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POWER SYSTEMS
DC POWER
DISTRIBUTING FRAME
J86334D

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SECTION I - GENERAL DESCRIPTION

1. PURPOSE OF CIRCUIT

1.01 The J86334D is a 6-foot general purpose negative 48-volt battery power distributing frame (PDF). The J86334D is equipped with a "0" and "1" feeder bus and an associated return bus. The PDF provides redundant, protected direct current to power equipment frames.

2. GENERAL DESCRIPTION OF OPERATION

2.01 The J86334D PDF is equipped with a control panel and from one to four distribution panels. These panels may consist of any combination of fuse panels (74-type or high-current).

2.02 The 74-type fuse panel (ED-83024-30,GR2) has a total of 48 load fuse and alarm-indicating fuse positions (24 load fuse and 24 alarm-indicating fuse positions per bus). The INVOLT connection is made at the fuse block bus. The VRTN connection is made at a common input voltage return bus of the energy storage capacitor bank on the panel. Each fuse panel has two INVOLT bus and two VRTN bus feeders.

2.03 The 74-type fuse panel (ED-83024-30,GR4) has a total of 32 load fuse and alarm-indicating fuse positions (16 load fuse and 16 alarm-indicating fuse positions per bus). The INVOLT connection is made at the fuse block bus. The VRTN connection is made at a common input voltage return bus of the energy storage capacitor bank on the panel. Each fuse panel has two INVOLT bus and two VRTN bus feeders.

2.04 The high-current fuse panel has a total of eight load fuses and associated alarm-indicating fuses (four load fuses and four alarm-indicating fuses per bus). The fuse panel has two INVOLT bus and two VRTN bus feeders and contains six electrolytic energy storage capacitors (three per bus).

2.05 An integral part of the J86334D frame is the control panel. This panel contains an alarm circuit module and a charge circuit module and a charging probe.

2.06 The alarm circuit module relays information to the office that a fuse has blown in the PDF. Alarms are either major (indicating that a load fuse has opened) or minor (indicating that a filter, charging, or control panel fuse has opened). The audible and visible minor alarm can be turned off at the control panel. A major alarm can be turned off only by removing the indicator fuse.

2.07 The combination of the charge circuit module and charging probe is used to charge equipment frame filter capacitors and capacitive loads prior to inserting the fuse.

SECTION II - DETAILED DESCRIPTION

1. CONTROL PANEL - FS 1

1.01 The control panel (ED-83024-30,GR1) consists of an alarm circuit module (ED-82949-30), two alarm circuit module protection fuses, a charge circuit

protection fuse, a charge circuit (ED-82950-30) and a charging probe (ED-82923-30,GR2).

1.02 The control panel wiring is fused by FF1.1 and FF2.1 and is powered by two separate battery supplies that are ORed together and isolated by blocking diodes CR1.1 and CR2.1. The charge circuit is powered by the ORed source and is protected by fuse FF3.1. A control panel fuse failure (FF1.1 through FF3.1) will be indicated by:

(a) the fuse tip protruding the fuse cap

(b) a minor (MN) alarm being issued

(c) the DS1.1 and DS2.1 frame alarms (FRAME ALM) being lighted.

ALARM CIRCUIT MODULE - FS 1, FS 5

1.03 The alarm circuit module provides alarm information when a fuse in the frame operates. Isolated relay contact closures are provided for communicating audible, visible, and status information to the office. This information is recognized as major or minor in significance.

1.04 The major alarm A [MJ(A)] relay will operate whenever a load fuse operates on a fuse panel associated with the INVOLT(A) bus. The MJ(B) relay will operate whenever a load fuse operates on a fuse panel associated with the INVOLT(B) bus. Since both major alarm circuits are the same, only the MJ(A) circuit will be explained. The MJ(A) circuit consists of relay MJ(A) and diode MJ(A) and series voltage-dropping resistors located on the fuse panels. The MJ(A) diode is an arc suppressor diode that prevents a voltage transient (caused by the removal of the INVOLT source from the relay) from appearing across the panel alarm (PANEL ALM) light-emitting diode (LED), located on the fuse panels, which could destroy the LED. Once the major alarm relay has been energized, it can be de-energized only by removing the operated indicator fuse.

