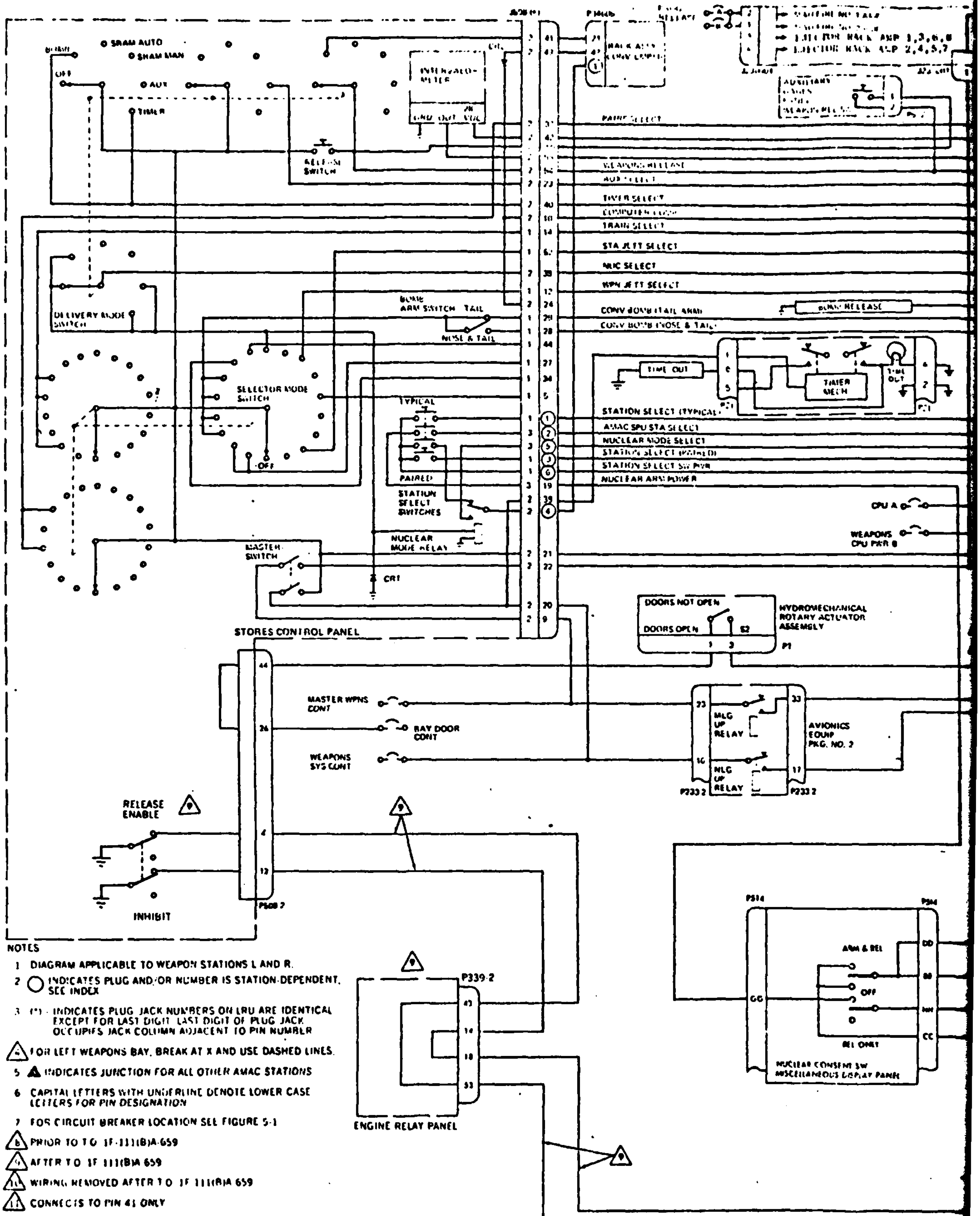


Figure 5-36. Weapons Bay AMAC SPU and Nuclear Weapons Simulator Plug Removal and Installation

Figure 4.2-E Weapons Bay AMAC SPU Location



NOTES

1. DIAGRAM APPLICABLE TO WEAPON STATIONS L AND R.
2. ◯ INDICATES PLUG AND/OR NUMBER IS STATION-DEPENDENT, SEE INDEX
3. (*) - INDICATES PLUG JACK NUMBERS ON LRU ARE IDENTICAL EXCEPT FOR LAST DIGIT. LAST DIGIT OF PLUG JACK OCCUPIES JACK COLUMN ADJACENT TO PIN NUMBER
4. FOR LEFT WEAPONS BAY, BREAK AT X AND USE DASHED LINES.
5. ▲ INDICATES JUNCTION FOR ALL OTHER AMAC STATIONS
6. CAPITAL LETTERS WITH UNDERLINE DENOTE LOWER CASE LETTERS FOR PIN DESIGNATION
7. FOR CIRCUIT BREAKER LOCATION SEE FIGURE 5-1
8. PRIOR TO T.O. 1F-111(B)A-659
9. AFTER T.O. 1F-111(B)A-659
10. WIRING REMOVED AFTER T.O. 1F-111(B)A-659
11. CONNECTS TO PIN 41 ONLY

Figure 1-10. Stores Management System Weapons Bay Integrated Schematic

Figure 4.2-F Weapon Station R Circuitry (Sheet 1 of 4)

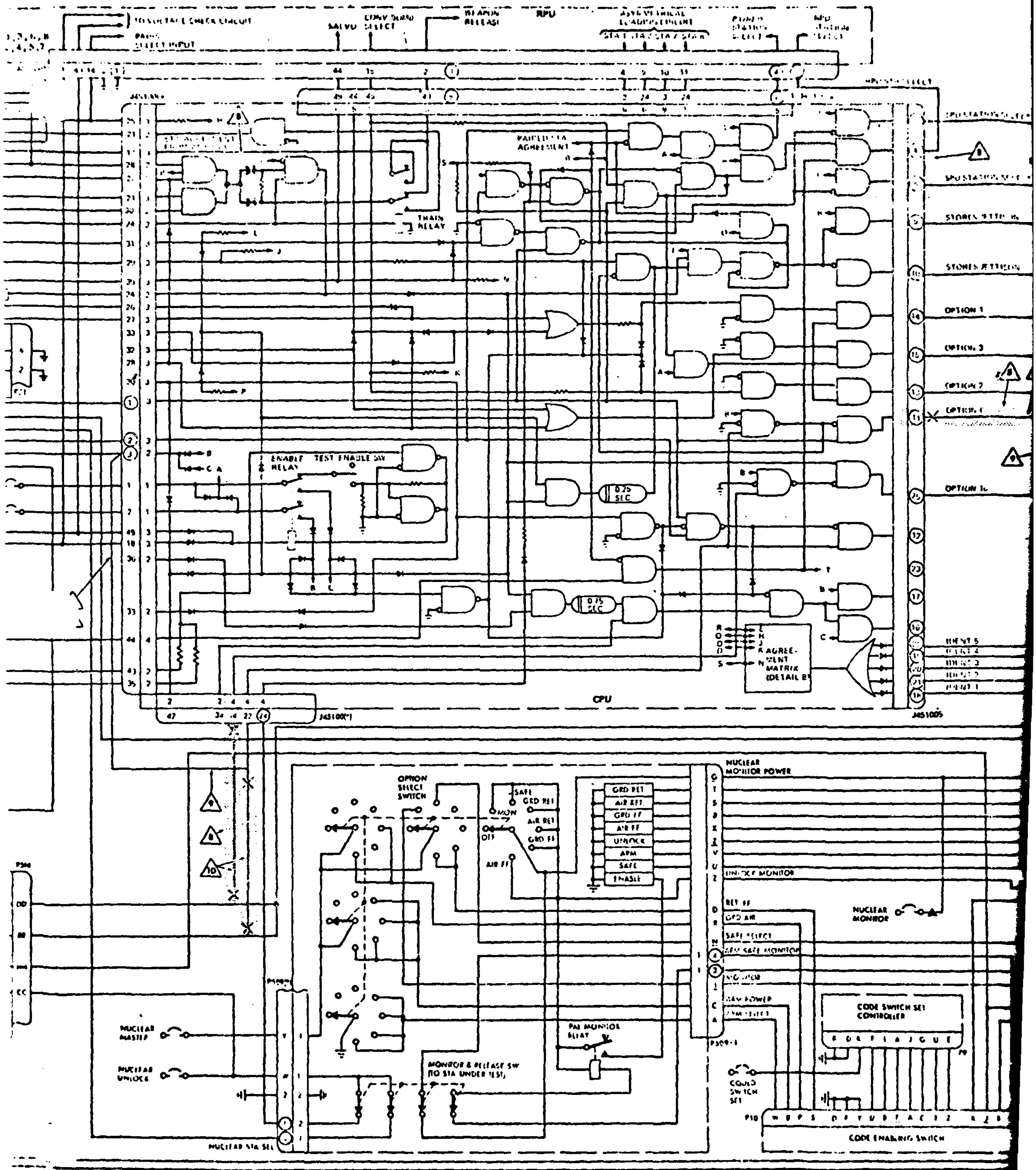


Figure 4.2-F Weapon Station R Circuitry
(Sheet 2 of 4)

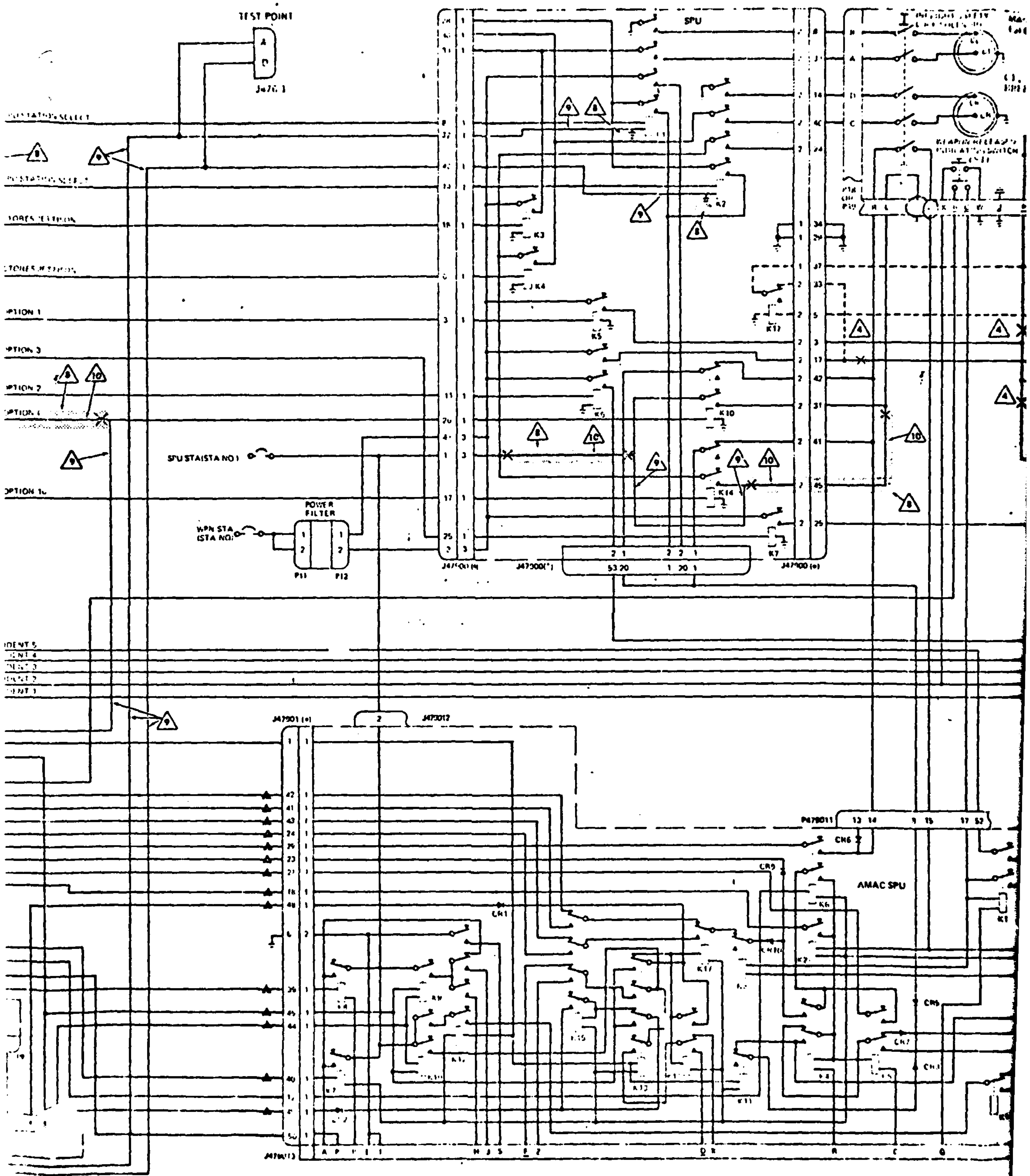
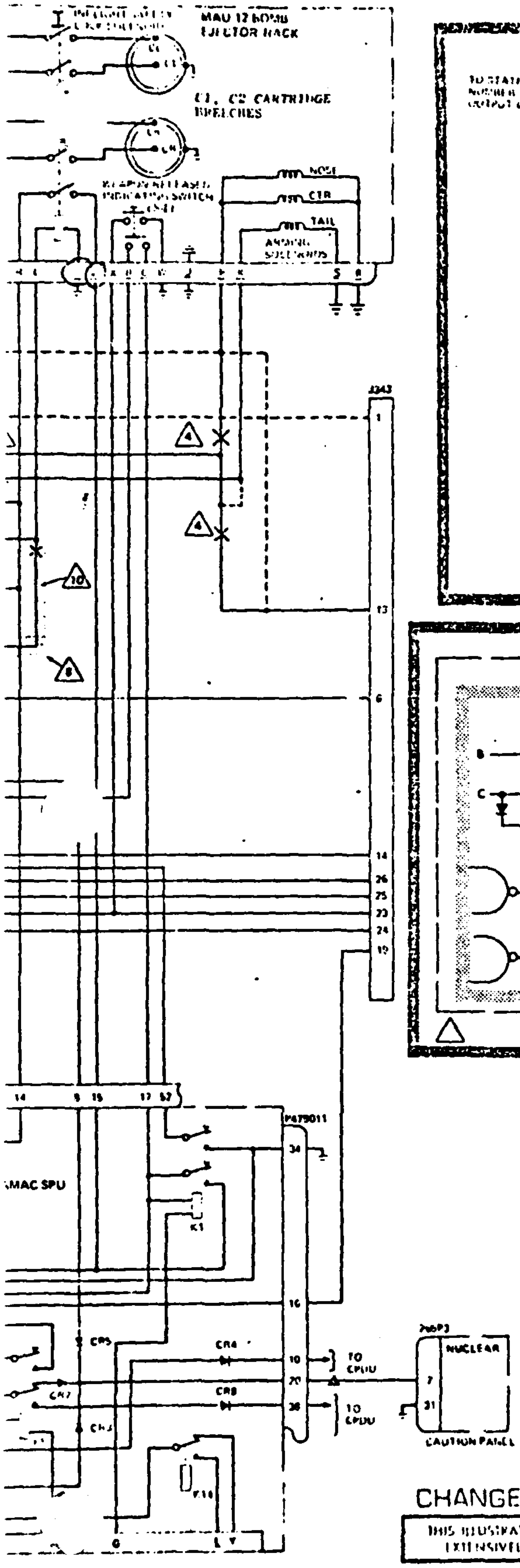
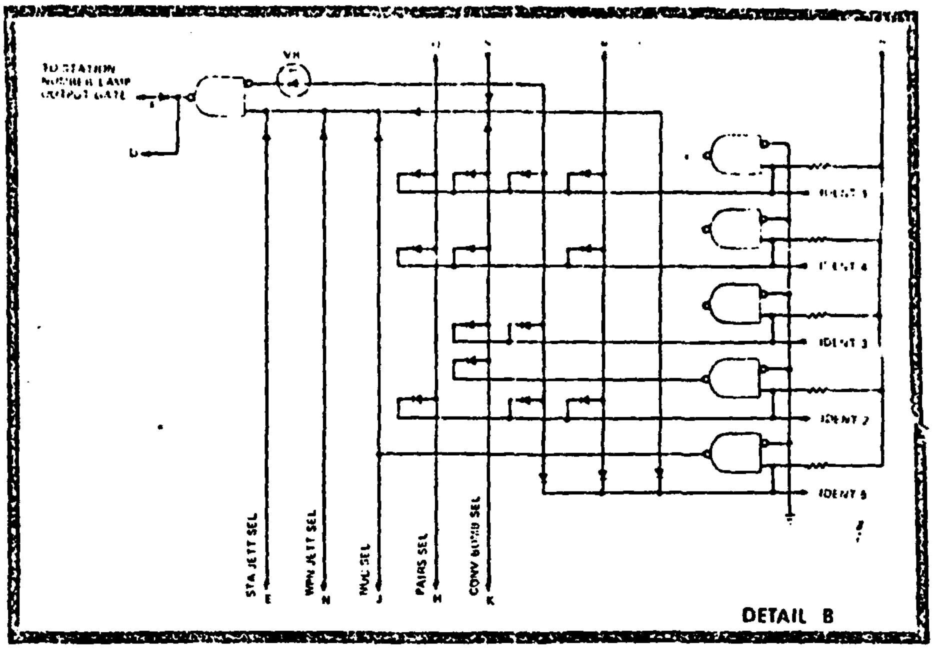
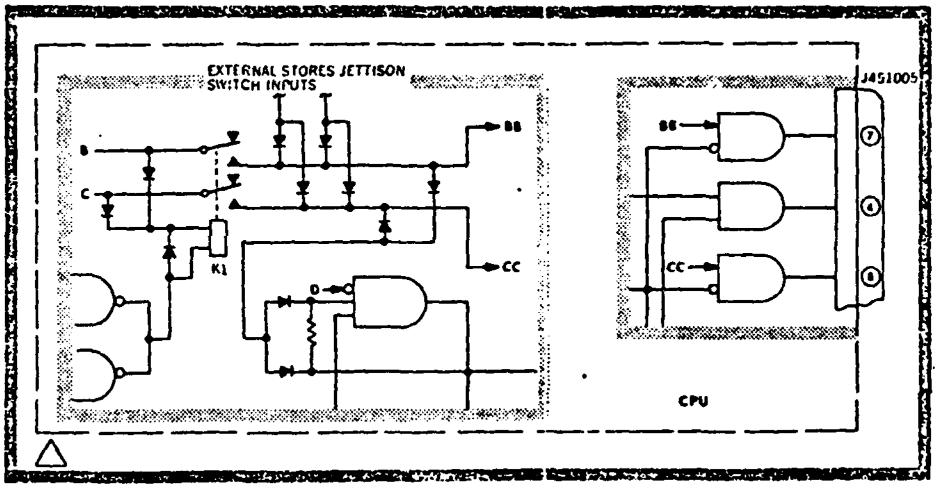


Figure 4.2-F Weapon Station R Circuitry
(Sheet 3 of 4)







INDEX TO STATION DEPENDENT PLUGS AND PIN NUMBERS					
STORES CONTROL PANEL			CPU		
INDEX	L	R	INDEX	L	R
1	PIN 21	PIN 22	1	PIN 9	PIN 10
2	PIN 12	PIN 10	2	PIN 10	PIN 8
3	PIN 22	PIN 21	3	PIN 44	PIN 41
4	PIN 52	PIN 15	4	PIN 3	PIN 23
5	PIN 13	PIN 4	5	NOT CONNECTED	
6	PIN 15	PIN 32	6	PIN 23	PIN 3
DCU [illegible] A			7	PIN 1	PIN 22
1	PIN D	PIN N	8	PIN 4	PIN 31
2	PIN [illegible]	PIN [illegible]	9	PIN 5	PIN 24
3	PIN CC	PIN HH	10	PIN 7	PIN 32
4	PIN [illegible]	PIN J	11	PIN 17	PIN 38
RACK ASSY CONV CMPTR			12	PIN 19	PIN 24
1	PIN 32	PIN 33	13	PIN 13	PIN 34
RPU			14	PIN 12	PIN 33
1	PIN 41	PIN 42	15	PIN 14	PIN 35
2	PIN 12	PIN 13	16	NOT CONNECTED	
3	NOT CONNECTED		17	NOT CONNECTED	
4	PIN 11	PIN 12	18	PIN 8	PIN 28
5	PIN [illegible]	PIN 13	19	PIN 7	PIN 29
6	PIN 12	PIN 14	20	PIN 11	PIN 28
			21	PIN 10	PIN 27
			22	PIN 6	PIN 30
			23	NOT CONNECTED	
			24	PIN 5	PIN 6
			25	PIN 21	PIN 42

CHANGE LEGEND

THIS ILLUSTRATION HAS BEEN EXTENSIVELY CHANGED

Figure 4.2-F Weapon Station R Circuitry (Sheet 4 of 4)

4.2.2 (Continued)

- 0 Interface with gravity bombs are the connectors shown in the aircraft wiring diagrams.
- 0 Analyses of abnormal environments are considered only one fault at a time.
- 0 Wiring faults within aircraft wiring harnesses were limited to those within shared cables and connectors. Cable-to-cable and bundle-to-bundle wiring faults were excluded.
- 0 Release circuits were not included as nuclear weapon interface circuits during load analysis for abnormal environments.
- 0 Short circuits in terminals and faults internal to components were not considered except in the worst-case abnormal environment analysis for each model.
- 0 The abnormal environments analysis of the FB-111A escape capsule disconnects were limited to circuits related to nuclear weapons.
- 0 FB-111A SRAM interfaces were excluded.

4.2.3 IDENTITY OF CIRCUITS

The analysis used sneak circuit network trees and Air Force technical orders to identify adjacent and interrelated circuits for fault analysis. Network trees and other diagrams used to analyze the circuits are included in the individual analysis packages in section 4.2.6 of this report.

4.2.4 NORMAL ENVIRONMENT

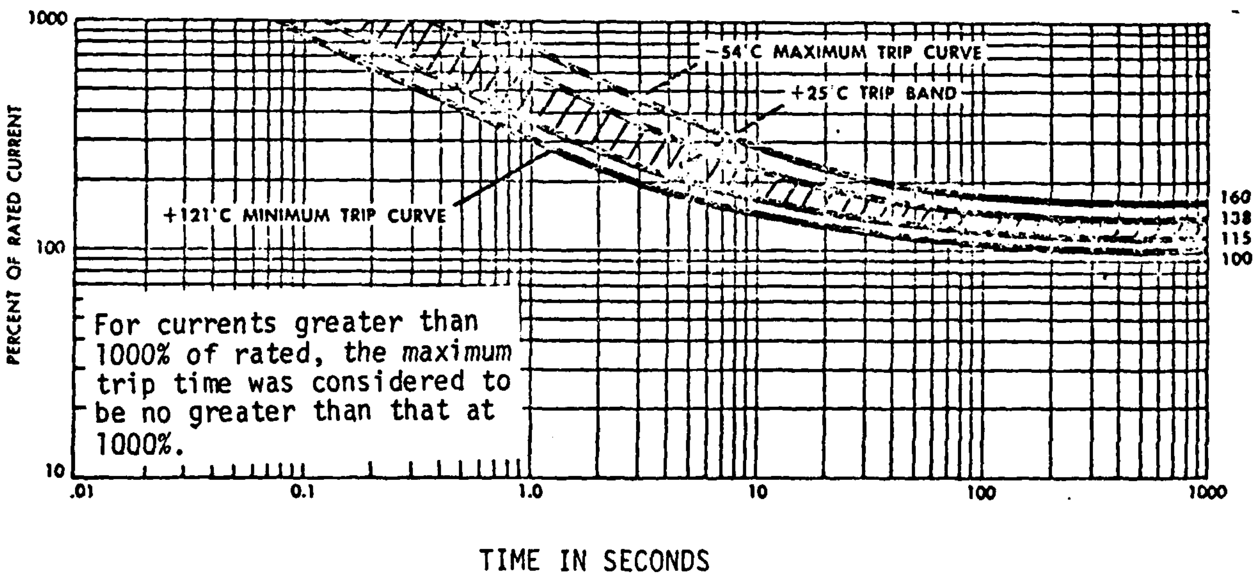
Power capability of each interfacing circuit was calculated for open circuit voltage and short circuit current at the weapon interface.

4.2.5 ABNORMAL ENVIRONMENTS

Each network tree was analyzed for postulated faults. The faults are identified in the analysis package diagrams by numbered circles. In most instances, the worst case is a postulated short circuit at the point of lowest impedance. Worst case current and circuit breaker trip times have been calculated for each interfacing circuit.

4.2.5.1 GROUND RULES

Resistances across relays and trip times of circuit breakers have been selected from available data based on standard temperatures. On the ground, a temperature of +25°C is used. In flight, a temperature of -54°C is used for components outside the crew compartment. Components inside the crew compartment were assumed to be at +25°C. Most circuit breakers in this study are located outside the crew compartment. This accounts for the significantly longer trip times of faults postulated in flight. The following curve, based upon Texas Instrument data, and General Dynamic Circuit Breaker Standard C2697 were used to compute trip times.



CB TRIP TIME VS CURRENT PROFILE

4.2.5.1 *(Continued)*

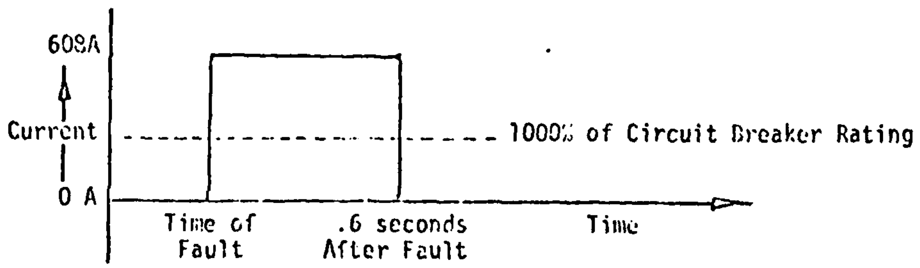
Circuits fed by TR (Transformer/Rectifier) power were assumed to carry 28 volts direct current. There are some faults to circuits carrying either 115 volts or 28 volts alternating current. In all cases, power profiles were found to be step functions, lasting until the circuit breaker trips. No current was found that was high enough to weld the circuit breaker closed, however some fault currents would be so low (mA) that they would remain indefinitely on cirucits protected against much higher currents.

