FEATURE DOCUMENT
TRUNKING ARRANGEMENTS
NO. 2 ELECTRONIC SWITCHING SYSTEM

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FEATURE DEFINITION AND DESCRIPTION

1. DEFINITION

1.01 Trunking arrangements is the feature that provides interconnections between one central office and another when a telephone subscriber places a call to a telephone not served from the subscriber's central office.

1.02 In the No. 2 Electronic Switching System (ESS), provision of interoffice trunking requires that the office be capable of switching subscriber line circuits to various outgoing and incoming trunk circuits through the line and trunk switching network. "Trunk Circuits" are those control circuits that associate the switching network terminals with the transmission facility to distant offices. In addition to voice frequency transmission elements, they contain means for transmitting and receiving supervision from or to other offices. The term "Trunk" is generally used to mean the entire channel from the switching network terminal of one office to the switching network terminal of another. This includes trunk circuits, signaling equipment, and transmission equipment as well as physical wires or carrier channels from one office to another.

1.03 This document covers trunking arrangements which apply to interoffice and operator trunking. Those sections which deal with interoffice trunking also apply to centrex trunking (tie trunks, common control switching arrangement (CCSA), and foreign exchange (FX)), but does not cover these features completely. Feature Document 232-190-313 should be used in conjunction with this document for centrex trunking.

1.04 The trunking arrangements for a particular No. 2 ESS office may be implemented using any current generic program. The specific hardware required to provide standard applications of the various central office trunking arrangements is described here and is detailed in the J2H031A-1 Trunk and Service Circuit Engineering Specification.

1.05 The specific details for implementing the translation information associated with various trunking arrangements are found in the No. 2 ESS Translation Guide TG-2H, Forms 2201, 2202, 2204, and 2303.

2. DESCRIPTION

A. Customer (User) Perspective

2.01 When the customer desires to call a telephone served by a distant office, the customer dials either a 7- or 10-digit number (with or without a prefix). The number has the following format:

PREFIX (IF REQUIRED)	AREA CODE	OFFICE CODE	STATION NO.
0 or 1	N0X* N1X*	NNX	XXXX

* Current AT&T standard uses a 0 or 1 for the middle digit of an area code, but the No. 2 ESS can handle any digit in this position.

Where: X = Any Number 0 Through 9

N = Any Number 2 through 9

0/1 = The Number 0 (Zero) or 1 (One)

A prefix may precede the dialed number to indicate that that special handling or conditions may apply. The generally accepted meanings are as follows, depending on whether or not the No. 2 ESS is connected to a TSPS office.

non-TSPS:

0- = operator assistance

1+ = toll call

TSPS:

0- = operator assistance

0+ = customer dialed operator assisted call (credit card, person to person, etc.)

1+ = toll call, no operator required

When TSPS is not used 0/1 prefix can be used in any way seen proper by the telephone company for added distinction in the call.

B. System Implementation

GENERAL TRUNK OPERATING METHODS

2.02 Several aspects of interoffice trunking are common to all types of trunks. These include the method of supervising the trunk, the types of address transmission (pulsing), and start dial signals. In addition to the above, the method of assigning trunk groups in the No. 2 ESS is discussed.

Supervision

2.03 Supervision is the term used to indicate the passing of trunk control information (called signaling) from one machine to another. In No. 2 ESS, two types of supervision may be used, loop and E&M. Loop supervision is a method of signaling, utilizing the presence, absence, and direction of current in the tip and ring trunk conductors. E&M supervision is a method of signaling, using certain levels of dc voltage on two leads (designated "E" and "M") which are external from the tip and ring trunk conductors. Examples of loop and E&M signaling are shown in Figures 1 and 2.

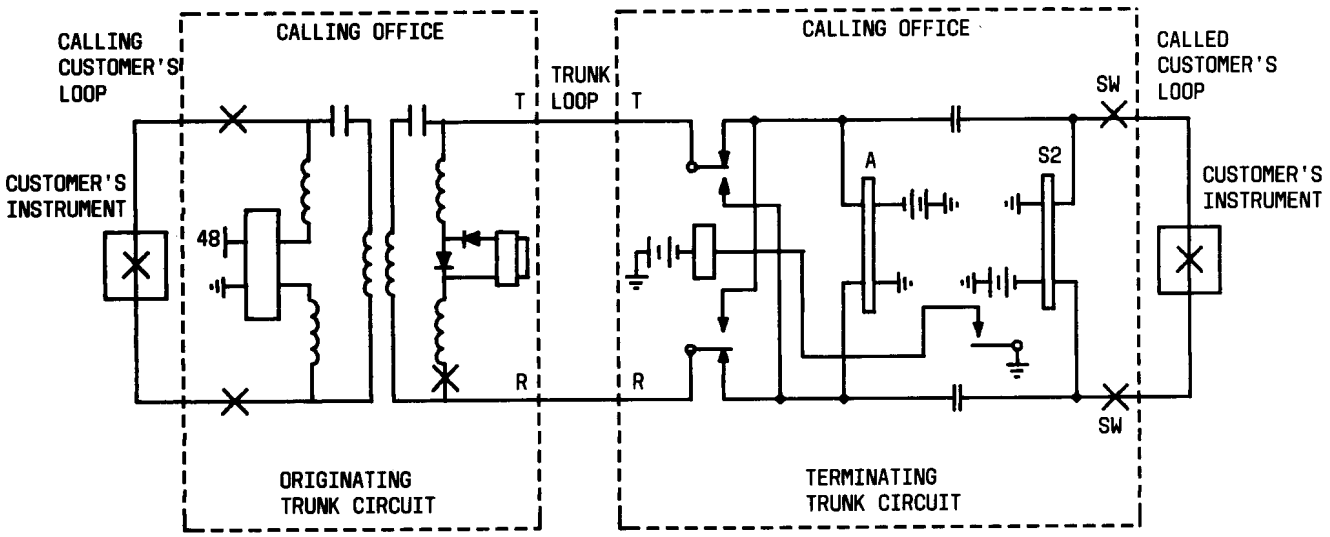

Fig. 1—Loop Supervision

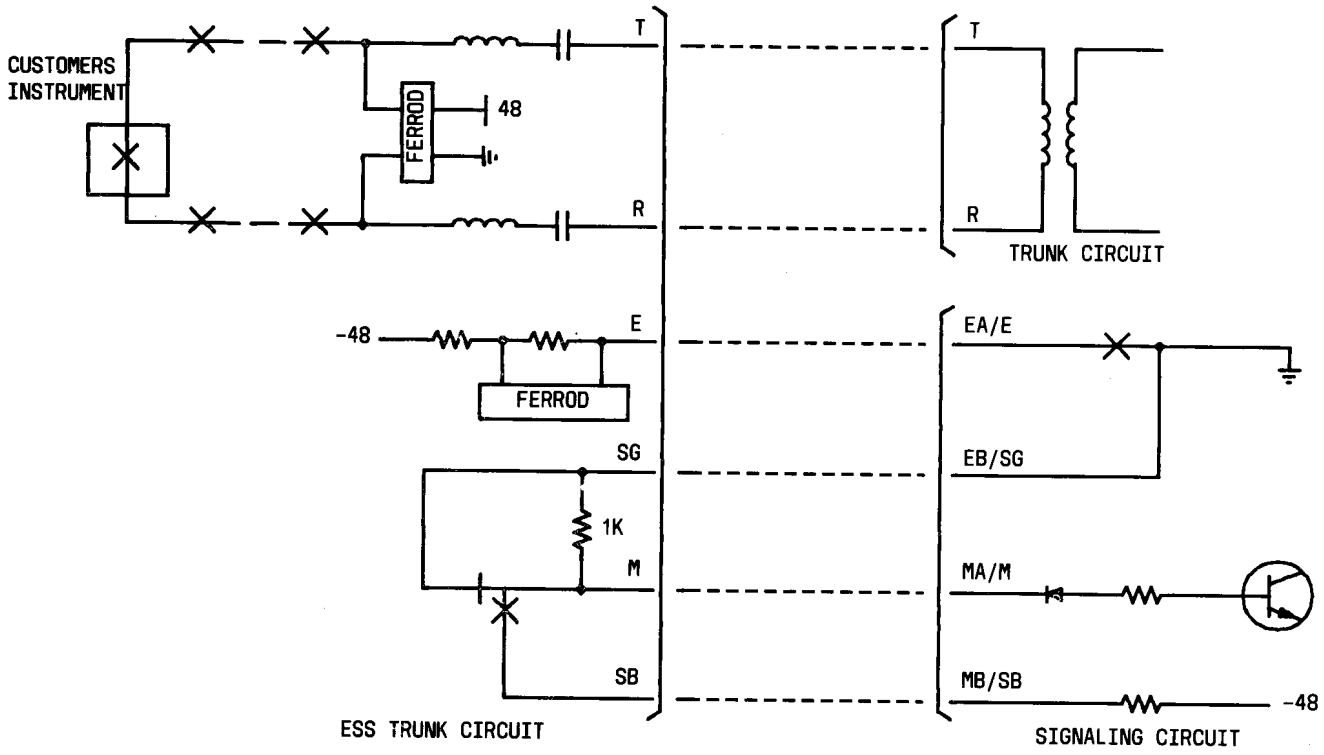

Fig. 2—E & M Supervision

2.04 The terms ***on-hook*** and ***off-hook*** are generally used to refer to the idle or seized condition of the trunk. An idle trunk is said to be on-hook while a seized trunk is referred to as off-hook. Also, if a trunk is in a condition of awaiting an answer from the called end, the called end is signaling on-hook toward the calling end. Answer of the call results in the sending of an off-hook signal back toward the calling end. A given trunk can be on-hook or off-hook in ***either*** direction. Table A summarizes the physical conditions of both types of trunks in various states of supervision.

TABLE A

SUPERVISORY STATES

SIGNALING CONDITION		LOOP TRUNK		E&M TRUNK		TYPICAL STATE(S)
OUTGOING END	INCOMING END	OUTGOING END	INCOMING END*	OUTGOING END	INCOMING END	
ON-HOOK	ON-HOOK	SD-2H103, loop open SD-2H144, high resistance loop	Battery on Ring Ground on Tip	Ground on M Open E	Ground on M Open E	Idle
ON-HOOK	OFF-HOOK	SD-2H103, loop open SD-2H144, high resistance loop	Battery on Tip Ground on Ring	Ground on M Ground on E	Battery on M Open E	Disconnect by originating party
OFF-HOOK	ON-HOOK	SD-2H103, loop closed SD-2H114, low resistance loop	Battery on Ring Ground on Tip	Battery on M Open E	Ground on M Ground on E	Outgoing call seizure, disconnected by called party
OFF-HOOK	OFF-HOOK	SD-2H103, loop closed SD-2H114, low resistance loop	Battery on Tip Ground on Ring	Battery on M Ground on E	Battery on M Ground on E	Talking, wink start

* Depends on how the originating office expects it. An option in the incoming trunk allows for "Battery" and "Ground" to be reversed in this column.

2.05 Loop supervision is used when it is convenient to signal using the tip and ring trunk conductors themselves as the signaling transmission medium. An example of this arrangement is an SD-2H103 trunk circuit in an originating No. 2 ESS office connected by a cable pair to another No. 2 ESS using an SD-2H101 trunk circuit as an incoming trunk. Signaling in the forward direction is affected by a dc loop closure (off-hook) or an open loop (on-hook). In the reverse direction an off-hook is recognized by ground on the ring and battery (-48V) on the tip. The on-hook signal is the reverse of the above condition. Refer to Figure 1 for an example of loop supervision.

2.06 E&M signaling is used when it is necessary to interface with transmission or signaling systems where dc signaling is not possible due to loop loss or other factors. An advantage of E&M signaling is the greater range afforded over loop signaling. Figure 2 shows the interconnection required between No. 2 ESS trunk circuits and E&M signaling units. It is not necessary to use E&M trunks when interfacing with T1 carrier facilities because there are loop signaling channel units available for use in the T1 carrier system. An ESS loop signaling trunk circuit may be directly connected to a T1 carrier loop signaling channel unit without regard to the type of signaling required at the distant end. This is usually a more economical arrangement than using E&M trunk circuits at the No. 2 ESS. See Figure 3 for a typical example of this type of trunk arrangement.

