COMMON SYSTEMS
OUTPULSER CIRCUIT
AUTOMATIC NUMBER
IDENTIFICATION - TYPE B
CROSSBAR NO. 1, PANEL, OR STEP-BY-STEP OFFICE

CHANGES

D. Description of Changes

D.01 A glare condition that can occur during testing, when one of the two identifiers is made busy, is corrected by the addition of option YY, replacing option YX in FS9. The new option YY is especially helpful in offices equipped with No. 1 AMARC and toll identifiers where such glare conditions cause trouble time-outs and loss of service call work time. Option YY wiring consists of adding 7B of relays MBI0 and MBI1 on the DO/CO leads to other outpulsers. Circuit Note 104 is changed, Note 128 is added, and CAD 5 is changed for this new feature.

D.02 Circuit Note 120, which specified the replacement of option YB by YC on circuits prior to Issue 18B, is modified to state that option YC is a required prerequisite when the outpulser is operating with a No. 1 AMARC and toll identifier. This is to eliminate an interference problem, between the OITT and the line verification test circuit which can cause relay PS in the outpulser to be held operated too long, blocking subsequent line verification attempts.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 5413-DAJ

WE DEPT 45240-WCR-JTT-MS

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AUTOMATIC NUMBER
IDENTIFICATION - TYPE B
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SECTION I - GENERAL DESCRIPTION

1. PURPOSE OF CIRCUIT

1.01 The outpulser is part of a system that automatically identifies the number of the calling customer and transmits the calling number to a CAMA or TSPS office for automatic recording on AMA tape. In panel and step-by-step offices served by an Automatic Intercept Center (AIC), this system also identifies the number of the called line that is on intercept and transmits this number to the AIC.

1.02 Automatic Number Identification (ANI) may be used in panel, No. 1 crossbar, and step-by-step offices. Number identification is made by means of tone applied to the sleeve of the trunk used in the transmission path. The applied tone appears also on the line sleeve, emerging through a capacitor-resistance network where it is amplified and detected in the identifier. Number register relays that identify the calling office and the four digits of the calling number are operated. This number is now sent to the CAMA or TSPS office by the outpulser. The MF signaling is used, and sent over the talking circuit. During MF pulsing, the trunk is split so that the calling station does not interfere. A relay connector serves as a connector between the outpulser and the trunk. One or two available identifiers is required on each call. The identifier is selected by the outpulser.

1.03 The system may be used with individual lines and 2-party lines on a fully automatic basis and with other multiparty lines on a semiautomatic basis. If the party lines served have more than two stations, the individual numbers associated with such stations are not automatically identified. Instead, the line is recognized as one requiring the services of a CAMA attendant. The outpulser outpulses an appropriate signal that the MF receiver recognizes and causes an attendant to be summoned. The attendant then obtains the calling number from the calling customer.

2. GENERAL DESCRIPTION OF OPERATION

2.01 Information Note 301, sheet D3, shows in block diagram form how the principal circuits of this number identification system are associated one with another. It also shows in block diagram the principal subdivisions of the outpulser itself.

2.02 Identification of a calling number is made one at a time within an identifier group.

2.03 After the called number is sent to the CAMA or TSPS office, either by PCI or MF pulsing, the call is momentarily suspended at that point until the calling number is obtained. This is done to permit recording all necessary information on the AMA tape. Included in this information is the number of the calling line. This number is usually obtained by the ANI circuits and transmitted by MF pulsing to the CAMA office. There it is recorded on an MF register and later transferred to the transverter for AMA recording. If the calling station is one on a multiparty line (other than 2-party), the identifying circuits in the originating office will cause a distinctive digit to be transmitted. This digit carries instructions to the MF receiver which in turn instructs the tandem sender to summon an attendant to obtain the calling number, and key it back into the sender. The sender later transfers this number to the transverter for AMA recording.

2.04 In like manner, an attendant is called in whenever the originating number identification equipment encounters trouble.

2.05 The outpulser has means for making a party test in panel offices to determine which of two parties on a line is calling. This is necessary in order to direct the identifier to the bus system network tip or ring where the calling number will be found.

2.06 In crossbar offices, party identification is made in the sender and passed on to the identifier via the trunk, connector, and outpulser.

2.07 In step-by-step offices, party identification is made by the ANI trunk. The party test is made in the interdigital time between the first and second digits and then passed on to the identifier via the trunk, connector, and outpulser. Also, in step-by-step offices this circuit is available on either 11-foot 6-inch or 9-foot 0-inch frames.

OPERATION WITH OUTPULSER CONNECTOR

2.08 After the called number has been recorded in the tandem or toll office, the trunk bids for an outpulser through the outpulser connector. Each subgroup of trunks normally prefers a particular outpulser, but may connect to other outpulsers in a fixed preference. Each trunk subgroup has associated with it an Outpulser Preference (OP) relay and an Outpulser Busy (OB) relay. If two or more subgroups are bidding for the same outpulser, the preference relays will determine the group that has the preference, and the busy relays will direct the other subgroups to other outpulsers. Only one call may be served in a subgroup at one time, but different subgroups may connect at the same time to different outpulsers. When an outpulser is seized, it causes the busy relays for that outpulser that are associated with other subgroups to advance start leads away from the selected outpulser. (See also 2.21 for operation with AIC service.)

TYPES OF TRUNKS

A. Panel Office

2.09 This panel office trunk works off the district or office multiple and is arranged to recognize reversals of polarity from the tandem end. It supplies talking battery to the calling station. The district is in the cut-through position. Relays in the trunk permit the outpulser to look toward the calling customer during party test or toward tandem during outpulsing.

B. No. 1 Crossbar Office

2.10 The No. 1 crossbar office trunk is similar in basic operation to the panel office trunk. It is a 4-wire circuit and connects to the office link and connector circuit, the extra lead being used to control a relay from the marker to indicate which party on a party line is calling.

C. Step-by-Step Office

2.11 The step-by-step trunk works off a selector level and has access to the outpulser through the outpulser connector. The trunk signals the outpulser when the CAMA office is ready to receive the calling line number. The trunk informs the outpulser whether a tip or ring party is calling.

INFORMATION RECEIVED FROM TRUNK

2.12 In crossbar and step-by-step offices, the outpulser receives information from the trunk that tells the outpulser which party is calling. In step-by-step offices where special toll and attendant assistance traffic is served, the trunk also indicates to the outpulser that the calling customer dialed a one prefix or whether a zero prefix or zero only was dialed; the outpulser uses this information to determine which of two possible start pulses it must outpulse toward CAMA or TSPS. In addition, when combined coin and noncoin trunks are provided the trunk signals whether coin or noncoin and the outpulser then must choose which of four possible start pulses to outpulse. In step-by-step offices, the trunk also:

(a) Indicates whether the call is coin or noncoin on combined trunks.

(b) Sends ground removal failure signals to the outpulser.

In panel offices, the outpulser receives one of three possible signals instructing it to make a party test, make a ground removal test, or omit party test. Signals for AIC trunks are somewhat different, as described in 2.21.

OPERATION WITH IDENTIFIER

2.13 Outpulsers seize identifiers to obtain the calling line number. Each outpulser bids for preference in seizing one of the two identifiers. Having obtained preference, the identifier seized will depend upon the position of a W-Z relay combination that alternates the choice of identifiers between successive calls. Cut-in relays associated with each outpulser and each identifier close through leads needed for number registration and other functions.

2.14 The identifier obtains the calling office and directory number by looking for a tone on the four outputs of the secondary network circuit. The particular four outputs on which the tone appears determines the directory number. The particular secondary network unit in which the tones are found determines the calling office. The office and directory number is registered in the identifier on fast-operate reed relays; this information is passed to the outpulsers on a 2-out-of-5 basis where registration is checked on the same basis by check relays associated with the digit register relays. There is a check relay associated with the office relays and a check relay associated with each digit group. The check relays indicate the results of the identification, and are always consulted before the identified number is outpulsed.

OUTPULSING

2.15 The MF signaling is used for outpulsing. The frequencies are generated by transistor oscillators unique to each outpulser, or by a common MF supply. A steering circuit is used to control each digit pulsed out. In general, ten digits are sent out. They are: keypulse signal, an information digit, calling office (three digits), followed by a 4-digit station number, and a start digit. If an attendant is to be called in, a keypulse signal and an information digit will be outpulsed; a start pulse may or may not be sent, depending on the options furnished. The information digit always conveys one of six possible items of information that tells the tandem sender whether the calling number has been identified automatically or whether an attendant is needed to obtain the number from the calling customer. The information digit also tells the tandem end whether the call was picked up at the originating office by a service observing attendant. If so, the call is then recorded on the AMA tape as a service observed call.

OPERATION WITH TROUBLE TICKETER

2.16 Trouble records are recorded on a ticket printed by a 1A message ticketer. One trouble ticketer is furnished per building and is accessible to each outpulser. The ticketer is designed to print a total of 40 characters on paper fed from a reel. The paper is cut automatically after a predetermined number of characters have been printed. The characters that can be recorded are 0 to 9, a star (asterisk), and a dash. The machine prints at a rate of six characters per second. Register relays in the ticketer circuit record whatever information is to be printed, after which the outpulser is released. The outpulser and other common control circuits are then free to serve other calls while the ticket is being printed. Outpulsers that find the ticketer busy will be released at once, but a display lost lamp will light to indicate the outpulser that attempted to record a trouble.

TESTING, LINE VERIFICATION, AND PERMANENT SIGNALS

2.17 Testing means are provided to assist in locating trouble and to detect the approach of operational failures by the application of marginal tests. Direct access to each trunk is obtained from the test frame. Overall operation of the system may be checked with any desired combination of trunk, identifier, outpulser, and line network.

2.18 Means are also provided in connection with service order work to verify that correct identification is obtained on new and changed line numbers.

2.19 Lines that encounter a permanent signal condition can be identified, and the line number is printed on a trouble ticket.

AUTOMATIC IDENTIFIED OUTWARD DIALING (AIOD) FROM PBX STATIONS

2.20 The ANI calls originated from PBX stations are normally identified by a billing number associated with the PBX. This billing number is transmitted to a CAMA office where it is recorded for billing purposes. Thus, all calls originated by stations of the PBX and completed over trunks to the central office that are cross-connected in the ANI primary network to the billing number network are billed to the same number. However, where Automatic Identified Outward Dialing (AIOD) is provided, each station of the PBX is identified by a distinct number by means of the ANI and AIOD equipment. The ANI equipment first identifies the PBX trunk over which the PBX station is placing the call. This trunk number is then passed by the outpulser to the AIOD equipment, which returns an AIOD office index and the 4-digit station number of the station using the PBX at that moment. The outpulser converts the

office index to a 3-digit office code and outpulses the office code and the station number, together with the information digit and start pulse, to the CAMA office.

OPERATION WITH AN AUTOMATIC INTERCEPT CENTER

2.21 When automatic intercept service is provided, a call completed to an intercepted line will be directed to an outgoing trunk to the AIC in panel and step-by-step offices. The outgoing trunk, upon signal from the AIC, will bid for an ANI outpulser. The outgoing trunk is assigned to a particular trunk group in the outpulser connector. This connector trunk group will ground lead INT to indicate to the outpulser that an intercepted line is to be identified. The outgoing trunk passes to the outpulser information about the type of intercept line, ie, regular, blank number, or trouble intercept. The line is identified and the outpulser then MF outpulses a digit to the AIC to identify the type of intercept and the intercepted line number. This information is used by the AIC to give the calling customer the proper information relative to the intercepted line.

OPERATION WITH CALLING LINE IDENTIFICATION

2.22 Calling Line Identification (CLI) equipment is provided where identification of a calling customer is required on calls terminated to particular lines. When a call is originated to a CLI-equipped customer line, an interoffice alerting network functions to activate scanner circuits in the originating office. The scanner circuits function to locate the originating supervisory circuit involved; lock up the originating connection; and determine, by means of the tone and supervisory signals received from the terminating equipment, whether a CLI is to be made via the ANI facilities. The scanner circuit obtains access to the ANI circuits via the auxiliary circuit ANI type B for CLI. The auxiliary circuit has an appearance in the outpulser connector circuit in the trunk group which serves permanent signal and line verification trunks. It bids for connection to an outpulser, recognizes outpulser seizure, and presents CLI class information which causes the outpulser to function as on a regular service call except that the identification information is not outpulsed but is passed to the trouble ticketer for printing of a CLI ticket. A major alarm is brought in when the trouble ticketer is seized for printing a CLI ticket. If a trouble is encountered in the identification process or a multiparty line is involved, or if the trouble ticketer is not available, a trouble indication is given to the CLI equipment as a signal to hold the originating connection for manual trace.

SECTION II - DETAILED DESCRIPTION

1. SEIZURE OF OUTPULSER - SC1

OUTPULSER CONNECTOR - FS1

1.01 When the trunk closes battery on a start lead to the outpulser connector circuit, the trunk preference TP-- relay in the connector circuit operates. The relay TP-- operates the outpulser preference OP-- relay for the preferred available outpulser. The operation of TP-- and OP-- relays grounds the start lead to the outpulser, operating relay ST. Relay ST starts the work timing and the overall timing in the outpulser, and also grounds the OPB- lead to the outpulser connector. Ground on the OPB- lead operates the BY- relays in the connector for the outpulser that was seized. The BY- relays operate the busy OB- relays for the corresponding outpulser in each trunk subgroup, except the subgroup being served by the outpulser. That OB- relay is short-circuited by a ground over the OBG lead from the outpulser circuit.

OUTPULSER OFF-NORMAL AND TRUNK CUT-IN - FS1

1.02 When the OP-- relay in the outpulser connector operates, the chains through the back contacts of the OP-- relays are opened, releasing relays CH1 and CH2 in the outpulser circuit. Relay CH1 is a slow-release relay used to prevent the outpulser from going off-normal until the outpulser connector preference relays have stabilized.

1.03 When both relays CH1 and CH2 have released, relays ON and ON1 operate and lock. Relay ON operates the Trunk Cut-In (TKCI) relay to close leads from the trunk to register trunk information on relays I1, I2, I3, and I4.

INFORMATION FROM TRUNK - FS5

1.04 The trunk, now being connected to the outpulser, furnishes information that the outpulser needs with respect to the party that is calling. When the outpulser later seizes the identifier, it instructs that circuit whether to test for the calling number in the tip bus field or in the ring bus field. If the trunk is a crossbar or step-by-step circuit, it has a record of the party identity of the calling station. The trunk passes this information to the outpulser by operating relay I1, if the identifier circuit is to check the ring bus field for the calling line number, and relay I2 if the identifier is to check the tip bus field.

1.05 If the trunk serves a panel office, it will not know the party identity. Panel trunks therefore tell the outpulser to make a test to determine the calling party or, if there are no party lines in the office, the trunk tells the outpulser to omit party test. If party test is required, relay I3 will operate. If party test is to be omitted, I1 will operate (same signal as used for ring party in a crossbar or step-by-step office).

1.06 One other signal is needed from panel trunks, namely, a signal to make a ground removal test. This test is made only in panel offices and only on calls from stations that have been identified as tip party stations. The outpulser is called in to make this test after conversation ends. Relay I4 operates when a ground removal test is ordered.

1.07 If the trunk serves a step-by-step office where party test is made by the ANI trunk and if a ground removal failure is recorded by the trunk, two additional signals are required from the ANI trunk to the outpulser circuit. These two signals are needed so that the line which indicated the ground removal failure can be identified and the line directory number can be recorded on a trouble ticket.

1.08 One signal is for a ground removal failure on a tip party of a 2-party message rate line in order that the identifier can be primed to check the ring bus field to identify the line number. (In step-by-step offices, 2-party message rate lines have each of the parties in the ring bus field for automatic identification.)

