L MULTIPLEX TERMINALS
COMMON EQUIPMENT
A6 CHANNEL BANK
CARRIER SUPPLY
DESCRIPTION

CONTENTS PAGE

1. GENERAL

1.01 The A6 carrier supply and distribution panel (Fig. 1) generate and distribute, at the proper level, the 12 individual channel carrier frequencies and the one channel bank carrier frequency required for operation of the J68929AA (A6) channel bank. ♦The significant characteristics of the A6 regular carrier supply are listed in Table A; the A6 auxiliary carrier supply in Table B.♦

1.02 This section is reissued to include the A6 auxiliary carrier supply. Arrows are used to indicate significant changes.

2. EQUIPMENT DESCRIPTION

2.01 The A6 regular carrier supply equipment comprises one J68929AB carrier supply shelf and two J68929AE carrier distribution panels mounted in two A6 channel bank bays, designated the first and second bays. Two of these units, the J68929AB carrier supply shelf and the J68929AE (L1 and L2) carrier distribution panel, are mounted in the first bay as shown in Fig. 1; the J68929AE (L1 and L3) carrier distribution panel is mounted in the second bay.

2.02 The J68929AB carrier supply shelf is a die-cast aluminum unit having slots for mounting four types of plug-in units. These are one −12 volt regulator unit, 12 channel carrier amplifier units, one channel bank carrier amplifier unit, and one carrier supply generator unit.

2.03 The −12 volt regulator unit uses a die-cast aluminum faceplate with integral fins for dissipating heat from the voltage regulating transistor; all other units have a flat faceplate. A quick-release spring-loaded catch at the lower end of each faceplate holds the units in place.

2.04 The −12 volt regulator unit is 5 inches wide and 4 inches high; the carrier supply generator unit is 2 inches wide and 4 inches high. All other units are approximately 1 inch wide and 4 inches high.

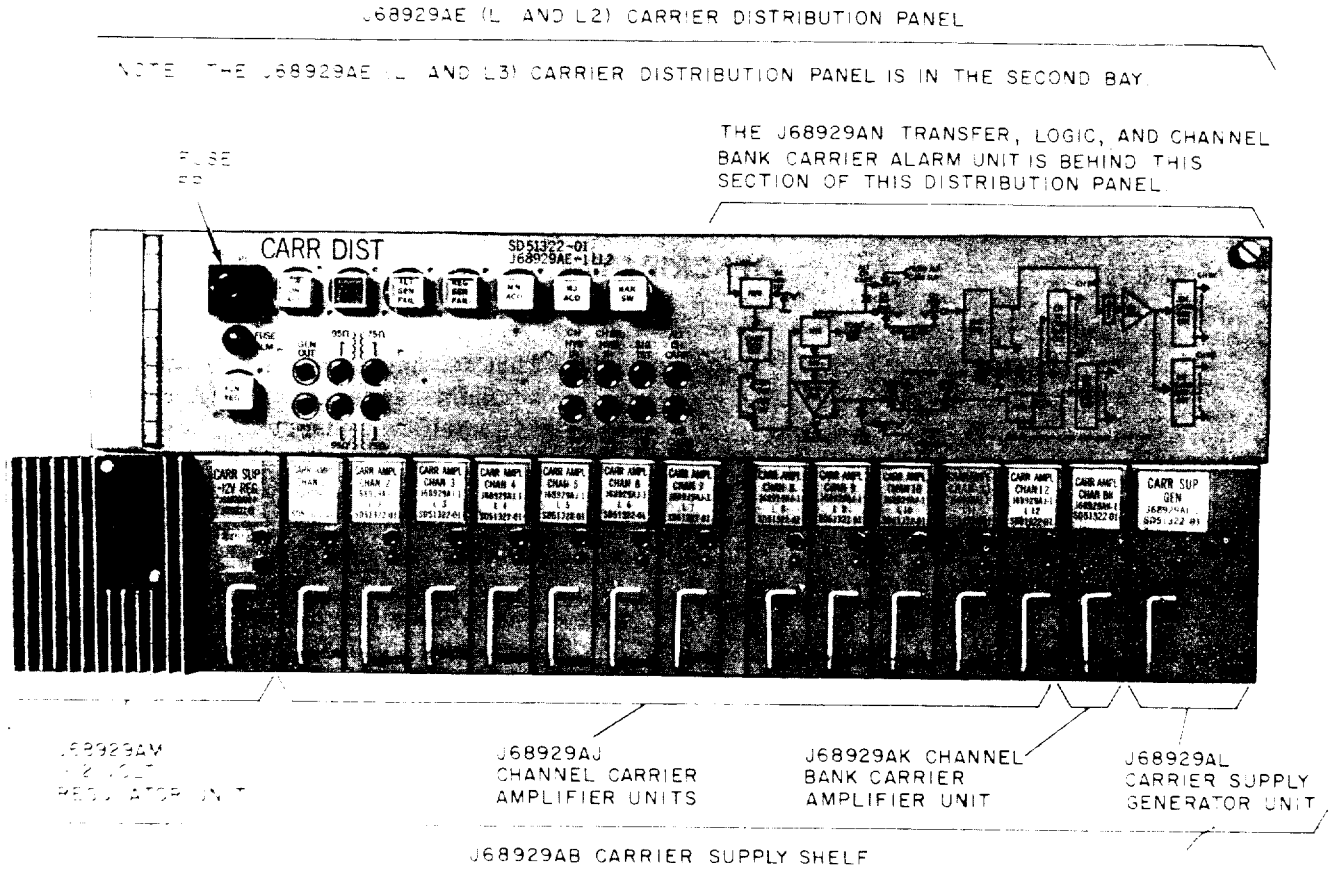

Fig. 1—A6 Carrier Supply and Distribution Panel—First Bay

2.05 Test jacks are provided on the faceplate of the −12 volt regulator for measuring the dc output voltage. A lamp and a jack are provided on the faceplate of each of the channel carrier amplifier modules for alarm indication and alarm detector testing, respectively.

