

N3 CARRIER TELEPHONE SYSTEM
ALARM AND RESTORAL UNIT
J99300AK
DESCRIPTION

	PAGE		PAGE
1. GENERAL	1	B. Third Time-out	16
A. Description and Application	1	C. Final Release	16
B. Transmission Alarm Indications	3	5. REMOVAL OF ALARM AND RESTORAL UNIT	
C. Simplified Circuit Description	3	17
2. DESCRIPTION OF CIRCUIT OPERATION (LIST 1)	3	6. REFERENCE LIST	18
A. Carrier and Signaling Transmission Paths	3	1. GENERAL	
B. TC Relay Operation	4	A. Description and Application	
C. First Amplifier	9	1.01 This section describes the J99300AK alarm and restoral unit used in the N3 and N3-L Carrier Telephone Systems.	
D. Second Amplifier	9	1.02 This section is reissued to add information on alarm threshold options A and B and external signaling. Arrows normally used to indicate changes have been omitted. This reissue does not affect the Equipment Test List.	
E. Signal Rectifier	9	1.03 Three versions of the alarm and restoral unit, designated Lists 1, 2, and 3, have been manufactured. The units perform the same system functions, but are different internally. Descriptions, figures, and references in this section are identified by list number when the information applies only to that type of alarm and restoral unit. Lists 1 and 2 are manufacture discontinued.	
F. Initiating Relay Circuit	10	1.04 The alarm and restoral circuit is contained in a single plug-in unit with components mounted on a printed wiring board (Fig. 1). The unit is enclosed by a cast aluminum frame which has a SYS ALM lamp and RLS key mounted in	
G. Guard Circuit	10		
3. DESCRIPTION OF CIRCUIT OPERATION (LISTS 2 AND 3)	11		
A. Carrier Transmission Path	11		
B. Transmission Failure and Alarms	11		
C. Guard Circuit	12		
4. SEQUENCE OF RELAY OPERATIONS	12		
A. First and Second Time-outs	15		

NOTICE

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the faceplate. Connections to and from the unit are made through a 20-pin connector at the rear.

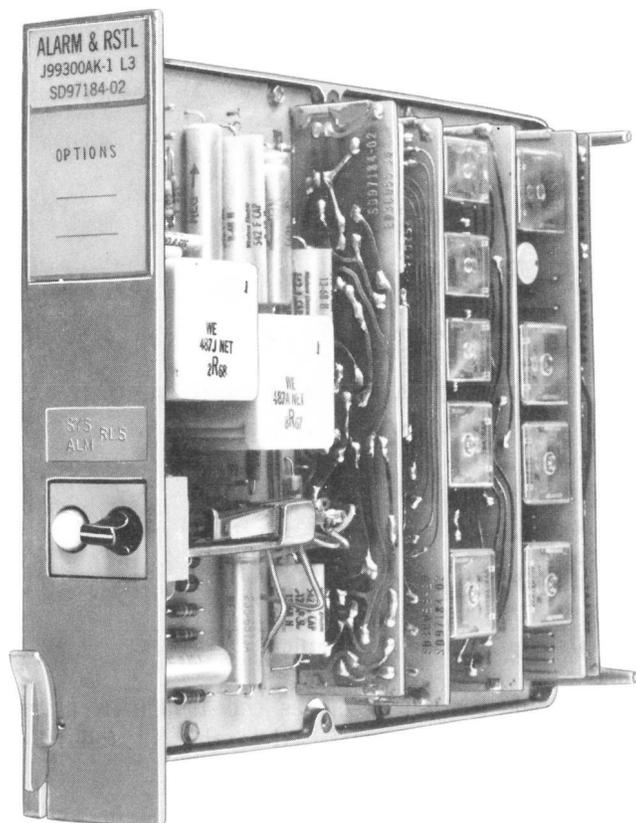


Fig. 1—Alarm and Restoral Unit J99300AK, List 3

1.05 The original scheme for transmission failure alarms in the N3 System was based on monitoring the total power of the received carriers. This scheme could not be applied to the N3-L System since spurious frequencies in the L facility may contain sufficient power to prevent registration of alarms when the N portion has failed. The N3-L System monitors the level of the frequency-correction carrier which is free of spurious frequencies. The concept of universally wired bays for N3 and N3-L Systems has required the use of the frequency-correction carrier for transmission alarms in later N3 Systems.

1.06 The change from total to single carrier monitoring has not required a modification of the alarm and restoral unit. The input signal is now provided by the frequency-correction unit, instead of the channel group modem, through a

change in the bay wiring. The difference in level is compensated for by using combinations of alarm threshold options A and B.

1.07 When a transmission failure is recognized, the alarm and restoral unit actuates office alarms and causes the associated internal or external trunk-release and make-busy circuits to remove the failed channels from service. The alarm unit continues to test until satisfactory transmission is restored and, at that time, enables the trunk-release circuit to return the channels to service. A time delay of two seconds is provided before alarms are registered or trunks are released to avoid removing circuits from service on hits. Signal-to-noise tests are conducted by the circuits in the alarm unit to prevent restoration of service to an N line before the repeaters stabilize at normal gain.

1.08 An alarm and restoral unit is normally provided for each 12-channel group in an N3 terminal, Type B N3-L Junction, or Type C N3-L Junction. The units at the two ends of a 12-channel group work together. When transmission fails in one direction, the alarm unit at the receiving end operates and interrupts the signal transmitted in the other direction for about ten seconds, forcing the far-end alarm unit to operate. The alarm units are then connected to opposite ends of two of the failed channels which are called test channels. The first test channel is used to test for satisfactory transmission of a 2600-Hz signal; the second, to synchronize restoration of service. Each alarm unit performs the same functions and together they automatically restore their 12-channel group to service.

1.09 An optional arrangement permits a single alarm and restoral unit at each end of a system to control the trunk-release and make-busy circuits for both 12-channel groups. This arrangement does not provide protection against failure of the frequency-correction unit and channel group modem associated with the group that has no alarm unit. Also, failure of these units in the monitored channel group will cause all 24 channels to be made busy to traffic even though 12 of the channels are still satisfactory. This arrangement, however, may be used for systems carrying message trunks. If this arrangement is used, the associated trunk-release and make-busy panels must be wired for single alarm unit operation and an ED-97245 alarm link unit (a dummy casting) must be inserted in the

vacant alarm unit position. The alarm link prevents the operation of the alarm unit removal alarm.