1.09 The other signal is for a ground removal failure on a tip party of a 2-party flat rate line order to prime the identifier to check the tip bus field to identify the line number.

1.10 The trunk passes information to the outpulser over the T, R, AB, and TPT leads. This information is registered in the outpulser on the I- relays as listed in Table A.

TABLE A

Office	Ground On Lead	Relay Operated	Information From Trunk To Outpulser
Crossbar	R	I1	Ring party identified by customer sender.
	T	I2	Tip party identified by customer sender.
Panel	R	I1	Omit party test. (All parties ring parties.)
	AB	I3	Outpulser to make party test.
	TPT	I4	Outpulser to make ground removal test.
Step-by-Step (without App Fig. 14 and 21; See 1.11, 1.12, 1.13, and 1.14)	R	I1	Ring party identified by ANI trunk or message rate line.
	T	I2	Tip party of flat rate line identified by ANI trunk.
	AB	I3	Ground removal failure - 2-party, message rate line.
	TPT	I4	Ground removal failure - 2-party, flat rate line.

INFORMATION FROM STEP-BY-STEP TRUNKS WHEN APP FIG. 14 IS FURNISHED

1.11 Where operation with step-by-step special toll (0+) or attendant assistance (0) trunks is required, App Fig. 14 is furnished in place of option ZD. With App Fig. 14, the outpulser is arranged to detect either a battery or a ground signal on the T and R leads from the trunk. Either signal on the R lead indicates a ring party call, and either signal on the T lead indicates a tip party call. However, a battery signal on either lead indicates that the calling customer dialed a zero (0) or a zero prefix (0+) to reach the trunk; this signal is not required for identification, but causes the outpulser to send a distinctive start pulse (referred to as the start prime pulse) to the CAMA office at the time of outpulsing. A ground signal on the R lead indicates a station-to-station call originated by a ring party or individual station, including a coin box station when the customer dialed a one prefix (1+); a ground signal on the T lead indicates a station-to-station call originated by a tip party. On station-to-station calls, the start pulse outpulsed is the standard signal.

1.12 To detect battery or ground on lead R, relays I1A and the I1B are connected to the R lead in place of relay I1. Relay I1A in series with diode I1A and -24 volts operates to ground on the R lead; relay I1B in series with diode I1B and -24 volts operates to battery on lead R. The -24 volts is derived from the voltage divider consisting of resistors I1A and I1B. Relay I1A or I1B operated operates relay I1 to cause the outpulser to proceed with the trunk information check.

1.13 A battery and ground detecting circuit, similar to that described for the R lead, is connected to the T lead in place of relay I2. Its operation is similar to that described for the R lead. With App Fig. 14, Table A is expanded as shown in Table B.

TABLE B

Lead	Potential On Lead	Relay Operated	Information From Trunk
R	BAT	I1B	Ring party - special toll (0+) or dial assistance (0) call.
	GRD	I1A	Ring party - station (1+) call.
T	BAT	I2B	Tip party - special toll (0+) or dial assistance (0) call.
	GRD	I2A	Tip party - station (1+) call.

As described in Table B, I1A or I1B operated, operates relay I1, and relay I2A or I2B operated, operates relay I2.

INFORMATION FROM STEP-BY-STEP COMBINED TRUNKS WHEN APP FIG. 21 IS FURNISHED

1.14 For operation with combined trunks, App Fig. 21 is provided in addition to App Fig. 14. Combined trunks additionally differentiate between coin and noncoin calls. The two needed signals from the combined trunks are obtained by expanding signals on leads AB and TPT, as is done in App Fig. 14 on leads T and R and described in 1.12 and 1.13. Different than the T and R lead actions, only ground signals which operate I3A and I4A on leads AB and TPT, respectively, operate relays I3 and I4, respectively. Relay I3 or I4 operated sends information as described in 1.07, 1.08, 1.09, and in the step-by-step portion of Table A. For combined trunk operation two signals are required:

(a) Battery on lead AB or TPT per Table C.

(b) Battery or ground on lead T or R per Table B.

TABLE C

Lead	Potential On Lead	Relay Operated	Information From Trunk
AB	GRD	I3A	Ground Removal Failure - 2-PTY MR (TRS NON-OPR)
	BAT	I3B*	Coin Call (TRS NON-OPR)
TPT	GRD	I4A	Ground Removal Failure - 2-PTY FR
	BAT	I4B*	Noncoin Call

*Relay I3B or I4B operates at the same time as I1A, I1B, I2A, or I2B. The I3 or I4 does not operate.

1.15 Prior to Issue 28B, trunks per SD-32342-01 and SD-32543 were incompatible with the Fig. 21 features. These two trunks have a new feature available to them which will allow them to be modified and become compatible with an outpulser which handles the supercombined trunk, such as SD-32542-01. In addition to the new trunk features, these two trunks must be in a separate trunk group (or groups) to TSPS than any combined trunk group to TSPS. This must be done to enable the TSPS office to interpret the Start Pulse (SP) outpulsed. Coordination with the TSPS office must be made, should this arrangement be implemented, to ensure that the proper start pulses are interpreted correctly at the TSPS office on the separate trunk group to the TSPS.

INFORMATION FROM TRUNK CHECKED - FS6 - SC1

1.16 Relays I1 to I4 operate on a 1-out-of-4 basis. If two or more operate, Trouble Ticketer Start (TTST) relay operates to produce a trouble ticket.

1.17 Tip Party (TP) or Ring Party (RP) relay, when operated, locks on its secondary winding and operates Party Check (PK) relay. Without App Fig. 9 or 11, relay I1 operated, operates relay RP and relay I2 operated, operates relay TP (see 3.08 and 3.10). With App Fig. 9, relay RP or TP is operated as described in 3.12 through 3.17 and for which relay PT or GRT may operate, operating relay PIK in series (instead of relay PK). With App Fig. 11, with or without App Fig. 14 and 21, relay RP or TP operates from relay I1 or I2, respectively, operated, operating relay PK. With option ZD, relay PK or PIK operates Information Check (IK) relay, which locks and releases relay I1 or I2. With App Fig. 14, relay PK operated, operates relay STP if relay I1A or I2A is operated, or operates relay STPP, if relay I1B or I2B is operated. Relay STP operated, operates relay IK and also causes this circuit to outpulse the standard start pulse; relay STPP operated, operates relay IK and causes this circuit to outpulse a special start pulse (start prime pulse). With App Fig. 21 (in addition to App Fig. 11 and 14), relays ST2P and ST3P are provided. Relay ST2P or ST3P operated operates relay IK, and causes the outpulsing of start two prime or start three prime pulse, respectively. With relays STP and STPP only App Fig. 11 and 14, the standard start pulse is sent with STP operated on 1+ calls and the start prime pulse is sent with STPP operated on 0 or 0+ calls, coin or noncoin according to trunk group. With App Fig. 11, 14, and 21, coin and noncoin calls are accommodated; that is, the STP and STPP signals described above are sent for coin calls; for noncoin calls, ST2P signals for 1+ calls and ST3P signals for 0 or 0+ calls. Relay IK operated closes the primary winding of relay SPL into the trunk. If lead SP is continuous, relay SPL will operate through the winding of the trunk splitting relay. The trunk relay does not operate at this time. The SPL operates relay SPL1. The SPL1 connects the low-resistance secondary winding of SPL to lead SP, operating the trunk splitting relay. The splitting relay locks and opens lead SP, releasing SPL. The SPL in releasing, checks the trunk relay for operation. The SPL in releasing, also operates Transfer (TRS) relay. The TRS disconnects the I-relays from the tip and ring leads, connecting these leads to Line (L) relay. Relay AB is connected to lead AB to check for an abandoned call.

1.18 If a cross or other trouble condition should cause both TP and RP to operate at the same time, relay TTST will operate to produce a trouble ticket. With App Fig. 11 and 14, relay TRS operates only with relay STP or STPP operated; if both relays STP and STPP operate or if neither operates, relay TRS fails to operate, causing the TM1 timer to function (see 9.03). With App Fig. 11, 14, and 21, relay TRS operates only when relay STP, STPP, ST2P, or ST3P operates; operation of none or more than one of these relays prevents relay TRS from operating, causing a time-out as described above.

INFORMATION FROM AIS TRUNKS IN PANEL AND STEP-BY-STEP OFFICES - APP FIG. 18 - SC15

1.19 Where automatic intercept service is provided in panel and step-by-step offices, App Fig. 18 is furnished. When the outpulser is seized by the AIS trunk group, relay INT is operated. Relay INT operated transfers the information leads T, R, and TPT from relays I2, I1, and I4 to relays INTB, INTA, and INTC, respectively. The trunk passes information over leads T, R, and TPT as listed in Table D. Relay INTA, INTB, or INTC operated operates relay I1 and the circuit functions as in 1.16.

TABLE D

Office	Ground On Lead	Relay Operated	Information from AIS Trunk to Outpulser
Panel or Step-by-Step	R	INTA	Regular Intercept (Changed Numbers)
	T	INTB	Blank Number Intercept (Vacated or Unassigned Numbers)
	TPT	INTC	Trouble Intercept

STEP-BY-STEP OFFICES - LOCAL DIRECTORY ASSISTANCE TRUNKS

1.20 No special features are required to arrange this circuit for the step-by-step local directory assistance trunk which is similar in operation to that of a regular ANI trunk, except that directory assistance requires connection of only one trunk per subgroup to the outpulser connector to which it can have any preference in that circuit except the first. This trunk utilizes an Access Circuit, SD-35028-01, to another 411 Information Trunk Circuit, SD-35027-01, or an Auxiliary Trunk Circuit, SD-35036-01, where the call is routed to either a TSPS No. 1 or a No. 1 ESS 411 bureau over a separate trunk group to a dedicated 411 incoming trunk. Two ANI DA trunks, SD-35029-01, will access either 50 or 200 information type trunks, SD-35027 or SD-35036 respectively. When a customer in a step-by-step office dials 411 to access the DA bureau, the TSPS or the No. 1 ESS which is interposed between the step-by-step office and the bureau will record the calling station number for billing purposes. One of the various step-by-step switching arrangements allows a distant local office, via an outgoing trunk repeater, SD-31779-01, to a tandem office, to access the DA bureau. This arrangement also permits a local office in the same tandem office to access to the same DA bureau.

2. ABANDONED CALL TEST - SC6

2.01 When relay TRS operates to transfer the T and R leads from the I relays to the relay L, negative battery on the SP lead from this circuit operates relay SP1 in the trunk circuit to switch the subscriber loop into the outpulser. If relay L operates indicating an off-hook condition, work timer TM1 is recycled and the outpulser proceeds with the call. If relay L does not operate to recycle the timer, TM1 functions and operates relays ETM1 and ETMA. The outpulser then attempts to determine if the customer has abandoned the call or if there is discontinuity in the T and R leads between the trunk and the outpulser. Relay ETM1 removes the battery from the SP lead, releasing the trunk relay SP1. When released, relay SP1 reconnects the calling line or the trunk relay A. If the customer has abandoned the call, relay A will not reoperate. The trunk off-normal relay which was held by relay SP1 will also release and ground the AB lead into the outpulser to operate relay AB abandoned. At the end of the abandoned call timing interval started by ETM1, relay RL will be operated to release the outpulser. If the trunk relay A reoperates because the customer is still on the line, the trunk off-normal relay will be held operated and relay AB will not operate; this is an indication that the failure of relay L to operate was caused by an open circuit between

the trunk and the outpulser, or by a momentary on-hook by the calling customer. Subsequent time-out of the abandoned call timer causes the outpulser to recognize a Continuity Check Failure (CCKF); subsequent action is described in 16.12 through 16.14.

3. PARTY IDENTIFICATION - SC1

GENERAL

3.01 In No. 1 crossbar offices arranged for ANI, a party identification test is made by the subscriber sender on calls made from 2-party lines. The party information is passed into the marker and then into the trunk. When the trunk is connected to the outpulser, the party information is passed into the outpulser. When the outpulser is connected to an identifier, the identifier receives this information from the outpulser so that the correct bus is used to find the calling number.

3.02 In panel offices arranged for ANI, party identification test is made by the outpulser before the identifier is seized. The outpulser determines which party on the line originated the call and transmits this information to the identifier. If the call originated from a tip party customer, a ground removal test is made after calling customer disconnect.

3.03 Apparatus Fig. 9 is provided when panel offices in the building arranged for ANI serve tip party stations.

3.04 In step-by-step offices arranged for ANI, party identification test is made by the ANI trunk circuit in the interval between the dialing of the first and second digits of the called number. The party information is registered in the trunk. When the trunk is connected to the outpulser, the party information is passed into the outpulser. When the outpulser is connected to an identifier, the identifier receives this information from the outpulser so that the correct bus is used to find the calling number.

3.05 Apparatus Fig. 11 is provided for use in the building arranged for automatic identification containing step-by-step offices. See also 1.11 through 1.18.

3.06 The distinction between parties is that the switchhook contacts of the tip party telephone set connect ground through the ringer winding to the tip lead when the receiver is off of the hook, whereas, no ground is connected at the ring party station. Party identification tests are made to check for the presence of this ground to identify a tip party calling station.

3.07 If the calling customer is a station on a multiparty (four or more parties) line, the party identification is passed to the identifier. The identifier determines that a multiparty line is involved and transmits this information to the outpulser. The outpulser releases the identifier and outpulses identification digit 1 or 4 to the distant tandem or toll office. An attendant will then be called in to identify the calling line number.

CROSSBAR OFFICE - PARTY IDENTITY

3.08 After the outpulser has gone off-normal and operated relay ON, relay TKCI operates to connect the tip and ring leads from the trunk to relays I1 and I2. Ground from the trunk over the ring lead operates relay I1, and ground over the tip lead operates relay I2. The operation of relay I1 or I2 operates relay RP or TP through its primary winding. Relay PK is closed to battery through the secondary winding of the operated relay RP or TP by a contact of relay RP or TP. The operation of relay PK closes the 1-out-of-2 check path of the information relays to operate relay IK if one and only one I- relay is operated. Relay IK locks and closes high-resistance ground to the SP lead to the trunk.

3.09 When the identifier connector relays operate, the party information is transmitted to the identifier to enable the identifier to select the correct bus for identifying the calling number.

PANEL OFFICE - NO PARTY TEST

3.10 The ANI trunk is arranged to give an omit party test indication if there are no tip party customers in the panel offices with which the trunk is associated. The omit party test signal to the outpulser is a ground on the ring lead. When relay TKC1 operates to cut the trunk through to the outpulser, this ground operates relay I1. Relay I1 operates relay RP through its primary winding. Relay PK is closed to battery through the secondary winding of the operated relay RP by a contact of relay RP. Relay PK closes the ground from relay I1 to operate relay IK. Relay IK locks and closes high-resistance ground to the SP lead to the trunk, operating relay SPL.

3.11 When the identifier connector relays operate, the ring party indication is sent to the identifier to prime the identifier to select the ring party bus for identifying the calling number.

PANEL OFFICE - PARTY TEST - SC1

3.12 If the panel offices associated with the ANI trunk serve tip party customers, the trunk is arranged to give a party test signal to the outpulser. This party test signal is ground on the AB lead to the customer. Relay I3 in the outpulser operates on trunk cut-in. The operation of relay I3 operates relay PT through its primary winding. Relay PIK is closed to battery through the secondary winding of the operated relay PT by a contact of relay PT. Relay PIK closes the ground from relay I3 to operate relay IK. Relay IK locks and closes high-resistance ground to the SP lead, operating relay SPL to battery in the trunk. Relay SPL operates relay SPL1 to close low-resistance ground to the SP lead, operating relay SP in the trunk. Relay SP in the trunk removes ground from the AB lead to release relay I3.

