CALL PROCESSING
SOFTWARE SUBSYSTEM DESCRIPTION
NO. 3 ELECTRONIC SWITCHING SYSTEM

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1. GENERAL

1.01 This section provides an overview of the software required to perform the call processing operations in No. 3 Electronic Switching System (ESS) offices. The areas discussed include:

(a) Originating functions

(b) Terminating functions

(c) Outgoing call functions

(d) Disconnects

(e) Network actions

(f) Base levels and interrupt levels

(g) Major memory areas.

1.02 This section is being reissued to include the following 3E3 generic information:

- 3E3 Base Level Loop
- Redesign and replacement of the Custom program (PR-3H152 in the SO-2 generic)
- Inhibit receiver off-hook (ROH) tone
- Expanded inband signaling
- 3-Way Operator 110 recall.

Revision arrows are used to emphasize significant changes.

1.03 Part 5 contains a glossary of terms, abbreviations, and definitions necessary for comprehension of the information contained in this document.

1.04 The purpose of this software subsystem description (SSD) is to give an ***overview*** of the software required by the No. 3 ESS to perform call processing functions. More detailed

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information about call processing functions is available in the following SSD sections:

SECTION	TITLE
233-151-110	Call Trace, Software Subsystem Description, No. 3 Electronic Switching System
233-151-111	Call Trace (3E3), Software Subsystem Description, No. 3 Electronic Switching System
233-151-115	Operator Functions, Software Subsystem Description, No. 3 Electronic Switching System
233-151-120	Call Charging, Software Subsystem Description, No. 3 Electronic Switching System
233-151-125	Input Processing and Scanning, Software Subsystem Description, No. 3 Electronic Switching System
233-151-130	Basic Call Processing, Software Subsystem Description, No. 3 Electronic Switching System
233-151-135	Custom Calling (SO-2), Software Subsystem Description, No. 3 Electronic Switching System
233-151-136	Custom Calling (Generic 3E3), Software Subsystem Description, No. 3 Electronic Switching System
233-151-140	Network Path Hunt, Software Subsystem Description, No. 3 Electronic Switching System
233-151-145	Digit Processing, Software Subsystem Description, No. 3 Electronic Switching System
233-151-150	Translations, Software Subsystem Description, No. 3 Electronic Switching System
233-151-155	Peripheral Input/Output Control, Software Subsystem Description, No. 3 Electronic Switching System
233-151-160	911 Emergency Service Bureau, Software Subsystem Description, No. 3 Electronic Switching System
233-152-125	System Control SO-2 Generic, Software Subsystem Description, No. 3 Electronic Switching System
233-152-126	System Control 3E3 Generic, Software Subsystem Description, No. 3 Electronic Switching System

1.05 A complete listing of all software documentation is included in the No. 3 ESS Software General Description (Section 233-150-100). The information contained in this SSD will aid in accessing the software listings which contain detailed program functions and coded software instructions. Table A contains the acronyms, names, and numbers of the programs which perform call processing functions and which are referenced frequently in this section.

1.06 It is important to note that calls are not processed in a continuous, uninterrupted series of actions. Instead, each call is processed in bursts, separated by gaps in time during which physical action or process synchronization occurs. Many calls are processed at the same time. The system processes a certain number of functions for all calls depending upon available time and interleaved with its administrative and maintenance functions.

1.07 Call processing functions are described from the following three viewpoints in this SSD:

(a) The system view includes major storage areas, base level and interrupt level, methods of control transfer, real-time breaks, and the processing of calls from the system viewpoint. Call processing from the system view is described in Part 2.

(b) Part 3 describes the major call processing functional areas and related subfunctions.

(c) The call view includes sequential operations involved with specific call types without regard to time manipulation (Part 4).

2. CALL PROCESSING—SYSTEM VIEW

MEMORY AREAS

2.01 The call processing software uses allocated blocks of storage to retain data associated with a call. Some of the major storage areas are described in the following paragraphs.

