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SERVICE CIRCUITS DESCRIPTION
NETWORK ADMINISTRATION
1/1A ESS™

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1. GENERAL

1.01 This section describes service circuits and explains their functions to provide a background for the administration and capacity determination of a 1/1A ESS Switch.

1.02 This section is being revised to include changes in operation through 1/1A ESS generics 1E8, 1AE8. The changes to this section are extensive and, therefore, no change arrows are used.

1.03 The title for each figure includes a number(s) in parentheses which identifies the paragraph(s) in which the figure is referenced.

1.04 This section does not include administrative information on service link networks other than to note that they are manufacture discontinued and should be removed from all offices.

1.05 Service Circuits are auxiliary circuits connected through the network to lines or trunks as required. Typical service circuits are customer digit receivers, (trunk) receivers, transmitters, ringing circuits, tone circuits, announcement circuits, coin control and supervisory circuits, and conference circuits.

1.06 HILO networks require a separate set of service circuits such as transmitters, receivers, and tone circuits.

1.07 Service circuits and the frames on which they are mounted are described in Part 2. Service circuit functions and network administration considerations are described in Parts 3 through 5.

1.08 The service circuits included in this section are the traffic sensitive items that are included in the capacity determination worksheets. The method of determining capacity for these items is found in Section 231-060-130. Many call store register groups are sized based on their associated service circuit groups. Their set cards are included in Section 231-060-130.

1.09 The name of an ESS switch is determined by the processor installed, either 1 or 1A. A 1 ESS switch retrofit to a 1A processor is known as a 1A ESS switch. Service circuit functions are the same for either 1 ESS or 1A ESS.

2. EQUIPMENT ARRANGEMENT

GENERAL

2.01 Service circuits are mounted on universal trunk frames or miscellaneous trunk frames. All tone circuits are mounted on universal trunk frames. All other service circuits are mounted on miscellaneous trunk frames.

TRUNK FRAME

2.02 Both the universal and miscellaneous trunk frames now come in miniaturized version (MUT and CMT). The miniaturized versions mount only plug-in units - no hard-wired units. For description of the trunk frames, see Section 231-033-000 for the Universal Trunk Frame, Section 231-034-020 for the HILO Universal Trunk Frame, Section 231-034-000 for the Miniaturized Universal Trunk Frame, and Section 231-034-010 for the Combined Miscellaneous Trunk Frame.

BYLINK TRUNK FRAME

2.03 A second miscellaneous trunk frame provided to mount all bylink trunks incoming from step-by-step offices. The bylink trunks may be modified for use with MF outpulsing. See Section 231-090-409. Nonbylink trunks are not mounted on this frame. Additional information on the trunk types that may be mounted on the miscellaneous trunk frame is contained in the Translation Guide, TG-1A.

RECORDED ANNOUNCEMENT FRAME

2.04 Each office may be equipped with up to 16 recorded announcement frames. Each frame has six channels, one for each six announcements. With the 1E8/1AE8 generic and the 13A bubble memory announcement frame, 8 channels are available per recorded announcement frame.

2.05 For more information on recorded announcement frames refer to Section 231-070-830.

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SERVICE CIRCUIT IDENTIFICATION

2.06 Service circuits are identified with a trunk order code, trunk group number and a route index number as described below.

A. Trunk Ordering Code and Circuit Program Index

2.07 Service circuit quantities provided by the network design engineer are specified in the combined No. 1/1A ESSs (E-8056) questionnaire. In this questionnaire, service circuits are identified by a 5-character trunk order code (TOC).

2.08 The trunk order code number is described as follows:

(a) The first three characters represent the circuit schematic drawing number and identify the circuit hardware. These three characters are referred to as the circuit program index (CPI).

(b) The fourth character indicates the circuit function (outgoing, incoming, 2-way, etc) and a circuit option (ie, dial tone first) in some cases.

(c) The fifth character indicates special usage of software or hardware options (ie, circuit resistance).

2.09 Trunk Order Codes and CPI numbers may differ between the hardwired and miniaturized versions of the same service circuit. Details for TOCs and CPIs can be found in the Trunk and Service Circuit Engineering Specification J1A063A-1.

B. Trunk Group Number

2.10 A group of service circuits intended for a single purpose are assigned in translation with a unique trunk group number (TGN). Refer to Section 231-070-415, Translations Office Records, for more information.

C. Trunk Class Codes

2.11 Trunk class codes save memory for trunks in a similar manner that abbreviated class codes save memory for lines.

2.12 The trunk class code is an arbitrary 3-digit number which represents a 5-digit trunk order code plus the four translation words expressing the software features and options of a trunk or service circuit.

2.13 The trunk class code expansion table is generated by the ESS 1204. Each 5-digit order code has a preprinted form ESS 1204. For more information on the trunk class code and the trunk class code expansion table, refer to Section 231-070-415.

D. Traffic Measurements

2.14 The TGN is also used when assigning traffic measurements to service circuits. Standard trunk group measurements are provided as follows:

- **Usage (Measurement Code 000):** Measures usage of each service circuit group. Most service circuit groups should be assigned as fast scan.
- **Peg Count (Measurement Code 001):** Counts the attempts to seize a service circuit. It includes overflow scores which must be subtracted to obtain processed calls.
- **Overflow (Measurement Code 002):** Scores when an attempt to seize a service circuit fails and is routed to overflow trunk circuits.
- **Maintenance Usage (Measurement Code 006):** Measures the maintenance usage of each service circuit group.

These four measurements should be assigned on the H schedule for each equipped service circuit group. For more information, refer to Section 231-070-515, Traffic Measurements—Hourly Schedules.

2.15 Additional traffic measurements for features using particular service circuits are discussed in Part 3 in connection with the service circuit.

E. Route Index Number

2.16 In the routing of a call, the 1/1A ESS machine gains access to the specific trunk group required through a route index. All outgoing trunk groups are assigned a route index. In addition, all service circuits are also assigned a route index (RI) or a pseudo route index (PRI).

2.17 Route indexes are assigned in translation using the ESS 1303A, B and C Forms—Trunk and Service Circuit Index Record. Refer to

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TG-1A, Division 3, Section 2 for translation information.

2.18 In the translation process the route index points to the TGN. The TGN points to an outgoing trunk, service circuit or other circuit as required.

2.19 A number of service circuit route indexes are "fixed" for all offices and these are preprinted on the ESS 1303A and 1303B Forms. The fixed route indexes are listed with each service circuit in the text and also in Fig. 1.

3. SERVICE CIRCUITS

3.01 The following paragraphs describe the use of the service circuits. When the 1/1A ESS serves a Remote Switching System (RSS), the RSS uses the service circuits of the host 1/1A ESS.

TRANSMITTERS (MF, DP, RP, AND TT)

3.02 Most outgoing calls from the 1/1A ESS require a transmitter (Fig. 2.D.1) to pulse digits to another switch or mechanized operator systems such as intraprocessor trunk groups in a combined local/HILO office, the traffic service position system (TSPS). Transmitters are not required for intraoffice calls, manually handled calls, or call involving Common Channel Interoffice Signaling (CCIS). (The continuity and polarity (CP) test circuit is used in place of a transmitter for manual and CCIS calls. The continuity check circuit is used in place of a transmitter and receiver for CCIS calls.

3.03 Transmitters are available in four types:

- Multifrequency (MF)
- Dial pulse (DP)
- Revertive pulse (RP)
- Touch-Tone (TT).

3.04 All transmitters of the same type generally appear as one transmitter group termed the office pool. However, transmitters used for data appear as a separate group. Each type of transmitter is assigned a trunk group number (TGN) and is accessed via a fixed RI. The type of transmitter selected for a call depends on the characteristics of the outgoing trunk group as reflected in the translations area of program store in 1 ESS and unduplicated call store in 1A ESS.

3.05 **MF transmitters**(CPI 066) should be used when pulsing to another switch that is capable of receiving MF pulsing, TSPS, or a 90A or 90B Customer Premise System (CPS). Many Private Branch Exchanges (PBXs) and Step-by-Step (SxS) systems cannot receive MF pulsing.

3.06 If *MF transmitters* are used for data transmission (90B CPS), a separate trunk group (PRI 001) will be established for these MF transmitters.

- If a transmitter in this group is out of service, an MF transmitter will be selected from the office pool (RI 0057).
- After repair of the out-of-service transmitter, it will be used at the next 100-second pulsing interval, and the transmitter accessed from the office pool will be released.

3.07 One MF transmitter is assigned to a separate group for service observing.

3.08 *DP transmitters* (CPI 069) (RI 0058) are used when pulsing to step-by-step offices, 101 ESS, and private branch exchanges (PBXs). They can be used to pulse to other switch types when the terminating switch is equipped to accept DP.

3.09 *RP transmitters* (CPI 071) (RI 0059) should be used when pulsing to a No. 1 crossbar switch. They may be used for other type switches equipped to receive RP although this is not recommended.

3.10 *TT transmitters* (CPI 167) (RI 0061) have specialized uses. When the ESS switch is equipped with the local and HILO TOUCH-TONE outpulsing feature (LHTO), available with the 1E5/1AE5 generic and later generic programs, particular customer services use these transmitters. Section 231-090-154 describes the uses of these transmitters for the Electronic Tandem Switching feature (ETS). Section 231-090-256 describes the use of these transmitters for the trunk and foreign exchange service features. These transmitters are also used for Direct Inward Dialing (DID) where

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the customer premise equipment can accept incoming TOUCH-TONE signals.

3.11 In addition to standard measurements, a peg count of transmitter time-outs for both first trial and second trial are available. Each time a transmitter of a given type times out while waiting for a start dial signal from the distant end, a time-out register is scored for that type transmitter. This same register will also score if interdigital or overall timing is exceeded in the case of overlap outpulsing.

3.12 Calls requiring a transmitter are routed to regular overflow tone (RI0080) when no transmitter of the required type is available.

3.13 If an office is equipped with a HILO network, another set of transmitter groups is provided for the HILO trunks. HILO does not support RP transmitters.

3.14 The HILO transmitters have characteristics similar to the 2-wire transmitters with the exception of the TOUCH-TONE transmitter. The TOUCH-TONE transmitter is used for Enhanced Private Switched Communications Service (EPSCS). See Section 231-190-127 for a description of EPSCS. See Section 231-190-134 for a description of off-network calling using TOUCH- TONE and dial pulse outpulsing (ONTTDP) capability for EPSCS subscribers. This transmitter will outpulse DP as well as TOUCH-TONE if required on th same call. Each transmitter group is assigned a TGN and a PRI.

3.15 Transmitters are mounted on miscellaneous trunk frames. For more details on the use of transmitters for special features, see Section 231-060-220.

RECEIVERS (MF, RP, DP, AND TT/DP)

3.16 Most incoming calls require a receiver to accept digits from another office. Receivers are available in four types: MF, RP, DP, and TT/DP. The type of receiver selected for a call depends on the pulsing to be received from the other office as reflected in the trunk translation. Step-by-step dial pulses are received via a bylink trunk circuit and stored in software, rather than via a receiver circuit. Figure 3.A illustrates the use of the receiver on an incoming call.

3.17 When an incoming call is detected through the scanning of interoffice trunks, the central control selects the proper type of receiver as reflected by pulsing requirements in the trunk translation. Central control connects a trunk receiver to the incoming trunk via trunk-to-trunk junctor (Fig. 3A). After the complete number is collected, it is stored in call store, and the receiver is released.

3.18 Incoming calls from a non-senderized step-by-step office do not require a receiver. The functions of the receiver are performed by the bylink trunk circuit and bylink junior and senior registers. See Section 231-070-430 for more information.

3.19 *MF receivers* (CPI 065) (RI 0065) (office pool) may be used to receive MF pulses from switches equipped to send MF signalling. A call store queue (set card MFQ) preserves the order of arrival when all circuits are busy. The queue size is one per MF receiver circuit.

3.20 If the switch is used as a centralized automatic message accounting (CAMA) serving office, an additional group of MF receivers must be provided. One MF receiver is provided for each occupied CAMA operator position including CAMA positions at TSPS. The MF receiver group for CAMA is assigned to RI 0161.

3.21 The Signaling Irregularities (SIGI) feature is available as an optionally loaded feature group in the 1E6/1AE6 generic programs. Its purpose is to combat electronic toll fraud perpetrated by the transmission of extraneous MF signals generated by illegal signaling devices. A separate (distinct from the office pool) MF receiver trunk group of modified MF receivers is required for SIGI observations on 2-wire outgoing trunks. These modified receivers (SD-1A246-01 with R option) are associated with PRI 064 and also may be equipped with the Q option for detecting mutilated digits. Refer to SL 79-08-016 for detailed information on the SIGI optional feature.

3.22 MF receivers are ordered as a single group; therefore, the traffic engineer should inform

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the network administrator of the number of receivers to be assigned in each trunk group. Do not include the MF receivers assigned to other than the office pool in the MF receiver capacity.

3.23 *RP receivers* (CPI 070) (RI 0067) may be used to receive pulses from switches equipped to send RP. In most 1/1A ESS offices, RP usage is declining because of the reduction or elimination of those end offices using RP. A call store queue (set card RPQ) preserves the order of arrival when all circuits are busy. The queue size is one per RP receiver circuit.

3.24 *DP receivers* (CPI 068) (RI 0066) may be used to receive pulses from switches equipped to send DP except non-senderized SxS offices. At least two dial pulse receivers are required for plant testing even if there is no traffic requirement. A call store queue (set card DPQ) preserves the order of arrival when all circuits are busy. The queue size is one per DP receiver circuit.

3.25 *TT/DP receivers* (CPI 029) (RI 0147) are used for calls from incoming tie trunks, tandem tieline cut-through distant office (TTLCT-DO) trunks and Electronic Tandem Switching (ETS) incoming tie trunks. Further details concerning the use of these receivers may be found under Tandem Tieline Cut-through Circuits in paragraphs 3.84 through 3.96 of this section. A call store queue (set card TQQ) preserves the order of arrival for service when all circuits are busy. The queue size is one per TT/DP trunk receiver circuit.

3.26 If an office is equipped with a HILO network, another set of receiver groups is provided for the HILO trunks. Revertive Pulsing receivers are not supported in the HILO.

3.27 Receiver performance may be monitored via the receiver attachment delay report (RADR). The RADR feature simulates a test call requiring a receiver every four seconds. Counts are kept on test calls and of the number of failures by receiver type on a total office basis. A failure is a call that did not attach a receiver within three seconds. The RADR feature generates an output report similar to that of the dial tone speed test. For a detailed description of RADR, see Section 231-090-309.

3.28 For more details on the use of trunk receivers, see Section 231-060-220.

RINGING CIRCUITS

A. Regular Ringing Circuits

3.29 Regular ringing circuits (CPI 061) are used to provide power ringing to 1- and 2-party lines in the host office and to all parties in an RSS when a call is terminated to the line. In order to provide prompt start of ringing, the 1/1A ESS switch furnishes three phases (cycles) of ringing. Each phase provides ringing for a 2-second interval and silence for a 4-second interval. The three phases provide ringing in three consecutive 2-second intervals. As a result, one of the three phases is always in a ringing state. The total number of ringing circuits required is divided equally among the three ringing phases. The 1/1A ESS switch will always attempt to connect a call to the ringing phase nearest to the start of its ringing period. If no ringing circuit is available in that phase, the attempt will route advance to the next phase. After all three phases have been tested, the machine routes the call into a queue. Figure 4 illustrates this procedure as well as the route indexes (RIs) used for the three trunk groups representing the three phases.

3.30 In a 1ESS switch, the regular ringing queue (set card RRQ) is based on the number of regular ringing circuits provided in an office (recommended maximum of 41 queuing registers for all offices with 120 or more regular ringing circuits). In a 1A ESS switch, 41 queuing registers are always provided. The arrangement is intended to preserve first in--first out service for calls requiring regular ringing circuits. If any calls are already in queue, all new calls enter queue before being served. A call will not come out of queue until a ringing circuit becomes available. The call goes from the queue directly to the available circuit regardless of the ringing phase of the circuit. It does not route advance from one phase to another.

3.31 If a call has routed through all three phases and finally to queue, it will have scored a peg count and an overflow in each phase. When the call is served after leaving the queue, an additional peg count is scored. Thus, a single call in this

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situation could cause four peg counts and three overflows.

3.32 It should be noted that during overload conditions, if any regular ringing circuits are made busy for maintenance, some calls that overflow through all three phases will not route to queue. Rather, they will route to overflow tone. This is because a call actually queues for a regular ringing register (set card NRR) rather than for a regular ringing circuit. Since regular ringing registers are provided in amounts equal to the number of regular ringing circuits, it is possible to obtain a register and not be able to access the associated circuit if it is out of service. Not being able to access a regular ringing circuit in this case will cause the call to be routed to common overflow tone (RI 0081).

3.33 Beginning with the 1E6/1AE6 generic programs, 1/1A ESS switch may serve as host to one or more Remote Switching Systems (RSS). In this application, regular ringing circuits are used on all calls to RSS lines that require any type of ringing. Along with calls to 1- and 2-party lines, they are also used for calls to 4- and 8-party lines, reverting calls, call-forwarding calls, and for on- or off-hook ringback calls. The regular ringing circuit does not provide ringing current to the line; however, it is used for line supervision and line testing functions. The ringing current is provided by the universal service circuit at the RSS.

3.34 Ringing circuits may be provided for serving normal loop or long loop conditions (>1500 ohms). Normal loop circuits, zone 13 circuits, now rated Additions and Maintenance only (A&M) are not compatible with the original plug-in type long loop circuit, zone 16 circuits. Where zone 16 circuits are employed, all zone 13 circuits required replacement. A new long loop circuit, zone 15, has replaced the zone 16 circuit. When zone 15 circuits are used, zone 13 circuits may be modified to be compatible.

3.35 Regular ringing circuit usage data is reported for each of the three phases. However, the circuit requirements are determined by using the total usage data. The resultant number of circuits required is rounded up to a multiple of 3 since each phase should have an equal number of circuits assigned to the trunk group.

