

TYPE N2 CARRIER TELEPHONE SYSTEM

ALARM UNIT

DESCRIPTION

1. GENERAL

1.01 This section describes the operation of the N2 carrier alarm circuit.

1.02 The N2 carrier alarm circuit essentially consists of two separate circuits: the 21-volt power supply alarm control circuit and the carrier alarm control circuit. (See Fig. 1.) Fig. 2 is discussed in Part 3, B, 3.11.

1.03 The 21-volt power alarm control circuit performs (or provides means for) the following functions:

- (a) Indicates an alarm (visual and audible) when variations in the -21 volt power supply exceed ± 1 volt.
- (b) Silences alarms by manual operation of an alarm release key.
- (c) Provides a TST PWR jack for connection to an N2 switching set, which is capable of switching from the normal -21 volt power supply to an alternate -21 volt power supply without disrupting service. The TST PWR jack can also be used to check the operation of the 21-volt power alarm control circuit.

1.04 The carrier alarm control circuit performs (or provides means for) the following functions:

- (a) Indicates an alarm when the received carrier fails.
- (b) Silences alarms by manual operation of an alarm release key.
- (c) Lights an alarm lamp for visual indication of received carrier failure.
- (d) Removes the -21 volts from the group transmitting circuit to alarm the distant carrier terminal.
- (e) Restores the -21 volts to the group transmitting circuit.

(f) Provides sufficient delays to prevent an alarm when carrier failures occur for a short duration of time.

(g) Provides an ALM OVRD key to remove a make-busy condition from certain channels of a failed system, which have been prewired for this option in an associated carrier group alarm circuit, when those channels are to be patched to alternate working systems.

(h) Provides an alarm lamp for visual indication of an alarm override condition.

(i) Provides an inductance-capacitance (LC) network to suppress the 304-kc carrier, which appears at the output of the group receiving circuit.

2. DESCRIPTION OF CIRCUIT OPERATION

A. 21-volt Power Supply Alarm Control Circuit

2.01 The 21-volt power supply alarm control circuit basically consists of a Schmitt trigger circuit controlled by an inverter stage. As shown in Fig. 1, transistor Q1 with its associated circuit elements forms the inverter stage, and transistors Q2 and Q3 with their associated circuit elements form the Schmitt trigger circuit.

2.02 The -21 volt supply is applied to the base of transistor Q1 through the voltage breakdown diode CR1 and four click reducers RV1 through RV4. Under normal input voltage conditions (-21 ± 1 volts), diodes CR2 and CR3 are both conducting; transistor Q2 is biased to cutoff; transistor Q3 is biased to saturation; and relay K6 is energized, indicating a no-alarm condition.

2.03 As the input voltage exceeds -22 volts, transistor Q1 becomes so negatively biased that the voltage across the collector resistor R5 is reduced to the extent that diode CR2 becomes

back biased. Diode CR3, on the other hand, conducts more heavily because the voltage at the junction of resistor R2 and diode CR3 has become more negative than the voltage at the base of transistor Q2. This condition causes transistor Q2 to be biased into saturation and transistor Q3 to be biased into cutoff. Relay K6 is released, indicating an alarm condition.

2.04 When the input voltage decreases below -20 volts, transistor Q1 becomes so positively biased that the voltage across resistor R5 is increased to the extent that diode CR2 becomes forward biased. Diode CR3, however, is back biased since the voltage at the junction of resistor R2 and diode CR3 is more positive than the voltage at the base of transistor Q2. This condition causes transistor Q2 to be biased into saturation and transistor Q3 to be biased into cutoff. With transistor Q3 biased into cutoff, relay K6 is released, indicating an alarm condition.

B. Carrier Alarm Control Circuit

2.05 The carrier alarm control circuit functions on total received carrier power and performs three operations: amplification, rectification, and switching. Transistors Q4 and Q5 amplify the received signal; the half-wave voltage doubler circuit (capacitors C4 and C5, diodes CR7 and CR8, and resistor R27) rectifies this received signal; and transistor Q6 responds by switching on when the received carrier is not present.

