

CONVERTER

J87332

OPERATING METHODS

1. GENERAL

1.01 The J87332 converter is designed primarily for use in the PBX—Automatic Identified Outward Dialing (AIOD)—type A2 equipment. The converter operates from the -48 volt central office battery and delivers outputs of +6 volts at 10 amperes, +12 volts at 6 amperes, and +24 volts at 0.5 ampere, simultaneously. Electrically, the converter is comprised of a dc-to-ac inverter, a blocking oscillator pulse generator, a 24-volt rectifier, a 12-volt rectifier, a 6-volt rectifier, and voltage monitors and alarm circuit. The dc-to-ac inverter plug-in unit includes the blocking oscillator pulse generator (CP1) plug-in unit. An output transformer provides the necessary inputs to the 24-, 12-, and 6-volt rectifiers. Located on the front panel of the inverter are the pulse generator input fuse (PULSE GEN), the frequency adjusting potentiometer (FREQ ADJ), the pulse generator test points, (TP1) through (TP8), and the inverter test points, (TP9) and (TP10). The INVR FAIL lamp is mounted on the framework adjacent to the inverter, along with the INPUT and CONTROL fuses, and INPUT switch which permits insertion and removal of all plug-in units without causing arcing across the connector contacts. The front panel of each of the three rectifiers has an OUTPUT CURRENT ammeter, INPUT VOLTAGE (TP1), (TP2), and (TP3) test points, OUTPUT VOLTAGE (TP4) and (TP5) test points, a TEST jack, and one 24V FAIL, 12V FAIL, and 6V FAIL lamp for the 24-, 12-, and 6-volt rectifiers, respectively. A two-sided printed wire board (CP2) contains the voltage monitors for the 24-, 12-, and 6-volt rectifiers and the dc-to-ac inverter. The front panel of the monitor mounts the ST-RLS key and potentiometers for 24V ALM ADJ LV and HV, 12V ALM ADJ LV and HV, and 6V ALM ADJ LV and HV. At the rear of the framework next to the inverter, the rear cover removed reveals the TSA terminal block for the connection of input and alarm batteries, output load, output ground, alarm, and frame ground terminals. There are separate output ground

terminals provided for each output voltage which permit the output grounds to be established either at the using equipment, or at the power supply framework by way of a lug located adjacent to the inverter socket.

1.02 This issue does affect the Equipment Test List.

1.03 The dc-to-ac inverter employs a resonant circuit in series with a switching network. The switching network contains a single silicon-controlled rectifier (SCR) in an inverse parallel connection with a fast recovery diode. A pulse from the blocking oscillator pulse generator triggers the silicon-controlled rectifier to begin conducting. The rate of pulse generation is varied at a measured interval to maintain a constant ac voltage across the primary of the output transformer, providing three different secondary output voltages to the associated rectifiers. A zener diode regulates the output voltage of each unregulated, full-wave center-tapped rectifier. An output voltage monitor is provided for the dc-to-ac inverter and each rectifier. The inverter monitor senses a no-voltage trouble condition while the rectifier monitors senses a low- or high-voltage trouble condition. When a trouble condition or a failure occurs, relay contacts are activated to provide visual and audible alarms and automatically shut down the entire converter. A trouble indicating lamp will light to identify the plug-in unit which has failed. The nonlocking ST-RLS KEY can be depressed to retire the visual and audible alarms and is also used to energize the start relay. Prior to the operation of the ST-RLS KEY, the INPUT switch should be operated to the OFF position.

Caution: *The J87332 converter includes automatically controlled equipment; care must be exercised to prevent accidentally starting the unit while maintenance work is being performed. Before starting work, prevent automatic starting of equipment*

by operating the INPUT switch to the OFF position.

1.04 Instructions are based on the following drawings. For detailed description of the operation of individual circuits, refer to the corresponding circuit description.