4.2.6 CIRCUIT ANALYSIS PACKAGES

Normal and fault analyses are documented in individual packages for the circuit groups. The following analysis packages cover all of the gravity weapon interface circuits at stations 3 and R:

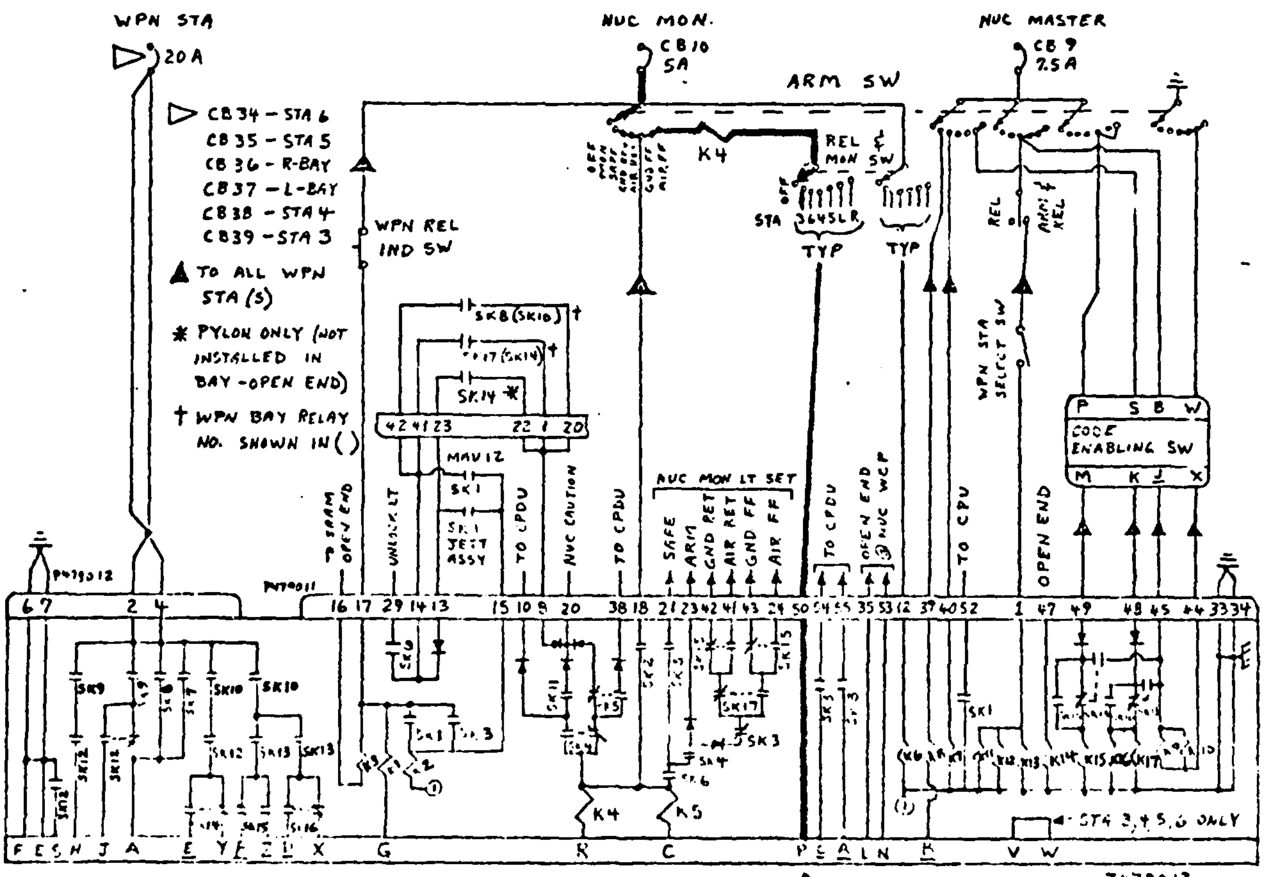
4.2.6.1	Pin P	Permissive Action Link Ground
4.2.6.2	Pins A,H,J,Y,X,Z, d, e, f	Arm/Safe Inputs, Burst Options, Plus Weapon Drop Config.
4.2.6.3	Pins L,N, a, c	Nuclear Weapons Control and SRAM Circuitry
4.2.6.4	Pin b	Master Power Distribution
4.2.6.5	Pins C,G,R	Monitor & Release Plus Option Selector & Monitor
4.2.6.6	Pins S,V,W	Station Select

Note: Power Profiles - In all cases the short circuit current was found to be either much less than the source circuit breaker ratings or much greater than the ratings. Where the current was much less than the rating the current will remain constant until the source is removed. Where the current is much greater, the current will remain constant until the circuit breaker trips. A typical profile of this case is shown below.



4.2.6.1 Circuit Analysis Package, Weapon Interfaces Pin P of AMAC SPU-3 and -R (Weapon Station 3 Pylon and Weapon Station R Bay)

These interfaces are shown in Figure 4.2-D, which is a copy of Figure 1-8 from T.O. 1F-111(B)A-2-11-1 (Change 2) showing the circuitry to the pivot pylon weapon station AMAC SPU interfaces and Figure 4.2-F which is a copy of Figure 1-10 from T.O. 1F-111(B)A-2-11-1 (Change 2) showing the circuitry to L and R-Bay AMAC SPU interfaces. A generalized schematic highlighting pin P circuitry is attached below. Maximum current available to Pin P in a normal environment is 48 mA (direct current). Worst-case current at 28VDC in an abnormal (faulted) environment would be 608 amps for weapon station 3 and 1333 amps for weapon station R. Worst case fault current at 115VAC would be 451 amps for a weapon station 3. No faulted AC current has been identified for weapon station R.



AMAC SPU INTERFACE

4.2.6.1

4.2.6.1 (Continued)

a. Normal Power and Loads Analysis

Reference Figure 4.2-1 Network Tree 334 and Monitor Relay Technical Data. From examination of network tree and the Monitor Relay Technical Data; J479013-P for any weapon station

V_{OC} = 28VDC; $I_{SC} = \frac{28}{579} = \underline{48}$ mA

b. Fault Analysis

Reference Figure 4.2-1 Network Tree 334, Figure 4.2-2 Fault Diagram Weapon Station 3 and Figure 4.2-3 Fault Diagram Weapon Station R. The following faults were postulated:

(1) Wiring Harness 247W2 Damaged

Wires to pin P shorted to 28VDC. See Table 4.2-1 for voltage sources.

(2) Nuclear Weapon Control Panel Damaged

Wires to pin P shorted to 28VDC. See Table 4.2-1 for voltage sources.

(3) Wiring Harness 247W3, 247W14, Wing-Fuselage Disconnect 301J10 or Wing Pylon 3 Disconnect J600-9 Damaged

Wires to pin P shorted to 28VDC. See Table 4.2-1 for voltage sources.

(4) Pylon 3 Wiring Harness 351W1, 351W2, 354W1, 354W2, or Wing Pylon Disconnect J613 Damaged (Worst Case -115VAC

Wires to pin P shorted to 28VDC or 115V 400H_z. See Table 4.2-1 for voltage sources.

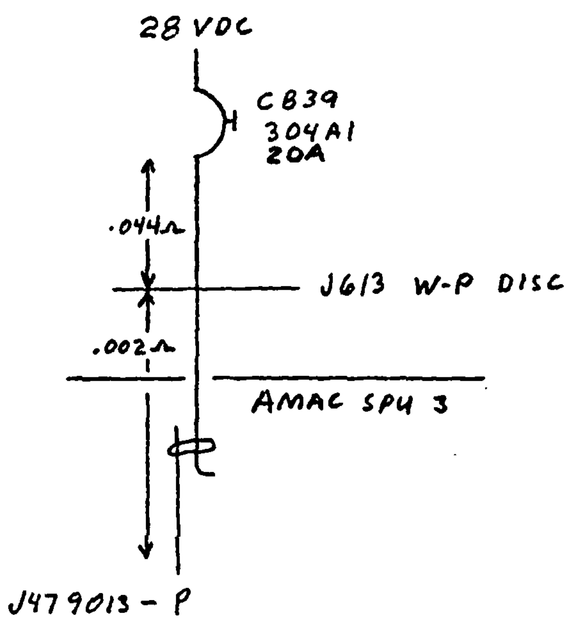
(5) AMAC SPU Damaged (Worst Case - 28VDC

Wires to pin P shorted to 28VDC. See Table 4.2-1 for voltage sources.

4.2.6.1 (Continued)

c. Worst Case Path for Weapon Station 3 at 28VDC

Reference path (5) from paragraph b.



Total resistance at path = .046Ω

V_{OC} = 28VDC

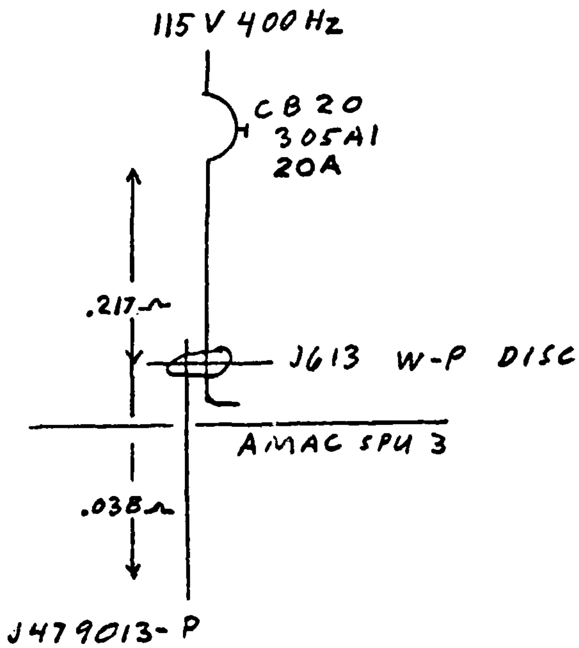
$I_{SC} = \frac{28}{.046} = \underline{608}$ A

Time = Less than .6 seconds at -54°C for circuit breaker to open. On ground alert at 25°C the time to open would be less than .35 seconds.

4.2.6.1 (Continued)

d. <u>Worst Case Path for Weapon Station 3 at 115V 400Hz</u>

Reference path (4) from paragraph b.



Total resistance of path .255 Ω

V_{OC} = 115V 400Hz

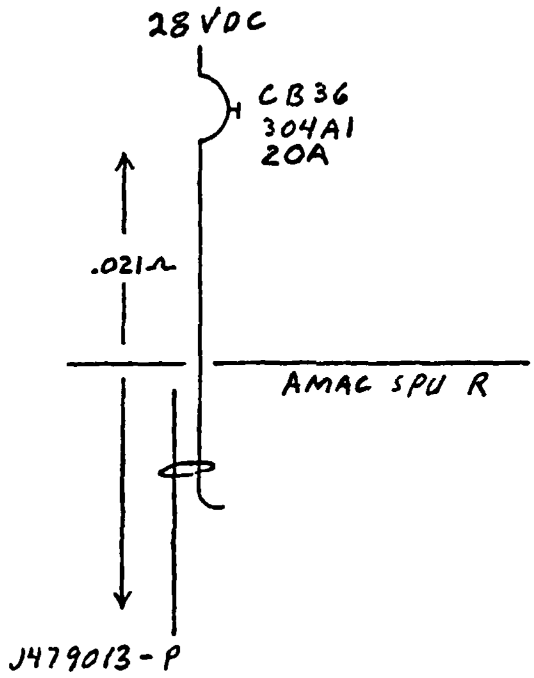
$I_{SC} = \frac{115}{.255} = \underline{451}$ A

Time = Less than <u>.6</u> seconds at -54°C for circuit breaker to open
On ground alert at 25°C the time to open would be less than .35 seconds.

4.2.6.1 (Continued)

e. Worst Case Path for Weapon Station R

Reference path (5) from paragraph b.



Total resistance of path .021 Ω

V_{OC} = 28VDC

$I_{SC} = \frac{28}{.021} = \underline{1333}$ A

Time = Less than .6 seconds at -54°C for circuit breaker to open. On ground alert at 25°C the time to open would be less than .35 seconds.

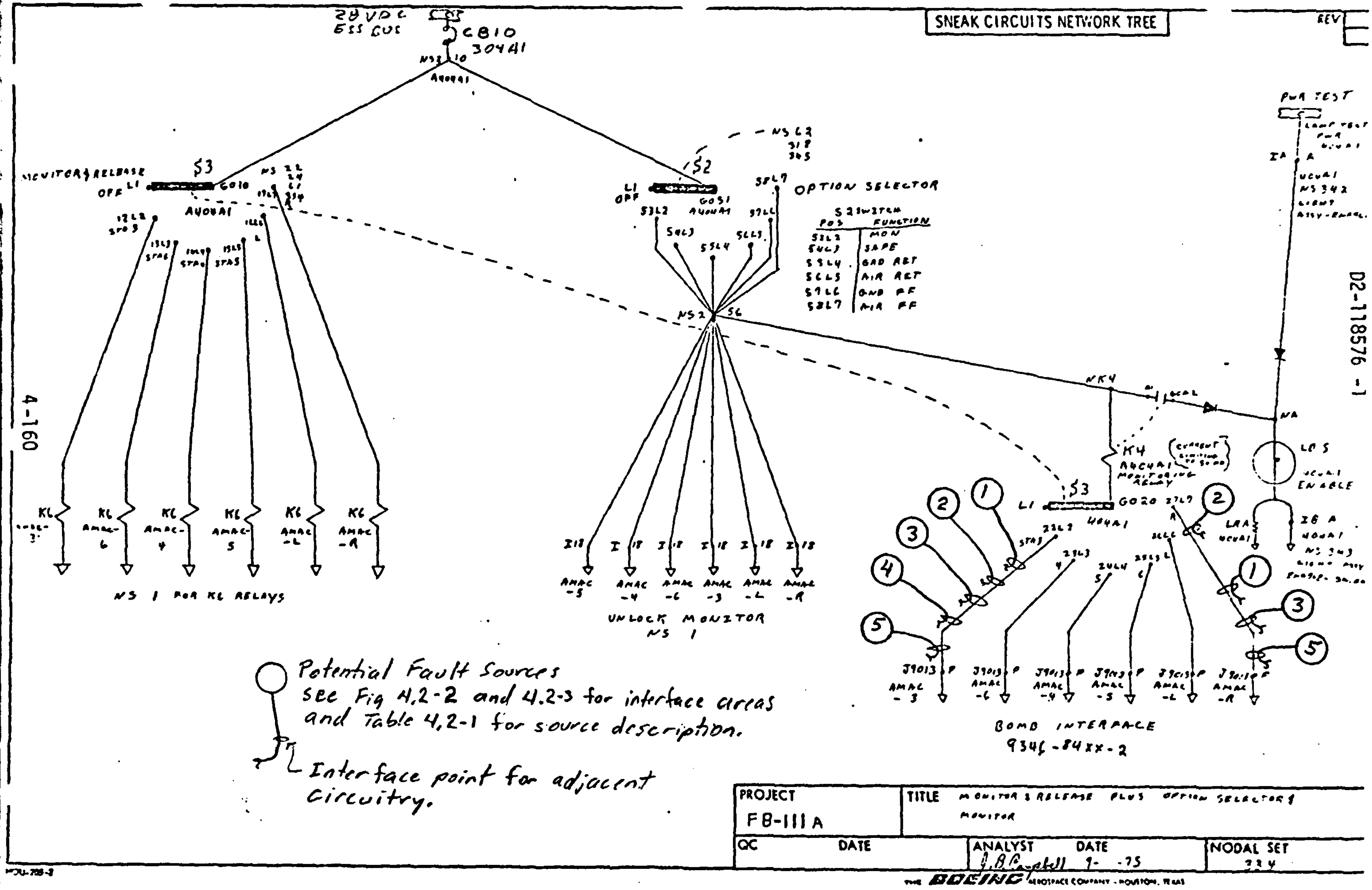


Figure 4.2-1 NETWORK TREE 334

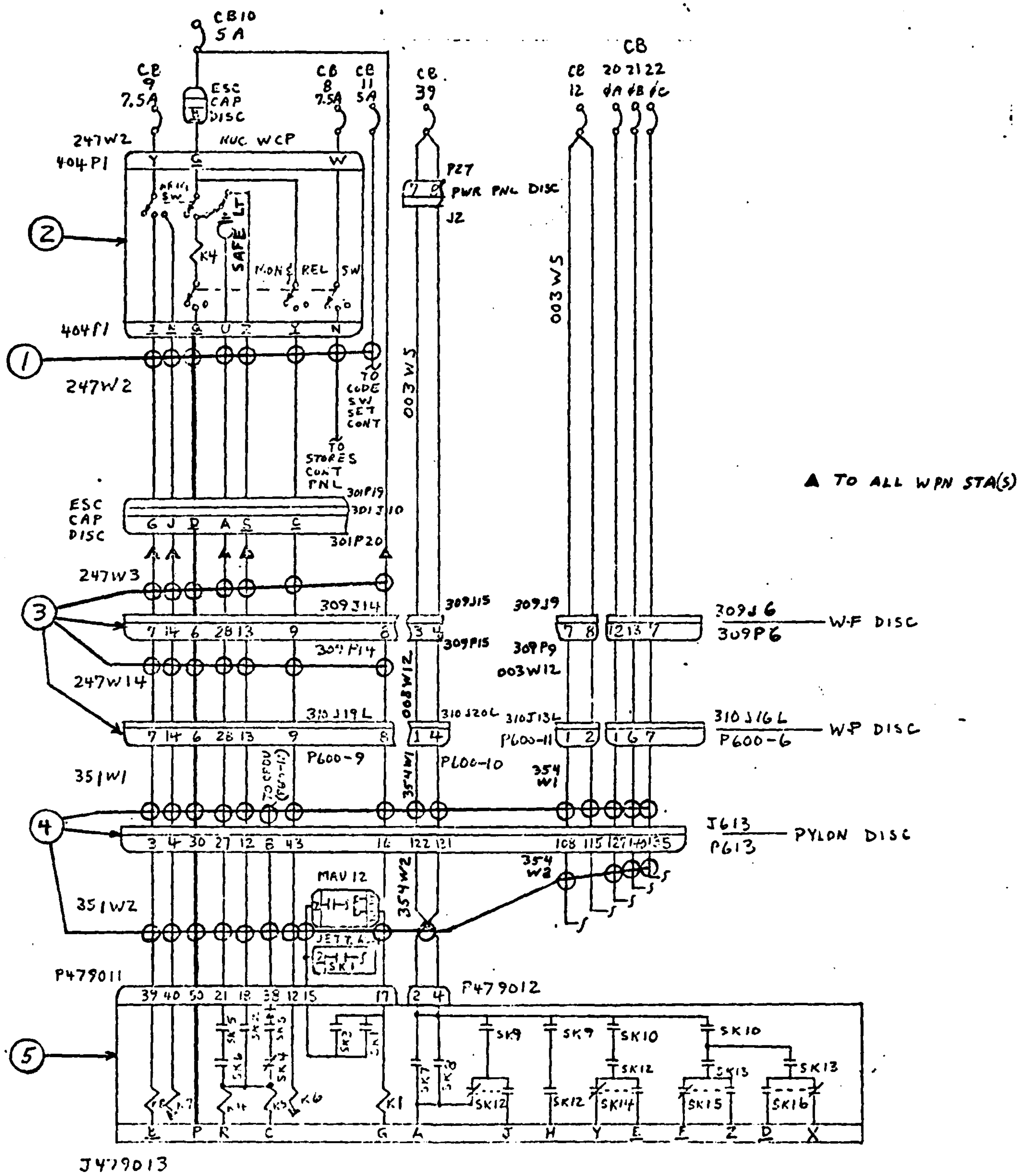


Figure 4.2-2 FAULT DIAGRAM WEAPON STATION 3

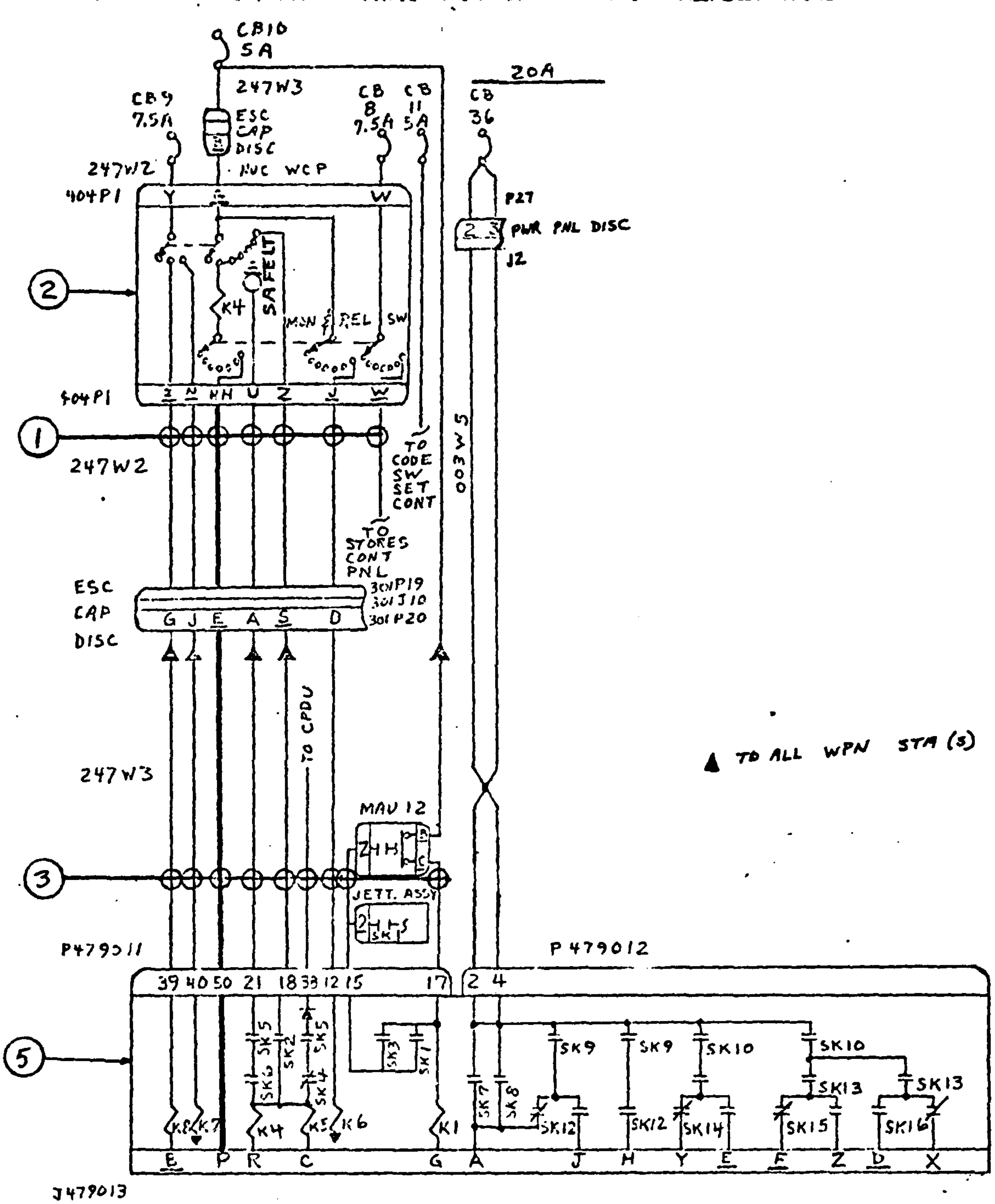


Figure 4.2-3 FAULT DIAGRAM WEAPON STATION R

4.2.6.1 (Continued)

TABLE 4.2-1

POTENTIAL FAULT POWER SOURCES

FIGURE INDICATOR	CIRCUIT BREAKER	POWER
1	CB8 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
	CB9 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
	CB11 (5A) UNIT 314A1	28VDC CREW STA ESS BUS
	CB10 (5A) UNIT 304A1	28VDC ESS BUS
2	CB8 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
	CB9 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
	CB10 (5A) UNIT 304A1	28VDC ESS BUS
3	CB9 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
	CB10 (5A) UNIT 304A1	28VDC ESS BUS
4	CB9 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
	CB10 (5A) UNIT 304A1	28VDC ESS BUS
	CB20 (20A) UNIT 305A1	115VAC 400Hz L MAIN BUS
	CB21 (20A) UNIT 305A1	115VAC 400Hz L MAIN BUS
	CB22 (20A) UNIT 305A1	115VAC 400Hz L MAIN BUS
	CB12 (35A) UNIT 315A1	28VDC MAIN BUS
	CB39 (20A) UNIT 304A1	28VDC ESS BUS
5	CB9 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
	CB10 (5A) UNIT 304A1	28VDC ESS BUS
	**CB39 (20A) UNIT 304A1	28VDC ESS BUS
	*CB36 (20A) UNIT 304A1	28VDC ESS BUS

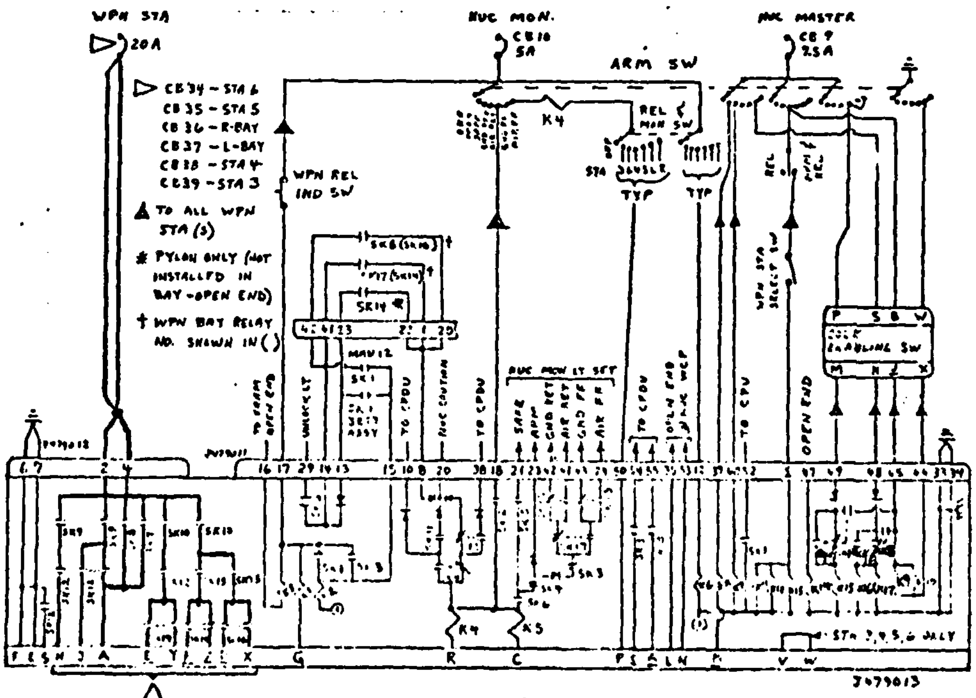
*Station R only

**Station 3 only

AMAC SPU PINS
A, H, J, Y, X, Z, d, e, & f
CIRCUIT ANALYSIS PACKAGE

4.2.6.2 Circuit Analysis Package, Weapon Interface Pins A, H, J, Y, X, Z, d, e, f of AMAC SPU-3 and -R. (Weapon Station 3 Pylon and Weapon Station R Bay)

These interfaces are shown in Figure 4.2-D, which is a copy of Figure 1-8 from T.O. 1F-111(B)A-2-11-1 (Change 2) showing the circuitry to the pivot pylon weapon station AMAC SPU interfaces and Figure 4.2-F which is a copy of Figure 1-10 from T.O. IF-111(B)A-2-11-1 (Change 2) showing the circuitry to L and R-Bay AMAC SPU interfaces. A simplified general schematic is attached below. Maximum current available to pin A in a normal environment is 608 amps (direct current) at Weapon Station 3 and 1333 amps at Weapon Station R. Maximum Current available to pins H, J, Y, X, Z, d, e and f in a normal environment for weapons station 3 and R is 0 amps. Worst case current at 28VDC in an abnormal (faulted) environment would be 608 amps at Weapon Station 3 and 1333 amps at Weapon Station R for all the subject interface pins. Worst case fault current at 115VAC would be 1983 amps at pin A for Weapon Station 3 and 3286 amps at pin A for Weapon Station R. No faulted AC current has been identified for pins H, J, Y, X, Z, d, e and f of Weapon Station 3 or Weapon Station R.



4.2.6.2 AMAC SPU INTERFACE

4.2.6.2 (Continued)

a. Normal Power and Load Analysis

Reference Figure 4.2-4 Network Tree 365 and Figure 4.2-5 Network Tree 300. Relays K7 and K8 in the AMAC SPU can be energized by selecting Monitor and Safe options respectively on the Monitor and Control switch on the Nuclear Weapons Control Panel. From examination of the network trees:

J479013 A weapon station 3

$V_{OC} = 28VDC$

$I_{SC} = \frac{28}{.046\Omega^*} = \underline{608}\ A$

*Wire resistance from CB to weapon interface

J479013-A weapon station R

$V_{OC} = 28VDC$

$I_{SC} = \frac{28V}{.021\Omega^*} = \underline{1333A}$

*Wire resistance from CB to weapon interface

Actual current is assumed to be something less than 20 amps, the rating of the 28VDC circuit breaker.

J479013-H, J, X, Y, Z, d, e, f for all weapon stations

$V_{OC} = 0V$

$I_{SC} = \underline{0A}$

b. Fault Analysis

Reference Figure 4.2-4 Network Tree 365, Figure 4.2-5 Network Tree 300, Figure 4.2-6 Fault Diagram Weapon Station 3 and Figure 4.2-7 Fault Diagram Weapon Station R. The following postulated faults were analyzed.

(1) Wiring Harness 003W5 Damaged

Wires to pin A (assuming K7 or K8 in the AMAC SPU are energized) shorted to 28VDC or 115V 400 H_z. See Table 4.2-2 for voltage sources.

(2) Wiring Harness 003W14 Damaged

Wires to pin A (assuming either K7 or K8 in the AMAC SPU energized) shorted to 28VDC or 115V 400H_z. See Table 4.2-2 for voltage sources.