2.06 The regular carrier supply contains all the circuitry required for generating the 13 carrier frequencies (12 channel carrier frequencies and one channel bank carrier frequency) for a maximum of 40 A6 channel banks on a normal basis or, when used in conjunction with an alternate (another regular) carrier supply, for a maximum of 80 A6 channel banks on an emergency basis.

Note: When two regular carrier supplies provide such mutual carrier protection, their respective −12 volt regulators also provide mutual protection to guard against loss of carrier due to regulator failure.

2.07 The J68929AE (L1 and L2) carrier distribution panel (in the first bay) has various switches and lamps mounted on the front panel for manually controlling and indicating the condition of the carrier supply. It also has jacks for testing and manual patching of the carrier supply generator. This arrangement is shown in Fig. 1. The J68929AE (L1 and L3) unit (in the second bay) has a blank front panel. It is equipped only with a resistor-type network for distribution of the 12 channel carriers and one channel bank carrier to the channel banks in the second bay.

2.08 The J68929AP auxiliary carrier supply (Fig. 2) consists of a die-cast aluminum shelf on which is mounted three types of plug-in units and a jack, lamp, and fuse panel. The plug-in units consist of one −12 volt regulator, one channel bank carrier amplifier, and one carrier supply generator unit.

2.09 The auxiliary carrier supply is used, in conjunction with a regular (J68929AB) carrier

♦TABLE A♦

A6 REGULAR CARRIER SUPPLY CHARACTERISTICS

Used with:	J68929AA (A6) channel blank
Consists of:	
In first bay	J68929AB carrier supply shelf J68929AE, L1 & L2 carrier distribution panel
In second bay	J68929AE, L1 & L3 carrier distribution panel
Input:	
Frequency	64 kHz
Power	−23 dBm
Impedance	135 ohms balanced
Output:	
Frequencies:	
Channel carriers	8.140, 8.144, 8.148 . . . and 8.184 MHz
Channel bank carrier	8.248 MHz
Power	−32 ± 1.0 dBm
Impedance	95 ohms balanced
Capacity:	
Normal	40 A6 channel banks
Emergency	80 A6 channel banks
Power requirements:	
−24 volt battery:	
Normal	1.7 amperes
Emergency	2.4 amperes
−12 volt regulator:	
Input potential	−24 Vdc
Input current:	
Normal	0.7 amperes
Emergency	1.3 amperes
Output potential	−12 Vdc
Output current:	
Normal	0.6 amperes
Emergency	1.2 amperes
Ambient temperature	40 to 120° F
Protective features:	
Switching	Automatic or manual transfer of load from defective regular carrier supply to alternate (or auxiliary) carrier supply.
Alarm indications	Minor and major
Lamp indications	(a) Condition of regular and alternate (or auxiliary) carrier supplies (b) Loss of 1 to 12 channel carriers (c) Transfer from regular to alternate (or auxiliary) carrier supply (d) Alarm identification (e) Alarm cutoff

♦TABLE B♦

A6 AUXILIARY CARRIER SUPPLY CHARACTERISTICS

Used with:	J68929AA (A6) channel bank — in conjunction with regular carrier supply
Input:	
Frequency	64 kHz
Power	—23 dBm
Impedance	135 ohms balanced
Output:	
Frequencies:	
Channel carriers	8.140, 8.144, 8.148 . . . and 8.184 MHz
Channel bank carrier	8.248 MHz
Power	—32 ± 1.0 dBm
Impedance	95 ohms balanced
Capacity:	
Normal	Standby
Emergency	40 A6 channel banks
Power requirements:	
—24 volt battery:	
Normal	0.6 amperes
Emergency	1.0 amperes
—12 volt regulator:	
Input potential	—24 Vdc
Input current:	
Normal	0.16 amperes
Emergency	0.66 amperes
Output potential	—12 Vdc
Output current:	
Normal	0.16 amperes
Emergency	0.66 amperes
Ambient temperature	40 to 120° F
Protective features:	
Switching	Automatic or manual transfer of load from defective regular carrier supply to auxiliary carrier supply.
Alarm indications	Minor
Lamp indications	(a) Condition of regular and auxiliary carrier supplies (b) Alarm identification (c) Alarm cutoff

