

## 26

CROSSBAR SYSTEMS  
NO. 3  
ALARM SENDING  
CIRCUIT

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## SECTION I - GENERAL DESCRIPTION

### 1. PURPOSE OF CIRCUIT

- 1.01 This circuit provides a means of communicating alarm information to an attended facility, concerning failure of various critical circuits or indications of impending failure.
- 1.02 Detection of an alarm situation initiates a dialer sequence to establish a call using the telephone network. The dialer is preset to dial a particular directory number to terminate the call to a dedicated alarm telephone.
- 1.03 The circuit also provides for detection and classification of the office alarms.
- 1.04 An alarm checking terminal is provided as a part of this circuit for the identification and control of alarms.
- 1.05 The circuit may be arranged to provide an alarm signal via a 2-way operator office trunk to backup the dialer circuit.

### 2. GENERAL DESCRIPTION OF OPERATION

- 2.01 The various office alarm conditions are classified according to their importance and assigned to one of seven alarm categories. These categories are represented by relays A0 through A6 in a descending order of importance, respectively. A chain circuit and a set of cross-connections then determine which alarm conditions are to signal the attendant.
- 2.02 When an alarm signal is to be sent to the attendant, this circuit dials the directory number of a dedicated TOUCH-TONE® alarm telephone at the maintenance facility. The attendant answers and dials a TOUCH-TONE digit 2, 5, or 8. The alarm sending

circuit interprets this as an answer signal and cuts through the alarm tone to the attendant. If the proper cross-connection is provided, releasable alarms will automatically release upon disconnect by the attendant. If the automatic release cross-connection is not provided or the attendant allows the connection to time out, the alarms will not release.

- 2.03 Both numbers of the alarm checking terminal will result in transmission of tone identification of the highest alarm category present. The alarm tone will be transmitted for a limited period of time and at completion of the timing interval the alarm tone is stopped and the circuit is prepared to receive one of two instructions from the attendant. The instructions are answer and number transfer. The answer instruction will reapply the alarm tone to the line and the number transfer instruction sets the dialer circuit to dial the alternate directory number.

2.04 When an attendant dials the ring number of the alarm checking terminal the circuit attempts to release releasable alarm conditions when the attendant disconnects. Remote transfer of alarms may be accomplished on a ring number termination with application of plus or minus 130 volts as described in 18. of SECTION II.

2.05 When an attendant dials the tip number of the alarm checking terminal the circuit will cut through the alarm signal if one exists. Alarms will not release when the attendant disconnects provided the attendant has not given the circuit an answer signal during the termination.

2.06 A timer is provided to resignal the attendant when an alarm condition remains for a period of 10 to 20 minutes after the disconnect.



SECTION II - DETAILED DESCRIPTION

1. COMMUNICATION OF ALARMS

ALARM DETECTION AND PREPARATION FOR DIALING - SC2

1.01 Assume that ground is applied and sustained on alarm lead A2 as would result from an announcement system failure. The circuit completed by this ground is through the winding of marginal alarm relay A2, through parallel break-contacts of the lower numbered A- relays, through the 3200-ohm AL resistor, and the winding of alarm relay AL to the battery of resistance lamp A. Relay AL operates and relay A2 does not.

1.02 A contact of relay AL shunts the winding of no alarm relay NA and relay NA releases.

1.03 The release of relay NA:

- (a) Starts the 2.5-minute TM timer.
- (b) Extends ground to the winding of relay ST operating it.
- (c) Partially closes the lock path of relay UA-.

1.04 The ST relay in operating:

- (a) Closes a loop across the tip and ring to the line switch termination of the dialer circuit.
- (b) Locks through normal contacts of relays RCY and SL1A.
- (c) Partially closes the lock path of relay UA3.
- (d) Partially closes the lock path of relays ANS and TRN.
- (e) Operates relay STA.
- (f) Partially prepares the TMA timer for its timing cycle.
- (g) Partially closes the operate path of relay SD.

1.05 The STA relay in operating:

- (a) Partially closes a lock path for relay RCY.
- (b) Operates relay AS.

(c) Enables the pulse generating circuit.

(d) Operates relay CPG.

1.06 Relay AS in operating:

- (a) Locks to relay STA.
- (b) Operates 2-out-of-5 R- relays representing the first digit of the directory number to be dialed.
- (c) Prepares the operate path for the next steering relay.

1.07 Relay CPG in operating:

- (a) Operates relay PG.
- (b) Partially prepares the operate path for relay S.

1.08 Relays R- 2-out-of-5 in operating:

- (a) Operates relay CHK.

1.09 Relay PG in operating:

- (a) Prepares the dialer terminal for dial pulsing.
- (b) Prepares the pulse generator circuit control relays for operation.

1.10 The SL1 relay operates when the linkage is closed to the originating register. When operated, the SL1 relay further prepares the TMA timer for its function.

1.11 When ground is removed from the tip conductor, relay RD operates and:

- (a) Opens the short across the tip and ring leaving the S relay alone across the loop.
- (b) Partially closes the lock path of relays SL1A and TD.

1.12 When party tests are completed relay S operates operating relay SD.

1.13 Relay SD in operating:

- (a) Closes a shunt path across the S relay releasing it.
- (b) Locks to relay ST.
- (c) Locks relay RD operated.

- (d) Opens the AS relay operate path.
  - (e) Further prepares the TMA timer for its function.
  - (f) Releases relay CPG.
  - (g) Prepares the pulse generator control relays for their function.
- 1.14 Relay CPG in releasing:
- (a) Opens the S relay operate path thus removing the S winding from across the tip and ring.
  - (b) Starts the pulse generator by first releasing the PG relay. (See Pulse Generator - 3.)

#### DIALING - SC3

- 1.15 The PG relay is now under full control of the pulse generating multivibrator which will operate and release relay PG at a rate of 10 pulses per second with an approximate 63 percent break. The PG relay will continue to operate and release until relay CPG operates when dialing is completed or aborted.
- 1.16 The first release of the PG relay:
- (a) Opens the loop on the dialer line thus providing the first open pulse for the first digit.
  - (b) Operates relay PG1.
- 1.17 The multivibrator reoperates relay PG after approximately 63 milliseconds following its release.
- 1.18 Relay PG in operating:
- (a) Closes the loop on the dialer line thus ending the first open pulse of the first digit.
  - (b) Operates relay PG2.
  - (c) Closes an operate path of relay SP to the digit one lead so that if the R- relays have registered a digit one the SP relay will operate to stop pulsing.
- 1.19 The multivibrator releases relay PG after approximately 37 milliseconds following its operation.
- 1.20 Relay PG in releasing:
- (a) Opens the loop on the dialer line thus providing the second open pulse for

the first digit if the digit is greater than one.

- (b) Releases relay PG1.
- 1.21 Relay PG1 in releasing operates relay PG3 with relay PG2 operated.
- 1.22 The multivibrator reoperates relay PG.
- 1.23 Relay PG in operating:
- (a) Closes the loop on the dialer line thus ending the second open pulse of the first digit.
  - (b) Releases relay PG2.
  - (c) Closes an operate path of relay SP to the digit two lead so that if the R- relays have registered a digit two, the SP relay will operate to stop pulsing.
- 1.24 The multivibrator releases relay PG.
- 1.25 Relay PG in releasing:
- (a) Opens the loop on the dialer line thus providing the third open pulse for the first digit if the digit is greater than two.
  - (b) Operates relay PG1.
- 1.26 The multivibrator reoperates relay PG.
- 1.27 Relay PG in operating:
- (a) Closes the loop on the dialer line thus ending the third open pulse of the first digit.
  - (b) Operates relay PG2.
  - (c) Closes an operate path of relay SP to the digit three lead so that if the R- relays have registered a digit three the SP relay will operate to stop pulsing.
- 1.28 Relay PG2 in operating operates relay PG4 with relays PG1 and PG3 operated.
- 1.29 The multivibrator releases relay PG.
- 1.30 Relay PG in releasing:
- (a) Opens the loop on the dialer line thus providing the fourth open pulse for the first digit if the digit is greater than three.
  - (b) Releases relay PG1.