4.2.6.2b (Continued)

(3) Connector 309J15 Damaged

Wires to pin A (assuming either K7 or K8 energized in the AMAC SPU) shorted to 28VDC from CB38 unit 304A1. See Table 4.2-2 for voltage source.

(4) Pylon 3 Wiring Harness 351W1, 351W2, 354W1, 354W2 or Wing Pylon Disconnect J613 Damaged

Wires to pin A (assuming either K7 or K8 energized in the AMAC SPU) shorted to 28VDC or 115V $400H_Z$. See Table 4.2-2 for voltage sources.

(5) AMAC SPU Damaged

Wires to pins A, H, J, Y, X, Z, d, e, f shorted to 28VDC. See Table 4.2-2 for voltage sources.

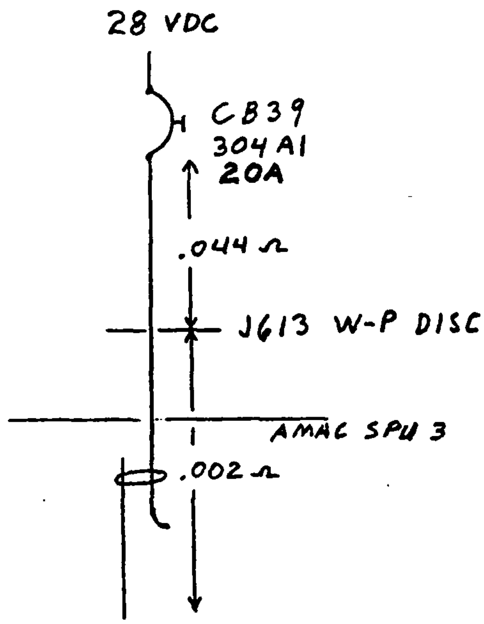
(6) Power Panel Disconnect P27 Damaged

Wires to pin A (assuming either K7 or K8 energized in the AMAC SPU) shorted to 28VDC. See Table 4.2-2 for voltage sources.

4.2.6.2 (Continued)

c. <u>Worst Case Path for Weapon Station 3 at 28VDC</u>

Reference path (5) from paragraph b.



J479013-A (Typical for H, J, X, Y, Z, d, e, f)

Total resistance at path = .046 Ω

V_{OC} = 28VDC

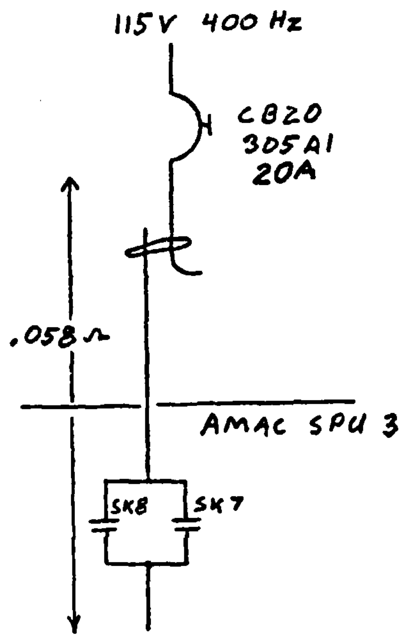
$I_{SC} = \frac{28}{.046} = \underline{608A}$

Time = Less than .6 seconds at -54°C for circuit breaker to open. On ground alert at 25°C the time to open would be less than .35 seconds.

4.2.6.2 (Continued)

d. <u>Worst Case Path for Weapon Station 3 at 115V 400 H_z</u>

Reference path (1) from paragraph b.



J479013-A

Total resistance of path = .058 Ω

V_{OC} = 115V 400 H_z

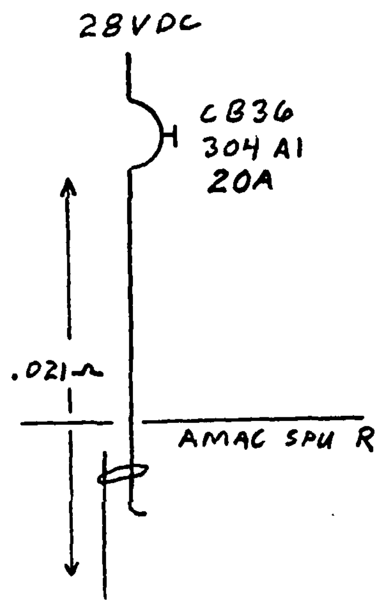
$I_{SC} = \frac{115}{.058} = \underline{1983}$ A

Time = Less than .6 seconds at -54°C for circuit breaker to open. On ground alert at 25°C the time to open would be less than .35 seconds.

4.2.6.2 (Continued)

e. <u>Worst Case Path for Weapon Station R at 28VDC</u>

Reference path (5) from paragraph b.



J479013-A (Typical for H, J, X, Y, Z, d, e, f)

Total resistance of path = .021 Ω

$V_{OC} = 28VDC$

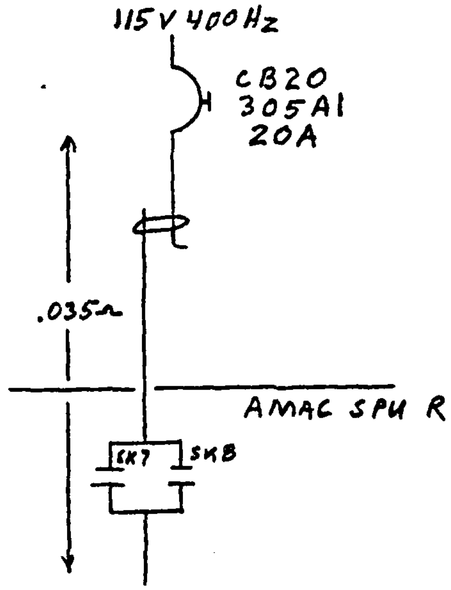
$I_{SC} = \frac{28}{.021} = \underline{1333}\ A$

Time = Less than .6 seconds at -54°C for circuit breaker to open. On ground alert at 25°C the time to open would be less than .35 seconds.

4.2.6.2 (Continued)

f. <u>Worst Case Path for Weapon Station R at 115V 400 H_z</u>

Reference path (1) from paragraph b.



Total resistance at path = .035Ω

V_{OC} = 115V 400 H_z

$I_{SC} = \frac{115}{.035} = \underline{3286}$ A

Time = Less than <u>.6</u> seconds at -54°C for circuit breaker to open. On ground alert at 25°C the time to open would be less than .35 seconds.

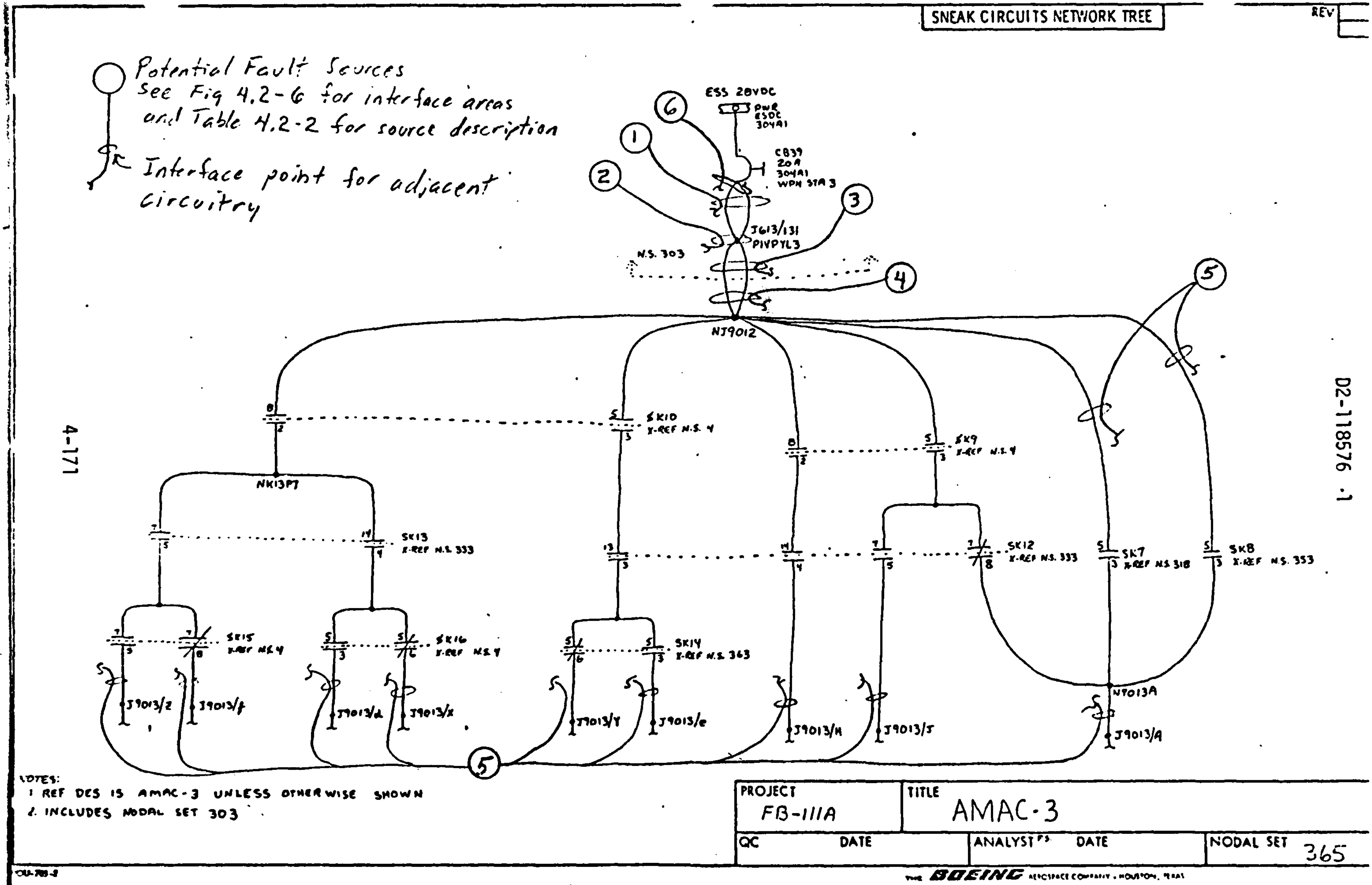


Figure 4.2-4 NETWORK TREE 365

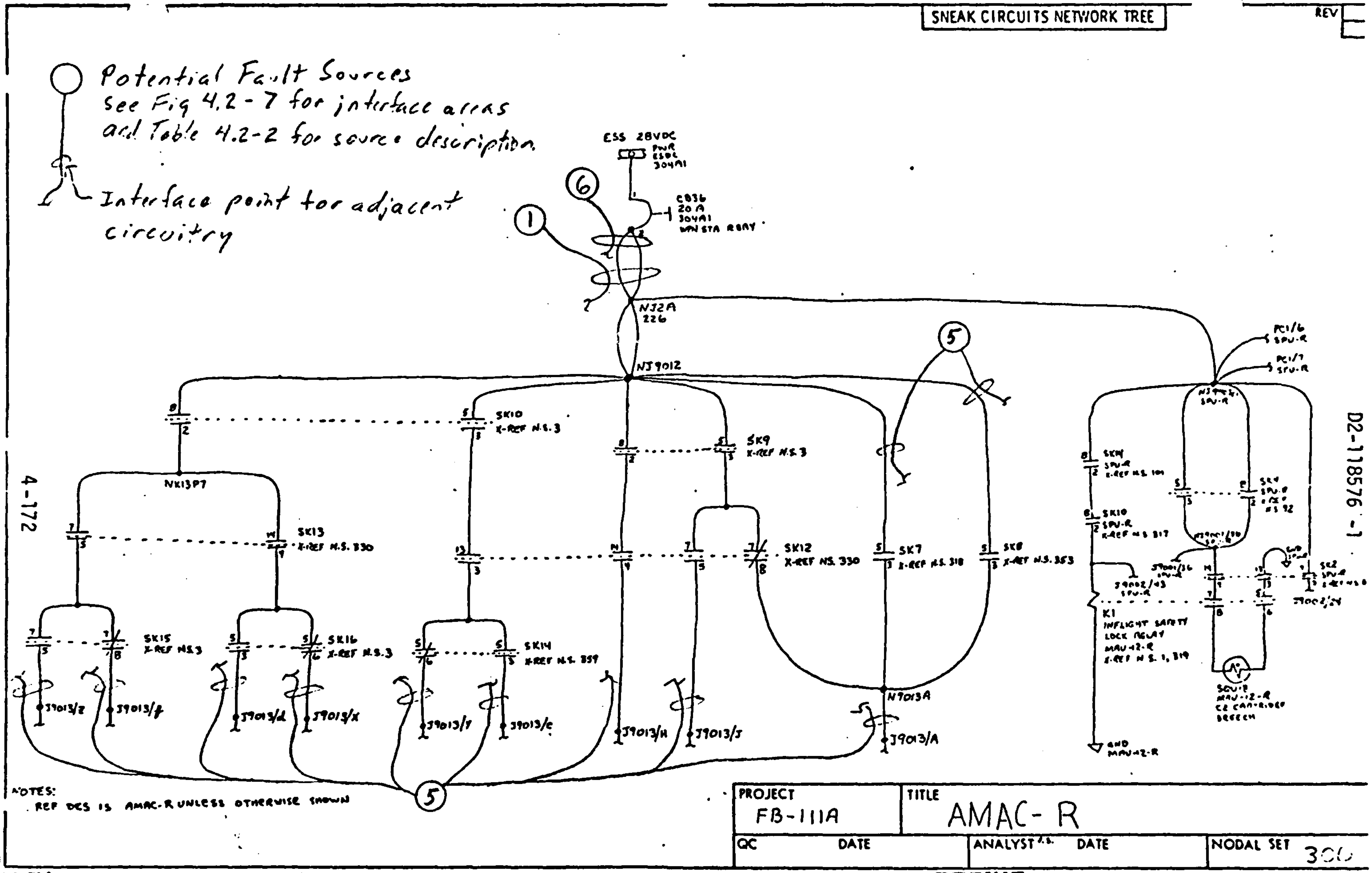


Figure 4.2-5 NETWORK TREE 300

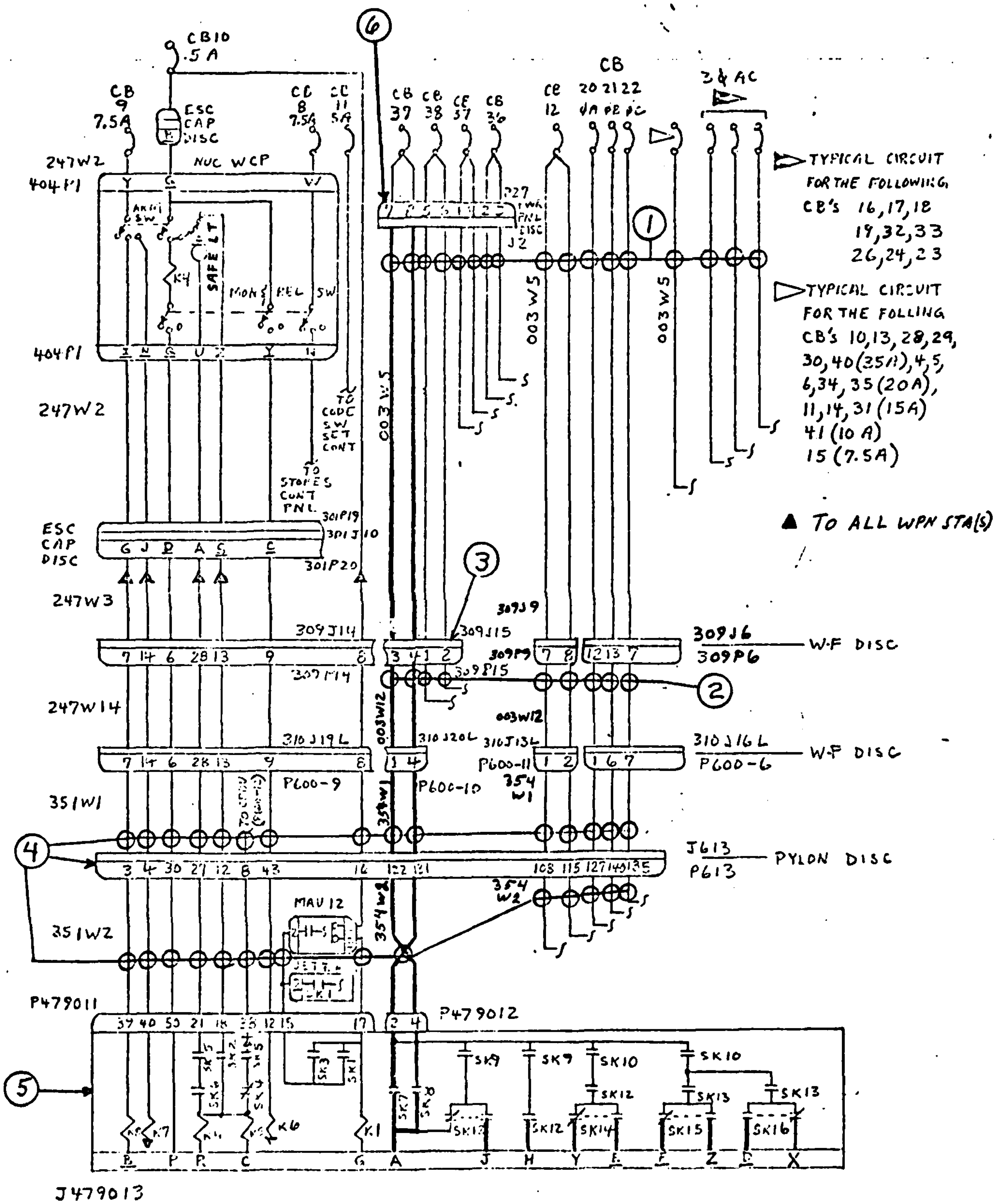


Figure 4.2-6 FAULT DIAGRAM WEAPON STATION 3

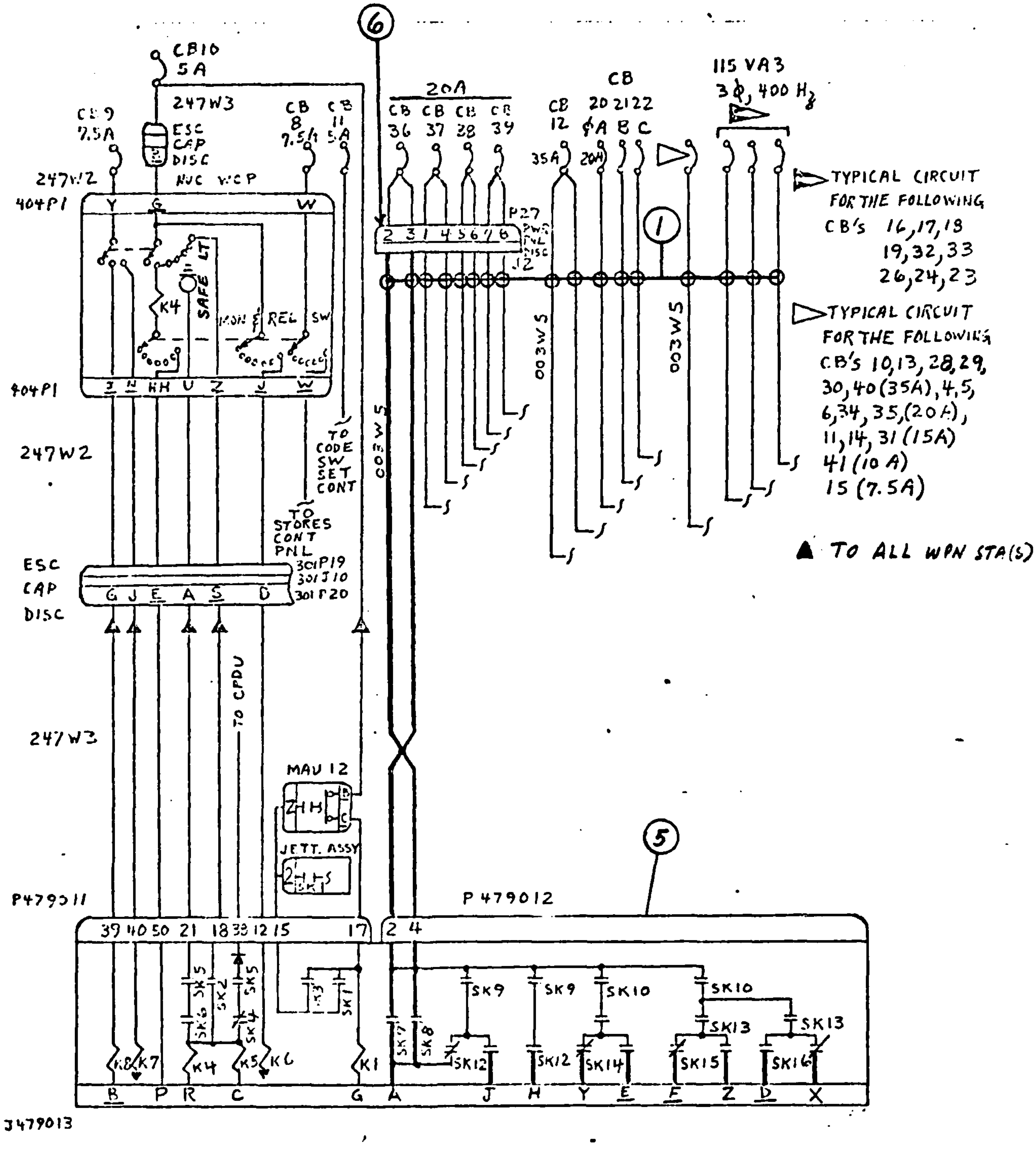


Figure 4.2-7 FAULT DIAGRAM WEAPON STATION R

4.2.6.2 (Continued)

TABLE 4.2-2

POTENTIAL FAULT POWER SOURCES

FIGURE INDICATOR	CIRCUIT BREAKER	POWER
	CB16 (20A) UNIT 305A1	115V 400Hz R MAIN BUS
	CB17 (20A) UNIT 305A1	115V 400Hz R MAIN BUS
	CB18 (20A) UNIT 305A1	115V 400Hz R MAIN BUS
	CB19 (20A) UNIT 305A1	115V 400Hz L MAIN BUS
	CB20 (20A) UNIT 305A1	115V 400Hz L MAIN BUS
	CB21 (20A) UNIT 305A1	115V 400Hz L MAIN BUS
	CB22 (20A) UNIT 305A1	115V 400Hz L MAIN BUS
	CB23 (20A) UNIT 305A1	115V 400Hz R MAIN BUS
	CB24 (20A) UNIT 305A1	115V 400Hz R MAIN BUS
	CB26 (20A) UNIT 305A1	115V 400Hz R MAIN BUS
	CB32 (20A) UNIT 305A1	115V 400Hz L MAIN BUS
	CB33 (20A) UNIT 305A1	115V 400Hz L MAIN BUS
	CB11 (15A) UNIT 315A1	28VDC MAIN BUS
	CB14 (15A) UNIT 315A1	28VDC MAIN BUS
	CB15 (15A) UNIT 304A1	28VDC ESS BUS
①	CB28 (15A) UNIT 315A1	28VDC MAIN BUS
	CB31 (15A) UNIT 315A1	28VDC MAIN BUS
	CB10 (35A) UNIT 315A1	28VDC MAIN BUS
	CB12 (35A) UNIT 315A1	28VDC MAIN BUS
	CB13 (35A) UNIT 315A1	28VDC MAIN BUS
	CB29 (35A) UNIT 315A1	28VDC MAIN BUS
	CB30 (35A) UNIT 315A1	28VDC MAIN BUS
	CB40 (35A) UNIT 315A1	28VDC MAIN BUS
	CB4 (20A) UNIT 304A1	28VDC ESS BUS
	CB5 (20A) UNIT 304A1	28VDC ESS BUS
	CB34 (20A) UNIT 304A1	28VDC ESS BUS
	CB35 (20A) UNIT 304A1	28VDC ESS BUS
	**CB36 (20A) UNIT 304A1	28VDC ESS BUS
	CB37 (20A) UNIT 304A1	28VDC ESS BUS
	CB38 (20A) UNIT 304A1	28VDC ESS BUS
	*CB39 (20A) UNIT 304A1	28VDC ESS BUS
	CB38 (20A) UNIT 304A1	28VDC ESS BUS
	CB12 (35A) UNIT 315A1	28VDC MAIN BUS
	CB41 (10A) UNIT 315A1	28VDC MAIN BUS
	CB19 (20A) UNIT 305A1	115V 400Hz L MAIN BUS
	CB20 (20A) UNIT 305A1	115V 400Hz L MAIN BUS
②	CB21 (20A) UNIT 305A1	115V 400Hz L MAIN BUS
	CB22 (20A) UNIT 305A1	115V 400Hz L MAIN BUS
	CB32 (20A) UNIT 305A1	115V 400Hz L MAIN BUS
	CB33 (20A) UNIT 305A1	115V 400Hz L MAIN BUS

4.2.6.2 (Continued)

TABLE 4.2-2 (Continued)

POTENTIAL FAULT POWER SOURCES

FIGURE INDICATOR	CIRCUIT BREAKER	POWER
(3)	CB38 (20A) UNIT 304A1	28VDC ESS BUS
(4)	CB9 (7.5A) UNIT	28VDC CREW STA ESS BUS
	CB10 (5A) UNIT	28VDC ESS BUS
	CB12 (35A) UNIT	28VDC MAIN BUS
	CB20 (20A) UNIT	115V 400HzØA L MAIN BUS
	CB21 (20A) UNIT	115V 400Hz ØB L MAIN BUS
	CB22 (20A) UNIT	115V 400Hz ØC L MAIN BUS
(5)	CB9 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
	CB10 (5A) UNIT 304A1	28VDC ESS BUS
	*CB36 (20A) UNIT 304A1	28VDC ESS BUS
	**CB39 (20A) UNIT 304A1	28VDC ESS BUS
(6)	**CB36 (20A) UNIT 304A1	28VDC ESS BUS
	CB37 (20A) UNIT 304A1	28VDC ESS BUS
	CB38 (20A) UNIT 304A1	28VDC ESS BUS
	*CB39 (20A) UNIT 304A1	28VDC ESS BUS

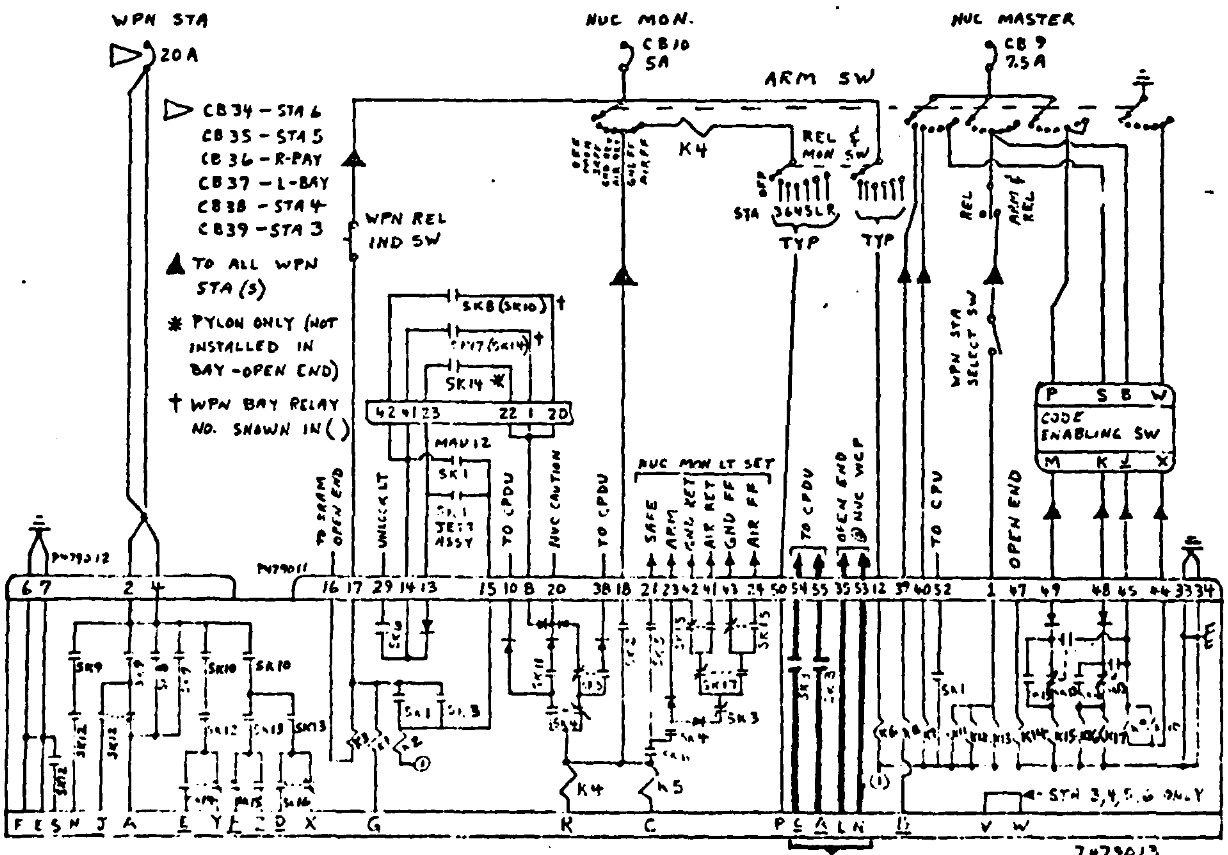
* STATION R ONLY

** STATION 3 ONLY

AMAC SPU PINS
L, N, a, c
CIRCUIT ANALYSIS PACKAGE

4.2.6.3 Circuit Analysis Package, Weapon Interface Pins L, N, a, c of AMAC SPU-3 and -R (Weapon Station 3 Pylon and Weapon Station R Bay)

These interfaces are shown in Figures 4.2-8 through 4.2-10 Sneak Circuits Network Tree 352, T.O. 1F-111(B)A-2-14 and T.O. 11N-T5036-2. Maximum current and voltage to all of these interfaces in a normal environment is 0. This is because the wiring to pins L and N dead ends at the Nuclear Weapons Control Panel and the wiring to pins a and c is connected to SRAM circuitry and is not used for gravity weapons. Worst case current, at 28VDC in an abnormal faulted environment and assuming a ground at the weapon interface is 608 amps for weapon station 3 and 1333 amps for weapon station R Worst case fault current at 115VAC would be 451 amps at weapon station 3 pins L and N and 215 amps at weapon station R pins L and N.