1.10 Another optional arrangement is the omission of the alarm and restoral unit for channel group 2 of the Type C N3-L junction. Since this is the portion of the junction providing interconnection of the L and N3 Systems, the trunk-release and make-busy functions do not apply. These functions and the normal transmission alarms are furnished by units at the two ends of the N3-L System. An alarm and restoral unit in channel group 2 of the Type C Junction provides an intermediate alarm when the N line fails in the N3 to L direction. An ED-97245 alarm link unit must be furnished to maintain continuity in the alarm unit removal circuit if the alarm and restoral plug-in is omitted.

B. Transmission Alarm Indications

1.11 Approximately two seconds after the carrier falls below the threshold level, the SYS ALM lamps on the alarm and restoral unit and in the MISC jack field light. At the same time, the MJN relay in the power, alarm, and miscellaneous panel operates to provide audible and visual office alarms. The failure is also indicated by the lighting of the ALM lamp on the miscellaneous panel. A few seconds later the FAIL REC lamp on the MISC jack field illuminates, indicating that the alarm circuit is fully operated and ready to start the restoral process. If transmission has failed in only one direction, the FAIL REC lamp will be extinguished in the office which is receiving a good signal and the REG ALM lamp will light.

1.12 Office alarms can be cut off by operating the RLS key on the front panel of the alarm and restoral unit. The release is indicated locally when the lamp on the alarm, power, and miscellaneous panel is extinguished. When transmission is restored, the SYS ALM and FAIL REC lamps will be extinguished and the office alarms will be operated again. These alarms can be released by returning the RLS key to its normal horizontal position.

C. Simplified Circuit Description

1.13 The following brief description of circuits in the alarm and restoral unit applies to the Lists 1, 2, and 3 units. A detailed description of each unit is presented later in this section.

1.14 The first amplifier is a carrier-frequency amplifier. The second amplifier also functions as a carrier-frequency amplifier except for the period when transmission tests are made on the first and second test channels. During this time, it is a VF amplifier.

1.15 The signal rectifier is connected to the output of the second amplifier and is used during normal carrier operation as well as during transmission tests. It rectifies the carriers or the VF test tone (and noise, if present) producing a positive dc voltage. This positive voltage is applied to the initiating relay circuit to hold relay CS released.

1.16 In the guard circuit, used in restoral tests, the noise received from the N line is amplified and rectified. This negative voltage is also applied to the initiating relay circuit, holding relay CS operated if the signal-to-noise ratio is unsatisfactory. If the signal-to-noise ratio is satisfactory, the relay releases. In this way, channel restoral is inhibited until transmission is accomplished with an acceptable noise level.

1.17 The timer operates approximately two seconds after the operation of the initiating relay. This 2-second delay (known as the first time-out) is a precautionary measure against carrier failures of short duration. Once operated, the timer causes operation of the relay control circuit which controls all alarm functions associated with a carrier fault. In addition to the 2-second delay, the timer provides two additional delays of ten seconds each. The first 10-second delay (second time-out) times the duration of the forced carrier failure toward the far end; the second (third time-out) times the duration of satisfactory signal-to-noise ratio on the first test channel. If a satisfactory signal-to-noise ratio exists on the first test channel for a period of at least ten seconds, a test tone is automatically applied to the second test channel. If the signal-to-noise ratio falls below an acceptable level during the third time-out, the timer is reset. Timing begins again when the signal-to-noise ratio is acceptable.

2. DESCRIPTION OF CIRCUIT OPERATION (LIST 1)

A. Carrier and Test-Tone Transmission Paths

2.01 The input carrier signal is connected to terminals 2 and 3 of plug P1 (Fig. 2) and

passes through transformer T1 and the first amplifier (transistors Q1.1 and Q1.2). At the junction of capacitor C7 and resistor R50, the path branches out in two directions. One is through resistor R50 and break contact 1 of relay DS to the second amplifier (transistors Q2.1 and Q2.2); the other is through make contact 6 of relay A to ground. The first path is employed during normal operation when carrier power is monitored and all relays are released. The second path, a signal shunt, is used after the received carrier power has dropped below the alarm threshold and the alarm has been registered. It shorts the output of the first carrier amplifier as a safeguard against interrupting the second time-out if a carrier signal should reappear during this 10-second interval.

2.02 During normal carrier operation, both test channel inputs are open. Upon operation of the alarm circuit, channels one and two of the failed channel group are connected to the alarm and restoral unit at each end. They are designated as test channels 1 and 2 until the restoral process is completed and they are returned to normal service. A 2600-Hz test tone is applied to the test channels during certain periods of the alarmed interval at a power of -20 dBm referred to a zero-system level point.

2.03 The test channels are connected one at a time to the input of the second amplifier. Relay M1 operates first, providing a path for channel 1 through make contact 3 (Fig. 2). Since relay DS has also been operated, the path continues through make contact 1 of this relay to the second amplifier. If the signal-to-noise test of the second time-out is satisfactory, relay M1 is released and relay M2 operates. A path for test-channel 2 is then formed through make contact 5 of relay M2 to make contact 1 of relay DS and the second amplifier.

2.04 From capacitor C9 (Fig. 2), the paths for carrier or test-tone transmission are almost identical. Both pass, though not simultaneously, through the second amplifier (transistors Q2.1 and Q2.2) and the signal rectifier circuit to the base of transistor Q3. Since resistors R25 and R26 are not required when carrier signals are being monitored, they are shunted by break contacts 5 and 6, respectively, of released relay DS. During an alarmed condition, when test tones are being monitored, resistors R25 and R26 are required. The shunts across them are removed by relay DS,

which is operated during the alarmed interval. Resistors R25 and R26 provide a predominantly resistive impedance for terminating one side of filter networks Z2 and Z3. This resistive build-out is necessary to obtain the desired rejection of the 2600-Hz signal for the guard circuit.

2.05 If noise is present on the carrier line when the 2600-Hz test tone is being transmitted on either test channel, the noise passes through the second amplifier with the test tone. From the collector of transistor Q2.2, it passes through make contact 5 of relay DS and resistor R29 to filter networks Z2 and Z3. These networks block 2600 Hz, but pass other frequencies (noise) through the guard circuit amplifier, transistor Q4, and the rectifier to supply a negative voltage to the base of transistor Q3. The rectified test-tone (2.15) provides a positive bias on Q3. The relative magnitude of these voltages is a measure of the signal-to-noise ratio of the failed system.

B. TC Relay Operation

2.06 During normal carrier operation, the TC relays are released and their break contacts complete the speech path between the compressor output and channel modulator input for channels 1 and 2 at the transmitting end and between the channel demodulator output and expander input for channels 1 and 2 at the receiving end (Fig. 3).