- 1.31 The multivibrator reoperates relay PG.
- 1.32 Relay PG in operating:
  - (a) Closes the loop on the dialer line thus ending the fourth open pulse of the first digit.
  - (b) Releases relay PG2.
  - (c) Closes an operate path of relay SP to the digit four lead so that if the R-relays have registered a digit four the SP relay will operate to stop pulsing.
- 1.33 The multivibrator releases relay PG.
- 1.34 Relay PG in releasing:
  - (a) Opens the loop on the dialer line thus providing the fifth open pulse for the first digit if the digit is greater than four.
  - (b) Operates relay PG1.
- 1.35 Relay PG1 in operating releases relay PG3 with relay PG4 operated and relays PG2 and PG5 released.
- 1.36 The multivibrator operates relay PG.
- 1.37 Relay PG in operating:
  - (a) Closes the loop on the dialer line thus ending the fifth open pulse of the first digit.
  - (b) Operates relay PG2.
  - (c) Closes an operate path of relay SP to the digit five lead so that if the R-relays have registered a digit five the SP relay will operate to stop pulsing.
- 1.38 The multivibrator releases relay PG.
- 1.39 Relay PG in releasing:
  - (a) Opens the loop on the dialer line thus providing the sixth open pulse for the first digit if the digit is greater than five.
  - (b) Releases relay PG1.
- 1.40 The multivibrator reoperates relay PG.
- 1.41 Relay PG in operating:
  - (a) Closes the loop on the dialer line thus ending the sixth open pulse of the first digit.
  - (b) Releases relay PG2.
  - (c) Closes an operate path of relay SP to the digit six lead so that if the R-relays have registered a digit six the SP relay will operate to stop pulsing.
- 1.42 Relay PG2 in releasing operates relay PG5 with relays PG1 and PG3 released.
- 1.43 The multivibrator releases relay PG.
- 1.44 Relay PG in releasing:
  - (a) Opens the loop on the dialer line thus providing the seventh open pulse for the first digit if the digit is greater than six.
  - (b) Operates relay PG1.
- 1.45 The multivibrator reoperates relay PG.
- 1.46 Relay PG in operating:
  - (a) Closes the loop on the dialer line thus ending the seventh open pulse of the first digit.
  - (b) Operates relay PG2.
  - (c) Closes an operate path of relay SP to the digit seven lead so that if the R-relays have registered a digit seven the SP relay will operate to stop pulsing.
- 1.47 The multivibrator releases relay PG.
- 1.48 Relay PG in releasing:
  - (a) Opens the loop on the dialer line thus providing the eighth open pulse for the first digit if the digit is greater than seven.
  - (b) Releases relay PG1.
- 1.49 Relay PG1 in releasing operates relay PG3 with relays PG2, PG4, and PG5 operated.
- 1.50 The multivibrator reoperates relay PG.
- 1.51 Relay PG in operating:
  - (a) Closes the loop on the dialer line thus ending the eighth open pulse of the first digit.
  - (b) Releases relay PG2.

(c) Closes an operate path of relay SP to the digit eight lead so that if the R- relays have registered a digit eight the SP relay will operate to stop pulsing.

1.52 The multivibrator releases relay PG.

1.53 Relay PG in releasing:

(a) Opens the loop on the dialer line thus providing the ninth open pulse for the first digit if the digit is greater than eight.

(b) Operates relay PG1.

1.54 The multivibrator reoperates relay PG.

1.55 Relay PG in operating:

(a) Closes the loop on the dialer line thus ending the ninth open pulse of the first digit.

(b) Operates relay PG2.

(c) Closes an operate path of relay SP to the digit nine lead so that if the R- relays have registered a digit nine the SP relay will operate to stop pulsing.

1.56 Relay PG2 in operating releases relay PG4 with relays PG1, PG3, and PG5 operated.

1.57 The multivibrator releases relay PG.

1.58 Relay PG in releasing:

(a) Opens the loop on the dialer line thus providing the tenth open pulse for the first digit if the digit is greater than nine.

(b) Releases relay PG1.

1.59 The multivibrator reoperates relay PG.

1.60 Relay PG in operating:

(a) Closes the loop on the dialer line thus ending the tenth open pulse of the first digit.

(b) Releases relay PG2.

(c) Closes an operate path of relay SP to the digit zero lead so that the R- relays which have registered a digit zero can operate the SP relay to stop pulsing.

INTERDIGITAL INTERVAL - SC3 - (END OF DIALING - SEE 1.80)

1.61 Relay SP in operating:

(a) Closes a loop across the dialer line to prevent further dial pulsing during the interdigital interval since the PG relay will continue to operate and release in order to time the interdigital interval.

(b) Operates relay BS.

(c) Operates relay WP.

1.62 The multivibrator releases relay PG.

1.63 Relay PG in releasing releases all operated PG- relays with relay SP operated.

1.64 The multivibrator reoperates relay PG.

1.65 Relay PG in operating releases relay SP.

1.66 Relay SP in releasing:

(a) Releases relay AS.

(b) Operates relay ZP.

1.67 Relay AS in releasing releases R- relays which were operated for the first digit and allows R- relays to operate which are to be operated for the second digit.

1.68 The multivibrator releases relay PG.

1.69 Relay PG in releasing operates relay PG1.

1.70 The multivibrator reoperates relay PG.

1.71 Relay PG in operating:

(a) Operates relay SP with relays ZP and PG1 operated.

(b) Operates relay PG2.

1.72 Relay SP in operating releases relay WP in preparation for ending the interdigital timing and starting the next digit.

1.73 The multivibrator releases relay PG.

1.74 Relay PG in releasing releases relays PG1 and PG2 with relay SP operated.

- 1.75 The multivibrator reoperates relay PG.
- 1.76 Relay PG in operating releases relay SP.
- 1.77 Relay SP in releasing releases relay ZP.
- 1.78 The multivibrator releases relay PG.
- 1.79 End of interdigital interval and start of next digit, see 1.15. The sequence outlined in 1.15 through 1.78 is repeated for each digit with relays -S providing the associated digit information.

DIALING COMPLETE - SC3

- 1.80 Relay SP in operating:
  - (a) Closes a loop across the dialer line to prevent further dial pulsing.
  - (b) Operates relay WP.
  - (c) Operates relay DC via the -D to DC across connect.
- 1.81 Relay DC in operating:
  - (a) Operates relay CPG.
  - (b) Releases the operated -S relay.
  - (c) Releases relay WP.
  - (d) Releases all PG- relays.
  - (e) Opens the sleeve lead to the second line switch.
  - (f) Locks to relay STA.
- 1.82 Relay CPG in operating:
  - (a) Holds relay PG operated and stops the multivibrator.
  - (b) Operates relay S which closes the T-, R- leads to the called number.
- 1.83 Relay -S in releasing releases the operated R- relays.
- 1.84 Relay WP in releasing, with all R- relays released, releases relay CHK.
- 1.85 Relay PG- released releases relay SP.
- 1.86 The circuit remains in this state until answered or until the TM timing interval has elapsed.

ANSWER - SC4

- 1.87 When the attendant answers a silent termination is received. The dual channel receiver is attached to the line to detect the instruction of the attendant. The attendant has the option of requesting the alarm signal or transferring the directory number of the dialer circuit to the alternate number. The attendant will normally request the alarm signal in this situation.

ATTENDANT REQUESTS ALARM SIGNAL - SC4

- 1.88 The attendant dials a TOUCH-TONE digit 2, 5, or 8 which the dual channel receiver recognizes as an answer signal and operates relay ANS.
- 1.89 The ANS relay in operating:
  - (a) Resets the TM timer.
  - (b) Operates relay AK.
  - (c) Transfers the attendant from the dual channel receiver to the alarm checking terminal.
  - (d) Locks to relay ST.
  - (e) Opens the NA relay path controlling reset of the TM timer.
  - (f) Transfers the output of the TM timer to relay TD from relay UA, UAl, etc. (See 10. TIMED RELEASE.)
  - (g) Partially closes a path to operate relay SR if the automatic alarm release cross-connection is provided.
- 1.90 Relay AK operates and:
  - (a) Starts the 120-IPM interrupter circuit.
  - (b) Completes the circuit of relay FL.
  - (c) Completes the circuit of relays W and Z.
  - (d) Closes alarm leads A3 through A6 if none of the options W, X, Y, and Z are provided.
  - (e) Operates relay AKA.
  - (f) Operates relay SR, if the automatic alarm release cross-connection is provided.
- 1.91 Relay AKA in operating:

- (a) Shunts the winding of relay AL to operate all A- relays that have ground on their alarm leads. Relay AL releases.
- (b) Partially closes the alarm tones to the T lead of the alarm checking terminal.
- (c) Opens the ground path to recycle the 10- to 20-minute alarm timing relay AT, and partially closes the start lead to the trouble recorder if provided.
- (d) Restarts the TM timer.