1.05 The minor alarm A [MN(A)] relay will operate whenever a filter fuse on a fuse panel associated with the INVOLT(A) bus operates. The MN(A) relay will also operate whenever the charge circuit protection fuse (FF3.1 - located on the control panel) operates. The MN(B) relay will operate whenever a filter fuse on a fuse panel associated with the INVOLT(B) bus operates. The MN(B) relay will also operate whenever either of the alarm circuit protection fuses (FF1.1 or FF2.1 - located on the control panel) operates. Since both minor alarm relay circuits are the same, only the MN(A) circuit will be described. The MN(A) circuit consists of relay MN(A) and diode MN(A) and a series voltage-dropping resistor (located on the fuse panel); opto-isolator U1.5; resistors R1.5, R4.5, R5.5, and R8.5; and a charge circuit fail light-emitting diode (CHG CKT FAIL LED). The MN(A) diode is an arc suppressor diode that prevents a voltage transient (caused by the removal of ground from the relay) from appearing across the FILTER FUSE ALM LED (located on the fuse panel); the CHG CKT FAIL LED; and the opto-isolator transistors, which could destroy them. Any one of four paths can energize the MN(A) relay. These paths are (1) through connector pin 1, the CHG CKT FAIL LED, and resistor R1.5 to the coil of the MN(A) relay; (2) through connector pin 27; (3) through connector pin 14, which turns on the U1.5 Darlington transistor, which, in turn, permits current to flow through resistor R8.5 to the coil of the MN(A) relay; and (4) through connector pin 15, which turns on the U1.5 Darlington transistor, which, in turn, permits current to flow through resistor R8.5 to the coil of the MN(A) relay. Once the minor alarm relay is energized, it can be de-energized by removing the indicator fuse or by pressing the alarm cutoff (ACO) switch on the control panel.

1.06 The operation of either the MN(A) relay or the MN(B) relay will activate the DS1.1 and DS2.1 FRAME ALM light to indicate that an alarm has been issued.

1.07 The alarm cutoff circuit consists of relay ACO, diode ACO, indicator diode DS1.5, switch ACO, and resistors R2.5 and R3.5. The purpose of the ACO circuit is to extinguish the minor audible and visible alarms. The alarms in the office are actuated through the series MN( ) relay contacts and the ACO relay contacts. The ACO relay contacts are normally closed and the MN( ) relay contacts are normally open. A pair of MN( ) relay contacts (in series with the ACO relay coil) is also closed. When the momentary ACO switch (whose contacts are in parallel with the ACO relay contacts) is pressed, the ACO relay energizes (latching itself) and extinguishes the minor alarms. The ACO indicator LED (on the front panel) lights, which indicates that the ACO circuit has been actuated. The ACO relay can be de-energized only after the minor alarm relay is turned off.

CHARGE CIRCUIT MODULE - FS 1, FS 4

1.08 The charge circuit consists of the charge circuit module (ED-82950-30) and the charge probe. This combination is used for charging equipment frame filter capacitors and capacitive loads on the -48 volt feeder before inserting the fuse. The charge circuit is made up of the following subcircuits: electronic switch, current source, reset, timer, and internal capacitive load.

1.09 The normal status of the circuit is for all transistors to be off, IC1.4 pin 1 (output) to be low, and IC1.4 pin 12 (reset) to be high. The maximum current drain in this state is 75 milliamperes.

1.10 The charge probe is connected to a discharged capacitor through an indicator fuse position or a load fuse position. With the probe inserted and

locked into place, switch S2.4 is closed, which completes the path from the capacitive load to the charge circuit. To activate the charge circuit, the CAP CHG/TEST switch is depressed and held. With the switch depressed:

(a) The path from the current source to the charge probe is completed.

(b) The electronic switch (consisting of transistors Q4.4, Q5.4, and Q6.4) is turned on.

(c) The reset circuit (consisting of resistors R17.4, R18.4, and R19.4; diodes CR7.4, CR8.4, and CR9.4; and capacitor C2.4) is turned off. Thirty-seven milliseconds after the reset circuit is turned off, the timer is turned on.