2.06 When the received carrier is not present, transistor Q6 is biased to saturation by the voltage appearing across resistor R26. This condition causes relay K1 to operate. When the received carrier is present, transistor Q6 is biased to cutoff by the rectified carrier, and relay K1 is released.

2.07 The 2-stage amplifier has a power gain of approximately 33 db and an open loop gain of about 18 db.

2.08 In the feedback circuit, the series LC network consisting of inductor L1 and capacitor C27 resonates at 304 kc. Its purpose is to suppress the 304-kc carrier which appears at the output of the group receiving circuit. Unsuppressed, the 304-kc tone may have sufficient

energy to prevent the alarm circuit from indicating an alarm when a carrier failure occurs.

3. DESCRIPTION OF ALARM OPERATION

A. 21-volt Power Supply Alarm Control Circuit

3.01 *Power Supply Failure:* Deviations greater than ± 1 volt on the -21 volt supply cause relay K6 to release (see Fig. 3). When relay K6 releases, -48 volts is applied to the 21V ALM lamp through contacts on relay K6, and also to relay K9 through contacts on relay K6, key 21V ALM RLS, and through diode CR6. Relay K9 is part of the fuse and alarm circuit and is located on the bay cable terminating panel. Operation of relay K9 causes the bay lamp ALM to light and office alarms to operate. Diode CR6 blocks -48 volts from entering the circuit when other alarm units function.

3.02 *Release of Office Alarms:* After an alarm condition has been initiated, the office alarms can be silenced and the bay lamp ALM extinguished by manual operation of the 21V ALM RLS key, which removes the -48 volts from relay K9. The 21V ALM lamp, however, remains lighted. Restoration of the -21 volt supply to normal will operate relay K6. Operation of relay K6 starts the alarm sequence all over again. To restore the -21 volt alarm system back to normal, the 21V ALM RLS key must be returned to its normal position.

B. Carrier Alarm Control Circuit

3.03 *Carrier Failure:* Upon loss of received carrier, relay K1 operates (see Fig. 4). When relay K1 operates, -48 volts is applied to relay K4B through contacts on relays K1 and K3. (Relay K4 is a thermal relay and actually contains two relays: one on top, K4T, and one on the bottom, K4B. Relay K4T takes from 10.7 to 22 seconds to operate or release its contacts, while relay K4B takes 2.5 to 5.5 seconds.)

3.04 When relay K4B operates, -48 volts is applied through its make contact to the following:

- (a) Lamp SYS ALM.
- (b) Relay K3, which is part of the alarm circuit, and is located on the line terminating unit. The ground for relay K3 is located in the carrier group alarm circuit.

Momentarily, -48 volts is also applied to relay K4T through break contacts on relay K2 and to relay K8 through SYS ALM RLS key and diodes CR9 and CR3; but when relay K3 operates, one set of its contacts parallels the K4B contacts to maintain -48 volts to these circuits. Relay K8 is part of the fuse and alarm circuit and is located on the bay cable terminating panel.

3.05 When relay K3 operates, the following results:

- (a) -48 volts is removed from relay K4B through contacts on relay K3. This allows relay K4B to cool.
- (b) Relay K3 locks up on its own contacts.
- (c) The first control signal to the carrier group alarm circuit is ground applied over the SA lead through contacts on relay K3. This causes relays to operate in the group alarm circuit to register alarm conditions, to release subscribers, and to set up a circuit for automatic testing and restoral.
- (d) -21 volts is removed from the transmitting group unit through a break contact on relay K3 to alarm the distant terminal.

3.06 When relay K8 operates, -48 volts is applied to the following:

- (a) Bay lamp ALM through contacts on relay K8.
- (b) Office alarms through contacts on relay K8. Ground is also sent as additional office alarms through other contacts on relay K8.

3.07 When relay K4T operates, -48 volts is applied through its make contact to relay K2.

3.08 When relay K2 operates, the following results:

- (a) Relay K2 locks up through contacts on relays K2 and K3.
- (b) -48 volts is removed from relay K4T to allow it to cool.

(c) -21 volts is applied to the group transmitting circuit through make contacts on relay K2 to restore the carrier transmitted to the distant end.