AMAC SPU INTERFACE

4.2.6.3

4.2.6.3 (Continued)

a. <u>Normal Power and Load Analysis</u>

Reference Figures 4.2-8, 4.2-9, 4.2-10, Network Trees 352, 354, 355, 356.

From examination of network trees in Figure 4.2-10 for pins L and N at any weapon station

V_{OC} = 0 V

I_{SC} = 0 A

From examination of network trees in Figures 4.2-8 and 4.2-9 for pins a and c at any weapon station.

V_{OC} = 0 V

I_{SC} = 0 A

Since relay K3 can only be energized if a SRAM is installed.

b. <u>Fault Analysis</u>

Reference Figures 4.2-8, 4.2-9 and 4.2-10, Network Trees 352, 354, 355, and 356 and Figure 4.2-11 Fault Diagram Weapon Station 3 and Figure 4.2-12 Fault Diagram Weapon Station R.

Since the wiring to pins L, N, a, and c are bussed to all nuclear weapons stations, any 28VDC or 115V 400 Hz power that might fault into these circuits for any weapon station will propagate to all weapon stations.

(1) <u>Wiring Harness 247 W2 Damaged</u>

Wires to pin L or N shorted to 28VDC. See Table 4.2-3 for voltage sources.

(2) <u>Wiring Harness 247 W3 Damaged</u>

Wires to pin L or N shorted to 28VDC. See Table 4.2-3 for voltage sources.

4.2.6.3 (Continued)

b. Fault Analysis (Continued)

(3) Wiring Harness 247 W14, 247 W15, Wing Fuselage Disconnect 308J13, 308J14, 309J13, 309J14 or Pylon 3, 4, 5, or 6 Wing Pylon Disconnect Damaged.

Wires to pin L or N shorted to 28VDC. See Table 4.2-3 for voltage sources.

(4) Pylon 3, 4, 5, 6 Wiring Harness 351 W1, 351 W2, 354 W1 354 W2 or Pylon Disconnect J613 Damaged

Wires to pin L or N shorted to 28VDC or 115V 400Hz. See Table 4.2-3 for voltage sources.

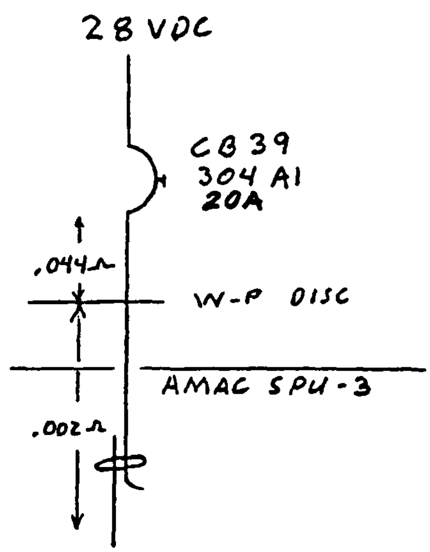
(5) AMAC SPU Damaged

Wires to pin L, N, a, c shorted to 28VDC. See Table 4.2-3 for voltage sources.

4.2.6.3 (Continued)

c. <u>Worst Case Path for Weapon Station 3 at 28VDC</u>

Reference path (5) from paragraph b.



J479013/L (Typical for N, a, c)

Total resistance of path = .046 ohms

V_{OC} = 28VDC

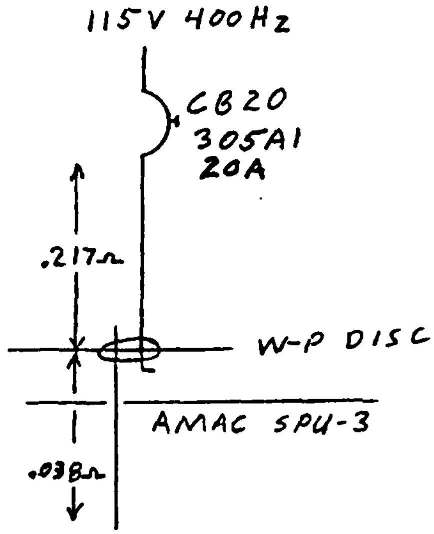
$I_{SC} = \frac{28}{.046} = \underline{608}$ amps

Time = Less than .6 seconds at -54^{o}C for circuit breaker to open. On ground alert at 25^{o}C the time to open would be less than .35 seconds.

4.2.6.3 (Continued)

d. <u>Worst Case Path for Weapon Station 3 at 115V 400Hz Pins L and N</u>

Reference path (4) from paragraph b.



J479013/L (Typical for N)

Total resistance of path = .255 ohms

V_{OC} = 115V 400Hz

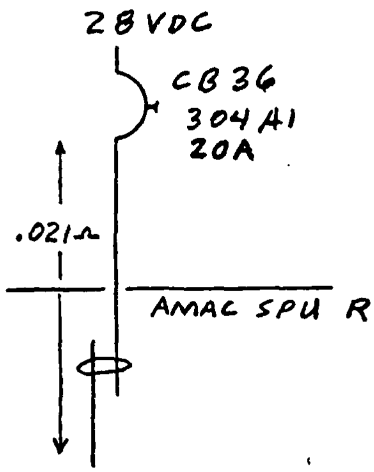
$I_{SC} = \frac{115}{.255} = \underline{451}$ amps

Time = Less than .6 seconds at -54°C for circuit breaker to open. On ground alert at 25°C the time to open would be less than .35 seconds.

4.2.6.3 (Continued)

e. Worst Case Path for Weapon Station R at 28VDC

Reference path (5) from paragraph b.



J479013/L (Typical for N, a, c)

Total resistance of path = .021 ohms

V_{OC} = 28VDC

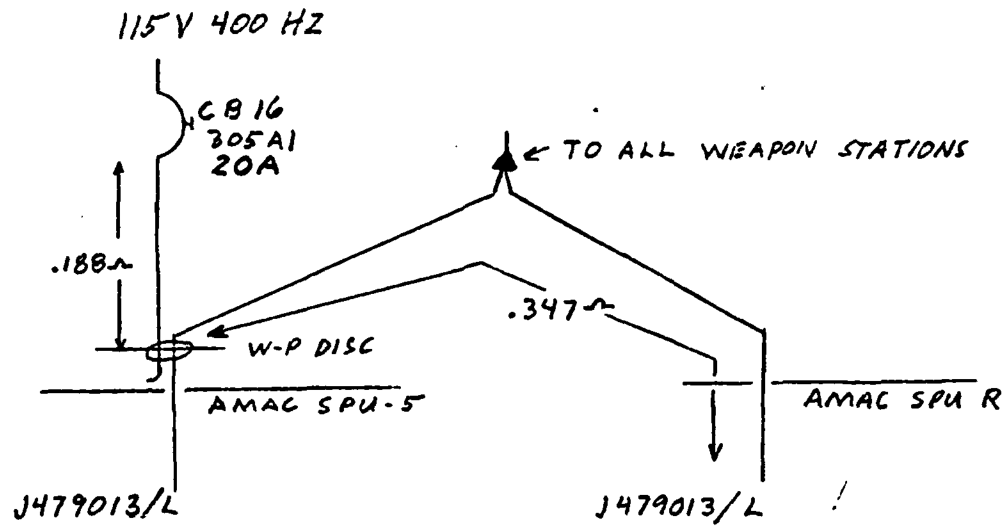
$I_{SC} = \frac{28}{.021} = \underline{1333}$ amps

Time = Less than .6 seconds at -54°C for the circuit breaker to open. On ground alert at 25°C the time to open would be less than .35 seconds.

4.2.6.3 (Continued)

f. Worst Case Path for Weapon Station R for 115V, 400Hz at Pins L and N

Reference path (4) from paragraph b.



Typical for N

Total resistance of path = .535 ohms

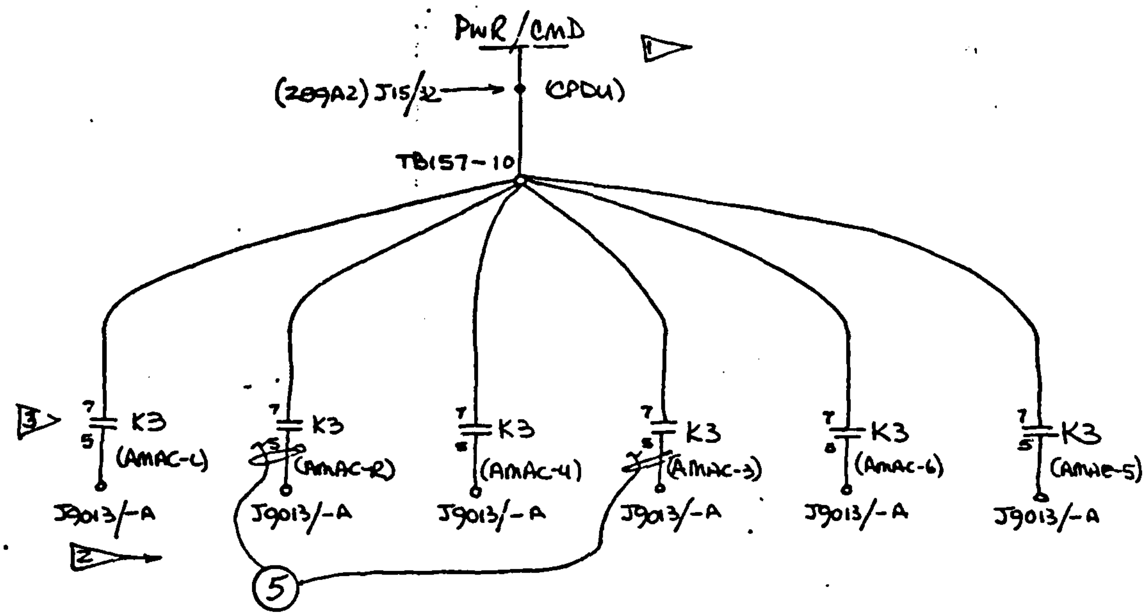
V_{OC} = 115V 400Hz

$I_{SC} = \frac{115}{.535} = \underline{215}$ amps

Time = Less than .6 seconds at -54°C for circuit breaker to open. On ground alert at 25°C the time to open would be less than .35 seconds.

SNEAK CIRCUITS NETWORK TREE

REV



1 COMMAND FROM CENTRAL PROCESSOR & DISTRIBUTOR UNIT: "SAF CLASS III CMD - UP".

2 J9013's ARE AT SRAM INTERFACE

3 FOR ALL K3's, REF. N.S.1

Potential Fault Sources
See Fig 4.2-11 and 4.2-12 for interface areas and Table 4.2-3 for source description.

Interface point for adjacent circuitry

PROJECT	TITLE		
FB111A	SAF CLASS III CMD. - UP		
QC	DATE	ANALYST	DATE
		[signature]	9-16-75

NODAL SET 352

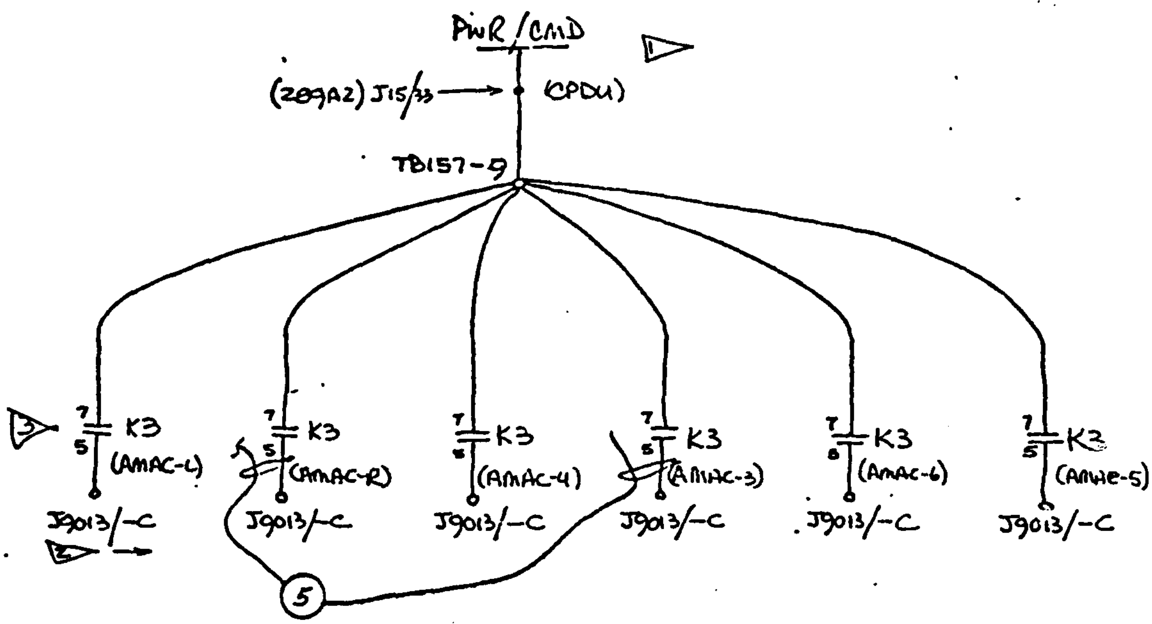
HOU-205

THE BOEING AEROSPACE COMPANY - HOUSTON, TEXAS

FIGURE 4.2-8. NETWORK TREE 352

SNEAK CIRCUITS NETWORK TREE

REV



1. Command from Central Processor & Distributor Unit: "SAF Class III Cmd - Dn".
2. J9013's are at SRAM interface
3. For all K3's, Ref. N.S. 1.

Potential Fault Sources
See Fig 4.2-11 and Fig 4.2-12 for interface areas and Table 4.2-3 for source description.

Interface point for adjacent circuitry

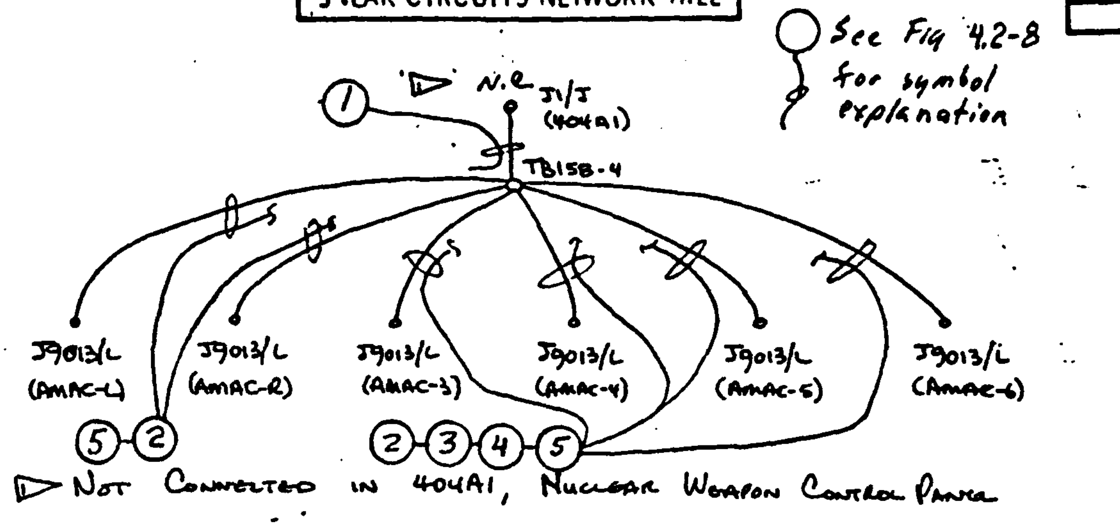
OJECT	TITLE		
FB111A	SAF Class III Cmd. - Down		
QC DATE	ANALYST	DATE 9-16-75	NODAL SET 354

HOU-705

THE BOEING AEROSPACE COMPANY - HOUSTON, TEXAS

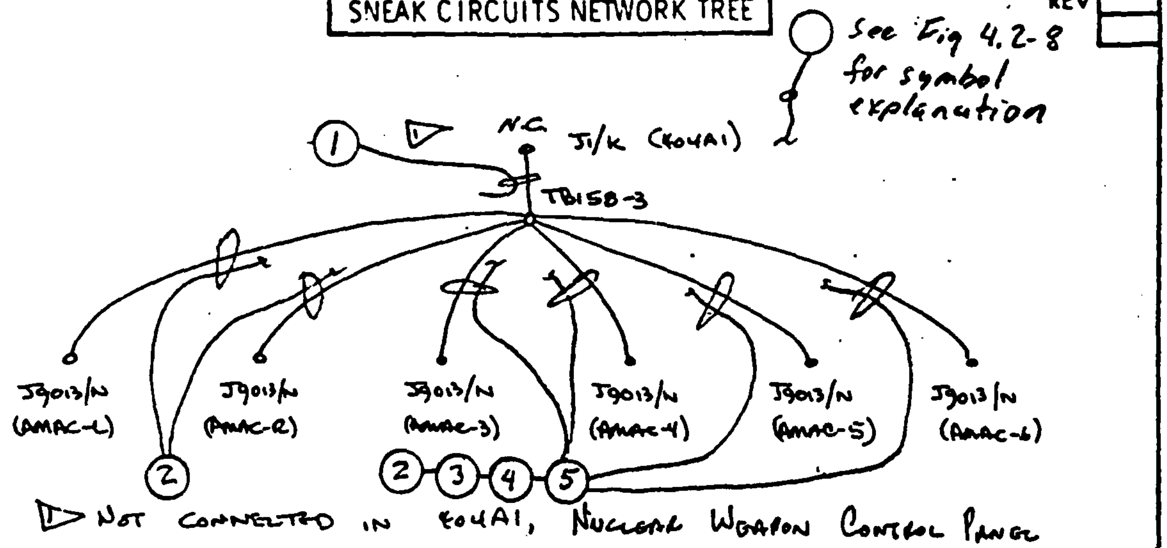
FIGURE 4.2-9. NETWORK TREE 354

SNEAK CIRCUITS NETWORK TREE REV



PROJECT	TITLE		
FB111A	Open End – No Function		
QC	DATE	ANALYST DATE 9-16-75	NODAL SET 355

SNEAK CIRCUITS NETWORK TREE REV



PROJECT	TITLE		
FB111A	Open End – No Function		
QC	DATE	ANALYST DATE 9-16-75	NODAL SET 356

THE BOEING COMPANY

FIGURE 4.2-10. NETWORK TREES 355 AND 356

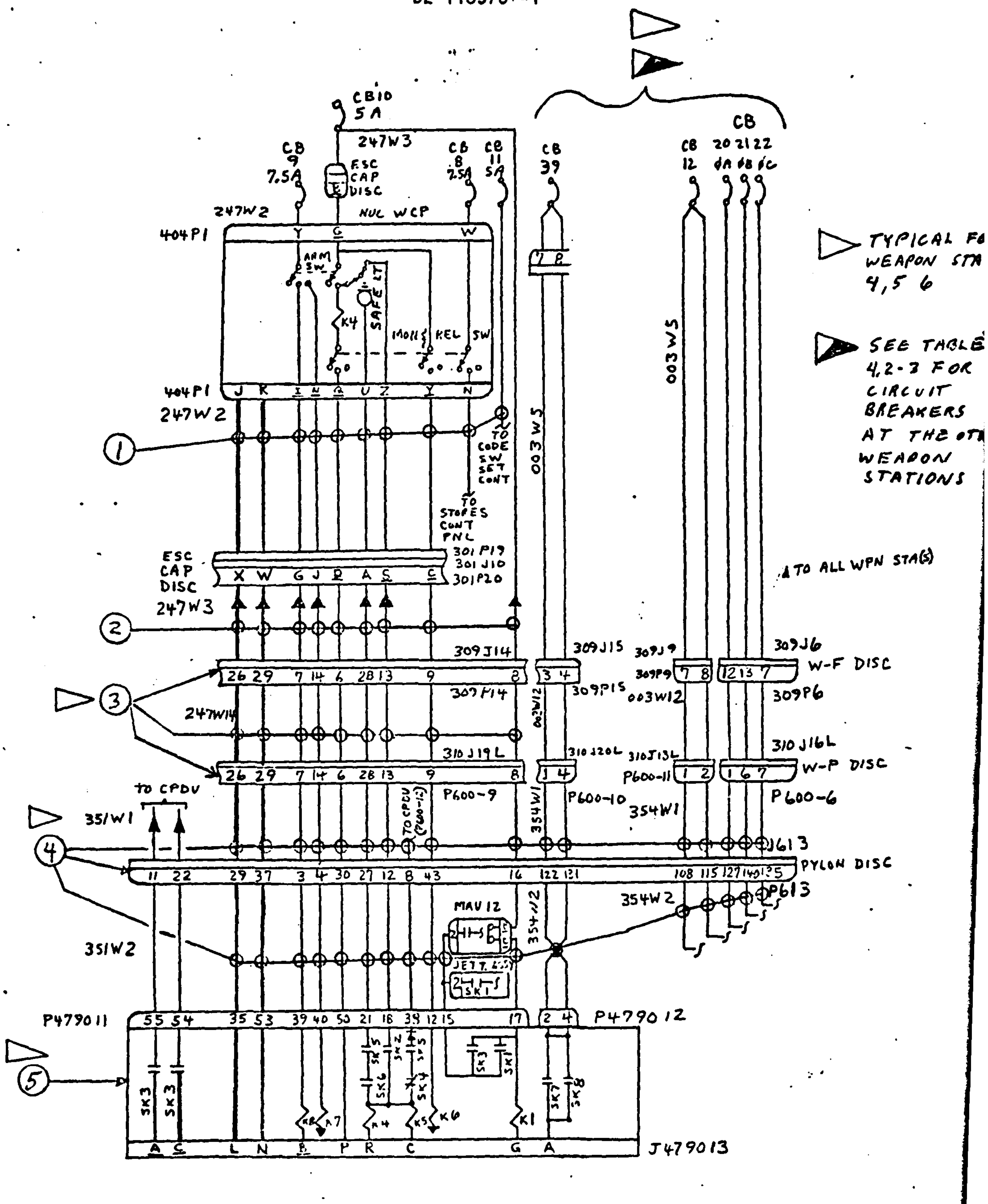


FIGURE 4.2-11. FAULT DIAGRAM WEAPON STATION 3

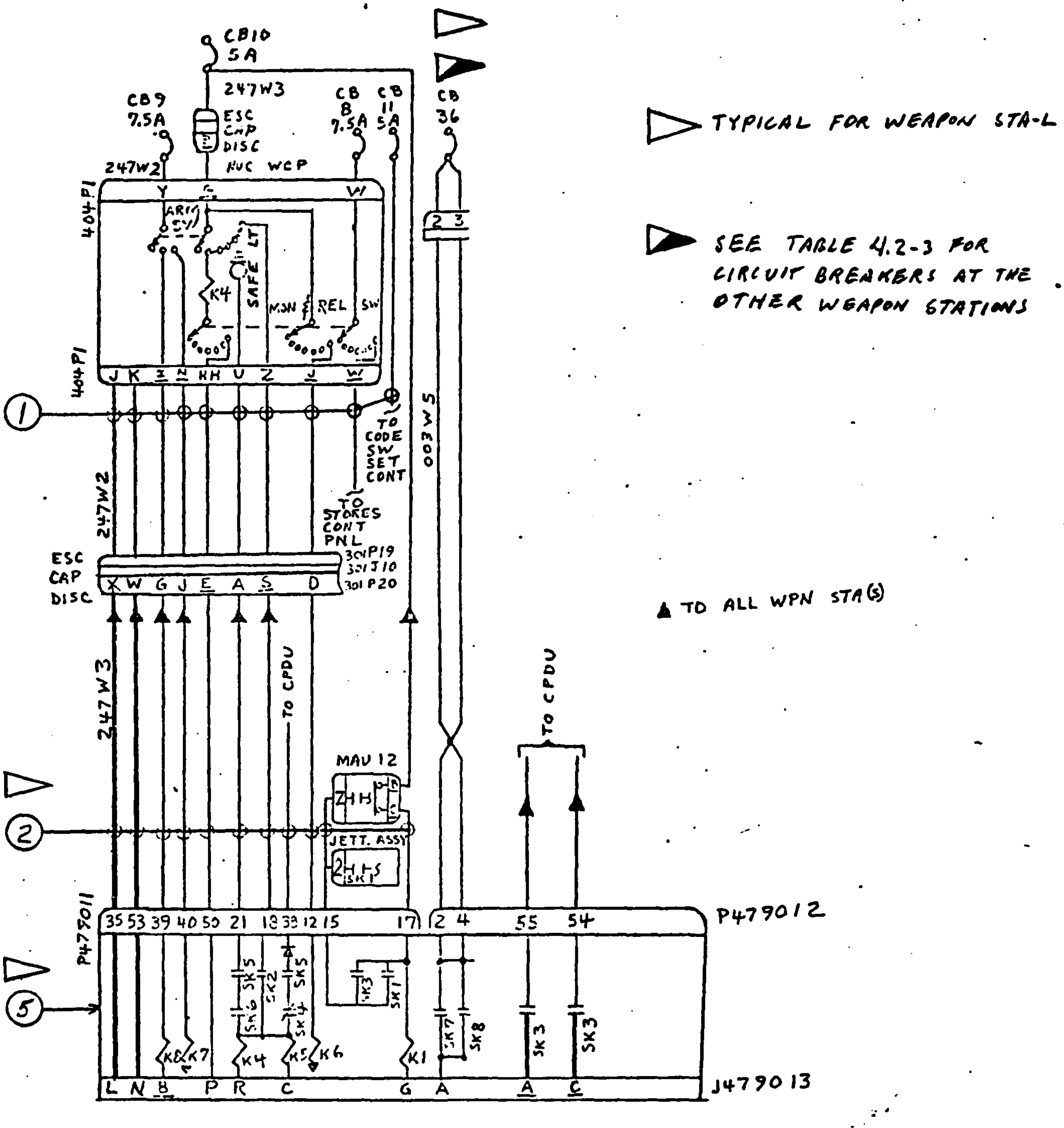


FIGURE 4.2-12. FAULT DIAGRAM WEAPON STATION R

4.2.6.3 (Continued)