B. Special Ringing Circuits

3.36 Special ringing circuits (CPI 072) provide power ring for the following:

- 4- an 8-party lines
- Reverting calls
- Call forwarding-variable calls
- On- or off-hook operator ringback calls
- Coded ring for Automatic Call-Back Call (ACBC) feature calls
- Coded ring for Distinctive Ringing/Distinctive Call Waiting Tone (DRNG) feature calls and Distinctive Alert
- Distinctive ringing for Electronic Tandem Switching (ETS) Ringback Queuing (RBQ) feature calls
- Circuit Switched Digital Capability (CSDC) loop testing.
- Ringback ringing for Local Area Signalling Services (LASS) feature (1AE9)
- Home intercom (HI) feature (1AE8A)

Special ringing circuits are not used for any of these calls that terminate to RSS lines (see regular ringing circuits). Two dedicated groups of special ringing circuits are required for Individual Customer Line Identification feature in 1AE9.

3.37 Four-party power ringing can be provided in one of two ways, AC/DC or superimposed-fully selective, as specified by the engineer in the equipment questionnaire. With AC/DC ringing, two or the four parties can ring simultaneously, but each has a different ringing code to identify the party to which the call is directed. Both parties hear the same ring, but only the party to which the ringing code is assigned should answer. If 4-party ringing also is superimposed-fully selective, only the party to which the call is directed receives ringing, and no coded ringing is provided.

3.38 Eight-party ringing can be provided only as superimposed-semiselective. Two of the

eight parties ring simultaneously, but only the party to which the ringing code is assigned should answer. Therefore, if an office has 8-party service but does have 4-party service, superimposed ringing may be provided. Superimposed ringing requires a separate ringing plant, at additional cost. It is therefore recommended that 4-party lines have AC/DC ringing when on 8-party service is present. Figure 5 shows the association of party number to ringing selection.

3.39 Reverting calls (Fig. 6) occur when one party of a party line (2, 4, or 8) attempts to dail a party on the same line. Reverting calls (Fig. 6) require the use of a special ringing circuit from the time the calling party goes on-hook after receiving busy tone until either party goes off-hook. The called party goes off-hook to answer the call, while the calling party goes off-hook to trip ringing in case of no answer.

3.40 Calls that are forwarded using the call forwarding-variable feature require the use of special ringing circuits. A half-second burst of special ring is applied to the called station to indicate that all calls are being forwarded. No special ringing of the called line is required if calls are forwarded using remote call forwarding, call forwarding-busy line, or call forwarding-don't answer. Special ringing circuits are also used when an operator or 911 agent attempts to ring back a station.

3.41 Beginning with the 1E/1AE6 generic programs, the Automatic Call-Back Call (ACBC) optional feature is available for centrex (CTX)/ESSX customers on a per station basis. It allows a station, that encounters a busy on an intragroup call, to dial a predefined code requesting the ESS to monitor the busy/idle status of the called line, notify the caller when the called line becomes idle, and complete the call. The ESS stores the calling line equipment number (LEN) and the LEN and directory number of the called line, and monitors the status of both stations are idle, coded ringing (400 ms on, 200 ms off, 800 ms on, 4 seconds off) is applied by the special ringing circuits to the originating (activating) station. Upon answer, the ESS automatically places the call to the called station.

3.42 Special ringing circuits are used for coded ringing with the Distinctive Ringing/Distinctive Call Waiting Tone feature (DRNG/DCWT) first available with the 1E6/1AE generic program. DRNG/DCWT is a CTX/ESSX feature that allows designated stations to determine the source of a terminating call by the application of a coded ringing signal or call waiting tone. Call sources are categorized into three classes, and each class is associated with a distinctive ringing or tone pattern (Fig. 7).

3.43 Among the group of features offered with Electronic Tandem Switching (ETS) to CTX/ESSX customers (1E6/1AE6 generic programs) is ringback queuing (RBQ). The user goes on-hook when all facilities are busy and is called back when a facility becomes available. When the facility does become available, it is reserved, and distinctive ringing, via special ringing circuits, is applied to the calling station. Upon answer, the calling station is connected to an announcement or music while the called number is outpulsed.

3.44 The Circuit Switched Digital Capability (CSDC) feature may place additional usage on the special ringing circuits. during CSDC loop testing, a special ringing circuit is connected to the CSDC loop to send coded ringing signals to activate the digital loopback circuit in either the near end terminal (NET), far end terminal (FET), or dataport (DP) under test. In the case of the Network Circuit Terminating Equipment test (NCTE), the special ringing circuit is connected briefly for a loop leakage test, even though a coded ringing signal is not required for this test.

3.45 Special ringing circuits are provided with a call store queue (set card SRQ) in the same manner as regular ringing circuits.

REVERTING CALL

3.46 *Reverting number machine handled circuits* (CPI 078) are used to connect a party-line subscriber to another subscriber on the same line or for the HI feature in generic 1AE8A. No automatic message accounting (AMA) record of this call can be made. Therefore, the originating party must have flat rate class of service. Otherwise, the call must be handled by an operator using an

operator trunk.

3.47 The calling party goes off-hook and seizes a CDR (Fig. 6A). The calling party then dials the number of the party station and receives busy tone (Fig. 6B). The calling party hangs up, and a special ringing tone is applied to both the calling and called parties (Fig. 6C). If the calling party does not hang up, the busy-tone circuit times out after 24 seconds and dial tone is returned to the calling party.

3.48 While special ringing is applied to both parties, a reserved talking path is set up to a reverting circuit (Fig. 6C). When the called party answers, ringing is stopped to both parties, and the path to the reverting circuit is connected (Fig. 6D). The calling party then goes off-hook to complete the connection (Fig. 6E). If the called party does not answer, the calling party does not answer, the calling party must go off-hook to stop ringing.

CUSTOMER DIGIT RECEIVERS

3.49 The main function of the CDR is to provide dial tone and to collect the digits dialed. On an originating, outgoing call, the circuit is held until all digits are outpulsed by a transmitter. See (Fig. 2.D.1) for a schematic of this connection. In the case of an intraoffice call, the circuit is held until ringing starts. Figure 2.A and 2.B or 2.C illustrate this network connection.

3.50 The hard-wired CDR (TOC 06370) is a two circuit unit mounted on a miscellaneous trunk frame (MT). The basic circuit provides for rotary dial service and is denoted dial pulse (DP). TOUCH-TONE service is provided by adding a pair of TOUCH-TONE calling detectors to the basic unit. The circuit then becomes CPI 064. The TOUCH-TONE calling detectors associated with the basic CDR unit must be mounted adjacent to the basic unit on the same frame. The plug-in version of the CDR (TOC 06301) is a single circuit unit mounted on a combined miscellaneous trunk frame (CMT). The shelf above the basic CDR unit is always reserved for an associated TOUCH-TONE calling detector.

3.51 A CDR is connected to a customer line in the following manner:

(1) During line scan the customer request for dial tone is detected.

(2) Central control (CC) translates the customer LEN into the type of CDR required.

(3) CC selects a CDR group via a route index and then selects an idle CDR in that group. An idle path is selected from the network map.

(4) If a CDR and a network path are available, the CDR is connected to the customer line and the dial tone signal is activated. The CDR is ready to monitor the digits dialed.

(5) Dial pulses are counted and recorded in the software junior originating register associated with the CDR.

(6) Digits dialed are stored in an originating register in software.

3.52 In a 1ESS switch, when a dial tone request is detected during line scan, it is placed in the line service request hopper (LSRH) and is then assigned to an idle CDR. The LSRH is found in software, set card LRH. Prior to generic 1E6, the calls in the LSRH were served on a first-in, first-out basis. If there were no idle CDR available, the call was placed in a CDR queue until a CDR became available. In a 1A ESS switch prior to generic 1AE6, there was no LSRH (dial tone service provided directly from line scan) and there was a CDR queue.

3.53 With generic 1E6 and later, the improved overload strategy (IOS) feature is introduced. The LSRH is enlarged, service is on a last-in, first-out basis. With the implementation of IOS in generic 1AE6, an LSRH is established with last-in, first-out servicing from the LSRH as CDRs became available, and the CDR queue is removed.

3.54 In both the 1 and 1A ESS the dial tone operation with IOS is as follows:

When all CDRs are busy, the dial tone attempt will overflow to a queue in call store; set card QCDS for a DP attempt or set card QTTS for a TT attempt. After one dial tone attempt from the LSRH is placed in queue, the LSRH will not attempt to find an idle CDR until the CDR queue is empty. The CDR queue may contain more than one dial tone

attempt waiting for a CDR only when the other attempts waiting for a CDR were created by delayed second dial tone attempts that do not originate from the LSRH. Example of second dial tone attempts are call transfers, three-way calling, etc. Thus, the LSRH becomes the main "queue" for dial tone requests recognized through line scan. All attempts that have been waiting 30 seconds in the LSRH are pushed out and returned to line scan. If the LSRH is full and a new dial tone request is detected during line scan, the oldest entry in the LSRH will be pushed out to make room for the new entry.

3.55 With IOS the traffic engineer determines the size of the LSRH for 1/1A ESS switch. See the feature document Sections 231-090-195 and 231-070-806 for more details on IOS for both 1 and 1A ESS switches.

3.56 With IOS, the LSRH becomes an important indicator of CDR provisioning since the LSRH effectively becomes the queue for the CDRs. The following are the LSRH measurements:

- LSRH Overflow - The TMC 5, EGO 596 measurement is an overflow count (for the LSRH), which counts the number of times the oldest entry in LSRH was removed (pushed out) to make room for a new entry.
- LSRH False Start Peg Count - The TMC 5, EGO 604 measurement is a peg count of false starts from the LSRH, which indicates the number of LENs found on-hook after being removed from the LSRH.
- LSRH Off-Hook Peg Count - The TMC 5, EGO 609 measurement is a peg count of the number of lines found off-hook after being removed from the LSRH due to 30-second time-out.
- LSRH On-Hook Peg Count - The TMC 5, EGO 610 measurement is a peg count of the number of lines found on-hook after being removed from the LSRH due to 30-second time-out.

These traffic measurements are printed as part of the TC15 output message.

3.57 When a 1/1A ESS switch acts as host for a remote switching system(s) [RSS(s)], the RSS uses the service circuits of the host ESS switch. Dial-tone service is obtained from the TOUCH-TONE service CDRs of the office. With generics 1E7/1AE7, an RSS dial-tone delay improvement arrangement is instituted. Two RSS voice channels are always preconnected to two CDRs in the ESS switch. These preconnected voice channels are first choice for the RSS dial tone request. When one of these preconnected channels is seized for dial-tone use, another channel is preconnected to a CDR.

3.58 TOUCH-TONE service CDRs are provided for testing purposes. With the introduction of generic 1E7/1AE7 and the Remote Trunk Test Unit (RTTU) feature, additional CDRs are required.

3.59 When TOUCH-TONE service main stations (host + RSS) represent 80 percent of the total main stations (host + RSS) in an office, 100 percent of the CDRs should be equipped for TOUCH-TONE service. In all other cases, three-group operation is recommended. Three-group operation consists of:

- A first route DP CDR group for rotary dial service
- A first route TOUCH-TONE service CDR group
- An overflow group for DP and TOUCH-TONE service groups--this group is equipped for TOUCH-TONE service and may also be used for rotary dial service.

3.60 When CDRs are assigned in three trunk groups: dial pulse group, TOUCH-TONE group and a combined TOUCH-TONE, dial pulse (overflow) group. Route index 0077 is reserved for a DP only trunk group. Route index 0078 is provided for the TOUCH-TONE group. Route index 0076 is reserved to handle the overflow for both the DP and TOUCH-TONE groups. Refer to Fig. 8 for the CDR hunting configuration.

3.61 Prior to 1E6/1AE6 and the IOS feature, if no CDRs are available in the overflow group, a new call enters a call store queue (DP or TT). No new call can be served prior to serving a call in queue. If any calls are already in queue, a new call enters queue (DP or TT) and is served on a first in-first out basis. A call is removed from the queue

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when an idle circuit is found or when the call is abandoned. See paragraph 3.54 for the queue operation with IOS.

3.62 The traffic engineer is responsible for determining:

- the quantity of CDRs
- the type CDRs - dial pulse vs. Touch-Tone
- the configuration of the CDRs - single or three-group
- size of the LSRH.

The quantity of CDRs by type and their CCS capacity are shown in the traffic order. The size of the LSRH is shown and the CDR queue(s) may be found in the latest Parameter Data Assembler run as quantities for the following set cards:

- LRH Set Card: for LSRH
- QCDS Set Card: for CDR-DP queue 1E6/1AE6 and later
- CDQ Set Card: for CDR-DP queue prior to 1E6/1AE6
- QTTS Set Card: for CDR-TT queue 1E6/1AE6 and later
- TTQ Set Card: for CDR-TT queue prior to 1E6/1AE6.

3.63 The CDR offered CCS, DP versus TOUCH-TONE service, may vary throughout the life of a job. When TOUCH-TONE service development is rapid between cutover and the end of the engineering period (EOP), the CDR requirements - DP versus TOUCH-TONE service - must be studied for several points during the engineering period. The network administrator is responsible for the interim job CDR configurations; consultation with the traffic engineer is advisable.

3.64 Referring to the hunting arrangement between the individual CDR groups, CDR overflow group and the CDR queue in Fig. 8, the traffic measurements are sequenced as follows:

(1) Each dial tone request is initially scored as a peg count on the initial DP or TT-CDR group.

(2) If the DP or TT-CDR group is busy, the overflow register is scored in the initial group and the peg count is also scored on the OFL-CDR group.

(3) If the OFL-CDR group is busy, the overflow register is scored for the OFL-CDR group and the request is placed in queue.

(4) Prior to 1E6/1AE6 with IOS, if all circuits are busy and the queue is full, the peg count and overflow registers are scored in both the initial and overflow CDR groups by the next dial tone attempt. Then the dial tone request is abandoned. With 1E6/1AE6 and later, this registration is unlikely to occur since the LSRH will not hunt an idle CDR as long as there is one dial tone request in queue.

The inflation of CDR peg counts during overload conditions is virtually eliminated with IOS. All abandoning of initial dial tone requests takes place from the LSRH.

3.65 A separate group of TT CDRs is provided for maintenance purposes. The CDRs provided for maintenance operations are dedicated to maintenance. This group overflows to the subscriber TOUCH-TONE CDR group. Prior to generics 1E7/1AE7, one TOUCH-TONE CDR was provided for the Master Control Center (MCC) test function. With the advent of generics 1E7/1AE7, it is recommended that a TOUCH-TONE CDR be provided for each test panel, Tieline Test Panel (TLTP), Master Trunk Test Panel (MTTP), Supplementary Trunk Test Panel (STTP) and each remote trunk test unit (RTTU). There is a maximum of 16 RTTUs per office.

TONES AND ANNOUNCEMENTS

3.66 Various tones and announcements are employed to indicate the progress of call to the telecommunications user.

3.67 Tone circuits (CPI078) are mounted on universal trunk frames. These circuits may also be used for barge-in announcements. The variations in tone types are obtained through cross-connection to the Ringing and Tone Frame. Each tone trunk group is assigned a TGN and an RI. This circuit is also used for Remote Office Test-Line

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(ROTL) access ports.

3.68 There are several types of announcement circuits all mounting on a miscellaneous trunk frame. The most common announcement CPI is 079. The CPI 079 circuits have three main options:

- no cut-through to operator
- cut-through to operator after announcement
- cut-through to operator with audible ring after announcement.

All CPI 079 circuits provide audible ring prior to the start of the announcement. This ringing does not require an audible ring tone circuit.

3.69 The coin overtime and partial dial announcement is CPI 080.

3.70 Each announcement trunk group requires a TGN and an RI. For details on the recorded announcement frames, see Section 231-070-830.

COIN CIRCUITS

3.71 The coin feature in 1/1A ESS switch provides station telephone service using a coin telephone set. The ESS switch can support coin first stations and dial-tone-first coin stations from the same central office. The coin circuits that support the coin feature include coin control circuits (CPI 059), coin zone circuits (CPI 010), and local coin overtime circuits (CPI 014). RSS uses the host coin circuits with exceptions as noted below. For a detailed description of the coin feature, see Section 231-090-095.

3.72 A *coin control circuit* (CPI 059, RI 0116) is connected to the coin line at some stage of every coin call.

(a) The initial deposit is refunded at disconnect on a noncharge or nonanswered local call. It is refunded also on operator answer on a toll switchboard if arrangements have not been made to retain the initial deposit.

(b) The initial deposit is collected at disconnect on a charged local call without overtime, or near the end of the initial period of a local call with overtime.

(c) The coin control circuit is connected to test for overtime deposit at the end of the initial and each overtime period. In generics prior to 1E5/1AE5, if no coin is found, the line is connected to a coin-absent (CPI 014) circuit.

(d) Deposits for overtime are collected near the end of an overtime period or on a disconnect before expiration of the period.

(e) If no coin is detected on a collect attempt or if a coin is still present following a collect attempt, the line is disconnected from the coin control circuit and is connected to a coin-absent circuit.

(f) If a coin is still present following a refund attempt, the line is disconnected from the coin control circuit and reseizes a CDR.

(g) The coin control circuit is also connected to a coin line upon disconnect of an incoming call.

Figure 9 illustrates the network connection for a coin control circuit in the main switch. Figure 10 illustrates the connection of the coin control circuit for RSS coin lines.

3.73 *Coin zone circuits* (CPI 010, RI 0124 through 0127) are provided for operator identification for charging purposes of the zones from which coin calls originate. Up to four coin zones are available, each with a separate trunk group. Each trunk group may be equipped with up to eight rate lamps to indicate the initial rates to the coin zone operator. RSS coin lines are not compatible with smart coin zone trunks. Figure 11 illustrates the network connections for a coin zone call in the main switch. Figure 12 illustrates the network connection for an RSS coin zone call.

3.74 *Local coin overtime circuits* (CPI 014, RI 0120) are used when local coin calls are timed and must be routed to an operator for collection of overtime charges in generic 1E5/1AE5 and earlier.

CONFERENCE CIRCUITS

3.75 Conference circuits permit connections among three through six parties. There are two types of conference circuits, three-port and six-port.

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A. Three-port Conference Circuits

3.76 The three-port conference circuit is the most commonly used circuit. A single group of 3-port conference circuits (CPI 043) (RI 0133) is provided for the following features:

- Three-way calling
- Call waiting
- Centrex-CO and MVP transfer calls
- Incoming PBX-CO calls
- Centrex-CO attendant camp-on
- Centrex-CO busy verification
- Six-port conference setup for station dialed conference
- Centrex-CO and MVP call hold
- Local coin overtime announcement.
- Centrex directed call pick-up with barge-in
- Centrex conference calling assist
- RSS coin intraoffice
- EPSCS-Network Attendant.