2.07 During a carrier failure, the TC relays of the failed 12-channel group are activated by make contact 6 of relay DS1 of the alarm and restoral unit associated with the same group (Fig. 3). The break contacts of these relays open and disconnect the speech path at both the transmitting and receiving ends for channels 1 and 2. The make contacts of the TC relays associated with test channel 1 close at the transmitting end and connect the 2600-Hz restoral oscillator to the channel modulator input. The make contacts of the TC relays associated with test channel 2 also close, but the 2600-Hz test tone is not applied to the channel until relay M2 operates. The tone is then connected through make contact 2 to the modulator input of test channel 2.

2.08 At the receiving end, the make contacts of the TC relays associated with test channels 1 and 2 close and connect the outputs of the channel demodulators of channels 1 and 2 to the alarm and restoral unit. Test channel 1 is connected

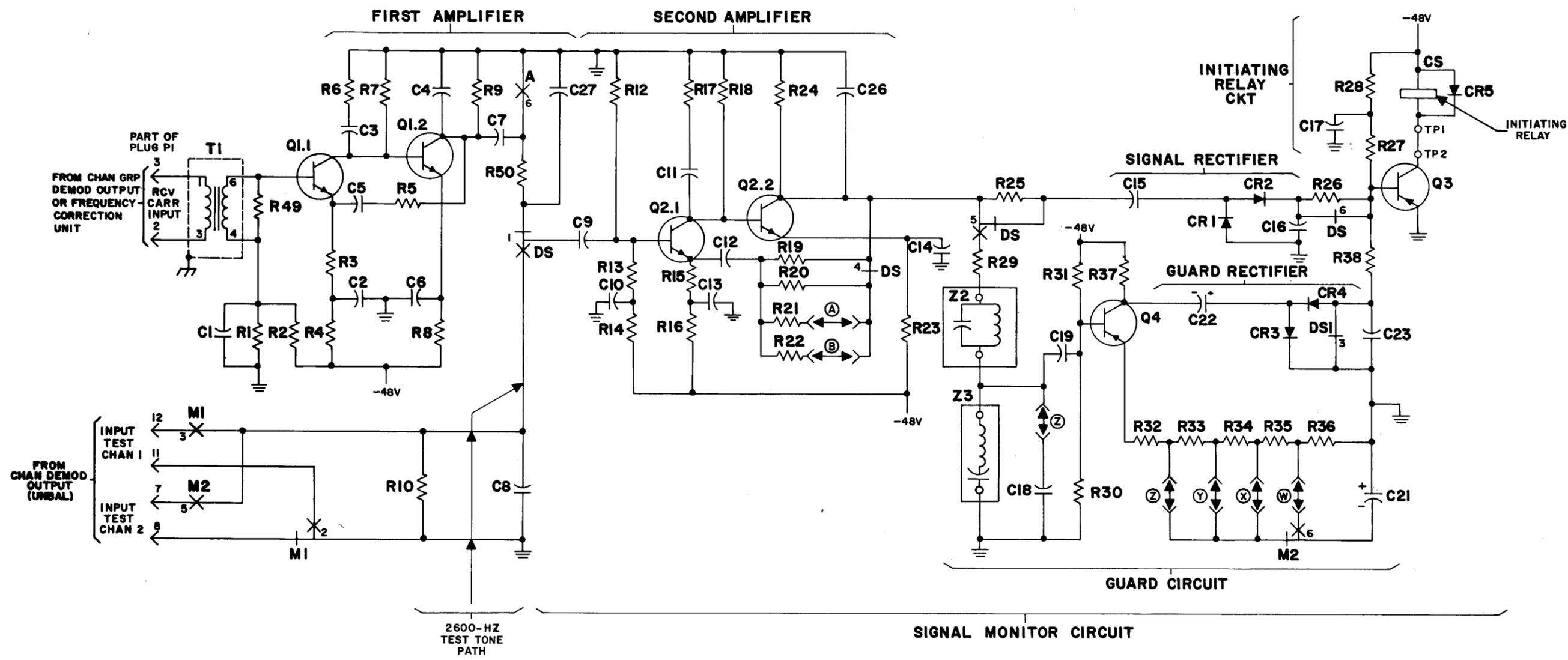


Fig. 2—N3 Alarm and Restoral Circuit J99300AK, List 1

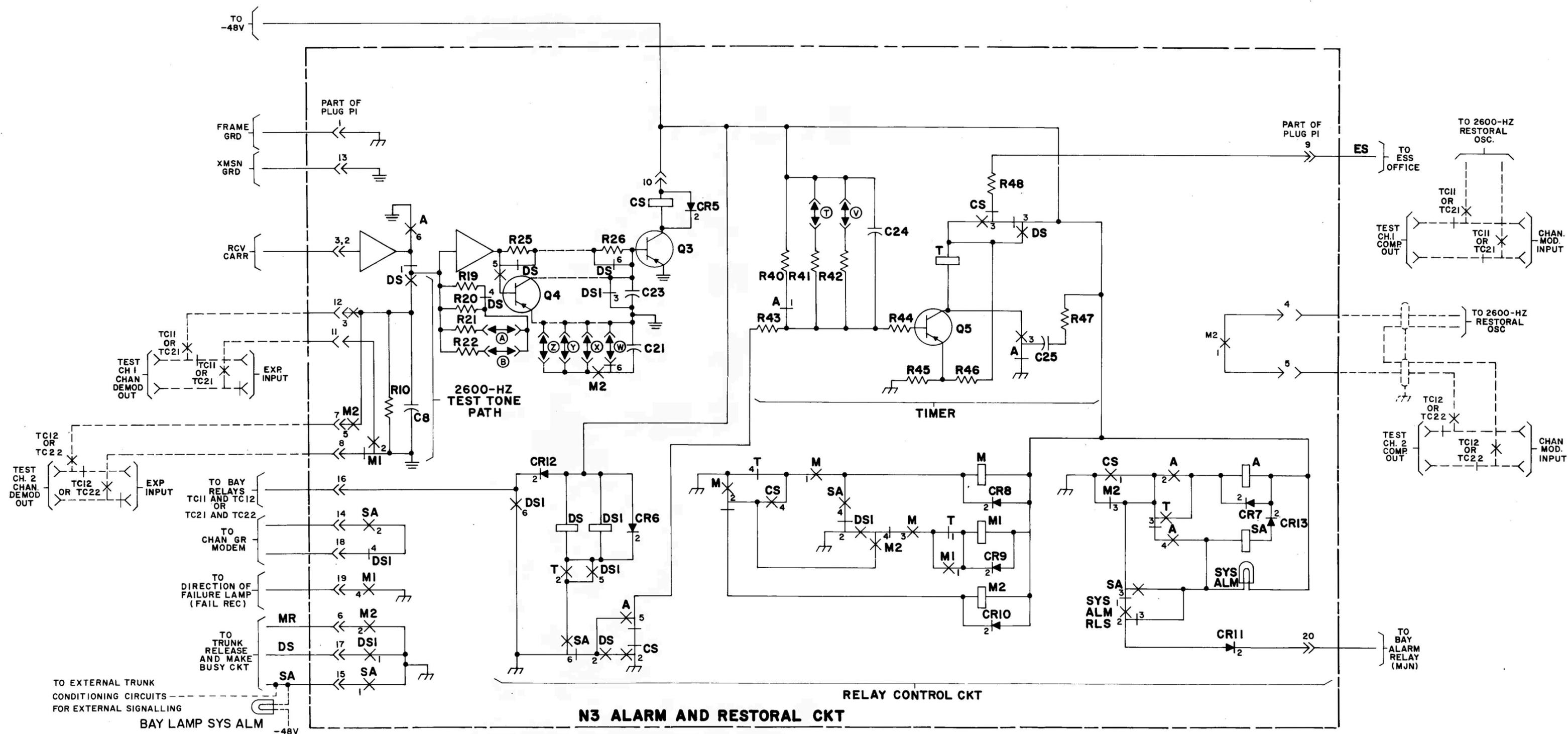


Fig. 3—Relay Connections for Failure of Received Carrier and Restoral (J99300AK, List 1)

through pins 11 and 12 of plug 1 on the alarm unit and test channel 2 through pins 7 and 8.

2.09 Relay TC11 provides connections for test channel 1 of channel group 1 and relay TC12 provides connections for test channel 2 of group 1. Relays TC21 and TC22 are associated with test channels 1 and 2, respectively, of channel group 2. The same relay is used for both directions of transmission at one end of a test channel. The TC relays are mounted on the bay framework at the rear of the channel modems for channels 1 and 2.

C. First Amplifier

2.10 The first amplifier (Fig. 2) has an overall voltage gain of approximately 16 dB and a nominal 29 dB of negative feedback. Since frequencies below carrier frequencies need not be passed through this amplifier, the low-frequency response drops off below approximately 100 kHz. This low-frequency response is controlled by capacitors C2, C5, and C6.

2.11 Resistor R50 and capacitor C27 form a low-pass filter and limit the bandwidth through the two 2-stage amplifiers when they are connected in tandem during the nonalarmed condition. This reduces the possibility of high-frequency instability which may arise because of various parasitic paths.

D. Second Amplifier

2.12 The second amplifier (transistors Q2.1 and Q2.2) is similar to the first amplifier but has a much broader frequency response since it must amplify the 2600-Hz test tone and low-frequency noise as well as carrier frequencies. Also, a 6-dB higher gain is required of this amplifier when it is amplifying the 2600-Hz test tone than when it is amplifying carrier frequencies. This is accomplished by break contact 4 of relay DS which parallels two resistors R19 and R20 in the feedback loop circuit when the relay is released, and disconnects resistor R20 from the feedback loop circuit when the relay is operated.

2.13 Under normal, nonalarmed conditions, the received carrier is amplified, the DS relay is released, and the alarm threshold is approximately 18 dB below the nominal received carrier level. This threshold may be adjusted by the use of the