Pulsing Types

2.07 Two methods are used in No. 2 ESS for transmitting and receiving called telephone numbers to and from distant offices. These are dial pulsing (DP) and multifrequency pulsing (MF). Dial pulsing is generally used on trunks to and from step-by-step offices. It may be used to common control offices (crossbar and ESS) but considerable savings in equipment and holding time can be realized by utilizing MF on trunks to these types of offices.

2.08 Dial Pulsing is a type of dc signaling utilizing either the trunk tip and ring conductors or E&M leads. It consists of an initial off-hook signal (seizure) and a series of on-hook pulses, the number of which correspond to a dialed digit. Between digits, there is a nominal interdigital time of 600 milliseconds. In No. 2 ESS, this time is variable as an office option between 100 and 1500 milliseconds. Pulsing speed is 10 pulses per second and the percent break (ratio of on-hook to off-hook time) of the pulses is approximately 61 percent. See Figure 4 for a graphical representation of a dialed digit.

2.09 Multifrequency pulsing is a system of transferring number information over trunks by various combinations of two and only two of six frequencies in the voiceband. Each combination of two frequencies represents a digit. Ten combinations are used for the digits 0 through 9

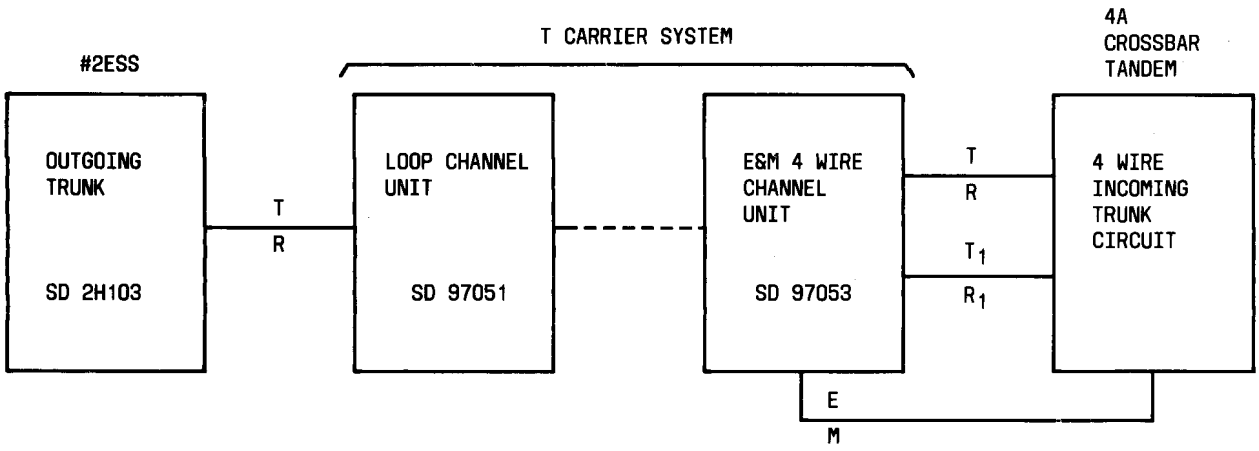

Fig. 3—Example of Combined Loop and E & M Supervision

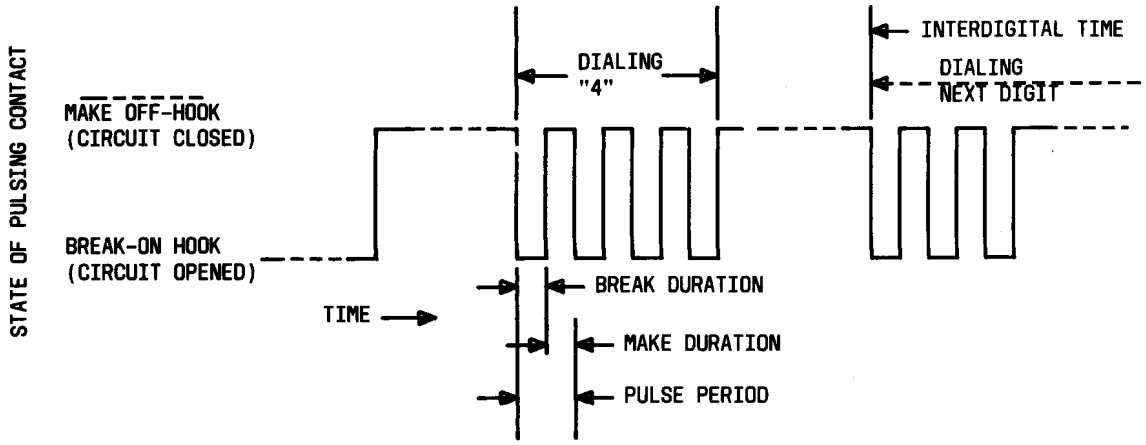

Fig. 4—Dial Pulsing

and one each for signals indicating the beginning (KP) and end (ST) of pulsing. The remaining combinations are reserved for special end signals to TSPS and for coin return and collect. Table B shows the relation between the digits and frequency combinations.

TABLE B

FREQUENCIES FOR MF PULSING

900	1				
1100	2 or CC	3	DIGITS		
1300	4	5	6		
1500	7	8	9	0	
1700	ST3P or Rering	STP	KP or CR	ST2P	ST
Frequency	700	900	1100	1300	1500

CC — Coin Collect

CR — Coin Return

KP — Keypulse (beginning of pulsing)

ST
STP
ST2P
ST3P — START (end of pulsing, indicating different classes of calls in different systems)

(*Note:* STP is sometimes called ST1P)

ST only is used to a 3CL switchboard. With TSPS, the various START signals have the following meanings:

ST — Coin, 1+ or no prefix

STP — Coin, 0+ or prefix, or 0—

ST2P — Non Coin, 1+ or no prefix

ST3P — Non Coin, 0+ prefix, or 0—

Multifrequency pulsing may be used with any of the No. 2 ESS interoffice trunks which require pulsing and should be employed where far office requirements make this possible. Multifrequency pulsing requires less holding time per call. This is because a complete MF digit can be transmitted in the time required for transmitting one pulse of a DP digit. Also since MF does not use overlap outpulsing, the caller cannot prolong the interdigital time.

Start Dial Signals

2.10 Common control offices may require some amount of time (a few hundred milliseconds to several seconds depending on traffic load) to prepare for the reception of dialing signals on incoming trunks. A start dial signal is sent from the called office when it is ready to accept these signals. The No. 2 ESS office can accept and provide two types of start dial signals These are

delay dial and wink. No start dial signal is given or received from nonsenderized step-by-step (bylink) offices as the switching elements in these offices are under direct control of the customer's dial.

2.11 A wink signal is defined as a momentary on-hook/off-hook/on-hook signal (140- to 290-millisecond off-hook interval) when pulse receiving equipment is ready to accept pulsing. This system is in general use in the local switching network between common control offices. Wink start may be employed (i.e., returned on an incoming trunk or expected on an outgoing trunk) on any No. 2 ESS trunk that uses MF pulsing. A wink start is ***always*** returned on an incoming trunk that requires either a DP or MF digit receiver. A wink ***may*** be returned on incoming DP E&M trunks.

2.12 A delay dial signal is defined in two ways generally called Method A and Method B. These are: Method A: When the seizure is recognized by the incoming office, the trunk goes or remains off-hook until the receiving equipment is ready to receive digits, then goes on-hook. Method B: When seized the trunk goes off-hook ***within 50 milliseconds.*** It remains off-hook until receiving equipment is ready to receive digits then goes on-hook.

2.13 No. 2 ESS can provide delay dial signals using either method, but basic differences exist depending on whether the trunk is outgoing or incoming. Each case will be described separately.

2.14 Considering the No. 2 ESS as the outgoing end of the trunk, the incoming office will provide a Method A or B delay dial signal. The No. 2 ESS will recognize either, since it does not care about the speed of the delay dial return. Whether the trunk is on-hook or off-hook idle must be specified in the ESS 2204 Trunk Feature Table by utilizing the GLARE column. (Note: In this case the GLARE column is not used to indicate a "glare" condition.) If the GLARE column is checked the other office is off-hook idle to the No. 2 ESS and the outgoing trunk must be an SD-2H103. Use of the Trunk Feature Table is further explained in Part 13 of this document and in the TG-2H.

2.15 If the No. 2 ESS is the incoming end of the trunk, it can provide a Method B type delay dial signal utilizing an SD-2H149 trunk circuit. With this circuit, the program sends a wink start signal, but hardware within the SD-2H149 has already sent (within 50 milliseconds) an off-hook. The trailing edge of the program controlled wink sets the trunk on-hook terminating the delay dial signal. Method A delay dial is possible with any appropriate incoming or 2-way trunk. The program actually sends a wink start signal, but the outgoing office recognizes the off-hook to on-hook transition (trailing edge) of the wink as a delay dial.

Trunk Numbering Scheme

2.16 Trunk and service circuit groups are assigned group numbers according to specific rules. A 3-digit trunk group number is assigned to each group. The quantity of trunk groups allowed differs with the generic program installed in the office as follows:

(a) In offices equipped with the LO-1 generic program, telephone company defined trunk group numbers are limited to the 070-255 range.

(b) In offices equipped with the EF-1 program, telephone company defined trunk group numbers are limited to the 070-511 range.

In addition to service circuit groups 000 to 069, all offices may assign additional service circuit groups beginning with trunk group number 080 with the following limitations:

(a) Starting with trunk group number 080, service circuit groups and trunk groups cannot be mixed within any group of 16 trunk group numbers, i.e., 080-095, 096-111, 112-127, etc.

(b) The first service circuit group must be assigned to the first trunk group number within the group, i.e., 080, 096, 112, etc.

2.17 Since trunk groups cannot be added via recent change, it is necessary to establish spare trunk groups in translations. Once these groups are established, their classification may be altered by recent change from spare to active and vice versa. Sufficient spare trunk groups should be established to take care of growth requirements between office data administration (ODA) runs. Spare trunk groups should be established to hold each type of spare trunk in the office. Other spare groups should be established for various trunk circuit SDs, type pulsing, supervision, etc., depending on forecast growth needs of the particular office.

With the LO-1 generic, specific data (pulsing, supervision) cannot be changed via recent change; therefore, it is important to have various types of spare trunk groups readily available when the need arises. With the EF-1 generic, the trunk group data is recent changeable, but it is more convenient to have the proper type spare group available when needed. When a trunk group must be created and no suitable spare group exists, an ODA run is the only alternative.

Alternate Routing

2.18 Alternate routing is the feature of the No. 2 ESS by which a call, after encountering an "all trunks busy" condition in the first choice route, is offered another route to, or toward its destination. An example of the use of this feature is where a small outgoing high-usage trunk group exists between the No. 2 ESS and another local office. Calls can be made to overflow into a tandem trunk group when all the trunks in the small group become busy.

2.19 The means of implementing this feature is contained in The Route Index Expansion Translations (ESS Form 2303). On this form, a "Next Route Index" may be specified as an alternate route. Six route indexes may be linked together in any one alternate route arrangement. If no alternate route exists for the route or if the route is the final route, the next Route Index Column is left blank. See TG-2H, Division 4, Section 3d for details.

OUTGOING TRUNK FUNCTIONS

Basic Considerations

2.20 The outgoing trunk function is that function which provides the interconnection between a customer that originates a call in a No. 2 ESS office and a called party in another office. This function may be classified into two general types, automatic (dial) operation and manual operation. Automatic operation involves interfacing the No. 2 ESS with another automatic type office (ESS, crossbar) in which a directing address (telephone number) must be forwarded over the trunk facility to the terminating office. Manual operation implies no address information is needed by the terminating office to route the call. For example, simply seizing a trunk to a repair service desk is enough information to establish a connection to the repair attendant.