(d) The second control signal to the carrier group alarm circuit is ground applied over the DS lead through contacts on relay K2. This causes the carrier group alarm circuit to complete registering of the alarm and to apply make-busy conditions.

3.09 Release of Office Alarms: After a carrier alarm condition has been initiated, the office alarms can be silenced and the ALM bay lamp extinguished by manual operation of the SYS ALM RLS key, which removes the -48 volts from relay K8. The SYS ALM lamp, however, remains lighted. When the fault on the carrier system is cleared, the SYS ALM lamp is extinguished, and -48 volts is again applied to relay K8, which again activates the office alarms and lights the ALM bay lamp. The office alarms are released and the ALM bay lamp is extinguished when the SYS ALM RLS key is returned to its normal position.

3.10 Restoral Sequence: When a fault occurs on the carrier system, the associated carrier group alarm units at both ends of the system are activated by the alarm circuits associated with the terminals of the system. Once activated, the carrier group alarm circuits cause the associated trunks first to go to an on-hook condition and then to an off-hook condition and arrange channel positions A and B (first and second test channels) of the system for automatic testing and restoral. Signalling checks are then made on channel positions A and B for the purpose of determining when the fault on the system is cleared. The fault on the system is cleared when the signalling tone from one end of the system is received successfully by the other end of the system. Once the fault on the system is cleared the carrier group alarm circuits recognize the presence of normal carrier and proceed to restore both ends of the system almost simultaneously. By a series of relay operations in the carrier group alarm circuits, the ground on the 30 lead at both ends of the system is momentarily removed. Relay K3 of the alarm circuit, which depends on this ground for its

operation, releases during the short period of time the 30 lead is off ground, and applies -48 volts through one set of its contacts to relay K8. Relay K8 causes the office alarms to operate, as was explained in 3.09.

3.11 The K11 relay, located in the alarm unit of the terminal, functions in conjunction with the carrier group alarm circuit (see Fig. 2). This relay and others in the carrier group alarm circuit assure that alarms are released or restored almost simultaneously at both ends of a system after a transmission fault has been cleared. The K11 relay assures that an off-hook condition is maintained on channel position B (in the good direction of transmission) until the on-hook sampling circuit of the carrier group alarm circuit (at the end of the system) times out.

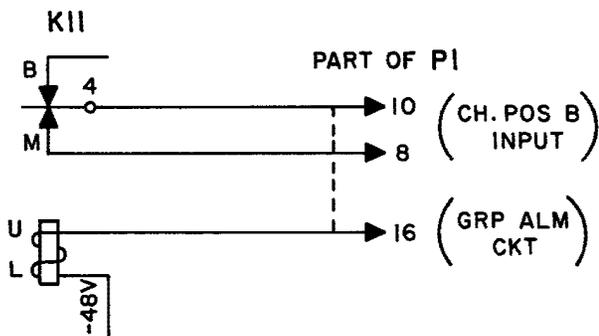


Fig. 2 - Part of Test Circuit for Test Channel Number 2

3.12 When the K11 relay operates, a set of its make contacts shorts the transmitting voice-frequency leads (T and R) of channel position B. The K11 relay remains operated until the on-hook sampling circuit times out and releases the A1 relay of the carrier group alarm circuit. This prevents bursts of the 2600-cycle test tone and transients that occur under certain restoral conditions from releasing the alarms at one end of a system prematurely. The K11 relay receives its ground over the 31 lead, which is controlled by the A1 relay.

3.13 Alarm Override: When a carrier system fails, the associated carrier group alarm circuit applies make-busy conditions to trunks

associated with the channels of the failed system. Certain special trunks associated with the failed system may be restored to service if they have been prewired for this option to relay C4 in an associated carrier group alarm circuit. To restore these special trunks of the failed system to service, it is required that the VF jacks of the failed system be patched to an alternate working system and that the ALM OVRD key on the alarm unit associated with the failed system be manually operated to the vertical position. Operation of the ALM OVRD key, which is connected to the A01 and A02 leads, releases relay C4 in an associated carrier group alarm circuit. When relay C4 releases, the make-busy condition from these special trunks is removed. The ALM OVRD lamp is lighted when the ALM OVRD key is operated as a reminder that special trunks are patched. After the failed system is restored, the ALM OVRD key is returned to normal and the patch from the VF jacks to the alternate working system is removed. When the ALM OVRD key is returned to normal, the ALM OVRD lamp is extinguished.