A and/or B options (R21 and R22). Table A shows how much the received carrier power must decrease from normal for each option to initiate an alarm. The use of A and/or B options is not recommended on repeatered line systems, as the system may realarm following restoral due to line gain transients.

TABLE A
ALARM THRESHOLD USING OPTIONS A AND B

OPTION	DECREASE IN RECEIVED CARRIER REQUIRED TO ACTIVATE ALARM
	dB
None	18
A	12
B	9
A and B	6

2.14 When the total carrier power is monitored for alarm purposes, the A and/or B options are not normally required. However, in N3-L Systems and later N3 Systems where the frequency-correction carrier is monitored, the threshold must be adjusted on the basis of the actual received level of this carrier, and option A and/or B may be required.

2.15 When the second amplifier is connected to the test-tone path, its input circuit is shunted by capacitor C8 (Fig. 2). The impedance of this capacitor is approximately 600 ohms at 1000 Hz. However, since its impedance decreases with increasing frequency, it causes the 2600-Hz test tone to be reduced approximately 5 dB below what it would be if the impedance at that point were a constant 600 ohms.

E. Signal Rectifier

2.16 The signal rectifier is composed of diodes CR1 and CR2 and capacitors C15 and C16. It rectifies the carrier or the 2600-Hz signals and produces a positive dc voltage for biasing transistor Q3. Resistors R25 and R26 are part of the circuit only when 2600-Hz signals are being rectified.

F. Initiating Relay Circuit

2.17 The initiating relay circuit consists mainly of switching transistor Q3 and relay CS. When the received carrier or test tone (without excessive noise) is present, relay CS is released; when the carrier is absent or the tone is accompanied by abnormal noise, the relay is operated.

2.18 Normally, the negative bias applied to transistor Q3 by resistors R27 and R28 is sufficient to switch on transistor Q3 and operate relay CS. However, when the received carrier or the 2600-Hz test tone is present, the signal rectifier produces a positive dc voltage sufficient to overcome the negative base bias of transistor Q3 which holds relay CS released. When a carrier fault occurs or the 2600-Hz test tone is removed, the positive voltage from the rectifier becomes insufficient to override the negative bias, and transistor Q3 switches on and operates relay CS.

2.19 Diode CR5 minimizes the inductive release transient of relay CS. Capacitor C17 is a bypass capacitor. Its use is explained in paragraph 5.04.

G. Guard Circuit

2.20 Line repeaters regulate on total carrier power and maintain a fairly constant output as long as carrier signals are present at their inputs. In the absence of carrier signals caused by a fault in the repeatered line, the repeaters near the fault regulate to maximum gain and those away from the fault regulate to higher than normal gain. Consequently, the line noise and crosstalk are amplified by each repeater following the fault until the total noise and crosstalk power is the same value as the normal carrier signal output power. This high noise condition persists for some minutes after the line fault has been repaired. The noise plays an important part in withholding service restoral during these intervals.