3.13 Relay TRS operates to place relay L across the tip and ring and also places -48 volt resistance battery on the SP lead to operate relay SP1 in the trunk.

3.14 When relay L operates over the subscriber loop, relay L1 is operated to recycle the first timing interval and to start the second timing interval. Relay L1 also operates relay PT1 which in turn holds relay L1. Relay PT1 locks and disconnects relay L from the tip and ring leads. The tip and ring leads are connected through the windings of the tip Party Test (PT2) relay to different negative battery potentials.

3.15 If the calling customer is the tip party station of a 2-party line, ground from the tip party telephone set operates relay PT2, which in turn operates relay PT1. When the TM2 work timer times out in 0.190 to 0.350 second, the operation of relay ETM2, with relay TP1 operated and relay RP1 nonoperated, operates relays TP and PK.

3.16 If the calling customer is the ring party station of a 2-party line or an individual line, ground is not present on the subscriber loop. When the TM2 work timer times out in 0.190 to 0.350 second, the operation of relay ETM2, with relays PK and TP1 nonoperated, operates relay RP1. Relay RP1 locks through a back contact of relay IYK and operates relays RP and PK.

3.17 The operation of relay PK closes the battery supply for operating relay OP. When the OP relays operate, the party information is given to the identifier to enable the identifier to select the correct bus for identification of the calling number.

PANEL OFFICE - GROUND REMOVAL TEST - SC1

3.18 When a call is identified as originating from a tip party station, the operated relays PT and TP place ground on the TPT lead to prime the trunk with the tip party information. When the calling party disconnects, the trunk signals the connector to seize an outpulser for ground removal test. The connector seizes the outpulser and after the outpulser has gone off normal, the trunk is cut through to the outpulser.

3.19 Ground on the TPT lead operates relay I4 to indicate a ground removal test. Relay GRT operates through its primary winding and a contact of relay GRT closes battery through the secondary winding of relay GRT to operate relay PIK. Relay PIK closes the ground from relay I4 to operate relay IK. Relay IK locks and closes -48 volt resistance battery to the SP lead to operate SP1 in the trunk. The slow-release relay TP in the trunk releases to remove ground from the TPT lead, releasing relay I4. Relays TRS and PT1 operate to connect the subscriber loop to the P1 winding of relay PT2 to battery through voltage divider V1 and V2 and to start the timing interval TM2.

3.20 If the ground from the tip party telephone set has been removed, relay PT2 does not operate. When the TM2 timing tube breaks down at the end of the timing interval, relay ETM2 is operated. With relays PK and TP1 nonoperated, relay RP1 operates to indicate that the ground has been removed.

3.21 If the ground from the tip party telephone set has not been removed or a false ground is present on the line, relay PT2 operates. Relay PT1 is operated to prepare a circuit for operating relay TP. When the TM2 timing tube breaks down at the end of the timing interval, relay ETM2 is operated. With relay TP1 operated and relay RP1 nonoperated, relay TP is operated to indicate a ground on the subscriber loop. With relays GRT and TP operated, relay GRF is operated to indicate a ground removal failure. The identifier is seized to identify

the calling line number and the trouble ticketer is called in to print a trouble ticket as described in 4.02.

PANEL OFFICE - INTEGRITY TEST - SC1

3.22 An integrity test of relay PT2 is applied on every call where a party test on the calling line is made by the outpulser. An operate test is applied if the call was identified as originating from a ring party station, and a current flow release test is applied if the call was identified as originating from a tip party station.

3.23 If relay RP1 is operated as a result of party test by the outpulser, the release of relay PT1, after the party test timing interval of 0.190 to 0.350 second, applies a current flow operate test on the nonoperated relay PT2. Relay PT2 operates and operates relay TP1. With relays TP1 and RP1 operated, relay IYK is operated to indicate an integrity test check of relay PT2.

3.24 If relay TP is operated as a result of party test by the outpulser, the release of relay PT1 places release test on the operated relay PT2. The release of relay PT2, with relay TP operated, operates relay IYK to indicate an integrity test check of relay PT2.

3.25 On those calls where party test is made by the outpulser, the operation of relay PT makes the operation of relay MF dependent upon the operation of relay IYK. If relay IYK does not operate, outpulsing is held up and the timing interval of TM1 will be exceeded. Relay ETM1 operates to seize the trouble ticketer to print a trouble ticket.

4. GROUND REMOVAL FAILURE - SC9

GENERAL

4.01 On calls from a tip party station of a 2-party line, a ground removal test is applied to the customer line. If a ground is found, a record of the ground removal failure is made to identify the line having the false ground.

PANEL OFFICE - APP FIG. 9

4.02 In panel offices, ground removal test is made by the outpulser circuit as described in 3.19 through 3.23. If relay GRF operates, resistance battery is closed to the OP- relay. The OP- relay operates and locks. Relays OCA to OCE and IC-A to IC-E operate to connect the outpulser to an identifier. The identifier identifies the customer line number. When the complete number is registered and checked in the outpulser circuit, relay IRL operates to release the identifier and to operate relay TTST. The operation of relay TTST places resistance battery on the TTST lead to seize the trouble ticketer circuit for recording the ground removal failure and the line number. When the information is registered and checked in the trouble ticketer, relay TTB operates to start the release of the trouble ticketer and the outpulser circuits. The trouble ticketer meanwhile prints the trouble ticket.

STEP-BY-STEP OFFICE - APP FIG. 11

4.03 In step-by-step offices, the ANI trunk applies the ground removal test. If a ground removal failure is registered, the ANI trunk seizes the outpulser to control the recording of the ground removal failure and the customer line number. If the call was from a tip party station of a 2-party message rate line, lead AB is grounded to operate relay I3. Relay I3, in turn, operates relays RP and GRFS. If the call was from a tip party station of a 2-party flat rate line, lead TPT is grounded to operate relay I4. Relay I4 operates relays TP and GRFS. With App Fig. 21 provided (see 1.14), lead AB grounded operates relay I3A, which in turn operates relay I3; and lead TPT grounded operates relay I4A, which in turn operates relay I4.

4.04 When relay TRS operates, relay GRF is operated to seize the identifier circuit for identification of the line number. When the complete number is registered and checked in the outpulser circuit, relay IRL operates to release the identifier and to operate relay TTST to seize the trouble ticketer circuit. The trouble ticketer registers the information. When relay TTB operates, the outpulser releases. Meanwhile, the trouble ticketer prints the trouble ticket.

5. IDENTIFIER SEIZURE - SC2

GENERAL

5.01 When the outpulser has ascertained that party information has been registered and checked and that the call has

not been abandoned, it selects an identifier to identify the number of the calling line. The outpulser connects to the identifier through the connector circuit and transfers the party information to the identifier.

5.02 The outpulser preference circuit consists essentially of two chains of relays, one relay in each chain in each outpulser, and a transfer circuit, provided one per group of outpulsers, to control the operation of one chain or the other. The transfer is accomplished either automatically, in case of certain trouble conditions, or manually, when this is desired for maintenance reasons.

5.03 The preference relays operate the outpulser connector relays, which in turn operate the identifier connector relays. The selection of one of the two identifiers is controlled by the setting of a W-Z relay combination, provided per each outpulser.

OPERATION OF OUTPULSER PREFERENCE RELAY

5.04 When party information is registered and checked in the outpulser, relay PK operates. The operation of relay L over the subscriber loop operates relay L1. With relay TR nonoperated, the operation of relays PK and L1 closes resistance battery of relay OP-. Relay OP- operates and locks to ground through one of its own contacts.

5.05 Assuming that an intermediate outpulser has operated its OP- relay, OP- relays in lower-numbered outpulsers cannot operate, since these are cut off by the contacts of the operated OP- relay. However, OP- relays in higher-numbered outpulsers can operate.

5.06 While the above description refers only to the OP- relays, the operation is the same if relay TR is operated and the Emergency Outpulser Preference (E-) relay chain is used.

OPERATION OF CONNECTOR RELAYS

5.07 If the OP- relays in all lower-numbered outpulsers are nonoperated, the operation of an OP- relay operates relays OCA to OCE in the outpulser. When a connected outpulser releases its OP- relay and OP- relays in higher-numbered outpulsers are operated, the next higher-numbered outpulser with an operated OP- relay will be served.

5.08 The operation of OC- relays operate relays ICA- to ICE- for the preferred identifier as determined by the preset relays W and Z. The operated IC-- relays ground the start ST lead to operate relay ON in the selected identifier.

5.09 The operation of relays OCC and ICC- in the outpulser also extends ground from either the operated relay TP or RP in the outpulser to operate relay TP or RP in the identifier. This information directs the identifier to the tip or ring bus field.

6. IDENTIFICATION OF CALLING LINE NUMBER - SC2

GENERAL

6.01 After the outpulser seizes the identifier, the identifier looks in the tip or ring party bus for the office serving the calling customer. The identifier detects the calling office and the directory number which is steered and registered in the reed relays in the identifier. Contacts on these reed relays in turn operate wire spring relays in the outpulser that check each digit on a 2-out-of-5 basis. A check relay is operated for each digit. After the office and digit check relays are operated, the outpulser sends a release signal to the identifier.

6.02 If the calling number is that of a multiparty customer, the identifier, upon identification of the office, registers a multiparty indication in the outpulser. After the registration of the multiparty indication, the outpulser sends a release signal to the identifier.

CALLING NUMBER REGISTER RELAYS

6.03 The digits of the calling number are registered on a 2-out-of-5 basis by relays TH-, H-, T-, and U- of FS15.

CALLING NUMBER REGISTER CHECK RELAYS

6.04 A check is made that the correct number of office and calling number register relays are operated. Relay OFK operates if one and only one OF- relay is operated. Check relays THK, HK, TK, and UK operate if 2-out-of-5 of each of relays $TH\overline{5}^{2}$, $H\overline{5}^{2}$, $T\overline{5}^{2}$, and $U\overline{5}^{2}$ are operated. These check relays ground the THK, HK, TK, and UK leads to operate corresponding relays in the identifier.

IDENTIFIER RELEASE

6.05 The operation of all of the check relays closes a path to operate relay IRL. If Fig. 8 is required, the path to operate relay IRL is also closed through contacts of relays OF-, OFP-, and OFT-. Relay IRL opens the ST lead to the identifier, releasing relay ON in the identifier to start identifier release.

6.06 Relay OP- or E- is released, releasing the outpulser cut-in relays to advance the outpulser preference to the next higher-numbered outpulser with an operated OP- or E- relay. The release of the outpulser cut-in relays releases the identifier cut-in relays.

OFFICE TRANSLATION

A. Physical Office Only (Fig. 8 Not Required)

6.07 If the office number, as registered on relay OF- by the identifier circuit, is for a 10,000 number series which contains physical numbers only, relay OF- connects the frequencies for the A, B, and C digits of the office code to the input side of the T transformer through relays AS, BS, and CS.

B. Physical and Theoretical Office (Fig. 8 Required)

6.08 If the office number, as registered on relay OF-, is for a 10,000 number series which contains both physical and theoretical numbers, further translation into either a physical or a theoretical indication is necessary. This translation is accomplished by means of the thousands, or thousands and hundreds, digit of the calling line.

6.09 If Fig. 13 is furnished, a maximum of three theoretical office codes may be associated with the same physical office code in a 10,000 number series. If option ZC is furnished, only one theoretical office code is associated with the same physical office code in a 10,000 number series.

6.10 Relay OFA-, associated with a particular Fig. 8, is operated by relay OF- associated with the 10,000 number series containing the physical and theoretical numbers. Relay OFA- connects either the OFP- or one of the OFT- relays to the translating network on the contacts of relays TH(0-7), H(0-7), and (1-5)TH as shown in FS22. The OF- and either the OFP- or OFT- relays then connect the frequencies for the A, B, and C digits of the office code to the input side of the T transformer through relays AS, BS, and CS. Thus, any thousand series of numbers can be translated and represented by a 3-digit office code, or different thousands series may be combined to cause the same OFP- or OFT- relay to operate to produce the same 3-digit physical or theoretical code. The maximum number of thousands series translated in each office unit is six, and the maximum number of offices per building that may have translated physical and theoretical codes is three. If Fig. 13 is furnished, all three of these theoretical codes may be contained in one 10,000 number series or one 1000 number series.

6.11 If the line numbers within a given thousands series bear different office names, the translation into physical and theoretical codes is accomplished by means of Z wiring associated with the hundreds relays.

6.12 If this circuit is used in a No. 1 crossbar office and the trouble ticketer circuit is arranged to print the LIT directory number of the office number upon an LIT test failure, translation of the A, B, C office digits may be required when both physical and theoretical office numbers are used. In this case, option YW should be provided in all the outpulsers in the identifier groups having the translated office codes. This option extends the existing translation data to the trouble ticketer on a permanent signal type call which is used to identify the line failing the LIT test. The data is transmitted by a ground signal from operated relays OFP- and OFT- through connector relay TTC9 directly to the trouble ticketer. It then translates the data into an A, B, C digit for the LIT control circuit which prints the complete directory number on a teletypewriter.

6.13 When option YW is not provided, option YV is provided and relay TTC9 and the TTC4 diode are not provided.

7. TRUNK TEST

7.01 When relay IRL operates, it releases TNK and operates the Multifrequency (MF) relay. It also grounds the AB lead to operate relay MF in the trunk. The operation of relay MF in the trunk transfers the tip and ring leads from the customer loop out to the tandem office. Relay MF in the outpulser places the T transformer and the Trunk Test (TT) relay across the tip and ring leads. If the tip and ring out to the tandem office is continuous, battery on the tip and ground on the ring operates relay TT to indicate completion of trunk test.

8. OUTPULSING - SC2

GENERAL

8.01 When trunk test is completed, the outpulser is ready to start outpulsing. The time of application of the MF frequencies to the tip and ring leads, and consequently, the speed of pulsing is under control of a pulse generator FS21. The frequencies are connected to the input side of the T transformer by the contacts of the outpulse steering relays under control of the pulse generator. One frequency is connected to the tip and the other to the ring, therefore, one frequency lead serves as a return path for the other frequency. At the end of outpulsing, the outpulser is released.

A. Number of Digits Outpulsed

8.02 If the calling number has been successfully identified, the number of digits outpulsed is ten (consider the KP signal as a digit); however, if trouble was encountered or if the calling line was identified as a multiparty line, then two digits (or three digits with App Fig. 14) are outpulsed (see SC3 for attendant identification on multiparty lines). The number of digits to be outpulsed [ten or two (or three with App Fig. 14)] is determined by the information digit.

B. Information Digit - Nonintercept Call

8.03 The information digit, outpulsed immediately after the KP signal, informs the tandem equipment whether the calling number has been automatically identified, the calling number is to be attendant identified, or if trouble has been encountered in automatically identifying the calling number. It also indicates whether or not the calling line is being observed. Table E lists the information digits and their indications.

TABLE E

	Information Nonobserved	Digit Service Observed
Automatic Identification	0	3
Attendant Identification	1	4
Trouble in Identification	2	5

C. Information Digit - Intercept Call - SC15

8.04 On intercept calls the information digit, outpulsed immediately after the KP signal, informs the AIC of the type of line intercept that is made. Table F lists the information digit indications.