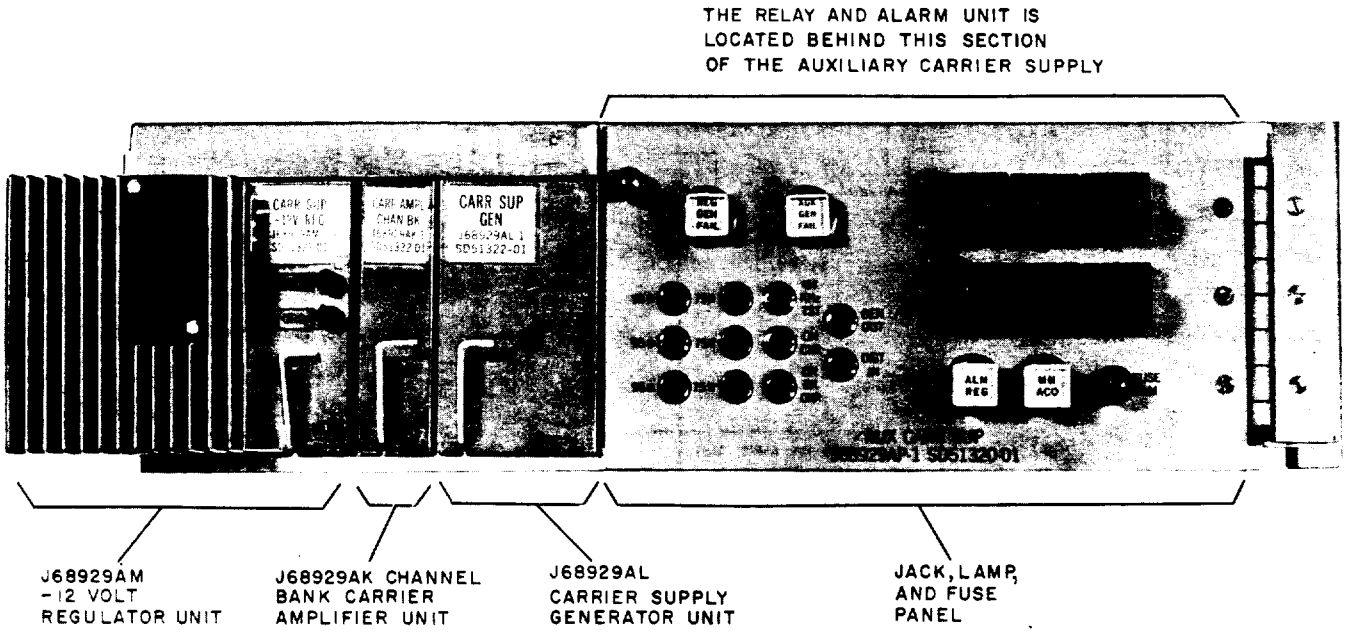

Fig. 2—A6 Auxiliary Carrier Supply

supply, to provide the channel and channel bank carriers in the event the associated regular carrier supply fails. Since, during normal conditions, the auxiliary carrier supply does not provide carriers for any channel banks, it is not protected by the associated regular carrier supply; however, its −12 volt regulator both protects the associated regular regulator and is protected by it.

2.10 The maximum length of KS-20906, List 1 cable between a J68929AE (L1 and L2) carrier primary distribution panel, or a J68929AP auxiliary carrier supply, and any associated carrier secondary distribution circuit (served by the same carrier supply) shall not exceed 80 feet under normal or emergency switched conditions. This cable limitation is controlled by the cable loss at the 8-MHz carrier frequencies.

3. FUNCTIONAL DESCRIPTION

3.01 The A6 carrier supply consists of carrier frequency generating and distributing circuits, protective switching circuits, alarm circuits, manual patching and test arrangements, and a dc voltage regulator.

A. Carrier Generating and Distributing Circuits

3.02 The carrier supply generating circuit consists of a 64-kHz input circuit, a carrier generator circuit, a splitting network, a hybrid tree, 12 channel amplifiers, one channel bank amplifier, and a channel bank hybrid. The carrier distributing circuit consists of 12 channel carrier distribution networks and one channel bank carrier distribution network. This arrangement, including associated patching and alarm detector circuits, is illustrated in Fig. 3 and 4.

3.03 The carrier generator (Fig. 5) uses a phase-locked 8.192-MHz oscillator, synchronized to the office 64-kHz distribution circuit, to generate the 12 channel carrier frequencies (8.140, 8.144, 8.148...and 8.184 MHz) and one channel bank carrier frequency (8.248 MHz) for use in the channel and channel bank circuits, respectively, of the A6 channel bank (356-016-100).

3.04 Part of the output from the 8.192-MHz oscillator is divided down to 64 kHz and compared, in a phase detecting circuit, with the incoming 64-kHz signal. If the frequency of the derived 64-kHz signal (and thus the 8.192-MHz signal) is incorrect, the phase detector develops a dc voltage, the amplitude of which is proportional