2.21 The guard circuit is only used when the 2600-Hz test tone is being monitored on either of the two test channels. Its purpose is to prevent restoral when the signal-to-noise ratio is inadequate for satisfactory channel performance.

2.22 After amplification by the second amplifier, the 2600-Hz test tone and the noise follow two paths. In the signal rectifier, a positive dc

voltage is produced and applied to the base of transistor Q3. In the guard circuit, the 2600-Hz tone is suppressed in networks Z2 and Z3 and noise alone is amplified and rectified to produce a negative dc voltage, which is applied to the base of transistor Q3 via resistor R38. If the rectified noise is low compared to the rectified 2600-Hz test tone, the output voltage from the signal rectifier will predominate and release relay CS. If the rectified noise is high compared to the rectified 2600-Hz test tone, then the output voltage from the guard rectifier will predominate and hold relay CS operated.

2.23 For a given amount of noise, the amplitude of the output voltage from the guard rectifier depends upon the gain of the guard amplifier. If the gain of the guard amplifier is increased, the output voltage from the guard rectifier is increased.

2.24 Adjustment of gain is accomplished by changing the local feedback in the guard amplifier. Bypass capacitor C21 is connected to various points in the emitter circuit through the use of the X, Y, Z, or W option. The X, Y, or Z option is used only with the first test channel. The highest signal-to-noise ratio in the carrier system channels at restoral is obtained through the use of option Z. The X option provides a lower ratio, and the Y option, an intermediate ratio. The W option, providing the least signal-to-noise ratio, is always employed with the second test channel. The function of this test channel is not to test transmission but to convey the information to the receiving terminal that transmission to the far terminal on test channel 1 is satisfactory. Break and make contacts 6 of relay M2 change the guard amplifier gain from the value for the first test channel to that for the second test channel by removing options X, Y, or Z and connecting option W.

2.25 The signal-to-guard ratio is defined by the amount of noise that will release relay CS when mixed with the 2600-Hz test tone. For example, the 2600-Hz test tone nominally received at the output of the test channel demodulator is -15 dBm; if the release of relay CS occurs when the noise is -35 dBm at the same point, the signal-to-guard ratio is 20 dB. This is the case when option Y is selected.

2.26 The test channel 1 signal-to-guard ratio and the approximate idle circuit noise in all

channels of the channel group at restoral are listed for each option in Table B.

TABLE B
TEST CHANNEL NOISE AT RESTORAL

OPTION	SIGNAL-TO-GUARD RATIO	NOISE AT EXPANDOR OUTPUT
	dB	dBrn0
Z	25	25
Y	20	31
X	15	37
W*	12	—

* Applies to List 1 only.

2.27 Since the Y option will be most extensively used, it is a factory provision. The Z option is to be used only for very quiet systems, whereas the X option is primarily used for noisy systems.

3. DESCRIPTION OF CIRCUIT OPERATION (LISTS 2 AND 3)

A. Carrier Transmission Path

3.01 The first amplifier consists of two transistors and associated components mounted on a printed wiring board. This circuit amplifies the carrier-frequency signal received during normal transmission conditions. Operation of the A relay approximately two seconds after a transmission failure shorts the output of the first amplifier through make contact 4 (Fig. 4). After continuity is restored and the signal-to-noise ratio is satisfactory, the short will be removed.

3.02 The second amplifier performs two functions, a second stage of amplification for the received carrier during normal conditions and amplification of 2600-Hz test tones and low-frequency noise during alarmed conditions. Break contact 6 of the DS relay connects the output of the first amplifier when transmission is good, and the make contact 6 provides a test-tone input after a failure occurs.

3.03 Options A and B provide adjustment of the second amplifier gain by connection of resistors R21 and R22 in parallel with the normal

feedback path through resistors R19 and R20. Although these options were a part of the original design, they were not generally used until the alarm scheme was changed from monitoring the total received carrier power to monitoring the level of the frequency-correction carrier. Since the new scheme decreases the nominal input to the alarm and restoral unit, it may be necessary to employ options A and/or B to set the proper threshold level for the initiation of alarms.

3.04 During transmission failures, break contact 5 of the DS1 relay removes resistor R20 and optional resistors R21 and R22 from the feedback path. In this configuration, the gain is increased for amplification of the 2600-Hz test tone and low-frequency noise.

3.05 The output of the second amplifier is connected to a voltage-doubler rectifier consisting of capacitors C15 and C16 and diodes CR1 and CR2. The positive potential on C16 overcomes the negative fixed bias on the base of Q3, thus keeping the transistor shut off as long as a good carrier signal is received.

B. Transmission Failure and Alarms

3.06 When the carrier input is faulted, the positive voltage from the rectifier decreases and Q3 starts to conduct (Fig. 4). The collector current operates the CS relay, thereby providing an initial alarm to an associated ESS office by removing voltage from the ES lead. The operated CS relay also disconnects capacitor C24 from 48 volts normally connected through R43 and make contact 3. The capacitor discharges through parallel resistors R40 and R41 or R42. Options T and V are provided for the shop to strap these resistors so that the discharge of C24 and bias change on Q6 will cause the transistor to conduct two seconds after the carrier fails. This 2-second delay is known as the first time-out.

3.07 Conduction through Q6 causes Q5 to conduct, operating the T relay. Make contact 4 of the T relay provides an operating path for the A relay, which locks through its own make contacts 3. Until this point, restoral of the carrier will return the transistors and relays to their normal conditions and no alarm will be registered. However, when the A relay operates and locks, the alarm sequence must be completed.

3.08 Operation of the A relay provides another path through R51 to charge timing capacitor C24. This low resistance allows C24 to cut off Q6 quickly, thereby releasing the T relay. Make contact 4 of the T relay and operated contacts of the CS and A relays then form a path to ground to energize the SA relay. Office alarms are actuated at this time through the MJN relay and transmission towards the distant office is faulted by shorting the input of the channel group modem through make contact 2 of the SA relay. Interruption of transmission initiates an alarm in the distant office if the failure was only in one direction. Office alarms can be cut off by operating the SYS ALM RLS key which removes ground from the MJN relay.

3.09 When the SA relay is energized, one side of CR12 is grounded and current flows through the diode and pin 16 to energize the appropriate TC relay (Fig. 4). Operation of the TC relay opens the voice path between the compandors and channel modems on channels 1 and 2 of the failed system. At the same time 2600 Hz is applied to the input of the channel 1 modulator from the restoral oscillator. This signal will be transmitted towards the distant end approximately ten seconds later when the DS1 relay is operated, thereby removing the short from the input of the channel group modem. The level of the 2600-Hz signal is -20 dBm referred to a zero-test level point.

