TYPE N2 CARRIER SYSTEM
CARRIER GROUP ALARM AND E-SIGNALING
CONNECTING PANEL FOR PACKAGED N2 TERMINALS
DESCRIPTION

CONTENTS PAGE

1. GENERAL

1.01 This section describes the physical and functional characteristics of the J99285P carrier group alarm and E-signaling connecting panel (CGA) associated with each N2 terminal in packaged N2 terminal frames. The CGA, in conjunction with an associated alarm and restoral unit in the packaged N2 terminal, automatically detects failure of the N2 system received carriers and removes the system and associated trunks from service. When the trouble conditions have been cleared, the CGA and alarm and restoral unit automatically return the terminal to service.

1.02 The CGA also provides E-signaling connectors for each of the 12 channels of the N2 terminal and spare connectors for use in cases where auxiliary E-signaling units are required. The CGA also registers the number of carrier failures that occur in the transmitting direction toward the far terminal.

1.03 Whenever the carrier is interrupted for more than a predetermined time (to distinguish between momentary service interruptions and true carrier failure), the CGA circuit performs the necessary switching to remove any established trunk connections, to stop service charges, and to make the trunks busy to prevent seizure by incoming calls. This trunk conditioning is not removed until the trouble condition is cleared. The CGA circuit also introduces a short delay in returning the trunks to service after the fault is cleared to permit the N2 line repeaters to return to normal operation.

1.04 The carrier group alarm arrangement for a packaged frame is compatible with older carrier group alarm arrangements which may be installed at the other end of the system.

2. EQUIPMENT DESCRIPTION

2.01 The carrier group alarm and E-signaling connecting panels (see Fig. 1) are mounted between the top and bottom E-signaling shelves on the rear of a packaged N2 terminal frame. The panel has a 2-inch mounting strip at the front which contains 13 wire-spring relays and a message register. The rear of the panel is made up of a 6-inch terminal strip. The relay strip at the front of the panel and the terminal strip at the rear are held together by brackets to form a shop-wired assembly. The terminal strip is hinged to provide access to the relay and register terminals and to the inner surface of the terminal strip.

2.02 The carrier group alarm terminal strip is divided into 12 channel blocks, 3 spare blocks and a miscellaneous block. The channel