1.92 Relay SR if operated:

- (a) Partially closes a ground to the operate path of relay AR.
- (b) Partially closes a lock path for relay TD.

1.93 Relay AL in releasing removes the shunt from the winding of relay NA allowing it to reoperate.

1.94 The A- relays operate and:

- (a) Partially close a path to start the 10- to 20-minute AT timing relay.
- (b) The lowest numbered A- relay operated closes its alarm to the checking terminal T lead.
- (c) Lock to battery of resistance lamp A and will remain operated until the alarm condition is removed or the alarms are restored to the office. Relays A3 through A6 are the exception as they will release when the AK relay is released if none of the options W, X, Y, and Z are provided; however, relay A3 will remain operated if relay A3A is off-normal.
- (d) Closes the start lead ground to the trouble recorder if provided for any alarm category except A4.

ATTENDANT REQUESTS NUMBER TRANSFER - SC4

1.95 The attendant dials a TOUCH-TONE digit asterisk or pound sign which the dual channel receiver recognizes as a number transfer signal and operates relay TRN.

1.96 The TRN relay in operating:

- (a) Starts the 120-IPM interrupter circuit.
- (b) Completes the circuit of relay FL.

- (c) Completes the circuit of relays W and Z.
- (d) Transfers the attendant from the dual channel receiver to the alarm checking terminal.
- (e) Locks to relay ST.
- (f) Transfers the output of the TM timer to relay TD from relay UA, UAl, etc.
- (g) Operates or releases relay WN.

1.97 The combination of relays WN, FL, W, and Z operated or released and TRN operated provide a signal to the attendant indicating the number to which transfer has been effected.

2. MUTILATED DIGIT DETECTION - SC12

2.01 Dialing may be aborted due to a mutilated digit detected by a self-checking feature in the digit registration circuit.

2.02 An operate path of relay CHK is provided through a 2-out-of-5 check circuit of relays RO, 1, 2, 4, and 7 to detect by releasing if a condition other than 2-out-of-5 develops during dialing.

2.03 Released, relay CHK operates relay CPG to stop the pulse generator.

2.04 Since dialing is not completed relay DC is not operated, and with relay CHK down and CPG operated with relay DC normal, an operate path is closed to relay UA, UAl, or RCY.

- (a) If the directory number which was aborted was being dialed to the first line switch relay UA will operate and the circuit will proceed to release itself from the first line switch appearance and seize the second to dial again.
- (b) If 2-way operator trunk operation is provided and the directory number which was aborted was being dialed to the second line switch relay UAl will operate and the circuit will proceed to release itself from the line switch appearance and seize an operator trunk.
- (c) If 2-way operator trunk operation is not provided and the directory number which was aborted was being dialed to the second line switch relay RCY will operate and the circuit will proceed to restore to normal while it signals the trouble recorder of the recycle alarm situation. After restored to normal

the circuit will again attempt to dial via the first line switch appearance.

### 3. PULSE GENERATOR - SC3

3.01 The pulse generator is a transistorized, free-running multivibrator. Transistors Q1 and Q2 are the active elements whose durations being on or off are controlled by RC networks made up of the C5 and C6 capacitors and their associated resistor networks.

3.02 The length of the period of one cycle of the pulse generator is controlled by the PG6 resistor and C5 capacitor in stage one, and the PG7 resistor and C6 capacitor in stage two.

3.03 Pulsing control of the multivibrator resides with the CPG control pulse generator relay. With relay STA and CPG operated the multivibrator is held in its zero state, Q1 conducting, Q2 off. The CPG through its 3 make-contact prevents Q2 from turning on by applying ground through PG11 to the base of Q2. With Q1 conducting C6 charges to 48-volt battery through PG7.

3.04 The start-dialing signal results in CPG releasing. When it releases it not only removes ground from the base of Q2 but through its 5 break-contact, applies negative battery at the junction of C5, PG4, and the base of Q2. The Q2 begins conducting. The Q2 conducts in the saturated mode thereby causing ground potential to appear at its collector and on one side of C6. Because that capacitor is charged, its other side which is attached to the base of Q1 is forced to become positive with respect to ground. The Q1 is turned off. The multivibrator is in state one. That is, Q1 off, Q2 conducting. The C5 is charging rapidly through Q2 and PG1 resistor to battery. The C6 is discharging through PG10 resistor to battery. The length of time that the pulse generator remains in state one is dependent on how long C6 takes to discharge.

3.05 The multivibrator remains in state one until C6 discharges. This occurs, when the point in the circuit at the junction of C6, PG10, and the base of Q1 becomes slightly negative. The Q1 turns on and saturates. Capacitor C5 shifts the base voltage of Q2 positively shutting it off. The pulse generator is back to state zero. The C6 charges rapidly through Q1 conducting, and PG7 to battery. The C5 starts

discharging through PG6 to battery. The length of time the multivibrator remains in state one now depends on the time constant C5 forms with PG6. However, when C5 discharges sufficiently to shift the base of Q2 to a slightly negative potential that transistor will turn on and the pulse generator will again change state.

3.06 The pulse generator continues pulsing until CPG is again operated. When CPG operates the multivibrator will be thrown into or held in state zero and remain there.

3.07 Transistors Q3 and Q4 are the output transistors of the multivibrator. Transistor Q3 is controlled directly by transistor Q2. When Q2 is turned on during state one of the multivibrator, it electrically shorts the Q3 base and emitter. Therefore in state one Q3 is turned off. But during state zero Q2 is off and Q3 is on and saturated. The Q3 transistor controls Q4 directly. The purpose of Q4 is to provide a stable driving source for the PG relay. When Q3 is on during state zero Q4 is on, and when Q3 is off during state one Q4 is off. The Q4 stage also acts as a buffer between the Q3 stage and the PG relay. Relay PG is operated when transistor Q4 is on. Therefore, during state zero of the multivibrator the PG relay is operated and during state one the PG relay is released. Since contacts of the PG relay open and close the loop on the dialer terminal to provide dial pulsing, the proper operation of the multivibrator in combination with the PG relay is essential to provide dial pulses with pulses per second and percent break within limits as indicated in the circuit requirements.

### 4. DISCONNECT FROM THE DIALER TERMINAL BY THE ATTENDANT - SC4

4.01 The attendant disconnects, releasing relay S and SL1.

4.02 The SL1 relay in releasing starts the TMA timer.

4.03 The TMA timer provides 850 to 990 milliseconds before operating relay SL1A.

4.04 Relay SL1A operating:

(a) Releases the ST relay.

(b) Locks to relay RD.

4.05 Relay ST released:

- (a) Releases relays ANS or TRN, and SD and STA.
- (b) Transfers the battery supply of the TM timer from battery F to battery B.
- (c) Opens the lock path of relay UA3.
- (d) Opens the ring lead to the line switch termination of the dialer.

4.06 Relay STA released releases relays DC and PG.

4.07 If operated, relay ANS released:

- (a) Starts the release of relay SR if the automatic release cross-connection is provided. If arranged for trouble recorder transmission of alarms the trouble recorder may fail to grant preference to the alarm transmission prior to release by the attendant. If this happens, automatic release will be delayed (see 16).
- (b) Releases relay AK.
- (c) Opens the tip and ring to the alarm checking terminal.
- (d) Restores control of the TM timer to relay NA.

4.08 If operated, relay TRN released:

- (a) Opens the tip and ring to the alarm checking terminal.
- (b) Restores the output of the TM timer to the UA, UAl, etc, relays.
- (c) Removes the start from the 120-IPM interrupter circuit.
- (d) Opens the FL relay operate path.
- (e) Opens the W and Z relay circuit.
- (f) Enables the TMI timer.
- (g) Operates or releases ZN and ZNA relays.

4.09 Relays ZN and ZNA complete the directory number transfer function initiated by the signal from the attendant.

4.10 Relay SD released releases relay RD.

4.11 Relay AK released:

- (a) Operates relay AR if the cross-connection is provided for automatic release.

- (b) Releases relays W, Z, FL, and removes the start to the interrupter.