TABLE 4.2-3

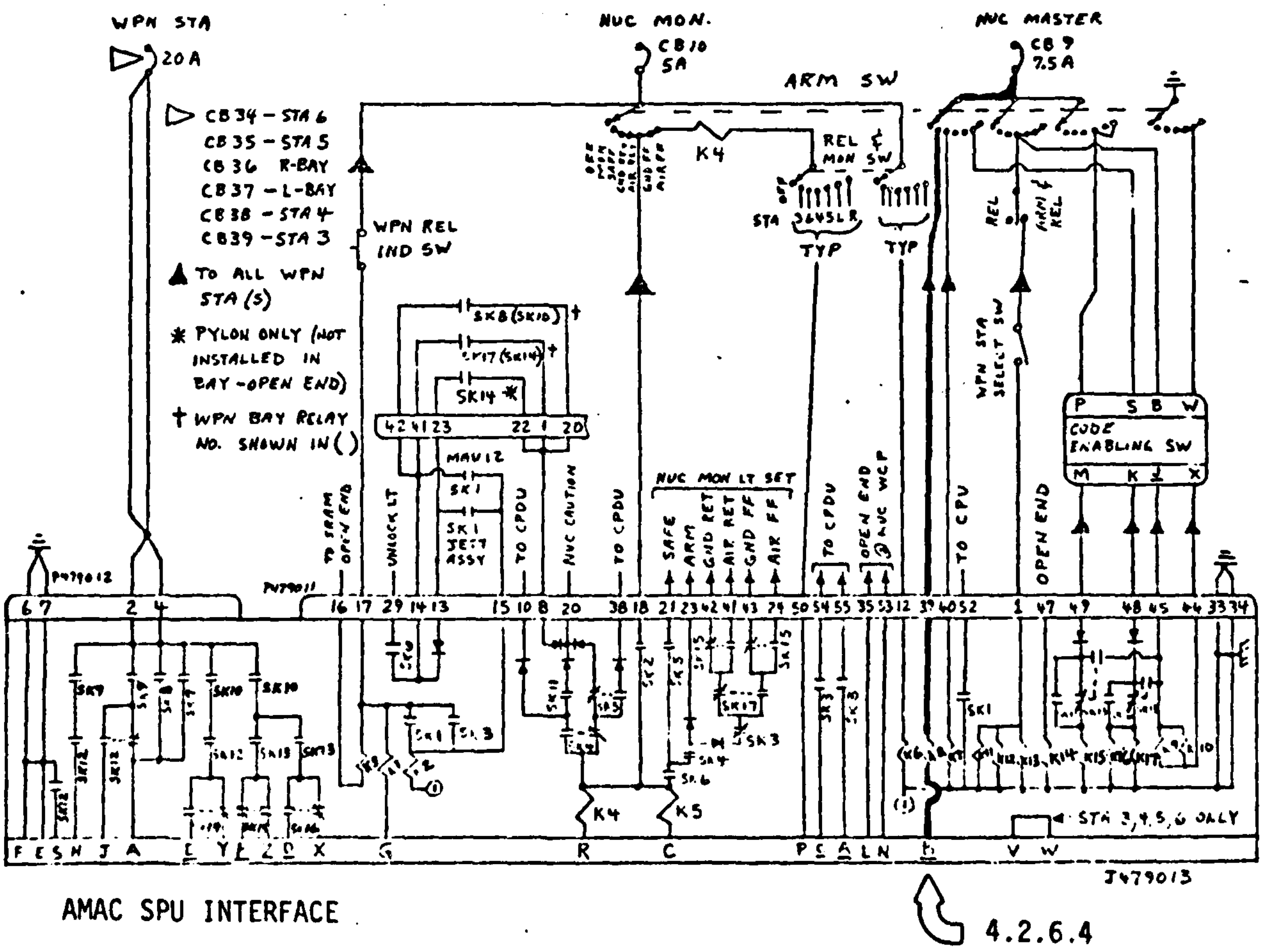
POTENTIAL FAULT POWER SOURCES

FIGURE INDICATOR		CIRCUIT BREAKER	POWER
①		CB8 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
		CB9 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
		CB11 (5A) UNIT 314A1	28VDC CREW STA ESS BUS
		CB10 (5A) UNIT 304A1	28VDC ESS BUS
② ③		CB9 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
		CB10 (5A) UNIT 304A1	28VDC ESS BUS
④		CB9 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
		CB10 (5A) UNIT 304A1	28VDC ESS BUS
	3>	CB20 (20A) UNIT 305A1	115VAC 400Hz L MAIN BUS
	3>	CB21 (20A) UNIT 305A1	115VAC 400Hz L MAIN BUS
	3>	CB22 (20A) UNIT 305A1	115VAC 400Hz L MAIN BUS
	3>	CB12 (35A) UNIT 315A1	28VDC MAIN BUS
	3>	CB39 (20A) UNIT 304A1	28VDC ESS BUS
	4>	CB38 (20A) UNIT 304A1	28VDC ESS BUS
	4>	CB29 (35A) UNIT 315A1	28VDC MAIN BUS
	4>	CB19 (20A) UNIT 305A1	115VAC 400Hz L MAIN BUS
	4>	CB32 (20A) UNIT 305A1	115VAC 400Hz L MAIN BUS
	4>	CB33 (20A) UNIT 305A1	115VAC 400Hz L MAIN BUS
	5>	CB35 (20A) UNIT 304A1	28VDC ESS BUS
	5>	CB13 (35A) UNIT 315A1	28VDC MAIN BUS
	5>	CB16 (20A) UNIT 305A1	115VAC, 400Hz R MAIN BUS
	5>	CB17 (20A) UNIT 305A1	115VAC, 400Hz R MAIN BUS
	5>	CB18 (20A) UNIT 305A1	115VAC, 400Hz R MAIN BUS
	6>	CB34 (20A) UNIT 304A1	28 VDC ESS BUS
	6>	CB30 (35A) UNIT 315A1	28VDC MAIN BUS
	6>	CB26 (20A) UNIT 305A1	115VAC, 400Hz, R MAIN BUS
	6>	CB24 (20A) UNIT 305A1	115VAC, 400Hz, R MAIN BUS
	6>	CB23 (20A) UNIT 305A1	115VAC, 400Hz, R MAIN BUS
⑤		CB9 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
		CB10 (5A) UNIT 304A1	28VDC ESS BUS
	3>	CB39 (20A) UNIT 304A1	28VDC ESS BUS
	R>	CB36 (20A) UNIT 304A1	28VDC ESS BUS
	L>	CB37 (20A) UNIT 304A1	28VDC ESS BUS
	4>	CB38 (20A) UNIT 304A1	28VDC ESS BUS
	5>	CB35 (20A) UNIT 304A1	28VDC ESS BUS
	6>	CB34 (20A) UNIT 304A1	28VDC ESS BUS

R> STA R ONLY   L> STA L ONLY   3> STA 3 ONLY   5> STA 5 ONLY
6> STA 6 ONLY   4> STA 4 ONLY

4.2.6.4 Circuit Analysis Package, Weapon Interface Pin b of AMAC SPU-3 and -R (Weapon Station 3 Pylon and Weapon Station R-Bay)

These interfaces are shown in Figure 4.2-13 Sneak Circuits Network Tree 318, Figure 4.2-D, which is a copy of Figure 1-8 from T.O. 1F-111(B)A-2-11-1 (Change 2) showing the circuitry to the pivot pylon weapon station AMAC SPU interfaces and Figure 4.2-F which is a copy of Figure 1-10 from T.O. 1F-111(B)A-2-11-1 (Change 2) showing the circuitry to L and R-Bay AMAC SPU interfaces. Maximum current available to the interfaces in a normal environment is 48 mA (direct current). Worst case current at 28VDC in an abnormal (faulted) environment would be 608 amps for weapon station 3 and 1333 amps for weapon station R. Worst case fault current at 115VAC would be 198 mA for weapon station 3 and R.

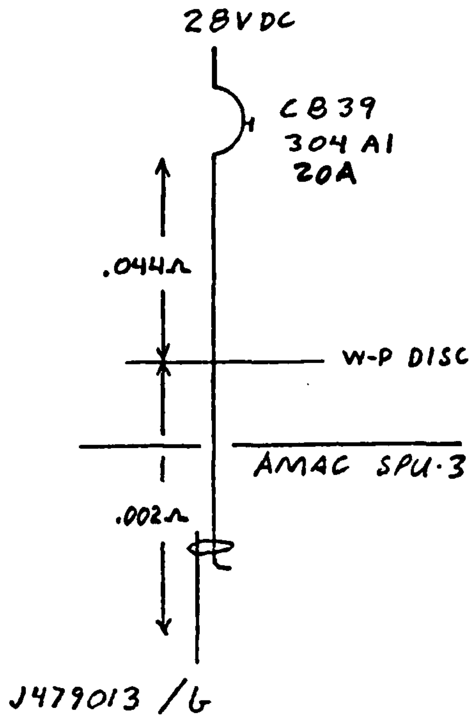


AMAC SPU INTERFACE

4.2.6.4 (Continued)

c. Worst Case Path For Weapon Station 3 at 28VDC

Reference: Path (5) from paragraph b.



Total resistance of path = .046 Ω

V_{OC} = 28VDC

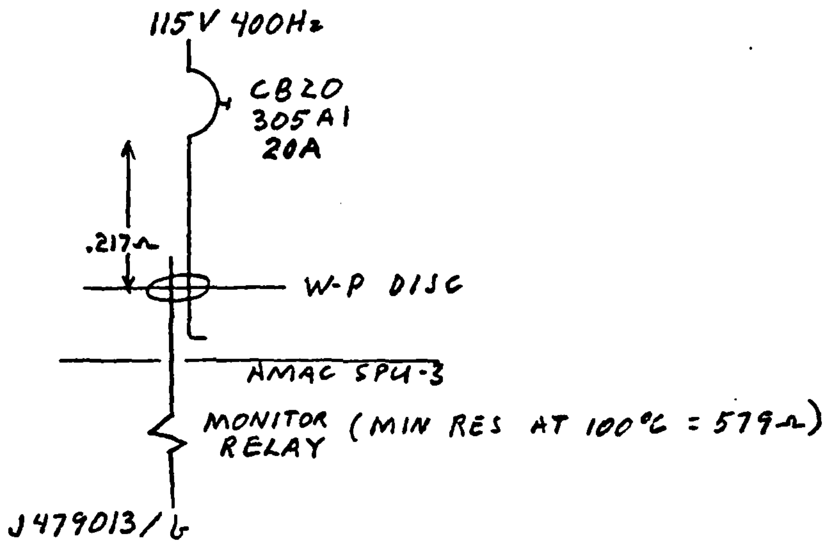
$I_{SC} = \frac{28}{.046} = \underline{608}$ A

Time = Less than .6 seconds at -54°C for circuit breaker to open. On ground alert the time to open would be less than .35 seconds at 25°C.

4.2.6.4 (Continued)

d. <u>Worst Case Path for Weapon Station 3 At 115V 400Hz</u>

Reference path (4) from paragraph b.



Total resistance of path $\approx$ 580 Ω

V_{OC} = 115V 400Hz

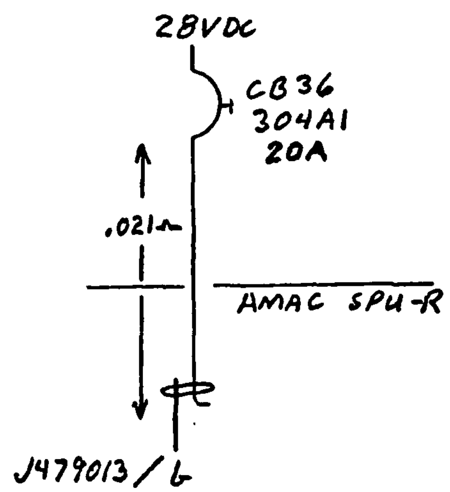
$I_{SC} = \frac{115}{580} = \underline{198}$ mA

Per telecon with relay manufacturer, Leach, the thermistor and varistor inside the relay will probably open at this voltage causing a net increase in resistance. At 25°C this is 800 Ω resulting in an I_{SC} of 144 mA.

4.2.6.4 (Continued)

e. <u>Worst Case Path For Weapon Station R At 28VDC</u>

Reference path (5) from paragraph b.



Total resistance of path = .021 Ω

V_{OC} = 28VDC

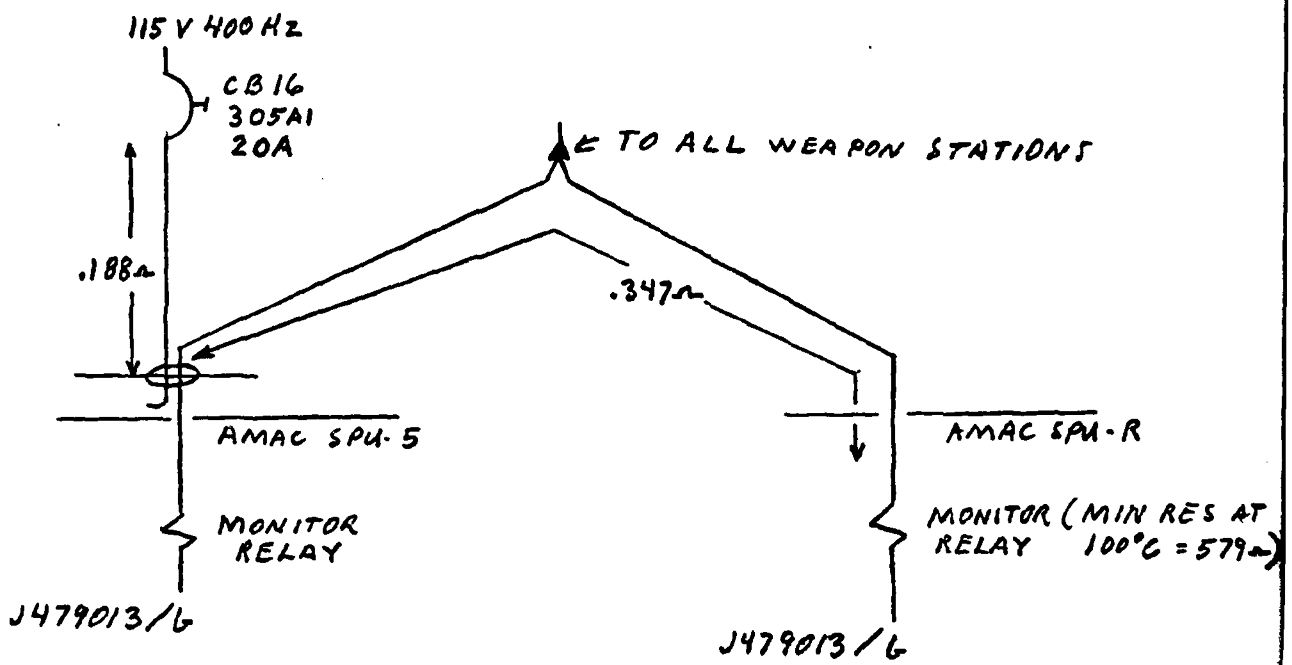
$I_{SC} = \frac{28}{.021} = \underline{1333}$ A

Time = Less than .6 seconds at -54°C for circuit breaker to open.
On ground alert the time to open would be less than .35 seconds at 25°C.

4.2.6.4 (Continued)

f. Worst Case Path for Weapon Station R at 115V 400Hz

Reference path (4) from paragraph b.



Total resistance of path ≈ 580 Ω

V_{OC} = 115V 400 Hz

$I_{SC} = \frac{115}{580} = \underline{.198}$ mA

Per telecon with relay manufacturer, Leach, the thermistor and varistor inside the relay will probably open at this voltage causing a net increase in resistance. At 25°C this would be 800 Ω resulting in an I_{SC} of 144 mA.

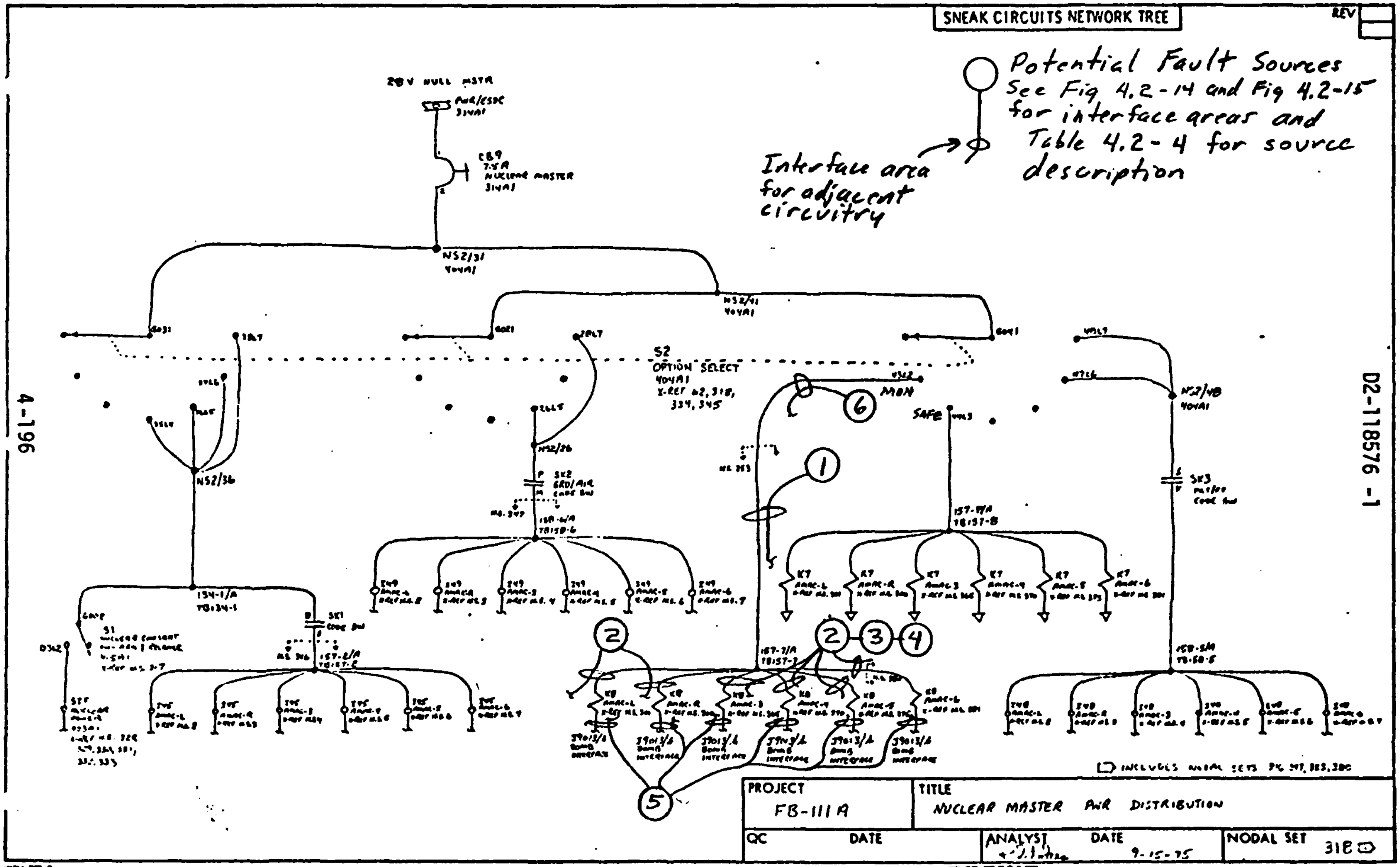


FIGURE 4.2-13. NETWORK TREE 318

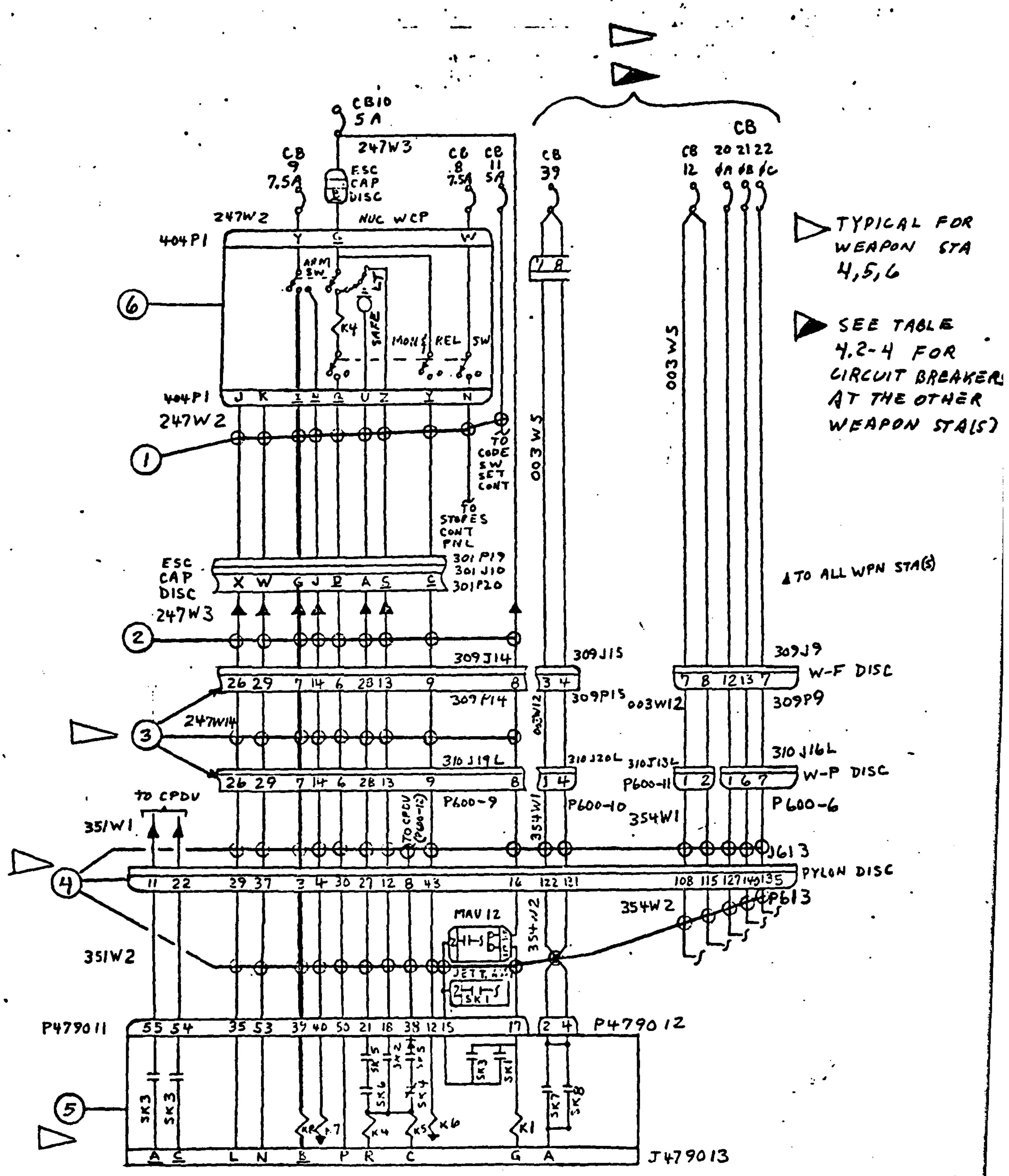


FIGURE 4.2-14 FAULT DIAGRAM WEAPON STATION 3

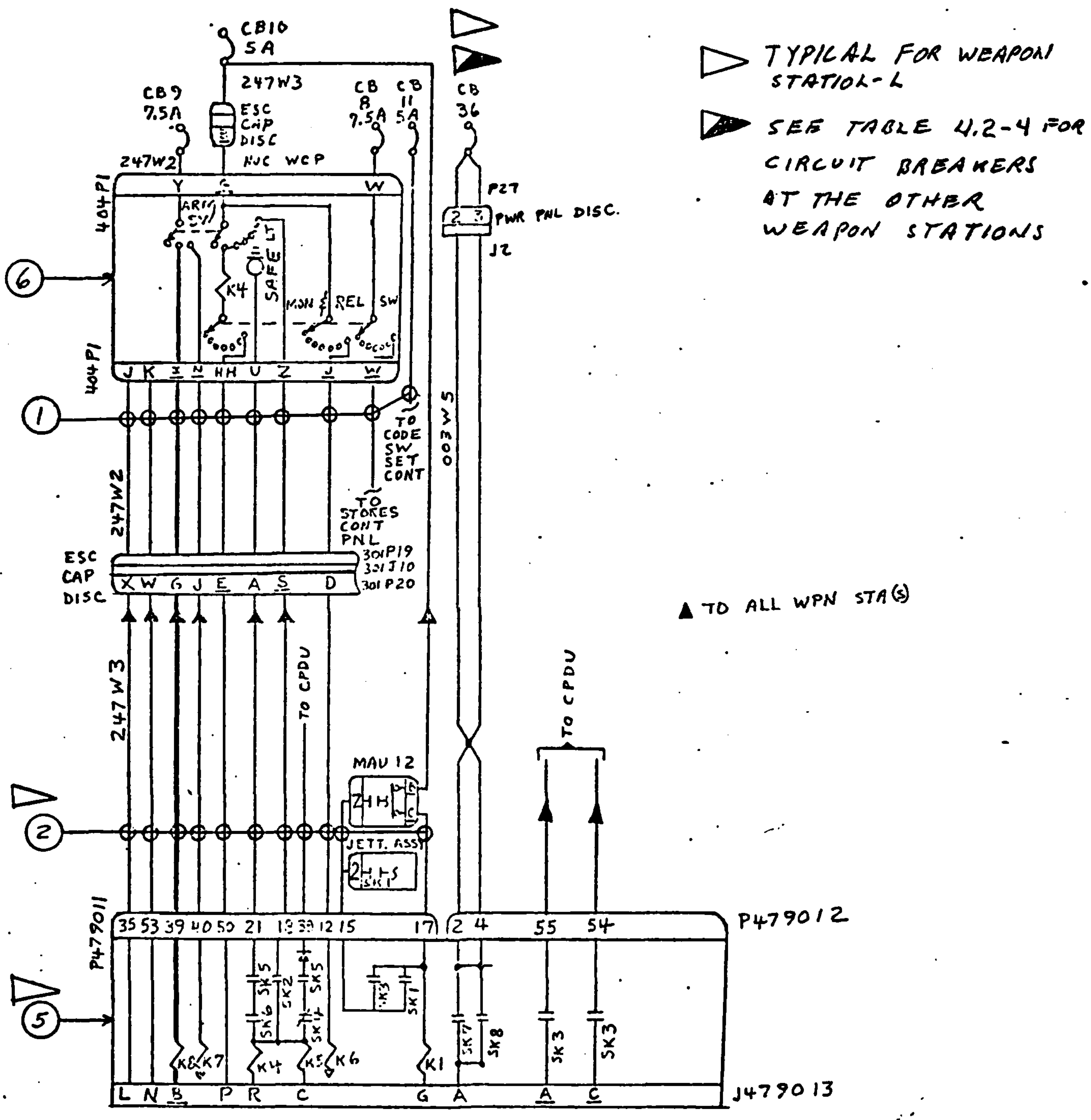


FIGURE 4.2-15 FAULT DIAGRAM WEAPON STATION R

?.6.4 (Continued)