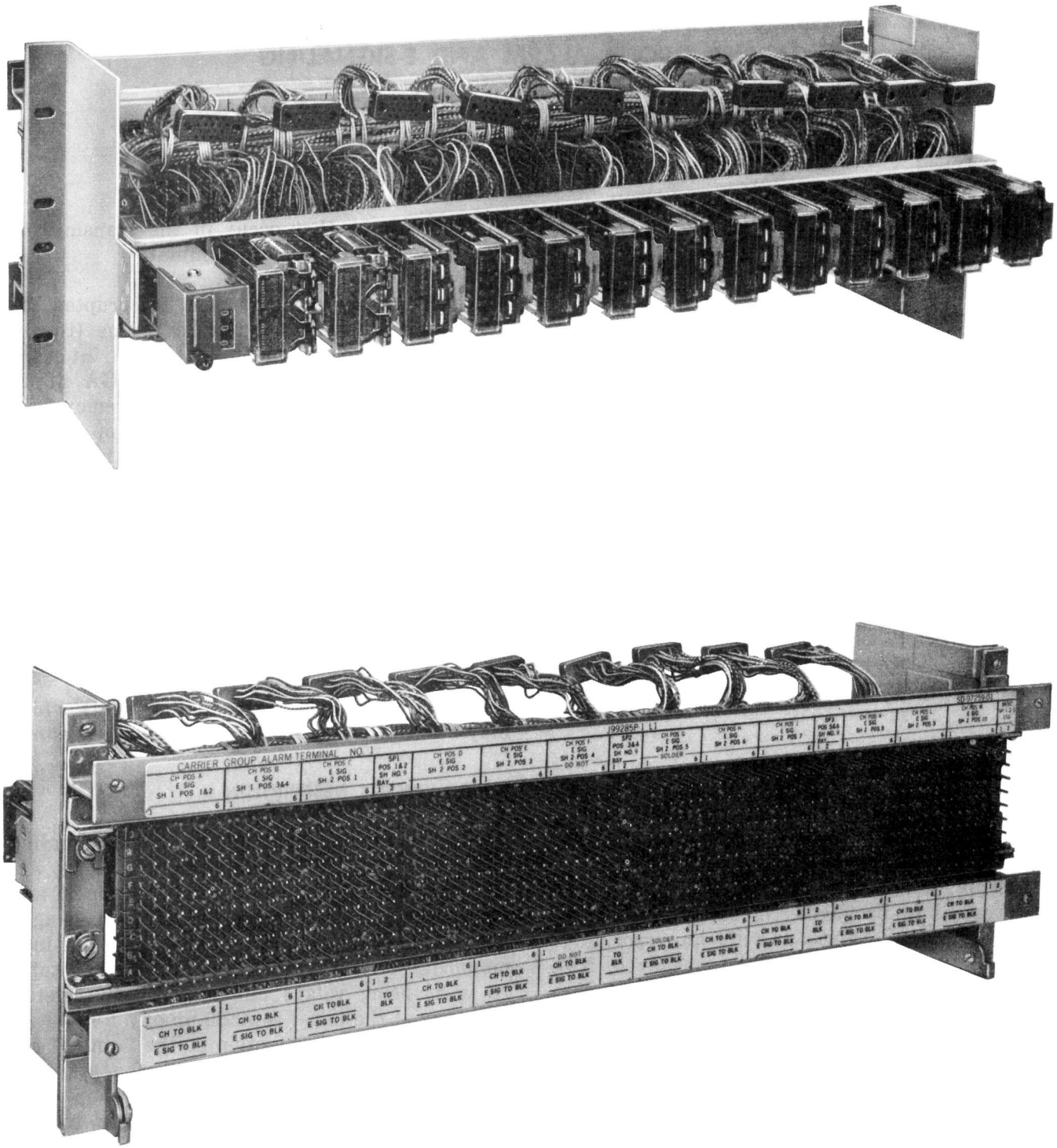

Fig. 1 — Carrier Group Alarm and E-Signaling Connecting Panels

blocks provide interconnections between the voice-frequency leads of the 12 channels of an N2 carrier terminal and associated E-signaling units, and between the CGA relay contacts and the E-signaling units. The spare blocks provide connections to additional E-signaling unit positions for use when auxiliary signaling units are required. Each channel block consists of six columns of nine terminals each. The spare and miscellaneous blocks are arranged in two columns of nine terminals each.

2.03 The CGA and E-signaling connectors are universally arranged so that they can be used with any of the various trunks and lines that are used with the N2 carrier system. By optional strapping applied to the channel block, a channel can be arranged for the E-signaling unit and for the trunk conditioning required by the assigned trunk or line.

2.04 Plastic templates per ED-97262-30 are available for use with the CGA to provide a simple guide for applying the optional strapping on the terminal strip. The templates are perforated for mounting over the terminals of the channel block after installer wiring has been connected. The necessary straps for the desired condition are indicated by heavy black lines and option letters engraved on the template.

2.05 Across the top of the CGA terminal block there is a designation strip which indicates the channel positions and the associated E-signaling shelf and position numbering. This strip is white corresponding to the white templates used for strapping during normal association of channel position and E-signaling shelf position. Under certain conditions, when the channel position and E-signaling shelf position are not associated as indicated on the white strip, the telephone company craftsman makes the necessary entries on a blue designation strip at the bottom of the CGA terminal block.

2.06 A template file for unused templates is provided above each CGA behind the signaling units. The file consists of a narrow strip with paired U-shaped hooks arranged for 15 types of templates.

3. FUNCTIONAL DESCRIPTION

A. General

3.01 The CGA in conjunction with an associated alarm and restoral unit provides automatic trunk processing, testing, and restoral in the event of carrier failure. A loss of carrier lasting 1.5 to 2 seconds will initiate an alarm, force a failure at the distant terminal, and cause associated trunks to be processed at both locations. When the trouble condition is cleared, both terminals are automatically restored to service.

3.02 For automatic trunk protection, the trunk processing circuits of the CGA are interposed between the trunk terminal equipment and the E-signaling units associated with the message channels (see Fig. 2). Under normal conditions, the trunk processing circuits provide direct connections for the supervisory leads required between the E-signaling unit and the trunk circuit assigned to the message channel. Each CGA unit is capable of providing trunk conditioning for each of the 12 channels of the associated carrier terminal. Since trunk conditioning is accomplished by changes in dc supervisory signals, channels not equipped with E-signaling units cannot be conditioned.

B. Alarm Sequence

3.03 Whenever a transmission failure occurs, the failure is detected by the alarm and restoral unit at the receiving terminal. After a delay of 1.5 to 2 seconds, to distinguish between momentary service interruption and actual carrier failure, the alarm and restoral unit activates office and bay alarms, removes the −21 volt power (for a 15-second interval) from the group transmitter, and provides a "system alarm signal" to the CGA circuit. Removal of −21 volt power from the group transmitter forces a failure and subsequent alarm at the far terminal. The system alarm signal applied to the CGA circuit initiates the trunk processing and causes the alarm and restoral circuit to open the paths between the compandors and modems for channel positions A and B (test channels 1 and 2). Opening this path has the effect of isolating the N2 terminal from the trunk circuits associated with test channels 1 and 2.

