

CIRCUIT DESCRIPTION

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APPENDIX 1M  
DWG ISSUE 2M  
DISTR CODE BT13

7

ELECTRONIC SWITCHING SYSTEM  
5ESS®  
OPERATOR SERVICES POSITION SYSTEM  
POWER DISTRIBUTION CABINET

CHANGES

D. Description of Changes

- D.1 LDI 1A changes pin numbers on the terminal strip located on alarm circuit, to ease the connection of the wires to the terminal strip.
- D.2 Changed the ED5D627-30 fuse panel to allow the fuse alarm boards to be installed from the front of the fuse panel.

AT&T BELL LABORATORIES

DEPT 55222-DEH-DPS

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5ESS™  
OPERATOR SERVICES POSITION SYSTEM  
POWER DISTRIBUTION CABINET

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SECTION I - GENERAL DESCRIPTION

1. PURPOSE OF CIRCUIT

1.01 The J5D003H is a 6-foot general purpose negative 48-volt battery Power Distributing Frame (PDF). The J5D003H 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 J5D003H PDR is equipped with a control panel, or two distribution panels, and from one to ten ED5D627-30 fuse panels.

2.02 The 74-type fuse panel 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 connect 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 ED5D627-30 fuse panel has six 30D fuse blocks, each equipped with four load fuses and four

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alarm-indicating fuses. Each 30D fuse block has its own INVOLT bus and alarm bus. The fuse panel is equipped with two alarm circuits with three 30D blocks connected to each alarm circuit.

2.04 An integral part of the J5D003H frame is the control panel. This panel contains an alarm circuit module, a charge circuit module, and a charging probe.

2.05 The alarm circuit module relays information to the office that a fuse has blown in the PDF. Alarms are major, indicating that a load fuse has opened, or indicating that a filter, charging, or control panel fuse has opened. A major alarm can be turned off only by removing the indicator fuse.

2.06 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 3

1.01 The control panel (ED-82947-30 GR10) 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 to the fuse cap;
- b. a filter fuse alarm being issued; and

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

### ALARM CIRCUIT MODULE - FS 3

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. The minor alarms are internally connected, at the control panel, to the major alarms so that any failure in the cabinet is considered to be a major alarm.

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), 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). Once the major alarm relay has been energized, it can be de-energized only by removing the operated indicator fuse.

1.05 The filter fuse alarm A relay will operate whenever a filter fuse, on a fuse panel associated with the INVOLT(A) bus, operates. The filter fuse(A) relay will also operate whenever the charge circuit protection fuse (FF3.1 - located on the control panel) operates. The filter fuse(B) relay will operate whenever a filter fuse, on a fuse panel associated with the INVOLT(B) bus, operates. The filter fuse(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 filter fuse(A)

circuit will be described. The filter fuse(A) circuit consists of relay filter fuse(A) and a series voltage-dropping resistor (located on the fuse panel); opto-isolator U1.5; resistors R1.5, R4.5, and R8.5; a charge circuit fail light-emitting diode (CHG CKT FAIL LED). The filter fuse(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 filter fuse(A) relay. These paths are: 1) through connector pin 1, the CHG CKT FAIL LED, and resistor R1.5 to the coil of the filter fuse(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 filter fuse(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 filter fuse(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 filter fuse(A) relay or the filter fuse(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 filter fuse() relay contacts and the ACO relay contacts. The ACO relay contacts are normally closed and the filter fuse() relay contacts are normally open. A pair of filter fuse() 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 3

1.08 The charge circuit consists of the charge circuit module (ED082950-30) 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 turned 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 discharge 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.

- 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 plan voltage is connected to the charging circuit through circuit module connector pines 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 illuminate, which will indicate that the load is not fully charged. When the voltage across the load is about 20 volts (determine by  $V_{CR,4} + V_{Q1,4} BE + IR_{2,4}$ ), transistor Q1.4 will turn on. With transistor Q1.4 on, translator 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) in parallel with R6.4 and Q3.4 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 turn 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 illuminate the LOAD FAULT LED. However, if the CAP CHG/TEST switch remains depressed with the LOAD FAULT LED illuminated for an additional 30 seconds, the LOAD FAULT LED will extinguish, the CAP CHG/TEST LED will illuminate, 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 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 2

2.01 The 74-type fuse panel (ED-83024-30G2) has a total of 48 load fuse positions and associated alarm-indicating fuses (24 load and alarm-indicating fuse positions per bus) and a energy storage capacitor bank (three electrolytic capacitors per bus). The INVOLT() is connected directly 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 illuminate 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 circuit containing 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 illuminate.

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

3. FUSE PANEL ED5D627-30 FS 4

3.01 The ED5D627-30 fuse panel has a total of six 30D type fuse blocks that provide four load fuses and associated alarm-indicating fuses for a total of 24 load fuses. Each 30D fuse block is equipped with its own power and alarm bus. The fuse panel is equipped with two alarm circuit boards with three 30D fuse circuits tied to each one. This allows the fuse panel to be divided between the "A" and "B" bus.

3.02 When a load fuse operates, the associated indicator fuse will also operate and transmit a major alarm signal to the alarm circuit module. The CONTROL PANEL ALM LED, the CAB ALARM LEDS, and the ALARM CIRCUIT LED (on associated "A" or "B" bus) will illuminate.

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

<u>Designation</u>	<u>Meaning</u>
ACO	Alarm Cutoff - illuminates whenever the filter fuse audible and visible alarm is out off.
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 - illuminates whenever the FF3 fuse blows.
FILTER FUSE ALM	Filter Fuse Alarm - indicates that an FF() is blown or missing.
FRAME ALM	Frame Alarm - illuminates when either a major or a filter fuse 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

<u>Designation</u>	<u>Meaning</u>
ACO	Alarm Cutoff
MJ	Major Alarm
Filter Fuse	Filter Fuse

2.03 Switches

<u>Designation</u>	<u>Meaning</u>
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 OSPS DC power distributing cabinet is designed to include the following functions:

- a. To provide protected dual bus direct current distribution for the RISLU cabinet, OSPS data set cabinet, LTP cabinet, and BSTs or VDTs;
- b. to provide major alarm;
- c. to provide a visible frame alarm if a major alarm occurs;
- d. to provide a visible panel alarm on either bus if a major alarm occurs; and
- e. to provide major scan points.

4. CONNECTING CIRCUITS

4.01 None.

5. MANUFACTURING TESTING REQUIREMENTS

5.01 The manufactured test requirements are specified in the X80211 specification.