2.21 In addition to the general trunk operating methods outlined in paragraphs 2.02 through 2.13, there are several operating features unique to outgoing trunks. These are:

- Digit prefixing and deleting
- Overlap outpulsing
- Access codes
- Trunk Diagnostics.

Digit Prefixing and Deleting

2.22 To facilitate routing flexibility, one, two, or three leading digits of the dialed telephone number may be deleted from the digits outpulsed to the terminating office. In addition, arbitrary digits may be prefixed to the string of outpulsed digits. With the LO-1 generic program, prefixing more digits than are deleted is prohibited except for calls to Automatic Intercept System (AIS) where an additional information digit is required. With the EF-1 program up to three digits may be prefixed regardless of the number of digits deleted. The route index expansion has provision for specifying the digits to be prefixed and/or deleted. See the TG-2H, Form 2303 for details on using the feature.

Overlap Outpulsing

2.23 When an outgoing trunk uses dial pulsing as its method of signaling, overlap outpulsing may be specified. This allows outpulsing to start after reception of the first three digits from the customer as opposed to waiting for the entire telephone number to be stored in the originating register before the start of outpulsing. Any prefixed digits specified are outpulsed immediately, then succeeding digits are outpulsed as they are received from the customer (except those that are to be deleted). With this method, transmitter holding time is longer, but call completion time is faster since the system only needs to wait for the last customer dialed digit. See the Trunk Feature Table (ESS Form 2204) section in the TG-2H for implementation of this feature.

Access Codes

2.24 As described in the Customer (User) Perspective section of this document, the customer may be required to dial a 0 or 1 prefix before dialing

the telephone number. Options exist to either require, ignore, allow, or prohibit dialing a "1" prefix for any particular 3-digit code (first three digits of a 7- or 10-digit telephone number). The "0" prefix may be allowed for any 3-digit code. When so allowed the "0" may or may not be dialed depending on whether operator assistance is needed. These options are implemented by the proper completion of the Three- and Six-Digit Translator. See the TG-2H, ESS Form 2300 for details.

Trunk Diagnostics

2.25 A request for an automatic test of a trunk can originate from any one of four places. These test request sources are:

- Traffic work table
- Maintenance TTY
- Trunk test panel
- A circuit failure during regular call processing.

Certain outgoing, nonoperator trunks can be tested to the distant office according to a schedule in the traffic work table. Tests to a permanent busy number (in the distant office) can be made on all trunks that are tested in this manner. Operational tests, i.e., tests that check the supervisory features of the trunk may also be made when the distant office is equipped with a synchronous or nonsynchronous test line. SD numbers of trunks that may be diagnosed in this manner are as follows:

SD-2H103

SD-2H112

SD-2H144 (See note)

SD-2H148, SD-2H157, SD-2H158 — EF-1 Generic Program Only

Note: Only permanent busy tests may be made on the SD-2H144 trunk when used to TSPS or CAMA.

All tests can be made in other applications. See the Automatic Trunk Test Table (TG-2H Form ESS 2505) for implementation of this feature.

2.26 In addition to the diagnostic programs built into the No. 2 ESS, various transmission and noise measurements may be made on outgoing nonoperator trunks by means external to the No. 2 ESS, utilizing the Remote Office Test Line (ROTL) feature. The ROTL allows trunk testing automatically from a Centralized Automatic Reporting On Trunks (CAROT) system. Manual trunk transmission testing may also be performed locally or at a remote location using a Manually Controlled Interrogator/ROTL Control Unit test set or a ROTL System Test Set (H-310-150). See Sections 232-132-101 and 232-190-205 for further descriptive and implementation information.

OUTGOING TRUNK AUTOMATIC (DIAL) OPERATION

Interoffice Trunks

2.27 Outgoing trunks from a No. 2 ESS to a local or tandem dial central office typically use SD-2H103 or SD-2H144 trunk circuits. Proper selection of dial pulse or multifrequency pulsing, type of start dial signal, overlap outpulsing, etc., depends on the type of terminating office as covered in the general trunk operating methods of this description.

2.28 If E&M lead signaling is required at the originating end because of transmission facility arrangements, SD-2H112 may be used. This trunk circuit is intended to be used as a two-way trunk but one-way operation is possible. It may also be used as a substitute for SD-2H103 provided that E&M transmission facilities are available at the originating end. This use involves a considerable cost penalty and should be avoided when possible. If the far-end requires E&M signaling and a T1 carrier facility is involved, use loop supervision methods at the No. 2 ESS and convert to E&M signaling at the far-end.

2.29 Other trunk circuits that may be used in this application are SD-2H148, SD-2H157, and SD-2H158. Since these trunk circuits are designed for 2-way operation, their use imposes a cost penalty when used as a one-way outgoing trunk. See the Two-way Trunk Functions section of this document for a complete description of these trunk circuits.

Centralized Automatic Message Accounting (CAMA) Trunks

2.30 For offices without local AMA or when it is otherwise desirable to record billing information at another location, a CAMA trunk group may be set up. This trunk group usually connects to a crossbar tandem office equipped with AMA, although several other tandem-type offices may be available. Appropriate routing and trunk group information must be entered in translations, such as 1+ or 0+ prefixing if required, the proper trunk type marked in the Trunk Feature Table (CAMA-ANI), and all other usual information pertaining to outgoing trunks (MF pulsing, supervision, etc.).

2.31 The hardware required for this type trunk group is either:

- SD-2H144 (Hi-low and reverse battery supervision)
- SD-2H112 (E&M supervision).

If the far-end requires E&M signaling and a T1 carrier facility is involved, use loop supervision methods at the No. 2 ESS and convert to E&M signaling at the far-end.

Traffic Service Position System (TSPS) Trunks

2.32 When operator services (i.e., local assistance, person-to-person collect calls, credit card, etc.) are provided by a TSPS, a trunk group from the No. 2 ESS to a toll office has TSPS trunk circuits interposed between the No. 2 ESS and the toll office. This trunk group may be considered as one connecting the No. 2 ESS and TSPS even though the ultimate connection is onward through the TSPS to the toll office. The TSPS only provides the switching and control to the operator position through a bridged connection. When the operator functions are completed, the TSPS disconnects the operator and sets up the through connection to the toll office.

2.33 The following type of calls can be handled by the No. 2 ESS over separate trunk groups, the same trunk group, or any combination of trunk groups to a TSPS:

1+ calls

0+ calls

no prefix calls

0- (dial zero) calls.

The single group method (called a "combined" group to TSPS) is recommended, and is preferred over separate groups. Various combinations of coin, noncoin, and hotel-motel are allowed over the same No. 2 ESS trunk group to TSPS.

2.34 For trunk groups not arranged for Dial Tone First (DTF) Coin, trunk groups can be set up to handle noncoin traffic only, prepay coin traffic only, or a combination of both types over the same trunk group. The latter is recommended. In trunk groups arranged for DTF (+48 volts) operation, trunk groups may handle noncoin traffic only, DTF coin traffic only, or a combination of both types over the same trunk group. Again the latter is recommended.

2.35 Regardless of the group arrangement, translations in the TSPS machine must be set up to receive combined, coin, and noncoin traffic over each group from a No. 2 ESS office. (This type of group is called a "supercombined" group in TSPS language.) This arrangement is required when working with No. 2 ESS for two reasons.

(1) No. 2 ESS can only send the supercombined type of signals to a TSPS. (These signals will also work when separate groups are set up.)

(2) TSPS will not always send inband MF signals for rering (required by No. 2 ESS) in the nonsupercombined mode of operation.

2.36 Special translation treatment for this type of trunk group consists of 0 or 1 prefix treatment in the Three- and Six-Digit Translator and the proper trunk type (TSP, TSPS) marked in the trunk feature table. Also, a separate route index is required. Multifrequency pulsing must be specified in this table. The trunk type used is SD-2H144 when loop supervision is appropriate. Use SD-2H112 when E&M lead signaling is necessary.

2.37 When manual telephone service is to be provided (e.g., to handicapped customers) a TSPS trunk group may be used for this purpose. A special originating major class (10) exists for

this purpose. When the customer originates the system, the call is routed to TSPS via a dedicated route index (11). Since the customer dials no digits, the call arrives at the TSPS as a 0- call. The operator may then route the call as appropriate.

Automatic Intercept System (AIS) Trunks

2.38 AIS is a system that routes a call, placed to a nonworking number, to a recorded announcement specifically tailored to each intercept case. When a call to a nonworking number is processed by the No. 2 ESS, the called number is outpulsed over the AIS trunk. The AIS then provides an automatically assembled recorded announcement or routes the call to an intercept operator as appropriate.

2.39 Translation treatment for AIS involves setting the AIS bit in the trunk feature table in addition to specifying MF pulsing and the appropriate information prefix digit. Delay dial or wink start signal is specified according to the requirements of the AIS. Loop or E&M signaling may be used depending on the transmission facilities available.

2.40 The prefix digit informs the AIS of the reason the No. 2 ESS is routing the call to AIS. The following prefix digits have designated meanings as defined by the AIS system:

0 = Blank or unassigned number

1 = Trouble intercept

3 = Disconnected or changed number

The route indexes pointing to an AIS trunk group must prefix a digit in accordance with the above codes. The allowable prefix digit combination is as follows:

TYPE OF TREATMENT	PREFIXED DIGIT
Regular Intercept	0 or 3
Disconnect Intercept	3
Trouble Intercept	1
Blank Number or Translation Error	0 or 3

2.41 If loop supervision is possible at the No. 2 ESS, use an SD-2H103 or SD-2H144 trunk circuit. If E&M signaling is required because of transmission facility arrangements at the originating end, use an SD-2H112 two-way trunk circuit as a one-way trunk.

OUTGOING TRUNK MANUAL OPERATION

Recording Completing Trunks (3CL)

2.42 When operator services are provided by a 3CL switchboard, any one of several types of trunk groups may be created depending on individual office needs. The following are examples of different types of trunk groups that may be required:

- "0-" Assistance (Noncoin)
- "0-" Assistance (Coin)
- "0-" Assistance (Coin-Dial Tone First)
- Manual Operator
- Emergency Services.

2.43 When assistance services (0-) are provided to customers from a 3CL switchboard, it is sometimes desirable to segregate customers by class of service such as coin or noncoin, flat rate, or message rate, etc., in order that the proper charge treatment may be made or for other traffic operating reasons.

2.44 When Dial Tone First Coin service is provided, operator trunks should be arranged to return +48 volts and ground to the calling station. This permits the signaling of coin deposits of less than the local initial rate to the operator. Positive battery also serves to disable the TOUCH-TONE® dial, thereby preventing fraudulent operation of the TOUCH-TONE keys to simulate coin deposits.

2.45 When manual telephone service is to be provided via the 3CL switchboard, a special trunk group may be set up for this purpose. When the manual customer originates, the No. 2 ESS routes the call immediatly to a manual trunk group without a requirement for the customer to dial. The facilities of this trunk group may be connected to a 3CL board and designated ***manual.*** When a call arrives over a manual trunk, the operator

recognizes the call as a manual class of service and completes the call as appropriate.

2.46 Nine-one-one (911) emergency service may be provided by a special group of 3CL trunks or a Public Assistance Bureau external to the telephone company organization. The 3-digit code 911 must be pointed to a trunk group that goes to the 3CL switchboard or a private switchboard. This group is designated as 911 trunks and handled by the operator or attendant in an appropriate manner.

2.47 Translation treatment for 3CL trunk groups requires setting Loop and REC COMP bits in the Trunk Feature Table. Also, proper service code routing (0, 911) and class of service screening must be provided. In the case of the manual class of service, the use of a special MAJOR class code (10) will cause call processing to route an originating call attempt directly to the manual operator trunk group. No dial tone is sent to the customer. See TG-2H forms 2300, 2301, and 2306 for details.

2.48 The hardware required for 3CL application may be either the SD-2H105 or SD-2H110 trunk circuits. The SD-2H105 circuit is designed to provide supervisory functions, reverse battery ringback, and coin control on a dc basis over the tip and ring leads. All these functions are available provided that the ESS is in the same building as the 3CL. Coin and rering functions are not possible if the 3CL is in a distant building. The SD-2H110 trunk circuit may be used with a 3CL equipped for inband signaling. This circuit uses MF tones for coin control and rering signals, and dc for supervisory signals. It must be used when the 3CL is in a distant building from the ESS.