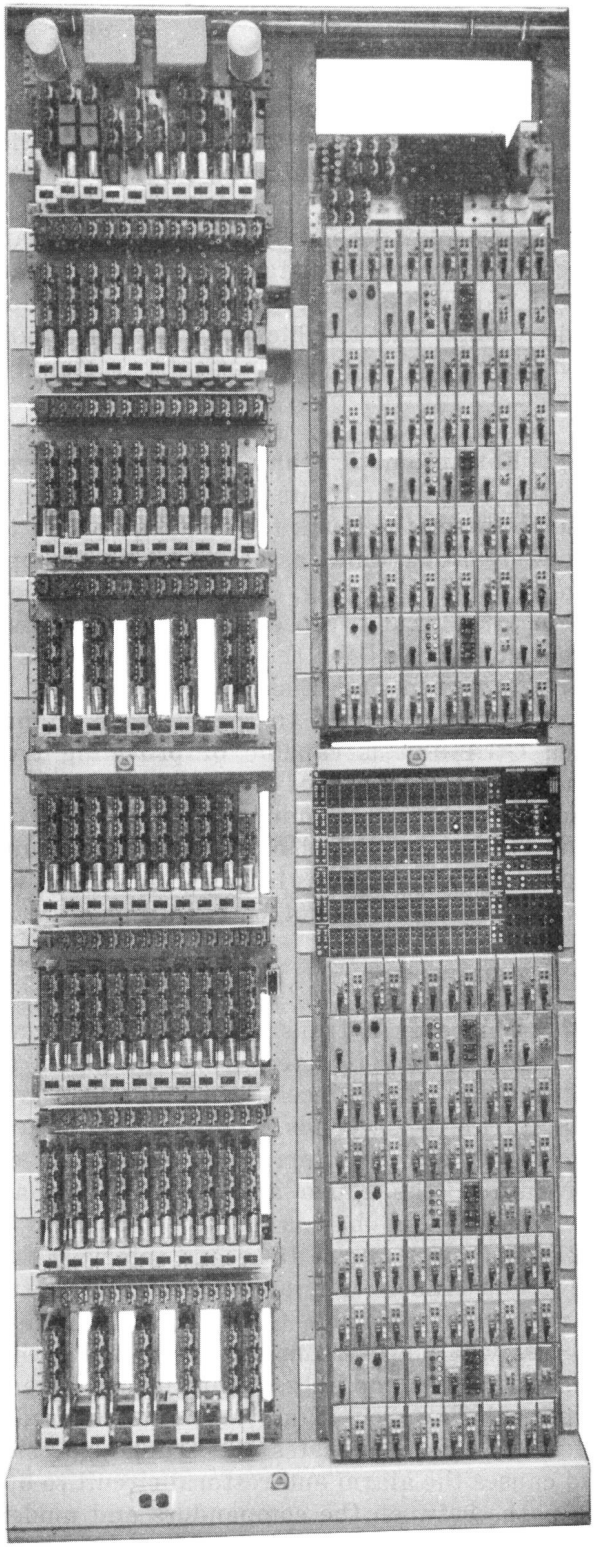

Fig. 2 — Typical N2 Packaged Terminal Arrangement

3.04 The first step of trunk processing involves making all trunks idle to stop subscriber charges and release calls in progress. This is accomplished by applying an on-hook signal on the dc supervisory leads. The system alarm signal from the alarm and restoral unit is followed after 15 seconds by a second alarm signal, "delayed signal," which causes the CGA to complete trunk processing, thus terminating the alarm sequence. This step of trunk processing maintains off-hook (busy) supervision on the trunk to prevent seizure of the trunk until the fault is cleared. The same alarm sequence occurs at the far terminal, but (due to the time required to register the forced carrier failure) with a time delay of 1.5 to 2 seconds.

C. Testing and Monitoring the System

3.05 During a carrier failure the alarm and restoral unit at both terminals transmits a 2600-cycle tone on the channel installed in channel position A and monitors this channel for a received signal with a proper signal-to-noise ratio. If a satisfactory signal is detected for a minimum of 10 seconds, the terminal is assumed suitable for restoration. To coordinate restoration at the two terminals, tone transmission and monitoring are transferred to the channel unit in channel position B. The terminal first receiving satisfactory tone on both test channels restores itself to service and in transmitting tone on the second test channel causes almost simultaneous restoration of service at the distant terminal. The alarm and restoral circuit is designed so that receipt of correct 2600-cycle signals over the first test channel verifies that transmission ***from*** the far terminal is satisfactory; receipt of correct 2600-cycle signals over the second test channel verifies that transmission ***toward*** the far terminal is normal. As both terminals detect normal transmission the system is automatically restored.

D. CGA Control

3.06 The control portion of the CGA circuit consists of four relays: A1L, A2L, A1U, and D (see Fig. 3). These relays receive the two alarm signals from the alarm and restoral circuit and control the operation of the trunk processing circuits, the delay circuit, and the carrier failure registration circuit.

