COMMON SYSTEMS
AUXILIARY SENDER
CIRCUIT
FOR DIRECT DISTANCE DIALING
PANEL AND CROSSBAR NO. 1 OFFICES

41

CHANGES

D. Description of Changes

D.1 A break-contact of the T relay is added to ZT option wiring in FS 9. This contact prevents the TM relay, on a 7DG call, from locking to a battery on the AV1 lead from the customer sender after the ST pulse has been sent. This contact is added on a D no-record basis.

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AUXILIARY SENDER
CIRCUIT
FOR DIRECT DISTANCE DIALING
PANEL AND CROSSBAR NO. 1 OFFICES

CHANGES

A. Changed and Added Functions

A.1 A feature is added whereby only 7 digits can be MF pulsed forward on a 7DG call. The auxiliary sender will outpulse the seventh digit as soon as it is received, followed by a start pulse.

A.2 A feature is added whereby the TM relay is inhibited from pulsing after the auxiliary sender times out.

A.3 A feature is added which removes from the circuit the locking and shunt contacts on the ON relay. The ON relay is now controlled directly from a make-contact on the SC relay.

B. Changes in Apparatus

B.1 Added

THA, 1/2 AK26 Relay, Opt ZT

THA, 185A Network, Opt ZT

BK, 400J Diode, Opt ZN

B.2

Superseded	Superseded By
ON, 18AG Resistor, Opt ZQ	ON, 446F Diode, Opt ZR

D. Description of Changes

D.1 Option ZT is added to FS8, FS9, FS10, and FS17 to provide the auxiliary sender with a means to MF outpulse the seventh PCI digit as soon as it is received and to follow with an interdigital interval and an ST pulse on 7DG calls. The circuit arrangement prior to this change is shown as option ZS.

D.2 Option ZN is added to FS9 and FS12 to provide a path with which to hold the TM relay on its back-contact upon time-out (BK operated).

D.3 Option ZR is added to FS1 to place the ON relay directly under control of a make-contact on relay SC. The circuit arrangement prior to this change is shown as option ZQ.

D.4 Note 102 has been divided as follows:

1) Note 102A Features Always Provided

2) Note 102B Optional Features

3) Note 102C Features or Options Always Provided After Introduction into Manufacture.

D.5 Circuit Note 104 has been modified.

D.6 The SC3 on sheets E6, E7, and E8 has been changed to show the circuit action when option ZT is applied. Note 5 has been added on E7 and Notes 4 and 5 on E8.

F. Changes in CD Sections

F.1 Under SECTION I, 1., 1.32 add before the first sentence:

(Mfr Disc)

F.2 Under SECTION I, 1., add:

1.321 The auxiliary sender is arranged to MF outpulse only 7 digits on a 7DG call. The change, to control by the MF pulse timer circuit, follows the registration of the seventh digit. That digit is immediately MF pulsed-forward followed by an interdigital interval and the ST pulse.

F.2 Under SECTION II, 6., change 6.5 as follows:

6.5 Multifrequency Pulsing to Remote Sender (Mfr Disc)

F.2 Under SECTION II, 6., add:

6.6 Multifrequency Pulsing to Remote Sender (ZT Option)

Multifrequency pulsing is similar to

the 10-digit call, with the exception that the transmission of the start pulse to the remote sender must follow the MF pulsing of the seventh CI digit registered in the auxiliary sender. The start pulse will be followed by a signal to the subscriber sender to disconnect.

6.61 When relay AC releases following reception of the fourth pulse of the seventh CI digit, a path is completed to operate the CE relay. Relay CE operated completes a path to an MF- (numerical) relay corresponding to the seventh digit registered on the odd CI register. The circuit action is the same as described in 4.31 through 4.36.

6.62 Relay H operated when relay AC reoperated. Relay CE releases, releasing relay AC. When the pulse timer relay TM was forced to its back-contact, relay TS also moved to its back-contact. This, plus relay AC released, operates relay CO. Relays H and CO operated open the inhibitor lead to allow relay TM to pulse at its natural period.

6.63 Relay TM times for 63 milliseconds before it moves to its front contact. This constitutes the interdigital timing between the seventh digit and the ST pulse.

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6.64 The MF transmission of the start pulse is the same as described in 4.6 except that the operate path for relay STC is as follows: Off-normal ground from the front contact of relay TS-1, through make-contacts on relay T, through break-contacts on relay U, through make-contacts on relay 7DG.

F.3 Under SECTION III, 2., add:

Relay	Meaning	Primary Functions
THA	Thousands Auxiliary	Initiates action to MF pulse seventh CI digit immediately after registration.

F.4 Under SECTION II, 3., add:

3.14 On a 7-digit call, to transmit on a multifrequency basis the seventh call indicator digit as soon as it is registered and a start pulse under control of a timing circuit in the auxiliary sender.

F.4 Under SECTION III, 3., to the end of 3.15 and 3.16, add Mfr Disc.

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AUXILIARY SENDER
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CHANGES

D. Description of Changes

D.1 The presentation of option ZK in FS11 has been revised to clarify the ZK information which was added on Issue 19D.

D.2 Circuit Notes 102 and 104 have been modified.

D.3 Circuit Note 108 has been added.

D.4 CAD 1 has been changed to agree with manufacturing drawings.

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AUXILIARY SENDER
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PANEL AND CROSSBAR NO. 1 OFFICES

CHANGES

B. Changes in Apparatus

B.1 Added

Fig. 3

MFPT, 221A Resistor, "ZK" Option
MFPR, 221A Resistor, "ZK" Option
MF, 542F Capacitor, "ZK" Option
MFP, 542AF Capacitor, "ZK" Option

B.2

Superseded	Superseded By
MFP Resistor, 18BD, "ZJ" Option	MFP Resistor, 18DR, "ZK" Option

D. Description of Changes

D.1 This change provides 900 ohm multi-frequency pulsing capability in order to optimize the impedance match between the auxiliary sender and 900 ohm local or tandem trunks.

D.2 In FS11, wiring and apparatus option "ZJ" is created and rated "Mfr Disc.". Wiring and apparatus option "ZK" is added replacing option "ZJ". Wiring and apparatus options "X" and "W" are rated "Mfr Disc." and replaced by option "ZK".

D.3 Circuit Note 104 is modified in order to reflect the above changes.

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DEPT 2311-JAH-MFF-LM

COMMON SYSTEMS
AUXILIARY SENDER
CIRCUIT
FOR DIRECT DISTANCE DIALING
PANEL AND NO. 1 CROSSBAR OFFICES

CHANGES

D. Description of Changes

D.1 Wiring options "ZG", "ZH", and "ZI" are added in FS1, FS6, and FS13 in order to provide alternate link closure check paths. These alternate paths are necessary due to the fact that the link closure signal to auxiliary senders equipped for reconstruction was provided through the auxiliary sender link extension switch and the subscriber sender recycle circuit. These circuits are not always provided when reconstruction is added, therefore; options "ZH" and "ZI" provide link closure check paths through the link extension switch and link switch, respectively. Option "ZG", previously part of Fig. 5, shows the original link closure check path.

D.2 Circuit Note 107 is added and Notes 102 and 104 are modified to reflect the above changes.

D.3 On Sheets A1, A3, B17, D1, D2, E24, and E25 references to "Universal Information" are changed to "Information Code 411", and references to "Emergency Operator" are changed to "Emergency Code 00".

D.4 CADs 1 and 5 are changed.

F. Changes in CD Sections

F.1 Under SECTION II, add:

9.113 When reconstruction is added to an auxiliary sender, the auxiliary sender link crosspoints are checked closed by:

Option "ZG": Extending a ground from the subscriber sender recycle circuit through a link extension switch crosspoint to operate the TGF1 relay.

Options "ZG" and "ZI": Extending TGF1 operate ground through a link extension switch crosspoint (when the extension switch is provided), or extending TGF1 operate ground through a link switch crosspoint.

Option "ZH": Extending the class lead through the "LC" lead of the link extension switch and operating the TGF1 relay from the TGF through a break contact of relay RE.

These various link closure signal paths are necessary due to the fact that groups of auxiliary senders which are arranged for reconstruction may be associated with a group of subscriber senders containing senders which are not necessarily equipped for recycle.

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DEPT 2311-JAH-MFF-LM

COMMON SYSTEMS
AUXILIARY SENDER
CIRCUIT
FOR DIRECT DISTANCE DIALING
PANEL AND CROSSBAR NO. 1 OFFICES

CHANGES

A. Changed and Added Functions

A.1 A feature is added to provide outpulsing of 411 and NPA 411 to a CAMA tandem.

A.2 A feature is added to transmit a special start signal on emergency operator calls to a traffic service position from No. 1 crossbar LAMA offices equipped with the ODN feature.

B. Changes in Apparatus

B.1 Added

Fig. 13

INF - INF1 - AK22 Relay
INFE - INFO - AK22 Relay
INF - 185A Network
INF1 - 185A Network
INFE - 185A Network
INFO - 185A Network

Fig. 14

EOP - S510 Relay
EOP1 - AK22 Relay
EOP1 - 185A Network

D. Description of Changes

D.1 Option 13 is added to the Option Index on Sheet A4 to provide outpulsing of 411 and NPA 411 to a CAMA tandem. The circuit arrangement prior to this change is shown as option ZE. Option 14 is added to provide sending a special start signal on emergency operator calls to a TSP from a No. 1 crossbar LAMA office equipped with the ODN feature. The circuit arrangement prior to this change is shown as option ZF. Option ZD is also added to limit the auxiliary sender to 7- and 10-digit calls. The circuit arrangement prior to this change is shown as option ZC. These changes shall be co-ordinated with a corresponding change in the subscriber sender circuit, SD-25012-01, Issue 92D.

D.2 FS17 is added to show the screening and outpulse control for the universal information feature.

D.3 Sheet C7 is added to show the new Fig. 13 and 14.

D.4 On Sheet D1, options 13, 14, ZE, and ZF are added to the Feature or Option Table and to the record of figures, wiring, and apparatus changes and rated AT&TCo Std. Option ZD is added to the record of figures, wiring, and apparatus changes and rated AT&TCo Std. Option ZC is added and rated "Mfr Disc." Fig. 13 and 14 are added to the Fusing Table.

D.5 On Sheet D2, the universal information feature connections and Fig. 13 are added to Block Diagram Note 302. The emergency operator feature connections and Fig. 14 are also added to Block Diagram Note 302. The equipment arrangements for Fig. 13 and 14 are added to Note 303.

D.6 On Sheets E24 and E25, Sequence Chart SC19 is added to show a 1 + 411 call.

D.7 On Sheet F1, EOP, EOP1, INF, INF1, INFE, and INFO relays are added to the Circuit Requirement Table.

D.8 On Sheet F3, Test Note 2 is added to the Circuit Requirement Table.

F. Changes in CD Sections

F.1 Under TABLE OF CONTENTS, Page 1 SECTION I - GENERAL DESCRIPTION, add:

1.6 Universal Information Feature

3.27 Emergency Operator Circuit With the Outpulsing Directory Number Feature (Emergency Operator 0-0)

3.28 Universal Information Circuit

F.2 Under SECTION I, Part 1, add:

1.6 Universal Information Feature

1.61 A feature is provided in the auxiliary sender to MF outpulse 411 or NPA 411 to a CAMA tandem

F.2 Under SECTION I, Part 3, add:

3.27 Emergency Operator Circuit With the Outpulsing Directory Number Feature (Emergency Operator 0-0)

(a) Registers the mark received over lead 14 from the subscriber sender circuit.

(b) Transmits a special start signal after the calling number is MF outpulsed.

(c) On multiparty and identification failures, a special start signal is transmitted after the identification signal.

3.28 Universal Information Circuit

(a) Registers the mark received over lead DC from the subscriber sender circuit.

(b) On a 1 + 411 call, will screen for a 1 PCI transmitted forward in the ACB and ACC digits from the subscriber sender.

(c) To MF outpulse 411 or NPA 411 and cut off outpulsing of all zeroes, followed by a regular start signal.

F.3 Under SECTION II - DETAILED DESCRIPTION, Part 10, add:

10.3 Emergency Operator Call

The auxiliary sender is used to complete the connection when emergency operator traffic is routed to a traffic service position.

The functions remain the same as a zero operator call (10.2) except for the following.

10.31 The subscriber sender places a solid ground on lead 14, operating the EOP, OPR, and CL3 relays in series. The operation of the EOP relay closes a link in the path to operate the EOP1 relay after the ODN1 relay has operated.

10.32 EOP1 relay operated:

(a) Opens up a link to lead 7 (1500~) to the MF supply and distribution circuit and closes a link from lead 1 (900~) to the operated CL3 relay.

(b) Closes a link in the path to operate the STC relay after the AA relay operates on multiparty and identification failures.

(c) Opens up a link to the operate path of the STE relay.

F.3 Under SECTION II, add:

11. UNIVERSAL INFORMATION FEATURE

11.1 Universal Information 1 + 411 Call (SC19)

This type of call is similar to a 7-digit call except that the subscriber sender grounds the DC lead to the auxiliary sender as a mark indicating a universal information call. The grounded DC lead operates the INF relay.

11.11 INF Relay Operated:

(a) Locks to off-normal ground.

(b) Closes a link in the path to operate the INFE relay if a 1 is PCI transmitted forward from the subscriber sender during the ACB digit.

(c) Closes a link in the path to operate the INFO relay if a 1 is PCI transmitted forward from the subscriber sender during the ACC digit.

(d) Closes a link to lock, operated the INFE and INFO relays.

11.12 INFE Relay Operated:

(a) Locks to ground at the operated INF relay.

(b) Closes a link between the operated ACCA relay and the normal AA relay to operate the INFO relay if a 1 is PCI registered in the ACC digit.

11.13 INFO Relay Operated:

(a) Locks to ground at the operated INF relay.

(b) Closes a link to operate the INF1 relay when the AA digit control relay operates and the INFE relay has operated.

11.14 After registration of the universal information mark, screening of the ACB and ACC digits for a 1 PCI registered, the auxiliary sender prepares to cut off MF outpulsing.

11.15 INF1 Relay Operated:

(a) Opens up the tip and ring control leads to the MFP repeat coil and terminating resistor, cutting off the MF outpulsing of zeroes.

(b) Closes through the repeat coil to the STC relay in preparation of sending a start pulse.

11.16 1 + NPA + 411 Call

This type of call is similar to a 7-digit call, except that the DC lead is grounded. After the TH digit control relay operates, the INF1 relay operates, cutting off the MF outpulsing of a zero in the units position and then transmitting the start signal.