1.11 The principal path of power flow from the source through the charging circuit to the charging probe is as follows. The power plant voltage is connected to the charging circuit through circuit module connector pins 7 and 8. Current flows through transistor Q4.4, resistor R6.4, and transistor Q3.4 to the charging probe through connector pins A and B. One ampere will be delivered to the capacitive-resistive load, and the DS1.4 CAP CHG/TEST LED will be lighted, which will indicate that the load is not fully charged. When the voltage across the load is about 20 volts (determined by $V_{CR3.4} + V_{Q1.4_{BE}} + IR2.4$), transistor Q1.4 transistor Q2.4 will turn on, which places resistor R4.4 in parallel with resistor R6.4. Now, the charging current is increased to 2.5 amperes. About 8 seconds (depending on the size of the capacitive load) after the CAP CHG/TEST switch is depressed, the CAP CHG/TEST LED will extinguish, which will indicate that the voltage across (Q2.4 and R4.4) || R6.4 + Q3.4 and is <2 volts.

1.12 The failure of the CAP CHG/TEST LED to extinguish indicates that a load drain of greater than 2.5 amperes exists or that a fault exists in the circuit. Thirty seconds after the CAP CHG/TEST switch is pressed, IC1.4 pin 1 will go to a "1". With IC1.4 pin 1 high, transistors Q7.4 and Q8.4 will be turned on. Transistor Q7.4 will turn off transistor Q6.4, which will turn off transistors Q5.4 and Q4.4. The DS1.4 CAP CHG/TEST LED will also extinguish. Transistor Q8.4 will permit current to flow and light the LOAD FAULT LED. However, if the CAP CHG/TEST switch is kept depressed with the LOAD FAULT LED lit for an additional 30 seconds, the LOAD FAULT LED will extinguish, the CAP CHG/TEST LED will light, and the charging process will begin all over again.

1.13 The reset circuit is to ensure that the timer is set to zero each time the CAP CHG/TEST switch is released. However, a time delay was designed into the circuit to prevent the immediate reset on an accidental release of the switch. The timer will continue to count for an additional 5 seconds, after which time the timer will be reset to zero.

1.14 Should the charge probe become dislodged from the fuse holder during the charge cycle, the internal capacitive load (consisting of diode CR2.4, resistor R1.4, and capacitor C1.4) will act as a load for transistor Q3.4, which prevents possible damage to the fuse holder.

2. 74-TYPE FUSE PANEL - FS 1, FS 2

2.01 The 74-type fuse panel (ED-82947-30,GR2) has a total of 48 load fuse positions and associated alarm-indicating fuses (24 load and alarm-indicating fuse positions per bus) and an energy storage capacitor bank (three electrolytic capacitors per bus). The INVOLT( ) is connected direct to the fuse block bus bar. The VRTN( ) is connected to the common ground bus bar of the capacitor bank. The energy storage capacitor bank is required to minimize the voltage transients after a load fuse operates.

2.02 The 74-type fuse panel energy storage capacitors must be precharged before inserting the filter fuse because the surge of current would operate the fuse. Test the charge circuit by pressing the CAP CHG/TEST switch located on the control panel. The CAP CHG/TEST LED will light and extinguish (total duration of about 1 second), which indicates that the circuit is operational.

2.03 Insert the charge probe into the FF( ) fuse holder. Press and hold the CAP CHG/TEST switch and observe the CAP CHG/TEST LED. After the LED extinguishes and the CAP CHG/TEST switch is released, there are about 10 seconds in which to insert the fuse before the fuse will operate.

2.04 Load circuits having capacitive inputs must be precharged before inserting a fuse. Use the same procedure outlined in paragraph 2.03 except insert the charging device into the indicator fuse holder to charge the capacitor. Also, the time before the fuse will operate will vary from load to load.

2.05 When an F( ) load fuse operates, the associated FA( ) indicator fuse will also operate and transmit a major alarm signal to the alarm circuit module. The PANEL ALM LED will also light.

2.06 When an FF( ) filter fuse operates, a minor alarm signal is sent to the alarm circuit module. The FILTER FUSE ALM LED on the panel will also be lighted.

3. 74-TYPE FUSE PANEL - FS 6

3.01 The 74-type fuse panel (ED-82947-30,GR4) has a total of 32 load fuse positions and associated alarm-indicating fuses (16 load and alarm-indicating fuse positions per bus) and an energy storage capacitor bank (two electrolytic capacitors per bus). The INVOLT( ) is connected direct to the fuse block bus bar. The VRTN( ) is connected to the common ground bus bar of the capacitor bank. The energy storage capacitor bank is required to minimize the voltage transients after a load fuse operates.