3.10 If continuity exists or is restored, the 2600-Hz signal transmitted by the distant end is applied from the channel demodulator through the TC relay contacts to the input of the second amplifier. The amplified signal is rectified in the same manner as the carrier under normal transmission conditions to create a positive bias voltage on the base of Q3.

3.11 Relay TC11 provides connections for test channel 1 and relay TC12 provides connections for test channel 2 of group 1. Relays TC21 and TC22 are associated with test channels 1 and 2, respectively, of channel group 2. The same relay is used for both directions of transmission at one end of a channel. The TC relays are mounted on the bay framework at the rear of the channel modems for channels 1 and 2.

C. Guard Circuit

3.12 The 2600-Hz test signal is also applied to a filter composed of networks Z2 and Z3 through make contact 6 of the DS1 relay (Fig. 4). This filter rejects 2600 Hz, but passes low-frequency noise received with the test tone from the N repeatered line. The noise is amplified by Q4, rectified by CR3 and CR4, and appears as a negative bias voltage on the base of Q3. When the positive bias created by the 2600-Hz tone is great enough to overcome the negative fixed bias and the negative noise potential, Q3 will be cut off and the CS relay will be released. At this point, the signal-to-noise ratio is satisfactory for restoring the system to service, and the restoral process is initiated by the release of the CS relay. This is designated as the start of the third time-out and is described under the sequence of relay operations (see paragraph 4.02).

3.13 Options X, Y, and Z provide adjustment of the signal-to-guard noise ratio at which restoral will begin by altering the gain of transistor Q4 and therefore, the amount of negative bias on Q3 for a particular noise level. The option is selected to restore service at the highest ratio consistent with the intrinsic noise level of the particular system. Table B lists the signal-to-guard ratios and approximate idle circuit noise for each option. Option Y is designed for the most general application and is provided by the factory. Option X is used in systems with above average noise and option Z in exceptionally quiet systems.

3.14 When the second test channel is connected to the alarm and restoral unit by the operation of the M2 relay and the TC relays, make contact 6 of the M2 increases the gain of Q4 above any of the optional settings. This ensures that the exchange of tones over this channel will release the CS relay so restoral of service will proceed.

4. SEQUENCE OF RELAY OPERATIONS

4.01 The functions and operational sequence of the relays in the J99300AK, Lists 1, 2, and 3, alarm and restoral units are basically the same although the individual contacts and electrical paths differ. The following sequential description and associated timing diagrams (Fig. 4, 5, and 6) apply to both units unless otherwise noted.

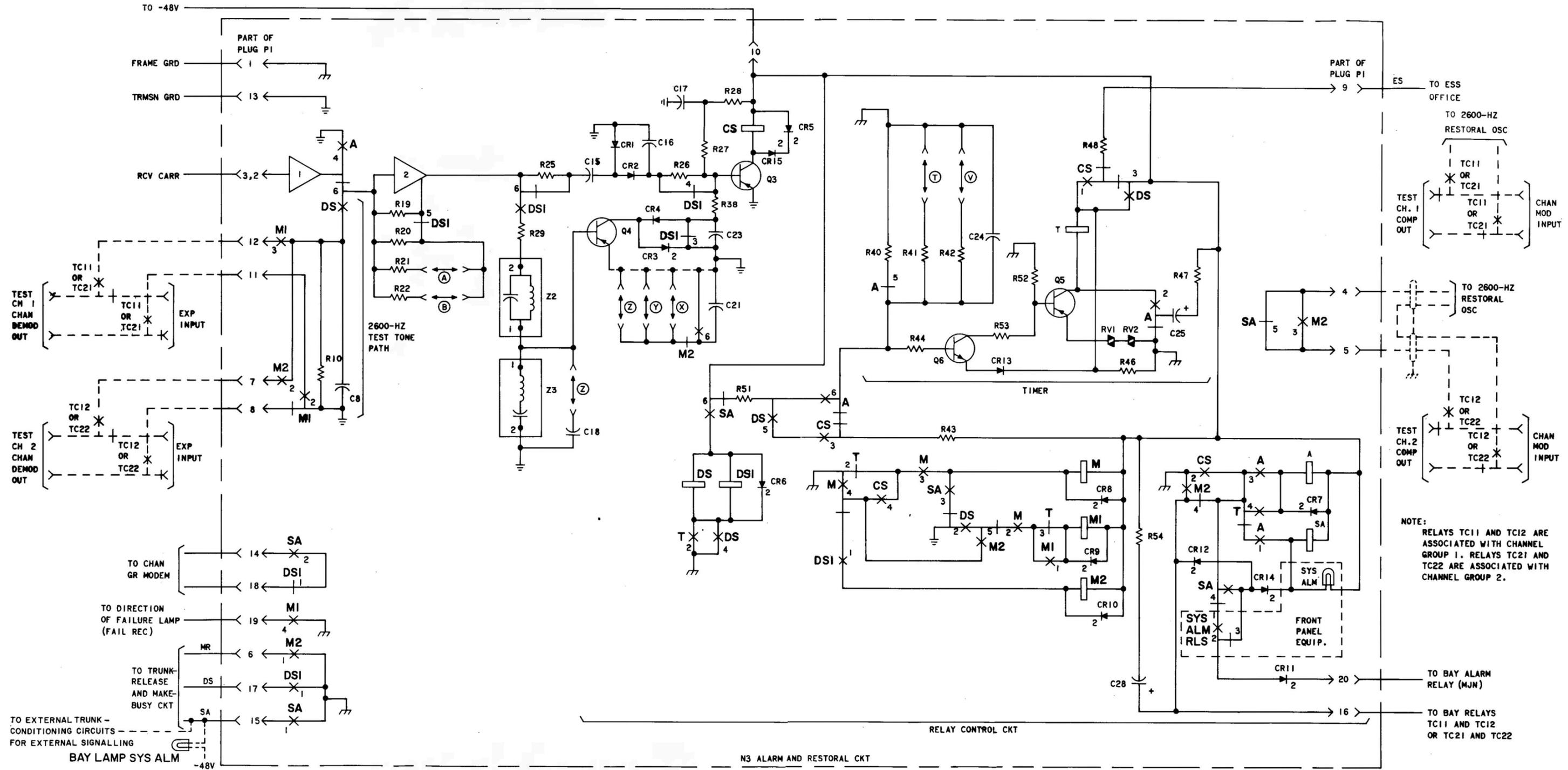


Fig. 4—Relay Connections for Failure of Received Carrier and Restoral (J99300AK, List 2 and 3)