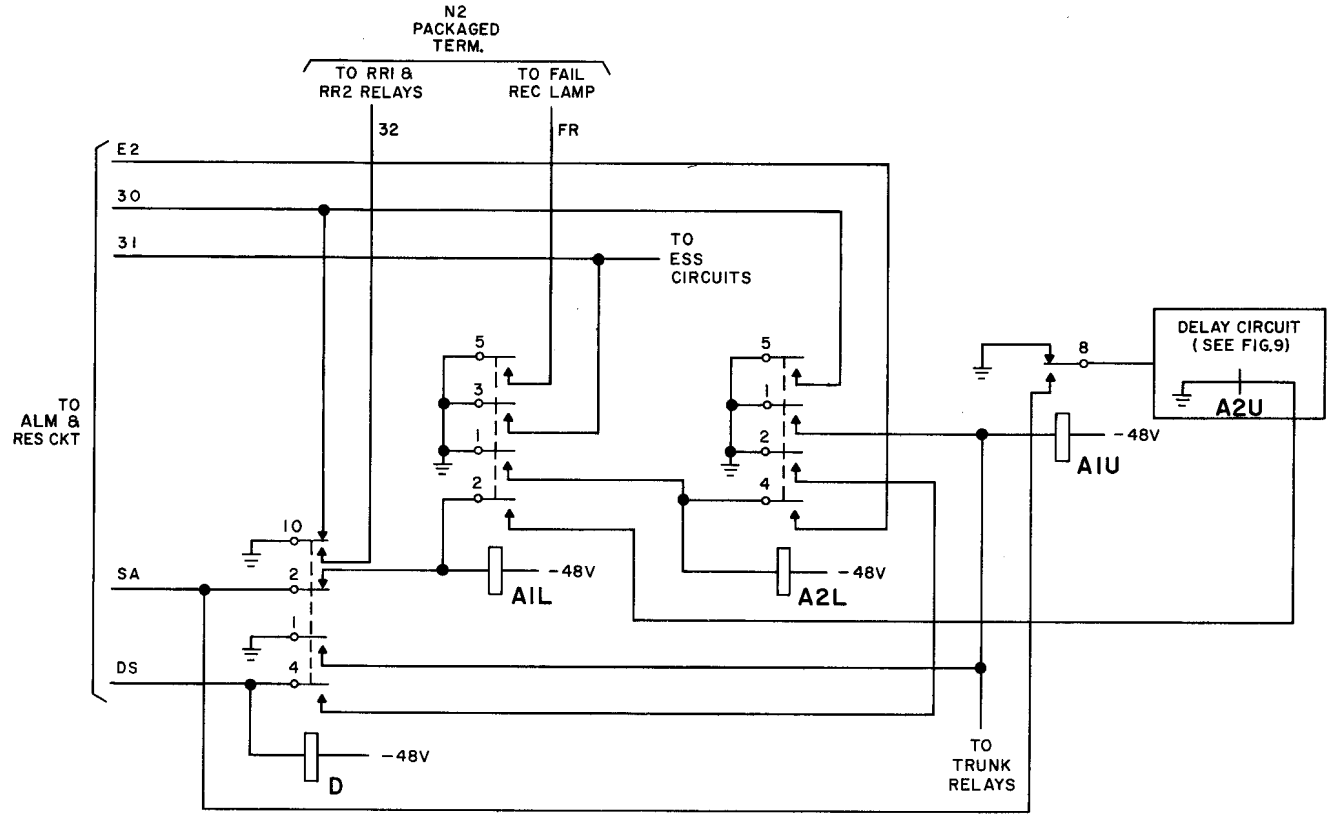

Fig. 3 — CGA Circuit Control Relays, Simplified Schematic

3.07 The system alarm signal from the alarm and restoral unit appears as a ground on lead SA. The ground operates relay A1L which locks operated on ground supplied through its own operated make contact and a break contact of relay A2U in the delay circuit. Relay A1L, when operated, supplies ground to relay A2L which operates and locks on ground from the alarm and restoral circuit over lead E2. Relay A2L will remain operated until signaling tone is received by the alarm and restoral circuit over the second test channel. Operated A2L, in turn, supplies ground to relay A1U and the trunk processing relays.

3.08 Operated relay A1L also supplies ground over the FR lead to the FAIL REC lamp on the N2 terminal frame jack field and over lead 31 to the alarm and restoral unit. Operated relay A2L supplies a ground to relay D which will lock D operated after the delayed alarm signal on lead DS causes D to operate. Relay A2L also applies ground to lead 30 in parallel with the ground applied through a break contact of relay D. This permits A2L to "wink-off" the alarm and restoral circuit when service is restored. The "wink-off" process is caused by the release of the operated make contact of relay A2L which removes ground from lead 30 before the slow release relay D replaces the ground through a nonoperated break contact. Relay A1U, when operated, transfers the delay circuit operating ground from the CGA chassis ground to the ground on lead SA which will remain grounded until signaling tone with the proper signal-to-guard ratio is received by the alarm and restoral unit over test channel 1. This transfer places the start of the relay circuit operation under the control of test channel 1.

3.09 After the delayed alarm signal from the alarm and restoral circuit is received and relay D operates, the alarm sequence is complete. The trunk processing is completed and relays A1L, A2L, A1U, and D are locked operated and under the control of the test and

monitoring circuits in the alarm and restoral unit. Operation of relay D places ground on lead 32 which, in turn, is applied to relays RR1 and RR2. These relays, which are located at the rear of the packaged terminal, open the path between the compandor and modem units used in channel positions A and B. The ground on lead 32 holds the relays operated until restoration is complete, thus ensuring that the 2600-cycle tone applied from the failed end (terminal first detecting failure) to the non-failed end, via test channel 2, is of long enough duration to complete the restoral process.

E. Trunk Processing

3.10 The CGA circuit contains relays for releasing and making busy the trunks and lines found in various types of offices. During normal operation these relays provide direct connections between the trunk circuit and associated E-signaling unit for certain of the supervisory leads. The supervisory leads required vary in accordance with the E-signaling unit and the trunk circuit assigned to the message channel. During an alarm the direct connection is broken and dc signals are applied by the CGA to the supervisory leads to disconnect busy trunk circuits, to stop service charges, and to prevent further seizures during the alarm period.