- SD-81928-01 Converter Circuit, 6 Volts at 10 Amperes, 12 Volts at 6 Amperes, and 24 Volts at 0.5 Ampere—J87332
- SD-1C236-01 Fuse, Alarm and Miscellaneous Circuit
- SD-81448-01 Plant Discharge Fuse Board

1.05 The abbreviations cw and ccw used herein refer to clockwise and counterclockwise, respectively.

2. LIST OF TOOLS AND TEST APPARATUS

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
—	Blocking Tools as required. (Use as covered in Section 069-020-801.)
KS-6278 (2 reqd)	Connecting Clip
3W4A	1-W3M Cord, 6 ft. long, E/W 1-310 Plug, 1-360A Tool, 1-360B Tool, and 1-360C Tool

CODE OR SPEC NO.

DESCRIPTION

TEST APPARATUS

KS-14510	Volt-Ohm-Milliammeter
—	Voltmeter, DC Weston Model 911, 20,000 Ohms/Volt, 0 to 10-, 30-, and 100-Volt Scale (or equivalent)
—	Voltmeter, AC Ballantine Model 321 (or equivalent)
—	Oscilloscope, Tektronix Model 560 (or equivalent) with differential plug-ins
—	DC Power Supply, variable 0 to 30 Volts at 300 Milliamperes (or equivalent)

3. OPERATION

3.01 Starting the Converter:

- (1) Depress the ST-RLS KEY and hold it operated until the INPUT switch is operated to the ON position. Observe that all trouble indicating lamps are extinguished and the audible alarm is silenced.
- (2) Verify the OUTPUT CURRENT ammeters for each rectifier for an indication that does not exceed 10 amperes for the 6-volt rectifier, 6 amperes for the 12-volt rectifier, and 0.5 ampere for the 24-volt rectifier.

3.02 Stopping the Converter:

- (1) Operate the INPUT switch to the OFF position. The 24V FAIL, 12V FAIL, 6V FAIL, and INVR FAIL lamps light and an audible alarm sounds.
- (2) Momentarily depress the ST-RLS KEY and observe that all trouble indicating lamps extinguish and the audible alarm is silenced.

4. ROUTINE CHECKS AND ADJUSTMENTS

4.01 The purpose of routine checks on the converter is to determine whether or not all the features, indications, and alarms are in proper operating condition. The checks should be made semiannually or whenever operations indicate doubtful adjustments or trouble conditions.

4.02 Output Voltage Check:

- (1) Using the Weston model 911 voltmeter set on the 30-volt scale, connect the leads of the voltmeter to the OUTPUT VOLTAGE TP4 (+) and TP5 (-) pin jacks of the 24-volt rectifier while ensuring the correct polarity.

Requirement: The voltmeter shall indicate between 23.6 and 25.2 volts.

- (2) Disconnect the leads of the voltmeter from the 24-volt rectifier and connect the leads of the voltmeter to the OUTPUT VOLTAGE TP4 (+) and TP5 (-) pin jacks of the 12-volt rectifier while ensuring the correct polarity.

Requirement: The voltmeter shall indicate between 11.6 and 12.4 volts.

- (3) Disconnect the leads of the voltmeter from the 12-volt rectifier; change the setting to the 10-volt scale; and connect the leads of the voltmeter to the OUTPUT VOLTAGE TP4 (+) and TP5 (-) pin jacks of the 6-volt rectifier while ensuring the correct polarity.

Requirement: The voltmeter shall indicate between 5.9 and 6.5 volts.

Note: If the output voltage is not within the designated limits in the previous checks, check that input voltage at terminals 1 (-48V)

and 3 (GRD) of TSA is between 44 and 52 volts.

- (4) Disconnect the Weston model 911 voltmeter from the 6-volt rectifier.

Pulse Generator Adjustment

4.03 The FREQ ADJ (R4) potentiometer of the pulse generator circuit pack CP1 is adjusted at the factory and ordinarily should not require any field adjustment. However, if the INPUT fuse repeatedly blows during starting operations, adjust the pulse generator as in the succeeding outline.

- (1) Using the KS-14510 volt-ohm-milliammeter set on the 3-volt dc scale, connect the positive lead of the meter to TP3 and the negative lead of the meter to TP5 test points of the inverter plug-in unit.