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TABLE OF CONTENTS

SECTION I - GENERAL DESCRIPTION

1. GENERAL METHOD OF OPERATION

1.1 General Functions

The Auxiliary Sender supplements the digit dialing capacity of the subscriber sender and enables the subscriber to dial 10 digits when required for Direct Distance Dialing. This sender transmits the called number information forward to the crossbar tandem office or to the toll dialing control switching point office (when either is provided with centralized automatic message accounting equipment) on a multifrequency pulsing basis. Local area 7 or 8 digit calls may also be pulsed forward on an MF basis by the Auxiliary Sender.

1.2 Ten Digit Call

1.21 When the digit dialed on the B register of the subscriber sender is 0 or 1, the sender is put on notice that the use of an auxiliary sender will be required for completion of the call. When the seventh digit has been dialed the subscriber sender will:

(a) Connect ground to the start lead to the auxiliary sender link circuit.

(b) Connect a class signal (ordinarily a 1711 ohm ground) to the class lead to the link circuit.

1.22 If an idle auxiliary sender is available, connection to it will be completed at once. If the subscriber sender cannot be connected to an auxiliary sender before the start of dialing of the 9th digit, it will send the call to overflow. The first and subsequent attempts by the link to obtain an idle auxiliary sender should ordinarily occur in a short enough interval to have the auxiliary sender waiting for the dialing of the ninth digit. The signal to the subscriber sender that an auxiliary sender is connected, is given by the link circuit.

1.23 When the subscriber sender is connected to the auxiliary sender the dial pulse lead and the AV-1 lead of the subscriber sender are extended through the link to the auxiliary sender. Within the subscriber sender, the pulsing tip and ring leads (FT and FR) are split in such a way, that the subscriber sender can look at the auxiliary sender with its call indicator trunk guard bridge and the auxiliary sender can look at the remote crossbar tandem or CSP incoming trunk through the switch train. The four leads of the split pulsing fundamental circuit are also extended through the link to the auxiliary sender. These leads are designated FT and FR in and out (FTI, FRI, FTO and FRO).

1.24 After the connection through the auxiliary sender link is set up, the ninth and tenth digits are dialed into the auxiliary sender. When the last digit has been dialed, the auxiliary sender signals the subscriber sender by grounding lead DC.

1.25 The connection through the switch train to the incoming trunk in the remote office should be set up well in advance of the completion of dialing. The auxiliary sender when seized connects a high resistance check circuit to each half of the split pulsing fundamental circuit. The check circuit looking toward the remote office through the switch train determines whether or not the incoming trunk is normal. The check circuit toward the subscriber sender recognizes the subscriber sender attempt at call indicator trunk test. The subscriber sender closes the trunk test bridge following the grounding of lead DC. If the remote incoming trunk is normal, the auxiliary sender closes a 400 ohm termination toward the remote office incoming trunk as a signal to have a sender attached. (If the remote trunk is off-normal when the subscriber sender attempts call indicator trunk test, the subscriber sender is given an overflow signal.)

1.26 The signal that a sender is attached to the trunk at the remote office is a reversal of polarity over the pulsing tip and ring to the auxiliary sender for 120 to 240 milliseconds. The auxiliary sender reacts by connecting a 6300 ohm battery to lead FTI at the start of the wink which permits the subscriber sender to complete trunk test. For Crossbar No. 1 with LAMA, the subscriber sender connects to a transverter following the completion of trunk test. The transverter in turn connects to the auxiliary sender via the auxiliary transverter link circuit. The transverter then proceeds to cause an initial entry to be made on the LAMA tape. At the end of the wink, the auxiliary sender assigns the call indicator loop back to the subscriber sender (by transferring it from battery and ground to the dry call indicator relay loop) and transfers the pulsing leads toward the switch train to the winding of the MF repeat coil in the multifrequency relay circuit.

1.27 As the first digit (ACA from register A of the subscriber sender) is call indicator pulsed to the auxiliary sender the latter circuit multifrequency pulses the KP signal toward the remote office starting at the end of the second radiant of the digit. As the second digit is call indicator pulsed, the auxiliary sender pulses forward the digit first received on the odd register (for a nominal 63 milliseconds) and then unlocks the register preparatory to its re-use to register the third digit. As the third digit is call indicator pulsed, the auxiliary sender multifrequency pulses

forward the digit on the even register and then unlocks it preparatory to registering the fourth digit. The call proceeds in a similar manner until the seventh digit has been pulsed and the eighth digit has been registered. The control of the pulsing of the eighth and remaining numerical digits and the start pulse is under control of the multifrequency pulse timing circuit which now has its interlock with call indicator registration removed and pulses at the rate of eight per second.

1.28 When the start pulse has been transmitted to the remote office, the auxiliary sender grounds the AV-1 lead toward the subscriber sender as a signal to remove the split in the pulsing fundamental circuit and to disconnect from the auxiliary sender circuit. The subscriber sender thereafter opens the start lead to the auxiliary sender link. When the link crosspoints are opened, the auxiliary sender restores to normal. The last relay released is the AB-relay associated with the auxiliary sender in the link circuit. When the AB-relay releases the auxiliary sender may be reseized by the link circuit.

1.3 Seven Digit Call (Any further reference to seven digit calls includes eight digit calls unless otherwise specified.)

1.31 Seizure of the auxiliary sender, trunk test, assignment, call indicator registration and multifrequency pulsing are similar to the 10-digit call previously described. The principal differences are that the decision to seize an auxiliary sender must come from translation of the code (rather than from the digit on the subscriber sender B register) and that there is no dial pulse registration in the auxiliary sender.

1.32 The change to control of the MF pulse timer circuit follows the registration of the eight digit. If lead DC is grounded to the auxiliary sender, the station digit will be MF pulsed forward as received. If the DC lead is not grounded, a zero, CI pulsed to the auxiliary sender as the eighth digit, causes the start pulse to be MF pulsed forward following the seventh digit.

1.33 Since no dialing is done in the auxiliary sender for this class of call a marker or decoder delay will have no effect on the dial pulse registration.

1.4 Reconstruction of Recycled Area Code Feature

1.41 A feature is provided in the auxiliary sender to translate a recycled area code back to the three digits it represents and to MF outpulse this reconstructed area code prior to outpulsing the seven digits registered in the subscriber sender.

1.5 Outpulsing Directory Number Feature

1.51 A feature is provided for No. 1 Crossbar LAMA offices to outpulse the subscribers directory number to a CAMA office when required.

2. TIMING FEATURES

2.01 One timing interval nominally six to twelve seconds is used for causing the stick or release of the subscriber sender and the auxiliary sender if the call cannot proceed for any reason, or if dialing is not done with reasonable expedition.

2.02 When the auxiliary sender is seized, the time allowed for dialing the eighth digit in the subscriber sender and the start of dialing of the ninth digit in the auxiliary sender is a total of six to twelve seconds. From the dialing of the ninth to the start of the tenth digit the time is again six to twelve seconds. From the dialing of the tenth digit until the start of the remote sender attached wink is six to twelve seconds. From the wink to the completion of MF pulsing the interval is six to twelve seconds.

2.03 The timeout of a ten digit call before the start of dialing of the tenth digit or of a seven digit call before closure of the trunk test bridge by the subscriber sender is arbitrarily classified as a partial dial. Such a timeout will count the partial dial register and cause the SS lamp to change from steady to flashing but will cause no other alarms. Timeouts after the start of dialing of the 10th digit or after closure of the trunk test bridge (by the subscriber sender) for a seven digit call are regarded as trouble timeouts. To prevent false trouble timeouts with crossbar No. 1 with LAMA, the timing in the auxiliary sender is suspended while the transverter is connected and restarts when the transverter disconnects.

2.04 Auxiliary senders will ordinarily be operated with the CTR keys pulled out. Under this condition the first auxiliary sender in a group to time out for a trouble condition will stick, count the stuck sender register, cause the single stroke bell alarm to sound once and cause a minor alarm, but it will take no action to cause the restoral of circuits associated with it in the attempt to establish a DDD connection. The stuck auxiliary sender awaits release by the restoral of the subscriber sender to which it is held.

2.05 To have a stuck condition persist for trouble tracing purposes it is necessary to have the CTR key of the associated subscriber sender pulled out also, as a timed release of the subscriber sender will allow the auxiliary sender to restore from even the stuck condition.

2.06 Once an auxiliary sender in a group has timed out and stuck, no other auxiliary sender will stick on a trouble timeout until the first stuck sender has been restored. Auxiliary senders timing out for trouble after one in the group has stuck will count the stuck sender register and cause a bell tap, and will then proceed to take appropriate action to free themselves for further use. The action taken depends on the class of call (10 or 7 digit) and the point in the call at which the timeout occurs. The procedures are outlined in the following paragraphs.

2.07 If an auxilairy sender is seized, no dialing is received and the trunk test bridge is not closed it may be either a 10 digit call with a seven digit partial dial or a 7 digit call with a local trouble in the subscriber sender. The auxiliary sender on partial dial timeout will give the subscriber sender a "dialing completed" signal to cause a 10 digit partial dial call to make trunk test. When trunk test is attempted the subscriber sender will be signaled to route the call to overflow and disconnect. In the case of a local trouble in the subscriber sender on a 7 digit call, the subscriber sender must itself break down the connection through its own timed release feature.

2.08 If only one digit is dialed into the auxiliary sender it is disposed of on a partial dial timeout in a manner similar to paragraph 2.07.

2.09 If after dialing completed on a 10 digit call the trunk test bridge is not closed by the subscriber sender the auxiliary sender on timeout will not be able to cause the subscriber sender to reroute to overflow, and again disconnect will depend on the subscriber sender timed release.

2.10 With the trunk test bridge closed (10 or 7 digit call) on auxiliary sender timeout, because of a failure to receive the sender attached wink, will cause a signal to the subscriber sender to reroute to overflow.

2.11 After the wink, a failure to complete MF pulsing in less than 6 to 12 seconds will cause the auxiliary sender to generate a misplaced start pulse (to dismiss the remote sender) and then to signal the subscriber sender to cut through and disconnect. If the misplaced start pulse does not cause the remote sender to reroute the call to overflow, it will time out in 20 seconds after seizure and itself cause a reroute to overflow.

2.12 On ODN calls, if the calling line identification is not registered within 2 to 5 seconds after the called number is outpulsed to CAMA, the auxiliary sender will operate the ID2 relay and MF outpulse forward the identification failure signal.

2.13 On ODN calls, if the steady reversal signal to send the calling number is not received within 180 milliseconds from the end of the called number start pulse, the auxiliary sender will operate the STE relay which grounds the AV1 lead to the subscriber sender. The subscriber sender will advance the district junctor to cut-through for talking and release the auxiliary sender.

3. PRINCIPAL DIVISIONS OF THE AUXILIARY SENDER

3.11 The Class and Off-Normal Circuit recognizes the seizure of the sender, prepares for the reception of dial and call indicator pulsing and transmission of multi-frequency pulsing, recognizes the 7-digit call condition, causes the correct peg count for 10 or 7 digits, and assists in skipping the first two or three digits received from the subscriber sender when such pulsing is indicated by the class information received from the subscriber sender.

3.12 The Dial Pulse Repeater Circuit provides two counting leads to the dial pulse counting relays since only one pulse lead is brought through the link from the subscriber sender. It also has a pulse correcting feature to improve the dial pulses received from panel senders with older types of L relays, and controls the register advance for the digits dialed into the auxiliary sender.

3.13 The Dial Pulse Counting Relays count the number of pulses on each dial digit received by the auxiliary sender.

3.14 The Dial Pulse Register Circuit is used to store the digits dialed into the auxiliary sender.

3.15 The Dial Pulse Sequence Circuit causes the digits dialed to the auxiliary sender to be directed to the proper register for storage. This circuit also signals the subscriber sender when the last required digit has been registered.

3.16 The Trunk Test, Assignment and Timing Circuit:

(a) Recognizes trunk test by the subscriber sender.

(b) Checks that the incoming trunk at the remote office is normal.

(c) Signals the remote incoming trunk to go for a sender.

(d) Recognizes when a sender has been attached to a remote incoming trunk.

(e) Assigns the backward loop from the subscriber sender and switches it to the call indicator relay circuit.

(f) Simultaneously with the assignment of the backward loop transfers the forward loop to the multifrequency pulse relay circuit.

(g) Times the sequence of the call and provides for the various irregular stick, overflow, or release conditions involved in a failure to complete a call in the allotted time intervals.

(h) Checks crosspoint closure of the auxiliary sender link extension frame on a trunk test basis, if area code reconstruction is used.

(i) Subscribers sender assignment is delayed if reconstruction of the recycled area code is to be MF outpulsed.

3.17 The Call Indicator Relay Circuit recognizes the pulses of the call indicator digits and distributes them within one digit. It also provides the actuating ground for causing the call indicator and multifrequency pulse sequence circuit to advance between the two call indicator registers while call indicator pulsing is being received. When this ground is connected for the first time it causes relay KP to operate and start MF transmission of the KP (gate opener) signal.

3.18 The Call Indicator and Multifrequency Pulse Sequence Circuit has a double function:

(a) To advance under control of the call indicator Z relay to distribute the call indicator digits received to the proper one of the two call indicator registers and to assist (under joint control of the call indicator register circuits and the multifrequency pulse timer circuit) in causing the multifrequency relay circuit to connect the required signals toward the remote incoming sender. A call indicator registered digit is pulsed forward on a multifrequency basis while the subsequent call indicator digit is being registered until the last call indicator digit has been registered in the auxiliary sender.

(b) For a 7 digit call, to sequence the pulsing forward of the last digit call indicator pulsed into the auxiliary sender, and the start pulse, under control of the multifrequency pulse timer circuit. For a 10 digit call, to pulse forward the last call indicator digit pulsed into the auxiliary sender, the digits dialed into the auxiliary sender, and the start pulse, under control of the multifrequency pulse timer circuit.

3.19 The Odd and Even Call Indicator Register Circuits store the digits alternately (under control of the call indicator and multifrequency pulse sequence circuit) and assist in the operation of the multifrequency relay corresponding to the digit on the call indicator register. After the digit on a call indicator register has been multifrequency pulsed for a measured time interval the register is restored for reuse on the next digit but one.

3.20 The multifrequency Pulse Relay Circuit is operated under control of the call indicator and multifrequency pulse sequence circuit, the call indicator or dial register circuits, and the multifrequency pulse timer circuit, to connect the two frequencies of a multifrequency signal toward the incoming sender in the remote office. When a start pulse has been transmitted the multifrequency relay circuit signals the subscriber sender circuit to cut through and disconnect and stops the multifrequency pulse timer circuit.