3.11 ***Trunk Processing Relays, Operating Circuit (Fig. 4):*** The trunk processing relays are operated by a ground applied through contacts of relay A2L immediately after the system alarm signal is received by the CGA circuit. An auxiliary operate path is provided when relay D operates after the delayed alarm signal is received. Relays TR2, TR4, and E2 are connected to the ground path through the normally closed contacts of the ALM OVRD key in the jack field of the packaged N2 frame. Releasing these relays and patching the lines or trunks to stand-by facilities permit their return to service.

3.12 ***Processing Interoffice Trunks with E and M Leads (Fig. 5):*** The release and make-busy functions for trunks with E and M lead supervision are performed by relays E1 and D1. Relay E1 operates when the system alarm signal is received. Operation of relay E1 opens the E lead between the trunk and the associated E-signaling unit. The open E lead applies on-hook (idle) supervision toward the trunk terminals to release existing calls and to stop service charges. After 15 seconds the delayed alarm signal subsequently causes relay D1 to operate, applying ground to the E lead toward the trunk terminals through make contacts of D1 and E1. The grounded E lead simulates an off-hook (busy) condition, preventing seizure of the trunk until the alarm is cleared.

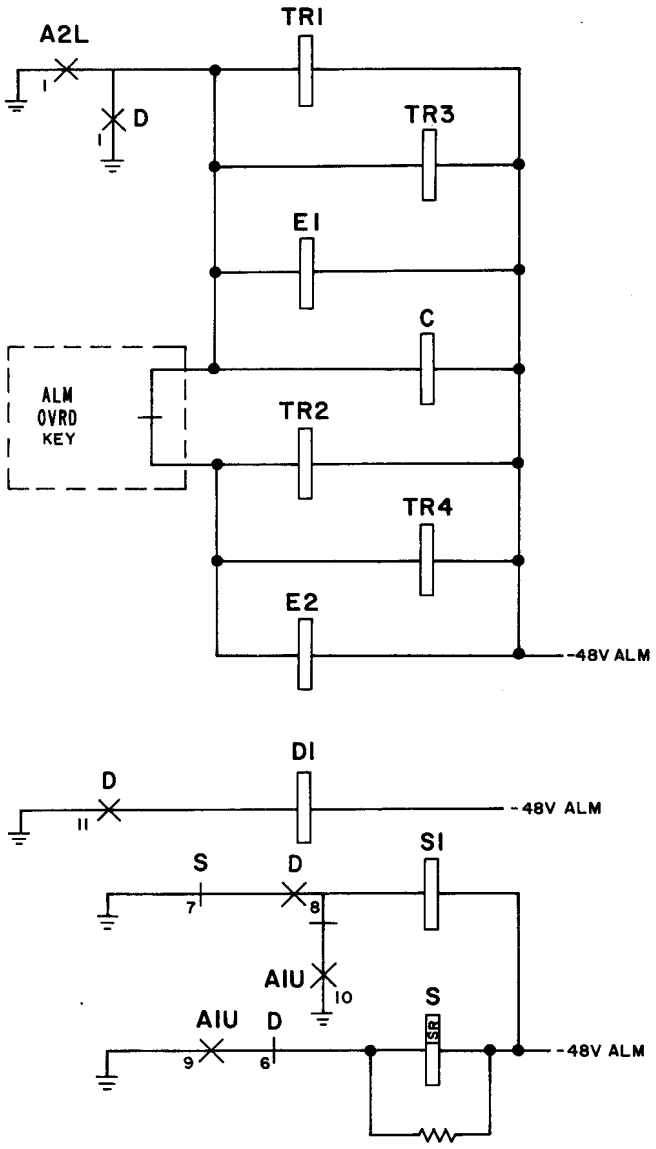

Fig. 4 — Trunk Processing Relays, Operating Circuit

Note: In step-by-step offices utilizing certain types of trunks with E and M lead supervision, there is a possibility of a calling subscriber remaining connected throughout the duration of the alarm. In the event the calling subscriber does not go on-hook before the delayed alarm signal is received, the associated line circuit will remain connected to the step-by-step switches.

3.13 Trunks with E and M lead supervision which require override are connected to contacts on relays E2 and D1. These relays operate in the same manner and perform the same functions as E1 and D1. See 3.21 for method of overriding the alarm condition for these trunks.

3.14 ***Processing Trunks with Loop Supervision (Fig. 6):*** One-way outgoing trunks or trunk circuits in an SXS office are released and made busy by relays TR1, TR3, C, and S1. These relays operate on receipt of the system alarm signal and disconnect the tip, ring, and sleeve leads between the selector bank and the associated E1C signaling unit or the trunk circuit. Opening the T and R leads places the trunk in an on-hook condition to stop service charges. The trunks are released and made busy by the action of relays C, S, and S1. The system alarm signal causes relays A1L, A2L, and A1U to operate, which closes the operate path to relays C, S, and S1. (See Fig. 4.) These relays operate, opening the sleeve lead between the trunk circuits and the signaling unit and grounding the S lead toward the trunk circuits. The delayed alarm signal operates relay D which opens the operate path to relays S and S1. Relay S1 releases immediately, removing the ground from the S lead and releasing the calling subscriber. Relay S is a slow release relay. When relay S does release, it reoperates relay S1. When S1 reoperates, ground is reapplied to the S lead, making the trunks busy and preventing seizure until the alarm is cleared. The ungrounded interval between the release of relay S and the operation of relay S1 serves to "wink-off" the existing call.