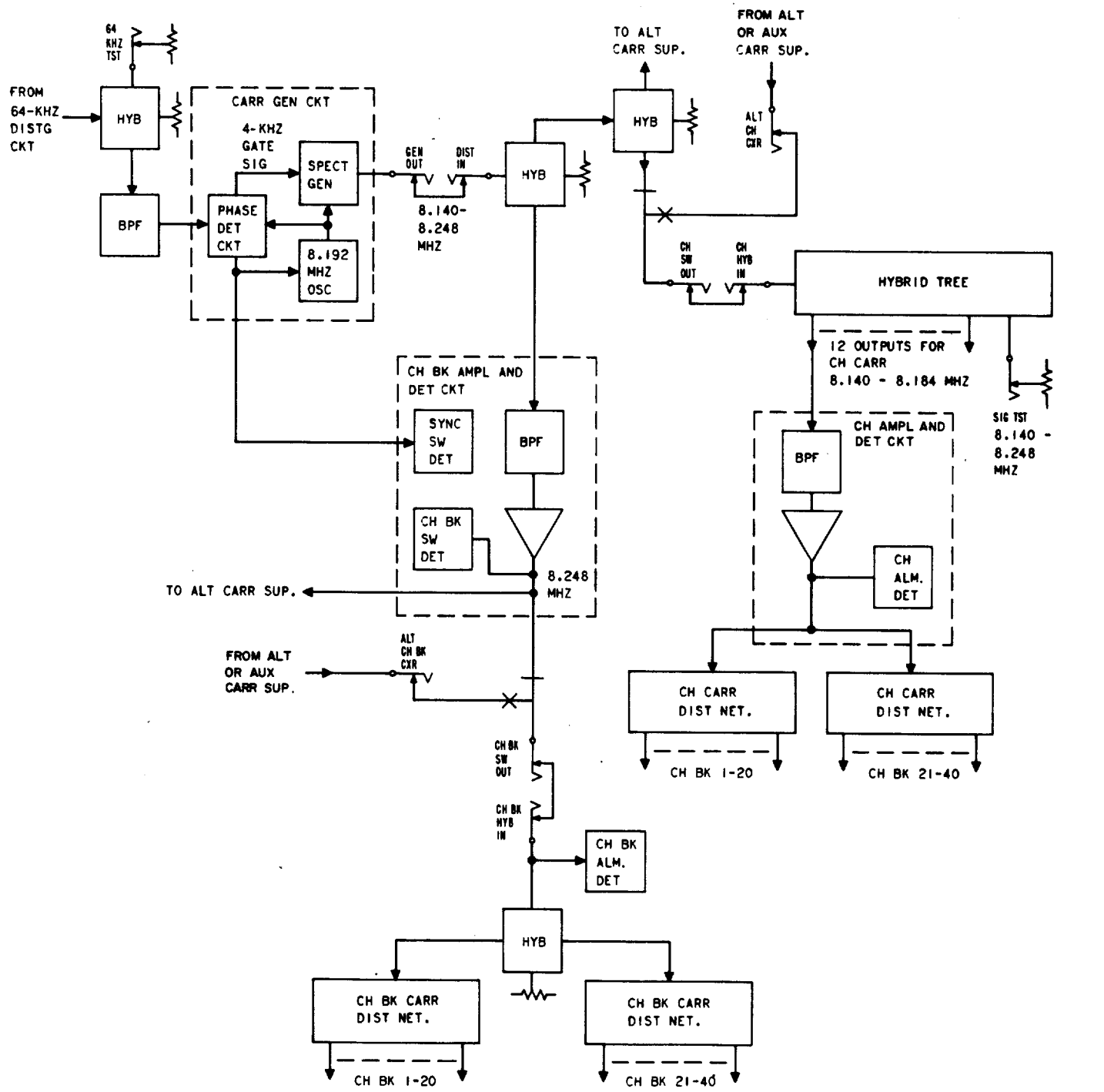

Fig. 3—A6 Regular Carrier Supply

to the frequency difference between the primary frequency supply and the derived 64-kHz signal. This dc error voltage is applied to the 8.192-MHz oscillator where it is used to correct the oscillator output frequency.

3.05 The 64-kHz signal derived from the accurate 8.192-MHz signal is also divided down to 4 kHz where it is used to generate a stream of 3-microsecond unipolar pulses at a 4-kHz rate. This pulse stream is combined with the 8.192-MHz signal