Other Manual Trunks

2.49 A number of other applications of outgoing manual operation is possible. Some examples are given in the following paragraphs. In all cases, this type of manual operation is implemented in translations by the route index specifying delete 7 digits and no prefix digits.

Intercept and Directory Assistance

2.50 When manual intercept service is required (as opposed to an AIS), disconnected or unused directory numbers are routed to a trunk group connected to a manual intercept bureau such as a 6A Intercept System.

2.51 When connecting to a 6A intercept system, three types of intercept service can be provided over the same trunk group. These are:

- Machine intercept—used for unassigned or vacant number treatment
- Regular intercept—used to provide operator handling of disconnected numbers requiring number change information
- Trouble Intercept—used when called number is in "plugged up" state (trouble in outside plant).

Regular and trouble intercept may also be provided by a 3CL or 23-type desk.

2.52 These types of intercept services are implemented by assigning directory numbers requiring intercept to one of three route indexes that point to the intercept trunk group. Each route index has a different call type to specify the intercept treatment required. See TG-2H, Division 4, Section 3d for details on constructing route index expansion tables to meet these requirements. Loop supervision, NORM trunk type, and no outpulsing must be specified in the Trunk Feature Table for the trunk group.

2.53 Hardware and call type required for various intercept services are shown in Table C.

TABLE C

CALL TYPE AND HARDWARE FOR INTERCEPT SERVICE

CALL TYPE	DESTINATION	
	6A ANNC. SYSTEM (USE 2H107 OR 2H112 TRUNK)	OTHER (USE 2H110 OR 2H112 TRUNK)
16 (Mach. Int)	6A Annc.	Not Valid
17 (Reg. Int)	6A Oper. (23 Type Desk)	23 Type Desk or 3C Swbd*
18 (Tbl. Int)	6A Oper. (3C Type Swbd)	23 Type Desk or 3C Swbd*

* In this application, call types 17 and 18 behave identically, and are similar to call type 30 (Recording Completing) except that joint holding is *not* in force.

2.54 Directory assistance is provided in a similar manner except multiple route indexes are not required and either SD-2H103 or SD-2H107 may be used depending upon requirements of the directory assistance office.

Repair Service and Local Test Desk (LTD) Trunks

2.55 A special trunk circuit is available to complete a call from a No. 2 ESS to a No. 2 Repair Service Desk. This circuit enables the repair attendant to busy the trunk circuit from the repair position, which alternate routes calls to another group of trunks, possibly to a different repair bureau. Trunk circuit SD-2H147 provides the necessary hardware to implement this route transfer capability. Either a 3-digit service code or a regular 7-digit telephone number may be used to access the repair desk trunk group. A route index is assigned to the telephone number or service code. This route index is a route transfer route index which points to both the repair service trunk group and the alternate trunk group.

2.56 LTD trunks have a requirement that a metallic path between the subscriber line and the test desk be established for dc measurement purposes. Compatibility with No. 14 or 16 LTD circuits and sleeve lead supervision is also required. Trunk circuit SD-2H141 is designed to be used in this application. Methods similar to repair service desks are used to assign service codes and/or telephone numbers. See TG-2H, Forms 2300, 2303, and 2204 for detailed translation information.

Business Office Trunks

2.57 A trunk group may be provided to the business office in a manner similar to a directory assistance trunk group. Call type 20 on Form ESS 2303 should be used with an SD-2H103 trunk circuit if the business office equipment provides an audible ring to the customer. Call type 22 and SD-2H110 or SD-2H112 should be used if audible ring must be provided by the No. 2 ESS.

Remote Office Test Line (ROTL)

2.58 When the office is equipped with a ROTL, it is necessary to create two special trunk groups to interface the ROTL with test centers and trunks to be tested. One trunk group (used as access ports) must be constructed using SD-2H103 outgoing trunk circuits. A telephone number, designated as the ROTL access number points to a route index which in turn points to the trunk group number of the access ports. When the telephone number is called by the outside world, the processor establishes a connection between the calling party and one of the ROTL access ports. This enables the calling party to direct the ROTL testing using MF commands.

2.59 A ROTL test port in a different trunk group must be established. This port is used by

the ROTL to connect to the trunk under test in the No. 2 ESS. The hardware used for the test port shall be an SD-2H110 trunk circuit. ROTL requires the installation of the EF-1 or later generic program. See Sections 232-190-205 and 232-132-101 for details on implementing ROTL trunk groups.

INCOMING TRUNK FUNCTION

Basic Considerations

2.60 The incoming trunk function is that function which provides the interconnection between a call originated in another central office and a customer in the No. 2 ESS. In noncentrex trunking, only automatic (dial) trunking exists; there are no incoming manual trunk calls.

2.61 In addition to the general trunk operating methods outlined in 2.02 through 2.13, there are two operating features that must be considered concerning incoming trunks. These are:

- Bylink Operation
- Delay Dial Start.

Bylink Operation

2.62 Nonbylink incoming trunk processing requires a digit receiver and an originating register be associated with the incoming trunk. When this is accomplished, a wink is sent to the originating office to indicate readiness to receive pulsing. This may take from 250 milliseconds up to several seconds depending on office load. In nonsenderized step-by-step offices, pulsing is under direct control of the customer's dial. Therefore, the need exists to detect and store pulses that may arrive at the No. 2 ESS before a connecting path can be established to a digit receiver. To accomplish this, no digit receiver is used in bylink operation. Instead, the trunk side ferrod of the incoming trunk is scanned for dial pulses. An originating register, selected on interrupt level, is then used to accumulate the dialed digits. Thus, time is saved since the call processing programs need not find and connect receivers and network paths before collecting digits.

2.63 Incoming E&M trunks that use dial pulse signaling present a problem that is solved in a manner similar to bylink trunks. Dial pulses arrive at the trunk circuit over the E lead. To prevent call processing from interpreting pulses as a series of on-hook hits, the bylink method of digit collection is used. All phases of processing dial pulse E&M trunks are identical to the way bylink trunks are handled with the exception that dial pulse E&M trunks are allowed to return a wink over the M lead if a start dial signal is required.

Delay Dial Signal

2.64 A special case exists when immediate receipt of a delay dial signal is required by the originating office. Hardware in the SD-2H149 incoming trunk circuit is arranged to return a delay dial signal (an on-hook to off-hook change in supervision) upon seizure. When a trunk is connected to a receiver and the trunk put in the bypass state, the receiver maintains the off-hook supervision. The wink is then converted to the trailing edge of the delay dial signal by hardware within the trunk circuit.

INCOMING TRUNK AUTOMATIC (DIAL) OPERATION

Interoffice Trunks

2.65 Incoming trunks from local or tandem dial offices may utilize the following trunk circuit types:

- SD-2H101 Reverse Battery Supervision
- SD-2H149 Reverse Battery-Delay Dial
- SD-2H154 Reverse Battery-Step-by-Step.

The following trunks may also be used but are rated A&M:

- SD-2H104 Reverse Battery
- SD-2H111 Reyerse Battery-Step-by-Step.

2.66 The following two-way trunk circuits may be used as one-way incoming although at a cost penalty or when it is necessary to interface with E&M lead controlled facilities:

- SD-2H112 E&M Lead
- SD-2H148 Reverse Battery
- SD-2H157 E&M Lead with 4-wire Terminating Set—Dial Pulse

- SD-2H158 E&M Lead with 4-wire Terminating Set—MF.

The SD-2H148, SD-2H157, and SD-2H158 may not be used when the office is equipped with the LO-1 generic program.

2.67 Translation data required to implement the incoming trunk function is covered in Section 11 of this feature document and in the TG-2H.

Toll Switching Trunks

2.68 When operator services are provided by a 3CL toll switchboard and toll switching trunks are required from the switchboard to the No. 2 ESS, they can be provided by using the SD-2H108 or SD-2H110 trunk circuit. This circuit is used as an incoming trunk and can provide the controlled ring function and coin signaling as required. If a verification trunk is required, this circuit may be used as a no-test trunk to verify a busy number or provide emergency communication to a busy number through the use of the no-test vertical in the No. 2 ESS.

2.69 The SD-2H108 circuit may be used incoming from a 3CL more economically when the No. 2 ESS is in the same building as the 3CL and it is convenient to use a sleeve lead (third wire).

2.70 There are special marks in the trunk feature table (ESS Form 2204) that when marked, define the trunk group as a toll switching trunk or a no-test trunk. The appropriate one should be selected depending on the type of toll switching trunk group being built.

2.71 When working with DTF coin lines, toll switching trunks must be provided with the +48 volt option for reasons outlined in 2.44.

Local Test Desk (LTD) Trunks

2.72 The purpose of LTD trunks is to provide a means of establishing a metallic test connection from a No. 14 or 16 test desk or a No. 3 test cabinet to a customer line through the No. 2 ESS. The connection is made through the regular switching network path if the line is idle or through the no-test vertical if the line is busy. Provision is made to send various supervisory signals back to the test position (flashes, interrupted tone, etc.) when various conditions are encountered. The trunk circuit used for this application is SD-2H109. Construction of this type group is similar to other incoming trunk groups with the exception of the LTD and NO-TEST marks in the trunk feature table (ESS Form 2204).

TWO-WAY TRUNK FUNCTION

Basic Considerations

2.73 It is sometimes desirable for traffic engineering reasons to provide a trunk group with combined incoming and outgoing functions. This may be done in No. 2 ESS by using certain trunk circuit hardware and constructing translation data as if the trunk group was both an incoming and outgoing group. In particular, in the trunk direction portion of the Trunk Feature Table, ***both*** incoming and outgoing columns should be marked. In all other portions of translations, the 2-way trunk group should be considered as an outgoing group only and the translations constructed accordingly. The same procedure is then applied as if the trunk group were an incoming group only.

2.74 Two-way trunks are subject to occasional simultaneous seizures at both ends because of the unguarded interval between the seizure of the trunk at one end and the consequent making busy of the trunk at the other end. This is called "glare." In No. 2 ESS, provision is made for resolving this conflict by providing a special mark (glare) in the trunk feature table. A check mark in this column indicates that the No. 2 ESS relinquishes control of the trunk when a glare situation occurs. The absence of a check mark indicates that the distant office must relinquish control. If the outgoing portion of the trunk in the No. 2 ESS is utilizing delay dial, the terminating office must back off under glare conditions, since the No. 2 ESS cannot check for glare in this case.

TWO-WAY TRUNK AUTOMATIC (DIAL) OPERATION

2.75 Two-way trunks between a No. 2 ESS and a local or tandem dial central office use one of four types of trunk circuit. These are:

- SD-2H112—used when E&M Leads are necessary to interface with the near-end transmission facilities. Either dial or MF pulsing may be used.

- SD-2H148—used when reverse battery incoming and high-low outgoing supervision is required. Either type of pulsing may be used. This circuit may not be used when the LO-1 program is installed in the office.

- SD-2H157—E&M Type trunk with a built in 4-wire terminating set. Either type of pulsing may be used. Not for use with LO-1.

- SD-2H158—This trunk is similar to SD-2H157 except MF pulsing only is possible. Not for use with LO-1.

EXAMPLES OF TYPICAL CALLS

2.76 The following paragraphs describe the sequence of actions that occurs when a typical outgoing call to a dial office is placed (refer to Figure 5). After the customer dials the desired number, the No. 2 ESS will:

(a) Determine from the dialed digits the trunk group required to route the call.

(b) Select an idle trunk from this group for use on this call.

(c) Seize the trunk and wait for the appropriate start dial signal if necessary.

(d) Select and connect through the network the proper type of transmitter (dial pulse or multifrequency)

(e) Transmit the required portion of the called telephone number to the distant office over the selected trunk.*

(f) Remove the transmitter network connection.*

(g) Establish talking connection.

(h) Supervise call for answer and disconnect.

(i) When disconnect occurs, idle network connection and trunk, restore line ferrod, and resume line scanning.