3.77 Usage, peg count, and overflow measurements are available for the group of three-port conference circuits. In addition usage and peg count measurements are provided for each of the features contributing traffic to the three-port conference circuits. All measurements, three-port and feature, should be scheduled for both the three-port conference circuit busy hour as well as the individual feature busy hour. Refer to Section 231-060-130 for the capacity determination of three-port conference circuits, Section 780-200-116 and TG1A Division 2 Section 4a for feature descriptions.

3.78 When an office presently equipped with conference circuits per SD-1A189 - CPI 073 (now Manufacture Discontinued) and additional circuits are required, the conference circuit per SD-1A284 - CPI 043 may be added using a separate Trunk Group and another nonfixed Route Index. RIO133 will then alternate route to the Route Index of the second group of circuits.

3.79 Figure 13 illustrates the use of the three-port conference circuit when employing the call waiting feature.

B. Six-port Conference Circuit

3.80 Six-port conference circuits (CPI 044) are used by centrex-CO customers who require four to six conferees on a call. Since the groups of circuits are provided per customer, the route indexes are nonfixed. The feature may be provided either as attendant controlled or as station controlled. If the feature is attendant controlled, only two 6-port conference circuits per centrex console may be assigned. If the feature is station controlled, any number of 6-port conference circuits may be assigned to a centrex-CO customer. A centrex-CO customer may have both station dialed conference and attendant dialed conference.

3.81 Six-port conference circuits do not have a fixed route index and are not put in a pool accessible by all centrex customers in an office. Each group of circuits dedicated to a particular customer are assigned a trunk group number and route index.

3.82 If the feature is attendant controlled, only five conferees can be connected on a conference circuit simultaneously. The sixth leg of the circuit is used by the attendant to set up the call and, therefore, cannot be used for a conferee. If the feature is station controlled, the exclusion of a new conferee from the conference is done with a 3-port conference circuit, thus allowing the use of all six ports of the circuit for conferees.

3.83 Figure 14 depicts the sequence of network connections required to establish a station dialed conference call.

(a) Going off-hook (Fig. 14A)

(b) The controller dials a 1XX access code, which reserves a talking path (Fig. 14B) to a 6-port conference circuit.

(c) A reserved path is set up from the first conferee (outgoing trunk) to the 6-port conference circuit (Fig. 14C).

(d) After the first conferee answers, both the conferee and the controller are connected to

the 6-port circuit via their respective reserved talking paths (Fig. 14D).

(e) When the controller flashes the switchhook (Fig. 14E), the controller is connected to a CDR, a path is reserved to a 3-port conference circuit, and the original path between the controller and the 6-port circuit is reserved.

(f) When the controller dials the second conferee (Fig. 14F), a path is reserved between the 3-port circuit and the second conferee (outgoing trunk).

(g) Upon answer by the second conferee (Fig. 14G), the reserved path between the second conferee and the 3-port circuit is connected, the reserved path between the controller and the 3-port circuit is connected, and a path between the 3-port circuit and the 6-port circuit is established. This path is bridged so that the second conferee and the controller are not yet able to confer with the first conferee.

(h) When the controller flashes the switchhook (Fig. 14H), the controller and the second conferee are connected to the first conferee via the 6-port conference circuit, and the 3-port circuit is disconnected.

(i) When the controller flashes the switchhook again (Fig. 14I), a path between the controller and a CDR is established, a reserved path between the controller and a 3-port conference circuit is connected, and the original path between the 6-port circuit and the controller is reserved.

(j) During ringing of the third conferee (Fig. 14J), reserved paths are established between the 3-port circuit and the 6-port circuit and between the 3-port circuit and the third conferee.

(k) Upon answer of the third conferee (Fig. 14K), the three reserved paths to the 3-port circuit are connected. However, the path between the 3-port and 6-port circuits is bridged, thus excluding the third conferee and the controller from the conference.

(l) When the controller flashes the switchhook again (Fig. 14L), the controller and the third conferee are connected to the 6-port conference circuit, the 3-port circuit is disconnected, and a 4-way conference is established.

Two additional conferees may be added to the conference in the same manner described for either the second conferee (interoffice) or third conferee (intraoffice).

TANDEM TIELINE CUT-THROUGH CIRCUITS

3.84 Tandem tieline cut-through allows calls on tie trunks to be switched through several offices, with the calling party having direct control over routing the call. The calling party establishes a tandem tie line path by calling the proper codes for each leg of the call. Call progress is indicated to the calling party by dial tones.

3.85 Tandem tie line networks generally are comprised of step-by-step switches using dial pulse operation which:

- Cut through to the next office over tie trunks determined by the first few digits (access code) received
- Do not receive, send, or reconstruct subsequent digits (senderized)
- Permit subsequent offices to return tones through the office switched path to the caller.

3.86 Tandem tieline cut-through is available in either a senderized or a nonsenderized mode.

3.87 The senderized mode, provides service within the following restrictions to tandem tie line traffic.

(a) The total number of digits to be outpulsed must not exceed 12.

(b) A time-out mode to permit a variable number of digits to be outpulsed over the same trunk group; however, the number of digits must not exceed 12.

(c) Only two dial tones are available. The second optional dial tone may be returned immediately after the access digits, since there is no control of outpulsing after the required start

signal and after the transmitter begins pulsing to the next office.

(d) A distant office TOUCH-TONE station in the tandem tie line network cannot be served unless a conversion to dial pulse was continuously provided for all digits after the access code was dialed.

3.88 The nonsenderized mode provides service with the following features to tandem tie line traffic.

(a) Receive digits on a TOUCH-TONE or dial pulse basis and transmit only on a dial pulse basis.

(b) Receive/transmit an unlimited number of digits when handling a tandem type of call.

(c) Receive/transmit a variable number of digits (mixed traffic) on a given trunk group.

(d) Interrupt digit transmission an unlimited number of times upon receipt of stop dial or subsequent dial tone from other offices.

(e) Allow dial tone to return to the calling station as well as returning dial tone when stop dial signal or intermediate dial signal is used in lieu of dial tone from the next office.

(f) Always return second dial tone after access code from tandem tie line cut-through circuit or from the next office.

(g) Permit digit receiving to lead digit transmission (after access code) by a maximum of 12 digits.

(h) Allow for variable timing to detect end of dialing

(i) Transmit all digits as they are received (no additions, deletions, or conversion of digits).

(j) Route a call to overflow tone is an answer is detected prior to completion of digit transmission.

3.89 Tandem tieline cut-through calls may be either local originating (centrex station or attendant) or distant office originating.

A. Local Originating Circuit

3.90 A tandem tieline cut-through call originating (CPI 027) (RI 0148) from a centrex station is processed in the same manner as any other originating call until receipt of the access code.

3.91 Figure 15 depicts the sequence of network connections required to establish a tandem tie line cut-through local originating call.

(a) After going off-hook, a CDR is attached to the originating CTX station (Fig. 15A). The originating station then dials a tandem tie line cut-through access code. The digit interpretation program identifies the access code as a tandem tie line local origination requiring cut-through service.

(b) The existing connection to the CDR is released; the station is connected to the CDR portion of a tandem tie line cut-through service circuit (CPI 027) (Fig. 15B), and second dial tone is returned to the station. The DP transmitter portion of the tandem tieline cut-through circuit is attached to a tandem tie line outgoing trunk, and a reserved talking path is set up between the originating station and tandem tie line outgoing trunk.

(c) After all digits have been outpulsed, the tandem tie line cut-through service circuit is released, and the reserved path from the centrex station to the tie trunk is established for conversion (Fig. 15C).

B. Centrex-CO Attendant Originating Circuit

3.92 A tandem tieline cut-through call originating (CPI 042) from a centrex attendant follows normal processing for an attendant call.

3.93 Figure 16 depicts the sequence of network connections required to establish a tandem tie line cut-through centrex-CO attendant originating call.

(a) A path is established from the destination port of the attendant loop to a CDR, dial tone is provided to the attendant, and digit collection is initiated (Fig. 16A).

(b) After the access code has been translated and the program identifies the code as a tandem tie line cut-through call, the program releases the existing connection from the attendant loop to the CDR; the attendant destination port is connected to the CDR portion of a tandem tie line cut-through service circuit and second dial tone is returned to the attendant. The transmitter portion of the tandem tie line cut through service circuit is connected to a tie trunk of the selected trunk group, and a reserved path is set up between the attendant loop port and the selected tie trunk (Fig. 16B).

(c) After all digits have been outpulsed, the tandem tie line cut-through service circuit is released, and the reserved path from the attendant loop destination port to the tie trunk is established for conversation (Fig. 16C).

C. Distant Originating Circuit

3.94 With tandem tieline cut-through distant office originating (CPI 028) (RI 0149), the incoming call on a tie line is recognized by the supervisory scan of the trunk circuit ferrods. Translation of the scan points directs the program to establish a connection from the incoming tie line to a trunk DP receiver.

3.95 Figure 17 depicts the sequence of network connections required to establish a tandem tie line cut-through distant originating circuit.

(a) If the incoming call is received via a trunk group that can carry either TOUCH-TONE or dial pulse, the trunk tieline is connected to a trunk dial pulse receiver with a TOUCH-TONE applique attached (Fig. 17A).

(b) Upon receipt of the access code identified as tandem tieline cut-through, the trunk dial pulse receiver circuit or TT/DP receiver is released. The incoming tie trunk is connected to the receiver port of the tandem tieline cut-through service circuit and the transmitting port is connected to the tie trunk of the selected trunk group. A reserved path is set up between the incoming tie trunk to the tie trunk of the selected trunk group (fig. 17B).

(c) After all digits have been outpulsed, the tandem tie line cut-through service circuit is released, and the reserved path from the incoming tie trunk to the tie trunk of the selected trunk group is established for conversation (Fig. 17C).

3.96 Changes in the 1E6/1AE6 generic programs provide for an improved tandem tieline service (11XX). These changes consist primarily of modifications of the tieline trunk circuits and the TTLCT circuit.

CONTINUITY CHECK CIRCUITS

3.97 The continuity check circuit is used primarily for CCIS applications, local or toll, and direct signaling features such as INWATS Originating Serving Office (OSO). Unlike inband single-frequency/multifrequency signaling, CCIS does not pass signals for calls routing over the voice channel. Thus, trunk failures cannot be detected by the loss of supervision. To determine that the voice path continuity and transmission levels are acceptable, continuity checks are required during call set up. A continuity check consists of passing a tone (or tones) between switching offices as each link of the call is connected. The outgoing continuity check is canceled fifty percent of the time to save real time when the system is under heavy load. In 1/1A ESS 2-wire switches, this tone is provided and detected by continuity check circuits. This circuit is used as a transceiver during outgoing calls and as a transponder for incoming calls.

3.98 Continuity check circuits are provided for traffic, service protection, and for carrier failure (software Carrier Group Alarm). Fixed RI 0062 is used for continuity checks of the voice path of outgoing trunks. Fixed RI 0070 is used for the continuity check of the voice path on incoming trunks.

CONTINUITY AND POLARITY TEST CIRCUITS

3.99 Continuity and polarity (CP) circuits (CP1 082) serve both maintenance and traffic functions as follows:

- The CP circuits used for maintenance diagnostics and maintenance spare require up to eight

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circuits (RI 0129) per office.

- The CP circuits used for traffic on trunk groups where no outpulsing is performed (RI 0056) require circuit quantities based on traffic usage. Example: Centrex manual tie trunks and HILO intraprocessor trunks.

3.100 In order to provide independent capacity and traffic measurements for CP-maintenance and CP-traffic, separate trunk groups are recommended, one for RI 0129 and another for RI 0056.

3.101 To provide more CP-traffic capacity during heavy traffic loads, the recommendation is to assign the CP-traffic trunk group (RI 0056) to route advance to the CP-maintenance trunk group (RI 0129). This assignment must be done by recent change messages as the traffic data assembler (TDA) will not permit this route advance at the present time. Under this route advance arrangement, overflows can be recorded in the CP-traffic group without impairing customer service.

3.102 An overflow threshold should be placed in Network Operation Report Generator (NORGEN) to monitor the CP-traffic. This monitoring will provide the network administrator with a threshold indicator. This indicator coupled with Central Office Equipment Reports (COER) will permit the early detection of CP capacity exhaust before design loads are reached.

NETWORK ACCESS CIRCUITS

3.103 The Network Access Circuit (CPI067) has a variety of uses. The main use is for any test circuit requiring access to the line or trunk link network. The circuits are also used as holding trunks. These are holding trunks which are connected to Ground Start PBX lines while the operator is connected to the receiver, or to Ground Start non-PBX lines to provide holding current while class-of-service tone is provided to the operator (when applicable.) Remote Switching Systems also use holding trunks in the host ESS Office to match ROH tone appearances. Six circuits are provided per RSS module (maximum 2 modules per RSS).

LOOP-AROUND TRUNK CIRCUIT AND CONTROLLED GAIN TRANSMISSION UNIT

3.104 This combination circuit (CPI 165, PRI 053 for out-going side, CPI 166 for incoming side) is used for the Routing Selected Transmission Control (RSTC) feature available with the 1E7/1AE7 generics. This feature was developed primarily as an adjunct to the Remote Call Forwarding (RCF) feature.

3.105 Since the RCF feature allows two direct distance dialing (DDD) calls to be connected in tandem, a user on the West Coast could - in an extreme case - dial an East Coast directory number (DN) and be forwarded back to the West Coast with a resulting transmission degradation. The RSTC feature provides additional gain in trunk-to-trunk transmission paths were RCF calls would otherwise violate DDD transmission criteria.

3.106 The circuit is held throughout the call. Normal trunk measurements are used to supply PC, OVFL, and USG for this trunk group. See Fig. 18 for an illustration of the use of this circuit.

4. HILO NETWORK SERVICE CIRCUIT

4.01 The HILO 4-wire switching feature permits the No. 1 ESS to function as a 4-wire, toll office. Either 2- or 4-wire trunk circuits can be used. Equivalent 4-wire switching is achieved by providing two switched metallic conductors and an unswitched metallic common return path, instead of providing four physical wires in the switching network.

4.02 In a trunk-only office, the trunk link networks may be either the 1024 type or 2048 type, but not both. A combined local/toll office is viewed as having two separate and distinct parts: local and toll. There is no direct connection between line link networks and HILO (toll) trunk link networks. The local portion of a combined office uses non-HILO (local) trunk link networks to interconnect with toll facilities.

4.03 With a HILO network, incoming pulsing can be MF, DP, and Outgoing pulsing can be MF, DP, TT, and no pulsing. Revertive pulsing is not

available. Appropriate transmitter and receiver service circuits must be provided for each type of pulsing required. In the combined local/toll office two sets of service circuits must be provided: one set for the Local-TLN and another set for the Toll-HILO-TLN.

4.04 HILO service circuits are mainly accessed through pseudo route indexes. See TG1A Div. 3, Section 3d.

5. REFERENCES

5.01 The following material supplements the subjects covered in this section:

SECTION	TITLE
231-033-000	Universal Trunk Circuits and Frame
231-033-010	Miscellaneous Trunk Frame
231-034-000	Miniaturized Universal Trunk Frame
231-034-010	Combined Miscellaneous Trunk Frame
231-060-130	Capacity Determination
231-060-210	Service Circuits
231-060-220	Trunk Receivers and Transmitters
231-060-270	Service Circuits-Revision Notes
231-070-415	Translations/Office Records
231-070-430	Call Store Items
231-070-830	Recorded Announcements
231-090-ZZZ	Feature Documents-1/1A ESS
231-190-ZZZ	Feature Documents-1 ESS
780-200-116	Subscription Customer Feature
Translation	TG1A
Parameter	PG1 and PG1A
E8056	Questionnaire
J1A063A-1	Trunk and Service Circuit Engineering Specifications

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SERVICE CIRCUIT NAME	CIRCUIT PROGRAM INDEX	ROUTE INDEX
Person-to-person not allowed announcement	079	0055
Special service error announcement	079	0087
Vacant code announcement	079	0089
10-digit call misdialed office code announcement	079	0140
Common intercept (CTX) announcement	079	0150
Call forwarding denied announcement	079	0115
Dial tone first announcement	079	0154
CAMA access code dialed in error announcement	079	0160
No circuit announcement (NMGT)	079	0180
Emergency announcement No. 1	079	0181
Emergency announcement No. 2	079	0182
No circuit announcement (TANDEM)	079	0183
Reorder announcement (TANDEM)	079	0184
Receiver off-hook announcement	080	0091
Partial dial announcement	080	0122
Coin overtime prompt announcement	080	0155
Person to person not allowed	079	0055
Special service error	079	0087

Fig. 1-Service Circuit - Summary of Circuit Program Index with Fixed Route Index of Pseudo Route Index (Sheet 1 of 4)

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SERVICE CIRCUIT NAME	CIRCUIT PROGRAM INDEX	ROUTE INDEX
Custom calling denied	079	0162
Vacant code from toll/tandem trunks	079	0185
Coin control	059	0116
Coin zone	010	0124-7
Coin overtime	014	0120
3-port conference	043	0133
6-port conference	044	NOT FIXED
Customer transmitter receiver tandem tie	027	0148
Trunk transmitter receiver tandem tie	028	0149
TT/DP receiver	029	0147
MF receivers	065	0065
RP receivers	070	0067
DP receivers	068	0066
MF transmitters	066	0057
RP transmitters	071	0059
DP transmitters	069	0058
TT transmitters	167	0061
TT CDR	064	0078

Fig. 1-Service Circuit - Summary of Circuit Program Index with Fixed Route Index of Pseudo Route Index (Sheet 2 of 4)

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SERVICE CIRCUIT NAME	CIRCUIT PROGRAM INDEX	ROUTE INDEX
DP CDR	063	0077
Regular ring (phase 1)	061	0032
Regular ring (phase 2)	061	0033
Regular ring (phase 3)	061	0034
Special ring	072	0038
Audible ring tone (phase 1)	078	0040
Audible ring tone (phase 2)	078	0041
Audible ring tone (phase 3)	078	0042
Busy tone	078	0051
Regular overflow tone	078	0080
Common overflow tone	078	0081
Interrupted high customer service	078	0012
Permanent busy no. test	078	0096
High tone steady	078	0113
Low tone steady	078	0114
Receiver off-hook tone	078	0121
Reverting number machine-handled	078	0142
Call waiting tone	078	189