- (c) Opens the alarm detection leads of relays A3 to A6.

4.12 Relay RD released releases relay SL1A and opens a lock path of relay TD.

4.13 Relay AR operated and results as described in 6.02 and 6.03.

5. TERMINATION TO THE ALARM CHECKING TERMINAL - SC6

5.01 Two directory numbers are assigned to the alarm checking terminal. Ringing combination 0 is used for one number and ringing combination 1 is used for the other number. These numbers are noncharge and nonrestricted so as to be accessible for maintenance purposes from any phone or attendant switchboard. The tip number is used to transmit a tone identification of the highest alarm condition present. The ring number accomplishes the same purpose but will also attempt to release the alarms upon disconnect from the terminal.

5.02 Since the maintenance facility has responsibility for alarms, the attendant, upon recognizing that alarms have not been transferred, must contact an operator to transfer alarms. (See 18.)

5.03 A call terminating to the alarm checking terminal operates sleeve relay SL in parallel with the hold magnet of the line switch.

5.04 Relay SL in operating:

- (a) Resets the TM timer thus preventing the operation of unanswered relay UA, or holds relay UA operated if it had already operated.
- (b) Removes the shunting ground from ring relay R.
- (c) Operates alarm check relay AK.
- (d) Starts the TMI timer.

5.05 Relay AK in operating:

- (a) Starts the 120-IPM interrupter circuit.
- (b) Completes the circuit of flashing relay FL.
- (c) Enables the W-Z relay circuit.
- (d) Alarm leads of relays A3 to A6 are closed if none of the options W, X, Y, and Z are provided.

(e) Operates relay AKA.

5.06 Relay AKA operated:

(a) Shunts the winding of relay AL to release it and to operate all A- relays that have ground on their alarm leads.

(b) Partially closes the alarm tones to the T lead of the alarm checking terminal.

(c) Resets the 10- to 20-minute AT relay timer.

5.07 An A- relay except A4, operated closes a start signal to the trouble recorder if provided.

5.08 Relay AL releasing removes the shunt path across the winding of relay NA allowing it to reoperate.

5.09 The FL and W-Z relays interrupt the tones and ringing signals as shown on SD Note 306 and the A- relay chain circuit connects the tone of the lowest numbered A- relay operated to the tip conductor of the alarm checking terminal. The lower numbered A- relay represents the more important alarm condition. The operated A- relays have locked to battery of resistance lamp A and will remain operated until the alarm condition is removed or the alarms are restored to the office. Relays A3 through A6 are the exception as they will release when the AK relay is released if none of the options W, X, Y, and Z are provided; however, relay A3 will remain operated if relay A3A is off-normal.

5.10 The alarm tone is applied to the checking terminal as described above from the beginning of termination for an interval of approximately 21 seconds. At the end of the TML timed interval the checking terminal is switched to the dual channel receiver to provide the attendant the opportunity to transfer the directory number dialed by this circuit. Since number transfer may not be desired, the answer signal may be given by the attendant to cause the alarm signals to be reapplied to the line. (See 1.88 and 1.95.)

5.11 Termination to the checking terminal when an alarm signal is being sent via the 2-way operator office trunk circuit results in ground being connected to the CK0 or CK1 lead to signal the trunk circuit to release its alarm signal to the attendant. Note that relay SL has transferred the ground path of the operated T- relay so that it becomes self-locking. The trunk circuit releases the alarm signal to the attendant and opens its ST lead to release the T- relay. The trunk circuit is now

under control of the attendant. Relay SL removes the shunting ground from ring relay R and operates alarm check relay AK.

RING TERMINATION - SC6

5.12 When ringing current is applied to the ring conductor of the alarm checking terminal by the incoming trunk circuit, the ring cold cathode tube R conducts to operate relay R.

5.13 The contacts of relay R are arranged to provide maintenance access to the winding of relay SL and operate slow-release relay SR.

5.14 Relay SR locks under control of relay SL and shunts the winding of relay R to increase the flow of ringing current through cold cathode tube R enough to trip ringing in the incoming trunk circuit. No DC termination is made to operate the charge relays of the incoming trunk circuit. Relay R releases. The operated SR relay will initiate the alarm release function upon disconnect.

5.15 With ringing tripped the alarm tones are heard at the alarm checking terminal until the end of the TML timed interval as previously described. If a new and higher order alarm condition occurs during the termination, its A- relay will operate and its alarm tone will supersede the existing tone. A new and lower order of alarm will operate its A- relay but will not make its presence known because of the chain path of the tone lead.

TIP TERMINATION - SC6

5.16 When ringing current is applied to the tip conductor of the alarm checking terminal the tip cold cathode tube T will conduct to trip ringing in the incoming trunk circuit. No DC termination is made to operate the charge relays of the incoming trunk circuit. The alarm tones are heard as described for a ring termination. No attempt is made to release alarms on a tip termination unless the attendant has given this circuit an answer signal (see 5.10) after the initial application of alarm tones has timed out.

## 6. DISCONNECT FROM THE ALARM CHECKING TERMINAL - SC7

DISCONNECT FROM THE RING SIDE

6.01 Relay SL releases in parallel with the hold magnet of the line switch. The release of relay SL operates alarm release relay AR because of the operated SR relay, opens the holding path of slow-release relay SR, releases relay UA if it was operated, and releases relay AK. The

release of relay AK stops the interrupter circuit and releases any operated A3 to A6 relays if none of the options W, X, Y, and Z are provided, with the exception of relay A3 if relay A3A is off-normal.

6.02 Relay AR operates its auxiliary relay ARL. Relays ARL and AR open or close ground leads or open a loop to release the releasable office alarm conditions. The combined release times of relay SR and the alarm release relays allow 475 to 995 milliseconds for the office alarm conditions to release before restoring these ground leads to normal. The release of relay AR releases its auxiliary relay and slow-release relay AKA. Alarm conditions that did not release will operate and lock their A- relays during the 300- to 600-millisecond release time of relay AKA.

6.03 The release of relay AKA removes the shunt from the winding of relay AL, starts the 10- to 20-minute alarm timing relay AT if any A0 to A5 relays remain operated, and removes the start signal to the trouble recorder if provided.

6.04 If arranged for trouble recorder transmission of alarms the trouble recorder may fail to grant preference to the alarm transmission prior to release by the attendant. If this happens, automatic release will be delayed (see 16).

#### DISCONNECT FROM THE TIP SIDE

6.05 Relay SL releases in parallel with the hold magnet of the line switch. The release of relay SL releases relay AK and relay UA if it was operated.

6.06 The release of relay AK:

- (a) Stops the interrupter circuit.
- (b) Releases any operated A3 to A6 relays if none of the options W, X, Y, and Z are provided, with the exception of relay A3 if relay A3A is off-normal.
- (c) Releases relay AKA.

6.07 Relay AKA removes the shunt from the winding of relay AL and starts the 10- to 20-minute alarm timing relay AT if any A0 to A5 relay is operated.

#### 7. TWO-WAY OPERATOR OFFICE TRUNK OPERATION - SC2, 4-6

7.01 This circuit arrangement provides a backup system for transmitting alarm

signals when the dialer circuit has failed to gain a response to an alarm situation.

7.02 Relay UA1 operated:

- (a) Resets the TM timer.
- (b) Locks to relays NTR and NA released.
- (c) Operates relay UAAL.
- (d) Releases relay ST.
- (e) Transfers the alarm forwarding attempt to the 2-way operator office trunks.
- (f) Opens the sleeve lead to the line switch termination of the dialer releasing relay SL1 if operated.

7.03 Relay UAAL operated:

- (a) Restarts the TM timer.
- (b) Partially closes the operate path for relay UA2.
- (c) Releases relay SD1.

7.04 Relay SL1 released starts the TMA timer.

7.05 Relay ST released:

- (a) Releases relay SD.
- (b) Releases relay S.
- (c) Resets the TMA timer.
- (d) Releases the STA relay.

7.06 Relay SD released releases relay RD.

7.07 Relay STA released:

- (a) Releases relay DC.
- (b) Releases relay CPG.
- (c) Releases relay PG.

7.08 The UA1 relay by operating connects the T- relays to the start leads of the 2-way operator office trunks. If a trunk is found idle, a T- relay will operate which will cause the alarm relay in the trunk to operate and consequently the trunk will forward the alarm signal to the operator. The operator then dials the checking terminal to receive the alarm signals in so operating relay SL which will reset the TM timer.