3.21 The Multifrequency Pulse Timer Circuit causes the release of the call indicator register circuits after the digits stored on them have been pulsed forward. When the interlock is removed, after the last call indicator digit has been registered, the pulse timer circuit both times the multifrequency pulses and advances the call indicator and multifrequency pulse sequence circuit for sequencing the pulsing of the last registered CI digit, the digits on the dial digit registers and the start pulse.

3.22 The Reconstruction of Recycled Area Code Circuit:

(a) Stores the compressed code digit of a recycled area code that is transmitted from the subscriber sender recycle circuit.

(b) Checks for proper registration of the compressed code digit on a two-out-of-five basis.

(c) Controls the number of digits (10, 7, 5, or 4) MF outpulsed with the assistance of "skip digit" information from the marker or decoder.

(d) Holds up the assignment of the subscriber sender if recycled area code to be MF outpulsed.

(e) Translates the compressed code digit back to the 3-digit code it represents while MF outpulsing the reconstructed recycled area code prior to outpulsing the digits registered in the subscriber sender.

(f) Resets circuit after the reconstructed recycled area code is MF outpulsed to

prepare for handling digits stored in the subscriber sender in the same manner as a 7-digit call.

3.23 The Directory Number and Party Control Circuit recognizes that directory number outpulsing is required and that a multiparty class subscriber originated the call. It also recognizes whether or not the multiparty originated call is service observed and controls the start of circuit functions for the outpulsing of directory number feature.

3.24 The Directory Number Connector Circuit closes through leads for receiving the directory number, office index digit, service observed mark, and an identification information digit from the special transverter.

3.25 The Directory Number Registration and Control Circuit:

(a) Stores the directory number, office index digit, service observed mark, and identification information digit that is transmitted from the transverter circuit.

(b) Controls the timing for registration of the directory number.

(c) Assists in timing and controlling the outpulsing of the directory number.

(d) Translates the office index digit back to the 3-digit central office code it represents while MF outpulsing the office code to the CAMA office.

(e) Restores the auxiliary sender timing while the transverter is connected on a call requiring outpulsing of the directory number in a LAMA office.

3.26 The Directory Number Reset Control Circuit resets circuits in the auxiliary sender after the called number has been MF outpulsed in preparation for controlling the outpulsing of the directory number. It also recognizes and assists in controlling a zero operator call that requires directory number outpulsing.

SECTION II - DETAILED DESCRIPTION

1. SENDER SEIZURE

1.1 General

When an auxiliary sender is idle, the associated busy AB- relays are released in the link circuit and the sender may then be seized for any subscriber sender which is on notice that the call it is handling requires the use of an auxiliary sender. The subscriber sender becomes aware that an auxiliary sender is required if the digit recorded on its B register is a one or a zero (or through the translation information received from the decoder or marker for a seven digit call). In either case the subscriber sender will not ground the start lead to the auxiliary sender link until the seventh digit has been dialed.

1.11 When the crosspoints in the auxiliary sender link are closed, the subscriber sender has a class signal connected to lead CL. The most usual signal is a 1711 ohm ground for "no skip". Under this condition relays SK3 and SK2 in the auxiliary sender are marginal and remain normal, but relay SC operates. Relay SC operated, operates relay ON. Relay ON operated:

(a) Grounds lead B to the auxiliary sender link to operate the AB-relays.

(b) Connects off-normal grounds to all the figures of the auxiliary sender that require them.

(c) Locks through its own make contact to ground.

(d) Operates relay ON-1.

(e) Operates slow releasing relay PC.

1.12 Relay ON-1, operated:

(a) Closes the battery supply to the MF generator circuit.

(b) Closes lead DC toward the link circuit.

(c) Closes ground to two contacts on relay TZ.

1.13 Relay PC, operated, closes a link in the circuit for operating the peg count register when the call is assigned.

2. TEN DIGIT CALL (SC1)

2.1 Dialing Digits After the Eighth Digit

The subscriber sender has only 8 digit registers. It is therefore necessary to dial the ninth and tenth digits into the auxiliary sender. The back contact of the subscriber sender L relay is closed to the auxiliary sender dial pulse repeater circuit over lead P1 through the auxiliary sender link. The dial pulse repeater circuit provides the double counting leads to the dial pulse counting relays and provides protection against contact chatter and split pulses from the older types of panel subscriber senders. The dial pulse repeater RA relay performs a function similar to that of relay RA in the subscriber sender, in that it operates on the first pulse of a digit and releases after the last pulse of the digit. It can, therefore, be used to control the registration and register advance for digits dialed into the auxiliary sender.

2.2 Pulsing - Dial Pulse Repeater Circuit

Lead P1 through the link is grounded by the back contact of the subscriber sender L relay for each pulse of the digit dialed. This ground operates relay RL. Relays RA and PW operate at the start of the first pulse. Relay PW locks to battery from relay RA but relay PZ has no operate path until relay RL returns to its back contact at which time relay PZ operates. Relay PZ operated, grounds lead P1 to the dial pulse counting relays to operate relay P1.

2.21 When relay RL leaves its back contact at the start of the second pulse, relay PW releases and when relay RL leaves its front contact at the end of the pulse, relay PZ releases. Relay PZ released, grounds lead P2 to operate relay P2. The operate and release cycle for relays PW and PZ is repeated for each two pulses of the digit.

2.3 Pulsing - Dial Pulse Counting Relays (SC2)

Lead P1 to the pulse counting relays is grounded for the first pulse of each dialed digit (this ground comes from the operated PZ relay of the auxiliary sender). Ground on lead P1 operates relay P1 through series break contacts on all higher numbered P- relays except P6 and the break contact of an early make-break transfer on P1. Relay P1 operated:

(a) Locks through the make of its early make-break transfer under control of a break contact on relay P2 to off-normal ground through a make contact on relay RAR.

(b) Closes a link in the operate path for relay P2.

(c) Arranges the registration leads to operate relays zero and one (if no more pulses are dialed for the digit).

2.31 With relay P1 operated relay P2 will operate when lead P2 is grounded for the second pulse of a dialed digit. Relay P2 operated:

(a) Locks through the make contact of its early make-break transfer to ground under control of a break contact on relay P3 and a make contact on relay RAR.

(b) Releases relay P1.

(c) Closes a link in the operate path for relay P3 and opens the operate path for relay P1.

(d) Arranges the registration leads to operate register relays zero and two (if no more pulses are dialed for the digit.)

2.32 The operation of relays P3, P4 and P5 is very similar in effect. Each relay as it operates releases the preceding relay and locks to the succeeding relay. Each relay operated also arranges the registration leads for the operation of the appropriate register relays if no further pulses are dialed for the digit.

2.33 The operation of relay P6 is also similar, except that relay P6 locks directly to the off-normal ground through the make contact of relay RAR. After the P6 operates, relays P1 to P4 may be reoperated if there are enough pulses in the digit. The indication of the number of pulses in the digit may be read as follows:

Digit	P- Relays Operated
1	P-1
2	P-2
3	P-3
4	P-4
5	P-5
6	P-6
7	P-6 P-1
8	P-6 P-2
9	P-6 P-3
0	P-6 P-4

2.4 Dial Digit Registration (SC1)

At the start of dialing of the ninth digit, ground on lead RA from the dial pulse repeater operates relay RAR. Relay RAR operated:

(a) Operates relay TD under control of a break contact of a transfer on relay TD'.

(b) Opens a link in the digit registration actuate lead to the dial pulse counting relays.

(c) Removes ground from interrupter TA and relays TW and TZ to recycle the timing whenever a digit is dialed.

2.41 Relay TD operated:

(a) Connects ground to one side of the winding of relay TD' in series with its own winding. Relay TD' cannot operate at this time because of the ground on the other end of its winding from relay RAR.

(b) The ground to the winding of relay TD is extended through a break contact on relay TD', through a chain circuit on the T- register relays to the winding terminal of relay TD' that is connected to relay TD. The chain circuit on the T- register relays insures that two T- relays have operated before TD' operates.

(c) Connects ground to the register relay actuate lead. This lead is open, however, at a break contact on relay RAR.

(d) Connects a supplementary ground under control of relay TD' to hold any pulse counting relays operated until registration is completed.

2.42 At the completion of the dialing of a digit, relay RAR releases closing the ground from the operated TD relay to a break contact on relay RAR over leads through the appropriate contacts on the dial pulse counting relays to operate the corresponding T- register relays (on a two out of five basis) under control of five transfer contacts on relay TD'. When two register relays have operated, the shunt around the winding of relay TD' is opened and with relay RAR released relay TD' operates in series with the operated TD relay and resistance TD in parallel. Relay TD' operated:

(a) Transfers the operate ground path from relay RAR to the UD-UD' combination.

(b) Opens a link in the shunt path around its own winding.

(c) Transfers the registration leads to control of relay UD'.

2.43 The registration of the ninth digit is on relays T-. Two of the five relays operate and lock to off-normal ground. With two of the T- relays operated, the shunt around relay TD' winding is opened allowing relay TD' to operate. The operated T- relays close links in a path (on a one in ten basis) over which the multifrequency relay corresponding to the digit registered can be operated for pulsing forward to the crossbar tandem or CSP incoming sender.

2.44 The counting of dial digit pulses and the registration of the tenth, digit is the same as for the ninth digit. The registration of the tenth digit is controlled by relays UD and UD' and registration is on the U- relays. Relay UD' connects ground (from a normal contact of relay BK) to lead DC as a signal at the completion of dialing.

2.45 Following the dialing completed signal the subscriber sender should attempt call indicator trunk test.

2.5 Trunk Test and Assignment

When the auxiliary sender is seized, the pulsing fundamental leads have already been split so that the auxiliary sender may look back at the call indicator test bridge in the subscriber sender over leads FTI and FRI, and may look forward through the switch train to the incoming trunk in the remote office over leads FTO and FRO. The circuit for checking the closure of the subscriber sender call indicator test bridge is from ground on lead FRI, through the link and subscriber sender, back on lead FTI, through the high resistance TGB and the TGB relay winding to battery. The circuit for checking that the incoming trunk is normal consists of high resistance relays OF and TGF bridged across the FTO and FRO leads. The high resistance check circuits in the auxiliary sender will enable the backward and forward test to determine the condition of the two pulsing loops without affecting either the subscriber sender trunk test bridge or the incoming trunk at the remote office.

2.51 After the subscriber sender has received the signal over lead DC that the last digit has been dialed, it closes the call indicator test bridge across leads FTI and FRI operating relay TGB. Relay TGB operates relay TGB-1. Relay TGB-1 operated:

(a) Locks to off-normal ground.

(b) Transfers the timeout lead from lead DC to the circuit for operating relay OF-1.

(c) Grounds the armature of relay OF.

(d) Closes a link in the circuit for operating relay 7DG for 7-digit calls.

2.52 Relay OF will stay normal if the remote incoming trunk is normal and relay TGF will operate in turn operating relay TGF-1. Relay TGF-1 operated:

(a) Locks to off-normal ground.

(b) Transfers the lead through the make contact of relay OF, from the winding of relay OF-1 to the winding of relay AS-1.

(c) Puts a direct shunt across the high resistance windings of relays OF and TGF to provide a low resistance bridge across leads FTO and FRO (as a signal to the remote incoming trunk to go for an incoming sender).

(d) Closes a link in the operate path for relay LR.

2.53 As the incoming sender is attached to the remote incoming trunk a momentary reverse of the polarity over leads FTO and FRO operates relay OF. Relay OF operated, operates relay AS-1. Relay AS-1 operated:

(a) Locks to off-normal ground.

(b) Closes a link in the operate path for relay AS.

(c) Transfers the timeout lead from the operate circuit for relay OF-1 to that for relay STC.

(d) Opens a link in the operate path for slow releasing relay PC. This relay releases in 27 to 48 ms after its operate circuit is opened.

(e) Release relays TZ and TW, if operated.

(f) Closes ground to the circuit to the peg count registers. The 10DG register will count if relay 7DG is normal or the 7DG register will count if the relay is operated. The later release of relay PC ends the pulse in less than 50 ms so that any other sender reaching the assignment condition may peg count.

(g) Puts a direct shunt across high resistance TGB to provide a 6300 ohm battery termination on lead FTI (to soak up and operate the TG relay in the subscriber sender).

2.54 When relay OF releases, relay TGF operated, operates relay AS. Relay AS operated:

(a) Locks to off normal ground.

(b) Transfers the FTI and FRI leads to the dry loop through the CI relays to "assign the trunk" and start call indicator pulsing from the subscriber sender.

(c) Transfers leads FTO and FRO to the secondary winding of the repeat coil in the multifrequency relay pulsing circuit in preparation for pulsing forward.

(d) Reconnects ground to the timing relays.

2.55 Thereafter the subscriber sender should pulse the eight digits registered in it to the auxiliary sender on a call indicator basis.

2.56 On prefix digit "0" calls (Option J) the subscriber sender connects ground to lead 14 through the auxiliary sender link to operate relay CL3. Relay CL3 operated prepares a path under control of relay STC to transmit a special start pulse (900 cycles, 1700 cycles) to signal a prefix digit "0" call.

3. CALL INDICATOR REGISTRATION - 10 DIGIT CALL

3.1 General

Due to the overlap operation used, the call indicator registration and the multifrequency pulse sequence circuit performs a dual function. For the sake of clarity the call indicator registration features will be described in detail first, with only general reference to multifrequency pulsing. This will be followed by a detailed description of multifrequency pulsing, with only general reference to call indicator registration.

3.2 Call Indicator Registration

3.21 Only two CI registers are provided for temporarily storing the eight call indicator digits pulsed into the auxiliary sender from the subscriber sender. The registers are used alternately, the first registering all the odd digits, beginning with the first, and second registering all even digits beginning with the second.

Two call indicator codes, the "regular" and the "thousands", are used to transfer digits from the subscriber sender to the auxiliary sender. This is accomplished by using simulated call indicator over 10,000 pulsing for all calls. The two codes are shown on the following table:

Digit	Regular Code	Thousands Code
0	-n-n	-n-n
1	pn-n	-n-N
2	-N-n	pn-n
3	pN-n	pn-N
4	-npn	-N-n
5	-n-N	-N-N
6	pn-N	pN-n
7	-N-N	pN-N
8	pN-N	-npn
9	-npN	-npN

In the table the p pulses (which occur in the first and third time divisions of a single call indicator digit) represent positive pulses which operate the SN+ relay of the call indicator relay circuit. These pulses may be sent or omitted as required by the digit pulsed. In the table, N indicates a heavy negative pulse, which may occur in the second or fourth time division of a call indicator digit. These pulses operate both the SN- and MG relays of the call indicator relay circuit. These pulses may or may not be sent as required by the digit. In the table n represents a light negative pulse which is always sent in the second and fourth time intervals of the digit when no N pulse is sent. This is necessary since a negative pulse is required in every second and fourth time interval of a digit to operate the SN- relay. The SN- relay supplies the actuating ground to function the Z and W relays which distribute the pulses within one digit and cause the advance of the call indicator and multifrequency pulse sequence circuit to direct the pulses to the digit registers.