Fig. 1-Service Circuit - Summary of Circuit Program Index with Fixed Route Index of Pseudo Route Index (Sheet 3 of 4)

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SERVICE CIRCUIT NAME	CIRCUIT PROGRAM INDEX	ROUTE INDEX
Pre-empt tone	078	0191
Access code dialed in error announcement	079	0053
Access code not dialed announcement	079	0054
Continuity check circuits	088 088	OUT 0062 INC 0070
Continuity and polarity test circuits	082 082	MTCE 0129 TFC 0056

Fig. 1-Service Circuit - Summary of Circuit Program Index with Fixed Route Index of Pseudo Rute Index (Sheet 4 of 4)

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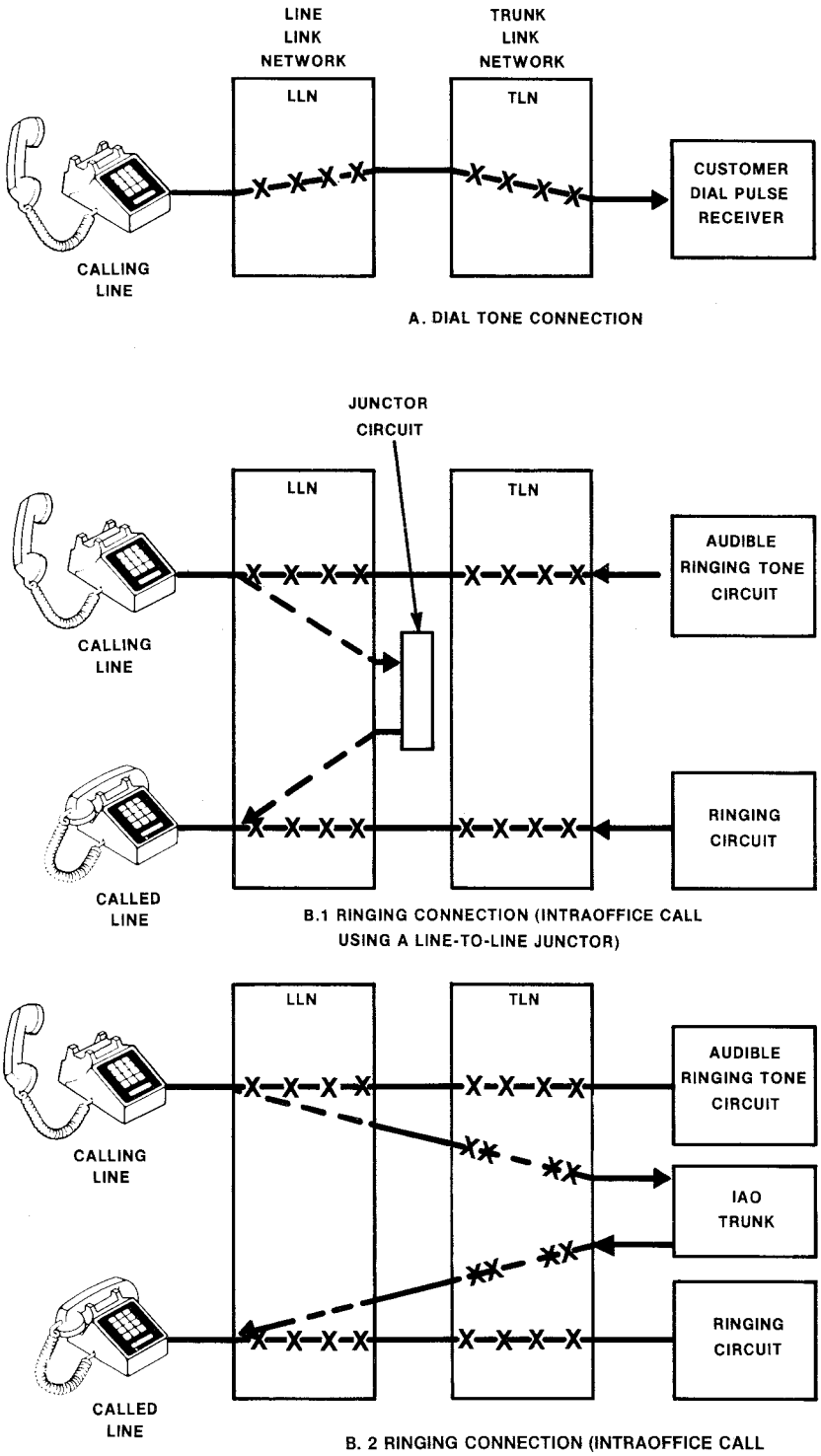
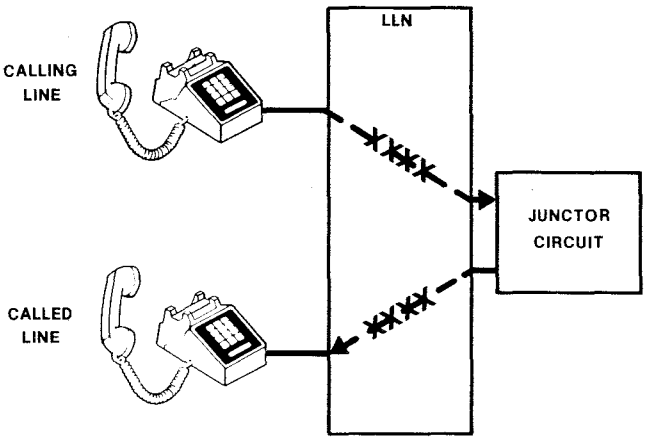
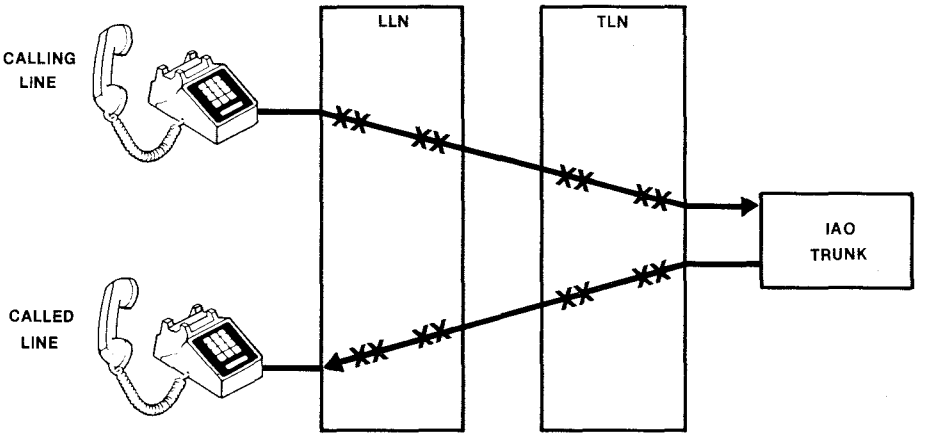


Figure 2 - Network Connections for an Originating Call (Sheet 1 of 3) (3.02, 3.49)

PROPRIETARY – BELLCORE AND AUTHORIZED CLIENTS ONLY
See proprietary restrictions on title page.



C.1 TALKING CONNECTION (INTRAOFFICE USING A LINE-TO-LINE JUNCTOR)



C.2 TALKING CONNECTION (INTRAOFFICE CALL USING AN INTRAOFFICE TRUNK)

Figure 2 - Network Connections for an Originating Call (Sheet 2 of 3)

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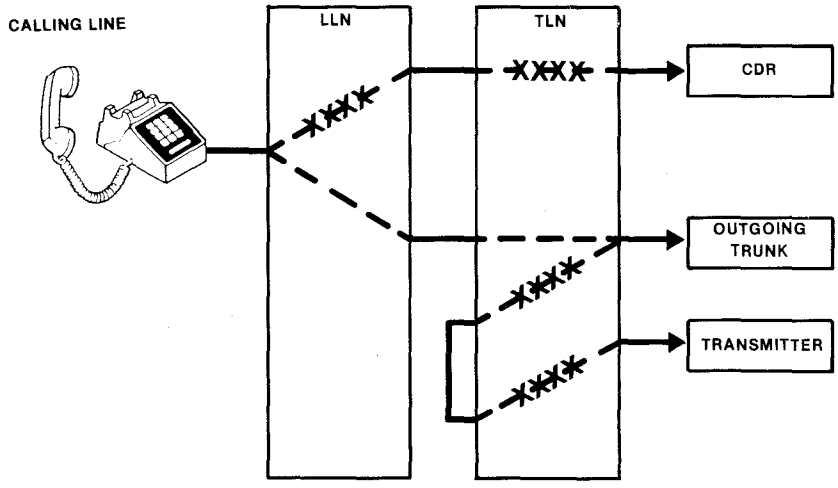
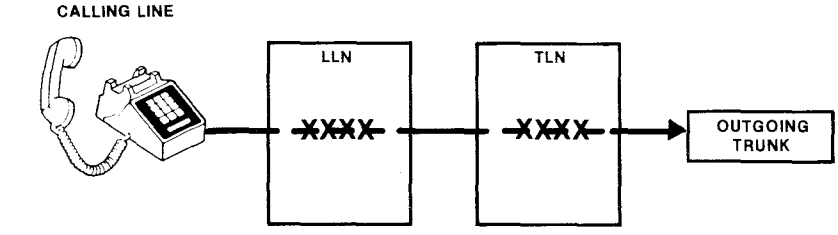


D.1 SIGNALING PHASE (OUTGOING CALL)



D.2 TALKING (OUTGOING CALL)

LEGEND:

CONNECTED NETWORK PATH

RESERVED NETWORK PATH

Figure 2 - Network Connections for an Originating Call (Sheet 3 of 3)

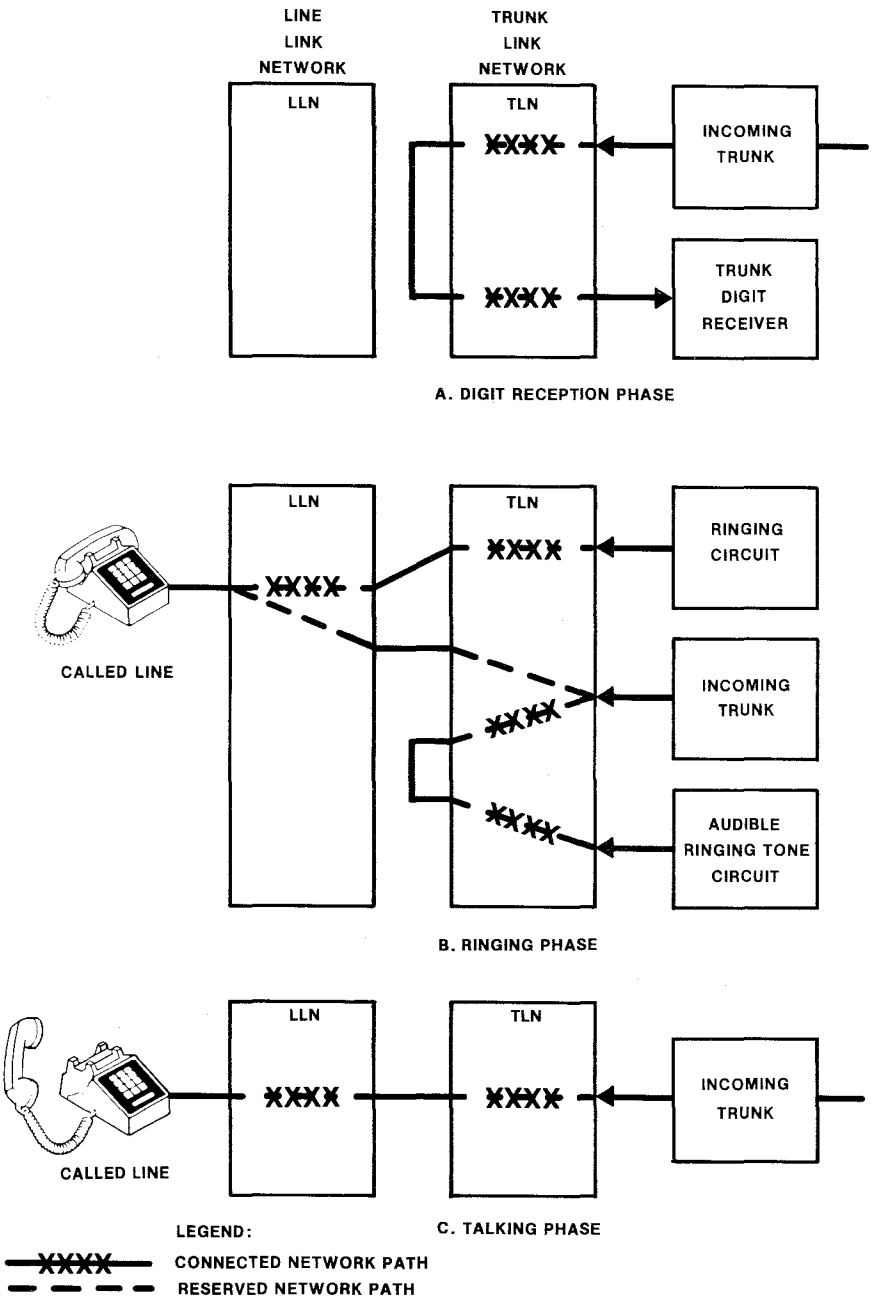


Figure 3 - Network Connections for an Incoming Call (3.16, 3.17)

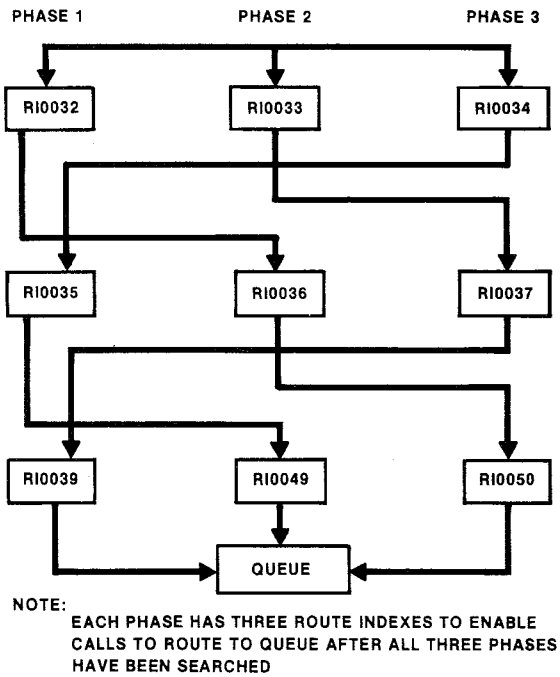


Figure 4 - Regular Ring Route Advance Diagram (3.29)

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(A) FOUR PARTY-AC/DC RINGING

PARTY NUMBER	RINGING METHOD	RINGING CODE (SEE NOTE)
1	RING TO GROUND	1
2	TIP TO GROUND	1
3	RING TO GROUND	2
4	TIP TO GROUND	2

(B) FOUR PARTY SUPERIMPOSED-FULLY SELECTIVE

PARTY NUMBER	RINGING METHOD AND RINGING POLARITY	RINGING CODE (SEE NOTE)
1	RING TO GROUND (–)	1 AND 3
2	TIP TO GROUND (–)	1 AND 3
3	RING TO GROUND (+)	1 AND 4
4	TIP TO GROUND (+)	1 AND 4

(C) EIGHT PARTY SUPERIMPOSED-SEMISELECTIVE

PARTY NUMBER	RINGING METHOD AND RINGING POLARITY	RINGING CODE (SEE NOTE)
1	RING TO GROUND (–)	1 AND 3
2	TIP TO GROUND (–)	1 AND 3
3	RING TO GROUND (+)	1 AND 4
4	TIP TO GROUND (+)	1 AND 4
5	RING TO GROUND (–)	2 AND 3
6	TIP TO GROUND (–)	2 AND 3
7	RING TO GROUND (+)	2 AND 4
8	TIP TO GROUND (+)	2 AND 4

NOTE: (1) CODE 1 - 2 SECONDS RINGING FOLLOWED BY 4 SECONDS SILENCE

(2) CODE 2 - 1 SECOND RINGING, 1 SECOND SILENCE
1 SECOND RINGING, FOLLOWED BY
3 SECONDS SILENCE

(3) SUPERIMPOSED WITH NEGATIVE (–) RINGING POLARITY

(4) SUPERIMPOSED WITH POSITIVE (+) RINGING POLARITY

Figure 5 - Association of Party Number to Ringing Selection (3.38)