C. Removal of Alarm Circuit

3.14 Relay K3, which is a part of the alarm circuit, is located in the line terminating unit. The location of relay K3 prevents loss of transmission when the alarm unit is removed from the terminal (for repair purposes or other reasons) by keeping the -21 volt path to the group transmitting circuit intact.

3.15 The ground path for relay K10, which is a part of the fuse and alarm circuit, is looped in series through each alarm unit in the same bay (see Fig. 5). Removal of an alarm unit from the bay opens the ground circuit and releases relay K10. When relay K10 releases, -48 volts is applied to the following:

- (a) ALM U RMV lamp.
- (b) Through the ALM RLS key and diodes CR3 and CR13 to relay K8, which causes the bay lamp ALM to light and the office alarms to operate. The ALM RLS key, ALM U RMV lamp, and relay K10 are located on

the MISC JK & ALM panel. Bay lamp ALM can be extinguished and the office alarm silenced by manually operating the ALM RLS key, which releases relay K8.

3.16 When the alarm unit is returned to the terminal, relay K10 operates and -48 volts is again applied to relay K8. Returning the ALM RLS key to normal silences the office alarms and extinguishes both ALM and ALM U RMV lamps. The carrier failure indications and automatic trunk conditioning are disabled whenever the alarm unit is removed from the terminal.

4. REFERENCE DATA

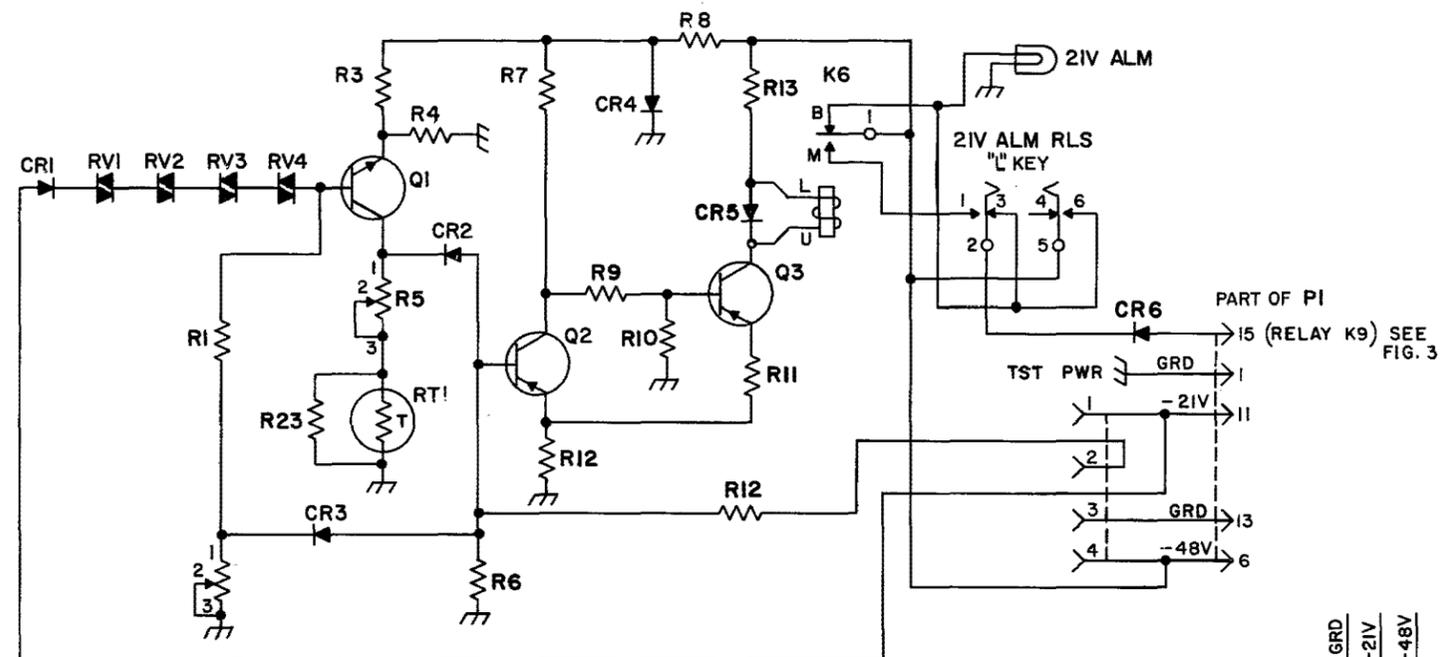
4.01 The following drawing (not attached) is listed for reference:

DESIGNATION	SUBJECT
SD-97116-01	Schematic Drawing

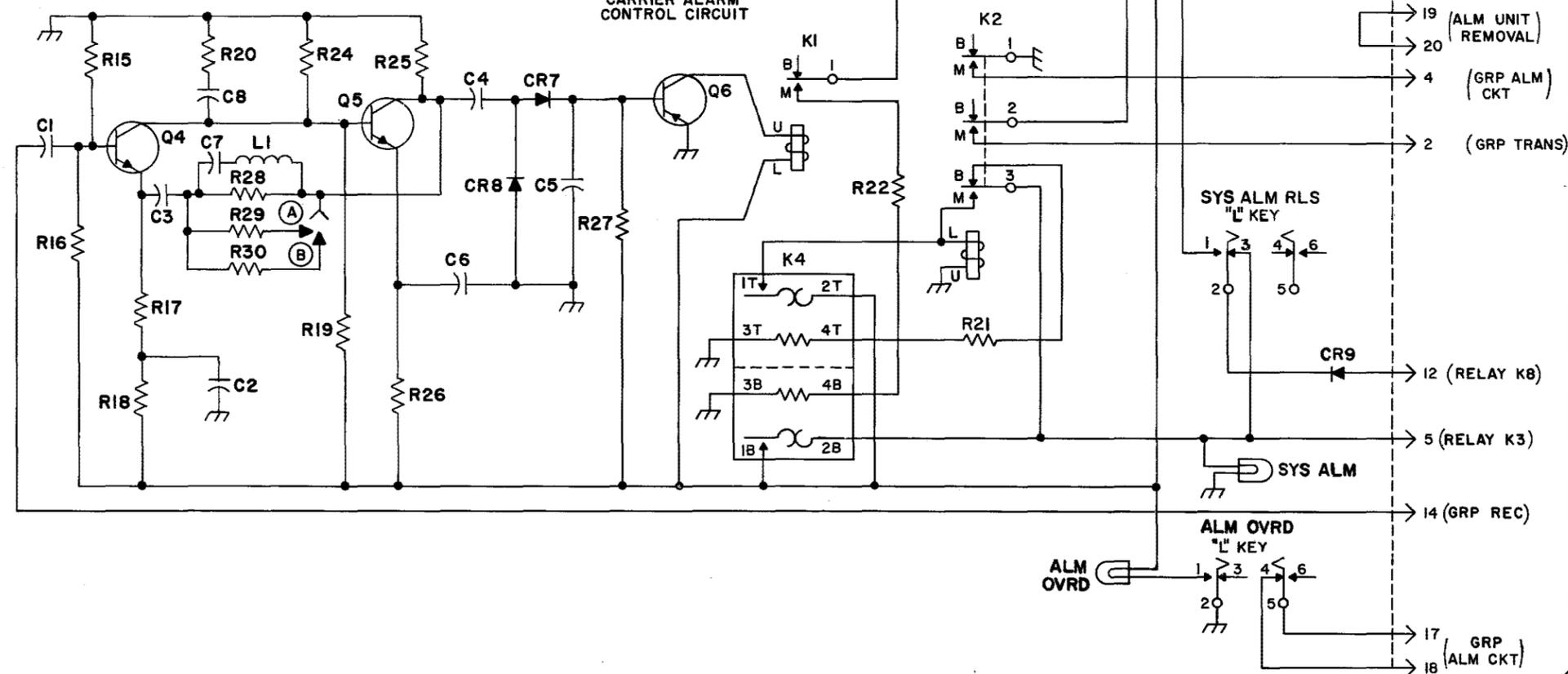
4.02 *Connecting Circuit:* The following connecting circuit (not attached) is applicable to this section:

DESIGNATION	SUBJECT
SD-97118-01	N2 Carrier Telephone — Application Schematic for Terminal Bay

2IV POWER SUPPLY ALARM
CONTROL CIRCUIT



CARRIER ALARM
CONTROL CIRCUIT



SEE FIGS 3,4,8,5

Fig. 1 - N2 Carrier Alarm Circuit

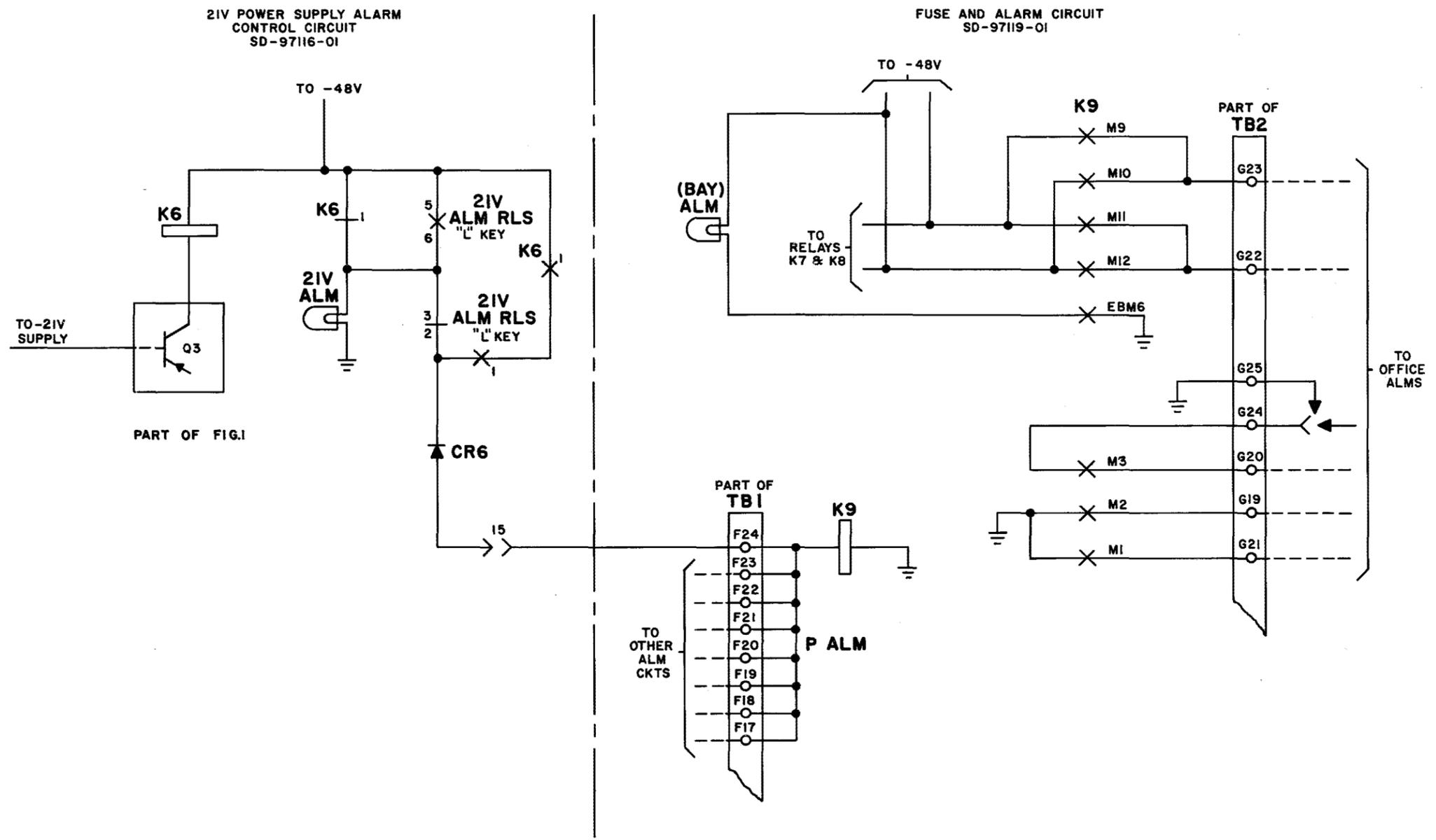


Fig. 3 - Relay Connections for Failure of -21 Volt Power Supply

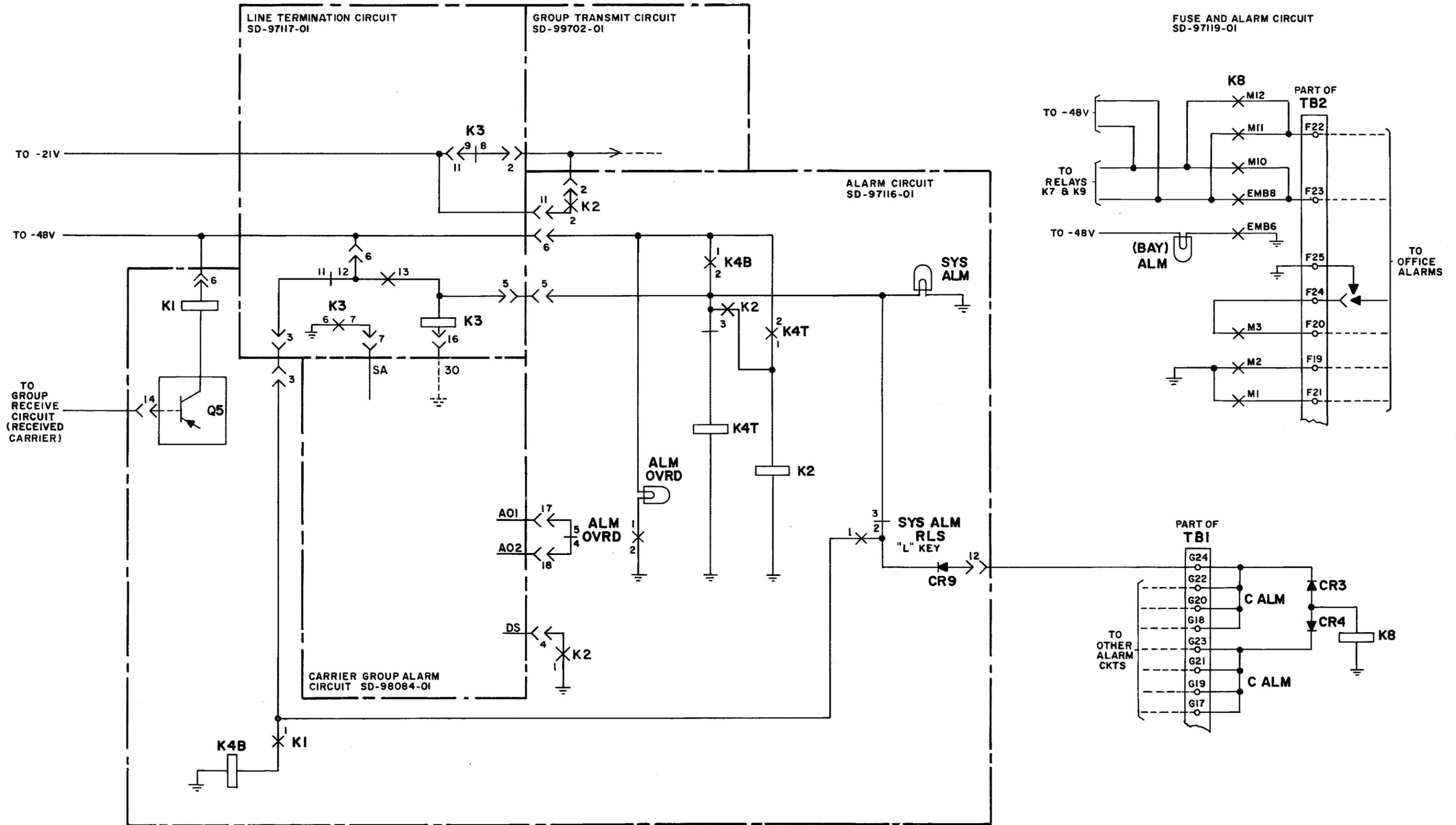