3.02 The 74-type fuse panel energy storage capacitors must be precharged before inserting the filter fuse because the surge of current would operate the fuse. Test the charge circuit by pressing the CAP CHG/TEST switch located on the control panel. The CAP CHG/TEST LED will light and extinguish (total duration of about 1 second), which indicates that the circuit is operational.

3.03 Insert the charge probe into the FF( ) fuse holder. Press and hold the CAP CHG/TEST switch and observe the CAP CHG/TEST LED. After the LED extinguishes and the CAP CHG/TEST switch is released, there are about 10 seconds in which to insert the fuse before the fuse will operate.

3.04 Load circuits having capacitive inputs must be precharged before inserting a fuse. Use the same procedure outlined in paragraph 3.03 except insert the charging device into the indicator fuse holder to charge the capacitor. Also, the time before the fuse will operate will vary from load to load.

3.05 When an F( ) load fuse operates, the associated FA( ) indicator fuse will also operate and transmit a major alarm signal to the alarm circuit module. The PANEL ALM LED will also light.

3.06 When an FF( ) filter fuse operates, a minor alarm signal is sent to the alarm circuit module. The FILTER FUSE ALM LED on the panel will also be lighted.

4. HIGH-CURRENT FUSE PANEL - FS 1, FS 3

4.01 The high-current fuse panel (ED-82947-30,GR6) has a total of eight load fuse positions and associated alarm-indicating fuses (four load fuse and four alarm-indicating fuse positions per bus) and a filter-capacitor bank (three electrolytic capacitors per bus). The INVOLT( ) is connected direct to the fuse block bus bar. The VRTN( ) is connected to the common ground bus bar of the capacitor bank. The energy storage capacitor bank is required to minimize the voltage transients after a load fuse operates.

4.02 The high-current fuse panel filter capacitors must be precharged before inserting the filter fuse because the surge of current would operate the fuse. Test the charge circuit by pressing the CAP CHG/TEST switch located on the control panel. The CAP CHG/TEST LED will light and extinguish (total duration of about 1 second), which indicates that the circuit is operational.

4.03 Insert the charge probe into the FF( ) fuse holder. Press and hold the CAP CHG/TEST switch and observe the CAP CHG/TEST LED. After the LED extinguishes and the CAP CHG/TEST switch is released, there are about 10 seconds in which to remove the charge probe and insert the fuse before the fuse will operate.

4.04 Load circuits having capacitive inputs must be precharged before inserting a fuse. Use the same procedure outlined in paragraph 4.03 except insert the charging device into the indicator fuse holder to charge the capacitor. Also, the time before the fuse will operate will vary from load to load.

4.05 When an F( ) load fuse operates, the associated FA( ) indicator fuse will also operate and transmit a major alarm signal to the alarm circuit module. The PANEL ALM LED will also light.

4.06 When an FF( ) filter fuse operates, a minor alarm signal is sent to the alarm circuit module. The FILTER FUSE ALM LED will also be lighted.

SECTION III - REFERENCE DATA

1. WORKING LIMITS

1.01 DC Power Source

Nominal: -48 volt

Normal:	-50.8 to -52.3 volts
Emergency:	-43.75 to -53.50 volts
Transient:	-41 to -60 volts

1.02 Ambient Temperature

Normal operating:	4°C to 38°C
Operating extreme:	2°C to 50°C

2. FUNCTIONAL DESIGNATIONS

2.01 Indicators

Designation	Meaning
ACO	Alarm Cutoff - lights whenever the minor audible and visible alarm is cut off.

Designation	Meaning
CAP CHG/TEST	Capacitor Charge/Test - indicates that the charge circuit has been activated and extinguishes when the load capacitor is charged or the test load capacitor is charged.
CHG CKT FAIL	Capacitor Charge Circuit Failed - lights whenever the FF3 fuse blows.
FILTER FUSE ALM	Filter Fuse Alarm - indicates that an FF( ) is blown or missing.
FRAME ALM	Frame Alarm - lights when either a major or a minor alarm is generated.
LAMP/TEST	Lamp/Test - indicates that the fuse to the charge circuit is in and good in the test mode or when the load capacitor is charged in the charge mode.
LOAD FAULT	Load Fault - indicates that the charge circuit has been on for 30 seconds and has been turned off.
PANEL ALARM	Panel Alarm - indicates that a load fuse has blown in the filter-fuse panel or that a circuit breaker has tripped in the circuit breaker panel.