TABLE 4.2-4

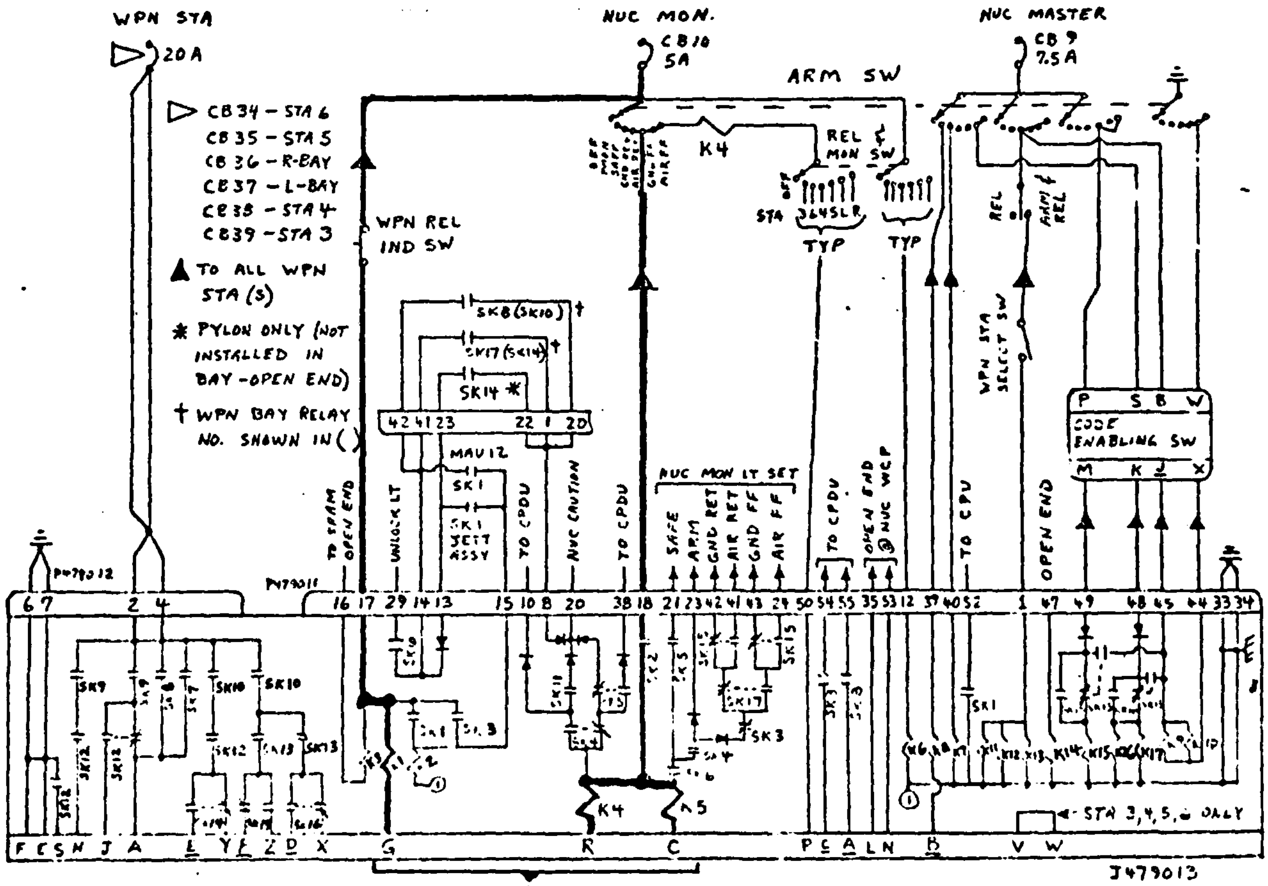
POTENTIAL FAULT POWER SOURCES

FIGURE INDICATOR		CIRCUIT BREAKER	POWER
(1)		CB8 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
		CB9 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
		CB11 (5A) UNIT 314A1	28VDC CREW STA ESS BUS
		CB10 (5A) UNIT 304A1	28VDC ESS BUS
(2) (3)		CB9 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
		CB10 (5A) UNIT 304A1	28VDC ESS BUS
(4)		CB9 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
		CB10 (5A) UNIT 304A1	28VDC ESS BUS
	3▷	CB20 (20A) UNIT 305A1	115VAC 400Hz L MAIN BUS
	3▷	CB21 (20A) UNIT 305A1	115VAC 400Hz L MAIN BUS
	3▷	CB22 (20A) UNIT 305A1	115VAC 400Hz L MAIN BUS
	3▷	CB12 (35A) UNIT 315A1	28VDC MAIN BUS
	3▷	CB39 (20A) UNIT 304A1	28VDC ESS BUS
	4▷	CB38 (20A) UNIT 304A1	28VDC ESS BUS
	4▷	CB29 (35A) UNIT 315A1	28VDC MAIN BUS
	4▷	CB19 (20A) UNIT 305A1	115VAC 400Hz L MAIN BUS
	4▷	CB32 (20A) UNIT 305A1	115VAC 400Hz L MAIN BUS
	4▷	CB33 (20A) UNIT 305A1	115VAC 400Hz L MAIN BUS
	5▷	CB35 (20A) UNIT 304A1	28VDC ESS BUS
	5▷	CB13 (35A) UNIT 315A1	28VDC MAIN BUS
	5▷	CB16 (20A) UNIT 305A1	115VAC, 400Hz R MAIN BUS
	5▷	CB17 (20A) UNIT 305A1	115VAC, 400Hz R MAIN BUS
	5▷	CB18 (20A) UNIT 305A1	115VAC, 400Hz R MAIN BUS
	6▷	CB34 (20A) UNIT 304A1	28 VDC ESS BUS
	6▷	CB30 (35A) UNIT 315A1	28VDC MAIN BUS
	6▷	CB26 (20A) UNIT 305A1	115VAC, 400Hz, R MAIN BUS
	6▷	CB24 (20A) UNIT 305A1	115VAC, 400Hz, R MAIN BUS
	6▷	CB23 (20A) UNIT 305A1	115VAC, 400Hz, R MAIN BUS
(5)		CB9 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
		CB10 (5A) UNIT 304A1	28VDC ESS BUS
	3▷	CB39 (20A) UNIT 304A1	28VDC ESS BUS
	R▷	CB36 (20A) UNIT 304A1	28VDC ESS BUS
	L▷	CB37 (20A) UNIT 304A1	28VDC ESS BUS
	4▷	CB38 (20A) UNIT 304A1	28VDC ESS BUS
	5▷	CB35 (20A) UNIT 304A1	28VDC ESS BUS
	6▷	CB34 (20A) UNIT 304A1	28VDC ESS BUS
(6)		CB8 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
		CB9 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
		CB10 (5A) UNIT 304A1	28VDC ESS BUS

R▷ STA R ONLY L▷ STA L ONLY 3▷ STA 3 ONLY 5▷ STA 5 ONLY
6▷ STA 6 ONLY 4▷ STA 4 ONLY

4.2.6.5 Circuit Analysis Package, Weapon Interface Pins C, G, R of AMAC-SPU-3 and -R (Weapon Station 3 Pylon and Weapon Station R Bay)

These interfaces are shown in Figure 4.2-16 and 4.2-17 Sneak Circuits Network Tree, Figure 4.2-D, which is a copy of Figure 1-8 from T.O. 1F-111(B) A-2-11-1 (Change 2) showing the circuitry to the pivot pylon weapon station AMAC SPU interfaces and Figure 4.2-F which is a copy of Figure 1-10 from T.O. 1F-111(B)A-2-11-1 (Change 2) showing the circuitry to L and R-Bay AMAC SPU interfaces. Maximum current available to the interfaces in a normal environment is 48 mA (direct current). Worst case current at 28VDC in an abnormal (faulted) environment would be 608 amps for weapon station 3 and 1333 amps for weapon station R. Worst case fault current at 115VAC would be 198 mA for weapon station 3 and R.



AMAC SPU INTERFACE

4.2.6.5

4.2.6.5 (Continued)

a. Normal Power and Load Analysis

Reference: Figures 4.2-16 and 4.2-17 Network Tree 1, Figure 4.2-18 Network Tree 334, Monitor-Relay Technical Data

From examination of the network tree

$V_{OC} = 28VDC$

$I_{SC} = \frac{28}{579} = \underline{48}$ mA for pin G

$I_{SC} = \frac{28}{579} = \underline{48}$ mA for pins R&C when the Option Select switch on the Nuclear Weapons Control Panel is in any position except off.

b. Fault Analysis

Reference: Figure 4.2-16 and 4.2-17 Network Tree 1, Figure 4.2-18 Network Tree 334, Figure 4.2-19 Fault Diagram for Weapon Station 3 and Figure 4.2-20 Fault Diagram for Weapon Station R.

Since the wiring to pins C, G, and R is bussed to all nuclear weapons stations any 28VDC or 115V 400Hz power that might fault into these circuits for any weapon station will propagate to all weapon stations.

(1) Wiring Harness 247 W2 Damaged

Wires to pin C or R shorted to 28VDC. See Table 4.2-5 for voltage sources.

(2) Wiring Harness 247 W3 Damaged

Wires to pin C, G or R shorted to 28VDC. See Table 4.2-5 for voltage sources.

(3) Wiring Harness 247 W14, 247 W15, Wing Fuselage Disconnect 308 J13, 308 J14, 309 J13, 309 J14 or Pylon 3, 4, 5, or 6 Wing-Pylon Disconnect Damaged

Wires to pin C, G, or R shorted to 28VDC. See Table 4.2-5 for voltage sources.

4.2.6.5 (Continued)

b. (Continued)

(4) Pylon 3, 4, 5, 6 Wiring Harness 351 W1, 351 W2, 354 W1, 354 W2 or Pylon Disconnect J613 Damaged

Wires to pin C, G, or R shorted to 28VDC or 115V 400 Hz. See Table 4.2-5 for voltage sources.

(5) AMAC SPU Damaged

Wires to pin C, G, or R shorted to 28VDC. See Table 4.2-5 for voltage sources.

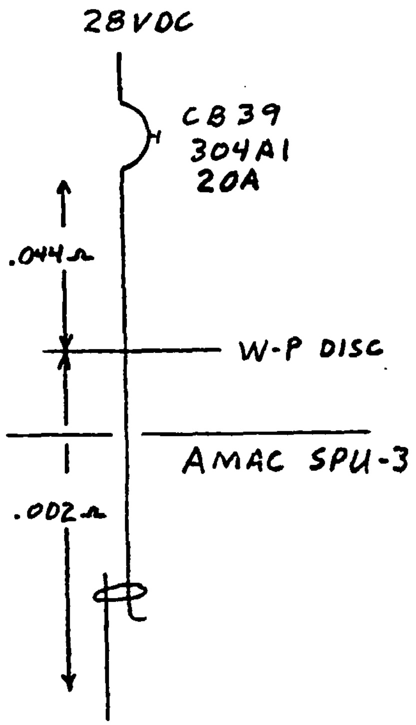
(6) Nuclear Weapons Control Panel Damaged

Wires to pin C or R shorted to 28VDC. See Table 4.2-5 for voltage sources.

4.2.6.5 (Continued)

c. Worst Case Path For Weapon Station 3 at 28 VDC

Reference path (5) from paragraph b.



J479013/C (Typical for G and R)

Total resistance of path = .046 Ω

V_{OC} = 28VDC

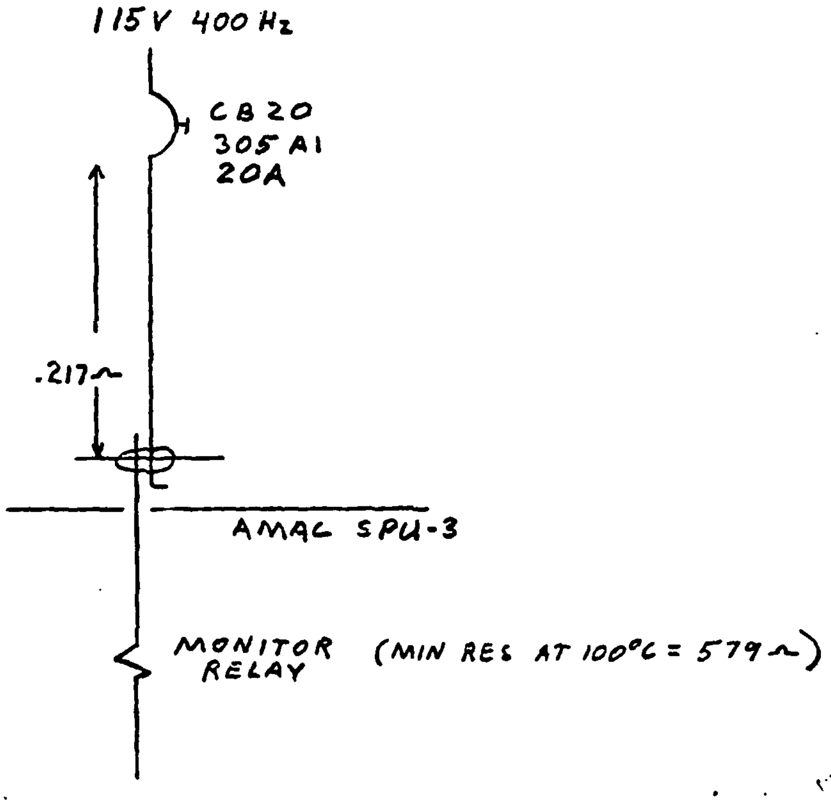
$I_{SC} = \frac{28}{.046} = \underline{608}$ A

Time = Less than .6 seconds at -54°C for circuit breaker to open. On ground alert at 25°C, the time to open would be less than .35 seconds.

4.2.6.5 (Continued)

d. Worst Case Path for Weapon Station 3 at 115V 400Hz

Reference path (4) from paragraph b.



J479013/C (Typical for G and R)

Total resistance of path ≈ 580 Ω

V_{OC} = 115V 400Hz

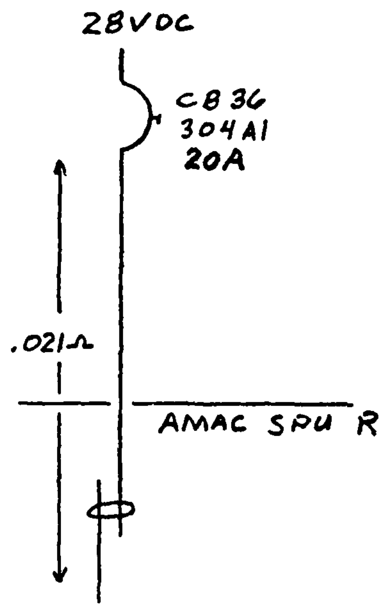
$I_{SC} = \frac{115}{580} = \underline{198}$ mA

Per telecon with relay manufacturer, Leach, the thermistor and varistor inside the relay will probably open at this voltage causing a net increase in resistance. At 25°C this is 800 ohms resulting in an I_{SC} of 144 mA.

4.2.6.5 (Continued)

e. Worst Case Path for Weapon Station R at 28VDC

Reference path (5) from paragraph b.



J479013/C (Typical for R and C)

Total resistance of path = .021 Ω

V_{OC} = 28VDC

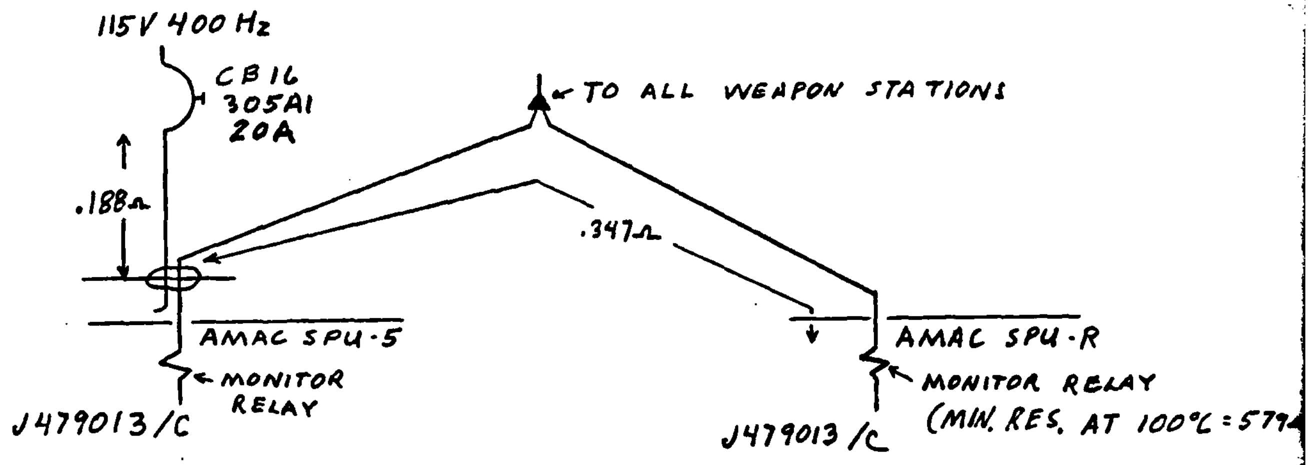
$I_{SC} = \frac{28}{.021} = \underline{1333}$ A

Time = Less than .6 seconds at -54°C for circuit breaker to open. On ground alert at 25°C, the time to open would be less than .35 seconds.

4.2.6.5 (Continued)

f. Worst Case Path for Weapon Station R at 115V 400Hz

Reference path (4) from paragraph b.



Typical for G and R

Total resistance of path approximately 580 ohms

V_{OC} = 115V 400Hz

$I_{SC} = \frac{115}{580} = \underline{198}$ mA

Per telecon with relay manufacturer, Leach, the thermistor and varistor inside the relay will probably open at this voltage causing a net increase in resistance. At 25°C this would be approximately 800 ohms resulting in an I_{SC} of 144 mA.