3.15 One-way outgoing trunks or trunk circuits in panel, No. 1 crossbar, and crossbar tandem offices are processed in the same way as those in step-by-step offices except that the "wink-off" function of relays S and S1 is not required to release the trunks and make them

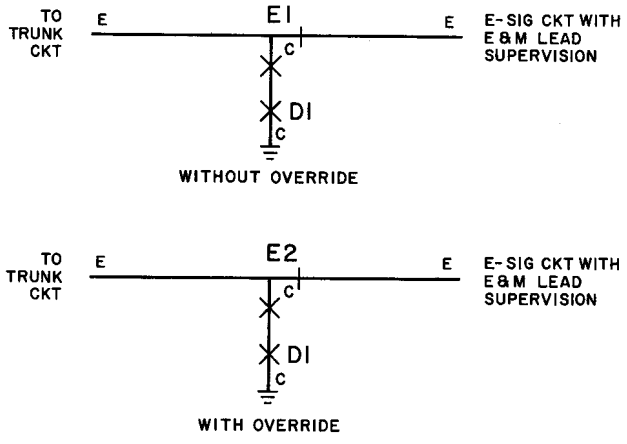

Fig. 5 — Release and Make-Busy Circuit — E and M Lead Supervision

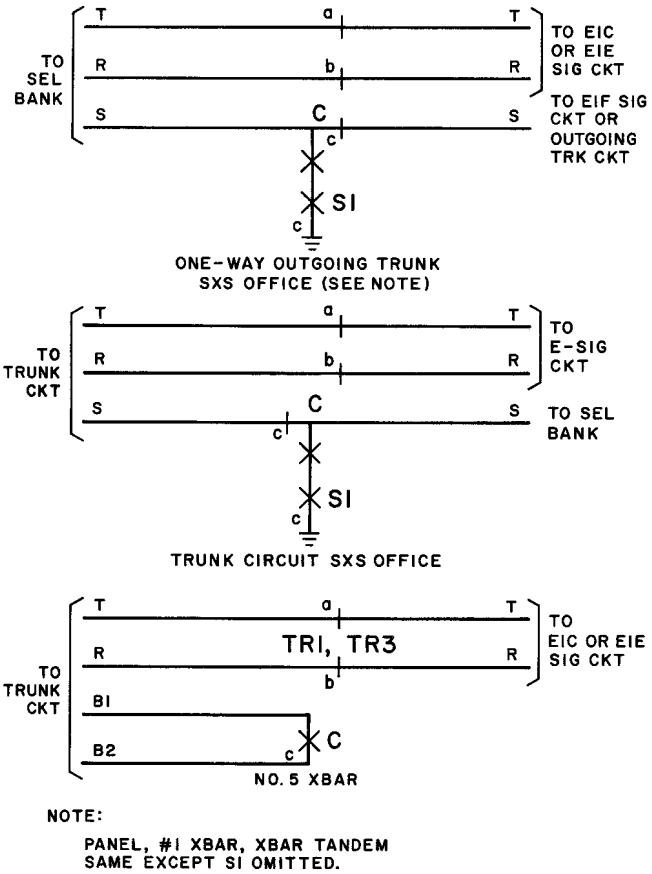

Fig. 6 — Release and Make-Busy Circuit — Loop Supervision

busy. The trunks are made busy by applying a ground over the S or S1 lead after receipt of the system alarm signal.

3.16 In No. 5 crossbar offices, on-hook supervision is applied by relays TR1 and TR3 as described above. The outgoing trunks are made busy when relay C operates, connecting leads B1 and B2.

3.17 ***Processing Trunks With Reverse Battery Supervision or Customer Lines (Fig. 7):*** The system alarm signal causes relays TR1 and TR3 to operate, opening the tip and ring leads between the trunk and the associated E-signaling unit. For incoming trunks with reverse battery supervision, this action releases the incoming connection. For customer lines, at either the station end or office end, opening the tip and ring leads places the line in an on-hook condition, preventing seizure, as well as releasing existing connections.

3.18 Alarm override may be used with the station end or office end of customer lines by connecting them to relays TR2 and TR4 rather than TR1 and TR3.