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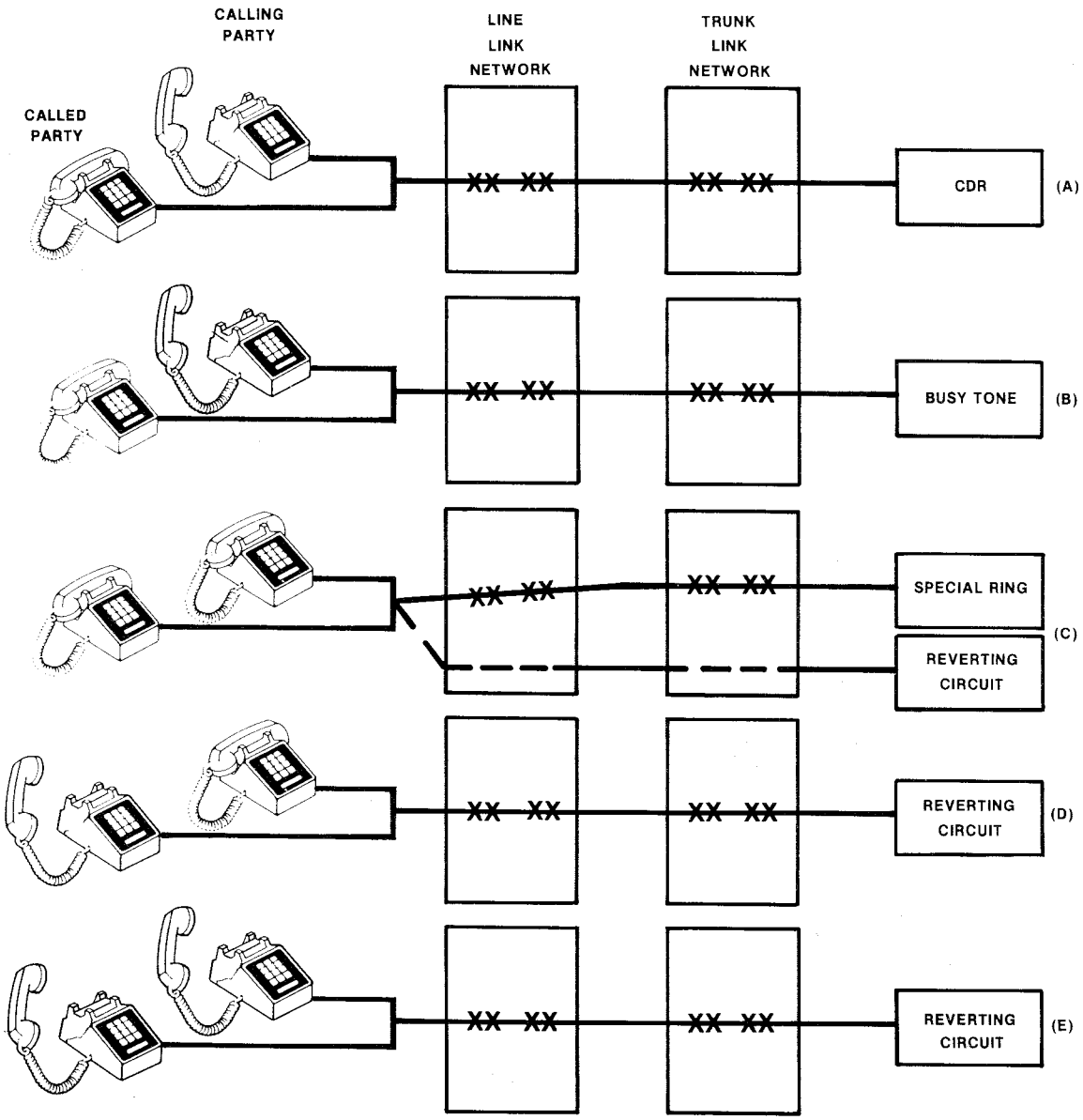

Figure 6 - Network Connections for a Reverting Call Machine Handled (3.39, 3.47, 3.48)

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CALL SOURCE	RINGING PATTERN	APPLICABILITY
CLASS A	PATTERN A	
INTRAGROUP	REGULAR RING	PER CTX/ESSX LINE
CLASS B	PATTERN B	
DIRECT INWARD DIAL	800 MS ON, 400 MS OFF,	PER CTX/ESSX LINE
ATTENDANT COMPLETED INCOMING FROM TIE TRUNK, CCSA	800 MS ON, 4 SEC OFF	
CLASS C	PATTERN C	
AUTOVON PRIORITY ATTENDANT EXTENDED	400 MS ON, 200 MS OFF,	PER CTX/ESSX GROUP
AUTOVON PRIORITY DIAL CALL WAITING	400 MS ON, 200 MS OFF, 800 MS ON, 4 SEC OFF	
CALL WAITING ORIGINATING ATTENDANT NIGHT SERVICE		PER CTX/ESSX LINE

Figure 7 - Ringing Patterns for Distinctive Ringing Feature (3.42)

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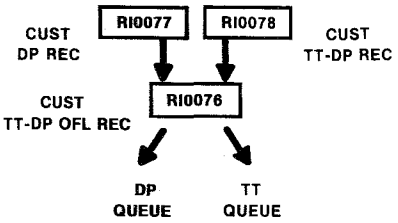
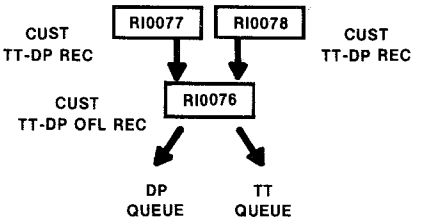
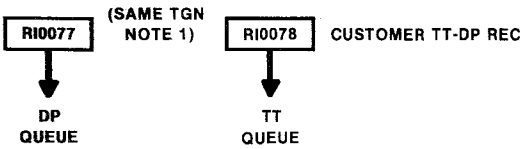
A. IF EQUIPPED WITH DP AND TT-DP RECEIVERS (NOTE 1)



B. IF EQUIPPED WITH ONLY TT-DP RECEIVERS (PRE CTX-7, G1 GENERIC PROGRAMS) (NOTES 1,2)



C. IF EQUIPPED WITH ONLY TT-DP RECEIVERS (CTX-7, G1 AND LATER GENERIC PROGRAMS (NOTE 1,3))



NOTE 1: THE TGNS FOR ROUTE INDEXES MUST BE DIFFERENT, WITH EXCEPTION OF CONFIGURATION C, WHERE THE TGN FOR RI0077 AND RI0078 MUST BE THE SAME.

NOTE 2: SUFFICIENT TT-DP RECEIVERS MUST BE PLACED IN THE DP RECEIVER GROUP AND ADMINISTERED BY RECENT CHANGE FROM RI0077 TO RI0078, AS TOUCH-TONE DEVELOPMENT TAKES PLACE, REFER TO SECTION 231-060-210.

NOTE 3: INITIALLY, THE USE OF ALL TT-DP RECEIVERS PROVIDED NO STANDARD METHOD OF PREVENTING CONNECTION OF UNAUTHORIZED TT STATION SETS. WITH CTX-7, G1 AND LATER GENERIC PROGRAMS, PARAMETER SET CARD TTAFP WILL INDICATE EITHER AUTOMATIC OR MANUAL TREATMENT OF UNAUTHORIZED TT STATION SETS. THE AUTOMATIC MODE WILL CAUSE THE PROGRAM TO IGNORE TT DIGITS RECEIVED ON A LINE MARKED DP. BY IGNORING THE TT DIGITS, THE FRAUDULENT TELEPHONE USER WILL TIME OUT AND RECEIVE A PERMANENT SIGNAL PARTIAL DIAL ANNOUNCEMENT. IF PARAMETER SET CARD TTAFP IS PLACED IN THE MANUAL MODE AND ILLEGAL TT DIGITS ARE RECEIVED, THE CALL WILL BE PROCESSED. HOWEVER, A PER05 ASSN MESSAGE WILL BE PRINTED AT THE LOCAL TEST DESK TTY UPON THE RECEIPT OF THE FIRST FRAUDULENT TT DIGIT. THIS MESSAGE WILL CONTAIN THE DIRECTORY NUMBER OF THE OFFENDING PARTY UNLESS IT IS A 2- OR 4-PARTY LINE, IN WHICH CASE IT MAY BE ANY ONE OF THE DIRECTORY NUMBERS ASSOCIATED WITH THE SPECIFIC LINE (APPLICABLE ONLY IN OFFICES EQUIPPED WITH 100 PERCENT TT-DP RECEIVERS)

TO AVOID DENYING SERVICE TO A TOUCH-TONE CUSTOMER WHOSE TRANSLATIONS ARE DP IN ERROR, IT IS RECOMMENDED THAT TTAFP SET CARD BE SET TO MANUAL UNTIL RECORDS HAVE BEEN VERIFIED.

Figure 8 - Customer Digit Receiver Hunting Configuration (3.60, 3.64)

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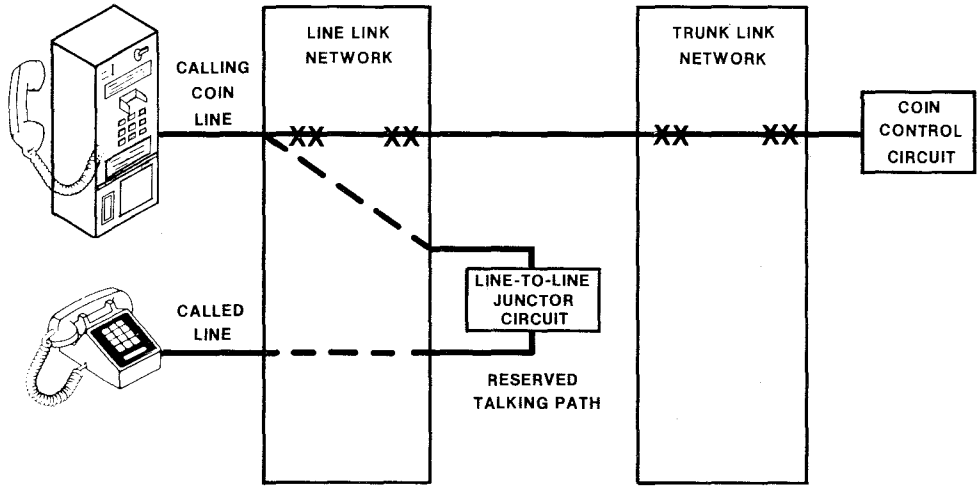
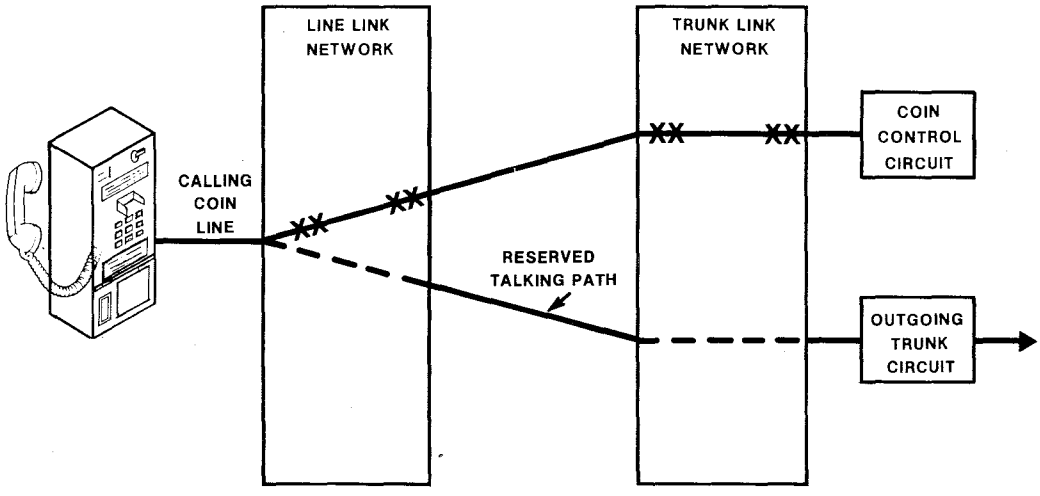


A. INTRAOFFICE CALL



B. INTEROFFICE CALL

Figure 9 - Network Connection for a Coin Control Circuit (3.72)

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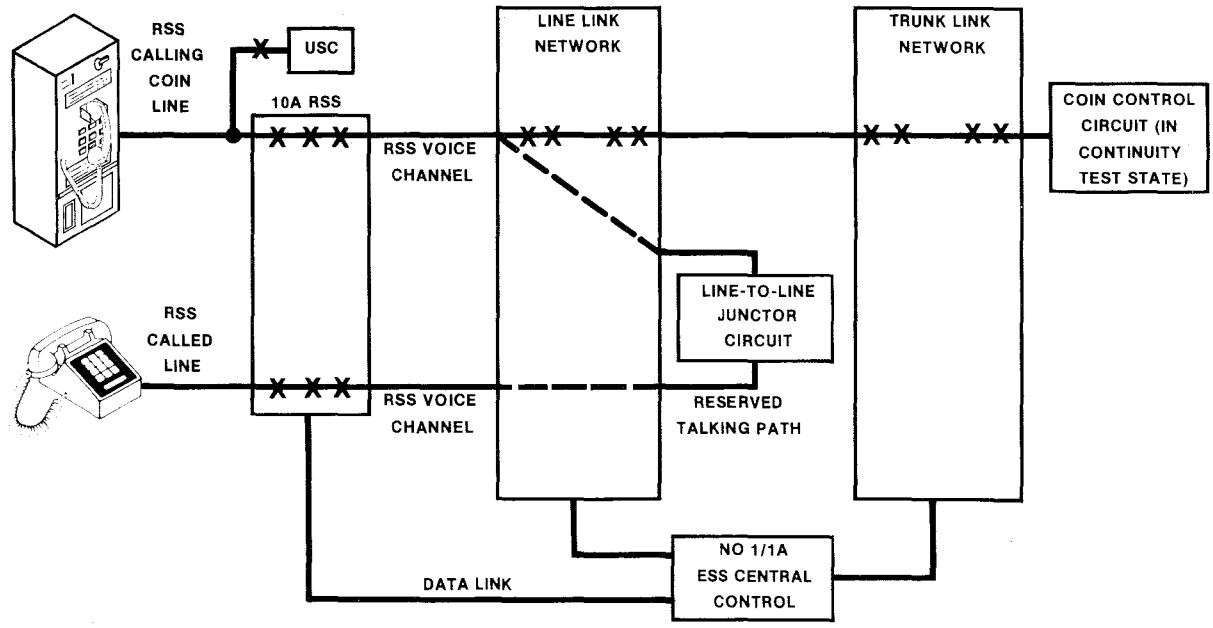
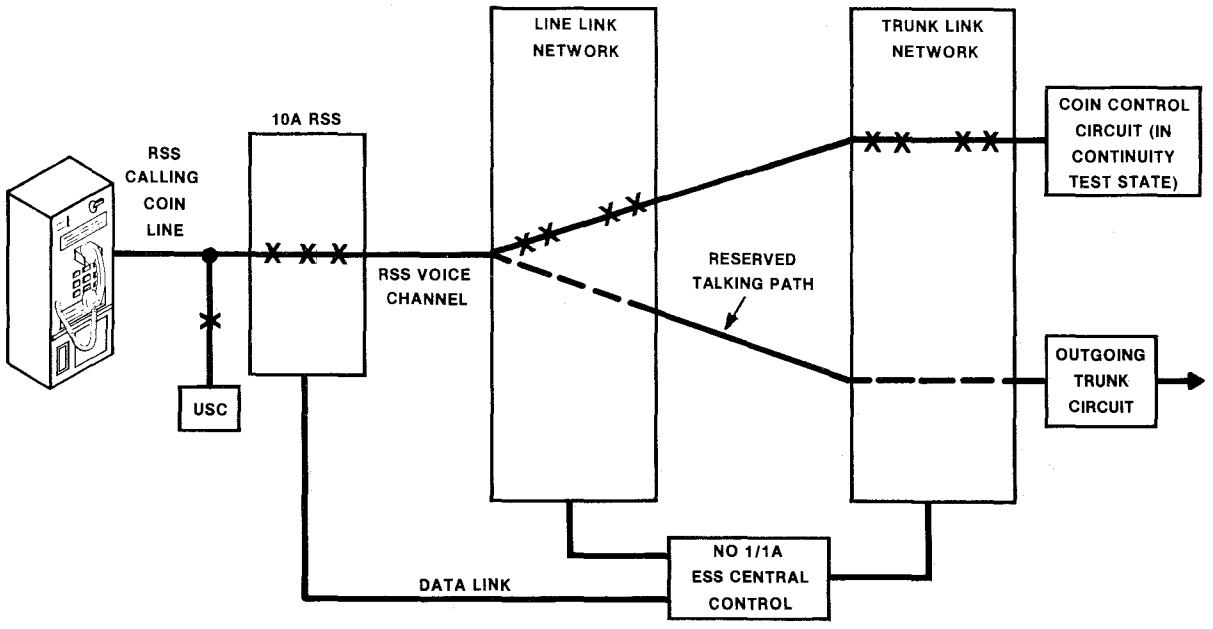


A. INTRAOFFICE CALL



B. INTEROFFICE CALL

Figure 10 - Connection for a Coin Control Circuit for RSS Coin Lines (3.72)

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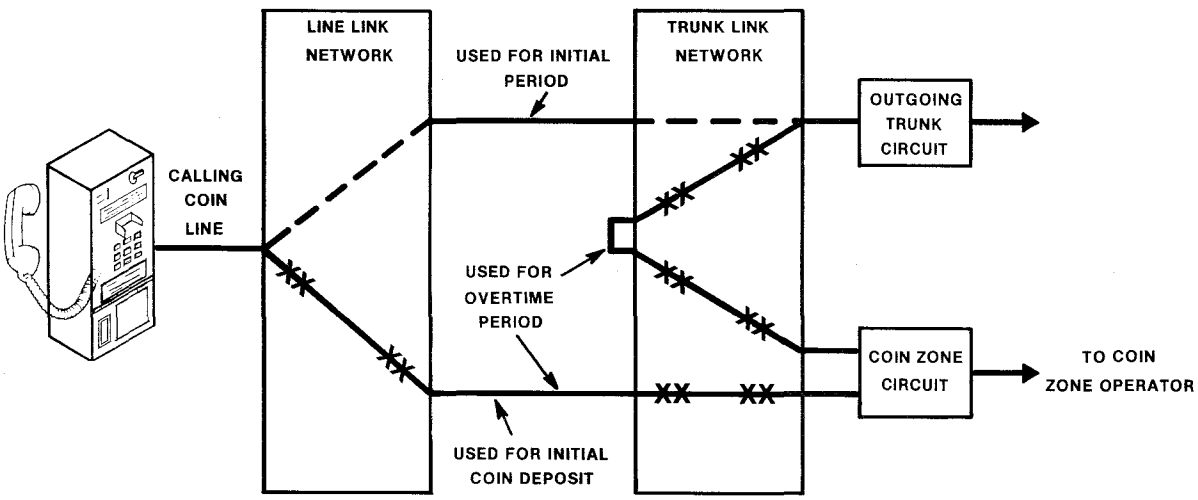

Figure 11 - Network Connection for a Coin Zone Call (3.73)