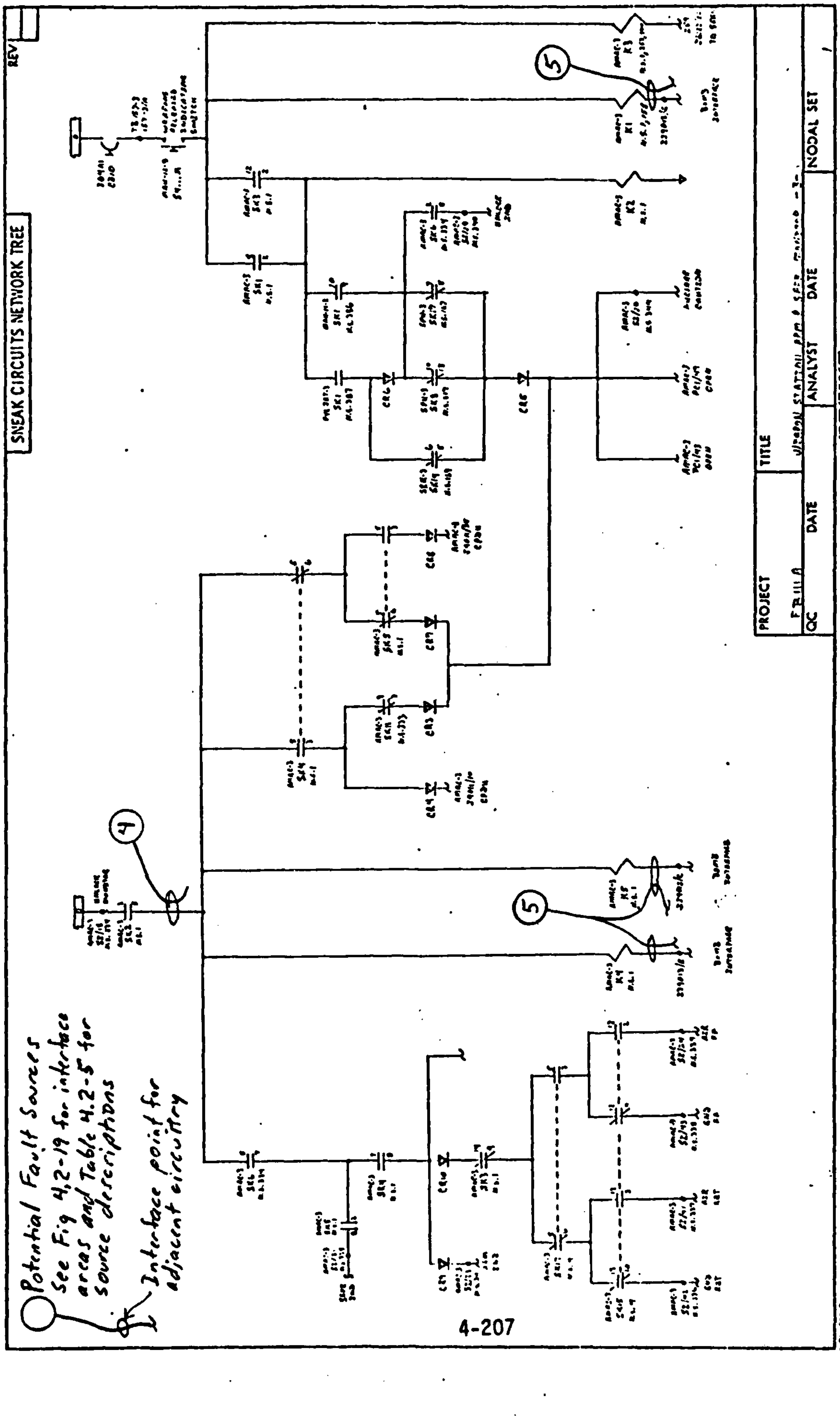


FIGURE 4.2-16 NETWORK TREE/STATION 3

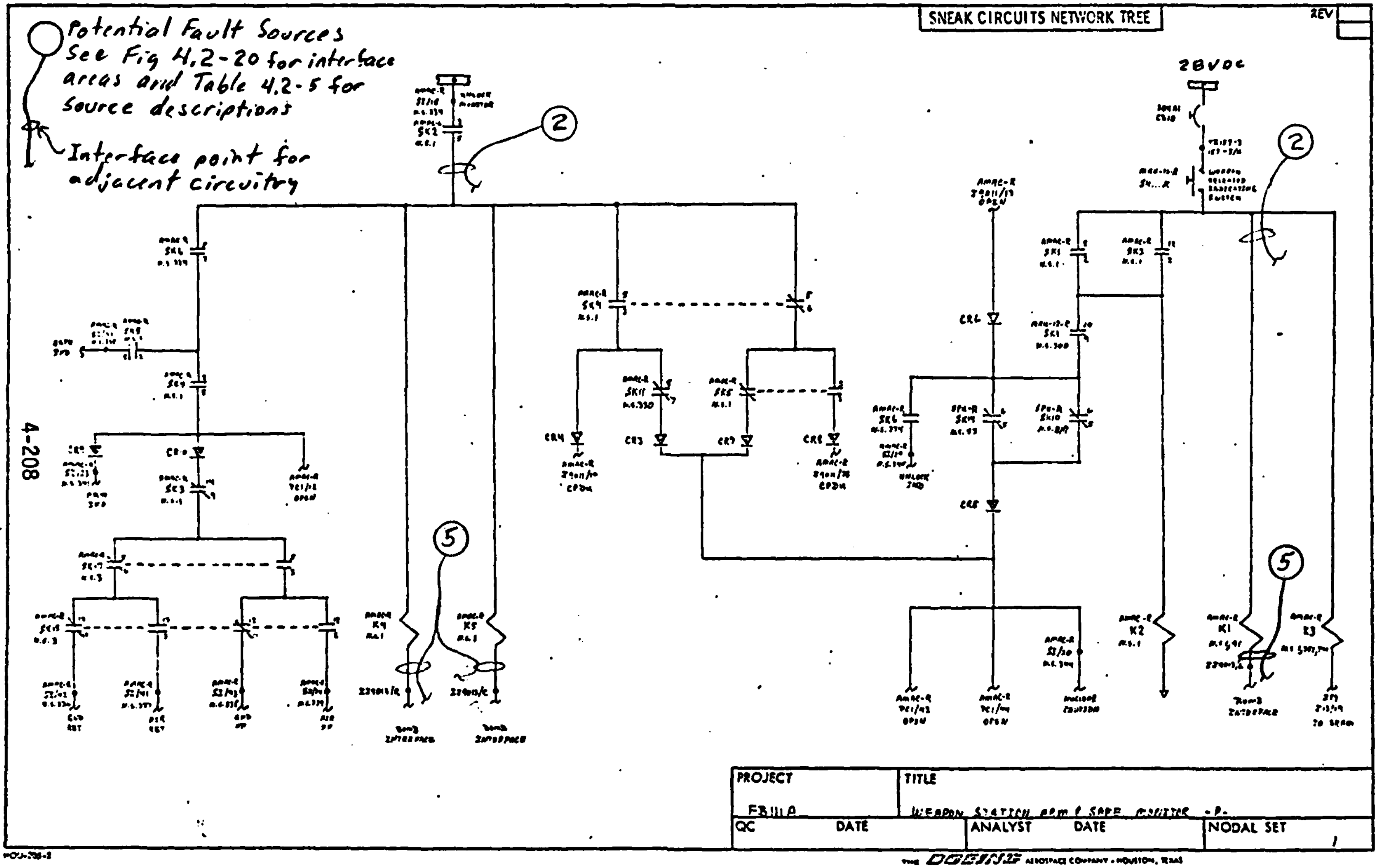


FIGURE 4.2-17 NETWORK TREE/STATION R

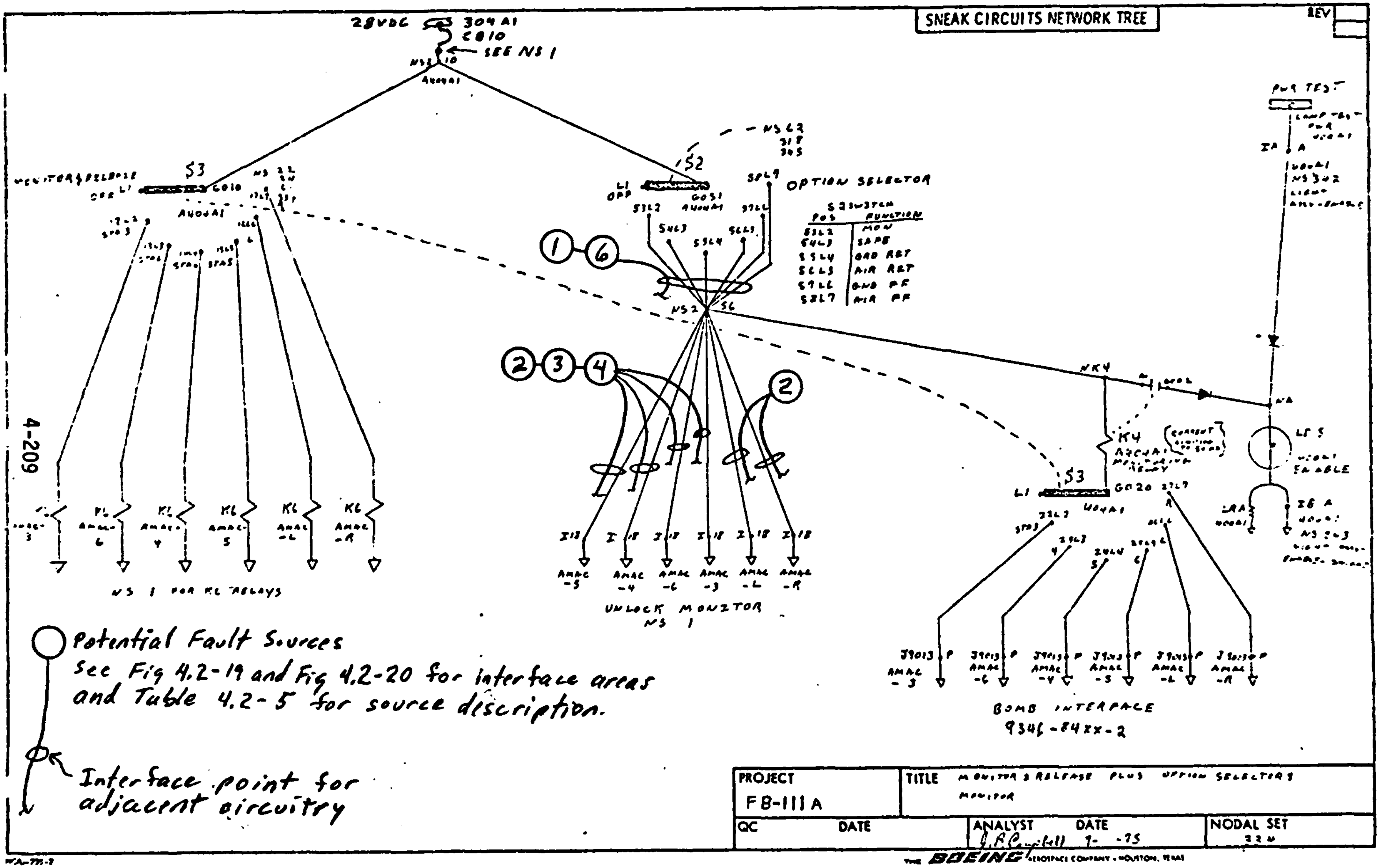


FIGURE 4.2-18 NETWORK TREE 334

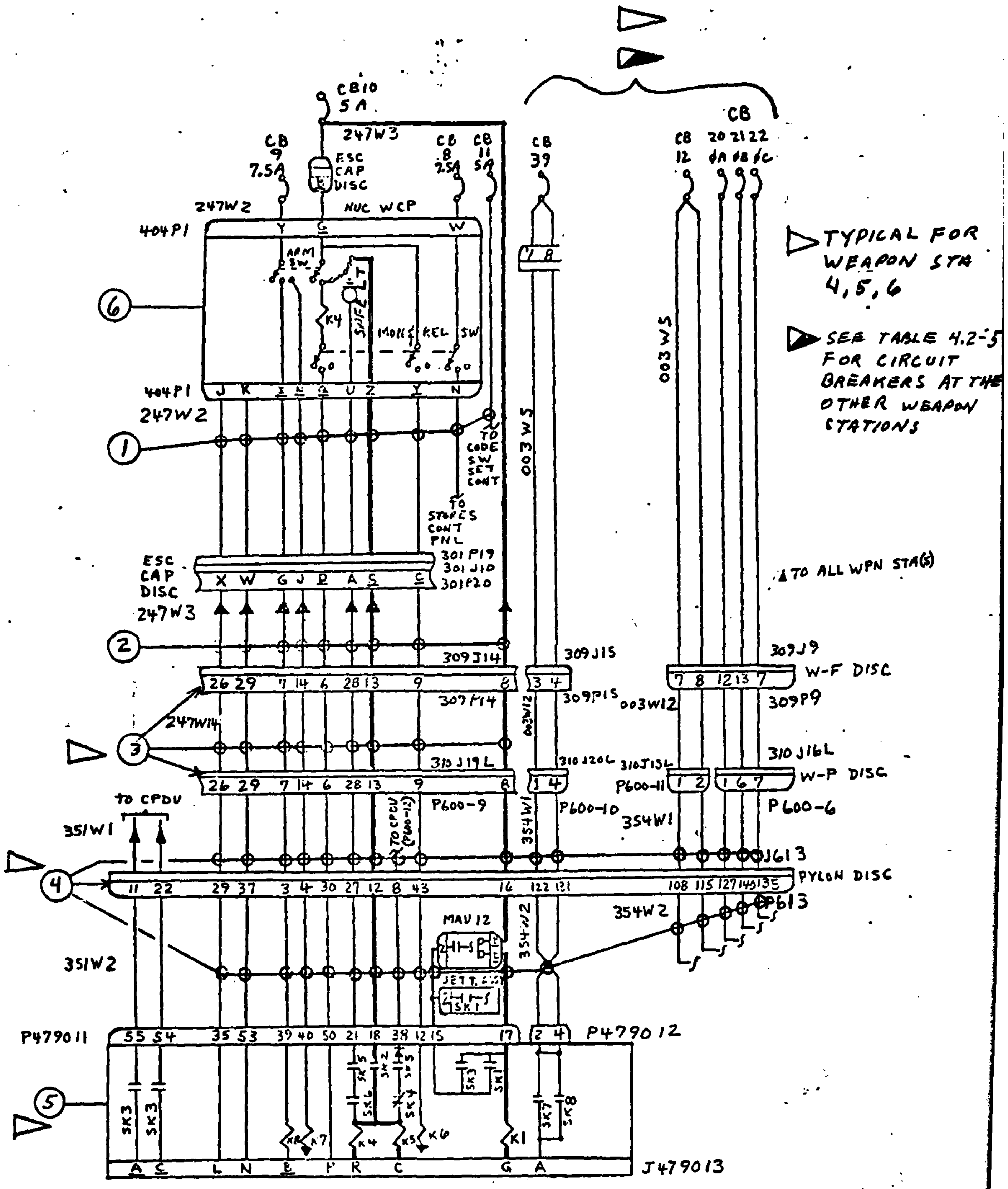


FIGURE 4.2-19 FAULT DIAGRAM WEAPON STATION 3

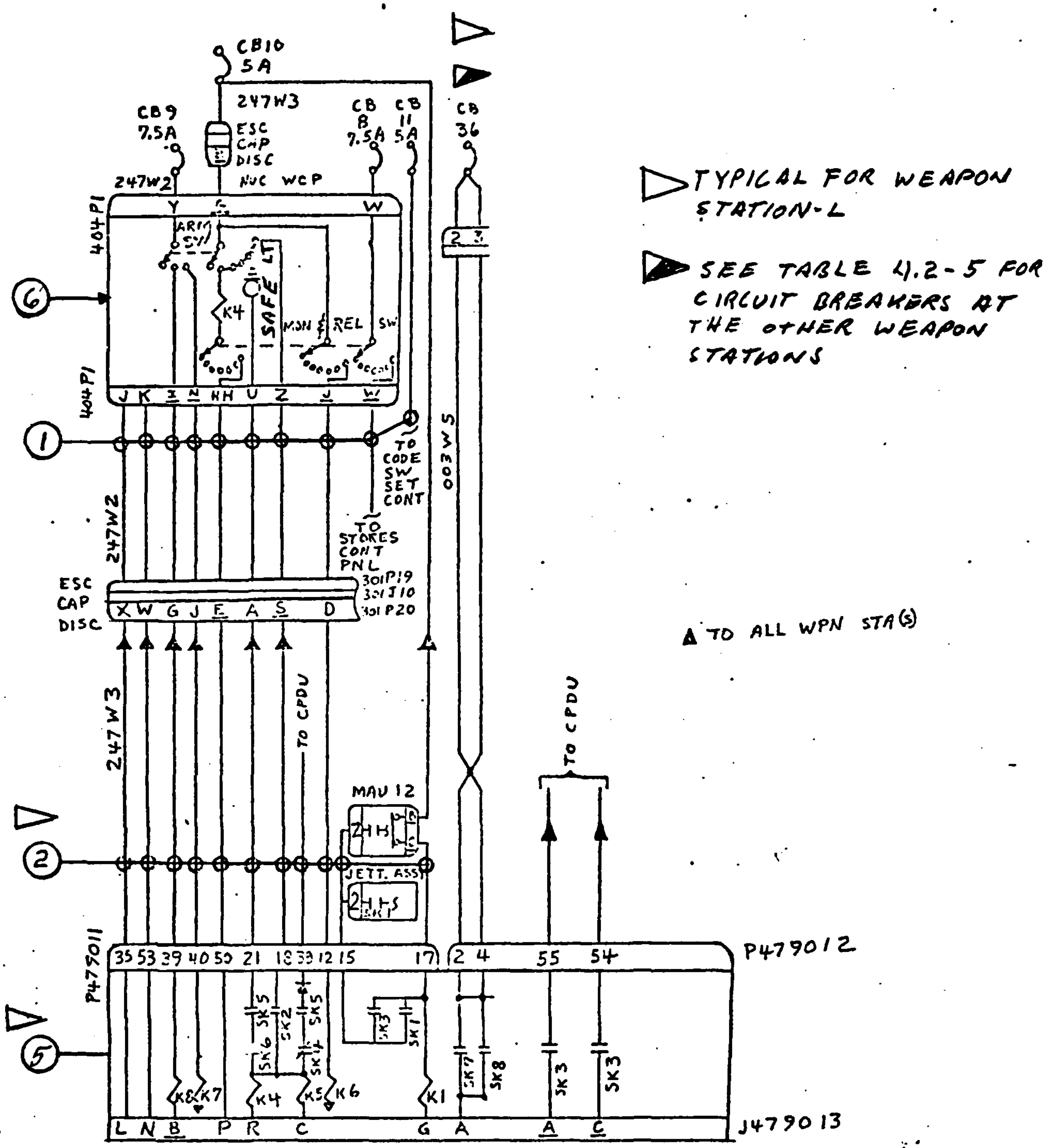


FIGURE 4.2-20 FAULT DIAGRAM WEAPON STATION R

4.2.6.5 (Continued)

TABLE 4.2-5

POTENTIAL FAULT POWER SOURCES

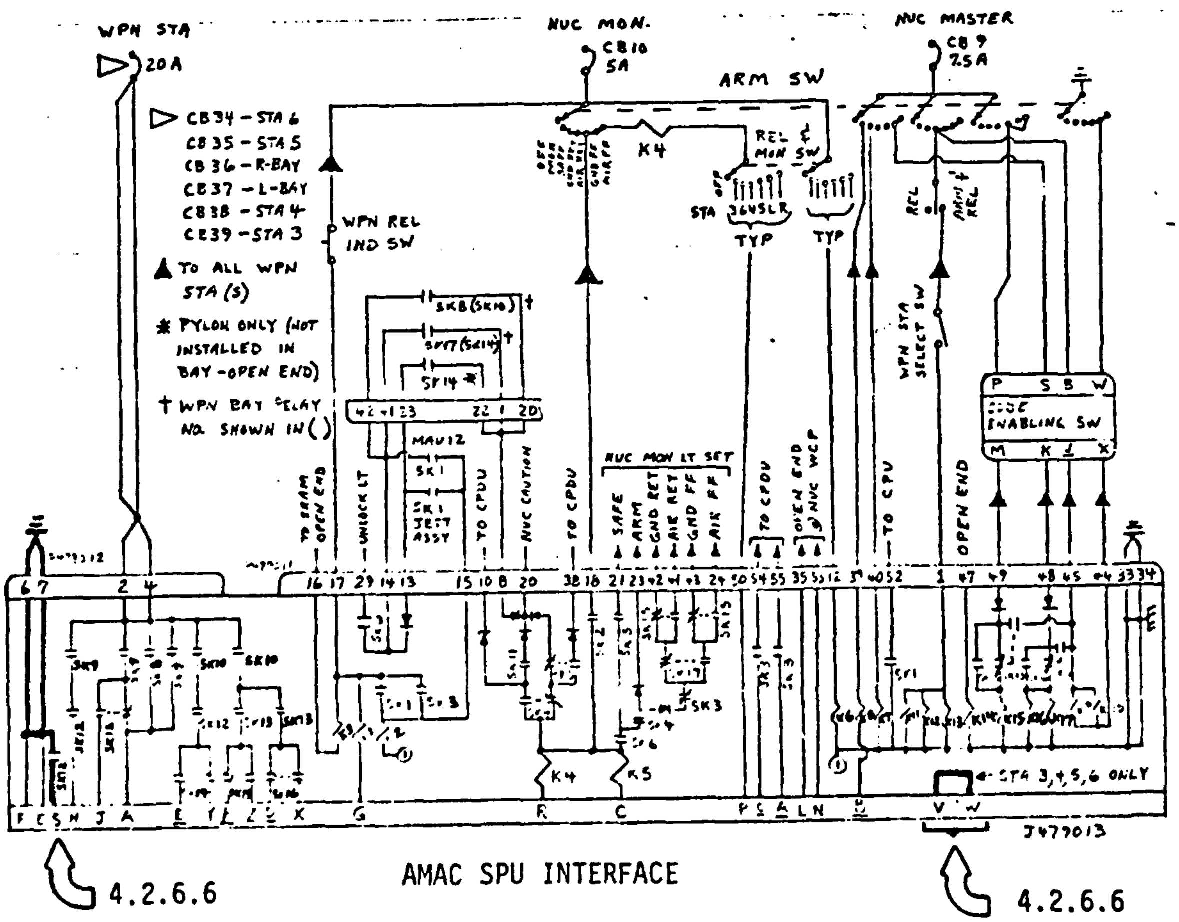
FIGURE INDICATOR		CIRCUIT BREAKER	POWER
(1)		CB8 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
		CB9 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
		CB11 (5A) UNIT 314A1	28VDC CREW STA ESS BUS
		CB10 (5A) UNIT 304A1	28VDC ESS BUS
(2) (3)		CB9 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
		CB10 (5A) UNIT 304A1	28VDC ESS BUS
(4)		CB9 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
		CB10 (5A) UNIT 304A1	28VDC ESS BUS
	3>	CB20 (20A) UNIT 305A1	115VAC 400Hz L MAIN BUS
	3>	CB21 (20A) UNIT 305A1	115VAC 400Hz L MAIN BUS
	3>	CB22 (20A) UNIT 305A1	115VAC 400Hz L MAIN BUS
	3>	CB12 (35A) UNIT 315A1	28VDC MAIN BUS
	3>	CB39 (20A) UNIT 304A1	28VDC ESS BUS
	4>	CB38 (20A) UNIT 304A1	28VDC ESS BUS
	4>	CB29 (35A) UNIT 315A1	28VDC MAIN BUS
	4>	CB19 (20A) UNIT 305A1	115VAC 400Hz L MAIN BUS
	4>	CB32 (20A) UNIT 305A1	115VAC 400Hz L MAIN BUS
	4>	CB33 (20A) UNIT 305A1	115VAC 400Hz L MAIN BUS
	5>	CB35 (20A) UNIT 304A1	28VDC ESS BUS
	5>	CB13 (35A) UNIT 315A1	28VDC MAIN BUS
	5>	CB16 (20A) UNIT 305A1	115VAC, 400Hz R MAIN BUS
	5>	CB17 (20A) UNIT 305A1	115VAC, 400Hz R MAIN BUS
	5>	CB18 (20A) UNIT 305A1	115VAC, 400Hz R MAIN BUS
	6>	CB34 (20A) UNIT 304A1	28 VDC ESS BUS
	6>	CB30 (35A) UNIT 315A1	28VDC MAIN BUS
	6>	CB26 (20A) UNIT 305A1	115VAC, 400Hz, R MAIN BUS
	6>	CB24 (20A) UNIT 305A1	115VAC, 400Hz, R MAIN BUS
	6>	CB23 (20A) UNIT 305A1	115VAC, 400Hz, R MAIN BUS
(5)		CB9 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
		CB10 (5A) UNIT 304A1	28VDC ESS BUS
	3>	CB39 (20A) UNIT 304A1	28VDC ESS BUS
	R>	CB36 (20A) UNIT 304A1	28VDC ESS BUS
	L>	CB37 (20A) UNIT 304A1	28VDC ESS BUS
	4>	CB38 (20A) UNIT 304A1	28VDC ESS BUS
	5>	CB35 (20A) UNIT 304A1	28VDC ESS BUS
	6>	CB34 (20A) UNIT 304A1	28VDC ESS BUS
(6)		CB8 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
		CB9 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
		CB10 (5A) UNIT 304A1	28VDC ESS BUS

R> STA R ONLY L> STA L ONLY 3> STA 3 ONLY 5> STA 5 ONLY

6> STA 6 ONLY 4> STA 4 ONLY

4.2.6.6 Circuit Analysis Package Weapon Interface Pins S, V and W of AMAC SPU-3 and -R (Weapon Station 3 Pylon and Weapon Station R Bay)

These interfaces are shown in Figures 4.2-21 and 4.2-22 Sneak Circuit Network Trees 364 and 360, Figure 4.2-D, which is a copy of Figure 1-8 from T.O. 1F-111(B)A-2-11-1 (Change 2) showing the circuitry to the pivot pylon weapon station AMAC SPU interfaces and Figure 4.2-F which is a copy of Figure 1-10 from T.O. 1F-111(B)A-2-11-1 (Change 2) showing the circuitry to L and R-Bay AMAC SPU interfaces. Maximum current and voltage to pin S interface in a normal environment is 0. Current and voltage to pins V and W in a normal environment is controlled by the weapon itself. Worst case current at 28VDC in an abnormal faulted environment is 608 amps for Pins S, V and W for weapon station 3. Worst case fault current at 28VDC for weapon station R is 1333 amps at pin S.



AMAC SPU INTERFACE

4.2.6.6 (Continued)

a. Normal Power and Load Analysis

Pin S

Reference figures 4.2-21 and 4.2-22 Network Trees 364 and 360. Relay K12 in the AMAC SPU is only energized when an arming function is being commanded. From inspection of the network trees

$V_{OC} = 0\ V$

$I_{SC} = \underline{0}\ A$

Pins V and W

Reference Figure 4.2-23 Fault Diagram for Weapon Station 3 Pins V and W are connected only to each other only in the pylon AMAC SPU's. Thus the power is determined by the weapon circuitry.

b. Fault Analysis

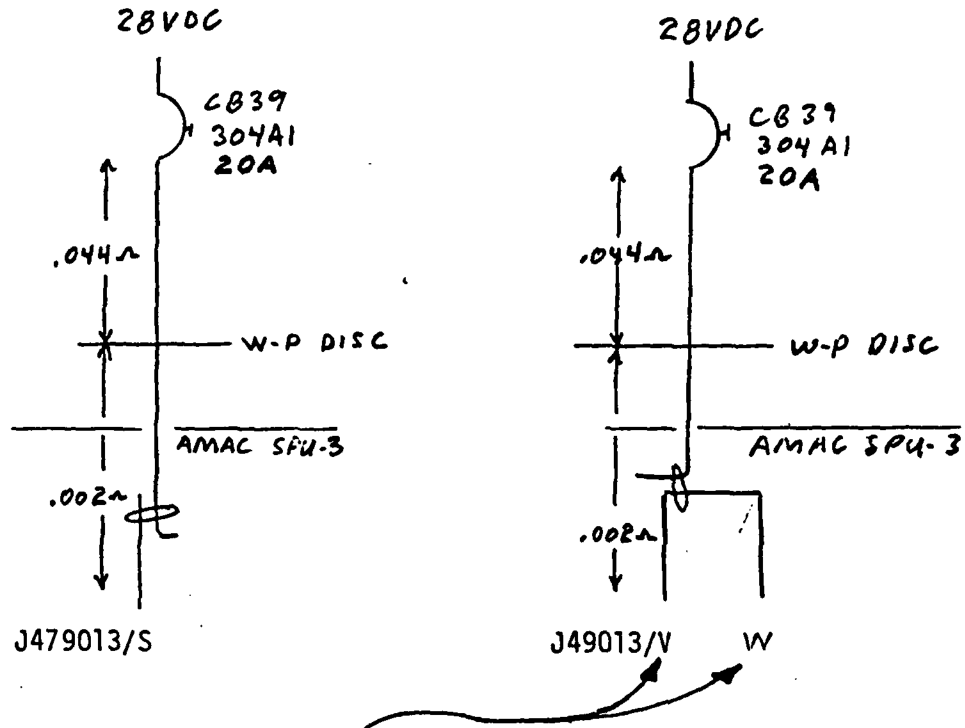
Reference Figure 4.2-21 Network Tree 364, Figure 4.2-22 Network Tree 360, Figure 4.2-23 Fault Diagram Weapon Station 3 and Figure 4.2-24 Fault Diagram Weapon Station - R.

(1) AMAC SPU Damaged

Wires to subject pins shorted to 28VDC. See Table 4.2-6 for the voltage sources. Since pin S is switching a ground into the weapon and K12 is only energized by an arming command the worst case fault could be relay K12 damaged such that the contacts are shorted or wires to pin S shorted to ground.

c. Worst Case Path for Weapon Station 3

Reference path (1) from paragraph b.



For maximum current calculations only one pin at a time is assumed grounded at the weapon interface.

Total resistance of each path = .046 Ω

V_{OC} = 28VDC

Pin S

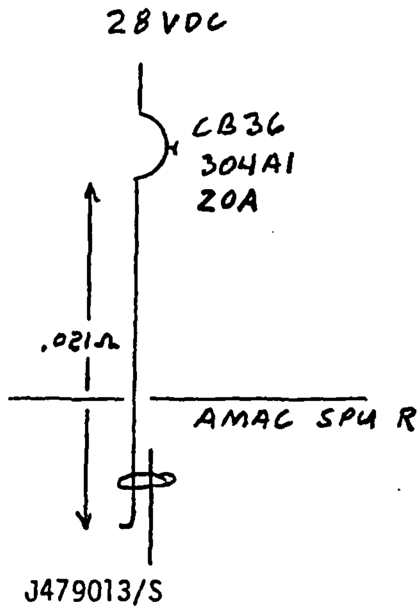
$I_{SC} = \frac{28}{.046} = \underline{608}$ A

Time = Less than .6 seconds at -54°C for the circuit breaker to open. On ground alert at 25°C the time to open would be less than .35 seconds.

4.2.6.6 (Continued)

d. Worst Case Path For Weapon Station R

Reference path (1) from paragraph b.



Total resistance at path = .021Ω

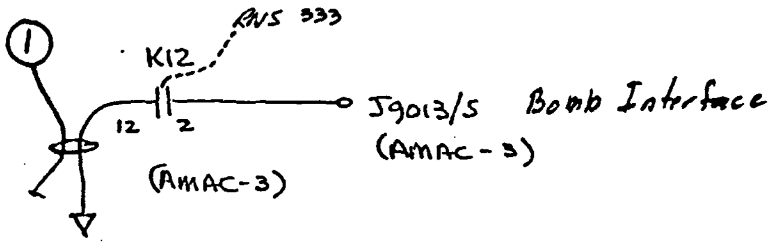
V_{OC} = 28VDC

$I_{SC} = \frac{28}{.021} = \underline{1333A}$

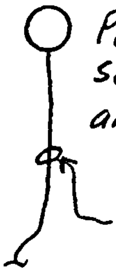
Time = Less than .6 seconds at -54°C for the circuit breaker to open. On ground alert at 25°C the time for the circuit breaker to open would be less than .35 seconds.

REV

SNEAK CIRCUITS NETWORK TREE



"AMAC-3 SPU STATION SELECT" PICKS UP K12 AND SWITCHES GND INTO WEAPON WHEN "OPTION SELECT" SWX. IS IN AN "ARM" POSITION AND "NUCLEAR CONSENT" SWX. IS IN "ARM & RELEASE" POSITION.



Potential Fault Sources
See Fig 4.2- for interface areas
and Table 4.2-6 for source descriptions

Interface point for
adjacent circuitry

PROJECT	TITLE		
FB111A	AMAC-3 "STATION 3 SELECT"		
QC	DATE	ANALYST	DATE 9-18-75

QC	DATE	ANALYST	DATE	NODAL SET
		[signature]	9-18-75	364

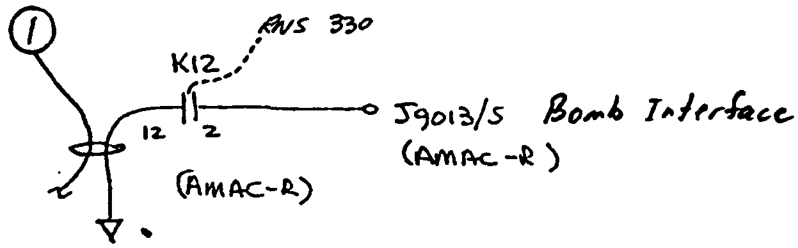
HOU-705

BOEING AEROSPACE COMPANY - HOUSTON, TEXAS

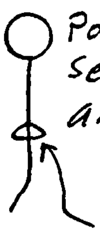
FIGURE 4.2-21. NETWORK TREE 364

SNEAK CIRCUITS NETWORK TREE

REV



"AMAC-R SPU STATION SELECT" PICKS UP K12 AND SWITCHES GND INTO WEAPON WHEN "OPTION SELECT" SWX. IS IN AN "ARM" POSITION AND "NUCLEAR CONSENT" SWX. IS IN "ARM & RELEASE" POSITION.



Potential Fault Sources
See Fig 4.2- for interface areas
and Table 4.2-6 for source descriptions

Interface point for adjacent circuitry

PROJECT	TITLE	
FB111A	AMAC-R "STATION R SELECT"	
QC DATE	ANALYST [signature] DATE 9-18-75	NODAL SET 360

HOU-705 BOEING AEROSPACE COMPANY - HOUSTON, TEXAS

FIGURE 4.2-22. NETWORK TREE 360

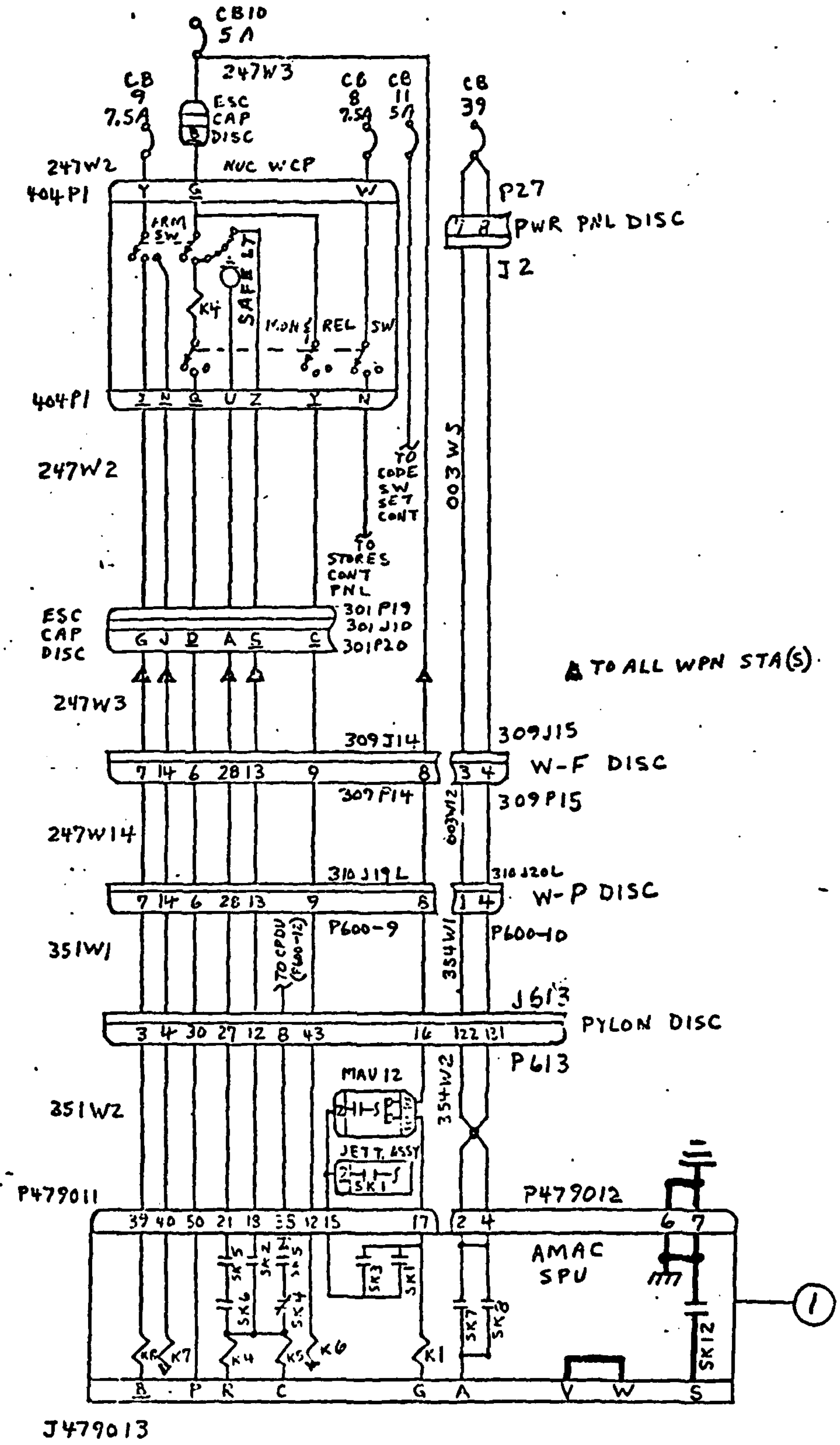


FIGURE 4.2-23. FAULT DIAGRAM WEAPON STATION 3

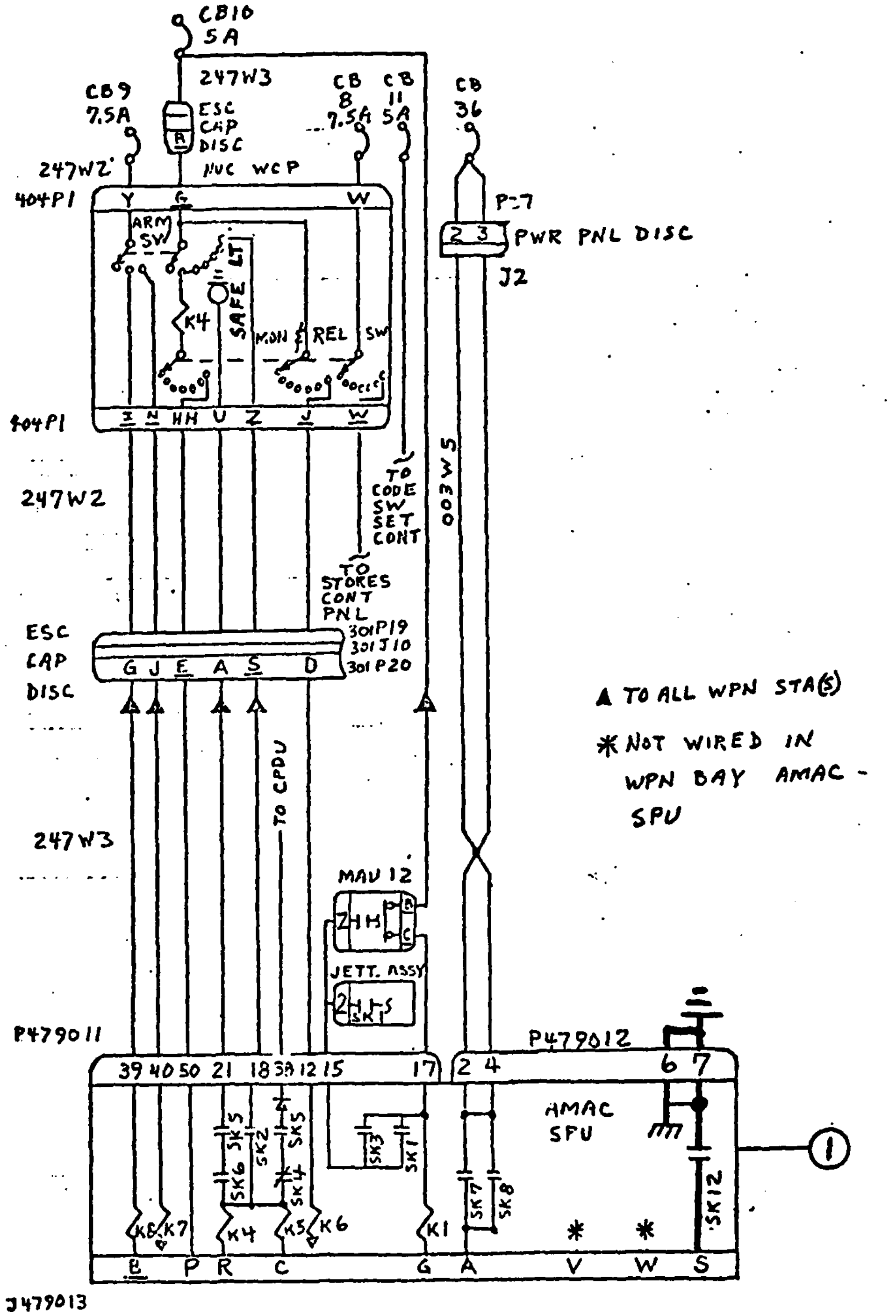


FIGURE 4.2-24. FAULT DIAGRAM WEAPONS STATION R

4.2.6.6 (Continued)

TABLE 4.2-6

FIGURE INDICATOR	CIRCUIT BREAKER	POWER
(1)	CB9 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
	CB10 (5A) UNIT 304A1	28VDC ESS BUS
	*CB36 (20A) UNIT 304A1	28VDC ESS BUS
	**CB39 (20A) UNIT 304A1	28VDC ESS BUS

*STATION R ONLY
**STATION 3 ONLY

4.3 ACCIDENT ANALYSIS

Boeing performed a system safety analysis of B-52 accident data as part of the power and load analysis.