7.09 If the TM timer is not reset before the end of its 2.5-minute interval, relay UA2 will be operated by the timer.

7.10 Relay UA2 operated:

- (a) Resets the TM timer.
- (b) Locks to relay NTR and NA released.
- (c) Reverses the STO and STI leads and CKO and CKI leads to attempt seizure of the other trunk.

7.11 If the other trunk circuit is busy, the original T- relay will operate to maintain the seizure of the original trunk circuit. If the other trunk is idle, it will be seized to send a new alarm signal and the original trunk is released. This one attempt to seize the other trunk is made because the first trunk may have failed to signal the operator.

7.12 If no response is received to this attempt the TM timer will again complete its cycle and operate relay RCY. (See 14.)

#### 8. UNANSWERED ALARM TIMER - 2.5 MINUTE - SC2-6, 10

8.01 The TM time delay control circuit is started with the absence of ground on terminal I and reset when ground is applied to terminal I.

8.02 With normal circuit operation, the release of relay NA, due to an alarm condition, removes ground from terminal I causing the time delay control circuit to start its interval. At the same time the NA relay started the dialer circuit as described in 1. If that call fails to terminate or the attendant fails to dial a TOUCH-TONE digit, 2, 5, or 8 then the ANS relay will not operate and the TM timer will complete its cycle and operate relay UA. If the attendant dials a TOUCH-TONE digit asterisk or pound sign to transfer the directory number, the TRN relay is operated but the TM timer is not reset. Therefore, the timer is allowed to continue its cycle with its output transferred to the TD relay. (See 10. TIMED RELEASE.) The TD relay will be operated if the attendant does not disconnect.

8.03 Relay UA operated:

- (a) Resets the TM timer.
- (b) Locks to relays NTR and NA released.

(c) Operates relay UAA.

(d) Operates relay UA3.

(e) Transfers the TM timer battery supply from A to F.

8.04 Relay UAA operated:

- (a) Restarts the TM timer.
- (b) Partially closes the operate path for relay UAL.

8.05 Relay UA3 operated:

- (a) Locks to relay ST.
- (b) Transfers the tip, ring, and sleeve leads to the second line switch appearance of the dialer.

8.06 When the linkage is established for the second call the dialer again dials the alarm number as described in 1. If that call fails to terminate or the attendant fails to dial a TOUCH-TONE digit 2, 5, or 8 then as in the first attempt, the TM timer will complete its cycle and operate relay RCY or relay UAL if 2-way operator office trunk operation is provided. (See 13. or 14. for RCY or 7. for UAL.)

8.07 The TM timer is bypassed if a mutilated digit is detected during dialing (see 2).

#### 9. SLEEVE GUARD TIMING - 850 TO 990 MILLI-SECONDS - SC4

9.01 The TMA time delay control circuit is started with the absence of ground on terminal I and reset when ground is applied to terminal I.

9.02 The function of the TMA timer is to provide guard timing for the sleeve lead indication. While establishing a call, common control equipment may open the sleeve lead momentarily allowing relay SL1 to release. Reaction to this is delayed by the TMA timer 850 to 900 milliseconds which will cover this situation but still allow an open sleeve to be detected.

9.03 Break-contacts of relays ST and SD prevent the TMA timer from functioning until the SL1 relay has operated. The timer is thus prepared to function when all three ST, SD, and SL1 relays are operated. In this situation the timer will detect a release of relay SL1 and begin to function. If the SL1 relay does not reoperate before the 850- to 990-millisecond interval ends, the timer will operate the SL1A relay.

9.04 Relay SL1A operated:

- (a) Locks to relay RD operated.
- (b) Releases relay ST.

9.05 Relay ST released:

- (a) Opens the ring lead to the line switch termination of the dialer releasing relay S.
- (b) Releases relay SD and STA.

9.06 Relay STA released releases relays DC and PG.

9.07 Depending on the state of the circuit at the time relay SL1A operates, the circuit will continue to release as previously described. If, when the SL1A relay releases at the end of the release sequence relay NA is still released, a new alarm sequence will start.

10. TIMED RELEASE - 2.5 MINUTE - SC4

10.01 Another function of the TM timer is to provide a timed disconnect feature. When the maintenance facility attendant answers the alarm telephone and dials the answer or number transfer digit, relay ANS or TRN is operated.

ANSWER SIGNAL - SC4

10.02 Relay ANS operated:

- (a) Locks to relay ST.
- (b) Resets the TM timer.
- (c) Operates relay AK.
- (d) Transfers the output of the TM timer from the UA- relays to the TD relay.
- (e) Partially closes a path to operate relay SR if the automatic release cross-connection is provided.
- (f) Connects the line switch termination of the dialer circuit to the alarm checking terminal.
- (g) Opens the NA contact control path of the TM timer to prevent this path from resetting the timer during the timed disconnect cycle.
- (h) Provides an auxiliary lock path for the UA- relays to prevent their premature release when relay NA reoperates.

10.03 Relay AK operated:

- (a) Operates relay AKA.
- (b) Operates relay SR if the automatic alarm release cross-connection is provided.
- (c) Enables the W-Z relay circuit.
- (d) Starts the interrupter circuit and closes the FL relay operate path to the interrupter.
- (e) Closes the A3-6 alarm detection leads to the A3-6 relays, respectively.

10.04 Relay AKA in operating:

- (a) Closes the alarm tones to the alarm checking terminal.
- (b) Resets the AT timing relay.
- (c) Closes the operate path of any A-relay with ground on its detection lead, and releases the AL relay.
- (d) Restarts the TM timer.

10.05 Relay AL in releasing removes the shunt path from the winding of relay NA allowing it to reoperate.

10.06 If for any reason the maintenance facility attendant fails to disconnect before the end of the TM timer interval, relay TD will be operated by the TM timer.

10.07 Relay TD operated:

- (a) Locks to relay RD and SR.
- (b) Disables the automatic release feature if the cross-connection is provided.
- (c) Resets the TM timer.
- (d) Releases relay ST.
- (e) Starts the release of relay SR.

10.08 Relay ST released:

- (a) Releases relay ANS.
- (b) Opens the ring lead to the line switch termination of the dialer.
- (c) Opens the lock path of the UA3 relay.
- (d) Releases relay STA.

- (e) Releases relay SD.
- 10.09 Relay ANS released:
  - (a) Disconnects the dialer circuit termination to the line switch from the alarm checking terminal.
  - (b) Releases relay AK.
  - (c) Transfers the output of the TM timer from relay TD to the UA- relays.
  - (d) Opens the lock path of relay UA releasing it if operated.
- 10.10 Relay STA released:
  - (a) Releases relay DC.
  - (b) Releases relays CPG and PG.
- 10.11 Relay SD released releases relay RD.
- 10.12 Relay AK released:
  - (a) Disables the W-Z relay circuit.
  - (b) Removes the start from the interrupter circuit.
  - (c) Disables relay FL.
  - (d) Starts the release of relay AKA.
  - (e) Opens the detection lead from relays A3-6.
- 10.13 Relay SR released opens a lock path of relay TD releasing it if the other lock path is also open.
- 10.14 Relay RD released:
  - (a) Opens a lock path of relay TD.
  - (b) Releases relay SL1A if operated.
- 10.15 Relay UA in releasing:
  - (a) Releases relay UAA.
  - (b) Releases relay UA3.
- 10.16 Relay AKA released:
  - (a) Removes the shunt from the AL relay winding.
  - (b) Removes alarm tones from the T lead of the alarm checking terminal.
  - (c) Starts the AT timing relay if any A- relays remain operated.
- (d) Removes the start signal to the trouble recorder if provided.
- NUMBER TRANSFER SIGNAL - SC4
- 10.17 Relay TRN operated:
  - (a) Locks to relay ST.
  - (b) Transfers the output of the TM timer from the UA- relays to the TD relay.
  - (c) Connects the line switch termination of the dialer circuit to the alarm checking terminal.
  - (d) Starts the interrupter circuit and closes the FL relay operate path to the interrupter.
  - (e) Enables the W-Z relay circuit.
- 10.18 The attendant hears the number transfer signal.
- 10.19 If for any reason the maintenance facility attendant fails to disconnect before the end of the TM timer interval, relay TD will be operated by the TM timer.
- 10.20 Relay TD operated:
  - (a) Locks the relay RD or SR.
  - (b) Resets the TM timer.
  - (c) Releases relay ST.
- 10.21 Relay ST released:
  - (a) Releases relay TRN.
  - (b) Opens the ring lead to the line switch termination of the dialer.
  - (c) Opens the lock path of the UA3 relay.
  - (d) Releases relay STA.
  - (e) Releases relay SD.
- 10.22 Relay TRN released:
  - (a) Disconnects the dialer circuit termination to the line switch from the alarm checking terminal.
  - (b) Transfers the output of the TM timer from relay TD to the UA- relays.
- 10.23 Relay STA released:
  - (a) Releases relay DC.
  - (b) Releases relay PG.