3.19 ***No. 1 ESS Trunk Processing (Fig. 8):*** No. 1 ESS trunks assigned to the carrier facilities are released and made busy by the ESS equipment. Two alarm signals are provided for the ESS equipment by the alarm and restoral unit and the CGA circuit. The first signal, removal of battery from lead A, occurs immediately after the carrier fault is detected by the alarm and restoral unit. A relay in the alarm and restoral circuit operates, removing

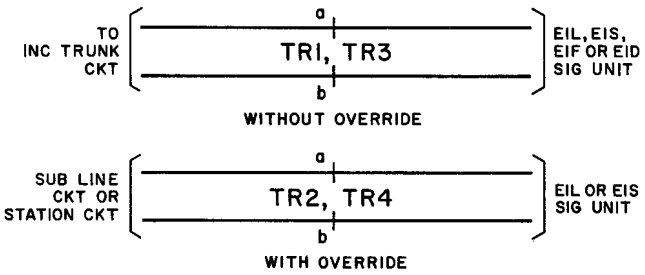

Fig. 7 — Release Circuit, One-Way Incoming Trunks, Reverse Battery Supervision or On-Hook Supervision, Station or Office End of Customer Line

—48 volts from lead 31 to the CGA circuit. This interrupts the normal flow of current to the ferrod winding of the ESS remote master scanner applique circuit over lead 31 and through a normal break contact of relay A1U in the CGA circuit. Return ground is provided over lead B. This signal causes the ESS processor to make busy trunks in the pulsing condition, and refuse to honor any further seizure signals on a trunk associated with the failed carrier system. Calls in progress are not affected at this time.

3.20 The second ESS alarm signal occurs approximately 1.5 to 2 seconds after the first when the system alarm signal is received by the CGA circuit. The system alarm signal causes relay A1U to operate, interrupting the normal flow of current to the second ferrod winding in the ESS master scanner over lead A. The return path for lead MSA1 is provided over lead B. Operated relay A1U also provides a secondary opening in the A lead of the first alarm signal to maintain the alarm condition until the alarm is completely cleared. This signal indicates to the ESS to stop charges on calls in progress, release called and calling subscribers, and to maintain all trunks associated with the failed carrier system in the busy condition.

F. Alarm Override

3.21 To return certain preselected trunks or lines to service during the alarm period, they are patched to alternate facilities. These trunks must be wired so that the alarm conditioning will be removed by operating the ALM OVRD key. This feature enables trunks and lines that are used for special service applications to be returned to service after only a short interruption. After the carrier fault has been cleared the ALM OVRD key is returned to normal, the patches are removed, and the trunks are connected to the original N2 system. Only trunks with E and M lead supervision and the station end or office end of a customer line may be returned to service in this manner.

G. Restoral Sequence

3.22 After a carrier failure has occurred and the system is completely alarmed, the alarm and restoral units in both terminals monitor test channel 1 for 2600-cycle signals. When

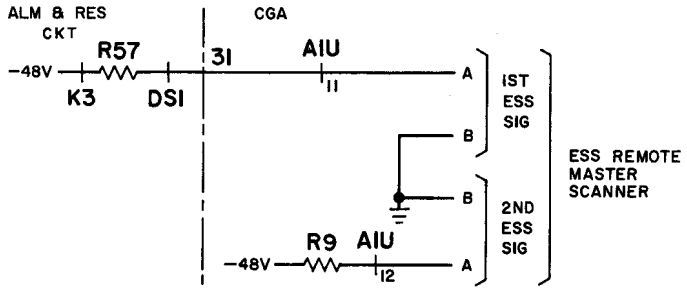

Fig. 8 — No. 1 ESS Alarm Indications

an alarm and restoral unit receives a signal with a satisfactory signal-to-noise ratio, lead SA between the alarm and restoral circuit and the CGA is opened. This starts the time out of the CGA delay circuit. The delay circuit prevents the system from restoring in the face of a high level of noise and crosstalk that may occur on a line where repeaters have regulated to high gain by recycling at each closure of a ground on the SA lead. Approximately 10 seconds after ground is removed from lead SA, the delay circuit operates and causes the release of relay A1L. The release of relay A1L removes ground from lead 31 which causes the alarm and restoral circuit to switch from monitoring on test channel 1 to test channel 2. Receipt of satisfactory signals on test channel 2 by the alarm and restoral circuit opens lead E2 which releases relay A2L and "winks-off" the alarm and restoral unit. Release of relay A2L releases other trunk processing relays, thus removing trunk conditioning signals and restoring the terminals to normal.

H. Delay Circuit Operation

3.23 The delay circuit (see Fig. 9) consists of relay A2U, switching transistor Q1, timing capacitor C1, and associated circuitry. This circuit provides approximately 10 seconds delay between the time a signal with the proper signal-to-noise ratio is received on test channel 1 and the beginning of the terminal restoral sequence.