Fig. 4 - Relay Connections for Failure of Received Carrier

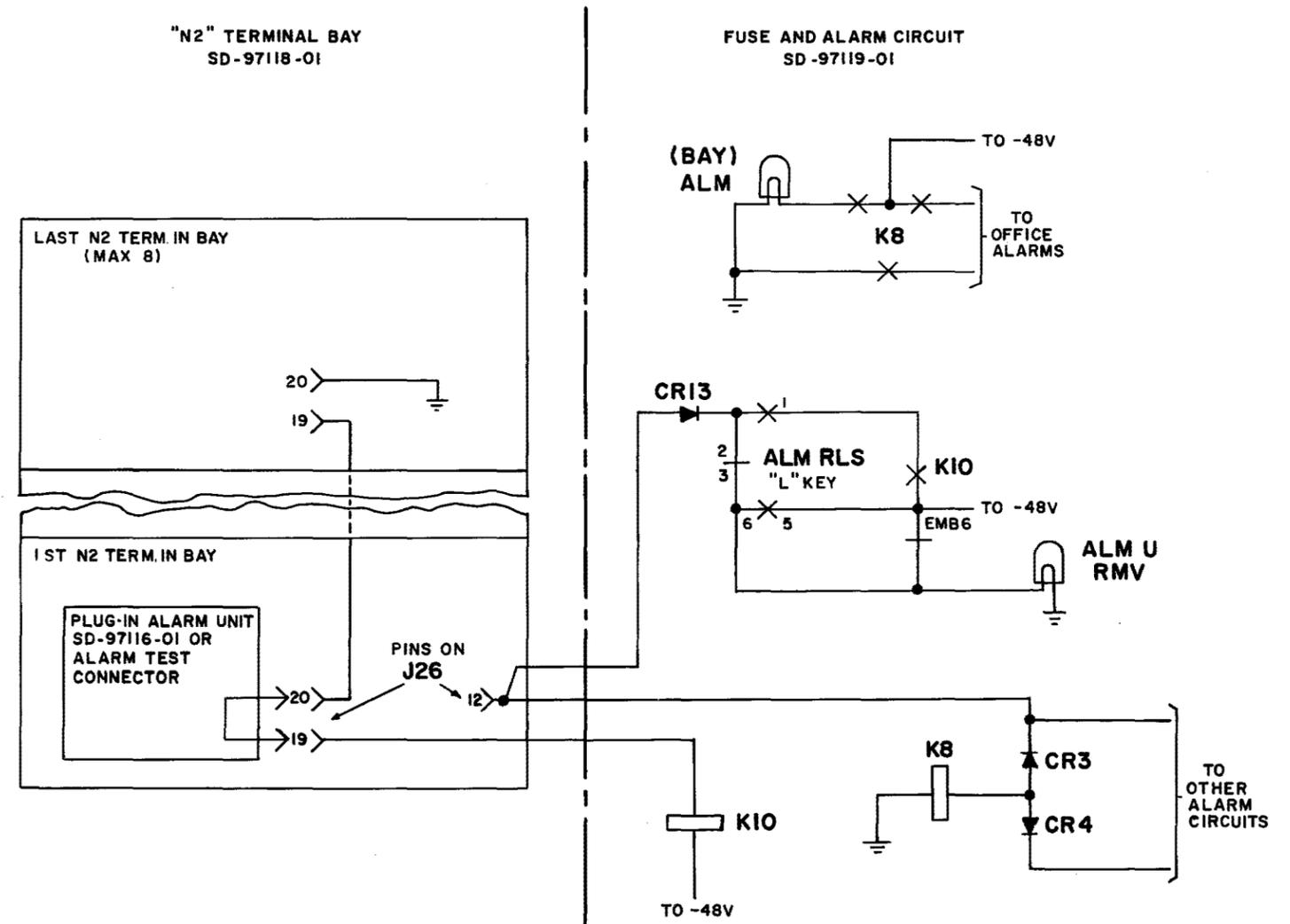


Fig. 5 - Relay Connections for Removal of Alarm Unit