TABLE F

Information Digit	Type of Intercept
0	Blank Number Intercept
1	Trouble Intercept
2	Identification Trouble
3	Regular Intercept

PULSE GENERATOR

8.05 The pulse generator consists of relays PG and PG1 and the associated capacitors and resistors. The PG is a mercury contact relay with two windings. This relay has a single armature spring which closes with two separate back contacts and with two separate front contacts. The actual contact is made

through a film of mercury; consequently, there should be no contact erosion. In this circuit the two front contacts are used in parallel and the back contacts are not used. This relay is polarized so that it can be controlled by current direction and it is not biased, so that with no current following the armature takes no definite position; that is, it may close with the front contacts or it may close with the back contacts. The current reversals are under control of the auxiliary relay PG1 and in turn is under control of PG, thus completing the self-interrupter circuit.

8.06 When ON operates, it connects ground through a normal contact of SP to one side of the PG capacitor which is in series with the primary winding and to the PG1 resistor, thus grounding out the battery and connecting ground to the -6 terminal of the secondary winding. At this time, the 7 terminal (+ for the secondary winding and - for the primary winding) is connected to resistance battery. The current in the secondary winding is in a direction to release PG, but the current in the primary winding charging the PG capacitor is in a direction to operate PG. Initially, the primary ampere turns are more powerful and the relay operates, but as the capacitors become charged, the primary winding ampere turns decrease and finally the secondary winding ampere turns become controlling to cause PG to release. The circuit remains in this condition until SP is operated. The SP in operating disconnects the ground from the PG capacitor and from the PG1 resistor, allowing the PG1 resistor battery to become effective and connects ground to the 7 terminal through PG1 normal contacts. This causes the current in the secondary winding to flow in a direction to cause operation of the relay and sets up a circuit for discharging and charging the PG capacitor in the opposite direction through the primary winding. At first, the primary winding ampere turns are controlling and the PG remains unoperated. Then, as the capacitor becomes charged, the primary ampere turns decrease and the secondary winding again takes control, causing PG to operate. The PG in operating with SP operated, operates PG1 to again reverse the circuits through both windings, causing PG to release after a timed interval. This cycle is repeated as long as PG1 remains under control of PG. When it is desired to stop the interrupter, an auxiliary circuit to PG1 is closed, thus preventing release of PG1 and stopping the interrupter.

8.07 The time PG remains on its back and on its front contacts is controlled by the values of the capacitor and resistors. On this circuit two sets of constants are provided. With KP operated, additional resistance is inserted in the secondary winding circuit to reduce the ampere turns of this winding and thus increase the intervals. With KP normal, the interrupter is designed to give a speed of approximately 7.2 pulses per second.

8.08 Facilities are provided for adjusting and controlling the output of the interrupter for the digit pulsing condition with KP normal by removing or adding resistance in the network.

ASSIGNMENT OF FREQUENCIES

8.09 The multifrequency signals are brought to the contacts of the translating relays on a lead per frequency basis. Six frequencies in steps of 200 hertz from 700 to 1700 hertz are used. The first five are assigned on a 2-out-of-5 basis to the digits 0 to 9, and the sixth is used in combination with others of the first five for the final digit, the start signal. These frequencies are assigned designations 0, 1, 2, 4, 7, and 10 so as to fit in with standard additive 2-out-of-5 code. The frequencies and their assignments are listed in Table G.

OUTPULSE STEERING

8.10 The generated frequencies are connected to the input side of the T transformer by the contacts of the outpulse steering relays under control of relays SP and PG1. One of the two frequencies transmitted is connected to one side of the T transformer and the other frequency is connected to the other side of the transformer; therefore, one frequency lead serves as a return path for the other frequency.

TABLE G

Digit	Frequency					
	700	900	1100	1300	1500	1700
	Designation					
	0	1	2	4	7	10
0				X	X	
1	X	X				
2	X		X			
3		X	X			
4	X			X		
5		X		X		
6			X	X		
7	X				X	
8		X			X	
9			X		X	
Keypulse			X			X
Start Pulse (ST)					X	X
Start Prime Pulse (STP)		X				X
Start Two Prime Pulse (ST2P)				X		X
Start Three Prime Pulse (ST3P)	X					X

8.11 The Keypulse (KP) relay is operated by the operation of relay MF when the identifier is released. The Start Pulsing (SP) relay operates upon completion of trunk test to operate the Information Digit Steering (IDS). With relays KP and SP operated, frequencies 2 and 10 are connected to the T transformer for transmission over the tip and ring leads to the tandem office. Relay PG1 operates after a timed interval, disconnecting these frequencies from the T transformer and releasing relay KP. After a timed interval, relay PG1 releases to connect the frequencies for the information digit to the T transformer for transmission to the tandem office. The release of relay PG1, with relays IDS and IDO operated and relay KP nonoperated, operates A digit Steering (AS) relay. The release of relay PG1, with relay IDS and either ID1 or ID2 operated and relay KP nonoperated, operates End of Pulsing (EP) relay to indicate an attendant identified call.

8.12 Assuming an automatically identified call relay IDO operated, after a timed interval relay PG1 again operates to terminate transmission of the information digit frequencies and to release relay IDS. When relay PG1 again releases, the frequencies for the A digit are transmitted and the B Digit Steering (BS) relay is operated. This process is continued with a combination of two frequencies being transmitted to the tandem office each time relay PG1 releases. The operation of the appropriate steering relay connects the frequencies for the office code, directory number of the calling line, and start pulse to the input side of the T transformer for the transmission to the distant office. When App Fig. 14 is furnished, the start pulse outpulsed depends on the trunk information registered earlier in the call. If relay STP is operated, the standard ST is sent; if relay STPP is operated, the STP is sent. Additionally, when App Fig. 21 is furnished, with relay ST2P operated, the ST2P is sent, and with relay ST3P operated, the ST3P is sent. With App Fig. 14 only:

(a) ST signifies 1+ calls.

(b) STP signifies 0 or 0+ calls.

With App Fig. 14 and 21:

(c) ST signifies 1+ calls from coin lines.

(d) STP signifies 0 or 0+ calls from coin lines.

(e) ST2P signifies 1+ calls from noncoin lines.

(f) ST3P signifies 0 or 0+ calls from noncoin lines.

It is to be noted that with App Fig. 14 and 21, calls from coin and noncoin lines can be handled over a single trunk group; whereas, with App Fig. 14 only, two separate trunk groups are required.

OUTPULSER RELEASE - SC4

8.13 With relay IDO operated, the release of relay PG1 to transmit the frequencies for the start digit operates relay EP to indicate pulsing of the last digit. The operation of relay PG1, at the end of the transmission of the start digit, releases Start Steering (STS) relay. The release of relay PG1 operates relay RL.

8.14 With either relay ID1 or ID2 operated and option ZD provided, the release of relay PG1 to transmit the frequencies for the information digit operates relay EP. The operation of relay PG1 at the end of transmission of the information digit releases relay IDS. The release of relay PG1 operates relay RL. With either ID1 or ID2 operated and App Fig. 14 furnished, a start pulse or a start prime pulse is outpulsed as on automatically identified calls.

8.15 The operation of relay RL opens the OBG lead to remove the short circuit from relay OB- in the connector circuit. Relay RL also releases relays ON, ON1, and TKCI to disconnect the trunk from the outpulser. The operation of OB- relay releases relay OP- in the connector to withdraw the start signal from the outpulser and to release relay ST. The outpulser releases and restores to normal as shown in sequence chart SC4.

9. OUTPULSER TIMING CIRCUITS

GENERAL

9.01 Four tube timing circuits are provided to time the various functions of the outpulser. Overall timing, effective from seizure to release of the outpulser, is provided by the TAL tube timer. Work timing intervals are provided by tube timer TM1 to time the various functions of the outpulser. To hold the timing intervals to periods of short duration, the timer is recycled during progress of the call. The work timer intervals are always the controlling intervals whenever they apply. There are also separate timers for party test and abandoned call TM2 and trouble ticketer TTT.

OVERALL TIMING - TAL

9.02 The TAL tube timing interval is for 7 seconds to 11 seconds. Relay TAL is operated when relay ST is operated or when relay CH1 or CH2 is released by the connector circuit. When relay TAL operates, it removes the TAL3 resistor from its shunting path around the TAL capacitor, and it connects the secondary winding of relay TAL1 to the capacitor and to terminal 4 of the TAL tube. Terminal 2 of the TAL tube is connected to the +130 volt battery. Capacitor TAL starts charging through the TAL1 resistor and the secondary winding of relay TAL1. Relay TAL is not released by normal outpulser disconnect, the charging action continues until the voltage across the TAL capacitor is sufficiently high to fire the tube across terminals 1 and 4. When the tube fires, relay TAL1 operates and locks through its primary winding to relay TAL. The trouble ticketer is called in to take a trouble record. Relay TAL2 is operated and locked to lead AR. Relay TAL2 lights the TA lamp.

WORK TIMING - TM1

9.03 Timer TM1 times the progress of the call from the time the connector starts for an outpulser (relay CH2 released by connector relay operated) until the outpulser releases. Two separate timing intervals are provided. One interval is 0.3 minimum and 0.5 maximum. These times are obtained when both outpulser relays L1 and SP are nonoperated. The other is 1.8 seconds minimum and 3.0 seconds maximum. This time is obtained with either L1 or SP operated. In addition, timer TM1 is recycled at intervals as shown on the sequence charts. If times

BSP TESTS

TIMEING CKTS

1 - E

2 - C - ?

3 - D

4 -

provided by timer 1 are exceeded, the trouble ticketer is seized for a record of the calls progress. The trouble ticketer provides for a central office alarm.

PARTY TEST AND ABANDONED CALL TIMER - TM2

9.04 Timer TM2 provided a measured time interval of 0.190 to 0.350 second with relay PT1 operated, and a longer interval of 0.4 to 0.650 second when PT1 is not operated. The shorter interval is used to measure the time allowed to make a party test or a ground removal test.

9.05 The longer time is used when relay L is connected to the subscriber loop before identification to check for an abandoned call. The timing interval is sufficient to allow slow-release relays in the trunk to restore if the call is abandoned. The outpulser releases on such abandoned calls but outpulses a failure signal if the call is not abandoned but relay L failed to operate.

TROUBLE TICKETER TIMING (TTT)

9.06 Timer TTT times for 0.550 second to 0.750 second to allow sufficient time for the trouble ticketer to be seized, to register all information to be printed, and to receive a releasing signal back from the ticketer circuit. It thus guards the outpulser against delays in service if the ticketer cannot be seized or the release signal cannot be returned to the outpulser. If the ticketer is busy printing a previous entry or plugged busy, the releasing signal is returned at once.

10. PERMANENT SIGNAL - SC8

GENERAL

10.01 In crossbar No. 1 and panel offices, and in step-by-step offices with TOUCH-TONE® calling or common control, the ANI equipment can be used to identify the directory number of a line in a permanent signal condition. The maintenance employee inserts the permanent signal cord into a permanent signal jack to cause the permanent signal identification circuit to seize the ANI circuits for the printing of the directory number of the line on a permanent signal record, produced by the trouble ticketer circuit.

10.02 Where the outpulser is arranged for operation with calling line identification equipment CL1, App Fig. 19 is provided in place of option ZP. Relays PSA and PSB and associated circuitry are connected to the PS lead and act as a battery and ground detector which causes the operation of a relay PSI on a permanent signal identification or the operation of a CLI relay on a calling line identification.

OUTPULSER SEIZURE

10.03 When the permanent signal identification circuit is seized, battery is placed on the start lead to the outpulser connector to operate the Permanent Signal (PS) preference relay. Relay OP-- for the preferred available outpulser is operated to seize the outpulser circuit.

OPTION ZP

10.04 The R and PS leads are grounded by the permanent signal identification circuit operating relay RC. When the permanent signal identification circuit is cut into the outpulser circuit, relays I1 and PS operate to prime the outpulser for a permanent signal call. Relay TRS operates to transfer the leads from the I- relays and to operate relay L on its primary winding. Relay L recycles the work timer and operates relay L1.

OPTION 19

10.05 The R and PS leads are grounded by the permanent signal identification circuit. Relay PSA operates from ground on the PS lead in series with diode PSA to -24 volts which is present at the midpoint of the PS resistor. Relay PSA operates relay RC which locks. When the permanent signal identification circuit is cut into the outpulser circuit, relays I1 and PS operate to prime the outpulser for a permanent signal call. A circuit is closed through operated contacts of relays PS, PSA, and RC to operate relay PSI which locks and opens the operating circuit of relay PSA, permitting its release. Relay TRS operates to transfer the leads from the I- relays and to operate relay L on its primary winding. Relay L recycles the work timer and operates relay L1.

IDENTIFICATION

10.06 The operation of relay L1 closes resistance battery to the outpulser preference chain to operate an OP or E-relay for identifier seizure. The identifier connector relays OC(A-E) and IC(A-E), operate to ground the start lead to the selected identifier circuit. Relay RP in the identifier is operated to direct the identifier to the ring bus field to identify the line connected to the permanent signal holding trunk. When relay TNK operates to indicate a tone check received by the outpulser, relay PSK operates.

10.07 If the line is connected in the ring bus field, the line directory number is registered and checked in the outpulser. The operation of any digit check relay releases relay PSK.

10.08 If no digits of the line directory number are found in the ring bus field, relay PSK remains operated. After two attempts to identify the line directory number, the identifier grounds the WC lead to operate the lTR and then relays IF in the outpulser. Relay TTB is operated to release the identifier and reset the W-Z relay combination to seize the other identifier for the second trial. The operation of relay IF1 releases relay TTB and, with relay PSK still operated, operates relay PST. The second identifier is seized and directed to the tip bus field by the operated relay PST. The identifier then looks in the tip bus field for the line directory number.

PERMANENT SIGNAL RECORD

10.09 When the office number and all of the digits of the line directory number have been registered and checked in the outpulser, relay IRL operates to release the identifier circuit. Relay IRL operates relay IRLA to seize the trouble ticketer for the printing of the permanent signal record. The trouble ticketer connector relays are operated to close through the information leads.

10.10 The permanent signal record is a 35-line ticket containing the following information:

(a) a permanent signal record indication

(b) the outpulser number

(c) the identifier group number

(d) the office number

(e) the line directory number

(f) multiparty indication

(g) the time of day

10.11 The operation of the trouble ticketer connector relays also grounds the AB lead to the permanent signal identification circuit to operate the TPD which lights the TPD lamp. A lighted TPD lamp indicates that a permanent signal record is being printed.

RELEASE

10.12 When the information for the permanent signal record has been registered, and checked in the trouble ticketer circuit, relay TTB operates, operating relay RL to release the outpulser.

10.13 The permanent signal identification circuit is released by removing the PS cord from the PS jack.

11. CALLING LINE IDENTIFICATION - SC16 - OPTION 19, RATED MFR DISC.

GENERAL

11.01 Where operation with Calling Line Identification (CLI) equipment is required, App Fig. 19 is furnished in place of option ZP. On calls originated to CLI-equipped customer lines, a CLI scanner circuit finds the originating supervisory circuit involved in the connection, locks up the connection to the calling customer, and determines by means of tone and supervisory signals received from the terminating equipment whether a calling line identification is to be made via the ANI facilities. The scanner circuit obtains access to the ANI circuits via the auxiliary circuit, ANI type B for CLI, for identification and ticketing of the calling line directory number.

OUTPULSER SEIZURE

11.02 The auxiliary circuit, ANI type B for CLI, bids for connection to an outpulser by operating the calling line identification preference relay CLI, in the outpulser connector. Relay OP-- for the

preferred available outpulser is operated to seize the outpulser circuit. The outpulser receives the same information via the outpulser connector on a calling line identification as on a permanent signal identification, except that battery instead of ground is connected to the PS lead. Relays PSA and PSB and associated circuitry are connected to the PS lead and act as a battery and ground detector which causes the operation of relay CLI on a calling line identification or relay PSI on a permanent signal identification.