3.22 For the purposes of this description, let us assume that a three has been dialed for the ACA digit to the A digit register in the subscriber sender. This three is to be call indicator pulsed into the auxiliary sender and registered as the ACA digit on the first or odd call indicator register under control of relays ACA and CO. The p pulse from the subscriber sender over leads FTI and FRI in the first time interval of the digit operates relay SN+. Relay SN+ operated closes a circuit traced from off-normal ground through a break contact on relay H, through the back contact of relay MG, through the make contact of relay SN+, through the break contact of a transfer on relay W, through the break contact of a transfer on relay ACA, through a break contact on relay CO through the break contact of an early make-break contact on relay O-1 and the winding of the relay to battery. Relay O-1 operated:

(a) Locks to off-normal ground under control of relay UNO. The relay locks through the make contact of the early make-break contact through which it operated, thereby preventing its locking ground from being connected back over the operating circuit.

(b) Switches leads in the operate circuits for the multifrequency pulse relays.

3.221 Relay SN+ releases at the end of the first time interval of the digit. In the second time interval the subscriber sender connects a heavy negative pulse to leads FTI and FRI operating relays MG and SN-. Relay MG operated, closes off-normal ground through the break contact of a transfer on relay Z, through the break contact of a transfer on relay ACA, through the break of an early make-break contact on relay O-2, operating the relay.

3.222 Relay SN- operated connects off-normal ground through the break of an early break-make contact on relay W, to the winding of the W relay in series with one half of resistance W-Z to battery, operating the relay. The same ground is connected to the winding of relay Z. Ground from relay SN- is also extended through the break contact of a make-break contact on relay Z, to the end of resistance W-Z connected to the winding of Z, and the Z relay cannot operate.

3.223 Relay O-2 operated (as in 3.221):

(a) Locks to off-normal ground through the make of the early make-break contact through which it operated.

(b) Makes further switching changes in the operating paths for the multi-frequency pulse relays.

3.224 Relay W operated (as in 3.222):

(a) Locks to off-normal ground through the make of an early make-break contact through which it operated.

(b) Closes a link in the path for operating the -4 relay of the CI register if a p pulse is received in the third time interval of the digit.

3.225 At the end of the second time interval of the digit, relays MG and SN- are released. The release of relay MG removes ground from the -2 relay operate path. The release of relay SN- removes the ground closed through to the battery supply of relay Z, and relay Z operates to the holding ground through the make contact of relay W. Relay Z operated:

(a) Closes a link in the path for shunting down relay W on the next operation of relay SN-.

(b) Transfers the circuit through the make contact of relay MG to the path for operating the -5 relay of the CI register in the fourth time interval of the digit.

(c) Closes ground to the circuit for operating relay CO preparatory to operating relay ACA at the end of the call indicator digit. The circuit from the make contact of relay Z is through the break of a transfer contact on relay ACA, through the winding of relay CO to battery. The same ground is connected through the break contact of a transfer on relay ACA to the junction of the lead from the winding of relay ACA and resistance ACA-ACB. This ground prevents the operation of the relay when relay CO operates.

(d) The Z ground is also closed through the break of a continuity transfer on relay KP through a normally made contact on relay ACA to the winding of relay KP which operates.

3.23 Relays CO and ACA constitute a specialized counting pair, until relay ACB operates to associate relay CO with relay ACC. Relays CE and ACB constitute a specialized counting pair until relay ACC operates to associate relay CE with relay A. In general relay CO is used to assist in the counting relay operation of the odd sequence relays, and relay CE is used to assist in the counting relay operation of the even sequence relays. When the sequence relays (ACA through STS) operate they lock through the make of early make-break transfer contacts and open a circuit through a second make-break contact for releasing the associated C- relay in order that it may be ready for reuse with the next progress relay with which it can be associated. The principal difference between the counting pairs of this circuit and conventional design (aside from repeated use of one counting relay with several prime relays) is the operation of the prime relays (that is the progress relays ACA, etc.,) to battery through both the C- relay winding and a resistance in parallel, and the independent locking of the prime relay to the battery through the resistance.

3.24 Relay CO operated (as in 3.225):

(a) Closes off-normal ground through a make contact, through the break contact of a transfer on relays ACB and ACA in series to the end of the winding of relay ACA which is not connected toward relay CO and the resistance battery. Relay ACA cannot operate at this time as it is shunted down by the operate ground for relay CO as traced in 3.225.

(b) Closes links used later in the actuating leads for operating MF pulse relays through the even CI register.

(c) Through a make and a break contact, transfers the operate path for the -1 call indicator register relay from the odd to the even call indicator register. This is done to insure an operate path from the beginning of the first quadrant of the next digit even though the previous sequence relay is somewhat slow to operate at the end of the first digit.

(d) Closes a link in the UNE relay operate path.

(e) Closes a link in the AC relay locking path.

3.25 With a three being pulsed there will be no p pulse for the third time interval of the digit and relay SN+ remains on its back contact. In the fourth time interval of the CI digit, a light negative pulse from the subscriber sender will operate relay SN- only. Relay SN- shunts down relay W but, as it releases, it transfers the holding path for relay Z from off-normal ground to the ground supplied by the operated SN- relay. Relay Z remains operated until relay SN- releases at the end of the fourth time interval of the CI digit. When relay Z releases at the end of the digit it removes the ground from the circuit preventing the operation of relay ACA. Relay ACA operated:

(a) Locks to off-normal ground through the make of an early make-break contact.

(b) Through an early make-break transfers the winding of relay CO to put it in series with relay ACC. Relay CO releases but relay ACA holds in an operated condition on the battery supplied through the resistance.

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(c) Opens the locking path to release relay KP and cut off the KP signal.

(d) Transfers the 1, 2, 4, and 5 registration leads (from the Z and W relays) to the even call indicator register under control of transfer contacts on relay ACB.

(e) Transfers the Z lead to control of relay ACB preparatory to the registration of the second digit.

3.26 The registration of the second CI digit is handled in a manner very similar to that detailed for the first digit except that it is registered on the even CI register. Relay CE operates preparatory to operating relay ACB at the end of the digit and relay ACB operates at the end of the digit. Relay ACB operated:

(a) Locks to off-normal ground through to make of an early make-break contact.

(b) Transfers the winding of relay CE to a series connection with relay A. Relay CE releases.

(c) Transfers register leads 1, 2, 4 and 5 to the odd CI register.

(d) Transfers the Z lead to control relay ACC in preparation of the registration of the third digit.

(e) Releases relay AC. (The function of relay AC described in paragraph 4.35).

(f) Closes a link in the regular code operate path for multifrequency relays through the even CI register.

3.27 There is no further variation in the registration of call indicator digits (except for the relays used) until relay H operates at the end of the eighth digit. Relay H operated:

(a) Locks to off-normal ground through the make of the continuity contact through which it operated.

(b) Transfers the operate circuit for relay CE to the winding of relay U.

(c) Transfers the operate circuit through the make contact of relay CO from the winding of relay TH to the winding of relay T.

(d) Transfers the control of the advance of the sequence chain circuit from the make contact of relay Z to the make contact of relay TS.

(e) Opens the inhibitor lead to the MF pulse timer relay to allow it to run free.

(f) In conjunction with a transfer on relay T causes the operation of the MF pulse relay through the register to be from the make contact of the TS-1 instead of directly from relay CO or CE operated.

(g) Removes the ground from the armatures of the CI relays. The CI registration leads are not switches as no further registration will take place.

3.28 If the subscriber sender is arranged, for a final heavy positive pulse, this pulse causes no registration in the auxiliary sender since both relays SN+ and MG operate. Diode SN- provides a shunt for the winding of relay SN- to protect its adjustment during a heavy final positive pulse.

3.29 SC101 shows the patterns for CI digit registration.

4. MULTIFREQUENCY PULSING TO REMOTE SENDER - 10 DIGIT CALL

4.1 Generation of Frequencies

4.11 The six frequencies used in multifrequency pulsing, are obtained from the MF Current Supply and Distribution Circuit, or in the case of very small offices, from the MF Signal Generator Circuit.

4.2 Transmission of Frequencies

4.21 To transmit multifrequency pulses over leads FTO-FRO through the switch train to the remote incoming sender, it is only necessary to operate the appropriate multifrequency pulsing relay. There are 12 of these relays, MF-1 to MF-9 and MF-0, KP and STC. Operation of any one of these 12 relays closes two single frequncies from the multifrequency signal supply to the primary of repeat coil MFP. The secondary of this coil is connected to leads FTO and FRO. The code used for multifrequency pulsing is based on the use of six frequencies (two at a time), to give a signal for each numerical digit, a KP (gate opener) signal and an ST (start) pulse. Since the number of digits to be transmitted varies, the start pulse is always transmitted following the last numerical digit as a signal to the remote sender that no further pulsing will be transmitted.

4.22 The KP "gate opener" signal is transmitted through the switch train towards the remote incoming sender from the operation of relay KP (from the end of the second quadrant of the first CI digit) until the operation of relay ACA (at the end of the registration of the first call indicator digit). The remainder of the signals whether controlled by the call indicator digit registration or the dial digit registers are transmitted for a nominal 63 milliseconds

and then ended by the action of the multifrequency pulse timer circuit.

4.3 MF Pulsing of First Seven Digits

4.31 When relay Z operates it closes ground to a circuit through a continuity transfer on relay KP through a break contact on relay ACA to the winding of relay KP operating relay KP. Relay KP operated, connects the 1100-cycle and 1700-cycle frequencies to the primary of coil MFP. When relay ACA operates relay KP releases and the signal is disconnected.

4.32 When relay CE operates, on the operation of relay Z for the registration of the second call indicator digit, it closes the last link in the circuit for operation of an MF- (numerical) relay corresponding to the digit previously registered on the odd call indicator register. This circuit is traced from off-normal ground through break contacts of relays AC, UNO and UNE and T, through a make contact on relay CE, through a break contact of relay SK, through the contacts of the O- relays to the winding of the MF- relay corresponding the digit registered on the odd call indicator register. Since we assume a three for the ACA digit the operate path through the register would be from the sequence circuit through a break contact on relay O-4, a break contact on O-5, a make contact on O-2, and a make contact on O-1, to the winding of relay MF-3. (See SC102 for MF digit pulsing patterns.)

Relay MF-3 operated:

(a) Connects the 900-cycle and 1100-cycle frequencies to the primary winding of repeat coil MFP to transmit a three towards the remote incoming sender.

(b) Opens a link in the inhibitor lead (preventing the free running of the MF pulse timing interrupter) which permits the timer to go through one cycle.

4.33 The inhibitor lead (which synchronizes the multifrequency pulse timer with the call indicator registration until the call indicator registration is completed) is traced from off-normal ground through a back contact chain circuit on all the MF- relays except KP, through a break contact on relays STC, IR, H, through resistance I, through varistor TMA, potentiometer "S" and through the secondary winding of relay TM to battery through resistance AP. This circuit overpowers the operate effect of the bias winding current and holds relay TM on its back contact. During call indicator registration, the operation of any MF- relay except KP opens the inhibitor lead. Thereafter, condenser T1, T2 charges, and its charging current keeps relay TM on its back contact until the voltage on the condenser reaches a point where the charge current is less than that required to overcome the effect of the primary winding current, and relay TM operates. Relay TM operated, closes its make contact operating relays TS and TS-1.

4.34 Relay TS-1 performs no useful function at this time. Relay TS operated, grounds lead TS to operate relay UNO of the odd call indicator register under control of a make contact on relay CE. Relay UNO operated:

(a) Unlocks the operated relays in the odd call indicator register circuit.

(b) Removes ground from the operate circuit for the MF- relay.

(c) Operates relay AC.

4.35 Relay AC operated:

(a) Locks to off-normal ground, through its own contacts under control of the CE/CO relays.

(b) Prevents relay MF-O from operating when relays UNO/UNE releases at the completion of MF pulsing of the digit.

(c) Prevents relay IR from reoperating when relay UNO/UNE releases on "Skip Digit" calls.

4.36 The previously operated MF- relay released:

(a) Opens the signal leads to end the digit.

(b) Recloses the inhibitor lead causing relay TM to move to its back contact.

4.37 As the third digit is call indicator pulsed to the auxiliary sender the operation of relay CO causes the multifrequency pulsing of the digit stored on the even call indicator register and the restore of that register after the operation of relay UNE.

4.38 The path for operating the MF- relay, from the even CI registers, is traced from off-normal ground through a break contact of relay AC, through break contacts of relays H and A, through a make contact of relay ACB, through a break contact of relay SK, through the contacts of the E- relays to the winding of the MF- relay. The fourth digit dialed into the subscriber sender is CI transferred to the auxiliary sender in the thousand code. This code operates different E- register relays. To compensate for this, the A relay operated switches the ground for operating the MF- relay, through contacts of the E- register relays corresponding to the thousands code under control of relay B. This insures that the proper MF- relay operates. The operation of relay B restores the E register operate path to the regular code contacts.

4.39 The multifrequency pulsing of the digits thus progresses through the pulsing of the seventh call indicator digit. It is then necessary to pulse the eighth digit, the digits registered on the dial pulse registers, and the start pulse.

4.4 MF Pulsing of the Eighth Digit

4.41 The release of relay Z following call Indicator Registration of the eighth digit, removes the shunt ground from the winding of relay H allowing relay H to operate.

Relay H operated:

(a) Locks to off-normal ground.

(b) Releases relay CE.

(c) Advances the leads for operating relay T, in conjunction with relay CO, to the control of relay U.

(d) Transfers the path for operating the MF- relay (Paragraph 4.32) on the eighth digit, from control of the UNO, UNE and AC relays to control of the TS-1 relay. (The path for operating MF-O on the eighth digit is extended through the normal E- registers, through a make contact on relay TD' to the winding of the MF-O relay.)

(e) Opens lead TS (used to operate UNO/UNE) toward the CO and CE relays.

(f) Removes ground from the armature of the MG and the SN+ relays.

(g) Transfers the Z lead for the call indicator and multifrequency pulse sequence circuit from relay Z of the call indicator relays to relay TS of the multifrequency pulse timer circuit.

(h) Opens the inhibitor lead to allow relay TM to pulse at its natural period (nominally 63 milliseconds make, 62 milliseconds break).

4.5 MF Pulsing of Ninth and Tenth Digits

4.51 When relay TM makes on its front contact it operates relays TS and TS1. Relay TS, operated, grounds lead TS which operates relay CO preparatory to operating relay T.