4.3.1 Purpose

The purpose of the accident analysis was to provide generalized electrical damage modes and to determine the conditions under which they are feasible. The goal was to define the abnormal environments in terms of electrical faults that could be reasonably postulated for the power and load analysis of any aircraft.

4.3.2 Source Data

Boeing-Wichita supported this effort by providing data on eleven B-52 aircraft accidents and two incidents where damage to electrical wiring was documented or where nuclear weapons were known to have been carried.
Four accidents (Cases 1, 2, 4 and 8) are known to have involved aircraft loaded with nuclear weapons. None of these weapons was detonated. The source material does not show that any stray power actually reached the weapon interfaces and Boeing investigators are unaware of any such findings. It is believed that all instances of weapons departing the aircraft involved structural failure due to inflight breakups and violent gyrations.
Two taxi accidents (Cases 3 and 13) involved collision with the inboard external stores station. Damage would probably have been the same if other aircraft or large vehicles had struck parked B-52 aircraft. There are two instances of wheel well fire due to tire or hydraulic line failure (Cases 10 and 12). Other feasible locations for fire are crew compartment spaces where gear can be improperly stowed (Case 2); electrical equipment compartments (Case 7) or connectors exposed to excessive moisture (Case 6). Disintegrating engine components are feasible sources of shrapnel damage (Case 11) to electrical circuitry. Table 4.3-1 is a summary of the source data.

TABLE 4.3-1 CRASH/FIRE DAMAGE-SOURCE DATA

CASE NO.	DESCRIPTION	AIRCRAFT IDENTITY	DATE	LOCATION	REMARKS
1	Wing Skin Failed during air refueling	B-52G 58-187	1-23-61	Goldsboro, N.C.	Was armed with nuclear weapons
2	Fire in rear of crew compartment lower deck	B-52G 58-188	1-21-68	Thule, Greenland	Was armed with nuclear weapons
3	Taxi collision with parked KC-97 tankers	B-52G 58-197	7-30-63	Plattsburgh, AFB	
4	Mid-air collision with KC-135 tanker	B-52G 58-256	1-17-66	SE Coast of Spain	Was armed with four nuclear weapons
5	Separation of forward fuselage due to hard nose gear landing	B-52H 60-006	6-3-74	Wright Patterson AFB	
6	Electrical fire in connector due to moisture	B-52C 54-2671	11-20-68	New Hampshire	
7	ALT/6B Power Supply fire	B-52F 57-154	12-10-70	California	
8	Structural breakup due to exceeding 80° bank angle in turbulence	B-52D 55-060	1-13-64	Cumberland, Md.	Was armed with nuclear weapons
9	Mid-air collision with tanker. Wing failed upon landing	B-52D 55-098	12-15-60	Larson AFB, Washington	
10	Brake fire	B-52D 55-115	11-3-68	Kadena AFB, Okinawa	
11	LH inboard engine starter disintegrated	B-52D 56-606	11-17-66	Pease AFB, N.H.	
12	Hydraulic/electrical fire from blown tire damage	B-52F 57-053	8-6-62	Barksdale AFB, Louisiana	
13	Collision with parked KC-135	B-52F 57-139	1-31-64	Columbus AFB, Mississippi	GAM-77 penetrated nose of KC-135

4.3.4 Crash/Fire Damage Analysis

The damage analysis shows that electrical faults in abnormal environments are usually caused by structural breakups, fire or both. Damage mechanisms are either excessive physical forces, or high temperatures. In summary, the principle causes of damages to electrical circuits are:

- o CRASH DUE TO COLLISION OR STRUCTURAL BREAKUP
- o FIRE DUE TO:

  CRASH

  TIRE/HYDRAULIC FAILURE

  ELECTRICAL FAILURE

  IMPROPER STOWAGE

Table 4.3-2 shows the causes and effects of electrical damage for the cases selected from the source data.

4.3.4 Findings

The accident analysis found that almost any electrical fault mode is feasible under conditions of crash or fire. This includes opens, shorts to power and shorts to ground. These faults can occur in wiring, components or equipment assemblies. The most likely locations are leading edges of wings and struts, wheel well areas, equipment bays and crew compartments. There is at least one instance where weapons bay components were probably damaged during initial breakup. These findings are shown in Table 4.3-3.

TABLE 4.3-2 CRASH/FIRE DAMAGE ANALYSI[illegible]ET 1 OF 2)

CASE NO.	OPERATIONAL MODE	ABNORMAL ENVIRONMENT	CAUSE	DAMAGE MECHANISM	ELECTRICAL CIRCUIT EFFECT(S)	ELECTRICAL FAULT(S)	PRIMARY LOCATION
1.	FLIGHT - REFUELING/ PRELANDING CHECKS	CRASH/FIRE	STRUCTURAL BREAKUP OF RIGHT HAND WING.	TENSION ON WING WIRING FOLLOWED BY VIOLENT INERTIAL FORCES, IMPACT WITH GROUND AND FIRE.	WIRE BUNDLES SEVERED OPEN, AND GROUNDED TO STRUCTURE. COMPONENTS CRUSHED WIRE BUNDLES MELTED TOGETHER.	ADJACENT WIRE BUNDLES FAULTED OPEN. ALL EQUIPMENT FAULTED TO GROUND. ADJACENT WIRE BUNDLES SHORTED TOGETHER.	ALL INBOARD WING WIRING.
2.	FLIGHT-CRUISE	FIRE	FOAM RUBBER SEAT CUSHION STOWED ON NAVIGATOR'S HOT AIR SPRAY TUBE UNDER SEAT.	HEAT FROM FIRE INTENSIFIED BY AIR BLAST AFTER ESCAPE HATCH JETTISONED.	CHARRED INSULATION IN WIRE BUNDLES.	ADJACENT WIRE BUNDLES SHORTED TOGETHER.	CREW COMPARTMENT.
3.	GROUND-TAXI	CRASH	COLLISION WITH PARKED AIRCRAFT DUE TO BRAKE FAILURE.	IMPACT FORCES	CRUSHED AND SEVERED WIRING.	ADJACENT WIRES SHORTED TOGETHER. ADJACENT WIRE BUNDLES FAULTED OPEN OR SHORTED TO COMMON GROUND.	INBOARD LEADING EDGE AT EXTERNAL STORES MOUNT.
4.	FLIGHT-REFUELING	CRASH/FIRE	BREAKUP OF FUSELAGE AT FORWARD BOMB BAY DUE TO COLLISION WITH TANKER, FOLLOWED BY SPIN AND IN-FLIGHT FIRE, ENDING WITH SCATTERED GROUND IMPACTS AND FIRES.	VIOLENT FORCES DUE TO IMPACT, INERTIA, GRAVITY AND WIND, FOLLOWED BY INTENSE FIRE, GROUND IMPACT AND FUEL-FED GROUND FIRES.	WIRE BUNDLES SEVERED OPEN, AND GROUNDED TO STRUCTURE. COMPONENTS CRUSHED. WIRES PINCHED TOGETHER. WIRE BUNDLES MELTED TOGETHER.	ADJACENT WIRE BUNDLES FAULTED OPEN. ADJACENT BUNDLES SHORTED TO COMMON GROUND. ALL EQUIPMENT SHORTED TO GROUND. ADJACENT WIRE BUNDLES SHORTED TOGETHER.	WEAPONS BAY IN FUSELAGE.
5.	FLIGHT-LANDING	CRASH	FORWARD FUSELAGE SEPARATED FROM REST OF AIRCRAFT ON INITIAL FRONT GEAR IMPACT DUE TO FAILURE TO FLARE AIRCRAFT.	SUDDEN TENSILE IMPACT LOADS ON WIRING.	WIRE BUNDLES: SEVERED OPEN AND GROUNDED TO STRUCTURE.	ADJACENT WIRE BUNDLES FAULTED OPEN. ADJACENT WIRE BUNDLES SHORTED TO COMMON GROUND.	BODY PRODUCTION BREAK BULKHEAD FORWARD OF WING CENTER SECTION.
6.	FLIGHT - LANDING APPROACH	FIRE	LOWER NOSE RADOME ELECTRICAL FIRE CAUSED BY ELECTRICAL SHORT IN CONNECTOR DUE TO MOISTURE IN THE PLUG.	HEAT AND ARCING.	CRACKED INSULATORS BETWEEN PINS IN BULKHEAD CONNECTORS.	SHORT CIRCUITS BETWEEN ADJACENT PINS.	FORWARD RADOME PRESSURIZED BULKHEAD.
7.	FLIGHT-CRUISE	FIRE	MATERIAL FAILURE OF TRANSFORMER IN POWER SUPPLY PANEL.	EXPLOSION OF POWER SUPPLY FOLLOWED BY ELECTRICAL FIRE.	BADLY BURNED TRANSFORMER. (EXPLOSION SEVERED STEERING CABLE LINKAGE. ELECTRICAL WIRING COULD HAVE BEEN SEVERED OR CRUSHED).	LOSS OF POWER TO CIRCUITS FED BY TRANSFORMER. SHORT CIRCUITS, OPENS AND SHORTS TO GROUND ON WIRING IN AREA.	CREW COMPARTMENT EQUIPMENT BAY.

TABLE 4.3-2 CRASH/FIRE DAMAGE ANALYSIS (SHEET 2 OF 2)

CASE NO	OPERATIONAL MODE	ABNORMAL ENVIRONMENT	CAUSE	DAMAGE MECHANISM	ELECTRICAL CIRCUIT EFFECT(S)	ELECTRICAL FAULT(S)	PRIMARY LOCATION
8.	FLIGHT-CRUISE	CRASH/FIRE	AIRCRAFT FAILED STRUCTURALLY IN TURBULENCE - EXCESSIVE BANK ANGLE	VIOLENT FORCES DUE TO INERTIA, GRAVITY & WIND FOLLOWED BY IMPACT & FIRE	WIRE BUNDLES SEVERED, PINCHED TOGETHER, GROUNDED & MELTED	ADJACENT WIRES SHORTED TOGETHER	OUTER WING AND AFT FUSELAGE. (NO WEAPON CIRCUITRY
9.	FLIGHT-REFUELING/LANDING	CRASH/FIRE	MID-AIR COLLISION WITH TANKER	IMPACT FORCES ON RH INBOARD WING LEADING EDGE	WIRES PINCHED TOGETHER	ADJACENT WIRES SHORTED TOGETHER	INBOARD WING ROOT LEADING EDGE
			WING FAILURE AND FIRE AFTER LANDING	TENSILE FORCES & GND FIRE	WIRE BUNDLES SEVERED & GROUNDED TO STRUCTURE	ADJACENT WIRE BUNDLES SHORTED TO COMMON GROUND. ADJACENT WIRE BUNDLES SHORTED TOGETHER	
					WIRE BUNDLES MELTED TOGETHER		
10.	GROUND-POST-LANDING TAXI	FIRE	PRESSURIZED HYDRAULIC FLUID LEAK ON BRAKE FRICTION SURFACE	HEAT & FLAMES FROM BURNING HYDRAULIC FLUID & TIRES	WIRE BUNDLES MELTED TOGETHER	ADJACENT WIRE BUNDLES SHORTED TOGETHER	MAIN GEAR WHEEL WELL
					ELECTRICAL COMPONENTS HEAT DAMAGED	ALL EQUIP FAULTED TO GND	
11.	FLIGHT-TAKEOFF	FIRE	NO. 4 ENGINE STARTER TURBINE DISINTEGRATED	SHRAPNEL FROM TURBINE WHEEL FOLLOWED BY FIRE	WIRE BUNDLES SEVERED	ADJACENT WIRE BUNDLES OPEN	INBOARD WING LEADING EDGE
					WIRES PINCHED TOGETHER	ADJACENT WIRES SHORTED TOGETHER	
12.	FLIGHT-TAKEOFF	FIRE	TIRE FAILURE SEVERED HYDRAULIC LINES AND ELECTRICAL WIRING	BLOWN TIRE SECTIONS STRUCK RELAYS AND WIRING	WIRING SEVERED & GROUNDED TO STRUCTURE	ADJACENT WIRE BUNDLES SHORTED TO COMMON GROUND. RELAYS FAULTED OPEN AND CLOSED	MAIN GEAR WHEEL WELL
					RELAYS CRUSHED		
13.	GROUND-TAXI	CRASH	COLLISION WITH: PARKED AIRCRAFT DUE TO FAILED BRAKES AND STEERING	METAL SHEARING & CRUSHING	WIRE BUNDLES SEVERED OPEN OR	ADJACENT WIRE BUNDLES FAULTED OPEN	LOWER FORWARD CREW COMPARTMENT & LEADING EDGE OF EXTERNAL STORES MOUNTING STRUCTURE
					SHORTED TO COMMON GROUND	SHORTED TO COMMON GROUND	
					WIRES PINCHED TOGETHER	ADJACENT WIRES SHORTED TOGETHER	

TABLE 4.3-3 CRASH/FIRE DAMAGE ANALYSIS FINDINGS

DAMAGE MODES	FEASIBLE LOCATIONS	ELECTRICAL FAULTS
o WIRE BUNDLES SEVERED	o INBOARD WING LEADING EDGE	o ADJACENT WIRES SHORTED TOGETHER.
o WIRING PINCHED TOGETHER	o INBOARD WING ROOT	o ADJACENT WIRE BUNDLES FAULTED OPEN, OR SHORTED TO COMMON GROUND.
o WIRING SHORTED TO STRUCTURE	o EXTERNAL STORES STRUT LEADING EDGE	o ALL EQUIPMENT IN AN ASSEMBLY SHORTED TO GROUND.
o WIRE BUNDLES MELTED TOGETHER	o MAIN LANDING GEAR WHEEL WELL	o SHORT CIRCUITS BETWEEN ADJACENT PINS.
o ELECTRICAL COMPONENTS HEAT DAMAGED	o LOWER FORWARD CREW COMPARTMENT	o LOSS OF POWER FED BY FAULTED COMPONENT.
o RELAYS CRUSHED	o CREW COMPARTMENT EQUIPMENT BAYS	
o COMPONENTS CRUSHED	o WEAPONS BAY IN FUSELAGE	
o WIRE BUNDLE INSULATION CHARRED	o BODY PRODUCTION BREAK BULKHEAD FORWARD OF WING	
o CRACKED INSULATORS BETWEEN PINS		

AD-A103 951   BOEING AEROSPACE CO HOUSTON TX   F/G 15/6
ELECTRICAL ANALYSIS OF B-52/FB-111 AMAC AND RELEASE CIRCUITRY U--ETC(U)
OCT 75   F29601-76-C-0017
UNCLASSIFIED   D2-118576-1   NL

4 of 4
AD
A103951

END
DATE
FILMED
10-81
DTIC

4.3.5 Conclusions

As a result of the accident analysis, the abnormal environments were defined in terms of generalized fault modes for use in the power and load analyses of B-52 and FB-111 aircraft nuclear weapon circuitry. It was concluded that under crash/fire conditions, wire-to-wire short circuits were confined to common cables and connectors in all known cases. It was also concluded that internal short circuits may result from any wire contacting any other wire in the same component. The accident analysis confirmed that faults postulated for the power and load analysis are feasible.

APPENDIX A

B-52G/FB-111A

TECHNICAL DATA UTILIZED

FOR POWER AND LOAD ANALYSIS

TABLE A1

B-52G DOCUMENTATION

B-52G DOCUMENTS

T.O. NUMBER	DATE	REV.	TITLE
1B-52G-1	4/15/75	Change 1	B-52G Flight Manual
1B-52G-2-12	12/20/74	Change 55	Electrical Systems and Data
1B-52G-2-14	9/30/74	Change 15	Airplane Systems Wiring Diagrams and Data
1B-52G-2-23	12/15/74	Change 16	Electronic Wiring Diagrams and Data
1B-52G-2-26	5/30/75	Change 8	Bombing-Navigational System
1B-52G-2-31	3/1/75	Change 38	Bomb Release System
1B-52G-2-39GA-1	1/15/75		B-52/AGM-69A Weapon System

TABLE A1

B-52G DOCUMENTATION (Continued)

BOEING DRAWINGS

DRAWING NUMBER	REVISION	TITLE
21A13198	D	Equipment Diagram Distribution Processor Group, Signal Data, B-52
25-2866	B	Box Installation Right Hand Forward DC Power
25-3541	AA	Equipment Installation Electrical, Section 41
25-5049	F	Power Box Assembly - DC Right Hand Forward (Item A216)
25-5067	D	Power Box Assembly - DC Left Hand Forward (A217)
25-5231	G	Panel Installation Circuit Breaker, RH Load Central (A113)
25-5235	K	Panel Installation Circuit Breaker, Aft BNS Overhead (A174)
25-5557	C	Shield Installation DC Power LH Forward
25-7231	E	Electrical Bundle - Bomb IND Panel, Assy
25-7383	E	Electrical Bundle - Inflight Control & Monitor Assembly
25-7410	G	Electrical Bundle - Control Flare Programming, Assy
25-8054	P	Equipment Installation LH Side Panel, BNS Operations' Station
25-10091	A	Equipment Installation - Panel Stowage, Special Weapons
25-12066	B	Fuse Installation - TR Unit No. LH DC Power Box, Kit
25-12403	L	Electrical Installation - Armament Provisions, Kit
31-3516		Wire Harness
31-3564		Wire Harness
35-5417	D	Electrical Bundle - Section 43, Assy of

TABLE A1

B-52G DOCUMENTATION (Continued)

BOEING DRAWINGS

Drawing Number	REVISION	TITLE
35-5419	E	Electrical Bundle - Section 43 Assy of
35-5427	H	Electrical Bundle - Section 41, Assy of
35-5497	D	Electrical Bundle - Section 43, Assy of
35-5531	D	Electrical Bundle - Section 41, Assy of
35-11014	B	Shield Instl. DC Power, LH FWD (A217)
35-11016	L	Panel Instl. - Circuit Breaker, RH Load Central (A113)
35-11301	F	Power Shield Assy DC, LH Fwd (A217)
35-11302	F	Power Shield,Assy - DC RH Fwd
35-11362	A	Electrical Bundle - Simplified Weapon Provision - Kit, Assy of
35-12642	F	Panel Assy, Pilots Readiness SW
35-12749	C	Package Instl. - Radar Pressure, BNS
35-12778	E	Panel Installation - Pilots Readiness (D&W) Switch
35-12938	A	Electrical Bundle - Section 43, Assy of
35-12939	C	Electrical Bundle - Section 43, Assy of
35-13009	D	Electrical Bundle - Armament Prov's Wiring, Assy of
35-13562	C	Electrical Bundle - Control Flare Programming, Assy of
35-13810	A	Relay Installation - In-Flight Control, Fwd and Aft
35-13841	E	Kit Installation - Readiness P/W Switch For Nuclear Safety
35-14355	B	Electrical Bundle - Inflight Control and Monitor, Assy of

TABLE A1

B-52G DOCUMENTATION (Continued)

BOEING DRAWINGS

DRAWING NUMBER	REVISION	TITLE
35-18096	B	Kit Installation - Resistance Improv Monitor Control Circuits
35-27389	A	Circuit Breaker Instl. Kit - LH Fwd DC Power Box, AGM69A, (A217)
35-28617	C	Controller Instal. Kit - Coded Switch Set and P/L
35-28618	B	Relay Location Instl. Kit - In-Flight Control, Fwd & Aft and P/L
35-28621	A	Switch Installation Kit - Code Enabling and P/L
35-29121	D	Wiring Harness Instal. Kit - Coded Switch Set and P/L
35-29257	T	Wiring Harness Instl. Kit - AGM-69A Missile System Provisions
35-58616	A	Interconnection Box Instl. Kit - Coded Switch System
39-24573	Basic	Panel Assy Kit - IFC Power Select, Battery & Xmfr. Rect.
39-24574	Basic	Panel Instal. Kit - DCU - 9A Power, BNS Side Console

TABLE A1

B-52G DOCUMENTATION (Continued)

AUTONETICS DRAWINGS

Drawing Number	REVISION	TITLE
WL30892-501	A	Wire List - Network Interconnect Memory/ Logic
30863-501	C	Sch. Dia.-No. 1 Input Output Network
30867-501	B	Sch. Dia.-No. 2 Input Output Network
30871-501	A	Sch. Dia.-No. 1 Arithmetic Control Network
30875-501	B	Sch. Dia.-No. 2 Arithmetic Control Network
30879-501	A	Sch. Dia. - Power Control and Clock Network
30883-501	A	Sch. Dia. - Digit Network
30887-501	B	Sch. Dia. - Selection Network
30891-501	D	Sch. Dia. - Current Source and Timing Network
31701-501	B	Sch. Dia. - Voltage Regulator
31707-501	Basic	Sch. Dia. - Filtering Network
31710-501	Basic	Sch. Dia. - Timing Network
31715-501	Basic	Sch. Dia. - Regulator, Voltage-Series
31721-501	Basic	Sch. Dia. - Power Converter

TABLE A1

B-52G DOCUMENTATION (Continued)

AUTONETICS DRAWING NUMBERS	REVISION	SHEETS	TITLE
WL30892-501-1	A	218	Wire List - Network Interconnect Memory/Logic
30863-501	Basic	1	Schematic Diagram - No. 1 Input Output Network
	B	2	
	Basic	3	
	C	4	
	C	5	
	C	6	
	Basic	7	
	A	8	
	C	9	
	Basic	10	
	C	11	
30867-501	Basic	1	Schematic Diagram - No. 2 Input Output Network
	Basic	2	
	Basic	3	
	Basic	4	
	Basic	5	
	B	6	
	Basic	7	
	A	8	
	A	9	
	Basic	10	
	B	11	
30871-501	Basic	1	Schematic Diagram - No.1 Arithmetic Control Network
	A	2	
	A	3	
	Basic	4	
	A	5	
	A	6	
	A	7	
	A	8	
	A	9	
	A	10	
	A	11	
	A	12	
	A	13	
	A	14	
30875-501	Basic	1	Schematic Diagram - No. 2 Arithmetic Control Network
	Basic	2	
	Basic	3	
	Basic	4	
	Basic	5	
	Basic	6	
	Basic	7	
	Basic	8	
	Basic	9	
	Basic	10	

TABLE A1

B-52G DOCUMENTATION (Continued)

AUTONETICS

DRAWING NUMBERS	REVISION	SHEETS	TITLE
30875-501 (Cont.)	Basic	11	Schematic Diagram - No. 2 Arithmetic Control Network
	Basic	12	
	A	13	
	Basic	14	
	Basic	15	
	B	16	
30879-501	Basic	1	Schematic Diagram - Power Control and Clock Network
	Basic	2	
	Basic	3	
	Basic	4	
	A	5	
30883-501	Basic	1	Schematic Diagram - Digit Network
	A	2	
	A	3	
	A	4	
	A	5	
30887-501	Basic	1	Schematic Diagram - Selection Network
	Basic	2	
	Basic	3	
	A	4	
	B	5	
	B	6	
30891-501	Basic	1	Schematic Diagram - Current Source And Timing Network
	C	2	
	D	3	
31701-501	Basic	1	Schematic Diagram - Voltage Regulator
	B	2	
31707-501	Basic	1	Schematic Diagram - Filtering Network
31710-501	Basic	1	Schematic Diagram - Timing Network
31715-501	Basic	1	Schematic Diagram - Regulator, Voltag Series
31721-501	Basic	1	Schematic Diagram - Power Converter
21A11007	Basic	2001.001	Power Regulator Unit

TABLE A2

FB-111 DOCUMENTATION

DOCUMENT NUMBER	TITLE
T.O. 1F-111(B)A-2-1	General Aircraft Information
T.O. 1F-111(B)A-2-11-1	Armament Systems
T.O. 1F-111(B)A-2-13-1	Electrical Power & Lighting Systems
T.O. 1F-111(B)A-2-14	Wiring Diagrams
T.O. 11B29-3-25-2	Aircraft Bomb Ejector Rack Assy
T.O. 11B29-3-25-12	Aircraft Bomb Ejector Rack Assy
T.O. 11F9-2-2, -3, -4	Electronic Command Signals Programmer
T.O. 11F97-2-2, -3, -4	Electronic Command Signals Programmer
T.O. 11G18-2-9-2, -4	Stores Control Panel
T.O. 11N-T5036-2-3-4	Station Program Units
T.O.11N-T5037-2-3-4	Control Monitor DCU-137A
T.O. 11N-T5054-2-3-4	Station Program Units
T.O. 11N-T5055-2-3-4	Station Program Units
T.O. 16W6-23-2	Weapons System Pivot Pylon Assy
---	Minutes of the Nuclear Weapons F-111 Model, Designation, and Series Project Officers Meeting (NW F-111 MDS POM 74-2)
Report - Leach Corp. to General Dynamics Corp. File No. 222-19-68 Dated March 26, 1968	Subject: Monitor Relay (9324-8245) Technical Data
Memo Leach Corp. to General Dynamics Corp. (No Number) Dated September 26, 1968	None - Referencing above report with corrections and additional data.
MIL-W-81044	Military Specification for Standard Silver Coated Copper Wire
C2697	General Dynamics Standard SCD for Circuit Breaker - Push-Pull, High Temperature, Trip Free
---	Texas Instrument TC Series Circuit Breaker Data