11.03 Ground is connected to the R lead and battery is connected to the PS lead by the auxiliary circuit, ANI type B for CLI. Relay PSB operates from -48 volt battery on the PS lead in series with diode PSB to -24 volts which is present at the midpoint of the PS resistor. Relay PSB operates relay RC, which locks. When the auxiliary circuit is cut into the outpulser circuit, relays I1 and PS operate to prime the outpulser for operation as on a permanent signal identification. A circuit is closed through operated contacts of relays PS, PSB, and RC to operate relay CLI which locks and opens the operating circuit of relay PSB, permitting its release. Relay CLI operated also transfers the PS lead from relay PSB winding to the winding of relay TRT. Relay TRS operates to transfer the leads from the I-relays and to operate relay L on its primary winding. Relay L recycles the work timer and operates relay L1. Relay TRS operated also connects negative battery to the SP lead to operate the Outpulser Hold (OPH) relay, in the auxiliary circuit, ANI type B for CLI. If relay TRT in the auxiliary circuit is operated at this time, ground is connected to the PS lead to operate relay TRT of the outpulser. Relay TRT operated provides an indication to the trouble ticketer that a trace-tone signal has been received from the called customer.

IDENTIFICATION

11.04 The identification functions are exactly the same as described for permanent signal identification.

CALLING LINE RECORD

11.05 When the office number and all of the digits of the line directory number have been registered and checked in the outpulser, relay IRL operates to release the identifier circuit. Relay IRL operates relay IRLA to seize the trouble ticketer for the printing of the calling line record. The trouble ticketer connector relays are operated to close through the information leads. Relay TTC7 grounds the CLI lead to the miscellaneous circuit for the trouble ticketer to cause the operation of a major alarm.

11.06 The calling line record is a 35-line ticket containing the following information:

(a) a calling line identification indication

(b) the outpulser number

(c) the identifier group number

(d) the office number

(e) the line directory number

(f) multiparty indication

(g) trace-tone indication

(h) the time of day

11.07 The operation of the trouble ticketer connector relays also grounds the AB lead to the auxiliary circuit, ANI type B for CLI to operate relay TPD which indicates to the CLI equipment that a record of the calling line identity is being printed. The CLI equipment then removes its start indication to the auxiliary circuit.

RELEASE

11.08 When the information for the calling line identification record has been registered and checked in the trouble ticketer circuit, relay TTB operates operating relay RL to release the outpulser. The outpulser removes ground from the SP lead to release relay OPH of the auxiliary circuit, ANI type B for CLI, permitting it to restore to normal.

CALLING LINE IDENTIFICATION TROUBLE

11.09 If a trouble is encountered in the identification process or the trouble ticketer is busy or if relay PTY is operated by the identifier indicating that a multiparty line is involved in the connection, relay FMT is operated to open the holding circuit for relay OPH of the auxiliary circuit, ANI type B for CLI. The premature release of relay OPH causes a trouble indication to be given to the CLI equipment as a signal to hold the originating connection for a manual trace.

TEST OF CALLING LINE IDENTIFICATION FEATURE

11.10 The outpulser identifier test circuit is arranged to test the ability of the outpulser to recognize seizure by an auxiliary circuit, ANI type B for CLI and its ability to return a trouble indication to the CLI equipment when a failure in the identification process occurs forcing a manual trace of the calling line identity. To test the CLI feature, a CLI key is operated at the OIT frame to simulate conditions for seizure by the auxiliary circuit. A TRT key is operated to simulate a trace-tone indication from the auxiliary circuit. An outpulser test is originated at the OIT frame in the usual manner. Relay OT9 operates in parallel with the outpulser test connector relays and closes through the leads for the CLI test. Resistance battery on the PSB lead operates relay PSB of the battery ground detector. Relay PSB operates relay RC and closes ground to operate relay CLIT to resistance battery in the test frame. Relays PSB, RC, and CLIT operated operate relay CLI which releases relay PSB and grounds the CLI lead to light a CLI lamp at the test frame. If the TRT key is operated, relay TRT operates lighting a TRT lamp at the test frame. If a trouble is encountered in the identification process or a multiparty indication is received from the identifier, relay FMT is operated. This causes the lighting of an FMT lamp at the test frame to indicate an identification failure.

12. LINE VERIFICATION - SC7

GENERAL

12.01 The ANI facilities can be used to verify the connection of the customer line into the ANI bus network. This verification is performed to check that the number identified by the ANI equipment is the same as the directory number of the customer line, so that the customer is correctly charged for all automatically identified calls. When the customer directory number has been identified by the ANI equipment, the identified number is displayed for approximately 30 seconds on a numerical indicator lamp display.

OUTPULSER SEIZURE - FS34

12.02 When the line verification connector and display circuit No. 1 crossbar, panel or the line verification circuit, step-by-step closes battery on a start lead to the outpulser connector circuit, the Line Verification (LV) preference relay operates. Relay LV operates an OP relay to seize the preferred available outpulser circuit. Ground on the PS and the TST leads operate relay RC to open leads to various plant and traffic registers. When relay TKCI operates, the grounds on leads TST and PS operate relays TST and PS to indicate a line verification. The R or T lead is also grounded to operate relay I1 or I2, indicating a verification of either a ring party or a tip party customer number. Relay PS operates to prevent the identifier relay TST from operating on a line verification.

12.03 Relay TRS operates to transfer the leads from the I- relays and to operate relay L on its primary winding. Relay L recycles the work timer and operates relay L1.

IDENTIFICATION

12.04 The operation of relay L1 closes resistance battery to the outpulser preference chain to operate an OP- or E-relay for identifier seizure. Relays OC(A-E) and IC(A-E) identifier connector operate to cut through a multiplicity of leads between the outpulser and the identifier and to ground the start lead to the selected identifier circuit. Relay RP or TP in the identifier is operated to direct the identifier to the proper bus field for the verification of the customer line. When option YK is provided for use with identifier SD-95810-01, the LT lead to the identifier is also grounded to prime the identifier for a light traffic condition. The light traffic condition forces the identifier to scan all of the offices to check that the identification signal appears in only one office.

12.05 If the customer number is not identified and not checked by the outpulser, a trouble ticket is printed. The operation of relay TTB grounds the TBL lead to light a TBL lamp. The TBL lamp indicates to the maintenance employee that a trouble occurred in the verification of the customer line number.

12.06 If the customer line number was identified and then checked by the outpulser or if a multiparty indication was received, relay IRL operates to release the identifier circuit.

DISPLAY OF VERIFIED NUMBER AND RELEASE

12.07 Relay IRL operates relay IRLA, with relays PS and TST operated, the operation of relay IRLA operates the Line Verification Connector (LV-) relays to transfer the identified number or the multiparty indication to the line verification connector and display circuit No. 1 crossbar, panel or to the line verification circuit, step-by-step. This information is then displayed for use by the maintenance employee.

12.08 The RS lead is also grounded to give a release signal to the verification circuit. The outpulser then receives a ground on the RLS lead to operate relay RL for release of the outpulser.

13. AIOD CLASS OF CALL - OPERATION WITH AIOD TRANSLATOR - SC14 - OPTION 15 AND ZF PROVIDED

GENERAL

13.01 On an AIOD call from a PBX station, the number identified by the ANI identifier represents an arbitrary PBX trunk number assigned to the PBX line over which the PBX station is placing the call. The outpulser, upon recognizing the AIOD class of call, delays the start of outpulsing and connects to an AIOD translator upon release of the identifier. The translator receives the arbitrary trunk number from the outpulser and passes the number into a No. 101 ESS Control Unit (ECU) or a PBX AIOD Station Identification Store (SIS). The ECU or SIS knows the number of the PBX station using the line; this information is transmitted to the ECU or the SIS from the PBX over a data link. The ECU or SIS then returns an AIOD office index and the station number to the translator which in turn passes this information to the outpulser. The office index is converted to a 3-digit ABC code by the outpulser. The ABC code plus the 4-digit station number are then outpulsed to CAMA just as on a non-AIOD call.

RECOGNITION OF THE AIOD CLASS OF CALL

13.02 The PBX lines have a normal position in the regular, miscellaneous, or X number network similar to the appearance of individual and 2-party lines. However, in order to provide a distinct AIOD class mark, those PBS lines arranged for AIOD service must be disconnected from their normal position in the ANI network system and given an appearance in the AIOD number network. This new appearance is associated with an arbitrary number (referred to as the PBX trunk number) assigned to the PBX line for the AIOD function and is identified by an office number reserved for AIOD. The office number may be any number 0 to 6 previously unused. In the outpulser relay OF- corresponding to the AIOD class is cross-connected to bring up the AIOD class relay IOD upon operation of relay OF by the identifier. The cross-connection arrangement for relay IOD is similar to that for operating OF-A relays for physical-theoretical office operation and ensures that on IOD calls the call will block if relay IOD fails to operate and the AIOD functions will be canceled and the trouble identification digit outpulsed causing the attendant to make the identification. Relay IOD locks when operated since relay OF will be released during the AIOD functions.

START OF AIOD FUNCTIONS - DELAY OF MF OUTPULSING

13.03 When the identification is completed, relay IRL is operated through the digit and office check relays; and relay IOD operated, to release the identifier. Relay IRL operates relay IRLA and also relay MF in the trunk. Normally (on non-AIOD calls), the outpulser relay MF would also operate at this time; however, on AIOD calls, in order to delay outpulsing, relay MF operate circuit is opened by relay IOD, but, since the trunk relay MF is operated (to hold the trunk) a 910-ohm bridge is connected across the T and R leads looking toward CAMA to hold the CAMA sender which is awaiting the calling number. Relay IRLA operates relay IOD1 to seize an AIOD translator. Relay IOD1 also disables timer TM1 and starts timer TM2; it also increases the normal timing interval of TM2.

SELECTION AND SEIZURE OF AIOD TRANSLATOR

13.04 An identifier group may serve up to three AIOD translators. Selection of a particular translator is made on the basis of thousands digit of the identified arbitrary PBX trunk number. A particular thousands digit is associated with a trans-

lator by a cross-connection described in Circuit Note 111. When relay IOD1 operates, it causes one of the Translator Start (TS0 to TS2) relays to operate. The TS- operated relay locks and connects battery toward the connector associated with the selected translator. The outpulser competes with other circuits for connection to the translator. It will maintain its bid for the translator until the translator is seized or until TM2 times out.

CONNECTION TO AIOD TRANSLATOR AND TRANSFER OF TRUNK NUMBER TO TRANSLATOR

13.05 When the outpulser is connected into the translator through the translator connector, it passes the four digits of the trunk number into the translator. At the same time, the translator operates the Translator Connected (CON) relay in the outpulser as an indication that it has been seized. Relay CON releases relay STM2 to cancel the TM2 timing interval. It also releases relay IOD1 to restart timer TM1. Relay IOD1 is slow to release and delays restarting TM1. This effectively increases the timing interval of TM1 during the AIOD functions. Relay IOD1 released, opens the circuit to the TS relays so that subsequent release and reoperation of the TH- relays does not cause false seizure of a second translator.

13.06 The translator makes a 2/5 check of the trunk number and grounds the Trunk Number Check (TNK) lead into the outpulser; however, this indication serves only as a progress mark when a trouble ticket is requested. The translator then passes the trunk number into the ECU or SIS.

RECEIPT OF AIOD OFFICE INDEX AND STATION NUMBER FROM THE TRANSLATOR

13.07 The trunk number passed into the ECU or SIS is matched with a station number previously registered, in a memory associated with the ECU or SIS, over a data link between the PBX and the central office. This station number and an AIOD office index is passed to the translator. The translator checks that it has received the required number of digits and operates the Station Number Check (SNK) over lead RR as a signal to prepare to receive the station number. Relay SNK operates and opens the IOD1 circuit to prevent its reoperation when CON releases; it also releases relay DWA which releases the office indication and trunk number previously registered in the outpulser by the identifier. The office and digit check relays also release and operate the Register Clear (RCL) relay which locks and reoperates relay DWA. Operation of RCL and reoperation of DWA signals the translator over lead RR to pass the AIOD office index and PBX station number into the outpulser. The AIOD office index is registered on one of the Office Index (OI-) relays and the station number is registered on relays TH-, H-, T-, and U-. The office and digit check relays reoperate, if the required number of digits have been received, and operate the Station Number Received (SNR) relay. When relay RCL operates it also operates relays RCL1, 2 (option ZW furnished). Relays RCL1, 2 open the trunk number sending leads to the translator to prevent the station number from being registered in the trunk number register of the translator. Relays RCL1, 2 are held operated until RCL releases.

RELEASE OF AIOD TRANSLATOR AND START OF OUTPULSING

13.08 Relay SNR when operated, locks and opens the locking circuit to the TS_ relay causing relay TS_ to release and remove the battery from the TS_ lead. The translator connector and translator circuits release. Relay CON releases as an indication that the translator has released. Relay SNR operated and relay CON released recloses the circuit to relay MF. Relay MF operates, removes the 910-ohm bridge from across the T and R leads, and allows the outpulser to resume its outpulsing function. The outpulser transmits the normal complement of digits to the CAMA office; however, in this case, the ABC code is generated by relay OI- similar to the way in which the OF relays generate the ABC code on non-AIOD calls. Relay OF- associated with the AIOD class is used only as a class mark and does not get cross-connected for an ABC code.

AIOD TRANSLATOR BUSY IN SERVICE OR PLUGGED BUSY

13.09 When the outpulser attempts to seize an AIOD translator and finds the translator busy, it calls for a trouble ticket, and outpulses the trouble information digit. If the translator is plugged busy, the battery on the TS_ lead into the translator connector will be connected back into the outpulser on lead TMB to operate the Translator Busy (TLB) relay which locks and operates relay TTST to request a trouble ticket. Subsequent operation of relay TTB causes operation of relay SNR and release of relay TS_.

13.10 If the translator is busy in service, the outpulser will time for one second nominal. At the end of the timing interval, relay ETM2 operates, removes the battery from the TS_ lead, and operates relay TLB which locks and operates relay TTST.

13.11 Subsequent operation of relay TTB causes operation of relay SNR and release of relay TS_. Relay TLB also prepares the circuit to operate the ID2 trouble information digit. Relay SNR also recloses the circuit to relay MF to permit the outpulsing to start. Attendant identification of the calling station will be required.

13.12 The trouble ticket produced on this type of call will indicate the arbitrary trunk number; it will also show a TLB mark. A TM2 mark will also be indicated if the translator had been busy in service.

TROUBLE BEFORE CONNECTION TO AIOD TRANSLATOR

13.13 When option 15 is furnished, the operate path of relay MF is opened by relay IOD and reclosed by relay SNR operated and relay CON released at the end of the AIOD functions. Therefore, it is necessary to force up relay SNR on troubles where this relay cannot operate in the normal manner; this permits operation of relay MF and subsequent outpulsing of the trouble digit. To accomplish this, relay SNR is operated by relay TTB after seizure of the trouble ticketer. Under this condition, relay SNR is operated through a make contact on relay IRL; this ensures that relay SNR will operate after a time-out during identification but not after a first trial identification failure, since operation after a first trial failure could prevent proper completion after a good second trial identification. Relay SNR is also operated by relay 2TR after a second trial failure if relay IOD had been operated during identification. Under this condition, the operation by relay 2TR is required since relay TTB may not remain operated long enough to ensure operation of relay SNR. Operation of relay SNR recloses the path to relay MF and opens the path to relay IOD1 to cancel the AIOD functions. Relay SNR operated, under normal conditions, grounds lead SNR toward the test circuit and the trouble ticketer as a progress indication; however, under the condition described above lead SNR is opened by either relay TTB or 2TR to cancel the accompanying indication, since this indication does not indicate the condition of the outpulser when it blocked.