4.52 When relay TM breaks its front contact, relays TS and TS1 release and relay T counts up in series with relay CO.

Relay T operated:

(a) Locks to off-normal ground.

(b) Releases relay CO.

(c) Advances the leads for operating relay U, in conjunction with relay CE, to off-normal ground.

(d) Closes a link in the path for operating an MF- relay from the ground supplied by relay TS-1 on the next operation of relay TM.

(e) Opens the lead for operating relay MF- for the ninth digit.

4.53 On the next operation of relays TS and TS-1 an MF- relay is operated over the circuits switched by the directing contacts of the T-dial registers and relay CE is operated in preparation for counting up relay U when relays TS and TS-1 release at the end of the pulse.

4.54 The pulsing forward of the U digit is done in a very similar manner to the T digit except for the steering relays involved.

4.6 MF Transmission of Start

4.61 Ground from the make contact of relay TS-1, through make contacts of transfers on relays T, U and STS in series, operates relay STC.

Relay STC operated:

(a) Closes the 900 cycle and 1700 cycle frequencies on prefix digit "0" calls or 1500 cycle and 1700 cycle frequencies on all other classes of calls to the MFP coil to send the start pulse.

(b) Operates relay STE.

4.62 Relay STE operated:

(a) Locks off-normal ground through a break contact on relay BK.

(b) Opens the shunt around varistor STE in the bias winding circuit of relay TM. Opening this shunt does not affect the cycle in progress but will prevent any further operation of relay TM after the cycle has been completed.

(c) Closes a link in lead AV-1 to advance the subscriber sender after the start pulse has been transmitted.

(d) Closes a link in a supplementary locking path controlled by a make contact on relay TW. (This path is used only to insure a ground to lead AV-1 after a misplaced start pulse after a trouble time-out.)

5. DISCONNECT AND RESTORE TO NORMAL

5.01 When lead AV-1 is grounded through the link to the subscriber sender,

the No. 1 crossbar sender cuts through and disconnects from the call. The panel sender sets the district circuit for talking selection, and disconnects from the call. In either case the subscriber sender opens its start lead to the auxiliary sender link. When the link hold magnets release, lead CL is opened releasing relay SC.

Relay SC released:

(a) Opens the operate circuit to relay ON.

(b) Shunts down and releases relay ON.

5.02 Relay ON released:

(a) Releases all relays operated from (or held to) off-normal ground circuits.

(b) Releases relays AB- in the link circuit, (unless they are held by an operated AP- or G relay in the link circuit).

With relays AB- released, the auxiliary sender may again be seized by the link for connection to a subscriber sender.

6. SEVEN DIGIT CALL (SC3)

6.1 Sender Seizure

Seizure of the auxiliary sender is similar to seizure for a 10-digit call. The function of relay SC is the same as for a 10-digit call, that is, to operate relay ON.

6.2 Omission of Dialing to Auxiliary Sender

Since seven or eight digits are dialed by the calling subscriber for a 7-digit call, all dialing is done to the subscriber sender digit registers and no dialing is necessary in the auxiliary sender.

6.21 The Auxiliary sender recognizes a call as one requiring seven digits if the subscriber sender attempts CI trunk test before time out with no dialing into the auxiliary sender. This condition results in the operation of relay 7DG in a circuit traced from off-normal ground, through series break contacts on relays BK and TD, through a make contact on relay TGB-1 to the winding of relay 7DG, through the break of an early make-break contact on relay 7DG.

Relay 7DG operated:

(a) Locks to off-normal ground through the make of the contact through which it operated.

(b) Through the make of a transfer contact closes a link in the path for operating relay STC instead of relay MF-0, if a zero is pulsed from the subscriber sender for the eighth digit when lead DC has not been previously grounded by the subscriber sender (as an indication that a digit had been dialed to the station register in that sender).

(c) Closes a link in the path for operating relay STC if an eighth digit is MF pulsed forward.

(d) Closes links in the circuits permitting the sender to stick on timeout.

6.3 Trunk Test and Assignment

Trunk test and assignment is the same for the 10-digit calls with the exception that the subscriber sender will attempt call indicator trunk test as soon as seven or eight digits are registered in it.

6.4 Call Indicator Registration

Call indicator registration is the same as for a 10-digit call with the exception that only seven call indicator digits may be pulsed from the subscriber sender to the auxiliary sender, followed by a meaningless zero which will be ignored.

6.5 Multifrequency Pulsing to Remote Sender

Multifrequency pulsing is similar to that for the 10-digit call with the exception that the transmission of the start pulse to the remote sender must follow the multifrequency pulsing of the last digit registered in the auxiliary sender on a call indicator basis. The start pulse will as usual be followed by a signal to the subscriber sender to disconnect.

6.51 Since eight digits are always CI pulsed to the auxiliary sender, the changeover to control of the CI and MF pulse sequence circuit is made in the same manner as for a 10-digit call. If, however, relay STR is normal the zero received as the 8th digit will not be pulsed forward, but a start pulse will be substituted. With relay STR operated, whatever has been dialed to the eighth register of the subscriber sender, is MF pulsed forward.

6.52 Relay STR operates in a path traced from ground on lead DC through a make contact on relay ON-1, a break contact on relay UD, through the break contact of an early-make break on relay STR, to the winding.

Relay STR operated:

(a) Locks through the make of its operating contact to off-normal ground.

(b) Transfers the 0 pulse path through the even CI register from relay STC back to relay MF-0.

6.53 If a 0 or a station letter is actually sent as the eighth digit, relay STC is operated to send the start pulse when relays TM, TS and TS-1 operate on the second cycle after the changeover. The operate path for relay STC is traced from ground through the make contact of relay TS-1, through a make contact on relay T, through a break contact on relay U, through make contacts on relays 7DG and STR, to the winding of relay STC.

7. SKIP DIGIT PULSING (SC1 and SC3)

7.1 "Skip 3" Pulsing

If the first three digits are to be omitted from the circuit order information pulsed forward, the subscriber sender will connect a solid ground to lead CL as soon as translation is completed. Relay SK3 operates in series with relay SC, and closes the circuit for operating relay SK until relay A operates (after the CI registration of the fourth digit). Relay SK2 will also operate but performs no useful function.

7.11 Relay SK operated:

(a) Closes a path to keep relay KP operated until the required digits have been skipped.

(b) Transfers the odd and even operate paths for the MF- relays to relay IR. The operation of relay IR allows the MF-pulse timer to make a cycle and unlock the CI registers. The operation of relay A releases relay SK and thereafter MF pulsing is as previously described.

7.2 "Skip 2" Pulsing

If only the first two digits are to be omitted from the MF pulsing the subscriber sender substitutes a 317 ohm ground for the 1711 ohm ground on lead CL as soon as translation is completed. Relay SK2 operates with relay SC and provides an operate path for relay SK from ground through a break contact on relay ACC. Relay SK3 is marginal and does not operate.

7.21 Thereafter the operation of the circuit is similar to the description for "skip 3" except that relay SK is released after the CI registration of the third digit.

8. LATE WIPE-OUT CONDITIONS

8.1 If the subscriber hangs up with 7 or more digits (but less than 10) dialed, the subscriber sender will register a late release and close the trunk test bridge and apply ground to lead LR. On ODN calls the LR relay operates through the operated ODN1 relay, to lead LR.

8.2 Closure of the trunk test bridge will result in the operation of relay TFG-1. With TGF-1 operated and lead LR grounded relay LR operates. Relay LR operated:

(a) Locks to off-normal ground.

(b) Opens the circuit through the primary winding of repeat coil MFP to prevent any MF transmission after a wipe-out.

(c) Operates relay OF-1 (under control of relay AS-1) to reverse the polarity to the subscriber sender trunk test bridge.

(d) Opens a link in the FTO lead to prevent seizing the remote incoming sender. If the sender attached wink has started, however, contacts on relay AS-1 will prevent the operation of relay OF-1 and the opening of the FTO lead.

8.3 If the wipe-out occurs before relay AS-1 operates (remote sender not attached) the remote trunk is allowed to wipe out and cancel its bid for an incoming sender.

8.4 If the wipe-out occurs after the operation of relay AS-1 (but before the start pulse is sent) MF pulsing is stopped but both the subscriber sender and auxiliary sender go through the motion of pulsing forward and the wipe-out of the connection is caused by the release of the district or district junctor.

9. RECONSTRUCTION OF RECYCLED AREA CODE FEATURE

9.1 Reconstruction of Recycled Area Code Without "Skip Digit" Pulsing (SC13)

9.11 The handling of a recycled area code call with this reconstruction feature is as follows: After the first three digits of an area code have been recorded, the subscriber sender calls for a code compressor which examines those digits. If it recognizes them as an area code to be recycled (maximum of 10 codes), it signals the sender to release the stored digits and to record the office code digits in the A, B, C registers as with a 7-digit call. The code compressor also transmits to the sender an arbitrary digit corresponding to the particular area code that is being recycled. The decoder or marker uses this compressed area code digit, the ABX code, and the class of service information in routing the call. If translation of this information indicates that the call is to be handled on a 10-digit MF basis, the marker or decoder will instruct the sender by means of a 7DG mark to call in an auxiliary sender for area code reconstruction and MF outpulsing. After an auxiliary sender is selected, the recycle circuit associated with the subscriber sender will pass the compressed area code digit to it on a two-out-of-five basis through the auxiliary sender link

extension crosspoints. Two CC relays (CC0, 1, 2, 4, or 7) in the auxiliary sender will operate. When the off-normal relay ON-1 operates, ground is connected to the CC relay checking matrix to verify that only two-out-of-five CC relays have operated.

9.111 The RE relay will operate to indicate an error if only one, or more than two, CC relays have operated.

RE relay operated:

(a) Locks to off-normal ground.

(b) Operates the RCA relay which releases the operated CC relay or relays to prevent their release through the auxiliary sender link crosspoints.

(c) Opens the operating path of the TGF1 relay to cause a stuck sender in trunk test.

9.112 The RRC relay will operate if two, and only two, CC relays have operated. The RRC relay operated prepares the circuit for reconstructing the recycled area code and delays assignment of the subscriber sender until the reconstructed area code has been MF outpulsed.

9.12 After an OK check and with the RRC relay operated, the operation of relay 7DG, trunk test, and receipt of "wink" from the remote office are the same as a 7-digit call until operation of the AS relay.

Relay AS operated:

(a) Locks to off-normal ground.

(b) Transfers leads FTO and FRO to the secondary winding of the repeat coil in the multifrequency relay pulsing circuit in preparation for pulsing forward.

(c) Reconnects ground to the timing relays.

(d) Operates relay RRC1.

9.13 Relay RRC1 operated:

(a) Opens the inhibitor lead and connects capacitor T2 to the timer circuit. This allows the MF pulse timer to run free (nominally 63 milliseconds make, 62 milliseconds break).

(b) Operates KP relay which transmits the KP signal to the remote incoming sender.

9.14 The MF pulse timer controls the time intervals during which the KP signal and area code digits are transmitted. The compressed code digit is translated back to the 3-digit code it represents during MF outpulsing of the reconstructed area code.

For the purpose of this description, let us assume that compressed code digit 4 represents recycled area code 914. The area code A digit (9) is transmitted 63 milliseconds after the KP signal is sent. This circuit is traced from off-normal ground through make contacts of relays TS1, RRC, and ACA, through a break contact of relay ACBA, through make contacts of relays CC4 and CC0, through the cross-connection wire placed on the RRC terminal strip from terminal 4 to terminal 39, to the winding of relay MF9. The operation of relay MF9 will cause a (9) to be MF outpulsed for the area code A digit.

9.141 The RRC terminal strip is used to translate the compressed code digit back to the area code it represents (see cross-connection Note 401). If the RRC terminals of a compressed code digit are not wired, the circuit will function when this digit is registered as described in the preceding paragraph but no area code digits will be MF outpulsed. This procedure may be applicable for the home area compressed code digit where it is not necessary to MF outpulse 10 digits to the home area on reconstruction.

9.15 In a similar manner, the area code B(1) and C(4) digits will be reconstructed and transmitted to the remote incoming sender. When the A relay operates after the area code C digit has been MF outpulsed, it will complete the path to operate the RC relay.

RC relay operated:

(a) Locks to off-normal ground.

(b) Opens operate path of RE relay to prevent possible false operation when CC relays are released.

(c) Opens operate path of KP relay to prevent KP signal from being transmitted a second time after the auxiliary sender relays are reset.

(d) Operates relay RCA.

9.16 RCA relay operated:

(a) Locks to off-normal ground.

(b) Releases the operated digit control relays.

(c) Closes the inhibitor lead to the MF pulse timer to prevent possible operation of the TM relay while the auxiliary sender relays are being reset.

(d) Releases the operated CC relays which in turn release the RRC relay.

9.17 RRC relay released:

(a) Transfers the FTI and FRI leads to the dry loop through the CI relays to "assign the trunk" and start call indicator pulsing from the subscriber sender.

(b) Restores the outpulsing timer and control circuits to normal in preparation for MF outpulsing the digits stored in the subscriber sender.

(c) Releases relay RRC1.

9.18 The RRC1 relay is made slow release by means of the RRC1 diode across its winding to allow sufficient time for release of the digit control relays. When the RRC1 relay releases, the auxiliary sender circuit is ready to MF outpulse the digits registered in the subscriber sender in the same manner as covered under the 7-digit call.

9.2 Reconstruction of Recycled Area Code With "Skip Digit" Pulsing (SC14)

9.21 The method of handling this type of call is similar to Reconstruction of Recycled Area Code Without "Skip Digit" Pulsing (paragraph 9.11) except that the marker or decoder will also pass "skip digit" information to the subscriber sender when it determines that less than ten digits should be MF outpulsed. The subscriber sender signals over the CL lead to the auxiliary sender for "skip digit" pulsing. A 317-ohm ground on the CL lead will operate the SK2 relay in series with the SC relay, while a solid ground will operate the SK2 and SK3 relays in series with the SC relay. Either relay operated, SK2 or SK3, completes the path to operate the SK relay which in turn operates the RCA relay when the off-normal relays ON and ON-1 operate.

RCA relay operated:

(a) Locks to off-normal ground.

(b) Releases the operated CC relays which in turn release the RRC relay.

9.22 With the RRC relay and the CC relays normal, the Reconstruction of Recycled Area Code Feature is effectively cancelled and the call is processed in the same manner as a 7-digit call. However, the number of digits MF outpulsed with "skip digit" pulsing will be different from a 7-digit call when wiring Option B or E is installed. These options do not affect "skip digit" pulsing on 7-digit or non-recycled area code calls. Table A lists the number of digits that can be MF outpulsed to adjacent foreign areas on a reconstructed recycled area code basis.