3.24 During normal carrier system operation, relays A1U and D are nonoperated. The −48 volt operating power is removed from the collector of transistor Q1 by a normally open contact of relay D. Nonoperated relay A1U provides a ground, through resistor R1, to the positive side of timing capacitor C1. During normal

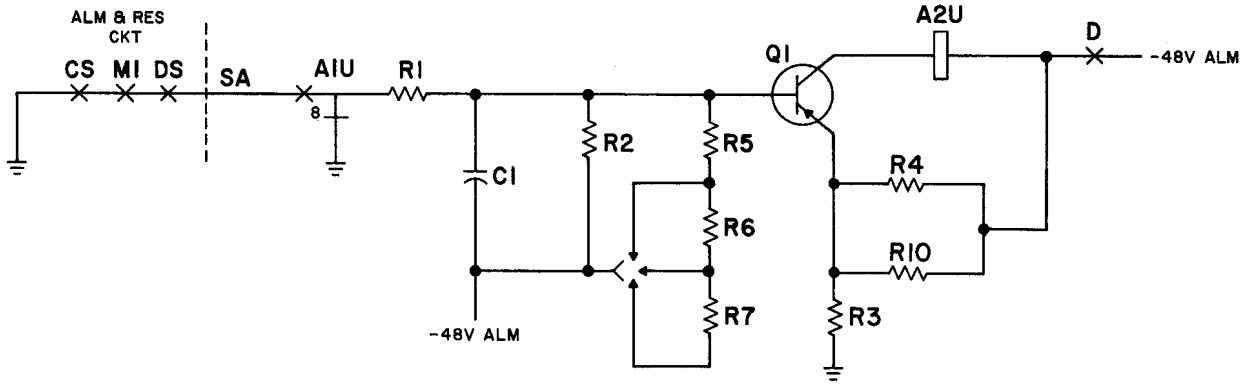

Fig. 9 — Delay Circuit

operation, C1 is fully charged to −48 volts. When an alarm occurs, lead SA is grounded and relays D and A1U are operated. Make contacts on relay D connect −48 volt operating power to the circuit and transfer contacts on relay A1U transfer the ground to capacitor C1 from the CGA circuit ground to the grounded SA lead. Under these conditions, transistor Q1 is biased to cutoff by the −48 volt charge across capacitor C1 applied to the base. The collector is biased by the −48 volts applied through the make contact of relay D and through the winding of A2U. The emitter is biased by the potential across the voltage divider (resistors R3, R4, and R10). The emitter bias determines the trigger potential of the transistor. This bias condition will remain as long as lead SA is grounded and C1 is fully charged.

3.25 When the carrier fault is cleared, relays in the alarm and restoral circuit release, removing the ground from lead SA. Capacitor C1 begins to discharge through resistor R2 and, if required for proper timing, resistors R5, R6, and R7. When C1 discharges to approximately −16 volts, transistor Q1 is turned on and current flows in the collector circuit. The collector current operates relay A2U, starting the restoral sequence.

I. Carrier Failure Registration Circuit

3.26 The carrier failure registration circuit (see Fig. 10) consists of message register MR1, thermistor RT1, a break contact on relay A1L, a make contact on relay A2L, and two diodes. This circuit provides a ground on lead RG1 for operating relay RG in the power alarm and miscellaneous circuit in the packaged N2 terminal. The operation of relay RG lights a lamp in the frame jack field which provides an indication that a message register has operated and needs to be read.

3.27 As an aid to maintenance, carrier failures are registered only at the terminal transmitting toward the fault. The distant terminal detects the loss of carrier and, as part of the alarm sequence, interrupts the carrier transmitted to the near terminal. When the carrier is removed, the system alarm is received by the CGA circuit in the near terminal. This signal causes relays A2L and A1L to operate, closing the A2L make contact and opening the A1L break contact. When the distant terminal applies 2600-cycle tone to test channel 1, the delay circuit in the near terminal operates and, after the delay interval, releases relay A1L. Relay A2L will remain operated until tone is received on test channel 2 after the fault is cleared. The release of relay A1L completes the ground path to the message register MR1 through thermistor RT1. Current begins to flow in the thermistor causing the thermistor resistance to decrease. After approximately 0.3 seconds the thermistor resistance has decreased and the current in the circuit has increased sufficiently to operate MR1. The make contact of MR1 closes, grounding lead RG1 to the power alarm and miscellaneous circuit. The make contact of MR1 also shunts a diode across the thermister, removing the current through the thermistor and allowing it to cool.

3.28 Failure registration does not occur at the distant terminal because of the short time interval between release of relay A1L and relay A2L. At the distant terminal A1L releases after the delay circuits time out and A2L releases immediately after A1L. This interval is shorter than the 0.3 seconds required to operate message register MR1.

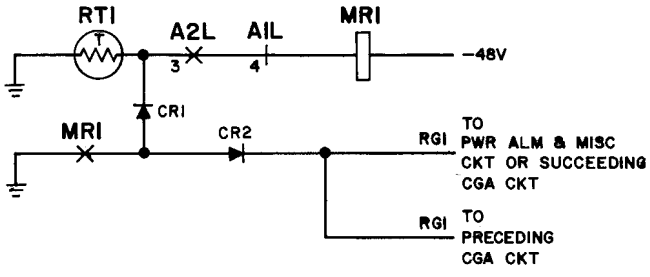

Fig. 10 — Carrier Failure Registration Circuit

4. DRAWINGS

4.01 The following schematic and equipment drawings (not attached) provide detailed information.

SD-97259-01 — Carrier Group Alarm and E-type Signaling Connecting Circuit

SD-97244-01 — Alarm and Restoral Circuit

SD-97256-01 — Application Schematic for Packaged N2 Terminals

J99285 — N2 Carrier Telephone Packaged Terminal Equipment

J99285P — Carrier Group Alarm and E-Signaling Connecting Panel