- (2) If the INPUT fuse is blown, operate the INPUT switch to the OFF position; replace the fuse with a good one and restart the converter as outlined in 3.01.

Requirement: The volt-ohm-milliammeter should indicate between 0.5 and 1.0 volt.

- (3) If the requirement in (2) was not met or if the INPUT fuse blows again, operate the INPUT switch to OFF (replace INPUT fuse if blown) and rotate the FREQ ADJ (R4) potentiometer one-half turn ccw.

- (4) Using the Tektronix model 560 oscilloscope, connect the output terminal of the scope to TP10 and the ground terminal of the scope to TP6 test points of the inverter plug-in unit.

- (5) Start the converter as outlined in 3.01 while observing a *trace* which is similar to the *trace* shown adjacent to the Q1 silicon-controlled rectifier of the inverter circuit on the schematic drawing.

- (6) If the converter misfires, repeat (3), (4), and (5).

- (7) Repeat 4.02.

- (8) Disconnect the KS-14510 volt-ohm-milliammeter and the Tektronix model 560 oscilloscope.

Voltage Monitors Adjustments Check

4.04 To check the voltage monitors adjustments for the 6-, 12-, and 24-volt rectifiers, proceed as follows.

- (1) Using the dc power supply, operate the POWER switch to OFF and connect the input to a 105 to 125 volt ac, 60-Hz supply. Set the selector switch to the 7.5-volt scale.
- (2) Connect the white (tip) wire of the 3W4A cord, using a KS-6278 connecting clip, to the positive terminal of the dc power supply. Connect the red (sleeve) wire of the 3W4A cord, using a KS-6278 connecting clip, to the negative terminal of the dc power supply.
- (3) Operate the POWER switch of the dc power supply to ON and adjust the output voltage to 6.2 volts.
- (4) Insert the 310 plug of the 3W4A cord into the TEST jack of the 6-volt rectifier. If the 6V FAIL lamp lights, momentarily depress the ST-RLS key.

Note: Should the converter shut down, restart the converter as outlined in 3.01.

- (5) Increase the output voltage of the dc power supply to approximately 7.0 volts.

Requirement: The 6V FAIL lamp lights.

- (6) Decrease the output voltage of the dc power supply to 6.2 volts.
- (7) Momentarily depress the ST-RLS KEY and observe that the 6V FAIL lamp extinguishes.
- (8) Momentarily decrease the output voltage of the dc power supply to approximately 5.75 volts.

Requirement: The 6V FAIL lamp lights.

- (9) Increase the output voltage of the dc power supply to 6.2 volts.
- (10) Momentarily depress the ST-RLS KEY and observe that the 6V FAIL lamp extinguishes.

Note: If any shutdown voltage adjustment limits are necessary, rotate the ALM ADJ HV potentiometer of the monitor unit under test cw to raise, or the associated LV potentiometer ccw to lower, the shutdown voltage limits.

- (11) Remove the 310 plug of the 3W4A cord from the 6-volt rectifier; set the selector switch of the dc power supply to the 15-volt scale; and adjust the output voltage to 12 volts.
- (12) Insert the 310 plug of the 3W4A cord into the TEST jack of the 12-volt rectifier (see note in Step 4).
- (13) Increase the output voltage of the dc power supply to approximately 13.0 volts.

Requirement: The 12V FAIL lamp lights.

- (14) Decrease the output voltage of the dc power supply to 12 volts.
- (15) Momentarily depress the ST-RLS KEY and observe that the 12V FAIL lamp extinguishes.
- (16) Decrease the output voltage of the dc power supply to approximately 11 volts.

Requirement: The 12V FAIL lamp lights.

- (17) Increase the output voltage of the dc power supply to 12 volts.
- (18) Depress the ST-RLS KEY and observe that the 12V FAIL lamp extinguishes (see note in Step 10).
- (19) Remove the 310 plug of the 3W4A cord from the 12-volt rectifier; set the selector switch of the dc power supply to the 30-volt scale; and adjust the output voltage to 24.4 volts.
- (20) Insert the 310 plug of the 3W4A cord into the TEST jack of the 24-volt rectifier (see note in Step 4).