2.02 Relays

Designation	Meaning
ACO	Alarm Cutoff
MJ	Major Alarm
MN	Minor Alarm

2.03 Switches

Designation	Meaning
ACO	Alarm Cutoff - operates the ACO relay.
CAP CHG/TEST	Capacitor Charge/Test - permits testing of the charge circuit (with charge probe in the holder) or if the probe is inserted into a fuse holder, it will charge the load capacitor.

3. FUNCTIONS

3.01 The dc power distributing frame is designed to include the following functions:

(a) to provide protected dual bus direct current distribution for power equipment frames

(b) to provide major and minor alarms

(c) to provide a visible frame alarm if a major or a minor alarm occurs

(d) to provide a visible panel alarm on either bus if a major or minor alarm occurs

(e) to provide major and minor alarm scan points

(f) to provide a means to cut off the minor audible alarms.

4. CONNECTING CIRCUITS

4.01 None.

5. MANUFACTURING TESTING REQUIREMENTS

5.01 The manufacturing test requirements are specified in the X-79910 specification.

SECTION IV - REASONS FOR REISSUE

B. Changes in Apparatus

B.1 Added

App Fig 6, FS6 (Y Option)

R23.4 Potentiometer, KS-20231,L4, 1K, Y Option - CM1 (App Fig 4)

B.2 Superseded	Superseded By
J2.1 Connector, 261-10015-2 (Amphenol) - App Fig 1	J2.1 Connector, 225A-01522-230 (Amphenol) - App Fig 1
CR1.1 & CR2.1 Diodes, 485A - App Fig 1	CR1.1 & CR2.1 Diodes, 828A - App Fig 1

Superseded	Superseded By
Fuse Holders, 18A E/W FF1.2 thru FF6.2 Fuses, KS-19780,L6 - App Fig 2	Fuse Holders, 20A E/W FF1.2 thru FF6.2 Fuses, KS-19780,L26 - App Fig 2
R2.2 & R9.2 Resistors, KS-20289,L1C, 787, Z Option - App Fig 2	R2.2 & R9.2 Resistors, KS-20289,L6C, X Option - App Fig 2
Q1.4 & Q5.4 Transistors, 147A - CM1 (App Fig 4)	Q1.4 & Q5.4 Transistors, KS-21945,L5 - CM1 (App Fig 4)
Q2.4 & Q4.4 Transistors, 130D - CM1 (App Fig 4)	Q2.4 & Q4.4 Transistors, KS-21944,L4 - CM1 (App Fig 4)

D. Description of Changes

D.1 FS6 (App Fig 6 - Y option) was added to provide information for the ED-83024-30,GR4 filter fuse panel.

D.2 In App Fig 1, the 485A diodes were changed to 828A diodes for standardization (cost reduction).

D.3 In App Fig 2, the KS-19780,L6 fuses were changed to list 26 as list 26 is UL approved.

D.4 Resistors 2.2 and 9.2, in App Fig 2, were changed from 787 ohms (option Z) to 750 ohms (option X) to use a standard resistance value.

D.5 Potentiometer R23.4 (Option Y) was added, in App Fig 4, to provide a means of trimming the gate drive voltage source.

D.6 In App Fig 4, the 130D and 147A transistors were changed to the KS-21944,L4 and KS-21945,L5 transistors, respectively.

D.7 The Option Index table and the Supporting Information table were updated.

D.8 In Equipment Notes 201, 202, and 203; list 1 of KS-22247 was removed on a line-out basis and replaced by list 4.

D.9 Equipment Note 205 was changed to add reference to 10 AWG stranded wire.

D.10 Equipment Note 206, specifying the requirements for critical wiring, was added.

D.11 Reference to Note 206 was added in FS2.

D.12 Reference to FS6 and App Fig 6 was added in Information Note 302. Information Note 303 was updated for drawing issue 2B.