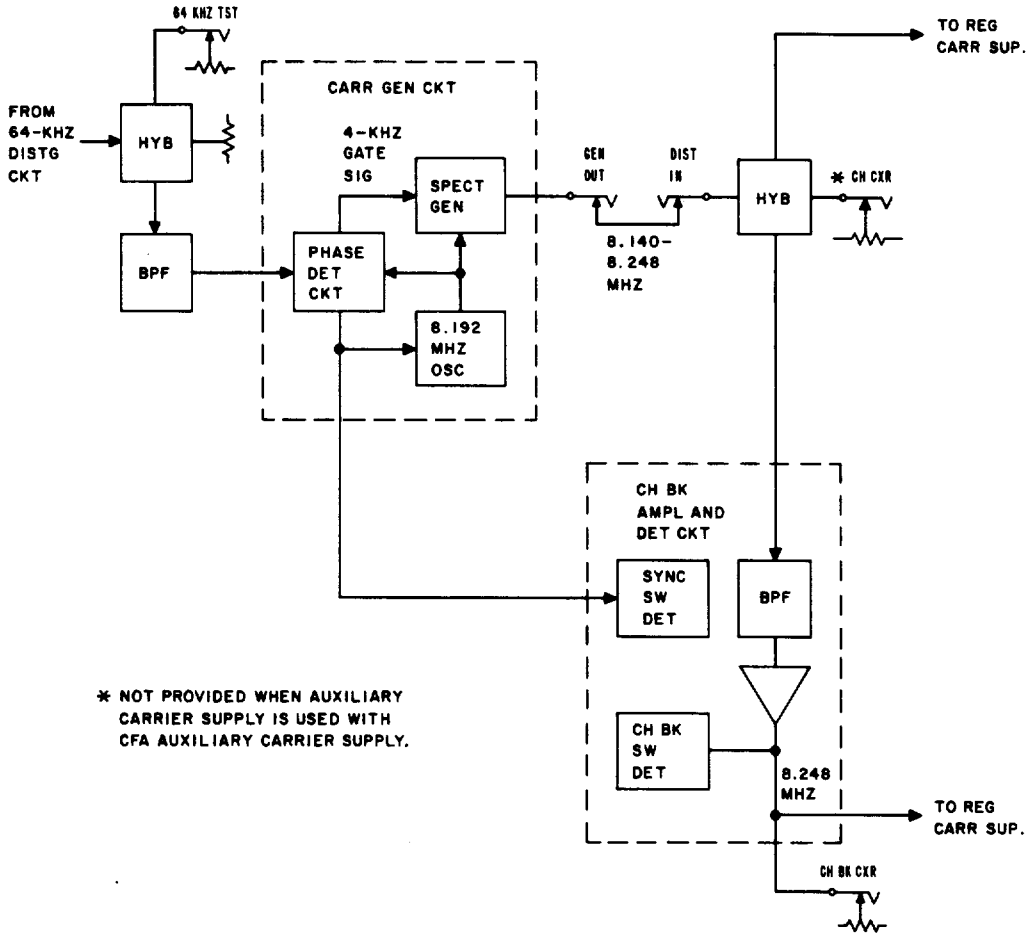

Fig. 4—A6 Auxiliary Carrier Supply

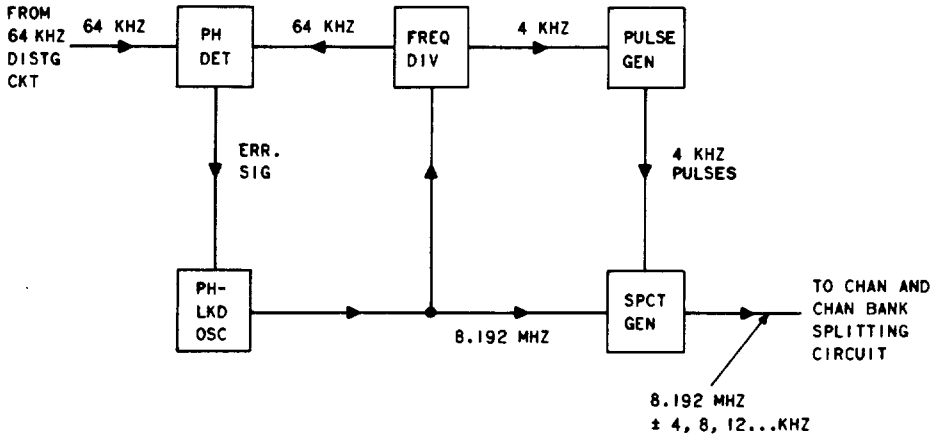

Fig. 5—Carrier Supply—Frequency Generating Circuit

in a spectrum generator to form a wide range of frequencies at 4-kHz intervals above and below 8.192 MHz. This resultant band of frequencies is applied to the channel and channel bank circuits via a splitting network.

3.06 The band of frequencies applied to the channel circuits (Fig. 3 and 4) contains the 12 channel carrier frequencies (8.140, 8.144, 8.148...and 8.184 MHz). Twelve separate signal paths and a test connection are provided by means of a hybrid tree circuit. The 12 channel frequencies are extracted by means of corresponding monolithic-crystal bandpass filters located in the 12 channel carrier amplifier units. Then they are amplified and applied to 12 resistive-type carrier distribution networks. Discrete channel carrier frequencies are applied, at a power of −32 dBm, to the channel modems for a maximum of 20 A6 channel banks in the first bay and 20 in the second bay.

3.07 Similarly, the band of frequencies applied to the channel bank carrier amplifier circuit is divested of all except the channel bank carrier frequency (8.248 MHz) by means of a monolithic-crystal bandpass filter. This 8.248-MHz signal is amplified, passed through a resistive-type carrier distribution network, and then applied, at −32 dBm, to the channel bank modems for a maximum of 20 A6 channel banks in the first bay and 20 in the second bay.

3.08 ◗When used in the A6 UTE [J68929( )] frames, the carrier supply distribution circuit consists of an unequal-ratio hybrid tree and associated resistive-type networks that provide for 4, 8, 12, 16, or 20 channel banks. This arrangement is described in CD-99600-01.