TROUBLE DURING CONNECTION TO AIOD TRANSLATOR

13.14 During the AIOD functions while connected to the translator, timer TM1 is in control. If the progress of the call is interrupted, TM1 will function, a trouble ticket will be requested, and the ID2 signal subsequently outpulsed to cause attendant identification. If the AIOD equipment cannot match the trunk number with a station number, the translator will ground the TRL lead into the outpulser to operate Failure To Match (FTM) relay which locks and requests a trouble ticket. Relay FTM then causes the ID2 signal to be outpulsed.

TRANSLATOR START LEAD CROSS

13.15 The Translator Start Lead Cross (TSX) relay is a marginal relay in series with the TS_ lead that will operate if more than one TS_ lead is energized, or if a false ground exists on a TS_ lead. Relay TSX operated, operates relays SNR and ETMA. Relay SNR cancels the AIOD functions and relay ETMA causes a trouble ticket request and subsequent outpulsing of the ID2 information digit.

PERMANENT SIGNAL, LINE VERIFICATION, AND TRUNK TEST OPERATION

13.16 If the outpulser is seized on a permanent signal or a line verification call and an AIOD class is indicated, the outpulser will cancel the AIOD functions. The calling line information printed on the trouble ticket or displayed on lamps will be the arbitrary trunk number and the office number representing the AIOD class. The outpulser will proceed as on a non-AIOD seizure. If the outpulser is seized on a trunk test call and an AIOD class is indicated, it will cancel the AIOD functions but will be unable to proceed as on a non-AIOD seizure, since the outpulser will be unable to outpulse an ABC code and the trunk test will block. Therefore, trunk test calls should not be attempted, using a test number that brings in the AIOD class indication.

CALLING LINE IDENTIFICATION OPERATION

13.17 If the outpulser is seized by the auxiliary circuit, ANI type B for

CLI, and an AIOD class is indicated, the identification proceeds as described for an AIOD call, except that the identification information is not outpulsed but is passed to the trouble ticketer for printing on the CLI ticket.

TRANSLATOR TESTING

13.18 The outpulser identifier test circuit is arranged to perform certain tests of the AIOD equipment. These tests are originated in the same manner as tests of the outpulser and require the use of an outpulser and an identifier.

13.19 On a translator test seizure, the outpulser grounds the TST lead into the translator connector. The number keyed up at the test frame is identified as the arbitrary PBX trunk and is transmitted to the translator via the connector. A station number will be registered in the outpulser subsequently; this number may be the same trunk number passed to the translator or it may be a completely different number, depending on the type of test setup. On certain tests, the translator will ground the TRL lead into the outpulser; however, relay FTM, which is normally expected to operate with ground on lead TRL, is shunted down by ground on lead FTM from the test circuit. The FTM diode, in series with lead TRL, prevents the shunting ground from falsely operating relay FTM in series with a relay in the translator.

13.20 Operation of relay FTM and subsequent operation of the outpulser can be tested on a separate test by operating a key in the test circuit to remove the ground on lead FTM.

13.21 Normally, the thousands digit of the identified trunk number is used to select a particular translator; this is determined by cross-connections made in FS22. However, a feature has been provided that permits the test circuit to select any one of three translators regardless of the thousands digit registered. This feature permits a more complete test of the AIOD registration features. The feature, when activated under key control at the test frame, causes the operation of Translator Test (TLT) relay which transfers control of the TS_ relay operate circuit from the outpulser to the test circuit.

13.22 A cancel make-busy feature has been provided that permits the outpulser, on test seizures, to override the translator plugged busy condition in the connector. The feature is activated on outpulser identifier and translator tests by a ground on lead CMB that operates relay CMB. Relay CMB prevents operation of relay TLB on a plugged-busy condition and causes seizure of the selected translator. The operation of the outpulser relay TLB and subsequent outpulsing of the trouble digit may be tested by canceling the operation of relay CMB by means of a key in the test circuit.

14. TRUNK TESTING

14.01 The automatic trunk test circuit can seize an ANI trunk circuit to apply the various trunk tests. Relays TT and TT1 in the trunk are operated to switch the incoming and outgoing ends of the tip and ring leads to the test circuit and to ground lead TST to the outpulser. The trunk seizes the outpulser through the outpulser connector and the ground on lead TST operates relay RC to control various leads to the plant and traffic registers. When the trunk is cut in by relay TKCI, the ground on lead TST operates relay TST, and an I- relay is operated to prime the outpulser with information from the ANI trunk.

14.02 The outpulser circuit performs its functions in a manner similar to that for a regular service call; however, when an identifier is seized, the identifier is primed for a test call by operated relay TST.

14.03 When the outpulser completes its functions, relay RL is operated to release the outpulser and to restore the outpulser and the connector to normal.

15. OUTPULSER IDENTIFIER TESTING - SC10

GENERAL

15.01 Test access to an outpulser or an identifier is provided on a direct seizure basis from the outpulser identifier test circuit. Keys at the OIT frame prime the circuits with the necessary information for the test and control which particular outpulser or identifier is to be tested. When the outpulser is normal and is made busy to service in all trunk subgroups, the outpulser test connector relays are operated to cut the outpulser through to the outpulser identifier test circuit.

15.02 The information registered in the outpulser and the progress of the outpulser and identifier circuits is registered in the test circuit and displayed on lamps. The outpulser identifier test circuit is arranged to simulate the ANI trunk, the originating equipment, and the terminating equipment. The test circuit also provides means to detect and register the information outpulsed by the outpulser circuit.

SEIZURE OF OUTPULSER AND IDENTIFIER

15.03 Ground on the OT- lead from the outpulser identifier test circuit operates relay OT in the selected outpulser circuit. relay OT operates relay MB, if not previously operated by a make-busy plug in the OPMB- jack. When the outpulser is normal and made busy to service calls in all trunk subgroups, the test circuit grounds the OC lead to operate relay OT1 in the outpulser. Relay OTL operates relay RC to control leads to the various plant and traffic registers and also operates relay ST to seize the outpulser for the test call. When the outpulser goes off-normal, the OTCI lead is grounded to operate relay OTCI in the test circuit. The test circuit returns ground over the OT lead to operate the OT- test connector relays.

15.04 If a particular identifier is selected for the test call, an IDO/1 key is operated at the test frame to operate the corresponding I-T relay in the outpulser.

15.05 If identifier 0 is selected, key IDO and relay IOT are operated. Relay IOT grounds the C- leads to all other outpulsers in the identifier group, operating the MBI0 relays in those outpulsers. Relay IOT also operates relay W and releases relay Z in the selected outpulser to set the W-Z relay combination to seize identifier 0 for the test call.

15.06 If identifier 1 is selected, key ID1 and relay I1T are operated. Relay I1T grounds the D- leads to all other outpulsers in the identifier group, operating the MBI1 relays in those outpulsers. Relay I1T also operates relay Z and releases relay W in the selected outpulser to set the W-Z relay combination to seize identifier for the test call.

15.07 When the identifier is connected, the OIT lead is grounded to prime the identifier for the test call.

CANCEL TIME-OUT IN OUTPULSER

15.08 If the Cancel Time-Out (CTO) key or the ICA control key is operated at the test frame, the CTO lead is grounded. The operation of relay CTO cancels the TM1 work timing and the TAL overall timing.

15.09 When the identifier is seized, the operation of relay OCC operates relay TSN to transfer control of connector relays OCA-E to relay IRLA and to release the operated outpulser preference relay OP- or E-. Other outpulsers can then use the other identifier circuit to serve waiting service calls. When relay IRL operates to release the identifier, relay IRLA operates to release connector relays OC(A-E) and IC(A-E) The release of relay OCC releases relay TSN.

OUTPULSER RELEASE

15.10 When relay RL operates to release the outpulser circuit, lead RL1 is grounded to operate relay RL in the outpulser identifier test circuit. Relay RL removes ground from the OT lead to release relay OT in the outpulser. The release of relay OT releases the OT- test connector relays to open the leads between the outpulser circuit and the outpulser identifier test circuit. The release of relay OT1 also releases relay ST to remove the outpulser busy signal from the connector circuit and to restore the outpulser to normal.

16. TROUBLE RECORDING

GENERAL

16.01 A general description of the 1-A message ticketer is included in 2.16, SECTION I.

16.02 Trouble tickets are printed whenever the outpulser encounters trouble. There are various conditions that will produce a trouble ticket, but in general the outpulser calls for a trouble ticket if the progress of the call is delayed sufficiently long to cause the timer in control to operate, or if a trouble is recognized by a check relay, or if relay AL operates because of overregistration in one of the relay groups protected by relay AL.

16.03 Any of the above conditions will operate relay TTST to seize the trouble ticketer. The TTST operates a preference relay in the trouble ticketer circuit. When preference has been obtained, TTC- relays operate to close through various leads to register the information to be printed.

16.04 When the register relays in the ticketer circuit have operated and locked, ground is returned over the busy lead TTB, operating relay TTB. The action taken following operation of TTB is governed by the circuit conditions that produced this trouble. In general, if a call is in progress, the outpulser will attempt to outpulse the information digit that calls for the help of a CAMA attendant because of trouble in automatic identification.

16.05 If a call is not in progress, or if outpulsing cannot be made or should not be attempted, the outpulser will release itself and any connected circuits.

FAILURE TO SEIZE OUTPULSER

16.06 If the chains through the connector circuit open, but the connector is unable to operate relay ST to seize the outpulser circuit, timer TM1 will function in 0.300 to 0.500 second. Relay TTST operates to seize the trouble ticketer circuit and to sound an alarm. The release of either of the normally operated relays CH1 or CH2 operates relays STM1 and TAL to start the work timing and the overall timing intervals.

16.07 The operation of relay TAL grounds the OPB lead to operate the BY- relays in the connector circuit. The BY- relays operate the OB- relays for this outpulser in all of the trunk subgroups. Any start signal from the ANI trunks is advanced away from this outpulser to other outpulsers.

16.08 If the work timer runs out, relay ETM1 operates relay ETMA, which locks. Relay ETMA operates relay TTST to seize the trouble ticketer for the printing of the trouble ticket.

FAILURE PRIOR TO OPERATION OF RELAY TRS

16.09 Between the time the outpulser is seized and the operation of relay TRS, just prior to the continuity check of the calling line, work timer TM1 is in control. If a trouble condition blocks progress of the call during this period, the work timer will operate to produce a trouble ticket and an alarm.

16.10 If a trouble condition is recognized by the outpulser before time-out occurs, ie, more than one I- relay operated, relay TTST operates to seize the trouble ticketer.

16.11 In either case, the operation of relay TTB operates relay RL to release the outpulser; however, since the outpulser has not advanced far enough to operate the trunk relay SP in the normal manner, the trunk will maintain its outpulser seizure signal and continue to hold the outpulser. If option ZK is furnished, relay TTB grounds the SP lead to operate the trunk relay SP to cause the trunk to remove its outpulser seizure signal. If option ZK is not furnished, the trunk will time out in either 2 to 5 or 3 to 6.24 seconds and remove the seizure signal allowing the outpulser to restore to normal.

FAILURE OF RELAY L1 TO OPERATE

16.12 If timer TM1 functions after relay TRS is operated and relay L1 is not operated, a test is made to determine whether or not the calling customer has abandoned the call. If the customer has abandoned the call, the outpulser releases the trunk, the connector, and itself. If the customer has not abandoned the call, the failure of relay L1 is presumed to be due to a failure in the T and R leads between the trunk and the outpulser or due to a momentary on-hook by the calling customer; under this condition the outpulser takes a trouble record and then proceeds as described below.

16.13 To make the abandoned call test, relay ETM1, having operated after the time-out of timer TM1, operates STM2 to start timer TM2. The ETM1 also removes a battery from lead SP to release the trunk relay SP1 and place the trunk holding circuit under control of the calling station. Since the trunk off-normal relay is slow to release, it is necessary to allow time for its release if the customer has disconnected. Timer TM2 provides this time interval. Relay AB monitors on lead AB and operates if the customer has abandoned, and the trunk off-normal relay releases and grounds lead AB. Subsequently, when ETM2 operates, at the end of the TM2 time interval, relay RL operates to release the trunk and the outpulser.

16.14 If relay AB is still normal when relay ETM2 operates, relay CCKF operates to cause a trouble ticket to be printed. Where option ZZ is provided, relay CCKF locks, reapplies battery to lead SP to hold the trunk, and operates relay TTST to cause a trouble ticket to be printed. Subsequent operation of relay TTB and release of relay DW cause operation of Continuity Check Failure 1 (CCF1) relay. Relay CCF1 releases relay ETMA which had previously been operated by ETM1 and had opened the normal operate circuit to relay L1 to prevent operation of L1 during the trouble ticket request. Release of ETMA causes Continuity Check Failure 2 (CCF2) relay to operate and completes the recycle of timers TM1 and TM2 initiated by TTST. Relay CCF2 operates relay L1 to start the identification function and causes relays CCKF, CCF1, TTST, and TTB to release. If the CCKF failure had been caused by an open T or R lead in the MF outpulsing path, relay TT will fail to operate after completion of the identification and TM1 will time out a second time and cause the outpulser to release. If the CCKF failure had been caused by a momentary on-hook by the calling customer, the outpulser will outpulse the calling line information to the CAMA office after the identification and thus eliminate the need for attendant assistance on the call. On calls involving panel trunks arranged for 2-party service, operation of relay CCF1, as described, causes Reorder (RO) relay to operate. Relay RO causes the panel trunk to set the panel district in the overflow position and then release. The trunk, in recognizing the reorder signal, grounds the R lead into the outpulser to operate relay RL through relay CCF2 operated. The outpulser then releases. Operation in this manner in the case of panel party service ensures against the possibility of outpulsing the wrong party information on those calls where there is an open in the T or R lead that involves the party test but not the outpulsing path.

16.15 Where option ZN Mfr Disc. is provided, the CCKF failure causes the outpulser to release after operation of relay TTB and release of relay DW. Subsequent time-out at the CAMA office causes a CAMA attendant to be called in to complete the call.

16.16 Where option ZM Mfr Disc. is provided, the CCKF failure causes the outpulser to attempt to outpulse the trouble information digit ID2 after the trouble ticket request. Under this condition, CAMA attendant assistance is required to complete the call.

FAILURE OF PARTY TEST RELAYS - INTEGRITY TEST

16.17 After each party test a check is made that the testing relay PT2 is in adjustment. If the relay does not operate on the regular test, a check is made that it is capable of operating on current applied through a local resistance. Relay IYK integrity check operates if party test relay PT2 is in adjustment.

16.18 The outpulser will not permit the calling number to be outpulsed if check relay IYK does not operate on calls that make a party test.

16.19 Timer TM1 is in control and will time out because the call will block just before outpulsing, since MF under this condition cannot operate with IYK down. Relay ETMA operates TTST to seize the ticketer. When TTB operates after recording the information in the ticketer, MF operates to outpulse the failure signal controlled by relay ID2 that also operated when ETMA operated.

FAILURE DURING IDENTIFICATION - SC5

A. Office or Numerical Digits Missing

16.20 With option YK provided for use with identifier SD-95810-01 and the office digit or one or more of the numerical digits are missing the corresponding check relays OFK, THK, HK, TK, or UK will not operate. This failure is indicated to the identifier by the absence of ground on leads connecting to contacts on the check relays. The identifier thereupon tries again to identify the missing digits. If it again fails, ground is closed to lead WC, operating relay 1TR. The 1TR now closes ground to operate IF. The IF operates TTST. When TTB operates after recording in the register of the trouble ticketer, DW releases, releasing the identifier by releasing the IC- relays. The 1TR releases and removes the short from IF1, allowing the relay to operate and lock. The 1TR releases the trouble ticketer. The DW in releasing also releases the register and check relays that were operated on the first attempt to identify. When identifiers arranged for use with No. 1 AMARS are used and one or more digits are not identified after two attempts, the identifier grounds the WC lead to cause a first or second trial failure, operating relays 1TR or 2TR as previously described.