- (21) Increase the output voltage of the dc power supply to approximately 26 volts.

Requirement: The 24V FAIL lamp lights.

- (22) Decrease the output voltage of the dc power supply to 24.4 volts.

- (23) Momentarily depress the ST-RLS KEY and observe that the 24V FAIL lamp extinguishes.
- (24) Decrease the output voltage of the dc power supply to approximately 23 volts.

Requirement: The 24V FAIL lamp lights.

- (25) Increase the output voltage of the dc power supply to 24.4 volts.
- (26) Momentarily depress the ST-RLS KEY and observe that the 24V FAIL lamp extinguishes (see note in Step 10).
- (27) Disconnect the testing apparatus.

5. TROUBLES

5.01 For each rectifier, a voltage monitor is provided to indicate a low- or high-voltage condition. A voltage monitor is also provided for the dc-to-ac inverter which senses a no-voltage trouble condition. Each time such a trouble condition occurs in the rectifiers or the inverter, visual and audible alarms are activated and the converter is

shut down. The particular rectifier or inverter trouble condition is locked in; an associated trouble indicating lamp remains lighted; and an audible alarm is sounded until the ST-RLS KEY is momentarily depressed.

Caution: *Do not remove or insert plug-in units unless the INPUT switch is operated to the OFF position.*

5.02 Should any of the following troubles develop, it is suggested that the possible causes be checked in the order given. If the trouble is not readily found, replace the suspected plug-in unit with a new unit or substitute a unit from an idle or spare converter.

Note: Before taking any resistance measurements in any of the plug-in units, disconnect the power and momentarily short-circuit all associated capacitors with a 100-ohm resistor to ensure a complete discharge of the capacitors, as any charge left in the capacitor may cause inaccuracies in the resistance indications.

(a) Converter Shutdown — All trouble indicating lamps lighted

TROUBLE	POSSIBLE CAUSE	SUGGESTED REMEDY
Blown input F1 fuse or no-voltage output from dc-to-ac inverter	Defective Q1 silicon-controlled rectifier in inverter	Disconnect power. Use KS-14510 Volt-Ohm-Milliammeter on X1 scale; check for short circuit by measuring resistance between anode and cathode. For a reading other than zero, the device is operable.
	Pulse generator out of adjustment	Check adjustment of pulse generator as outlined in 4.03.
	Defective CR1 diode in inverter	Disconnect power. Use KS-14510 Volt-Ohm-Milliammeter on X1000 scale; connect — lead of meter to cathode; connect + lead of meter to anode of CR1 diode. Meter should indicate on high portion of scale. Reverse the meter leads to diode. Meter should indicate 10 or lower. (This is a scale reading, not an ohm reading.)
	Defective input filter capacitor (C1) in inverter or non-polarized C2, C3.1, C3.2, or C4 capacitors	Disconnect power. Disconnect R1 leakage resistor and leads from one side of C1 capacitor. (See note under 5.02.) Use KS-14510 Volt-Ohm-Milliammeter on X1000 scale; connect — lead of meter to + terminal of capacitor; connect + lead of meter to — terminal of capacitor. The resistance reading should be low initially and then increase as capacitor charges. If resistance remains low, capacitor is shorted. If resistance is high, the capacitor has a high resistance or is open.
	Defective Q1 transistor in pulse generator	Disconnect power. Remove CP1 circuit pack and place on bench. Use KS-14510 Volt-Ohm-Milliammeter on X1 scale, connect — lead of meter to the emitter and the + lead of meter to the collector of the Q1 transistor. The measured resistance should be 50 ohms or greater.
	Defective shunt zener voltage regulator in pulse generator	While CP1 circuit pack is on bench, use KS-14510 Volt-Ohm-Milliammeter on X1000 scale; connect — lead of meter to the cathode and + lead of meter to anode of CR5 zener diode. Meter should indicate on high portion of scale. Reverse the meter leads to diode. Meter should indicate on low portion of scale.