*Steps e and f are omitted on a manual trunk call.

2.77 In the case of an incoming call the sequence is as follows: (see Figure 6)

(a) Recognize the arrival of a call on an incoming trunk and connect an appropriate type receiver (dial pulse or multifrequency) to the trunk through the network.**

(b) Collect incoming dialed digits and translate them to the called customer's appearance on the network.

(c) Apply ringing current to called customer's line.

(d) Return audible ringing tone to calling customer from incoming trunk circuit.

(e) When called customer answers, establish a talking connection through the network between the incoming trunk and the called customer's network appearance.

(f) Return answer supervision to originating office if call is a charge call

(g) Supervise call for disconnect.

**If the bylink feature is being used, a receiver is not connected. Dial pulses are detected by scanning the trunk ferrod.

3. FEATURE FLOW DIAGRAM

3.01 Feature flow diagrams giving the functional operations of incoming and outgoing calls are shown in Figures 5 and 6.

4. INTERACTIONS

4.01 Interactions with other features within the No. 2 ESS and with other offices are of a general nature and are covered in other paragraphs of this section.

ATTRIBUTES

5. STATION/SYSTEM

5.01 The various trunking arrangements are provided on a per-office basis.

5.02 Trunk circuits are provided in two types of trunk frames, universal trunk and junctor frames and miscellaneous trunk frames. The universal trunk and junctor frame can accommodate a maximum of 256 trunk circuits and their associated scanner points and peripheral decoder points. The

miscellaneous trunk frames contain a variety of trunk circuits which do not fit the universal trunk size and control point requirements. A complete list of universal and miscellaneous trunk circuits, their uses and specifications can be found in J2H031A Trunk and Service Circuit Engineering Specification Sections C and D.

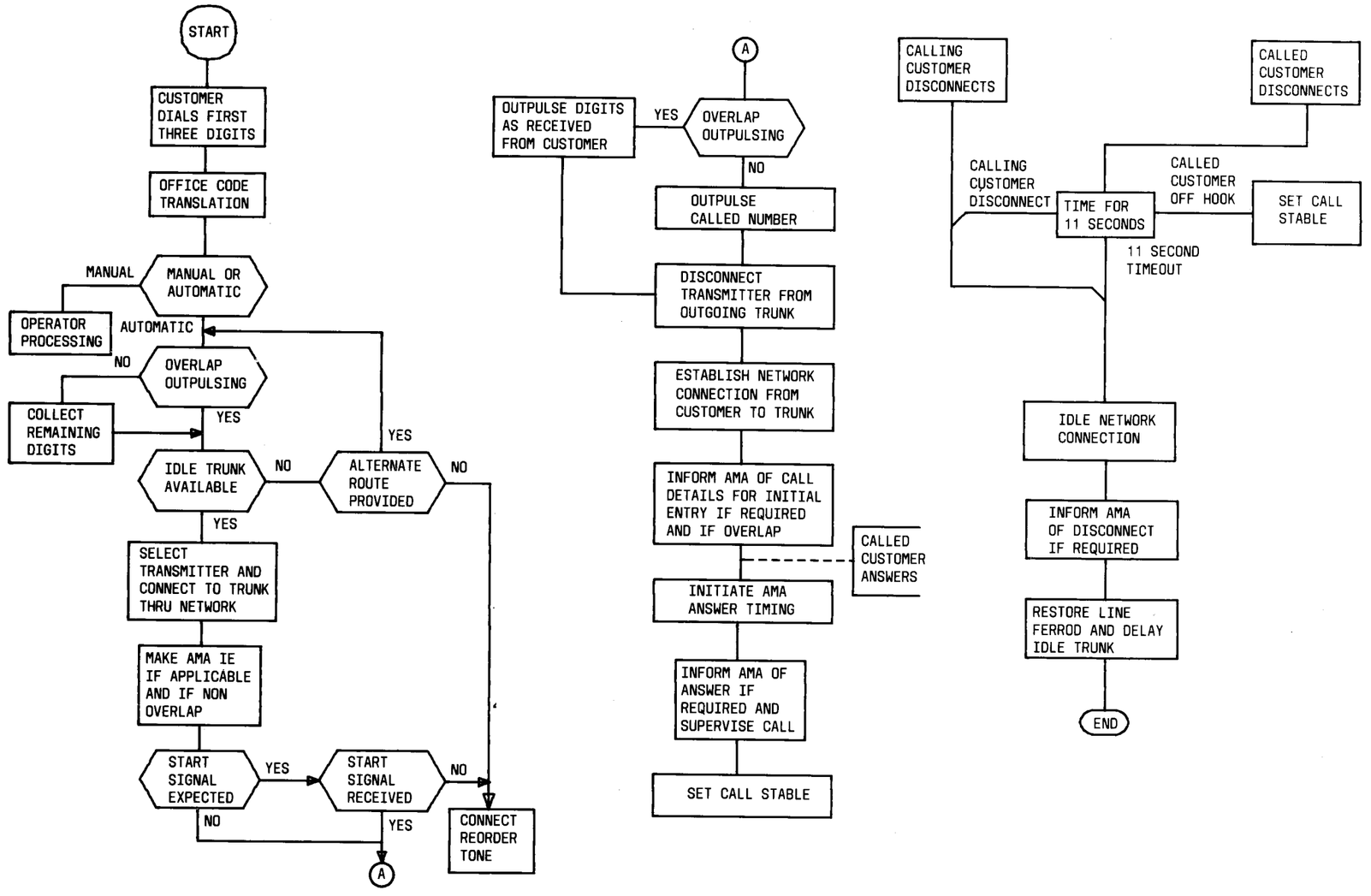

Fig. 5—Outgoing Call

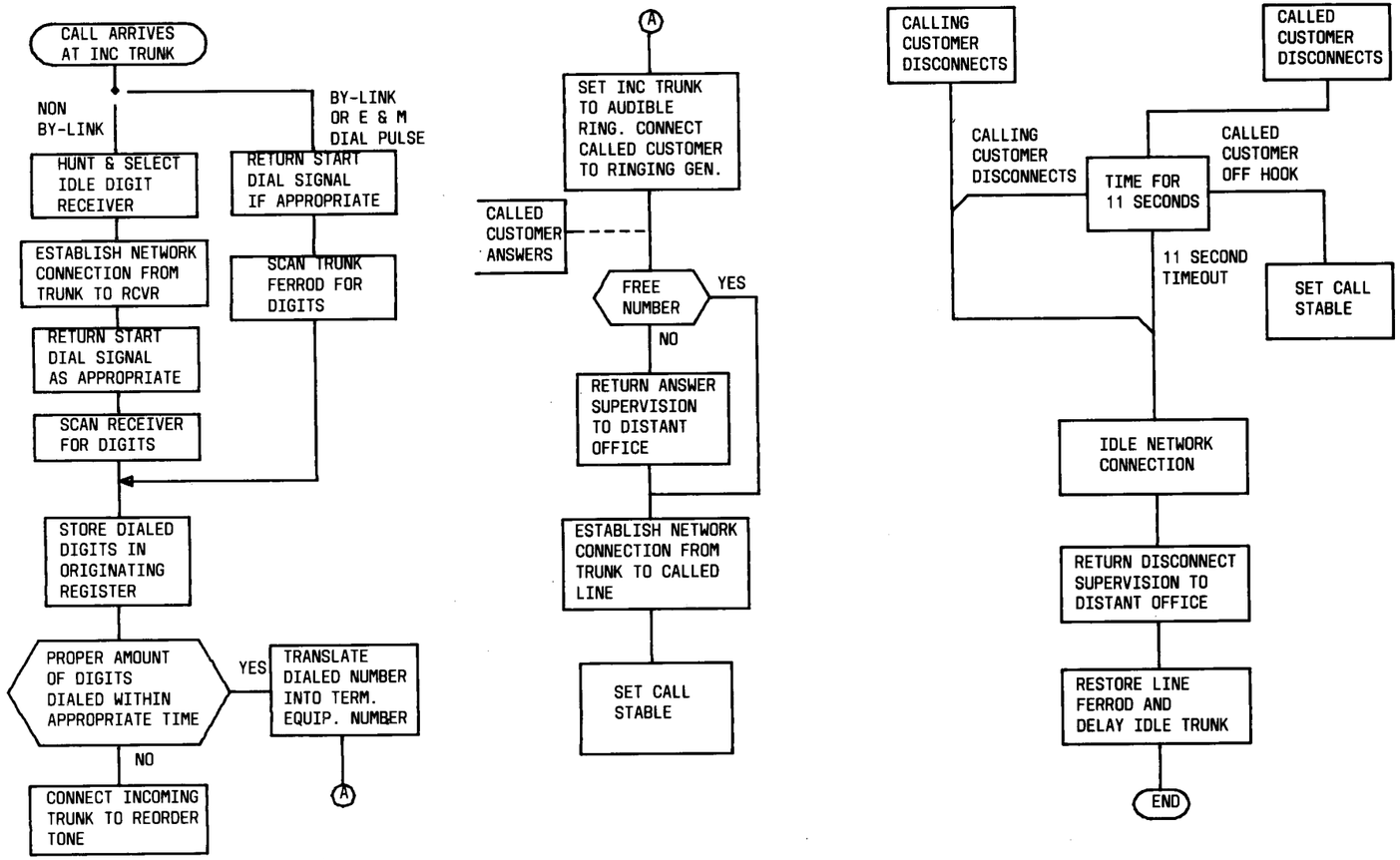

Fig. 6—Incoming Call

6. LIMITATIONS

6.01 The maximum number and size of trunk groups varies with the generic program. Table D shows these relationships.

TABLE D

RELATIONSHIP OF TRUNK GROUP SIZE TO GENERIC PROGRAM

GENERIC PROGRAM	MAXIMUM NUMBER OF TRUNK GROUPS	MAXIMUM NUMBER OF TRUNKS IN TRUNK GROUP
LO-1	186 (70 to 255)	512
EF-1	442 (70 to 511)	256

Trunk group numbers must be assigned starting with Trunk Group Number 070. Service circuit groups and trunk groups cannot be mixed within any group of 16 trunk group numbers above 070.

6.02 Trunk Groups cannot be added by recent change. Therefore, to provide for future growth, some trunk groups should be established in translations as spare (not in service) groups. Once trunks are assigned to a trunk group, their assignments can be changed from one trunk group to another via recent change procedures. All trunks in the office must be assigned to a spare trunk group of like numbered SDs. See TG-2H, Division 4, Section 2c, Figure 1 for other limitations in assigning trunks to spare trunk groups.