TABLE A

MF Outpulsing To Adjacent Foreign Areas For Reconstructed Compressed Area Codes

	Aux Sdr Wiring Option	Marker or Decoder Skip Digit Information None	SK2	SK3
Number of Digits MF Outpulsed	B	10	4	7
	E	10	5	7
	F	10	5	4

9.23 The number of digits MF outpulsed is controlled by the operation of the SK relay which closes a path to hold relay KP operated until the required number of digits have been skipped.

9.231 Options B and E provide 7-digit MF outpulsing on a reconstructed recycled call when the SK3 relay is operated. This is accomplished by a make contact of the RCA relay which completes the path to shunt down the SK relay and allow 7-digits to be MF outpulsed.

9.232 Option B also provides 4-digit MF outpulsing on a reconstructed recycled call when only the SK2 relay is operated. A make contact of the RCA relay completes the path to operate the SK relay until relay A operates and thus allows only four digits to be MF outpulsed.

9.233 Option E also provides for 5-digit MF outpulsing on a reconstructed recycled call when only the SK2 relay is operated by holding the SK relay operated until the ACC relay operates.

9.234 Option F provides for 4 and 5 digit MF outpulsing as covered under "Skip Digit" Pulsing (paragraph 7.)

DETAILED DESCRIPTION

10. OUTPULSING DIRECTORY NUMBER FEATURE IN LAMA

10.1 10 or 7 Digit Call (SC15)

The method of operation in the auxiliary sender for this type call is similar to a 7- or 10-digit call with the additional function of MF outpulsing a subscriber's calling number to the CAMA office. On multiparty originated calls, the calling number cannot be automatically identified and therefore the auxiliary sender will outpulse an operator identify information digit to the CAMA office.

10.11 After the subscriber sender is connected to an auxiliary sender, it places a 1711-ohm ground on lead ODN to operate the ODN relay in the auxiliary sender. (On prefix digit "0" calls, the

subscriber sender will also operate relay CL3 in the auxiliary sender to cause the transmission of a special start pulse after the called number is MF outpulsed).

10.111 On multiparty originated calls, the subscriber sender places a 317-ohm ground on lead ODN to operate the ODN and PTY relays in series in the auxiliary sender. (A solid ground is connected to lead ODN for a call that is service observed and operates the ODN, PTY and PTYO relays in series.) The operation of relay PTY closes a link in the path for operating the ID1 relay.

10.112 In either case, the operation of relay ODN completes the path to operate relay ODN1 which prepares the circuit for the outpulse directory number feature.

10.12 When the subscriber sender closes the trunk test bridge and provided the CAMA trunk tests normal, the auxiliary sender starts the CAMA incoming trunk for a sender. The signal that a sender is attached to the trunk at the remote office is a momentary reversal of polarity over the pulsing tip and ring. Upon recognizing the start of this wink signal, the auxiliary sender places a 6300-ohm battery on lead FTI (TGF1 relay operated) to satisfy the subscriber sender for trunk test.

10.13 The subscriber sender starts the transverter connector to seize one of the special transverters that has been modified for the outpulse directory number feature at the completion of trunk test. The special transverter connects to the required translator to obtain the calling line directory number but does not seize a recorder on this type call since no recording will be made on the LAMA tape. The transverter passes the directory number, office index digit, and service observed mark (if call is service observed) to the auxiliary sender through relays CTA0, CTB0 or CTA1, CTB1 and checks that the directory number information has been properly registered in the auxiliary sender. On a satisfactory check the transverter operates the ID0 relay in the auxiliary sender which grounds the IDOK lead back to the transverter. The transverter proceeds to disconnect and release the CTA0, CTB0 or CTA1, CTB1 relays in the auxiliary sender. If the auxiliary sender check is unsatisfactory or if the transverter encountered an internal check failure, the transverter operates relay ID2 in the auxiliary sender and calls in the trouble recorder. After a trouble record is taken, the transverter will proceed to disconnect and release the CTA0, CTB0 or CTA1, CTB1 relays in the auxiliary sender.

10.131 On multiparty originated calls, the marker will pass information to the subscriber sender indicating that a transverter is not required. Therefore, the subscriber sender will not start a seizure for a special transverter after completion of trunk test.

10.14 At the completion of the wink signal from the CAMA trunk, the auxiliary sender closes the CI loop to the subscriber sender which CI pulses the called number digits registered in it to the auxiliary sender. The auxiliary sender MF outpulses the KP signal, the called number and a start pulse to the CAMA office. After sending the start pulse, the auxiliary sender resets to prepare for outpulsing the directory number.

Relay RAS operates:

(a) Releases the operated digit control relays.

(b) Releases relays AS and AS1 to prepare for recognizing the signal from CAMA to outpulse the directory number (steady reversal).

(c) Releases relays TZ and TW if operated.

(d) Operates relay RAS1.

10.15 Relay RAS1 operated:

(a) Locks to off-normal ground.

(b) Completes the path to start a 2- to 5-second timing interval for registration of the subscriber's directory number in the auxiliary sender. If the transverter does not operate the ID0 relay within the time-out period, the ID interrupter ground will operate the ID2 relay. (See SC17).

(c) Closes a link in the path of the MF pulse timer.

(d) Operates relay RAS2.

10.16 Relay RAS2 operated:

(a) Locks to off-normal ground.

(b) Assists in preparing the circuit for outpulsing the directory number information.

(c) Releases the RAS relay which restores the operate and lock paths to the relays it released.

10.17 With the RAS1 and an ID0, ID1 or ID2 relay operated, the MF pulse timer is allowed to run free (nominally 63 milliseconds make, 62 milliseconds break) and control the timing intervals during outpulsing of the directory number information. The auxiliary sender will outpulse the directory number information provided the steady reversal signal to send the calling number has been received from the CAMA office within 180 milliseconds after starting the

MF pulse timer. A circuit path is provided through the AS1 relay normal and CE relay operated to operate the STE relay if the steady reversal signal is not received in the allotted time. The operation of the STE relay grounds the AV1 lead to the subscriber sender which will advance the district junctor to cut-through for talking and release the auxiliary sender. If the steady reversal has been received in the allotted time, the auxiliary sender outpulses the directory number information under control of the ID0, ID1, or ID2 relay.

10.171 The ID0 relay operated indicates automatic identification. The auxiliary sender MF outpulses a KP signal, ID0 signal (or ID3 if call is service observed), directory number A, B, C, TH, H, T and U digits, and a regular start pulse to the CAMA sender. The directory number A, B and C digits are reconstructed from the office index digit during MF outpulsing of the central office code. For the purpose of this description, let us assume that office index digit 2 (relay OFF 2 operated) represents central office code 845. After the identification information digit has been sent to the CAMA sender, the directory number A digit is transmitted when the TS1 relay operates. This circuit is traced from off-normal ground through make contacts of relays RAS1, ACCA, and TS1, through a break contact of relay T and make contact of relay RAS1, through break contacts of relays HA, TH, [illegible], and B, through make contacts of relays AA and OFF2, through the cross-connection placed on the OFF terminal strip from terminal 2 to terminal 38, to the winding of relay MF8. The operation of relay MF8 will cause an eight to be MF outpulsed for the directory number A digit. In a similar manner, the directory number B (4) and C (5) digits will be reconstructed and transmitted to the CAMA sender.

10.172 The ID1 relay operated indicates a multiparty originated call requiring operator identification. The auxiliary sender MF outpulses only the KP signal and an ID1 signal (ID4 signal if call is service observed).

10.173 The ID2 relay operated indicates a failure to identify the directory number. The auxiliary sender MF outpulses only the KP signal and the trouble identification signal.

10.18 After the directory number identification information has been MF outpulsed, the auxiliary sender grounds the AV1 lead to the subscriber sender which then proceeds to disconnect and restore to normal as covered in Paragraph 5.

10.2 Zero Operator Call (SC16)

The auxiliary sender is used to complete the connection when assistance operator traffic is routed to a traffic service position. On nonmultiparty originated calls, the auxiliary sender functions to MF outpulse the subscriber's calling number to the CAMA office. However, on multiparty originated calls the subscriber's calling number cannot be automatically identified and therefore the auxiliary sender only outpulses a KP signal followed by an operator identify information digit.

10.21 After timing to distinguish a zero operator call from a prefix "0" call, the subscriber sender calls in a marker for translation. On multiparty originated calls, the sender will be instructed by the marker that a transverter is not required for the calling number identification. Seizure of the auxiliary sender is similar to seizure for a 7-digit MF call including the omission of dialing into the auxiliary sender.

10.22 When the subscriber sender is connected to the auxiliary sender it grounds leads ODN and 14 in addition to lead CL. A 1711-ohm ground is placed on lead ODN to operate the ODN relay in the auxiliary sender and a 317-ohm ground is placed on lead 14 to operate the OPR and CL3 relay in series in the auxiliary sender. (Relay CL3 performs no useful function on this type call.)

10.221 On multiparty originated calls, the subscriber sender places a 317-ohm ground on lead ODN to operate the ODN and PTY relays in series in the auxiliary sender. (A solid ground is connected to lead ODN for a call that is service observed to operate the ODN, PTY, and PTYO relays in series.) The operation of relay PTY closes a link in the path for operating the ID1 relay which will control outpulsing of the operator identify information digit.

10.222 In either case, the operation of relay ODN completes the path to operate relay ODN1. The operation of relay ODN1 prepares the circuit for the outpulse directory number feature.

10.223 Relay OPR in operating closes a link in the path to operate the OPR1 relay after the ODN1 relay has operated.

10.23 After the trunk test bridge is closed by the subscriber sender and provided the CAMA trunk tests normal, the auxiliary sender starts the CAMA trunk for a sender and places a 6300-ohm battery on lead FTI to the subscriber sender (TGFI and OPR1 relays operated).

10.24 The subscriber sender functions to seize a special transverter which will register the calling number information in the auxiliary sender as covered in Paragraph 10.13.

10.241 On multiparty originated calls, the subscriber sender does not start a seizure for a special transverter.

10.25 When the incoming sender is ready to receive the calling directory number, it transmits a steady reversal of polarity over leads FTO and FRO to operate the OF relay in the auxiliary sender. The operation of relay OF causes the AS1 relay to operate. With the AS1 and OPR1 relays operated, a path is closed to operate the RAS relay.

RAS relay operated:

(a) Releases relay ACA which was operated by relay OPR1 but performed no useful function.

(b) Releases relays TZ and TW if operated.

(c) Operates relay RAS1.

10.26 The remaining operations in the auxiliary sender to outpulse the directory number information are the same as those covered in Paragraphs 10.15 to 10.18 inclusive, with the exception that the ACA relay is operated when the RAS relay releases and thereby reduces the calling number outpulsing time by approximately 125 milliseconds.

SECTION III - REFERENCE DATA

1. WORKING LIMITS

1.1 Toward the Subscriber Sender

(a) The total resistance of the CL conductor from the subscriber sender to the auxiliary sender shall not exceed 25 ohms.

1.2 Toward CAMA Crossbar Tandem or CSP

(a) Loop resistance 4850 ohms including winding of incoming trunk A relay.

(b) Insulation leak, tip to ring - 30,000 ohms.

(c) Insulation leak, tip to ground or ring to ground - 30,000 ohms.

1.3 Voltage Limits

Voltage	Min.	Max.
-48	-45	-50

2. FUNCTIONAL DESIGNATIONS

Relay	Meaning	Primary Functions
7DG	7 Digit	To recognize a seven digit call and assist in transmitting the MF start pulse in proper sequence.
A	Office Code Digit A	To assist in CI registration and MF pulsing of the 4th digit in a call.
AA	Office Code Digit "A" Auxiliary	To assist in MF pulsing "A" digit of the subscriber's directory number. Terminates MF pulsing after operator identify or identification failure signal.
AC	Actuate Cutoff	Cuts off the actuating ground for the MF-relays after each digit has been MF pulsed (applies to first seven digits).
ACA	Area Code Digit A	To assist in CI registration and MF pulsing of the first digit in a call. - Terminates the MF KP signal for no-skip calls.
ACB	Area Code Digit B	To assist in CI registration and MF pulsing of the second digit in a call.
ACBA	Area Code B Digit Auxiliary	Assists in MF pulsing the second digit of a call.
ACC	Area Code Digit C	To assist in CI registration and MF pulsing of the third digit in a call.
ACCA	Area Code C Digit Auxiliary	Assists in MF pulsing the third digit of a call.
AS	Assignment	To assign the CI trunk after trunk test by the subscriber sender.
AS-1	Assignment 1	To register the operation of relay OF on the sender attached "wink" so that relay TGF can operate relay AS.
B	Office Code Digit B	To assist in CI registration and MF pulsing of the fifth digit of the call.
BK	Block	Indicates sender has timed out. Permits subsequent stick or timed release in conjunction with key CTR and relay CTR.
BKA	Block Auxiliary	To assist in release of circuit on a timeout.
BK1	Block 1	To cause a major alarm and prevent excessive scoring of SS register on a timeout.

Relay	Meaning	Primary Functions
C	Office Code Digit C	To assist in CI registration and MF pulsing of the sixth digit of the call.
CCO, 1, 2, 4, 7	Compressed Code Register	Register the compressed code digit transmitted from the subscriber sender recycle circuit and assist in MF pulsing the reconstructed recycled area code.
CE	Count Even Digits	To assist in the CI registration of the even digits and MF pulsing of the odd digits of the call.
CL3	Class Special	Recognizes ground on lead 14 and assists in MF pulsing a special start pulse.
CO	Counts Odd Digits	To assist in the CI registration of the odd digits and the MF pulsing of the even digits of the call.
CTAO, CTBO	Cut Through 0	Connects circuit to first special transverter for directory number information.
CTA1, CTB1	Cut Through 1	Connects circuit to second special transverter for directory number information.
CTR	Cancel Timed Release	Permits only one sender in the group to stick. Causes a minor alarm.
DHNO-9	Directory Hundreds	To register the hundreds digit of the subscriber's directory number.
DTO-9	Directory Tens	To register the tens digit of the subscriber's directory number.
DTHO-9	Directory Thousands	To register the thousands digit of the subscriber's directory number.
DUO-9	Directory Units	To register the units digit of the subscriber's directory number.
E1, E2 E4, E5	Even Register	To temporarily register the even CI digits until they are MF pulsed forward.
H	Hundreds Digit	To assist in CI registration and MF pulsing of the eighth digit of the call. To change over control of MF pulsing to the MF pulse timer circuit.
HA	Hundreds Digit Auxiliary	To assist in MF pulsing H digit of subscriber's directory number.
IDO, 1, 2	Identification Digit	To assist in MF pulsing and control of identification information digit.
IDT	Identification Timeout	To assist in timing for registration of subscriber's directory number.
IR	Inhibitor Release	Opens lead I (the inhibitor lead) to permit operation of the MF pulse timer to unlock the CI registers for skipped digits.
KP	Keypulse	Transmits the MF keypulse "gate opener" signal frequencies.
LO	Line Observed	To assist in MF pulsing line service observe information with the identification digit.
LR	Late Release	Cancels MF pulsing on late disconnect.