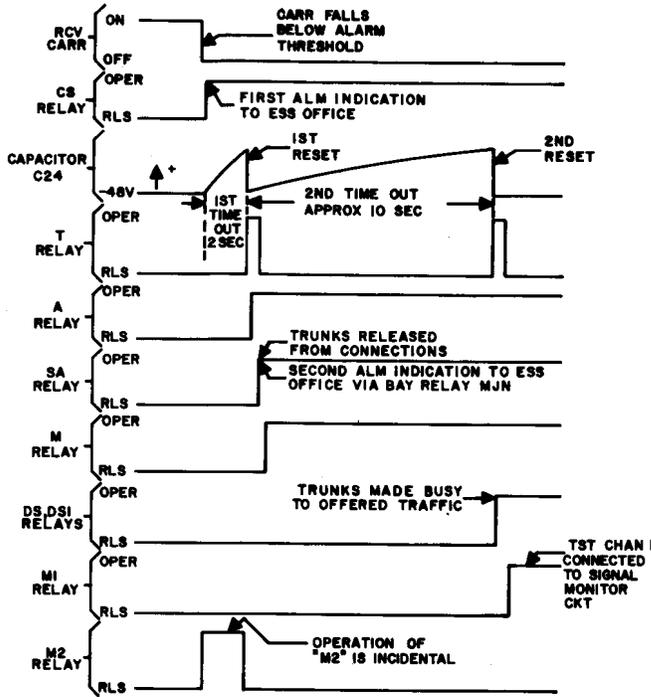


Fig. 5—Sequential Operation of Relays for First and Second Time-outs

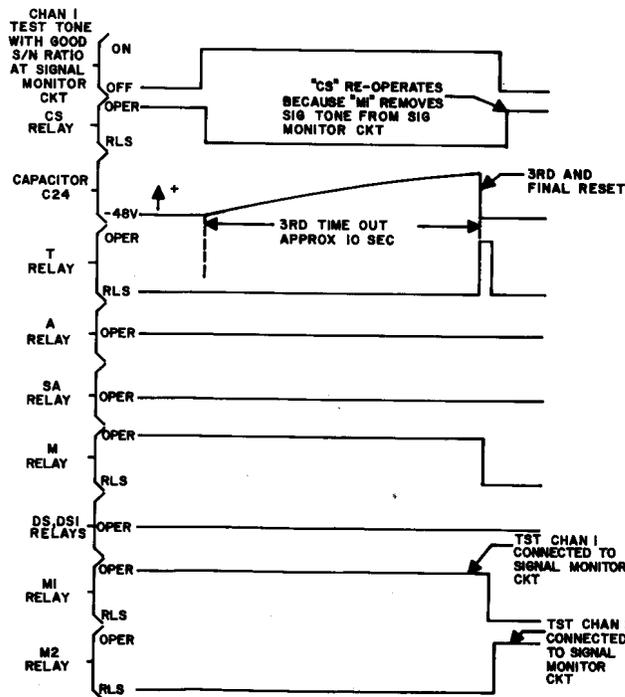


Fig. 6—Sequential Operation of Relays for Third Time-out

4.02 The alarm unit relays are normally released. During a transmission failure, successive operations occur with periodic delays called time-outs.

A. First and Second Time-outs (Fig. 5)

- (1) Relay CS is operated for the first time when received carrier power drops below the alarm threshold.
- (2) Operated relay CS starts the timer, beginning the first time-out (2-second delay) and gives the first failure indication to an electronic switching system (ESS) office by removing -48 volts from lead ES.

(3) At the end of the first time-out, relay T is operated for the first time by timing capacitor C24 and, in turn, operates relay A.

- (4) Operated relay A:
 - (a) resets the timer circuit,
 - (b) releases relay T,
 - (c) shunts the first amplifier output to ground.

(5) Released relay T operates relay SA.

- (6) Operated relay SA:
 - (a) initiates the second time-out (10-second delay),
 - (b) operates relay M,
 - (c) applies ground to lead SA, starts the trunk-release function of the associated trunk-release and make-busy circuits (or activates external trunk-conditioning circuits), and lights lamp SYS ALM on the miscellaneous jack, key, and lamp panel,

(d) shorts the transmitting input leads of the associated channel group modulator to force a carrier failure at the distant terminal,

(e) operates bay alarm relay MJN on the alarm, power, and miscellaneous panel.

Note: The office alarms can be silenced by manually operating key SYS ALM RLS on the alarm unit.

SECTION 362-908-100

- (f) operates bay relays TC which disconnect the compandors from the two test channels (Lists 2 and 3).
 - (7) At the end of the second time-out, relay T is operated for the second time by timing capacitor C24.
 - (8) Operated relay T operates parallel relays DS and DS1.
 - (9) Operated relays DS and DS1:
 - (a) start the trunk make-busy function of the trunk-release and make-busy circuit by applying ground to lead DS,
 - (b) operate bay relays TC which disconnect the compandors from the two test channels (List 1),
 - (c) reset the timer the second time,
 - (d) release relay T for the second time,
 - (e) remove the short on the associated channel group modem,
 - (f) disconnect the second amplifier input from the first amplifier and connect it to the 2600-Hz test tone path,
 - (g) connect the guard circuit to the second amplifier output.
 - (10) Released relay T operates relay M1.
 - (11) Operated relay M1:
 - (a) connects the first test channel to the signal monitor circuit,
 - (b) lights external lamp FAIL REC on the miscellaneous jack, key, and lamp panel.
- B. Third Time-Out (Fig. 6)**
- (12) Relay CS is released for the first time by the 2600-Hz test tone when the signal-to-guard noise ratio is satisfactory.
 - (13) Released relay CS starts the timer again and the third time-out begins (10-second delay).
 - (14) At the end of the third time-out, relay T is operated for the third time by timing capacitor C24.
 - (15) Operated relay T releases relay M.
 - (16) Released relay M releases relay M1.
 - (17) Released relay M1 disconnects the first test channel from the signal monitor circuit and relay CS operates for the second time.
 - (18) Operated relay CS:
 - (a) initiates the final timer reset,
 - (b) releases relay T for the last time.
 - (19) Released relay T operates relay M2.
 - (20) Operated relay M2:
 - (a) connects the second test channel to the signal monitor circuit,
 - (b) applies test tone on test channel 2 via bay relays TC.
- C. Final Release (Fig. 7)**
- (21) Relay CS is released for the last time when the 2600-Hz tone is received from the far end of the system on test channel 2.
 - (22) Released relay CS releases relays A and SA.
 - (23) Released relay SA releases relays DS and DS1 and removes ground from the SA lead to the external trunk-conditioning circuit, causing restoral of the channel group to service.
 - (24) Released relay DS1 releases relay M2 and removes ground from lead DS to the trunk release and make-busy circuit.
 - (25) The released bay relays TC and released relay M2 disconnect the second test channel from the signal monitor circuit and complete the restoral.
 - (26) With all relays released, the trunk processing is ended.