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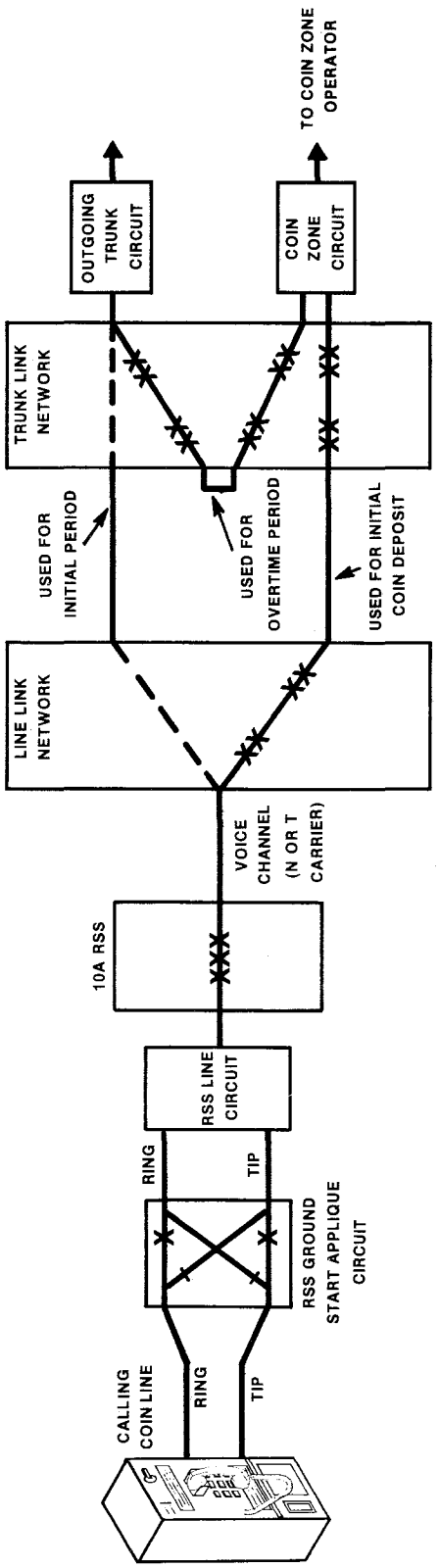

Figure 12 - Network Connection for an RSS Coin Zone Call (3.73)

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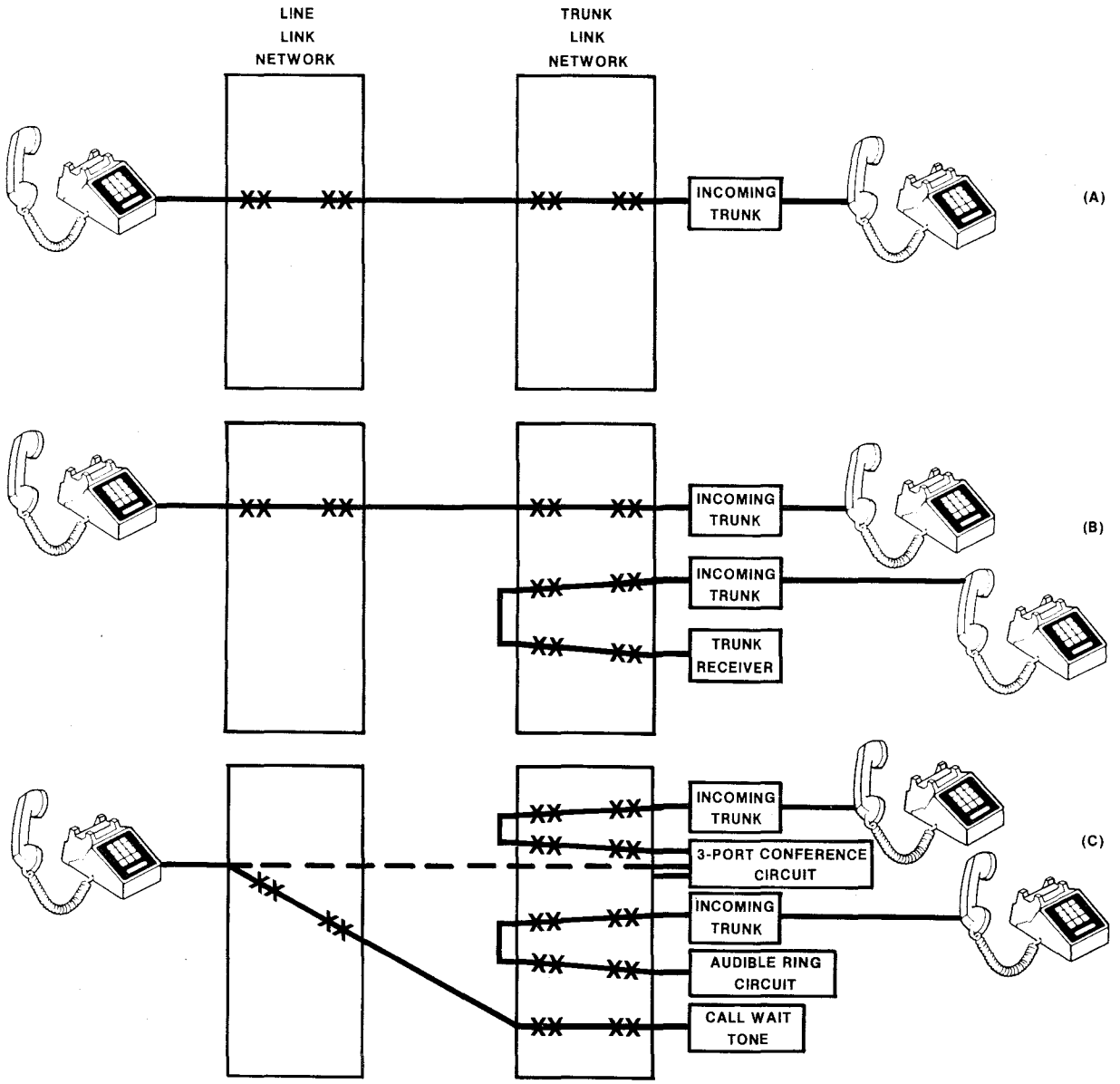

Figure 13 - Network Connections for Call Waiting Feature (Sheet 1 of 4) (3.79)

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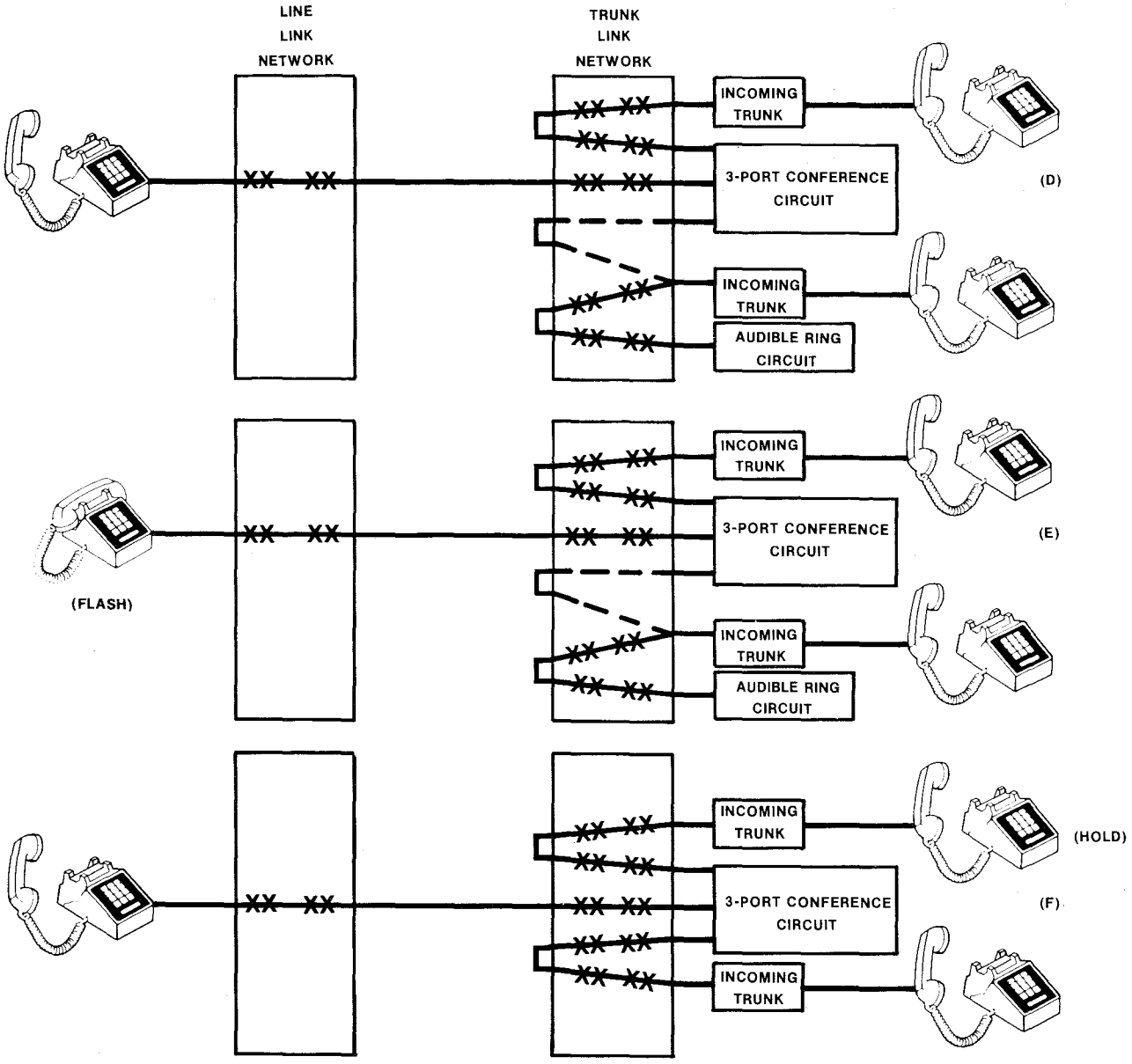

Figure 13 - Network Connections for Call Waiting Feature (Sheet 2 of 4)

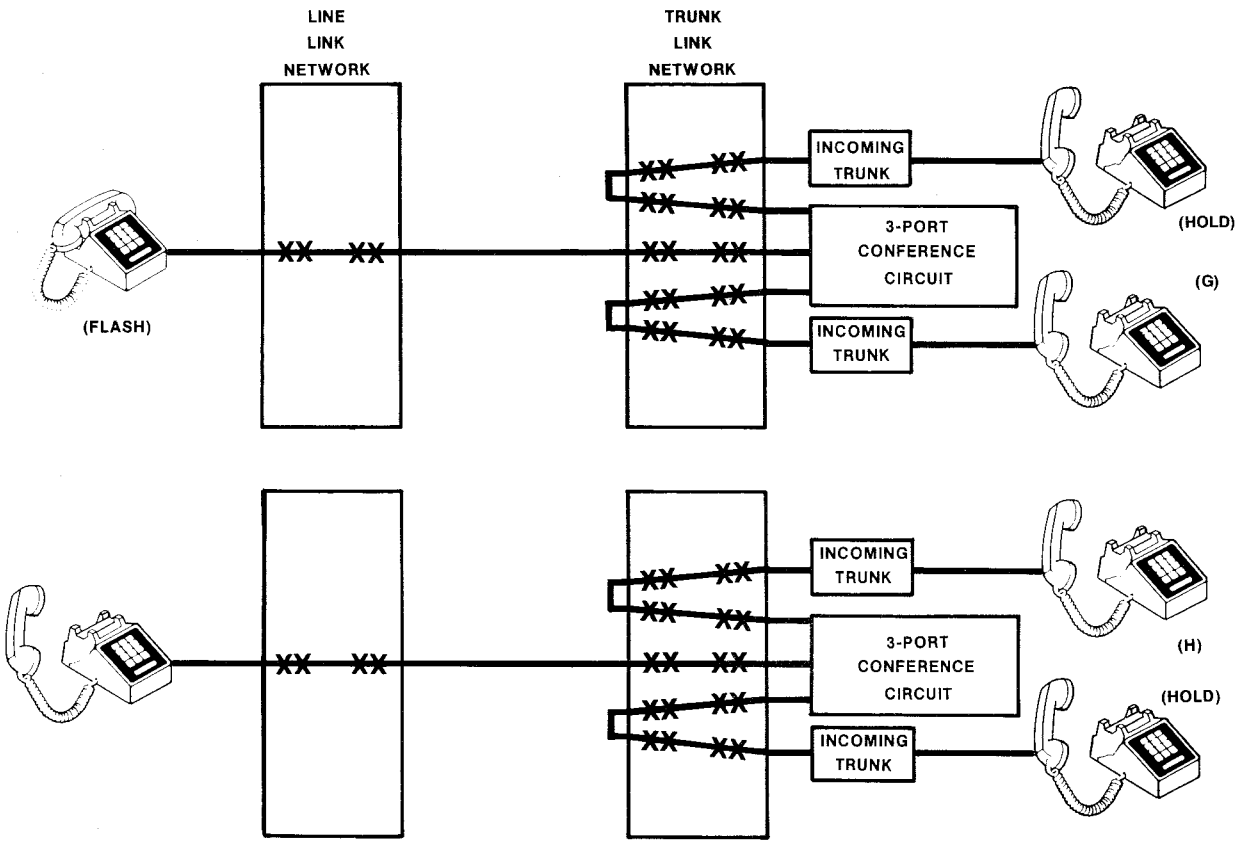

Figure 13 - Network Connections for Call Waiting Feature (Sheet 3 of 4)

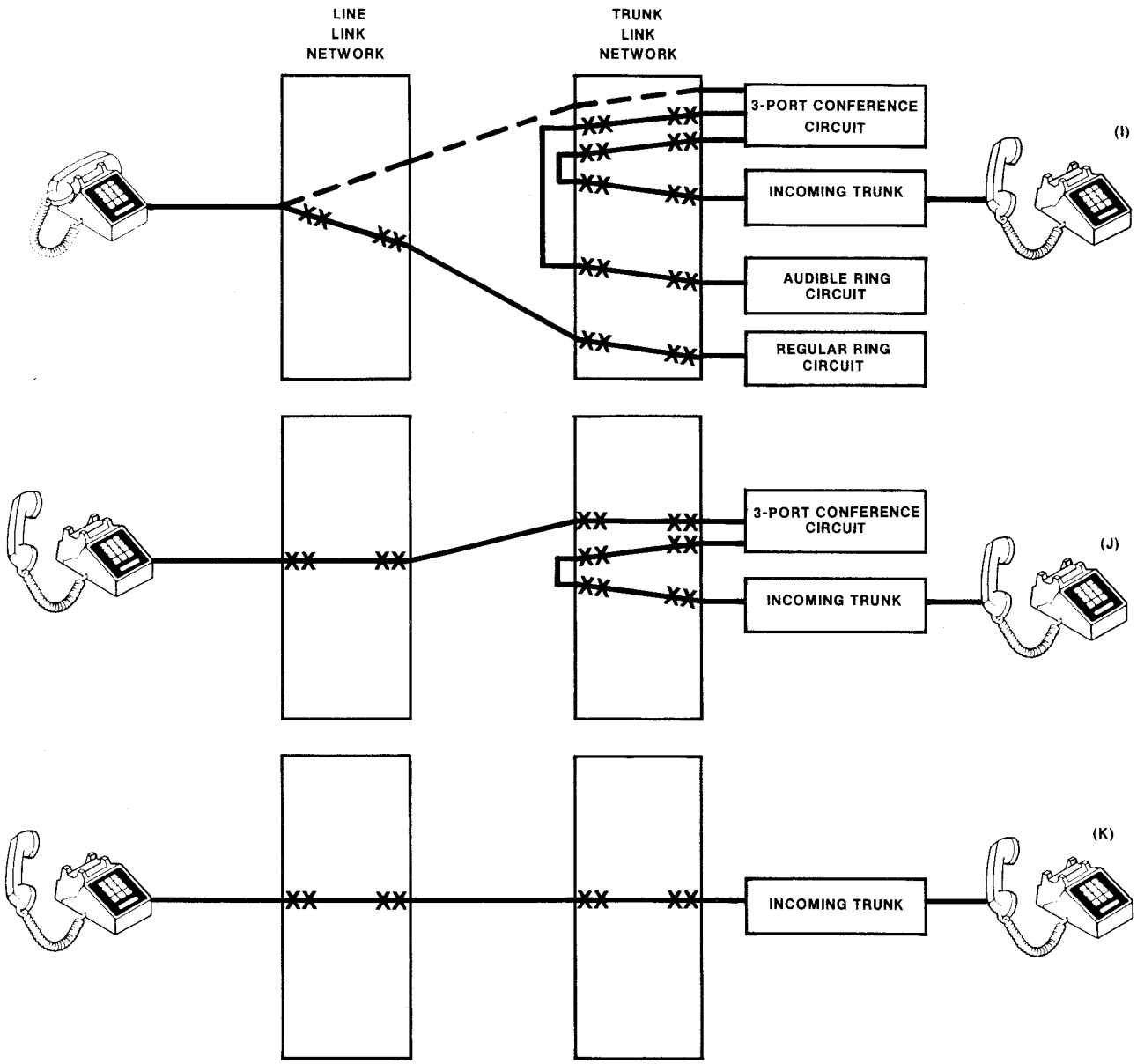

Figure 13 - Network Connections for Call Waiting Feature (Sheet 4 of 4)