Relay	Meaning	Primary Functions
MB	Make Busy	To remove sender from service when jack MB is plugged.
MF-0 to MF-9	MF Pulse	Transmit MF keypulse numerical digit frequencies.
MG	Marginal	Recognized heavy negative CI pulse.
O-1 O-2 O-4 O-5	Odd Register	Register odd CI pulsed digits until they are MF pulsed forward.
ODN	Outpulse Directory Number	Recognizes ground on lead ODN and operates ODN1 relay.
ODN1	Outpulse Directory Number 1	To assist in controlling the outpulse directory number feature.
OF	Overflow	Checks that remote incoming trunk is normal when seized. Assists in recognizing sender connected "wink" signal from CAMA trunk.
OF-1	Overflow 1	Reverses polarity to subscriber sender trunk test bridge if CAMA trunk is off-normal at seizure.
OFF 0-9	Office Index	To register the office index digit associated with the subscriber's directory number.
ON	Off-Normal	Provides all off-normal grounds for auxiliary sender.
ON-1	Off-Normal 1	Truns on MF signal generator and timing circuit.
OPR	Operator	Recognizes a 317 ohm ground on lead 14 and operates the OPR1 relay on outpulse directory number calls.
OPR1	Operator 1	To assist in controlling the outpulse directory number feature on a call to the operator.
P-1, P-2 P-4, P-5 P-6	Pulse	Count pulses of dialed digits.
PC	Peg Count	Times Peg Count pulse.
PTY	Party	Recognizes a 317 ohm ground on lead ODN and operates the ID1 relay.
PTYO	Party Observed	Recognizes a solid ground on lead ODN and operates the LO relay.
PW	Pulse W	Part of dial pulse multiplier.
PZ	Pulse Z	Part of dial pulse multiplier.
RA	Register Advance	Controls digit advance for dialed digits.
RAR	RA Repeat	Multiples RA ground circuits in register advance and registration of dialed digits.
RAS	Reset	Start reset of circuit in preparation for outpulsing the subscriber's directory number.

Relay	Meaning	Primary Functions
RAS1	Reset 1	To assist in preparing circuit for outpulsing the subscriber's directory number - Starts identification timing interval.
RAS2	Reset 2	To assist in resetting circuit in preparation for outpulsing the subscriber's directory number.
RC	Reconstruction Complete	Assists in resetting circuit at completion of MF pulsing the reconstructed recycled area code.
RCA	Reconstruction Complete Auxiliary	Assists RC relay in resetting circuit and cancels reconstruction of recycled area code when "skip digit" information is registered.
RE	Reconstruction Error	Recognizes registration error of compressed code digit.
RL	Repeat L	Regenerates dial pulses.
RRC	Reconstruct Recycled Code	Recognizes call requires reconstruction of recycled area code and assists in MF pulsing the reconstructed recycled area code.
RRC1	Reconstruct Recycled Code 1	Starts MF pulse timer circuit and assists in sending KP signal on reconstructed recycled area code call. Insures complete reset of circuit after reconstructed recycled area code is MF outpulsed.
SC	Sensitive Class	Recognizes closure of class lead. Operates and releases ON relay.
SK	Skip	Opens MF relay operate path while digits are being skipped.
SK2	Skip 2	Recognizes 317Ω ground on class lead and prepares to skip MF pulsing of first two digits.
SK3	Skip 3	Recognizes solid ground on class lead and prepares to skip MF pulsing of first three digits.
SN+	Sensitive+	Recognizes light positive CI pulses.
SN-	Sensitive-	Recognizes negative CI pulses.
STC	Start Closure	Connects MF start signal frequencies towards remote sender, prepares circuit to ground AV-1 after start pulse.
STE	Start End	Assists in AV-1 signal.
STR	Station Recognition	For 7 digit calls recognizes that a digit has been dialed on subscriber sender stations register and prevents turning a final 0 to a start pulse.
STS	Start Signal	Sequences MF pulsing of start signal after 10th digit.
T-0, T-1, T-2, T-4, T-7	Tens-	Tens register for dialed digits.
T	Tens	Sequences MF pulsing of the 9th digit of the call.

Relay	Meaning	Primary Functions
TD, TD'	Tens Digit	Sequences dial digit registration of 9th digit.
TGB	Trunk Guard Back	Detects closure of subscriber sender trunk test bridge.
TGB-1	Trunk Guard Back 1	Records operation of TGB. Grounds armatures of OF and TGF relays.
TGF	Trunk Guard Forward	Checks continuity to CAMA trunk normal. Assists in recognition of the sender connected "wink" signal.
TGF-1	Trunk Guard Forward -1	Records initial operation of TGF and prepares for recognition of the "wink" signal.
TH	Thousands	Sequences CI registration and MF pulsing of 7th digit.
TM	Time Multifrequency	Times MF pulsing of CI registered digits. Times MF pulsing and advances sequence circuit for dial registered digits.
TS, TS-1	Timing Slave-	Contact Multipliers for TM.
TW	Timing W	Interrupter Multiplier for over-all timing.
TZ	Timing Z	Interrupter Multiplier for over-all timing.
U-0, U-1, U-2, U-4, U-7	Units-	Dial digit register for 10th digit.
U	Units	Sequences MF pulsing of 10th digit.
UD, UD'	Units Digit	Sequences dial pulse registration of 10th digit.
UNE	Unlock Even	Releases even CI register after digit has been MF pulsed.
UNO	Unlock Odd	Releases odd CI register after digit has been MF pulsed.
W	-	Assists in steering CI pulses within a digit.
Z	-	Assists in steering CI pulses within a digit and advances sequence circuit between digits.

2.1

Terminal Strip	Meaning	Primary Functions
OFF	Office Index	Translates office index digit to central office code it represents and assists in MF pulsing the calling subscriber's central office code.
RRC	Reconstruct Recycled Code	Translates compressed code digit to area code it represents and assists in MF outpulsing the recycled area code.

3. FUNCTIONS

3.01 To recognize when the auxiliary sender has been seized for the subscriber sender (through the closing of the auxiliary sender link crosspoint) and to prepare to register the last two digits dialed for a direct distance dialed call.

3.02 To recognize that the call to be handled is a 7-digit call when no dial digits are registered before the subscriber sender closes its trunk test bridge before timeout.

3.03 To register any digits dialed and store them on the proper register circuits.

3.04 To signal the subscriber sender when the last dialed digit has been registered.

3.05 For Crossbar No. 1 offices with local automatic message accounting to suspend timing while the transverter is connected and to resume timing when the transverter disconnects.

3.06 To test that the incoming trunk in the remote office is normal when the subscriber sender attempts call indicator trunk test after dialing has been completed.

3.07 To signal to the incoming trunk in the remote office to go for a sender (if the incoming trunk is normal) or to send the subscriber sender to overflow (if the incoming trunk is off-normal).

3.08 To recognize the "wink" (momentary trunk reversal) from the remote office when a sender is connected to the incoming trunk to soak the subscriber sender trunk guard relays at the start of the wink, and to assign the trunk toward the subscriber sender.

3.09 To send a KP (gate opener) signal to the remote incoming sender after a start delay.

3.10 To accept the digits registered in the subscriber sender on a call indicator pulse basis and to register them alternately on two registers.

3.11 To terminate the KP signal when the first call indicator digit is registered and to transmit the first call indicator digit on a multifrequency basis to the remote incoming sender while the second call indicator digit is being registered.

3.12 To end the multifrequency transmission of the first call indicator digit after a measured time interval and to restore the register in time for its reuse for registration of the third call indicator digit.

3.13 To transmit the second call indicator registered digit to the remote incoming sender on a multifrequency basis; to cut off the transmission after a measured time interval; to restore the register in time for its reuse for registration of the fourth CI digit.

3.14 To continue to register the call indicator digits, to transmit each one forward on a multifrequency basis and restore the register during the registration of the next call indicator digit until the last call indicator digit has been registered.

3.15 For a 7-digit call, to transmit on a multifrequency basis, the last registered call indicator digit and a start pulse under control of a timing circuit in the auxiliary sender.

3.16 For a 7-digit call, to recognize a signal from the subscriber sender that a digit has been registered on the stations register and pulse the stations digit forward as received. When the signal is not received, a zero, CI pulsed in the stations position, is changed to the start pulse.

3.17 For a 10-digit call, to transmit forward on a multifrequency basis the last registered call indicator digit, the two digits dialed into the auxiliary sender and a start pulse under control of the timing circuit in the auxiliary sender.

3.18 On an Area Code Reconstructed Call, to store the compressed code digit of a recycled area code that is transmitted from the subscriber sender recycle circuit.

3.19 To check for proper registration of the compressed code digit on a two-out-of-five basis.

3.20 To control the number of digits (10, 7, 5 or 4) MF outpulsed with the assistance of a "skip digit" information mark from the marker or decoder.

3.21 To delay assignment of the subscriber sender until the reconstructed recycled area code is MF outpulsed.

3.22 To translate the compressed code digit back to the recycled area code it represents.

3.23 To reset the circuit after MF outpulsing the Reconstructed Recycled Area Code, to prepare for handling the digits stored in the subscriber sender in the same manner as a 7-digit MF call.

3.24 On "0" prefix calls to transmit a special start pulse.

3.25 For Crossbar No. 1 offices with local automatic message accounting to recognize AN outpulsing directory number call.

3.26 To register the calling subscribers directory number, office index digit and service observed mark (if call is service observed) on ODN calls.

3.27 To recognize the "steady reversal" signal from the remote office, as an indication to go ahead and MF outpulse the KP, identification signal and the calling directory number, followed by a regular start pulse.

3.28 To reset the circuit after MF outpulsing the called number start pulse and to start a 2 to 5 second timing interval for identification of the directory number, if not registered.

3.29 To translate the office index digit back to the ABC code of the calling directory number it represents.

3.30 To give a cut through and disconnect signal to the subscriber sender after the start pulse has been transmitted to the remote incoming sender.

3.31 To restore to normal after the crosspoints are opened in the auxiliary sender link when the subscriber sender disconnects from it.

3.32 To hold itself busy to the link circuit until it has restored to normal.

3.33 To time out on a partial dial basis in six to twelve seconds, if the dialing of the ninth digit on a 10-digit call has not been started or if the trunk test bridge is not closed by the subscriber sender on a 7-digit call. To recycle the timing at the start of dialing of each digit. To time out on a partial dial basis in six to twelve seconds if the dialing of the 10th digit has not started within that time, after the dialing of the previous digit.

3.34 To stick on timeout if dialing of the 10th digit has started or the trunk test bridge is closed, if the CTR key is normal and it is the first sender in the group to time out. To react as if the CTR key is operated if any other sender in the group is stuck.

3.35 To give the subscriber sender an overflow signal for time outs provided MF pulsing has not been started or the sender has not stuck.

3.36 To time for six to twelve seconds from remote sender attached until the completion of multifrequency pulsing and then to stick until the subscriber sender disconnects (CTR key pulled out and no other sender in the group stuck) or to send a false start pulse in one more second and to time release at the end of another six seconds (CTR key normal or another sender in the group stuck.)

3.37 To provide for removing the sender from service and for holding it busy to the link circuit.

3.38 To provide for a manual prime out release of the subscriber sender on failure to restore on the timed release.

3.39 To provide a steady sender lamp signal whenever the sender is off-normal and to change the steady lamp to a flashing lamp whenever the sender times out.

3.40 To provide for a register operation and a single bell-tap signal whenever a sender times out for trouble and to give a minor alarm if the sender sticks.

3.41 To provide sender busy and sender busy for maintenance signals to the traffic usage recorder.

3.42 To record each 7 and 10-digit usage or partial dial on group registers.

3.43 To give a major alarm and light an aisle pilot lamp if a second auxiliary sender in a group is stuck.

4. CONNECTING CIRCUITS

When this circuit is listed on a keysheet, the information thereon is to be followed.

This circuit will function with the following circuits.

COMMON SYSTEMS

4.01 Auxiliary Sender Link Circuit - SD-96483-01.

4.02 Multifrequency Current Supply and Distribution Circuit - SD-95391-01.

4.03 Traffic Usage Recorder - SD-95738-01.

4.04 Multifrequency Signal Generator Circuit - SD-95867-01.

NO. 1 CROSSBAR SYSTEM

4.05 Miscellaneous Circuit for Sender Make Busy Frame - SD-25076-01.

4.06 Interrupter Frame Circuit - SD-25062-01.

4.07 Traffic Register Circuit - SD-25317-01, SD-25942-01.

4.08 Aisle Pilot Circuit - SD-25087-01.

4.09 Auxiliary Transverter Link Circuit (LAMA) - SD-26211-01.

4.10 Alarm Transfer Circuit - SD-25885-01.

4.11 Transverter Circuit (LAMA) - SD-25802-01.

PANEL SYSTEMS

4.12 Miscellaneous Circuit for Sender Make Busy Frame - SD-21236-01, SD-21663-01.

4.13 Interrupter Frame Circuit - SD-21666-01, SD-21667-01.

4.14 Miscellaneous Registers - SD-20141-01, SD-21537-01.

4.15 Time and Time Alarm Circuit (BCO) - SD-21201-01.

4.16 Misc. Alarm Ckts. (GCO) - SD-20241-01.

4.17 BCO and GCO Alarm Transfer Circuit - SD-20733-01.

5. MANUFACTURING TEST REQUIREMENTS

The sender shall be capable of performing all the functions listed in this circuit description and shall meet the requirements listed in the Circuit Requirements table and circuit notes.

All operation and timing tests shall be made with the test voltages within the following limits.

	Minimum	Maximum
Signaling Battery	48.5	50.0

6. TAKING EQUIPMENT OUT OF SERVICE

6.1 Sender Circuit or any of its Associated Apparatus

Insert a No. 322A plug in the Associated Auxiliary Sender Make Busy Jack (MB) at the Sender Make Busy Frame.

If a particular Auxiliary Sender is to be taken out of service for routine testing, insert a No. 322A plug in the associated Auxiliary Sender Make Busy Jack (MB) at the Sender Make Busy Frame. Then operate the (PAS) key associated with this sender at the Originating Sender Test Frame and remove the 322A plug.