(c) Releases relay CPG.

10.24 Relay SD released releases relay RD.

10.25 Relay RD released:

(a) Releases relay TD.

(b) Releases relay SL1A if operated.

10.26 Relay TD released allows an alarm situation to immediately initiate a new call since the number transfer instruction does not attempt any alarm release function and does not provide for starting the AT relay delay timer since the attendant did not request the alarm signal.

#### 11. AT (ALARM TIMER) - 10 TO 20 MINUTES - SC2

11.01 If one or more alarm relays A0 to A5 remain operated for 10 to 20 minutes after a disconnect from the alarm checking terminal, alarm timing relay AT operates to shunt the winding of relay NA. The release of relay NA initiates a sequence to signal the attendant as described in 1. Minor alarms associated with the A6 relay do not operate this timer. The timer is recycled during each termination to the alarm checking terminal and a new timing cycle is started upon disconnect from the terminal if an A0 to A5 relay remains operated.

#### 12. SUBSEQUENT OFFICE ALARM SIGNALS TO THE ATTENDANT - SC2

12.01 Assume that a minor carrier alarm in the office has signaled the attendant and been answered by dialing the alarm checking terminal. Relay A2 will remain operated, if the condition causing the alarm has not cleared after being disconnected. Relay AT starts its timing interval and will re-signal the attendant in 10 to 20 minutes.

12.02 During this 10- to 20-minute interval, any new and lower order alarm conditions will operate their A3 to A6 relays but not the AL relay because of the chain path to relay AL. A higher order alarm, such as a power failure, will ground the A0 lead and operate the AL relay. Relay AL shunts the winding of relay NA. Relay NA releases to signal the presence of the new alarm as described in 1.

#### 13. RECYCLE - WITHOUT TWO-WAY OPERATOR OFFICE TRUNKS - SC10

13.01 The recycle function provides continuous call attempts at 2.5-minute intervals if no response is received.

13.02 Relay RCY operated:

(a) Alarm signal given to alarm circuit.

(b) Operates relay AKA if the trouble recorder is provided and operational.

(c) Opens the alarm forwarding start circuit releasing relay ST.

(d) Resets the TM timer.

(e) Releases the UA relay.

(f) Locks to STA and UAA- relays operated.

13.03 Relay AKA operated releases relay AL and operates relays A-.

13.04 Relay ST in releasing:

(a) Releases relay STA.

(b) Releases relay SD.

(c) Releases relay UA3.

(d) Disables the TMA timer.

13.05 Relay UA released:

(a) Releases relay UAA.

(b) Releases relay SD1.

13.06 Relay AL in releasing allows relay NA to reoperate.

13.07 Relay A- in operating closes the start signal to the trouble recorder if provided.

13.08 Relay SD1 in releasing releases relay SL1.

13.09 Relay STA releasing:

(a) Releases relay CPG.

(b) Releases relay PG.

(c) Releases relay DC.

(d) Releases relay RCY with relay UAA released.

13.10 Relay SD released releases relay RD.

13.11 Relay RCY released releases relay AKA if the trouble recorder is provided and operational. If the trouble recorder is not provided or not operational, relay RCY released restarts the TM timer.

13.12 Relay AKA released with an A- relay operated starts the 10 to 20-minute AT timer. (See 11.)

13.13 If the trouble recorder is not provided or not operational when relays RCY and SL1A release, the first dialer sequence is restarted. (See 1.03).

13.14 Relay NA in reoperating maintains reset on the TM timer.

14. RECYCLE - WITH TWO-WAY OPERATOR OFFICE TRUNKS - SC2,5

14.01 The recycle function in this case provides for continuously repeating the two dialer call attempts followed by two attempts at sending an alarm indication via 2-way operator office trunks if no response is received.

14.02 Following the second 2-way operator office trunk attempt the TM timer will operate relay RCY.

14.03 Relay RCY operated:

- (a) Alarm signal given to alarm circuit.
- (b) Operates relay AKA if the trouble recorder is provided and operational.
- (c) Opens the alarm forwarding start circuit.
- (d) Resets the TM timer.
- (e) Releases all UA- relays.
- (f) Locks to UAA- relays operated.

14.04 Relay AKA operated releases relay AL and operates relays A-.

14.05 Relay UA- releasing releases relays UAA-.

14.06 Relay AL in releasing allows relay NA to reoperate.

14.07 Relay A- in operating closes the start signal to the trouble recorder if provided.

14.08 Relays UAA- in releasing releases relay RCY.

14.09 Relay NA in operating maintains the reset on the TM timer.

14.10 Relay RCY in releasing releases relay AKA if the trouble recorder is provided and operational.

14.11 If the trouble recorder is not provided or not operational relay RCY in releasing:

- (a) Restarts TM timer.
- (b) Restarts the first dialing sequence.

14.12 Relay AKA in releasing starts the AT timer.

15. REMOTE TROUBLE RECORDING OF OFFICE ALARMS - SC2, 4, 5, 6, 10, 11

15.01 To provide a permanent record of alarm information and to backup alarm sending, the trouble recording feature may be used in parallel with alarm sending.

15.02 The office alarm signals within the office are terminated at the alarm circuit where they are grouped for alarm sending and segregated for office alarms and remote trouble recording.

15.03 The alarm sending circuit will respond to a sustained signal on its detection leads and will transmit a signal indicating an alarm exists within the category indicated and no alarms exist within higher priority categories.

15.04 The trouble recorder will, upon receiving a start signal, grant preference to an alarm transmission if idle and operational. An alarm transmission will include all existing alarm signals at the time of transmission without regard to priority. The trouble recorder start signal is provided by the alarm sending circuit or the alarm circuit. If preference to an alarm transmission is delayed due to a service busy condition in the trouble recorder, the alarm release function of the alarm sending circuit may be delayed in order to prevent loss of alarm information for the trouble recorder transmission. When the trouble recorder grants preference then, it allows the alarm release function to proceed in the alarm sending circuit.

15.05 The alarm sending circuit delivers a start signal to the trouble recorder on each successful termination by or to the alarm sending circuit. Unsuccessful terminations by alarm sending will result in recycle which also results in a start signal to the trouble recorder.

15.06 The alarm circuit will provide an immediate start signal to the trouble recorder if its primary battery is lost. Loss of this battery disables alarm sending.

15.07 The remote trouble analyzer and display has the capacity to display and record uniquely, all possible alarm signals in No. 3 crossbar simultaneously. Therefore, masking of alarms is eliminated and the combination of alarms received may indicate more precisely the origin of a problem.

#### 16. ALARM RELEASE DELAYED BY TROUBLE RECORDER - SC11

16.01 Remote alarm release may be delayed following disconnect from the alarm sending circuit by the attendant if the trouble recorder has not granted preference to the alarm transmission.

16.02 If relay SR was operated on the termination to or by alarm sending and the trouble recorder did not grant preference, the SR relay is held through the test circuit until preference is granted.

16.03 When preference is granted, the trouble recorder proceeds to transmit the alarm message while opening the SR relay lock path and closing the operate path of relay AR.

16.04 This allows releasable alarms to release as previously described.

#### 17. TRANSFER OF ALARMS TO THE DISTANT BUILDING - LOCAL - SC1

17.01 The transfer key at the test circuit is operated to release the not transferred relay NTR in this circuit.

17.02 The release of relay NTR prepares the office by silencing the audible alarms and initiating alarm grouping functions that are external to this circuit. In this circuit, the alarm release relay AR is enabled for remote alarm release; the "office not transferred" tone is removed from the checking terminal and the alarm forwarding circuit and TM timer are enabled.