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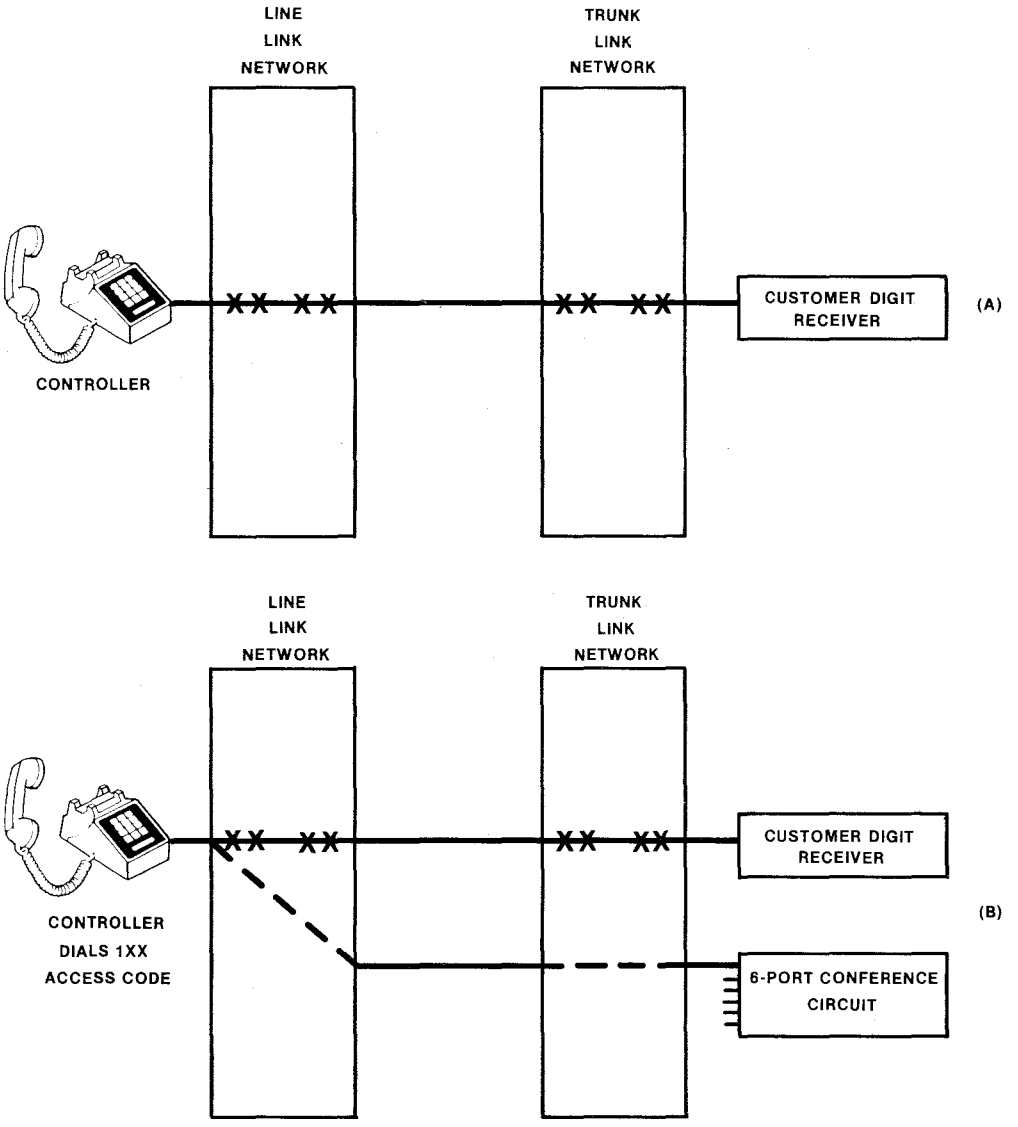

Figure 14 - Network Connections for Station Dialed Conference (Sheet 1 of 6) (3.83)

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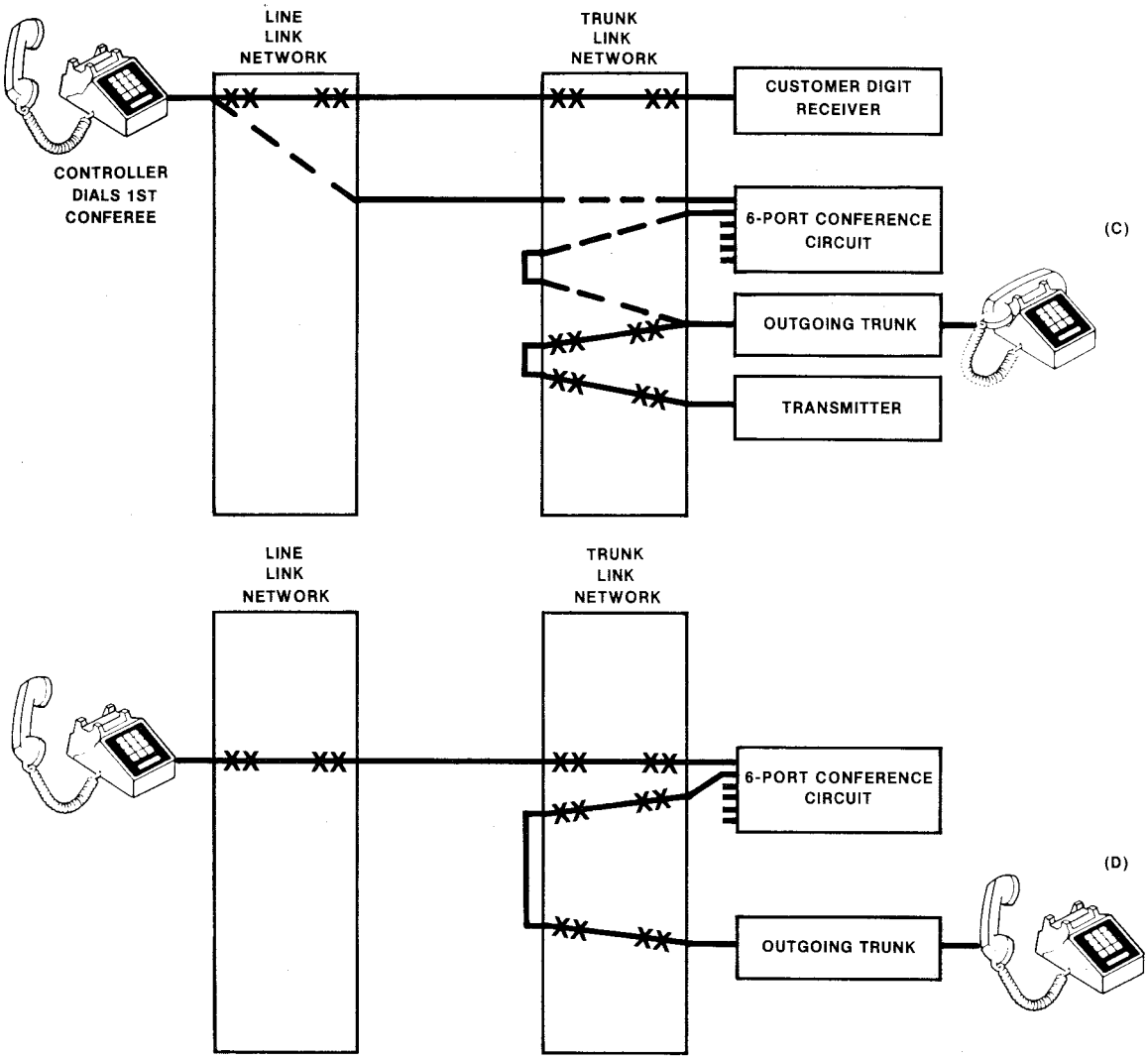

Figure 14 - Network Connections for Station Dialed Conference (Sheet 2 of 6)

PROPRIETARY – BELLCORE AND AUTHORIZED CLIENTS ONLY
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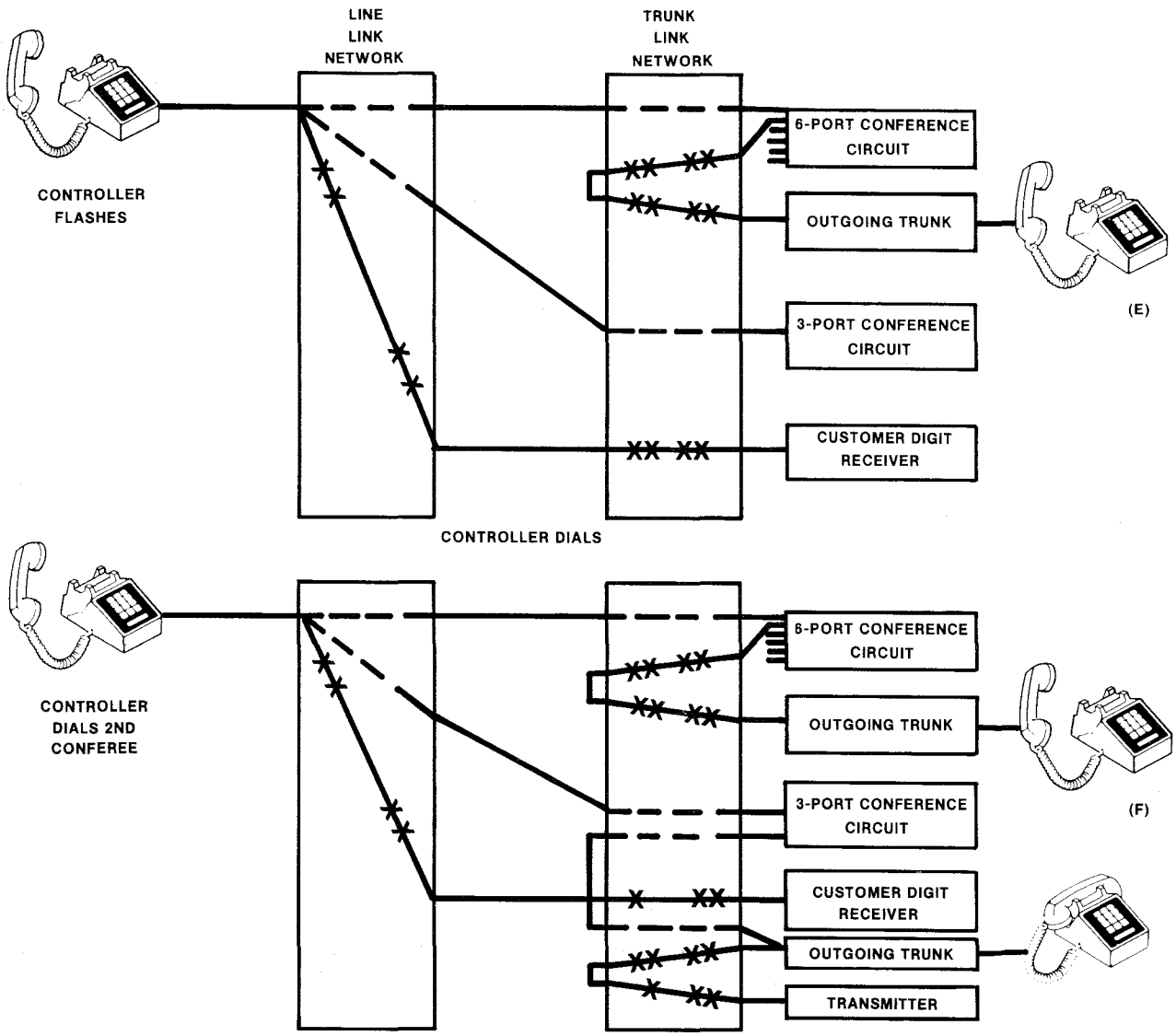

Figure 14 - Network Connections for Station Dialed Conference (Sheet 3 of 6)

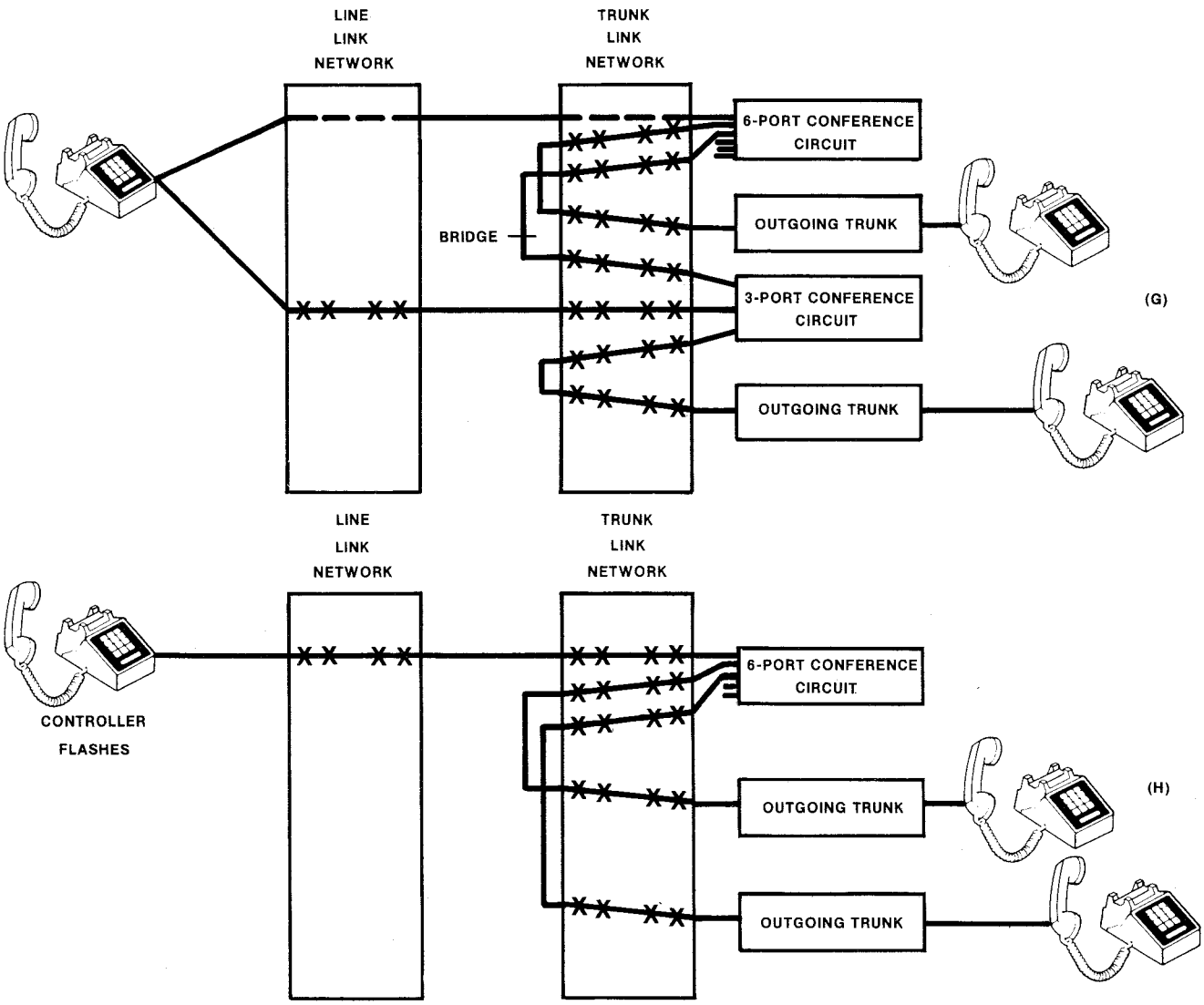

Figure 14 - Network Connections for Station Dialed Conference (Sheet 4 of 6)

PROPRIETARY – BELLCORE AND AUTHORIZED CLIENTS ONLY
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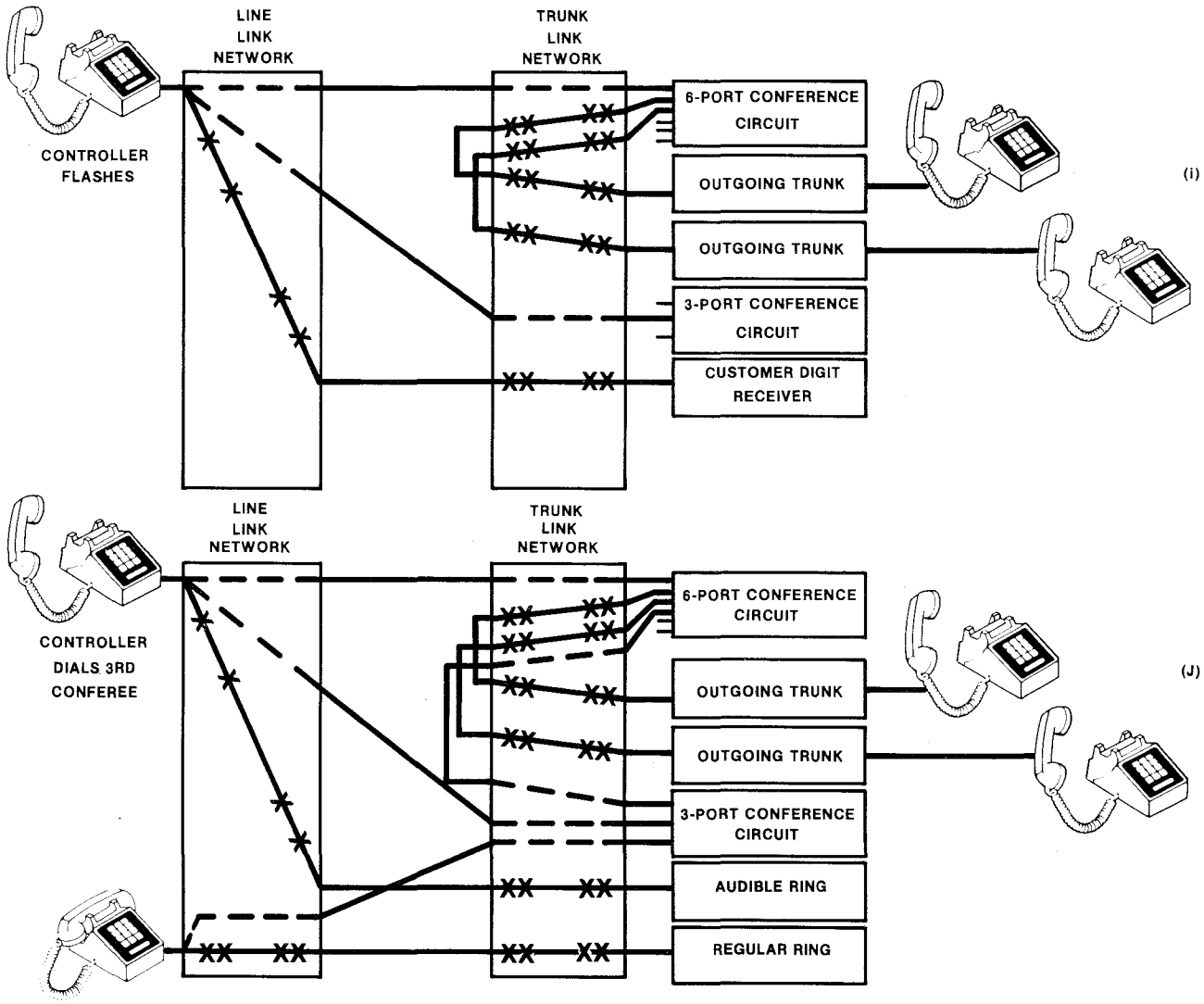

Figure 14 - Network Connections for Station Dialed Conference (Sheet 5 of 6)