3.09 The auxiliary carrier supply generates all required channel and channel bank carrier frequencies, but does not remove unwanted frequencies from the channel carrier-spectrum since it does not contain the 12 channel carrier amplifiers. When the auxiliary carrier supply is bearing the load of the associated regular supply, the channel carriers are applied to the channel banks via the channel carrier amplifiers and distribution circuits in the associated regular carrier supply. The channel bank carrier is applied to the channel banks via the channel bank carrier amplifier in the auxiliary supply and the distribution circuit in the regular carrier supply.◖

B. Protective Switching

3.10 Although the A6 carrier supply provides for a maximum of 40 A6 channel banks on a normal basis, it is capable of providing for a maximum of 40 additional A6 channel banks (in a second pair of bays) on an emergency basis. This is accomplished by channel and channel bank switching circuits in each A6 carrier supply. When two such carrier supplies are interconnected via these switching circuits, a mutual protective arrangement is provided whereby either supply automatically assumes the load of the other during an emergency. In addition, a locking MAN SW key mounted on the J68929AE (L1 and L2) distribution panel controls these switching circuits for manual transfer of the carrier supplies. In the automatic mode, the levels of the sync signal and the channel bank carrier are monitored by corresponding detectors to determine the need for one supply to assume the load of the other. When the channel bank carrier drops 4 dB below normal or the sync signal fails, transfer switching is initiated. This arrangement of mutual protection eliminates the need for standby carrier supplies.

Note 1: The 12 channel carriers are not protected individually.

Note 2: Neither manual nor automatic transfer switching can be initiated if the alternate carrier supply is not installed; however, patch access is provided at the interface between the generator output and the distribution circuit input to permit carrier restoration in the event of failure of the carrier generator in ***both*** the regular and alternate bay pairs.

◗***Note 3:*** The auxiliary carrier supply provides protection for the associated regular carrier supply, but it is not protected by the regular supply.◖

C. Alarms

3.11 Minor and major alarms are provided for the A6 carrier supply as follows:

A minor alarm is initiated by:

(a) Failure of either the regular or the alternate ◗(or auxiliary)◖ carrier supply

(b) Failure of any of the 12 channel carriers.

Note: A strapping option permits a major alarm to be initiated by failure of any of the 12 channel carriers.

A major alarm is initiated by:

(a) Failure of both the regular and the alternate ◗(or auxiliary)◖ carrier supply

(b) Failure of the system to make a transfer switch properly

(c) Failure of one or more channel carriers in each of three 4-channel sets of the A6 carrier supply

(d) Failure of the channel bank carrier.

D. Lamps and Switches

3.12 Lamps are provided on the A6 regular carrier supply as follows:

(a) Individual ALM lamps on the 12 channel carrier amplifier units to indicate failure of any of these units

(b) A SW ON ALT lamp on the J68929AE (L1 and L2) carrier distribution panel to indicate that the load (40 A6 channel banks) has been switched to the alternate (or auxiliary) carrier supply

(c) A CXR FAIL lamp on the J68929AE (L1 and L2) distribution panel to indicate concurrent failure of the regular and alternate (or auxiliary) carrier supplies

(d) An ALT GEN FAIL lamp on the J68929AE (L1 and L2) distribution panel to indicate that the alternate (or auxiliary) carrier supply has failed

(e) A REG GEN FAIL lamp on the J68929AE (L1 and L2) distribution panel to indicate that the regular carrier supply has failed

(f) ◗A FUSE ALM lamp on the J68929AE (L1 and L2) distribution panel to indicate that fuse FP1 has blown.

3.13 Lamps are provided on the A6 auxiliary carrier supply as follows:

(a) A REG GEN FAIL lamp to indicate that the associated regular carrier supply has failed

(b) An AUX GEN FAIL lamp to indicate that the auxiliary carrier supply has failed

(c) A FUSE ALM lamp to indicate that fuse F1, F2, F3, F4, FP1, or FR1 has blown.◖

3.14 Combined keys and lamps are provided on the A6 regular carrier supply as follows:

(a) An ALM REG key and lamp on the J68929AE (L1 and L2) carrier distribution panel. The lamp lights when either a minor or major alarm is initiated; it is extinguished by pressing the ALM REG key after the alarm condition has been corrected.

(b) An MN ACO key and lamp on the J68929AE (L1 and L2) distribution panel. Operation of the key cuts off the office minor audible alarm and causes the lamp to light. Restoration of the defective carrier supply to normal causes the MN ACO lamp to extinguish.

(c) An MJ ACO key and lamp on the J68929AE (L1 and L2) distribution panel. Operation of the key cuts off the office major audible alarm and causes the lamp to light. Restoration of the defective carrier supply to normal causes the MJ ACO lamp to extinguish.

(d) A MAN SW key and lamp on the J68929AE (L1 and L2) distribution panel. Operation of the key switches the A6 channel banks associated with the regular carrier supply to the alternate (or auxiliary) carrier supply and causes the MAN SW lamp to light. Operation of the key a second time switches the load back to the regular carrier supply and extinguishes the MAN SW lamp.

3.15 ◗Combined keys and lamps are provided on the A6 auxiliary carrier supply as follows:

(a) An ALM REG key and lamp that lights when a minor alarm is initiated. The ALM REG lamp is extinguished by pressing the ALM

REG key after the alarm condition has been corrected.

(b) An MN ACO key and lamp. Operation of the key cuts off the office minor audible alarm and causes the lamp to light. Restoration of the defective carrier supply to normal causes the MN ACO lamp to extinguish.◀

E. Manual Patching and Test Arrangements

3.16 Single and dual patching jacks are located on the J68929AE (L1 and L2) carrier distribution panel to permit a defective regular carrier supply generator to be replaced or the switching circuits to be bypassed as follows:

(a) The CH HYB IN ▶(95-ohm)◀ jack permits, on an emergency basis, patching of the 12 channel carriers from the ALT CH CXR ▶(95-ohm)◀ jack of a nearby carrier supply into the hybrid tree circuit.