6.2 General Precautions to be Followed When Working on the Apparatus.

When working on the apparatus, the sender should be made busy by inserting a No. 322A plug in the associated MB jack at the Sender Make Busy Frame. No further precautions are necessary other than those noted in the Circuit Requirements table.

7. ALARM INFORMATION

7.1 General

Any condition preventing the completion of a call in the normal interval is regarded as an irregular condition to be disposed of in the best available manner. If the call has progressed to a point where reference to an operator is impossible, the return of an overflow signal to the calling subscriber is a general practice. Since calls using an auxiliary sender will generally have progressed to the point where an outgoing trunk is connected by the time the auxiliary sender is seized, the overflow procedure is followed. Arrangements are also provided so that the first sender in the group to time out for trouble (not partial dial) can be caused to stick. Only one sender can be stuck and subsequent timeouts will result in an overflow signal to the calling subscriber.

7.2 Excessive Dial, Sender Attached or Pulsing Delay (SC 4, 5, 6, 7 and 8)

7.201 When the sender is seized, off-normal ground under control of break contacts on relays RAR and AS-1 is connected to the armature of interrupter TA and to the lock contacts of relays TZ and TW. If the interrupter makes and breaks its front contact and makes its front contact again between seizure of the auxiliary sender and before the first digit is dialed or the remote sender attached (a period of six to twelve seconds) ground is connected to relay BK, which operates.

Relay BK operated:

(a) Locks to off-normal ground.

(b) Opens a link in the path for grounding lead DC at the completion of 10 digit dialing. This contact prevents a lock-up in the subscriber sender if the calling subscriber sender hangs up after dialing 10 digits and the remote sender has not been attached. This contact also prevents operation of relay 7DG if a forced trunk closure is made on a partial dial 10 digit call.

(c) Opens a normally made contact shunting the SS interrupter to change the busy lamp from steady to flashing.

(d) Closes a link in the circuit to permit a manual prime-out of the subscriber sender on failure of automatic timed release.

(e) Closes a link in the circuit for operating relay CTR if no other sender in the group is stuck and if dialing of the 10th digit has started or the subscriber sender has closed the trunk test bridge.

(f) Closes a link in the circuit for giving an arbitrary "dial completed" signal (if the timeout occurs before assignment) or an arbitrary start signal (if the timeout occurs after assignment).

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(g) Opens a link in the path for operating relay TGF-1. If the timeout occurs before closure of the trunk test bridge by the subscriber sender relay TGF-1 remains normal and the low resistance closure will not be applied to the pulsing leads to start the remote incoming trunk.

7.202 As relay TW releases (on the second make of the interrupter in one time interval) a ground is closed through the make contact of a transfer on relay TZ to the sender make-busy frame to operate the stuck sender register for a trouble timeout or the ground is connected to lead PD to operate the partial dial register for a partial dial timeout. When the stuck sender register operates its make contact causes the single tap alarm bell to ring once.

7.203 If relay CTR operates after relay BK operates it:

(a) Locks to off-normal ground through the make contact of the early make-break through which it operated.

(b) Opens a contact in parallel with the contact of the CTR key.

(c) Opens a link in the chain circuit through all the CTR relays in the group to prevent the operation of a second CTR relay.

(d) Opens a link in the operate path for the stuck sender register. If the CTR relay does not operate the register lead will be opened when the interrupter breaks and permits the release of relay TZ.

7.204 If key CTR has not been pulled out, or relay CTR does not operate, the auxiliary sender cannot stick and will proceed with operations intended to cause its release as described in the following paragraphs.

7.205 When the interrupter breaks for the second time in one interval relay TZ releases. With relay BK operated and TW and TZ released, relay CTR released or key CTR normal a ground is closed through to the midpoint of a transfer contact on relay AS-1. Relay AS-1 will be normal if the timeout occurred before the start of MF pulsing or will be operated if the timeout occurred after the start of MF pulsing.

7.206 If relay AS-1 is operated a path is closed to operate relay STC and transmit a misplaced start pulse. If this pulse is received on any register in the tandem sender except 8th, 9th or 11th the tandem sender will cause the connection to be set up to an overflow trunk. This pulse is sent to save holding time of the tandem sender. If the misplaced start pulse does not register the tandem sender will time out in 20 seconds from seizure and set the connection to overflow. When the interrupter makes for the 3rd time in one interval relay STC releases and lead AV-1 is grounded to cause the subscriber sender to cut through and disconnect.

7.207 If relay AS-1 is normal (pulsing not started) the ground through the midpoint of the transfer through the break contact, through the midpoint and break contact of a transfer on relay TGB-1 normal (trunk test bridge not closed) is closed to lead DC as an arbitrary dial completed signal. This signal will cause the subscriber sender to close the trunk test bridge if 7 to 9 digits have been dialed on a 10 digit call.

7.208 With relay TGB-1 operated (on either a regular or forced closure of the trunk test bridge) the timeout ground through the make contact of the transfer operates relay OF-1 to give a reversed battery signal to the subscriber sender over leads FTI and FRI.

7.209 The operation of relay RAR at the start of dialing of the 9th or 10th digit releases relays TZ and TW (if operated) to recycle the timing. The operation of relay AS-1 at the start of the sender attached "wink" also releases TZ and TW if operated. The operation of relay AS at the completion of the "wink" restores ground to the timing circuit for the final work time interval. The four possible timing intervals are from seizure to start of dial of the 9th digit; end of dialing of the 9th digit to start of dialing of the 10th digit; end of dial (10 digit) or seizure (7 digit) to sender attached; and sender attached to end of MF pulsing. The timing interval from the end of dial (10 digit) to sender attached wink is stopped for LAMA while the transverter is connected and is restarted when the transverter disconnects. This is done by taking the ground lead for the timing circuit through a break contact on the auxiliary transverter link hold magnet.

7.3 Remote Incoming Trunk Off-Normal

7.31 If the remote incoming trunk has not restored to normal (leaving the trunk polarity reversed) relay OF will be operated when the subscriber sender attempts call indicator trunk test. The operation of relay TGB-1 then connects ground through the make contact of relay OF operating relay OF-1. Through two of its transfer contacts, relay OF-1 operated, reverses the polarity connected to leads FTI and FRI to operate relay OF in the subscriber sender. The call will be put up to overflow and the auxiliary sender will be released.

7.4 Major Alarm and Aisle Pilot Lamp, Option "S" and "H".

7.41 To cause a major alarm and light an aisle pilot lamp if a second auxiliary sender in a group is stuck because of an effective open trunk (E.g., an open in the FTI or FRI leads between the auxiliary sender and the subscriber sender), the first stuck auxiliary sender in the same group must have its CTR relay operated. When the second auxiliary sender sticks in the trunk test position, the timing feature in the auxiliary sender causes relays TW and TZ to operate and release from the TA Interrupter. After the first 6-second timing interval, relay TW releases, operates relay BK which locks to its own make contact, and scores the SS register. 0.95 seconds later the TA Interrupter causes relay TZ to release. Since the trunk circuit is effectively open, the operation of relay OF1 is prevented. Six seconds after the release of relay TZ, the TA Interrupter causes relay TW to operate for a second time. The second operation of relay TW operates relay BK1. Relay BK1 locks to its own make contacts, opens the ground supply path from the timing relays that cause the SS register to operate (thus preventing overscoring of the SS register), grounds lead "DL" or "DG" to operate a major alarm, and grounds lead "W" to light an aisle pilot lamp. (Since the CTR relay has operated in the first stuck auxiliary sender in the group, the CTR relay in the second auxiliary sender cannot operate. Thus the path from ground, through the CTR relay break contact, through the BK1 relay make contact is complete to the major alarm lead "DL" or "DG").

7.42 This change in circuit operation will also cause a momentary major alarm and light the aisle pilot lamp if with one auxiliary sender held on CTR, a second auxiliary sender times out after the start of MF pulsing and forces a release after timeout. If the major alarm on the second stuck auxiliary sender in a group is not required, the "DL" or "DG" connection may be omitted.

7.43 Wiring Options "S" and "H" will also cause a major alarm and light an aisle pilot lamp when the BK1 relay operates if an auxiliary sender sticks on a partial dial 10-digit call.

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SECTION IV - REASONS FOR REISSUE

CHANGES

A. CHANGES AND ADDED FUNCTIONS

A.1 A feature is added to provide outpulsing of directory numbers from No. 1 crossbar LAMA offices to a CAMA office when required.

B. CHANGES IN APPARATUS

B.1 Added

App. Fig. 7

DHN0-4	-	293A relay
DHN5-9	-	" "
DT0-4	-	" "
DT5-9	-	" "
DTH0-4	-	" "
DTH5-9	-	" "
DU0-4	-	" "
DU5-9	-	" "
ID0	-	AJ15 "
ID1	-	AF100 "
ID2	-	AJ14 "
IDT-L0	-	AK8 "
ODN1	-	AJ15 "
OFF0-1	-	AK6 "
OFF2-3	-	" "
OFF4-5	-	" "
OFF6-7	-	" "
OFF8-9	-	" "
DN	-	185A network
IDO	-	" "
ID1	-	" "
ID2	-	" "
ID2S	-	" "
IDT	-	" "
LO	-	" "
ODN1	-	" "
OFF0	-	" "
OFF1	-	" "
OFF2	-	" "
OFF3	-	" "
OFF4	-	" "
OFF5	-	" "
OFF6	-	" "
OFF7	-	" "
OFF8	-	" "
OFF9	-	" "
DN	-	KS-13490 L3, 0.1 meg. resistor
G	-	D5A terminal strip
H	-	" " "
J	-	" " "
OFF	-	" " "

App. Fig. 8

OPR	-	S533 relay
OPR1	-	AJ15 "
RAS	-	" "
RAS1	-	" "
RAS2	-	" "
OPR1	-	185A network
RAS1	-	" "
RAS2	-	" "
RAS	-	420G diode

App. Fig. 9

AA-HA	-	AK22 relay
AA	-	185A network
HA	-	" "

App. Fig. 10

BKA	-	AK22 relay
BKA	-	185A network

App. Fig. 11

CTA0	-	286H relay
CTA1	-	" "
CTB0	-	" "
CTB1	-	" "
CTB0	-	180A network
CTB1	-	" "
K	-	BT6A terminal strip (one per four auxiliary senders)
K1	-	BU6A terminal strip (one per four auxiliary senders)
L	-	BT6A terminal strip (one per four auxilairy senders)
L1	-	BU6A terminal strip (one per four auxiliary senders)

App. Fig. 12

ODN	-	S47 relay
PTY	-	S533 "
PTY0	-	S510 relay
ODN	-	239 jack
ODN	-	185A network
ODN	-	18FA resistor
E	-	D5A terminal strip
F	-	D5A terminal strip

Superseded:

CL3	-	S510 relay, option ZA

Superseded by:

CL3	-	S47 relay, option ZB

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 Options 7, 8, 9, 10, 11, 12, ZA and ZB are added to the Option Index on Sheet A3 to provide outpulsing of directory numbers from No. 1 crossbar LAMA offices to a CAMA office. Option ZA is rated "Mfr. Disc." and is superseded by Option ZB. The circuit arrangement prior to this change is shown as Option A. This change shall be coordinated with a corresponding change in the auxiliary sender link circuit SD-96483-01, Issue 15B, the auxiliary transverter link circuit SD-26211-01, Issue 4D, the transverter circuit SD-25802-01, Issue 27D, and the interrupter circuit SD-25062-01, Issue 66D.

D.2 Leads added to the Lead Index of Sheet A3 as follows: ODN under Auxiliary Sender Link Ckt., ID-F and ID-B under Interrupter Frame Ckt., CT0, CT1, and ODN under Auxiliary Transverter Link, ACT0, ACT1, ID0, ID2, IDOK, DHN0-9, DT0-9, DTH0-9, DU0-9, L0, and OFF0-9 under Transverter 0 and 1.

D.3 Apparatus added to the Apparatus Index of Sheet A3 as follows: Relays

AA, BKA, CTAO, CTA1, CTBO, CTB1, DHNO to 9, DTO to 9, DTHO to 9, DUO to 9, HA, IDO, ID1, ID2, IDT, LO, ODN, ODN1, OFFO to 9, OPR, OPR1, PTY, PTYO, RAS, RAS1, RAS2, resistor DN and ODN, diode RAS, and jack ODN.

D.4 FS15 and FS16 are added to show the registration and control circuitry of the outpulsing directory number feature.

D.5 App. Fig. 7, 8, 9, 10, 11, and 12 are added to show new equipment.

D.6 On Sheet D1, Options 7, 8, 9, 10, 11, 12, A, and ZB are added to the Feature or Option Table and to the Record of App. Figures, Wiring and Apparatus Changes and rated AT&TCo Std.. Option ZA, added to the Record of App. Figures, Wiring and Apparatus Changes, is rated Mfr. Disc.. App. Fig. 7, 8, 9, 10, 11, and 12 are added to the fusing table. Network No. 3 is added to the Network Value table. Note 106 is added to the circuit notes and Notes 203 and 204 are added to the equipment notes.

D.7 On Sheet D2, the outpulsing directory number feature connections and App. Fig. 6, 7, 8, 9, 10, 11 and 12 are added to Block Diagram Note 302. The equipment arrangement for App. Fig. 7, 8, 9, 10, 11 and 12 is added to Note 303. The outpulsing directory number feature is added to Block Diagram Note 304.

D.8 Cross connection Notes 404 and 405 are added to show connections for the OFF terminal strip.

D.9 On Sheet E1, a phrase is added to Sheet Note 2 to clarify the circuit operation with LAMA and a minor revision is made in SC1 to make it agree with the circuit operation.

D.10 SC15 is added to show the sequence of operation for outpulsing the directory number.

D.11 SC16 is added to show the sequence of operation for outpulsing the directory number on a zero operator call.

D.12 SC17 is added to show the timing for registration of the directory number.

D.13 SC18 is added to show the MF digit pulsing patterns for outpulsing directory numbers.

D.14 Relays AA, BKA, CTAO, CTA1, CTBO, CTB1, DHNO-9, DTO-9, DTHO-9, DUO-9, HA, IDO-ID2, IDT, LO, ODN, ODN1, OFFO-9, OPR, OPR1, PTY, PTYO, RAS, RAS1, RAS2 and Option ZB for relay CL3 are added to the Circuit Requirement tables.

D.15 On Sheet G1, the cabling for the ODN lead is added to CAD1. The cabling for the ID-B and ID-F leads is added to CAD2.

D.16 CAD's 6, 7, 8, 9, 10, 11, and 12 are added for the outpulse directory number feature.

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DEPT. 2319-JM-LF

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