6.03 See Tables E, F, and G for generic program limitations on the use of specific trunk circuits.

TABLE E

VALID TRUNK ORDER CODES FOR VARIOUS INTEROFFICE TRUNKING APPLICATIONS

	INCOMING PULSING	OUTGOING PULSING	SD-2H → HIGH 3 DIGITS OF TOC →	101 & 104 156 & 102	103 001	111 & 154 108 & 157	112 509	144 238	148 550	149 149	157 565	158 566
One-Way Outgoing	—	MF		—	00	—	37, (07,39)*	27	00	—	(07,39)*	44
	—	DP		—	00	—	07,39	27	00	—	07,39	—
	—	Manual		—	00	—	37, (07,39)*	27	00	—	(07,39)*	44
One-Way Incoming	MF	—		00	—		37, (07,39)*	—	00	00	(07,39)*	44
	DP (BYL)	—		—	—	03,04	38	—	—	—	(42,43)*	65
	DP (NON)	—		00	—		—	—	00	00	—	—
Two-Way	MF	MF		—	—	—	37, (07,39)*	—	00	—	(07,39)*	44
	DP (BYL)	MF		—	—	—	38	—	—	—	(42,43)*	65
	DP (NON)	MF		—	—	—	—	—	00	—	—	—
	MF	DP		—	—	—	07,39	—	00	—	07,39	—
	DP (BYL)	DP		—	—	—	42,43	—	—	—	42,43	—
	DP (NON)	DP		—	—	—	—	—	00	—	—	—

EF-1 Only

( )* Allowable but not recommended

Numbers within chart are last two digits of trunk order code (TOC)

BYL = Bylink

NON = Non Bylink

TABLE F

VALID TRUNK ORDER CODES FOR VARIOUS OPERATOR APPLICATIONS
(ONE-WAY OUTGOING TO OPERATOR)

			SD-2H →	103 & 147	105	107	110	112	113	141	144	151	186
			HIGH THREE DIGITS OF TOC →	001 & 248	203	204	481 (407)	509	210	235	238	239	672
TSP/ TSPS	Non Coin Only			—	—	—	—	01,22	—	—	01,22	—	—
	Non Coin and/or Prepay			—	—	—	—	01,22**	—	—	01,22**	—	—
	Non Coin and/or DTF			—	—	—	—	22	—	—	22	—	—
CAMA				—	—	—	—	37	—	—	27,28	—	—
AIS				—	—	—	—	37	—	—	27	—	—
6A Intercept				—	—	00	—	37*	—	—	—	—	—
3CL Recording Completing	DC Coin Control	Prepay		—	01,21**	—	—	—	—	—	—	—	—
		Dial Tone First		—	21	—	—	—	—	—	—	—	—
		Non Coin Only		—	01,21	—	—	—	—	—	—	—	—
	MF Coin Control	Prepay		—	—	—	01,21**	01,21**	—	—	—	—	—
		Dial Tone First		—	—	—	21	21	—	—	—	—	—
		Non Coin Only		—	—	—	01	01	—	—	—	—	—
3CL Stuck Coin or Coin Overtime		Prepay		—	—	—	—	—	01,21**	—	—	—	—
		Dial Tone First		—	—	—	—	—	21	—	—	—	—
3CL Verification Request				—	—	—	01	01	—	—	—	—	—
3CL — Coin Zone		Prepay		—	—	—	—	—	—	—	—	01,21**	—
		Dial Tone First		—	—	—	—	—	—	—	—	21	—
Line Access (e.g., 911)				—	—	—	—	—	—	—	—	—	00
Local Test Desk				—	—	—	—	—	—	00	—	—	—
Repair Service Desk				00	—	—	—	—	—	—	—	—	—

Numbers within chart are last two digits of trunk order code (TOC)

* With installer option

** If +48 volt feed to prepay coin telephone is acceptable.

EF-1 Generic Only

TABLE G

VALID TRUNK ORDER CODES FOR VARIOUS INCOMING OPERATOR AND MISCELLANEOUS APPLICATIONS

		SD-2H →	108	109	110	112	103
		HIGH THREE DIGITS OF TOC →	305	306	481 (407)	509	001
LOCAL TEST CABINET NO. 3			—	29,30	—	—	—
LOCAL TEST DESK NO. 14, 16			—	29,30	—	—	—
3CL TOLL SWITCH	DC COIN CONTROL		00	—	—	—	—
	MF COIN CONTROL		—	—	01	01	—
OUTGOING TO ROTL APPLIQUE			—	—	—	—	00
INCOMING FROM ROTL APPLIQUE			—	—	01	—	—

▭ EF-1 GENERIC ONLY

NUMBERS WITHIN CHART ARE LAST TWO DIGITS OF TRUNK ORDER CODE (TOC)

7. RESTRICTION CAPABILITY

7.01 Restriction of certain lines or groups of lines by class of service to the various trunk groups can be accomplished by using special line class codes and line screening codes. The method used involves translators set up by use of ESS Form 2301 Rate and Route Table and Form 2306 Line Class Code Table. The description and procedure is given in the TG-2H, Division 4, Section 3b and 3f. Changes to these translators are not recent changeable and must be changed via the ODA procedure.

8. COST DATA

8.01 Each trunk in the No. 2 ESS requires one trunk circuit mounted in a universal trunk and junctor frame or a miscellaneous trunk frame. Also each trunk requires one terminal equipment number appearance on the line and trunk switching frame. Some trunks, such as coin overtime trunks, require two terminal equipment numbers.

8.02 Program store translation word requirements consist of:

- Trunk Group Table: One word per 16 trunk groups
- Trunk Group Data Table: Eight words per trunk group
- Trunk Circuit List: One word per trunk plus three words per trunk group.

8.03 Call store requirements consist of one call store status block per outgoing or 2-way trunk group. The size of the block is dependent on the number of members per trunk group with a maximum size of 36 words (LO-1 generic) or 20 words (EF-1 generic).

8.04 Other related memory requirements are the remainder of translation tables related to routing and charging. This is dependent on the particular office routing plan rather than the total number of trunks and/or trunk groups.

INCORPORATION INTO SYSTEM

9. PLANNING

9.01 In planning the trunking job, completion of translation input forms listed in OFFICE DATA is required. An ODA run is necessary when incorporating new trunk hardware into the system never before assigned to a trunk group, or when defining a new trunk group. Normal lead time should be observed when ordering required hardware and making ODA changes.

9.02 Division D, Section 12 of the Traffic Facilities Practices contains all the information necessary for the Traffic Engineer to prepare the Traffic Order for initial installation of, or addition to, a No. 2 ESS office. This includes a description of each individual system component of interest to the Traffic Engineer, system features, use of system components in call processing, traffic data requirements for engineering an initial machine or a growth addition, capacity determination procedures for all traffic sensitive machine components, and recommendations for the service criteria which should be applied to the traffic engineering of the system.

10. HARDWARE ENGINEERING

10.01 The complete hardware engineering data for all No. 2 ESS trunk circuits can be found in the Trunk and Service Circuit Engineering Specification J2H031A-1 (Gold Book). This specification is a compilation of circuit drawing and specification drawing information for standard applications of trunk circuits for various central office trunking arrangements.

10.02 Division D, Section 12d of the Traffic Facilities Practices identifies by type, order code, schematic drawing, and functional use all of the trunks and miscellaneous circuits that may be used in a No. 2 ESS. Both types of trunk frames (miscellaneous and universal) used for mounting and controlling these units are also covered in detail.

10.03 Trunk Order Codes used for ordering and specifying valid options and uses of each of the No. 2 ESS Trunk circuits are given in Tables E, F, and G.

11. SOFTWARE ENGINEERING

11.01 The software engineering required to implement all or a part of the trunking requirements for a No. 2 ESS consists of completing the various ESS translation forms contained and and described in the TG-2H Translation Guide. These forms provide input to build the required translators in the No. 2 ESS memory.

11.02 On initial jobs, a complete set of these forms is submitted to the Western Electric Regional Engineering Center which is processed by the ODA. This is a computer process that generates a set of magnetic program store cards or a magnetic tape cartridge (2B ESS) which is sent to the office and installed in the program store translation area. In addition, computer printed office records are produced and sent to the office. See Section 3 of the TG-2H for a complete description of the ODA process.

11.03 On growth jobs or trunking rearrangements, an ODA run may be necessary only if software items affected are not recent changeable. The following is a partial list of important items changeable ***only*** by ODA.

- Scan Point Number and Peripheral Decoder Address for Trunks
- Screening Tables
- Charge Expansion
- All Trunk Group Data Except Traffic (LO-1 Generic Only)
- Trunk Testing Codes.

See Tables A and B of TG-2H, Division 3, Section 7 for a complete list of items alterable by recent change and ODA.

12. COMPATIBILITY

12.01 Various aspects of compatibility of trunks with other types of central offices can be divided into several categories. These include type of supervision, type of pulsing, start signal required, bylink operation, and special purpose trunks such as trunks to TSPS or AIS offices. To insure proper operation, the specific hardware (i.e., trunk circuits) should be selected using the J2H031A-1 engineering

specification. Most software compatibility requirements are met with the proper completion of ESS Form 2204 (TG-2H). This form contains the data that constructs the trunk feature information in the trunk group translator. It specifies for each trunk group the various operating parameters to make the trunk group compatible with other offices and/or transmission systems. Figure 7 tabulates the items contained in the Trunk Feature Table and associates specific attributes with types of trunks and their various operating features.

13. OFFICE DATA

13.01 The relationship of the various translation tables in No. 2 ESS is illustrated in Figures 8 and 9. Figure 8 shows the call processing flow through translations on an outgoing call. Figure 9 shows the processing flow on an incoming call. As an aid to understanding the translation process, the flow is presented from the point of view of the translation forms rather than the actual structure of translations in program store. The ESS form number appears in the lower right hand corner of the data blocks of the figures.

13.02 Translation forms related specifically to trunks and their purposes are as follows:

(a) Form ESS 2201 - Trunk Assignment Table - Used to associate the scan points, peripheral decoder points and their associated central pulse distributor points with particular circuits. This form must be completed with the following:

(1) Terminal Equipment Number Assignment

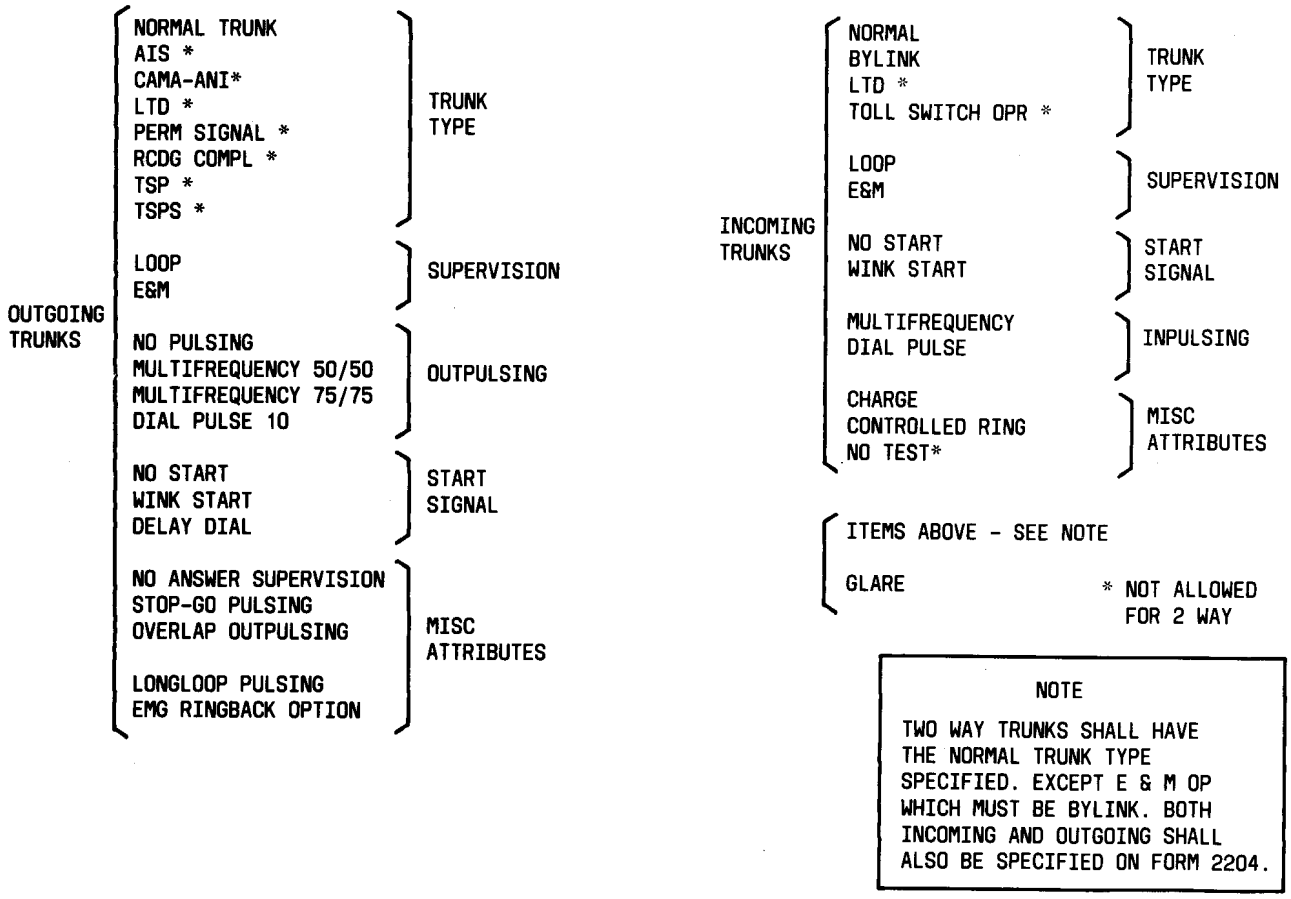

Fig. 7—Trunk Feature Table Options

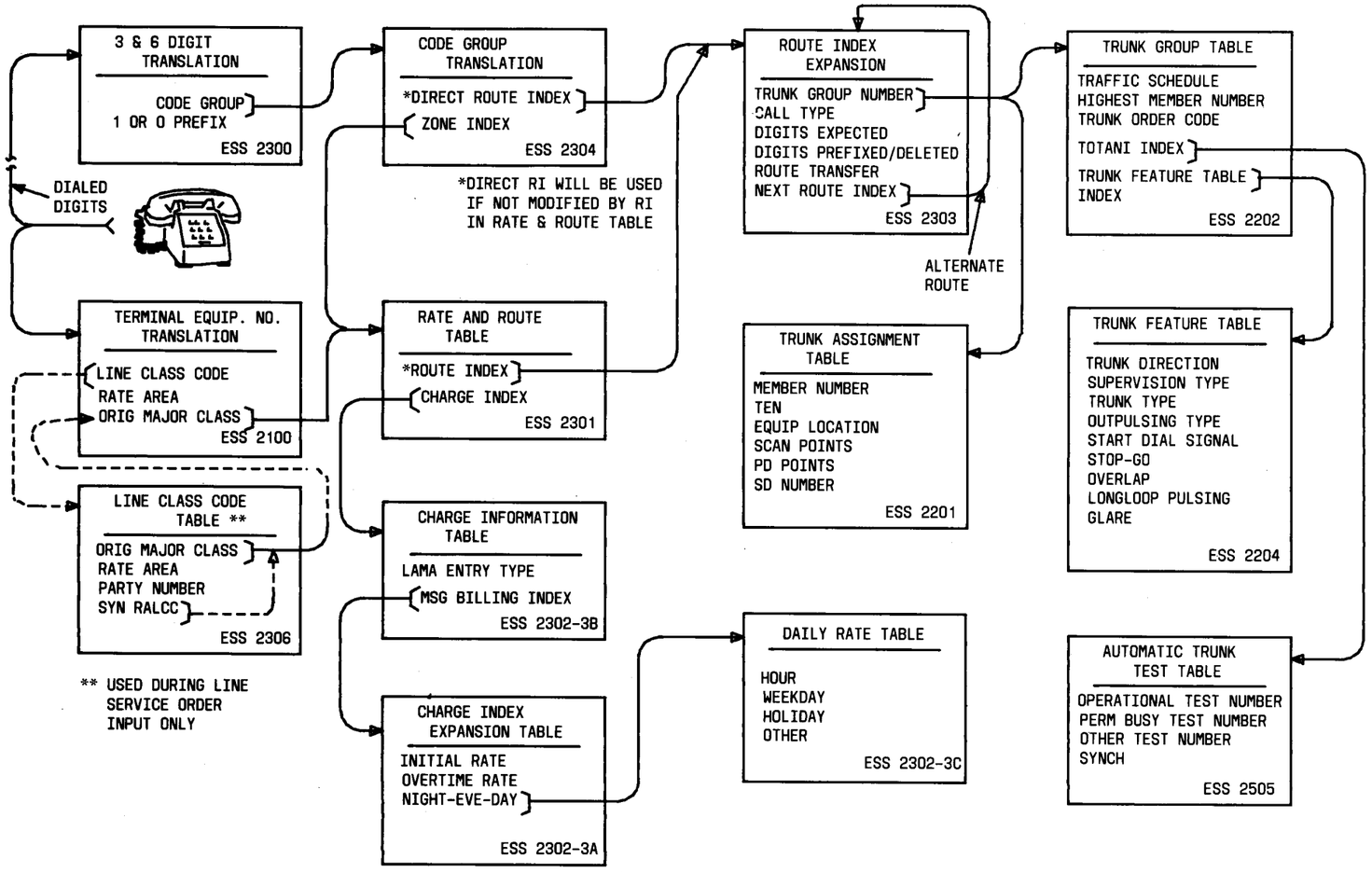

Fig. 8—No. 2 ESS Translation Interactions—Outgoing Call

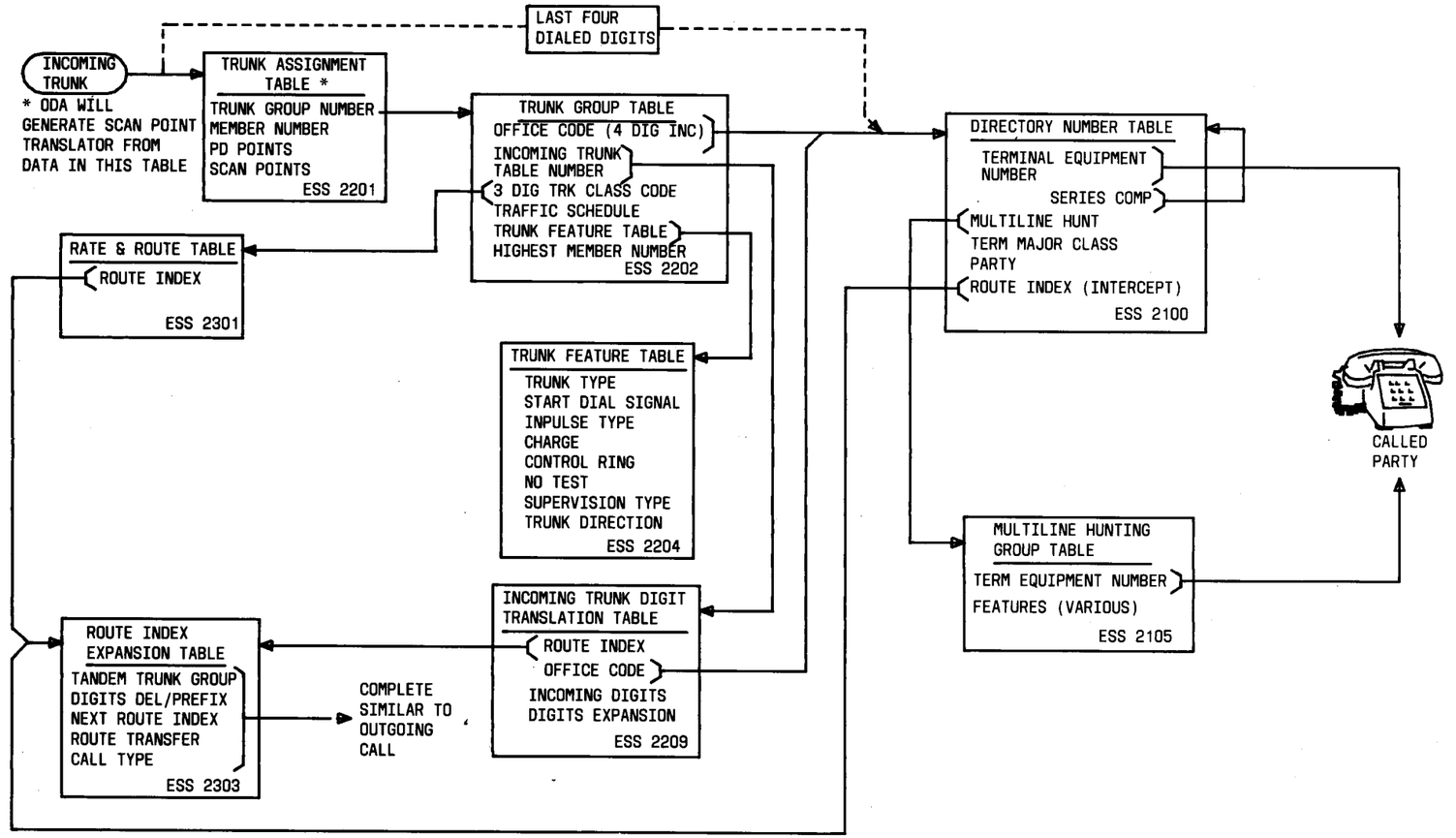

Fig. 9—No. 2 ESS Translation Interactions—Incoming Call

(2) Equipment Location Code

(3) Auxiliary PD Point - Trunk PD Point

(4) Supervisory Scan Point

(5) Directed Scan Point

(6) Option

(7) Trunk Group

(8) Member

(9) Trunk Order Code.

(b) Form ESS 2202-Trunk Group Table - Used to establish a trunk group number for each trunk group entering or leaving the office. Include spare or future growth trunk groups so trunk groups may be added without an ODA run.

(c) Form ESS 2204-Trunk Feature Table - Provides information associated with trunk groups specified on Form 2202 as follows:

(1) Trunk Type

(2) Supervision Type

(3) Outpulsing

(4) Inpulsing

(5) Miscellaneous Attritutes.

13.03 Generally, each trunk group must have an item in each of the above categories specified. Figure 7 outlines the various options available for each category. Certain items selected for each category require or restrict other items from being selected.

13.04 The various noncentrex trunk operation possibilities are shown in Figure 10. At the left of Figure 10, some of the ways that certain items in the trunk group data can be set are shown. There are four major breakdowns (horizontal) one of which (off-hook) applies to centrex and is shown for completeness only. The rest of the chart is separated into three parts (vertical):

- Two-way
- One-way incoming
- One-way outgoing.

Pick the one of interest. It is further separated into start dial and pulsing. A start dial signal shown inside the chart represents the actual start dial signal sent (or received) for the particular combination shown in that column and row. A dash ("-") means that combination is ***not*** allowed. A pulsing type(s) shown inside the chart represents an allowable pulsing type for the combination shown in that column and row. A dash means that combination is ***not*** allowed.

See Table A of TG-2H Division 4, Section 2e for a complete list of requirements and restrictions as applies to the Trunk Feature.

13.05 Translation forms related to other office functions such as routing, charging, etc., are as follows:

(a) ESS Form 2209—Incoming Trunk Digit Translation Table—If the trunking pattern of a particular incoming trunk group indicates the need for a more complex arrangement such as the need to distinguish variable digits reception, further interpretation can be accomplished using the incoming Trunk Digit Translation Table (one digit translator). The incoming digits received over a trunk group may be examined a digit at a time by the one digit translator until a destination and the number of digits expected can be determined. The final disposition of all calls handled via the one-digit translator is determined by the four-digit translator or three-and six-digit translator. The one-digit translator may also be used to direct an incoming call to the proper outgoing trunk group (tandem call). Tandem calls handled via the one digit translator may be defined as follows:

(1) A Route Index may be associated with a given combination of incoming digits to direct the call to the proper outgoing trunk group. See Figure 9.

(2) The one digit translator may be used to access the three- and six-digit translator for screening and routing the call. This is accomplished by associating the Trunk Class Code with a given combination of incoming digits. The screen class and the digits received

are passed to the three- and six-digit translator for final disposition of the call.

(b) Form 2300—Three- and Six-Digit Translation Table—The call processing program uses this table to examine the first three or six digits dialed to determine subsequent routing of the call.

(c) ESS Form 2301—Rate and Route Table—The Rate and Route Table is used to map a large number of lines (by originating major class) and office codes (by zone index) to a smaller number of route and charge indexes. This form is also used for Trunk Class code screening. See TG-2H for details.

(d) Form 2302—Charge Table—This form is used to define all required local charging instructions. It establishes charge indexes for coin, message register, and AMA calls. It also defines day-, evening-, and night-rate time boundaries.

(e) Form 2303—Route Index Expansion Table—This form is used to define the routing information for an office. The Route Index information may include the trunk group to be used on a call, any prefixing or deleting digits, any alternate routing information and the office code for four-digit translation.

(f) Form 2304—Code Group Translation Table—This form is used to group any number of 3- or 6-digit office codes that are to be routed and charged identically.