(b) The CH BK HYB IN ▶(95-ohm)◀ jack permits, on an emergency basis, patching of the channel bank carrier from the ALT CH BK CXR ▶(95-ohm)◀ jack of a nearby carrier supply into the channel bank hybrid circuit.

(c) The dual GEN OUT/DIST IN ▶(95-ohm)◀ jacks permit restoration of carriers to a failed carrier supply.

3.17 A single jack, designated 64 KHZ TST 135Ω, is provided for testing the 64-kHz sync signal from the 64-kHz distribution circuit; a single ▶(95-ohm)◀ jack, designated SIG TST, is provided for testing the band of locally generated carrier frequencies. Both jacks are mounted on the J68929AE (L1 and L2) carrier distribution panel. In addition, a single jack designated TST is provided on each of the 12 channel carrier amplifier units for testing operation of the channel carrier detectors.

3.18 Four jacks, two designated 75Ω and two designated 95Ω, provide access to two 75-ohm to 95-ohm transformers for connecting the 95-ohm jacks described in 3.16 and 3.17 to 75-ohm test equipment.

3.19 ▶The J68929AP auxiliary carrier supply is provided with:

(a) Dual GEN OUT/DIST IN (95-ohm) jacks for restoration of carriers to a failed carrier supply

(b) A 64 KHZ TST (135-ohm) jack for testing the 64-kHz sync signal from the 64-kHz distribution circuit

(c) A CH CXR (95-ohm) jack (not provided when the auxiliary carrier supply is used with the CFA auxiliary supply) for testing the channel carriers

(d) A CH BK CXR (95-ohm) jack for testing the channel bank carrier

(e) Six 75Ω/95Ω jacks that provide access to three 75-ohm to 95-ohm transformers for connecting the 95-ohm jacks described in 3.19(a), (c), and (d) to 75-ohm test equipment.◀

F. −12 Volt Regulator

General

3.20 The J68929AM regulator (Fig. 1) provides the −12 volt dc power required for operation of the A6 carrier supply. This unit consists of a voltage regulating circuit; overload, overvoltage, ▶and undervoltage◀ protection circuits; and a protective transfer switching circuit. Its significant characteristics are listed in Tables A and B.

▶***Note:*** The undervoltage protection circuit is not provided in the J68929AM, List 1 −12 volt regulator.◀

3.21 The −12 volt regulator obtains its input voltage from the −24 volt filtered supply (filtered battery) derived in the associated filter and fuse panel (Sections 356-016-100 and -102); it provides an output of −12 volts which is regulated to within ±2.5 percent. The circuitry for achieving output-voltage regulation; combined overload, overvoltage, ▶and undervoltage◀ protection (clamping, monitoring, and triggering); and protective transfer switching is located within the regulator module. The disconnect portion of the overload, overvoltage, ▶and undervoltage◀ protection circuit is located in the filter and fuse panel. These features are illustrated in Fig. 6.