17.03 The operated NA relay signifies that no alarm condition is present. While the alarms are transferred to the distant building, a release of relay NA will initiate an alarm signal to attendant.

#### 18. ATTENDANT TRANSFER OF ALARMS TO THE DISTANT BUILDING - REMOTE - SC1

18.01 The capability of transferring alarms from the office alarm circuit to a distant monitoring point is provided both in the office and from a remote location. Transfer of alarms from a remote location is performed by an operator but the need to transfer alarms must be recognized by the monitoring point when it is learned that the office has been left unattended without the local transfer function being performed.

18.02 An operator may transfer the alarms to the distant building by terminating to the ring side of the alarm checking terminal over a coin trunk. After ringing has tripped the operator applies either a coin collect or coin return signal. This signal appears as either a plus or minus 130 volts on the tip conductor which ionizes the tip cold cathode tube T to operate relay T.

18.03 Relay T operates the transfer relay TR.

18.04 Relay TR operated:

- (a) Locks to the transfer key at the test circuit.
- (b) Releases the not transferred relay NTR.
- (c) Lights the TR lamp as a reminder to maintenance personnel that the alarms were transferred by the operator.

18.05 Relay NTR released:

- (a) Opens the path of the T tube and relay.
- (b) Removes the not transferred signal from the line and applies the alarm signal or no alarm signal.
- (c) Starts the TMI timer.

18.06 The TMI timer completes its cycle (21 seconds) and operates relay AC if the attendant does not disconnect.

18.07 Relay AC operated:

- (a) Removes the alarm tone from the line and connects the attendant to the dual

channel receiver to provide the opportunity to transfer the dialer number.

18.08 No provision is made for the alarms to be restored to the office except by the local maintenance personnel operating the transfer key at the test circuit.

#### 19. RESTORING ALARMS TO THE OFFICE - SC9

19.01 The TR lamp will be lighted if the alarms were transferred to the distant building by the operator. The transfer key at the test circuit is then operated to release relay TR and extinguish the TR lamp.

19.02 Releasing the transfer key will re-operate relay NTR which restores the alarm grouping and audible alarms to the office. Battery of resistance lamp A is removed from the A- relays and the alarm release relay AR is disconnected from the alarm checking terminal. Relay NA and any operated A- relays are released. Only relay NTR remains operated.

#### 20. TONE INTERRUPTER - SC8

20.01 The tone interrupter consisting of relays FL, W, and Z along with the interrupter circuit which provides a 120-IMP interruption rate upon request, interrupts and groups tone and ringing signals in order to produce unique signals for the attendant indicating alarm categories.

20.02 The start signal to the interrupter circuit results in the FL relay being operated for 250 milliseconds then released for 250 milliseconds with this being repeated as long as the start signal is maintained.

20.03 The FL relay controls the W, Z, relay circuit to further break up and expand the interruption rate of the interrupter circuit.

#### 21. TROUBLE CONDITIONS WITHIN THE ALARM SENDING CIRCUIT - SC2

##### WITHOUT TWO-WAY OPERATOR OFFICE TRUNKS

21.01 No alarm signal returned by alarm sending:

- (a) Loss of battery in the alarm detection portion of this circuit will release battery guard relay BG. Released, relay BG will release relay NA and open the alarm tone lead to the alarm checking terminal thus indicating by default a

serious problem exists. Relay NA released starts the TM timer, operates relay ST, and provides a lock path for relay UA. The operation of the ST relay starts the dialer circuit as described in 1.

- (b) Loss of battery in the office alarm circuit will release relay NTR. Released, relay NTR will effect a transfer of alarms to the distant building if they were not previously transferred. Relay NA releases in parallel with relay NTR to operate relay ST which starts the dialer circuit as described in 1. When the attendant answers, the AKA relay will not operate to close the alarm tone lead to the alarm checking terminal, therefore, indicating by default a serious problem exists. The start signal for the trouble recorder, if provided, in this case, will be provided by the office alarm circuit.

- (c) False grounds within the alarm checking terminal will indicate by default a serious problem exists.

21.02 Alarm checking terminal fails to receive incoming calls.

- (a) Loss of battery in the alarm checking terminal will not allow relays SL and SR to operate which will not permit termination to the alarm checking terminal. However, the dialer circuit should function and indicate an AO alarm.

21.03 Dialer circuit fails to originate an alarm call.

- (a) Loss of any battery in the dialer circuit or pulse generator circuit will prevent the dialer from functioning but the TM timer will function to operate relay RCY. Relay RCY operated operates relay AKA if the trouble recorder is provided and operational, signals the alarm circuit of alarm sending failure, resets the TM timer, releases relay ST, releases relay UA, and locks to relays STA and UAA operated. Relay AKA operated restarts the TM timer and shunts the AL relay winding releasing relay AL and operating relay AO. Relay ST released releases relay STA. Relay UA released releases relay UAA. Relay AO in operating closes the start signal to the trouble recorder if provided, operating relay ALST in that circuit. Relay ALST operated will cause the trouble recorder to transmit the alarms to the remote trouble analyzer. Relays STA and UAA released releases relay RCY. Relay RCY released releases relay AKA and relay AKA released removes the start from the trouble recorder and starts the AT relay timer.

(b) A self-checking feature of the dialer circuit is arranged to detect a mutilated digit and abort dialing. If the condition causing the mutilated digit is permanent the second attempt at dialing will also be aborted and the RCY relay will be operated with results as previously described.

21.04 Alarm call originated by alarm sending but alarm signal indicates no alarm situation.

(a) False grounds within the alarm forwarding portion of this circuit will tend to operate relay ST to start dialer operation to terminate a call. However, with no A- relays operated a no alarm indication is given in response to an answer signal.

21.05 Alarm condition given by alarm sending found to be nonexistent.

(a) False grounds within the alarm detection portion of this circuit will tend to operate relay AL or shunt down relay BG, operated, relay AL or released relay BG will release relay NA to start dialer operation to terminate a call. Since the indicated alarms are not a result of office malfunction, problems will likely be found to be nonexistent.

21.06 Alarm release ineffective.

(a) Loss of battery in the alarm release circuit will prevent certain alarm release functions but will not prevent an AO alarm from being transmitted via the dialer circuit.

#### WITH TWO-WAY OPERATOR OFFICE TRUNKS

Note: With 2-way operator office trunks as a backup to the dialer circuit, most of the trouble conditions within the alarm sending circuit listed under operation without 2-way operator, office trunks apply in this situation also with the following exceptions:

21.07 Dialer circuit fails to originate an alarm call.

(a) Loss of any battery in the dialer circuit or pulse generator circuit will prevent the dialer from functioning but the TM timer will function to operate relay UAl. This will instigate an alarm signal to the 2-way operator office trunk.

(See 7.) If this signal fails to gain a response the RCY relay will be operated after two attempts at sending the alarm signal via the 2-way trunk circuits. (See 14.)

(b) Loss of battery in the alarm detection portion of this circuit will release battery guard relay BG. Relay BG released releases relay NA and operates relay UAl. The operation of relay UAl bypasses the dialer start and immediately attempts to seize a 2-way trunk for transmission of the alarm.

#### 22. CENTRALIZED STATUS, ALARM AND CONTROL SYSTEM (CSACS) USE OF ALARM SENDING CIRCUIT ALARM TRANSFER AND ALARM RELEASE FUNCTIONS

22.01 In the event that an operating company wishes to convert from existing alarm sending type remote office alarm monitoring systems to CSACS operation, the alarm transfer and alarm release functions of this circuit, which would also be necessary with CSACS, are made available through cross-connections. The cross-connections simply disable all alarm sending functions except for alarm transfer and alarm release.

22.02 The CSACS is a Centralized Computer System arranged to scan the alarm condition of many offices and record all pertinent data without masking.

22.03 The No. 3 crossbar office provides several scan points to CSACS to indicate specific alarm conditions. One scan point is provided by this circuit, namely the TR lead. This scan point indicates the transferred or not-transferred status of the office. In addition to scan points, control points are also provided to CSACS. The two control points provided by this circuit are the AR and RTR leads. The AR lead allows CSACS to attempt alarm release at the end of each scan. The RTR lead allows CSACS to transfer alarms to itself but not automatically.

#### ALARM TRANSFER

22.04 Upon command from operating personnel, CSACS closes ground to control point RTR. This ground operates relay TR.

22.05 Relay TR operated:

(a) Locks to the normal TR key in the test circuit.