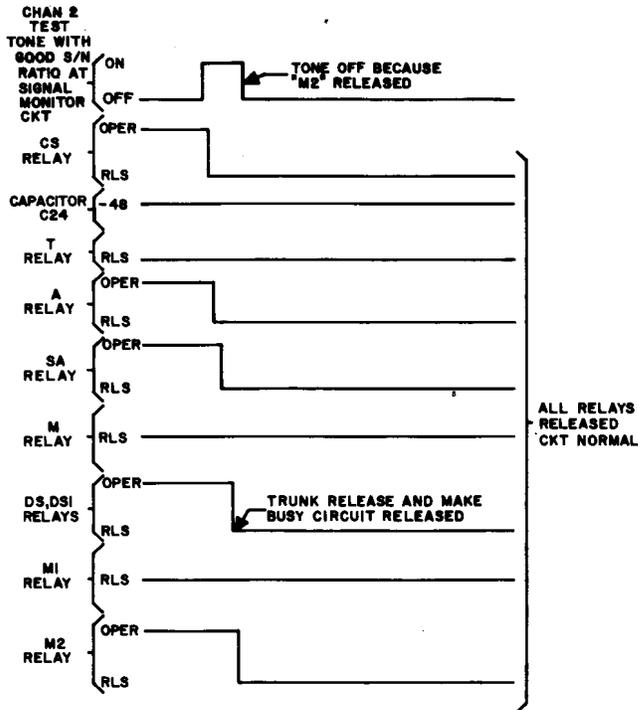


Fig. 7—Sequential Operation of Relays for Final Release

5. REMOVAL OF ALARM AND RESTORAL UNIT

5.01 When the alarm and restoral unit is in its position in the N3 terminal or N3-L junction, the metal frame of the alarm presses against a limit switch located on the terminal framework to hold the removal alarm relay RA operated on the alarm, power, and miscellaneous panel at the top of the bay (Fig. 8). The purpose of the limit switch is to release the RA relay when the alarm and restoral unit is removed from the terminal. When released, relay RA lights lamp RMV ALM on the miscellaneous jack, key, and lamp panel and operates relay MN via relay TFL on the alarm, power, and miscellaneous panel. Key RMV ALM RLS on the miscellaneous jack, key, and lamp panel is used to release relay MN which silences the office alarms and extinguishes lamp ALM. Lamp RMV ALM remains lighted when key RMV ALM RLS is operated. When the alarm and restoral unit is returned to the terminal, lamp RMV ALM is extinguished, lamp ALM is relighted, and the office alarms are reoperated. The office alarms are silenced and lamp ALM is extinguished by the use of key RMV ALM RLS.

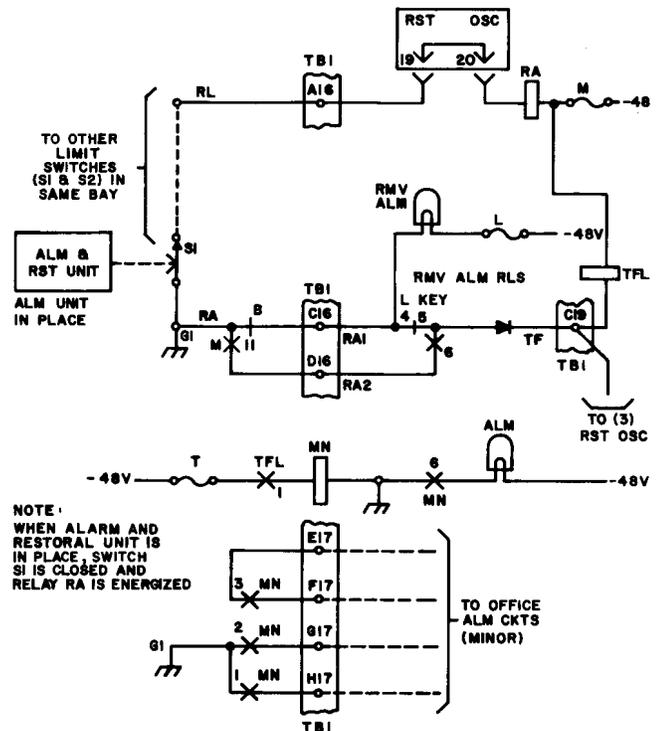


Fig. 8—Alarming Circuit for Removal of Alarm and Restoral Unit

5.02 During normal operation, service is not disrupted when an alarm and restoral unit is removed from the terminal; however, carrier alarm functions are lost and the carrier failure and trunk-release and make-busy circuits will not function until the alarm and restoral unit is replaced. The alarm and restoral unit, therefore, should be removed only when absolutely necessary.

5.03 During a carrier failure, the alarm and restoral unit should **not** be removed from the terminal. In the event such action is inadvertently made, trunk processing at that terminal will be removed and the failed channels will be offered to traffic. If restoration of the system does not occur after troubles are cleared and manual transmission tests between VF patch jacks (on channels other than 1 and 2) indicate transmission is satisfactory, manual restoration may be accomplished by removing alarm units at both ends of the system.

5.04 If an alarm and restoral unit is removed from a working terminal, it should not be reinserted for at least five seconds to prevent relay CS from operating and initiating the alarm sequence.

SECTION 362-908-100

Capacitor C17 and break contact 3 of relay DS1 suppress any transients that tend to develop when the alarm unit is inserted in the terminal (Fig. 2 and 3).

6. REFERENCE LIST

6.01 The following schematic drawings (not attached) are listed for reference:

NUMBER	SUBJECT
SD-97184-01	N3 Carrier Telephone Alarm and Restoral Circuit (J99300AK, List 1)

SD-97184-02 N3 Carrier Telephone Alarm and Restoral Circuit (J99300AK, List 2 or 3)

6.02 The following connecting circuits (not attached) are applicable to this section:

NUMBER	SUBJECT
SD-97185-01	N3 Carrier Telephone Terminal Bay Circuit (Shop Wired)
SD-97188-01	N3 Carrier Telephone Packaged Bay Application Schematic