16.21 The circuit is now prepared to seize the other identifier. If failure occurs on the Second Trial (2TR) relay, will operate instead of 1TR when ground is again closed from the identifier over lead WC. The 2TR will operate TTST for the second trouble, after which IRL will operate to release the identifier. Relay MF also operated followed by SP to start outpulsing and by ID2 to signal the CAMA office that a failure has occurred that required the aid of an attendant.

B. No Signal at All Over Buses

16.22 Under this condition, the operation is as described in 16.20 and 16.21, except that no check relays at all operate on first and second trials.

TRUNK LOCKUP - EXCEPT TIP PARTY PANEL

16.23 A feature is available that permits locking up a trunk and customer line for tracing the call if no signal at all is received. This feature is under control of a key provided one per building. The feature is activated by operation of the common key designated TKL. When the key is operated, it conditions each outpulser to recognize when no tone signal is found on the line buses when the system is attempting to identify. The first outpulser that recognizes this condition of no signal will cause a ticket to be printed and the failure signal will be outpulsed, after which a relay in the trunk will be locked operated, holding the trunk and the customer line so that the call will be held for tracing. The number of the trunk will be displayed on a lamp panel at the maintenance center.

16.24 After one trunk is locked in, no other trunk may be locked from any outpulser until the first locked-in trunk is restored to normal. The relay details are shown on SC5.

REORDER - TIP PARTY PANEL

16.25 If no digits can be identified on both first and second trial in the tip field of a panel office, it is assumed that the call originated at a PBX and that the tip party identification received on party test resulted from a false path to ground caused by overlapping talking keys at the PBX position. All PBX trunks are wired in the ring field, and a party test is made on calls incoming over these trunks, because it is not feasible to segregate the trunks or to avoid making the party test. Normally, the party test will indicate a ring party and the PBX will be identified.

16.26 When no digits can be found in the tip field as stated in 16.25, the outpulser operates a reorder relay in the trunk and then releases as indicated in SC5.

FAILURE DURING OUTPULSING

A. Steering Relays Fail

16.27 If, during outpulsing of the calling number, the steering relays should fail to operate correctly, the steering circuit will block. Relay EP cannot operate to indicate end of pulsing and relay RL cannot operate to release the outpulser. At the end of the timing interval provided by TM1, the TM1 tube breaks down to operate relay ETM1. The trouble ticketer is seized to print a trouble ticket to identify the trouble condition.

B. Steering Relays Function, but MF Signal Absent

16.28 If the steering relays function properly, the outpulser will release after the end-of-pulsing indication. The absence of complete MF signals to the distant tandem or toll office will cause the sender to time out and call for a CAMA attendant.

17. MAINTENANCE FEATURES

OUTPULSER MAKE-BUSY

17.01 The outpulser can be made busy to service usage by the insertion of a make-busy plug into the make-busy jack associated with the outpulser, and shown on the miscellaneous circuit for the trouble ticketer. The OPMB lead to the outpulser is grounded, operating relay MB. Relay MB places ground on the OPB lead operating the BY- relays in the connector circuit if they are not operated. The BY- relays operate the OB- relays in the connector, making the outpulser test busy to the connector. Under certain conditions, a test call can be set up to override the busy condition so that a test can be made of the made busy outpulser.

OUTPULSER MADE BUSY TO A PARTICULAR TRUNK SUBGROUP

17.02 The outpulser can be made busy to a particular subgroup of trunks by blocking the associated relay OB- operated in the connector circuit.

IDENTIFIER MAKE-BUSY

17.03 Either of the two identifiers can be made busy to service usage by the insertion of a make-busy plug into the make-busy jack associated with the identifier shown on the miscellaneous circuit for the trouble ticketer. In each outpulser, relay MBI- is connected to the MBI- lead through break-contacts of an identifier connector cut-in relay to prevent interference with a calling number identification if the made busy identifier is in use.

17.04 If identifier 0 is made busy, relay MBI0 is operated. Relay MBI0 operates relay Z and opens the operating path for relay W. This setting of relay WZ combination prevents the operation of the cut-in relays for identifier 0.

17.05 If identifier 1 is made busy, relay MBI1 is operated. Relay MBI1 operates relay W and opens the operating paths for relay Z. This setting of relay WZ combination prevents the operation of the cut-in relays for identifier 1.

IDENTIFIER PREFERENCE CHAIN TRANSFER

17.06 The identifier preference circuits are provided in duplicate with automatic and manual transfer arrangements. The automatic transfer arrangements will be described first. The two ends of relay CH are connected to the two ground chains. If the identifier is being used, relay CH will not operate because both chains will be open. However, if no identifier is being used and one of the chains becomes open, relay CH operates in series with one half of the A resistor to ground on the other chain. Relay CH operates relay ATR which locks to the AR key. Relay ATR operates or releases relay TR, transferring control to the emergency or regular identifier preference chain.

17.07 Manual transfer to the emergency preference chain may be accomplished by operating the TR key. The TR key applies relay CH winding to the chain circuits of the E- relays and also operates relay TR. Relay TR causes the E- preference relays to be used in all outpulsers.

17.08 Should a trouble occur while the preference relays are manually transferred, relay CH operates, operating relay ATR. With the TR key operated, relay ATR will release relay TR, transferring preference control back to the regular preference chain relay.

17.09 At all times when relay ATR is operated, relay CH is disconnected from the preference relay chain by means of break-contacts on relay ATR. Relay ATR, when operated, is locked to ground through the AR key.

SECTION III - REFERENCE DATA

1. WORKING LIMITS

1.01 Voltage Limits

Voltage	Min	Max
-48	-45	-50
-24	-22	-26
+130	+125	+135
-110	-100	-120

1.02 External Loop and Leak Resistance: This circuit is limited, as to external subscriber line loop and external trunk loop with which it may be used, to the operating limits of relays L, TT, and PT2 in regard to loop and leak resistance as follows.

Customer Line

	Supervision Relay L	Panel Pty Test Relay PT2
Max Ext Ckt Loop Res	1500 ohms	1500 ohms
Min Insulation Res	10,000 ohms	10,000 ohms
Earth Potential	±20 volts	+20 volts, -13 volts

Terminating Office

	Trunk Test Relay TT	
Min Voltage	-45	-48
Max Ext Ckt Loop Res	6650 ohms	7050 ohms
Min Insulation Res	30,000 ohms	30,000 ohms

2. FUNCTIONAL DESIGNATIONS

2.01 Relays

Designation	Meaning
1TH	First Thousands
1TR	First Trial
2TH	Second Thousands
2TR	Second Trial
3TH	Third Thousands
4TH	Fourth Thousands
5TH	Fifth Thousands
AB	Abandoned Call
AIB	All Identifiers Busy
AL	Alarm
AOPB	All Outpulsers Busy
AS	A Digit Steering (MF Outpulsing)
BS	B Digit Steering (MF Outpulsing)
CCF1,2	Continuity Check Failure 1,2
CCKF	Continuity Check Failure
CFTF	Cancel First Trial Failures
CH1,CH2	Chain (Connector Chain)
CLI	Calling Line Identification
CLIT	Calling Line Identification Test
CMB	Cancel Make-Busy (In Translator)
CON	Translator Connected
CS	C Digit Steering (MF Outpulsing)
CTO	Cancel Time-Out
CTT	Cancel Trouble Tickets
DL	Display Lost
DW,DWA	Down Check
DWB	Off-Normal Ground for Relays I3A, I3B, I4A, I4B - Step-by-Step App Fig. 21
E	Emergency Outpulser Preference
EP	End of Pulsing (MF Outpulsing)

Designation (Cont)	Meaning
ETM1	End Timing 1 (Work Timing)
ETM2	End Timing 2
ETMA	End Timing 1 Auxiliary
ETT	End Trouble Ticketer Timing
FMT	Force Manual Trace (CLI)
FTM	Failure to Match
GRF	Ground Removal Failure
GRFS	Ground Removal Failure - Step-by-Step
GRT	Ground Removal Test
H0,1,2, 4,7	Hundreds Digit
HK	Hundreds Check
HS	Hundreds Digit Steering (MF Outpulsing)
I0T	Identifier 0 Test
I1	Trunk Information - Ring Party (Crossbar, Step-by-Step) or Omit Party Test (Panel)
I1A, I1B	Trunk Information - Ring Party - Step-by-Step - With App Fig. 14
I1T	Identifier 1 Test
I2	Trunk Information - Tip Party (Crossbar, Step-by-Step)
I2A, I2B	Trunk Information - Tip Party - Step-by-Step - With App Fig. 14
I3	Trunk Information - Party Test (Panel) or Ground Removal Failure - 2-Party Message Rate (Step-by-Step)
I3A, I3B	Trunk Information - Ground Removal Failure, 2-Party Message Rate or Coin Class Call - Step-by-Step App Fig. 21

Designation (Cont)	Meaning
I4	Trunk Information - Ground Removal Test (Panel) or Ground Removal Failure - 2-Party Flat Rate (Step-by-Step)
I4A, I4B	Trunk Information - Ground Removal Failure, 2-Party Flat Rate or Noncoin Class Call - Step-by-Step App Fig. 21
IC-0	Identifier 0 Connector
IC-1	Identifier 1 Connector
ID0	Identification Digit - Automatic Identification
ID1	Identification Digit - Attendant Identification
ID2	Identification Digit - Trouble
IDS	Identification Digit Steering (MF Outpulsing)
IF, IF1	Identification Failure
IK	Information Check
INT	Intercept Call
INTA	Regular Intercept
INTB	Blank Number Intercept
INTC	Trouble Intercept
IOD	Automatic Identified Outward Dialed
IOD1	Start AIOD Functions
IRL, IRLA	Identifier Release
IYK	Integrity Check
IYT	Integrity Test
KP	Keypulse Steering (MF Outpulsing)
L	Line Relay
L1	Line Relay Auxiliary

Designation (Cont)	Meaning
LV-	Line Verification Connector
MB	Make-Busy (Outpulser)
MBI0	Identifier 0 Made Busy
MBI1	Identifier 1 Made Busy
MF	Multifrequency
NIK	No Identification Check
OB	Outpulser Busy
OC-	Outpulser Connector
OF0-6	Office Number
OFA-	Office Auxiliary
OFK	Office Check
OFP-	Office - Physical
OFT-	Office - Theoretical
OI-	Office Index (AIOD)
ON, ON1	Off-Normal
OP	Outpulser Preference
OPH	Outpulser Hold
OT	Outpulser Test
OT-	Outpulser Test Connector
OTM	Operate Relay TM (Trunk)
PIK	Party Information Check
PG, PG1	Pulse Generator
PK	Party Check
PS	Permanent Signal
PSA	PS Lead Ground Detector
PSB	PS Lead Battery Detector
PSI	Permanent Signal Identification
PSK	Permanent Signal Check
PST	Permanent Signal - Check Tip Field

Designation (Cont)	Meaning
PT	Party Test
PT1	Party Test Cut-In
PT2	Party Test-Tip
PTY	Multiparty (Attendant Identified)
RC	Register Control
RCL	Register Clear
RCL1,2	Register Clear - Open Trunk Number Sending Leads
RCY1, RCY2	Recycle Timer TM1
RL	Release
RO	Reorder
RP, RP1	Ring Party
SCC	Signal Control on Combined Trunk Calls - Step-by-Step App Fig. 21
SNK	Station Number Check
SNR	Station Number Received
SO	Service Observed
SP	Start Pulsing (MF Outpulsing)
SPL,SPL1	Split
ST	Start (Connector)
STM1	Start Timing 1 (Work Timing)
STM2	Start Timing 2
STP	Start Pulse - App Fig. 14
STPP	Start Prime Pulse - App Fig. 14
ST2P	Start 2 Prime Pulse - App Fig. 21
ST3P	Start 3 Prime Pulse - App Fig. 21
STS	Start Digit Steering (MF Outpulsing)
T 0,1,2,4,7	Tens Digit

Designation (Cont)	Meaning
TAL	Start Overall Timing
TAL1, TAL2	Time-out Alarm (Overall Timing)
TCK	Ticketer Cut-In Check
TH 0,1,2,4,7	Thousands Digit
THK	Thousands Check
THS	Thousands Digit Steering (MF Outpulsing)
TK	Tens Check
TKCI	Trunk Cut-In
TKL	Trunk Lockup
TLB	Translator Busy
TLT	Translator Test - Permits Test Circuit to Select Any Translator
TP	Tip Party
TP1	Tip Party-Party Test
TR	Transfer Preference Chain (Outpulser)
TRT	Trace Tone Received (CLI)
TRS	Transfer (Trunk Leads)
TS	Tens Digit Steering (MF Outpulsing)
TS0 to 2	Translator Start 0 to 2
TSN	Test Network
TST	Trunk Test Call
TSX	Translator Start Lead Cross
TT	Trunk Test
TTA	Trouble Ticketer Timing Auxiliary
TTB	Trouble Ticketer Busy
TTC0-9	Trouble Ticketer Cut-In
TTST	Trouble Ticketer Start
U 0,1,2,4,7	Units Digit
UK	Units Check
US	Units Digit Steering (MF Outpulsing)
W,Z	Alternate Identifier Preference

2.02 Electron Tubes

Designation	Meaning
TAL	Time-Out Alarm (Overall Timing)
TM1	Timing 1 (Work Timing)
TM2	Timing 2
TTT	Trouble Ticketer Timing

3. FUNCTIONS

3.01 To make itself busy under any of the following conditions:

(a) Outpulser engaged on a service call.

(b) Outpulser engaged on a test call.

(c) Outpulser made busy by means of a plug in the busy jack.

(d) Outpulser made busy by a fuse alarm.

(e) Outpulser engaged on a permanent signal call.

(f) Outpulser engaged on a line verification call.

3.02 When seized by the outpulser connector to register information from the trunk as follows.

(a) To register party information from crossbar and step-by-step trunks, and if App Fig. 14 is furnished, to recognize either a battery or a ground signal as the party indication from step-by-step trunks.

(b) To register party test information from panel trunks.

(c) To receive a request to make ground removal test from panel trunks.

(d) To receive a request to make ground removal failure from step-by-step trunks.

(e) To register permanent signal information from the permanent signal identification circuit.

(f) To register line verification information from the line verification connector and display circuit.

(g) To register trunk test information from the trunk when it is seized by the automatic trunk test circuit.

(h) To register intercept information from panel and step-by-step trunks outgoing to an AIC.

(i) With App Fig. 14, to receive (1) battery or (2) ground signal on lead T or R indicating (1) attendant (0) or prefix 0 (0+) or (2) prefix 1 (1+) calls (step-by-step).

(j) With App Fig. 21, to receive a signal per (i) and in addition a second signal on lead AB indicating a coin class call or on lead TPT indicating a noncoin class call. A single ground signal on lead AB indicates a ground removal failure 2-party message register, or, on lead TPT, indicates a ground removal failure 2-party flat rate.

3.03 To provide timing intervals for connector functions, overall outpulser timing, outpulser work timing, party test timing, and abandoned call timing.

3.04 To make party test on 2-party lines in panel offices.

3.05 To make ground removal test on calls from tip party stations in panel offices.

3.06 To supervise the calling line while party test and line identification is made.

3.07 To seize the identifier for calling number identification.

3.08 To register and check the calling number.

3.09 To release the identifier when the calling number has been identified or when the calling station is on a multiparty line.