(b) Lights the TR and AT lamps in the test circuit. Lighting the TR lamp indicates alarms were transferred by CSACS.

(c) Extinguishes the LAC lamp in the test circuit.

(d) Releases the NTR relay.

22.06 Relay NTR released:

(a) Enables the AR control point.

(b) Grounds the TR scan point to indicate alarms transferred.

(c) Disables the office audible and visual alarm functions.

#### ALARM RELEASE

22.07 Each scan by CSACS is followed by an alarm release signal on control point AR. If alarms are not transferred this circuit opens this control point. Ground on control point AR operates relay AR.

22.08 Relay AR operated:

(a) Operates relay AR1.

(b) Operates relay AKA.

22.09 Relay AR1 operated:

(a) Opens or closes grounds or opens a loop to release releasable alarms.

(b) Locks to relay AKA.

22.10 Relay AKA provides a lock path for relay AR1 which, due to its slow-release characteristic, provides additional time for the alarm release interval.

22.11 When CSACS opens the AR control point relay AR releases.

22.12 Relay AR released releases relay AKA.

22.13 Relay AKA released releases relay AR1.

22.14 Relay AR1 released recloses or opens grounds or closes a loop to allow new alarms to lock in.



SECTION III - REFERENCE DATA1. WORKING LIMITS

1.01 None.

2. FUNCTIONAL DESIGNATIONS2.01 Relays

<u>Designation</u>	<u>Meaning</u>	<u>Designation</u>	<u>Meaning</u>
A0-6	Alarm Category 0-6	S	Supervisory
A1A	Alarm Category 1A	SD	Start Dialing
A3A	Alarm Category 3A	SD1	Start Dialing 1
AC	Attendant Control	SL	Sleeve
AK	Alarm Check	SL1	Sleeve 1
AKA	Alarm Check Auxiliary	SL1A	Sleeve Auxiliary
AL	Alarm	SP	Stop Pulsing
ANS	Answer	SR	Slow-Release
AR	Alarm Release	ST	Start
AR1	Alarm Release Auxiliary 1	STA	Start Auxiliary
AS-HS, JS-LS	A-H, J-L Digit Steering	T	Tip
AT	Alarm Timer	TO,1	Trunk 0, 1
BG	Battery Guard	TD	Timed Disconnect
CHK	Check	TR	Transfer
CPG	Control Pulse Generator	TRN	Transfer Number
DC	Dialing Completed	UA	Unanswered
FL	Flashing	UA1	Unanswered 1
NA	No Alarm	UA2	Unanswered 2
NTR	Not Transferred	UA3	Unanswered 3
PG	Pulse Generator	UAA	Unanswered Auxiliary
PG1-5	Pulse Generator 1-5	UAA1	Unanswered Auxiliary 1
R	Ring	UAA2	Unanswered Auxiliary 2
RO,1,2,4,7	Register 0,1,2,4,7	W	Traditional
RCY	Recycle	WN	Traditional Number
RD	Ready Dial	WP	Traditional Pulsing
		Z	Traditional
		ZN	Traditional Number
		ZNA	Traditional Number Auxiliary
		ZP	Traditional Pulsing

### 3. FUNCTIONS

3.01 Detects alarm situations in the office which are grouped into seven categories of descending order of preference on relays A0 to A6, respectively.

3.02 Alarms can be either transferred to the distant office or not transferred, depending on the position of the TR key at the test circuit or the state of the TR relay in this circuit.

3.03 Provides an alarm checking terminal to which any operator or maintenance telephone may terminate to determine the nature of the alarm.

3.04 Provides tone signals on the alarm checking terminal for identification of the alarm category.

3.05 Allows for remote control of alarm transfer through the alarm checking terminal.

3.06 Allows for remote control of alarm release through the alarm checking terminal when the operator releases after having terminated to the ring side of the alarm checking terminal.

3.07 Provides for manual alarm release by a key at the office test frame.

3.08 If an alarm persists after the attendant has disconnected from the alarm checking terminal, a timer will function for a period of 10 to 20 minutes after which the alarm will be sent again.

3.09 If alarms are transferred, the circuit will initiate a pots call to a dedicated alarm telephone at a maintenance facility when an alarm situation is detected.

3.10 With the call terminated, this circuit will recognize a TOUCH-TONE digit 2, 5, or 8 dialed by the attendant as an answer and connect the alarm tones to the termination.

3.11 Provides unanswered timing allowing each call attempt 2.5 minutes to complete.

3.12 Provides for a second call attempt via a different line switch if the first attempt was unanswered.

3.13 Provides for a third attempt at sending an alarm indication by seizing a 2-way operator office trunk causing it to signal an operator (service option).

3.14 Provides for a fourth attempt at sending an alarm indication by seizing the same or a different 2-way operator office trunk causing it to signal an operator if the previous attempt did not result in a call terminated to the alarm checking terminal (service option).

3.15 Provides a timed disconnect feature allowing a maintenance facility attendant approximately 2.5 minutes before this circuit automatically drops the connection.

3.16 Provides for automatic alarm release of releasable alarms as a cross-connectable feature.

3.17 Provides through cross-connections, means for minimizing dialing-time by aborting unnecessary digit steering.

3.18 Provides a cross-connect field for setting up two directory numbers to be dialed by the dialer circuit.

3.19 Provides the capability for transferring from one directory number to the other from a remote location.

3.20 Provides a start indication to the trouble recorder for its transmission of alarm information (service option).

3.21 Failure to communicate an alarm situation will result in recycle which provides an unlimited number of attempts at terminating an alarm.

3.22 Provides a self-checking feature to detect a mutilated digit during dialing. The circuit will abort dialing the number on which the mutilated digit is detected and advance the circuit to dial again or seize a 2-way operator office trunk.

3.23 Provides the Centralized Status, Alarm and Control System with alarm transfer and alarm release functions when an office is converted from alarm sending to CSACS operation (service option).

4. CONNECTING CIRCUITSDesignationMeaning

4.01 When this circuit is listed on a key-sheet, the connecting information listed thereon is to be followed.

A1

Minor Power Alarms.

Major Carrier Alarm.

Interrupter Failure Alarm.

(a) Two-Way Operator Office Trunk Circuit - SD-26429-01.

Message Register Power Supply Failure.

(b) Alarm Circuit - SD-26393-01.

Connector Alarm.

(c) Circuits Requiring Remote Control of Alarm Release -

Reserved for Major CDO Alarm.

(d) Interrupter Circuit 60 or 120 IPM - SD-26407-01.

Reserved for Major PBX Alarm.

(e) Line, Line Switch and Connector Circuit - SD-26382-01.

First Preference Local Option.

(f) Marker Connector Circuit - SD-26389-01.

(g) Power, Ringing, and Tone Distributing Circuit - SD-26414-01.

A1A

Trouble Permanent Signal Overflow Alarm.

(h) Ringing and Tone Circuit - SD-26457-01.

A2

Alarm Sending Failure Alarm.

(i) Test Circuit - SD-26411-01.

7A Announcement System Alarm.

(j) Time Delay Control Circuit - SD-94820-01.

Minor Carrier Alarm.

(k) CSACS E2A Circuit -

Trouble Recorder Failure Alarm.

5. MANUFACTURING TESTING REQUIREMENTS

5.01 See SD-26442-01 Circuit Requirements Test Notes.

Second Preference Local Option.

6. FUNCTIONAL MEANING OF ALARMS

A3

Marker Time Out (0) - Major.

6.01 AlarmsDesignationMeaning

A0

Major Power Alarms.

Third Preference Local Option.

Major Central Office Alarms.

A3A

Calling Line Identification Alarm.

AC Commerical Power Failure.

A4

Marker Time Out (0) - Minor.

Pickup Alarm.

Marker Time Out (1) - Minor.

Emergency Reporting Alarm Circuit Failure.

Loss of Alarm Circuit Battery.

Stuck Sender Trunk Identifier Alarm.

<u>Designation</u>	<u>Meaning</u>	<u>Designation</u>	<u>Meaning</u>
A5	Load Alarms - Incoming Registers	A6	Minor Central Office Alarms.
	Originating Registers		Incoming Permanent Signal Alarm.
	Senders		Reserved for Minor CDO Alarm.
	Markers		Reserved for Minor PBX Alarm.

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