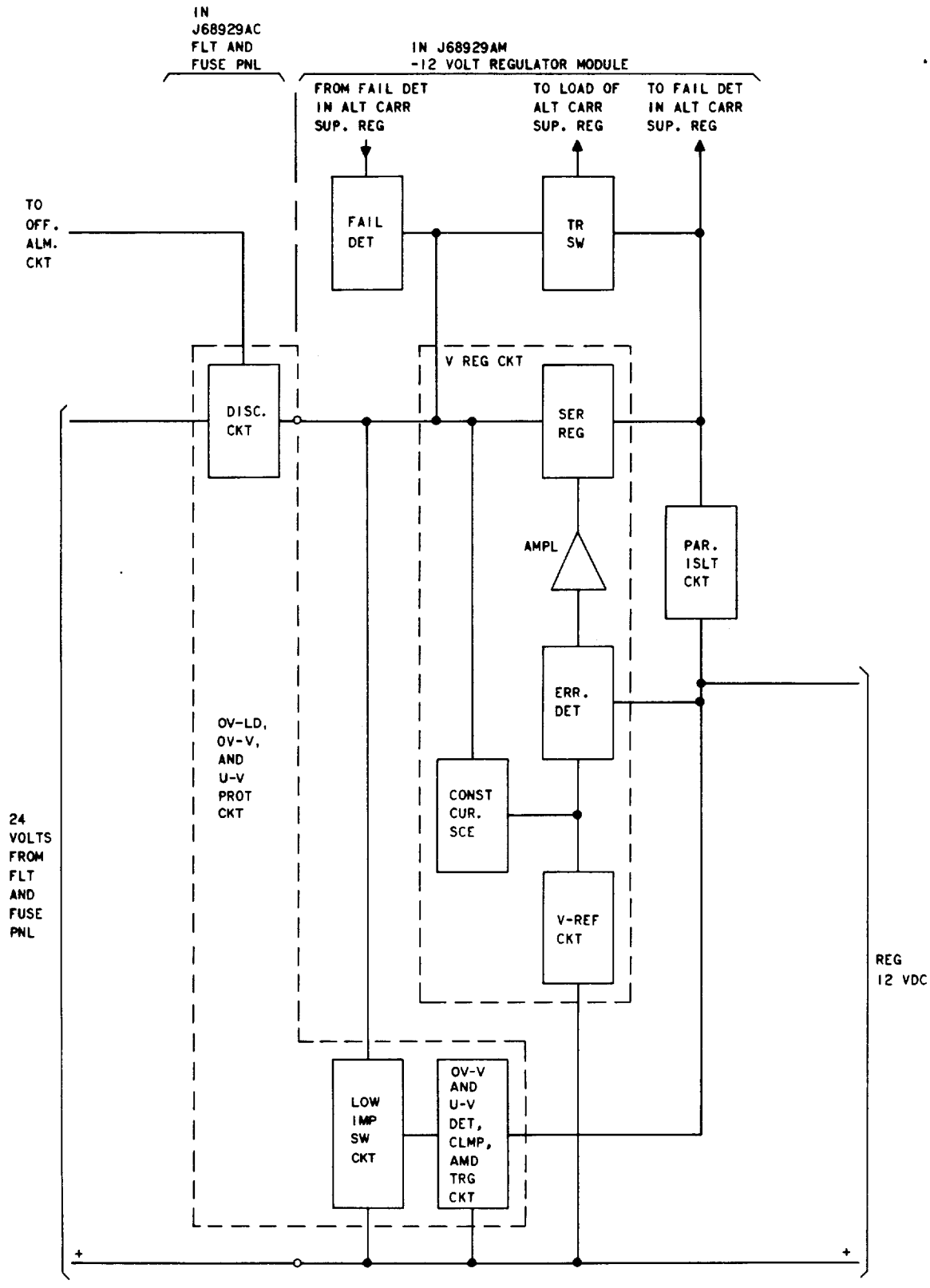

Fig. 6—J68929AM —12 Volt Regulator—Block Diagram

Voltage Regulating Circuit

3.22 The voltage regulating circuit consists of a voltage reference circuit, a constant current source, an error detector, an amplifier, and a series regulating stage.

3.23 The voltage reference circuit maintains a constant voltage across its terminals regardless of changes (within operating limits) in the −24 volt source, in load current, or in the ambient temperature. The constant current source aids in maintaining a constant reference voltage during changes in input voltage; the voltage reference amplifier aids during changes in temperature.

3.24 The error detector is used to compare a portion of the regulator output voltage with the constant voltage of the voltage reference circuit and thus is used to develop a difference voltage. The difference voltage is amplified and used to control the series regulating stage. The regulating circuit provides a −12 volt output that is constant within ±0.3 volt, regardless of changes in source voltage, loading, or temperature.

Overload and Overvoltage Protection Circuit

3.25 The overload protection circuit consists of a disconnect circuit; whereas, the overvoltage protection circuit consists of an overvoltage detector, clamp, and trigger circuit; a low impedance switching circuit; and the disconnect circuit. ▶The undervoltage protection circuit consists of an undervoltage detector, clamp, and trigger circuit; a low impedance switching circuit; and the disconnect circuit.◀

3.26 When the output current of the −12 volt regulator exceeds a safe value, the disconnect circuit (an alarm-indicating fuse in the filter and fuse panel) operates. This disconnects the −24 volt input power from the −12 volt regulator and applies an alarm indication to the office alarm circuit.

3.27 If the output voltage of the −12 volt regulator exceeds −15 volts, the overvoltage protection circuit detects such overvoltage, clamps the output voltage to −15 volts, and generates a trigger voltage that causes a low impedance to be shunted across the input terminals of the −12 volt regulator. An externally-located current-limiting resistor (contained in the disconnect circuit) holds the input current to a value that is sufficient to operate the fuse, but is not great enough to damage the series regulating stage. Operation of the fuse removes the −24 volt power from the −12 volt regulator and applies an alarm indication to the office alarm circuit.

3.28 ▶In the event the −12 volt regulator output voltage drops below approximately 11 volts, the undervoltage detector detects such condition and causes the regulator fuse to blow in the manner described in 3.27.◀

Protective Transfer Switching Circuit

3.29 The −12 volt regulator for the A6 carrier supply contains a protective switching circuit that automatically provides emergency service during a −12 volt regulator failure.

3.30 Two such −12 volt regulators operate as a pair, each having a detector that monitors the output from the other. If either −12 volt regulator fails, the operating unit automatically assumes the load of the defective unit. When the defective unit is replaced, it automatically assumes its normal load. ▶Failure of a −12 volt regulator causes its fuse to blow as described in 3.25 through 3.28 and thus prevents the trouble condition from removing the second −12 volt regulator from service. In addition, the blown fuse provides audible and visible indications of a defective regulator.◀

4. REFERENCES

4.01 Following is a list of schematic drawings (not included in this section) for the A6 carrier supply and associated equipment.

SD-51320-01	Auxiliary Carrier Supply—A6 Channel Bank
SD-51321-01	12-Channel Bank—Type A6
SD-51322-01	Carrier Frequency Supply—A6 Channel Bank
SD-51323-01	Application Schematic—A6 Channel Bank