3.10 To outpulse the calling office code, identification digit, calling number and start pulse to the distant tandem or toll office.

(a) With App Fig. 14 step-by-step, to outpulse a distinctive start pulse (referred to as the start prime pulse) when a battery signal is used on lead T or R to indicate tip or ring party from the step-by-step trunk; this signal is to indicate that the trunk was reached by the customer dialing a zero prefix or a zero only.

(b) With App Fig. 14, to outpulse a regular start pulse on all calls outpulsed when a ground signal is used to indicate tip or ring party from the step-by-step trunk; this signal is to indicate that the trunk was reached with a customer dialed prefix 1 (1+). With option ZD, to outpulse a start pulse only on automatically identified calls.

3.11 To make trunk test toward the distant tandem or toll office or AIC.

3.12 To seize the trouble ticketer on trouble conditions.

3.13 To translate the single-digit calling office indication into the corresponding office code.

3.14 When a 10,000 number series contains both physical and theoretical numbers, to provide translation into the physical or theoretical office code. In No. 1 crossbar offices arranged for LIT printout of the complete directory number upon LIT failures, this translation data will be provided to the trouble ticketer so it may further translate it into the A, B, C office code for the teletypewriter printout.

3.15 To permit direct seizure by the outpulser identifier test circuit for test purposes.

3.16 To permit outpulsing of the attendant identification signal before the time-out if all identifiers are made busy. The outpulser will then time out and leave a trouble record at the ANI trouble ticketer and release.

3.17 To permit the use of one identifier and one outpulser for small installations.

3.18 To provide indications for plant and traffic registers.

3.19 To cancel trouble tickets and alarms under control of the outpulser identifier test circuit.

3.20 To cancel trouble tickets and alarms when the step-by-step automatic trunk test circuit tests the ground removal failure feature.

WITH APP FIG. 15 AND OPTION ZF

3.21 To recognize the AIOD class of call and delay the start of outpulsing until after completion of the AIOD functions.

3.22 To connect a 910-ohm bridge across the T and R leads to hold the tandem sender during the AIOD functions prior to outpulsing.

3.23 Upon release of the identifier, to connect to an AIOD translator.

3.24 To check that only one translator start lead is energized and if relay TSX operates, to cancel the AIOD functions and to request that a trouble ticket be taken.

3.25 To start a timing interval while awaiting connection to the translator and to cancel the timing upon connection to the translator.

3.26 To cancel the request for a translator, to request a trouble ticket, and to outpulse the trouble information digit if the outpulser times while awaiting connection to a translator.

3.27 To start an extended work timing interval upon connection to a translator.

3.28 To pass the 4-digit arbitrary trunk number to the translator upon connection to the translator.

3.29 To recognize a station number check signal from the translator and to restore to normal the register relays on which the office number and trunk number were registered.

3.30 To open the trunk number sending leads to the translator and to indicate to the translator that the register is clear and ready to receive the AIOD office index and the calling station number.

3.31 To check the information received and to release the translator and to check the release of the translator.

3.32 To convert the AIOD office index to an ABC code and transmit the ABC code and the 4-digit station number to the CAMA office along with the KP, ID-, and SP signals.

3.33 To recognize a failure to match signal from the translator and to request a trouble ticket and the outpulse the failure signal.

3.34 To request a trouble ticket, remove the translator request, and outpulse the trouble information digit if the translator is plugged busy.

3.35 To cancel the AIOD functions on permanent signal and line verification seizures of the outpulser when the AIOD class is indicated and to retain the calling line number as identified.

3.36 To indicate to the translator when a test call is in progress.

3.37 On a test call, to override a translator plugged busy condition upon signal from the outpulser identifier test circuit.

WITH APP FIG. 18

3.38 To recognize an intercept call.

3.39 To register the type of intercept call: regular, blank number or trouble.

3.40 To outpulse to the AIC the called line number and a digit to indicate the type of intercept.

WITH APP FIG. 19

3.41 To distinguish between seizure by the permanent signal identification circuit and seizure by the ANI auxiliary circuit for calling line identification.

3.42 On seizure by the ANI auxiliary circuit for calling line identification, to control the identification and ticketing of the calling line directory number.

3.43 To give a CLI indication to the trouble ticketer.

3.44 To give a trace-tone received indication to the trouble ticketer.

3.45 To give a trouble indication to the ANI auxiliary circuit for calling line identification if a trouble occurs in the identification process or in connecting to a trouble ticketer or if the calling line is identified as multiparty.

4. CONNECTING CIRCUITS

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

(a) Identifier Circuit - SD-95810-01, or Identifier Circuit, ANI-B for use with No. 1 AMARC and Toll (Step-by-Step Offices) - SD-1C593-01.

(b) Outpulser Connector Circuit - SD-95890-01.

(c) Trouble Ticketer Circuit - SD-95816-01.

(d) Miscellaneous Circuit Outpulser Frame - SD-95820-01.

(e) Multifrequency Signal Generator Circuit - SD-95867-01.

(f) Miscellaneous Circuit - Trouble Ticketer Frame - SD-95823-01.

(g) Outpulser Identifier Test Circuit - SD-95815-01.

(h) Multifrequency Current Supply and Distribution Circuit - SD-95391-01.

(i) Permanent Signal Identification Circuit - SD-95817-01.

(j) Line Verification Connector and Display Circuit - No. 1 Crossbar, Panel - SD-95828-01.

(k) Line Verification Circuit - Step-by-Step - SD-32246-01.

(l) Traffic Usage Recorder Circuit - SD-95738-01.

(m) Traffic Register Circuit - No. 1 Crossbar - SD-25317-01.

(n) Traffic Register Circuit - No. 1 Crossbar - SD-25942-01.

(o) Miscellaneous Register Circuit - Panel, Battery Cutoff - SD-21537-01.

(p) Miscellaneous Register Circuit - Panel, Ground Cutoff - SD-20141-01.

(q) Traffic Register Circuit - Step-by-Step - SD-30896-01.

(r) AIOD Translator Connector - SD-99320-01.

(s) Auxiliary Circuit, ANI Type B for Calling Line Identification - SD-1C208-01, Mfr Disc.

5. MANUFACTURING TESTING REQUIREMENTS

5.01 The outpulser shall be capable of performing all the service functions specified in this circuit description and meeting all the requirements of the Circuit Requirements Table.

6. ALARM INFORMATION

TIME-OUT ALARM

A. Condition

6.01 If an outpulser encounters an extended delay in the progress of a call, the overall timing TAL circuit will function. The timing interval is 7 to 11 seconds from the seizure of the outpulser to time-out. Relay TAL1 brings in the trouble ticket with a major alarm and operates relay TAL2 which locks to the AR lead. Relay TAL2 lights the TA lamp.

B. Action Required

6.02 If in response to a major alarm, a lighted TA lamp is found, the alarm may be extinguished by operating the AR key. An examination of the trouble ticket produced will indicate what steps may be necessary to rectify the condition that caused the time-out alarm.

TROUBLE TICKETER REQUEST ALARM

A. Condition

6.03 If an outpulser encounters a trouble condition and requests connection to the trouble ticketer circuit, the operation of relay TTST grounds either the Major (MJ) or Minor (MN) alarm lead into the miscellaneous circuit for the trouble ticketer frame. With option YE or ZJ furnished, relay TTST operated grounds the MN lead to bring in a minor alarm on all trouble conditions with the exception that no alarm is brought in on a line verification call. With option YE furnished, on a call where the Trunk Lockup (TKL) feature is activated, the operation of relay OTM to lock up the trunk grounds the MJ lead to bring in a major alarm overriding the minor alarm. With option ZI furnished, relay TTST operated grounds either the MJ or MN lead depending upon the trouble condition, including troubles on line verification calls. With option YJ, the ground to the MN lead multiple is intercepted by the ANI lead and TRY diode which prevents feedback. This ANI lead provides an individual outpulser first trial failure indication, which is recorded for the duration of the scan cycle by the miscellaneous circuit for the trouble ticketer frame, and passed on to the CSACS interconnection circuit. At the end of each CSACS scan cycle, this locked in trouble indication is released; therefore, only one ANI outpulser indication per scan cycle will be recorded by CSACS for each outpulser.

6.04 If the trouble ticketer is busy at the time the outpulser attempts to seize it, the Display Lost (DL) relay operates and a corresponding DL lamp is lighted at the trouble ticketer frame. With option YE or ZJ furnished, a minor alarm is sounded as described above. With option ZI furnished, relay DL operated changes the minor alarm to a major alarm.

B. Action Required

6.05 The major or minor trouble ticketer request alarm can be silenced and the TRR lamp can be extinguished by means of the AR key or by the alarm sending circuit. The action taken to release the trouble ticketer request alarm releases relay DL, if operated, and extinguishes the DL lamp.

TROUBLE TICKETER TIME-OUT ALARM

A. Condition

6.06 If an outpulser encounters an extended delay in receiving a trouble ticketer release signal after relay TTST has operated, the TTT circuit will function. The timing interval is 0.550 second to 0.750 second from the operation of relay TTST to time-out. Relay ETT operates to advance the outpulser with a major alarm and to operate relay TTA which locks to the AR lead. Relay TTA lights the TTT lamp associated with the outpulser.

B. Action Required

6.07 If in response to a major alarm, a lighted TTT lamp is found, the alarm may be retired and the lamp may be extinguished by operating the AR key.

TROUBLE TICKETER CALLING LINE IDENTIFICATION ALARM

A. Condition

6.08 When the trouble ticketer is seized on a CLI connection which has resulted in a successful identification, the CLI lead to the miscellaneous circuit trouble ticketer frame is grounded to bring in a major audible alarm and light a CLIA lamp.

B. Action Required

6.09 If in response to a major alarm, a lighted CLIA lamp is found, the alarm may be silenced and the lamp extinguished by means of the AR key or by the alarm sending circuit. Immediate action should be taken to examine the CLI ticket obtained on the call.

PREFERENCE CHAIN TRANSFER AND ALARM

6.10 If trouble occurs in the outpulser preference chain, relay CHA operates to operate relay ATR. Relay ATR:

(a) Transfers outpulser (preference control to the alternate) preference chain.

(b) Lights the CH lamp.

(c) Causes a minor alarm to be sounded.

6.11 The minor alarm can be silenced by means of the AR key or by the alarm sending circuit.

FUSE ALARM

6.12 If a fuse has operated, operated relay FA in the miscellaneous circuit:

(a) Lights an FA lamp.

(b) Causes a major alarm to be sounded.

(c) Grounds the OB lead to the outpulser.

The ground on the OB lead operates relay MB to make the outpulser busy to the connector circuit.

6.13 If in response to a major alarm, an FA lamp is found lighted at an outpulser frame, it is an indication that a fuse has operated at the associated frame. To retire the alarm and to extinguish the FA lamp, replace the operated fuse. Replacing the fuse also lights the FG lamp at the outpulser frame.

6.14 To restore the outpulser circuit to service and to extinguish the FL lamp, operate the AR key at the outpulser frame.

7. TAKING EQUIPMENT OUT OF SERVICE

7.01 To take the outpulser out of service, insert a make-busy plug into the associated outpulser make-busy jack.

7.02 To take the outpulser out of service to a particular subgroup of trunks, block the associated OB- relay in the outpulser connector operated.

7.03 To take an identifier out of service, insert a make-busy plug into the associated identifier make-busy jack. Both identifiers should not be taken out of service at the same time.

8. PLANT AND TRAFFIC REGISTRATION

PLANT REGISTERS

A. First Trial Identifier Failure Register

8.01 When an outpulser registers a first trial failure of an identifier, relay 1TR operates to ground the 1TF0 or 1TF1 lead to the miscellaneous circuit, trouble ticketer frame. The release of relay ICC0 or ICC1 removes the ground from the respective 1TF- lead to release the 1TF- register, scoring the first trial failure of the identifier circuit. The operation of relay RC disables the first trial identifier failure register.

B. Second Trial Identifier Failure Register

8.02 When an outpulser registers a second trial failure of an identifier, relay 2TR operates to ground the 2TF lead to the miscellaneous circuit for the trouble ticketer frame. The release of the OCC relay removes ground from the 2TF lead to release the 2TF register, scoring the second trial identifier failure register. The operation of relay RC disables the second trial identifier failure register.

C. Outpulser Failure Register

8.03 When an outpulser registers a failure other than a failure by an identifier, relay TTST operates to ground the corresponding OPF- lead to the miscellaneous circuit for the trouble ticketer frame. The release of relay TTST removes ground from the OPF- lead to release the OPF- register, scoring the outpulser failure register. The operation of relay RC disables the outpulser failure register.

D. Test Call Register

8.04 Relay RC operates when an outpulser is engaged for:

(a) A trunk test call.

(b) A line verification call.

(c) A permanent signal call.

(d) An outpulser test call.

(e) An identifier test call.

8.05 With relay RC operated, the operation and release of relay ON scores the test call register in the miscellaneous circuit for the trouble ticketer frame.

E. Ground Removal Failure Register, Option YS, Step-By-Step - Fig. 11

8.06 When an outpulser registers a failure, other than by an identifier, and an ANI trunk of a step-by-step registers a ground removal failure (refer to 4.03 and 4.04 of SECTION II and SC9), relays TTST and GRFS operate to ground the GRF lead to the miscellaneous circuit for the trouble ticketer frame. When the outpulser releases and the off-normal relays release to score the GRF register. As with the OPF- register, the operation of relay RC disables the GRF register. As with the OPF- register, the operation of relay RC disables the GRF register. The operation of relay GRFS disables the OPF- register when scoring the GRF register. Since ground removal failures are not attributable to any particular outpulser, the GRF register is provided on a one-per-identifier-group basis; thus all outpulsers in the group must have YS wiring if the plant register is provided.

8.07 Option YR is provided in panel and No. 1 crossbar offices where App Fig. 11 is not provided.

TRAFFIC REGISTERS

A. Outpulser Usage Register

8.08 When an outpulser is seized, relay ON operates and CH1 releases to ground an associated OP- lead. The release of the outpulser circuit removes the ground from the OP- lead to score the outpulser usage traffic register.

B. Test Call Register

8.09 Relay RC operates when an outpulser is engaged for:

(a) A trunk test call.

(b) A line verification call.

(c) A permanent signal call.

(d) An outpulser test call.

(e) An identifier test call.

8.10 With relay RC operated, the operation and release of relay ON1 scores the test call traffic register.

C. Attendant Identified Call Register

8.11 When an outpulser is engaged on a call that requires attendant identification, relay ID1 or ID2 is operated. At the end of pulsing the attendant identified signal to the CAMA office, relay EP operates and then releases to score the attendant identified call traffic register.

TRAFFIC USAGE RECORDER

8.12 When an outpulser is seized for a service or a test call, lead OPB- to the traffic usage recorder circuit is grounded while the outpulser is in use. When an outpulser is made busy, relay MB operates to ground lead OPMB- to the traffic usage recorder circuit.

SECTION IV - REASONS FOR REISSUE

D. Description of Changes

D.01 When option YN replaced option YM on Issue 28B of this schematic, a trouble condition would occur in the identifier if the OIT circuit was off-normal during a line verification test call. The trouble was caused by a feedback ground on the TST lead from the OIT being applied to the second identifier over a common multiple, operating relays TST1,2 falsely and causing LV test call failures. This is corrected by replacing option YN with the former YM wiring between 9F of relay TST and 6B of relay PS in FS34. The record of options YM and YN are removed from Note 104, and Note 125 is deleted. The original purpose of the former option YN is corrected by adding option ZH of Issue 19AC of SD-95810-01.

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