(b) Converter Shutdown — 6V FAIL lamp lighted

TROUBLE	POSSIBLE CAUSE	SUGGESTED REMEDY
Low or high rectifier output voltage	6V ALM ADJ LV or HV potentiometers out of adjustment	Adjust voltage monitor in accordance with 4.04(1) through (10).
	Defective secondary portion of T1 output transformer	Disconnect power. Disconnect P1 plug from J1 connector. Use KS-14510 Volt-Ohm-Milliammeter on X1 scale; check continuity by connecting meter leads to terminals 3 and 4, and 4 and 5 of T1 transformer. Reconnect plug.
	Defective CR1 or CR2 rectifying diodes (part of voltage regulator)	Disconnect power. Remove 6V rectifier plug-in unit and place on bench. Use KS-14510 Volt-Ohm-Milliammeter on X1000 scale; connect — lead of meter to cathode; connect + lead of meter to anode of CR1 diode. Meter should indicate on high portion of scale. Reverse meter leads to diode. Meter should indicate 10 or lower. Repeat same operation for CR2 diode.
	Defective CR3 diode (used for temporary overload or short-circuit conditions)	While 6V rectifier plug-in unit is on bench, disconnect lead on terminal 2 of L1 inductor and test CR3 diode in similar manner as for CR1 and CR2 diode. Replace lead removed from L1 inductor after checking AR1 magnetic amplifier.
	Defective CR4 zener diode (part of voltage regulator)	Test CR4 zener diode in similar manner as for CR1 and CR2 diode.
Defective AR1 magnetic amplifier	See test for CR3 diode; then check continuity of AR1 magnetic amplifier using KS-14510 Volt-Ohm-Milliammeter on X1 scale. Connect meter leads to terminals 1 and 2, 3 and 4, and 5 and 6. (A short circuit will be difficult to detect due to low winding resistance.)	

(c) Converter Shutdown — 12V FAIL lamp lighted

TROUBLE	POSSIBLE CAUSE	SUGGESTED REMEDY
Low or high rectifier output voltage	12V ALM ADJ LV or HV potentiometer out of adjustment	Adjust voltage monitor in accordance with 4.04(1), (2), and (11) through (18).
	Defective secondary portion of T1 output transformer	Disconnect power. Disconnect P1 plug from J1 connector. Use KS-14510 Volt-Ohm-Milliammeter on X1 scale. Check continuity by connecting meter leads to terminals 6 and 7, and 7 and 8 of T1 transformer. Reconnect plug.
	Defective CR1 or CR2 rectifying diodes (part of voltage regulator)	Disconnect power. Remove 12V rectifier plug-in unit and test diodes in a similar manner as outlined for the 6V rectifier.
	Defective CR3 diode (used for temporary overload or short-circuit conditions)	Test diode in a similar manner as outlined for the 6V rectifier.
	Defective CR4 zener diode (part of voltage regulator)	Test diode in a similar manner as outlined for the 6V rectifier.
	Defective AR1 magnetic amplifier	Test magnetic amplifier in a similar manner as outlined for the 6V rectifier.

(d) Converter Shutdown — 24V FAIL lamp lighted

TROUBLE	POSSIBLE CAUSE	SUGGESTED REMEDY
Low or high rectifier output voltage	24V ALM ADJ LV or HV potentiometer out of adjustment	Adjust voltage monitor in accordance with 4.04(1), (2) and (19) through (27).
	Defective secondary portion of T1 output transformer	Disconnect power. Disconnect P1 plug from J1 connector. Use KS-14510 Volt-Ohm-Milliammeter on X1 scale. Check continuity by connecting meter leads to terminals 9 and 10, and 10 and 11.
	Defective CR1 or CR2 rectifying diodes (part of voltage regulator)	Disconnect power. Remove 24V rectifier plug-in unit and test diodes in a similar manner as outlined for the 6V rectifier.
	Defective CR3 diode (used for temporary overload or short-circuit conditions)	Test diode in similar manner as outlined for the 6V rectifier.
	Defective CR4 zener diode (part of voltage regulator)	Test diode in similar manner as outlined for the 6V rectifier.
	Defective AR1 magnetic amplifier	Test magnetic amplifier in a similar manner as outlined for the 6V amplifier.