(g) ESS Form 2505—In No. 2 ESS, provision is made for automatic testing for certain outgoing trunks. This form specifies the type of test the automatic diagnostic will perform and the directory number of the test line used for testing at the distant office. Outgoing trunk groups using the following trunk circuit SD numbers may be entered on this form.

SD-2H103
SD-2H112
SD-2H144
SD-2H148
SD-2H157 — EF-1 Generic Program Only
SD-2H158

13.06 Translation Forms related to customer line translations and included on Figures 8 and 9 for clarity are described briefly below:

(a) Form 2100—Directory Number Table—This form is used to list the directory number and its related information for use as part of the terminal equipment number (TEN) and 4-digit translators.

(b) Form 2102—Terminal Equipment Record—This form associates terminal equipment numbers with directory numbers, trunks and service circuits. The ESS 2102- forms are designed as ***optional manual*** office records only. These forms are ***not*** to be submitted to ODA; they will ***not*** be keypunched for input.

(c) Form 2105—Multiline Hunting Group Table—This form is used to associate a directory number with a group of lines (TENs). The call processing programs hunt an idle line among the group of lines and connect the incoming call to the selected line.

(d) Form 2306—Line Class Code Table—The line class code table is used to furnish information required by the system for processing calls to and from subscribers with various classes of service.

14. GROWTH/RETROFIT PROCEDURES

14.01 New trunk groups cannot be added to translations without an ODA run. Therefore, to provide for growth between ODA runs, a number of spare trunk groups should be provided on the initial ODA that can be activated by recent change procedures.

14.02 The general method for adding a trunk group to an office is as follows:

(1) Install necessary cross connects for each trunk in the group on the applicable distributing frames.

(2) Check Trunk Feature Table (Form 2204) for a valid combination of trunk attributes applicable to the trunk group being built. If no usable combination exists, one may be built using the A RC:GRP message if the office has

	TRUNK GROUP DATA INFORMATION			2-WAY OPERATION								1-WAY INCOMING OPERATION				1-WAY OUTGOING OPERATION			
				INCOMING CALL (START DIAL NO. 2 ESS GIVES)		OUTGOING CALL (START DIAL NO. 2 ESS EXPECTS)		GLARE CHECK POSSIBLE	PULSING (6, 7)				(START DIAL NO. 2 ESS GIVES)		PULSING (7)		(START DIAL NO. 2 ESS EXPECTS)		PULSING (7)	
									LOOP TRUNK		E&M TRUNK								
	SDIAL (OUT)	BYL (INC)	IDXLN	LO-1	EF-1	LO-1	EF-1		INCOMING	OUTGOING	INCOMING	OUTGOING	LO-1	EF-1	LOOP TRUNK	E&M TRUNK	LO-1	EF-1	LOOP TRUNK	E&M TRUNK
(NO START)	00	0	0	—	—	—	—	—	—	—	—	—	—	—	—	—	NO START	NO START	DP,MF,M	DP,MF,M
	00	0	1-5	WINK	WINK	NO START	NO START	NO	DP,MF	DP,MF	MF	DP,MF	—(1)	—(1)	—(1)	—(1)	—	—	—	—
	00	1	1-5	—	NO START	—	NO START	NO	—	—	DP(3)	DP,MF	NO START	NO START	DP(4)	DP(3)	—	—	—	—
(OFF-HOOK)	01	APPLICABLE TO CENTREX ONLY		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	01			—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
				—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
(WINK)	10	0	0	—	—	—	—	—	—	—	—	—	—	—	—	—	WINK	WINK	DP,MF	DP,MF
	10	0	1-5	WINK	WINK	WINK	WINK	YES	DP,MF	DP,MF	MF	DP,MF	WINK	WINK	DP,MF	MF	—	—	—	—
	10	1	1-5	—	WINK	—	WINK	YES	—	—	DP(3)	DP,MF	WINK	WINK	—	DP(3)	—	—	—	—
	10	0	7	—	—	—	—	—	—	—	—	—	—	—	MF	—	—	—	—	—
(DELAY DIAL)	11	0	0	—	—	—	—	—	—	—	—	—	—	—	—	—	DELAY DIAL	DELAY DIAL	DP,MF	DP,MF
	11	0	1-5	WINK	WINK	DELAY DIAL	DELAY DIAL	(2)	DP,MF	DP,MF	MF	DP,MF	—(1,5)	—(1,5)	—(1,5)	—(1,5)	—	—	—	—
	11	1	1-5	—	WINK	—	DELAY DIAL	(2)	—	—	DP(3)	DP,MF	—	—	—	—	—	—	—	—

0 — OUTGOING TRUNK ONLY
1-5 — INCOMING NON-CENTREX TRUNK TREATMENT
7 — ROTL

1 = SCAN POINTS OF THIS TRUNK DEFINED IN THE "BYLINK FIELD" (INCLUDES 1-WAY INCOMING BYLINK, AND 1-WAY INCOMING AND 2-WAY E&M DIAL PULSE TRUNKS)

START DIAL SIGNAL NO. 2 ESS EXPECTS TO RECEIVE WHEN NO. 2 ESS SEIZES A TRUNK FOR AN OUTGOING CALL

00 — NO START
01 — OFF-HOOK (CENTREX ONLY)
10 — WINK
11 — DELAY DIAL

NOTES:

(1) USE SDIAL = 10 (WINK START)

(2) NOT AT NO. 2 ESS END (GLARE CHECK AT OTHER END MAY BE POSSIBLE)

(3) DP DIGITS RECEIVED ON E-LEAD

(4) DP DIGITS RECEIVED ON SUPV FERROD OF 2H154 (OR 2H111) BYLINK TRUNK

(5) ALTHOUGH THE PROGRAM SENDS WINK START, THE 2H149 TRUNK CIRCUIT ACTUALLY GIVES DELAY DIAL

(6) INCOMING AND OUTGOING PULSING TYPES ARE GENERALLY THE SAME ON 2-WAY TRUNKS, BUT CAN BE DIFFERENT FOR SPECIAL CASES.

(7) PULSING TYPES ARE

DP — DIAL PULSE
MF — MULTI FREQUENCY PULSING
M — MANUAL TRUNK TO OPERATOR

Fig. 10—Trunk Operation Possibilites

the EF-1 generic (see IM-2H200). For LO-1 generic this must be done via ODA.

(3) Change the data in the spare Trunk Group Table (Form 2202) using the A RC:GRP message.

(4) Move trunk members from one trunk group to another (Form 2201) using the A RC:TRK message.

(5) Complete routing and charging translations as necessary. See Figures 8 and 9 to determine what data must be changed for the particular trunk group involved. (Three-digit codes and route indices may be changed using the A RC:RI and A RC:DIG messages.)

(6) Complete testing as described in Part 15 of this section.

14.03 The method for adding new trunks to an existing trunk group is as follows:

(1) Complete necessary distributing frame cross connects.

(2) Move the new trunk members to the new group (A RC:TRK message).

(3) Complete testing as described in Part 15 of this section.

14.04 To delete trunk groups and/or members follow the reverse sequence of the preceding paragraphs.

15. TESTING

15.01 All trunk testing can be performed at the No. 2 ESS Maintenance Center using the maintenance teletypewriter (TTY) and the Trunk Test Panel. Refer to Section 232-003-301 (Section 232-303-301 for 2B ESS) for TTY operating procedures and Section 232-130-301 for Trunk Test Panel tests and operating procedures.

15.02 The tests available for outgoing and 2-way trunks are operational supervisory tests and transmission tests. In addition, automatic diagnostic tests are available for the following type trunks provided the TOTANI table (Form 2505) is set up properly.

SD-2H103

SD-2H112

SD-2H144

SD-2H148
SD-2H157
SD-2H158
— EF-1 Generic Program Only

15.03 Testing on incoming trunks can be initiated by the distant office to various types of test lines such as synchronous test lines, balance terminations, etc. Manual tests on incoming trunks can also be performed using the trunk test panel. See Section 232-130-301.

ADMINISTRATION

16. MEASUREMENTS

16.01 Each trunk group defined in the office has assigned to it a set of four traffic registers. These are peg count, usage, overflow, and maintenance busy counts. These counts are collected continuously for all trunk groups in the office. The registers can be read when a TTY printout is requested or when traffic data is automatically printed out in accordance with an assigned schedule in the Traffic Work Table (TWT).

16.02 The TWT is a block of call store which schedules the printing of traffic measurements on a daily and hourly basis. A backup copy of the TWT is kept in program store or on magnetic tape (2B ESS) and used to restore the call store copy after system initializations. The program store copy can be changed by the TTY message T WT:UPD. The call store TWT can be changed or modified without affecting the program store copy. The flexibility is provided so that schedules may be changed for a short period of time. Refer to IM-2H200 and Section 232-120-301, Traffic and Plant Measurements for procedures on the administration of measurements.

17. RECORD KEEPING

17.01 The operating company may request a new partial or complete set of office translation records for a No. 2 ESS office. The operating company may request new copies of the records

from time to time to replace worn sets or to verify the actual machine translations. Form ESS 2002 in conjunction with the administrative data link is used to inform Western Electric Regional Engineering Center of the records required. Refer to Division 2, Section 7 of the TG-2H for details of the procedure.

17.02 Local records must be maintained of the layout, transmission facilities, and distant office trunk circuits for each trunk in the No. 2 ESS office.

18. CHARGING

18.01 Local Automatic Message Accounting (LAMA) is the standard feature provided for recording charging information on magnetic tape for calls processed by the No. 2 ESS. See Section 232-190-204 for a complete description and methods for implementing charging features.

18.02 In lieu of using the LAMA option, Centralized Automatic Message Accounting (CAMA) or Message Registers may be used for recording chargeable calls.

AVAILABILITY

19. NEW INSTALLATIONS

19.01 The trunking features described in this document are available with any issue of generic program. Availability of specific types of trunk circuits can be determined by referencing J2H031A-1 Trunk and Service Circuit Engineering specification.

20. GROWTH/RETROFIT

20.01 See Parts 9, 10, 11, and 13, of this feature document.

SUPPLEMENTARY INFORMATION

21. GLOSSARY

21.01 The following list identifies terms that may be unfamiliar to the reader.

- E&M Signaling—A local signaling system between trunk equipments and transmission facilities in which the near-end supervisory state is reflected by the M lead and the far-end state by the E lead.
- Loop Signaling—A signaling method which uses the metallic loop formed by the trunk conductors and terminating bridges and operates by opening, closing and reversing the polarity of the direct current path through the loop.
- Multifrequency Pulsing—A method of transferring numerical data over trunks by various combinations of two-out-six voiceband frequency combinations.
- Supervision—The function of indicating and controlling the status of a call.
- Start Dial—A signal sent from the receiving end of a trunk to indicate the receiving end is in a condition to receive digits.
- Delay Dial—A type of start dial signal. There are two types generally known as Method A and Method B. Method A works as follows: When the seizure is recognized by the incoming office, the trunk remains off-hook until the receiving equipment is ready, then goes on-hook. With Method B, the trunk goes off-hook within 50 milliseconds when seized. It remains off-hook until receiving equipment is ready, then goes on-hook.
- Two-Way Trunk—A trunk that has both outgoing and incoming attributes at each central office and can be used in either direction of calling.

22. REASONS FOR REISSUE

22.01 This is the initial issue of this section.

23. REFERENCES

23.01 The following documents may be referenced for supplementary information:

- Translation Guide, TG-2H
- Trunk and Service Circuit Engineering Specification J2H031A-1

- Traffic Facilities Practice—Division D, Section 12
- IM-2H200 Input Message Manual
- OM-2H200 Output Message Manual
- Traffic and Plant Measurements—Section 232-120-301
- Office Data Administration Description Section 232-124-101
- Office Update Procedures Using Regional ODA Program Section 232-124-301
- TTY Operating Procedures Section 232-003-301 (for 2B ESS, 232-303-301)
- Operational Trunk Tests Section 232-002-511
- Trunk Test Panel-Method of Operation Section 232-130-301
- Local Automatic Message Accounting FD 232-190-204
- PA-2H200 Office Data Table Layout (No. 2 ESS)
- PA-2H203 Office Data Table Layout (No. 2B ESS).