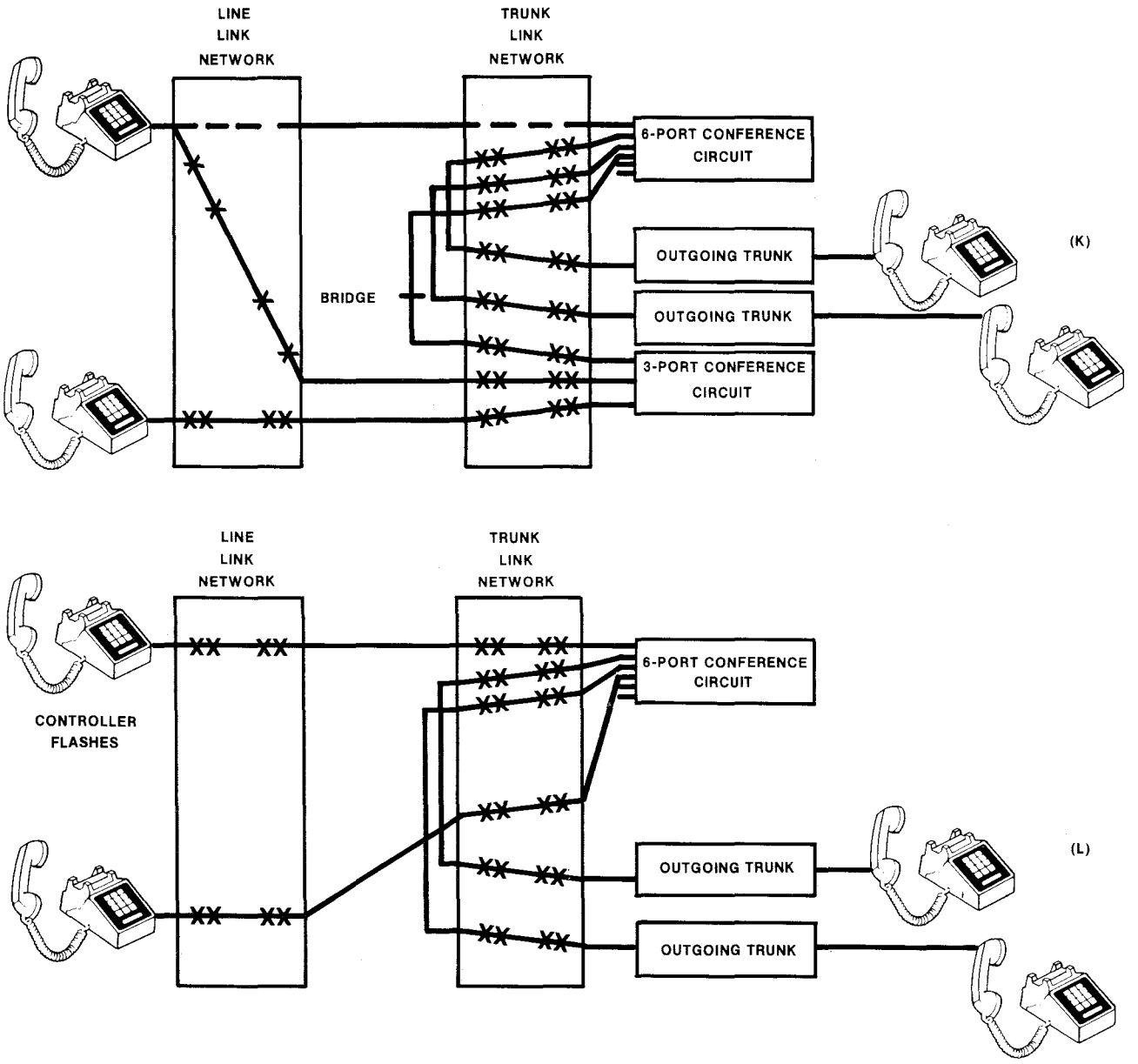

Figure 14 - Network Connections for Station Dialed Conference (Sheet 6 of 6)

PROPRIETARY – BELLCORE AND AUTHORIZED CLIENTS ONLY
See proprietary restrictions on title page.

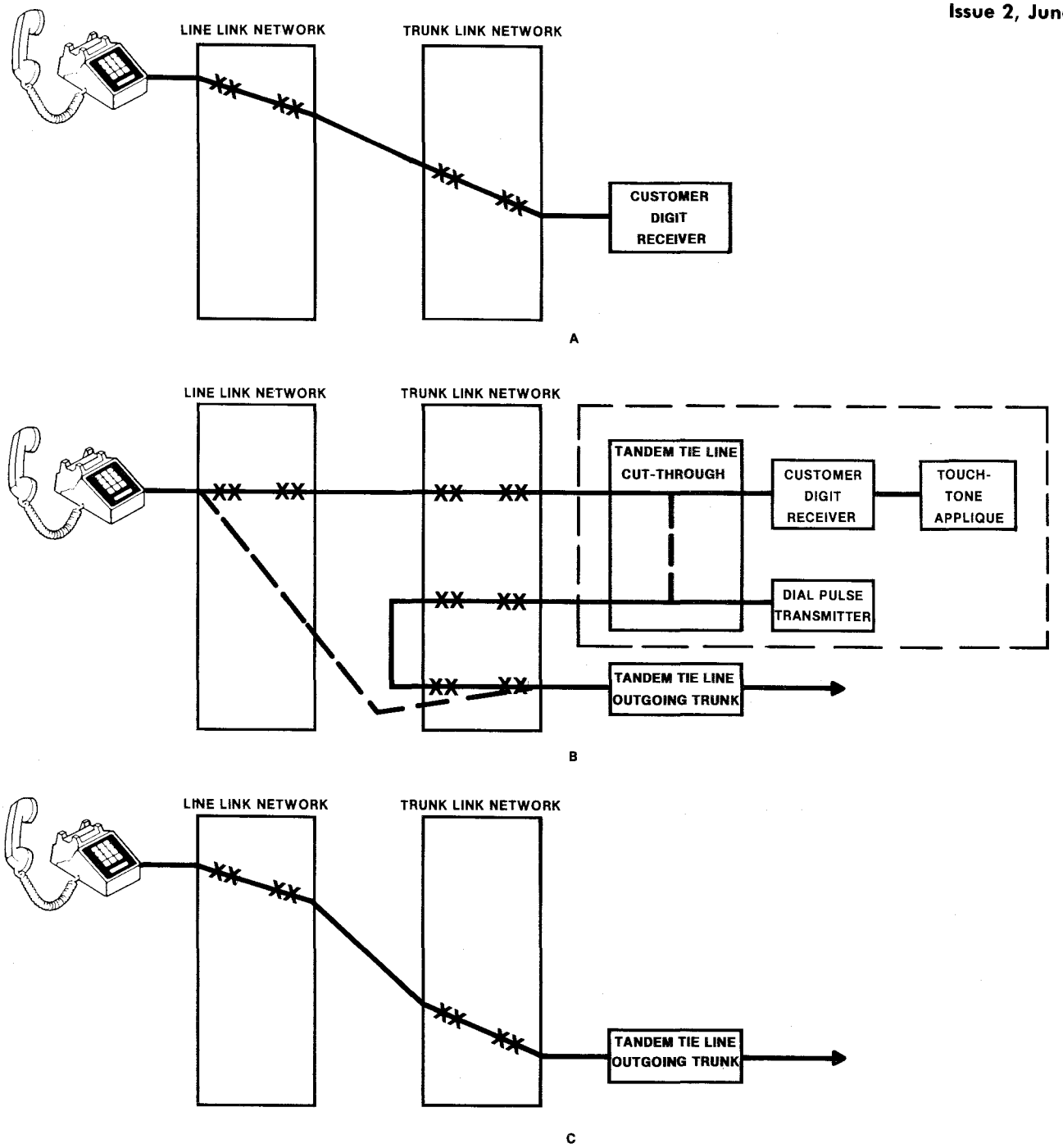

Figure 15 - Network Connections for Tandem Tieline Cut-Through Local Origination (3.91)

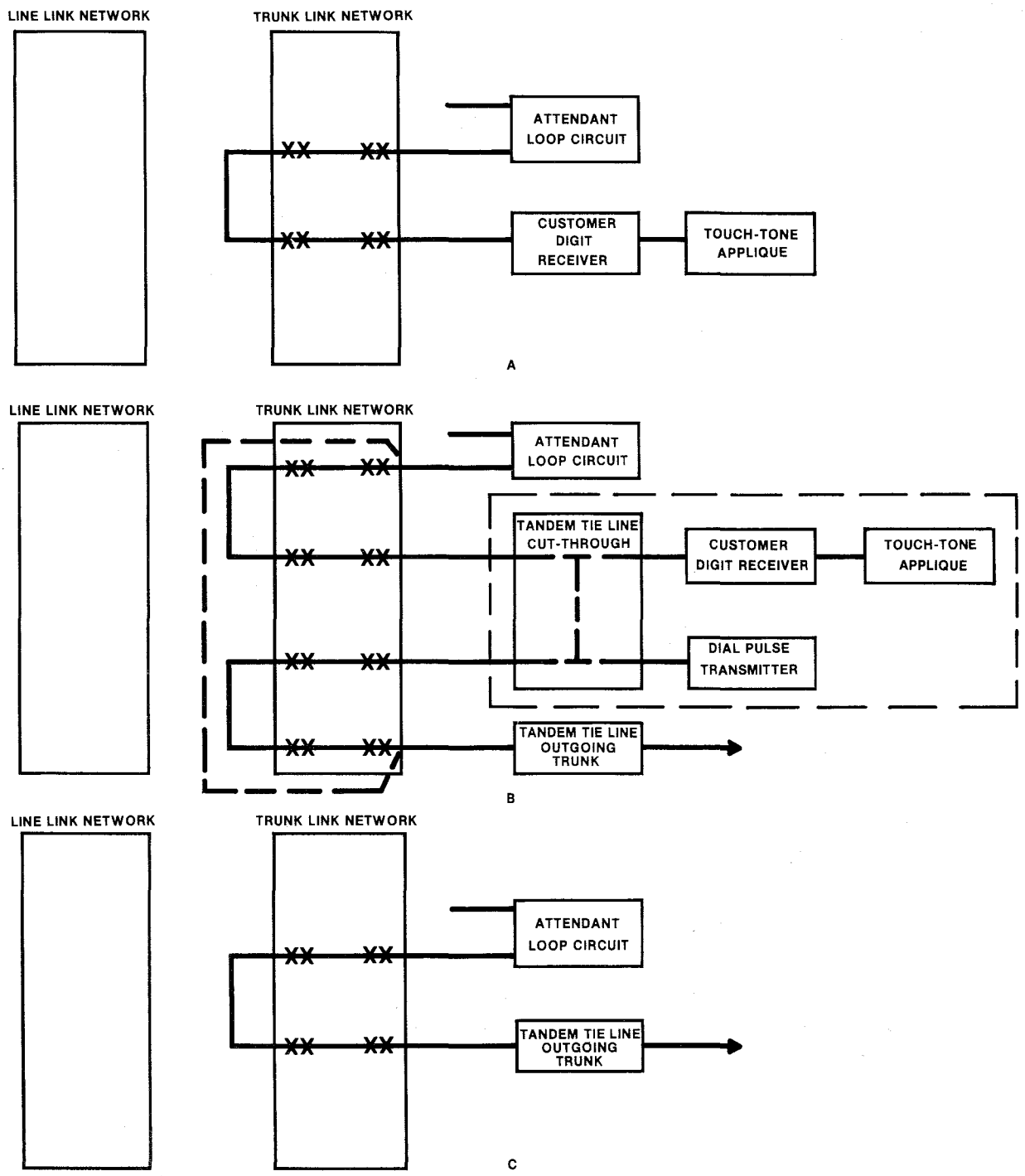

Figure 16 - Network Connections Tieline Cut-Through Centrex-CO Attendant Origination (3.93)

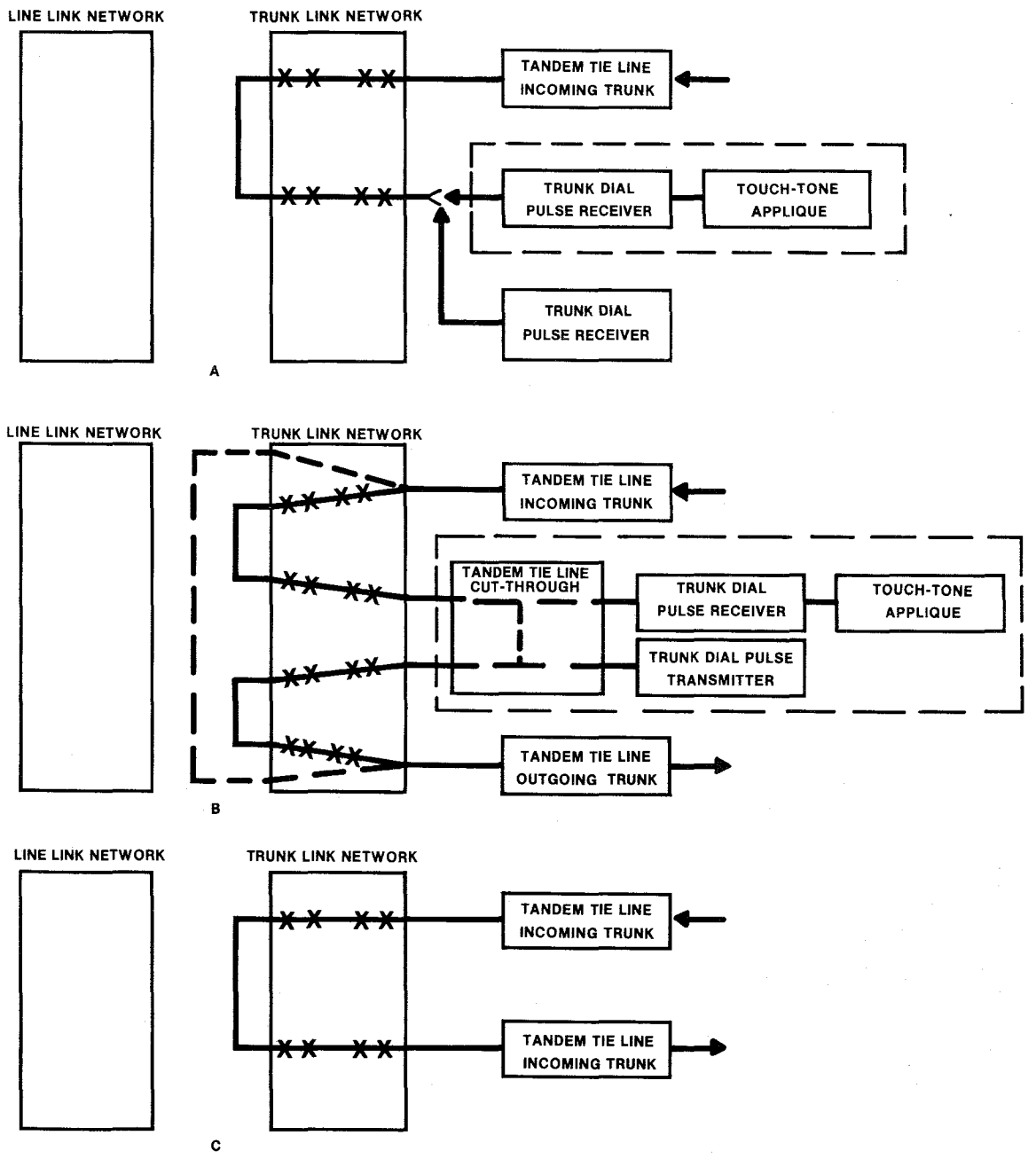

Figure 17 - Network Connections for Tandem Tieline Cut-Through Distant Origination (3.95)

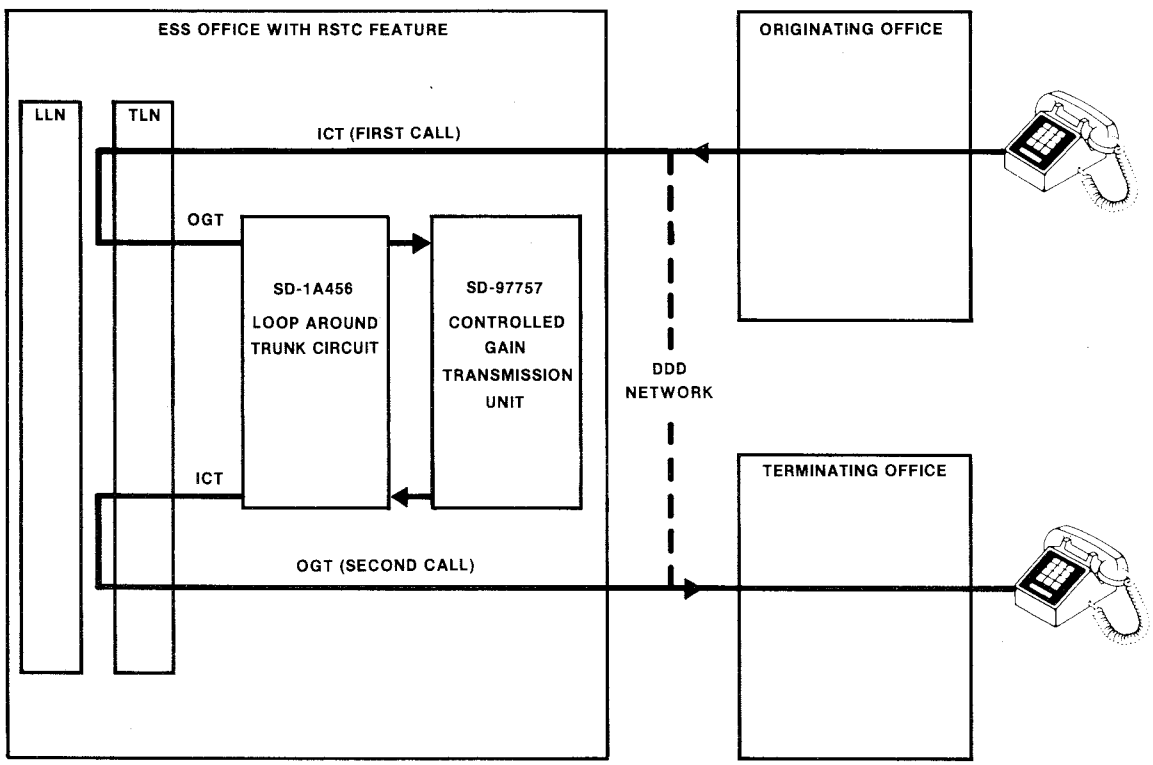

Figure 18 - Network Connection for Routing Selected Transmission Control (3.106)