A. Transient Call Record

2.02 A transient call record (TCR) is a 16-word block of writable main storage assigned to a call in the transient state. This area of storage contains control information, terminal and path information, and receiving and sending data applicable to a call. The information contained in the TCR and the format of the TCR constantly change as different call processing functions are performed for the call. A format of the TCR during digit processing is provided in Fig. 1 but for formats of the TCR as it appears for the different functions, refer to the program listings containing the software to perform the functions. The use of the TCR areas for a particular function is provided by the SSD describing that function.

B. Terminal Memory Record

2.03 The terminal memory record (TMR) is a 4-word block of writable main storage assigned to each junctor. See Fig. 2 for a format of a stable TMR and a transient TMR. For stable calls, the TMR of the junctor specifies the scan point number (SPN) of the talking parties and provides timing control. For transient calls, the TMR also specifies the TCR assigned to the call as well as the SPNs of the connected circuits. Custom calling information is stored in the fourth word of the TMR. For idle junctors, the TMR serves no function.

C. Originating Register

2.04 There is an originating register (OR) associated with each receiver scan point to be used in digit receiving. The OR (Fig. 3) is one word and provides a link between the receiver scan point and the TCR for the call. It contains the TCR number, an area to accumulate the pulse count for a digit dialed, and a receiver code. The receiver code is used to indicate the digit processing routine in the 10-millisecond interrupt program - digit receiving and sending (DIGPRO) which should be given control.

D. Hoppers

2.05 Hoppers are dedicated areas of writable memory into which entries with a fixed format are made. Scanning routines make an entry into the appropriate hopper for detected scan point state changes. These entries are used by subsequent software routines to process the inputs. The following three hoppers are used by scanning and input processing software:

(a) The line originating hopper for line originations. (See Fig. 4 for the format of the 2-word entry.)

(b) The trunk/junctor/service circuit input hopper for scan point state changes from trunks, junctors, miscellaneous scan points, and service circuits scanned at base level, as well as operator trunk originations found at interrupt level (Fig. 5).

(c) The interrupt hopper for immediate start and operator trunk scan point state changes and for stop dial and start signal detection (Fig. 6).

2.06 In addition, there is a dial pulse receiving trunk hopper (Fig. 7). Every active, incoming dial pulse trunk is assigned an entry in the hopper while the trunk is in the receiving state. The 2-word entry is used like an originating register for counting pulses from dial pulse trunks.

2.07 There is also a timing hopper in writable main store used to provide accurate timing for real-time breaks in peripheral order processing. The first two words in the hopper are control words and the remaining entries contain the TCR number and timer for the entry. See Fig. 8 for the control words and Fig. 9 for a slot in the hopper.

E. Network Controller Queues

2.08 The network controller queues (Fig. 10) are used to control the sending of peripheral orders to the network controllers and to ensure a high degree of occupancy for each controller. The queues are located in writable main store. The block of words is divided into left and right halves. The right half (bits 0 through 7) of each word

forms the queues for controller 0 and the left half (bits 8 through 15) forms the queues for controller 1. The first two words of the queue are used as control blocks and the remaining slots for the TCR numbers. One order is sent to each controller every 10-ms interrupt, if needed, and each order is verified the next interrupt.

BASE LEVEL AND INTERRUPT LEVEL

2.09 The base level loop is a major software loop of nontime critical programs which include all functions not performed during interrupt level. It includes most call processing programs and those maintenance tasks which can be deferred.

2.10 There are two types of interrupts into the base level loop. Timed interrupts are hardware-initiated interrupts every 10 ms for a period of time necessary to perform frequently required functions such as sending and receiving tasks, immediate start and operator trunk scanning, and most peripheral control functions. Demand interrupts occur when a fault or difficulty of high priority is discovered, for utilities, by manual request, or for TTY activities. After an interrupt of the base level loop has completed its functions, control is returned to the base level loop which continues from the point of interruption.

CONTROL TRANSFERS IN BASE LEVEL AND INTERRUPT LEVEL

A. Progress Marks

2.11 A progress mark is a number stored in a TCR that indicates via a program transfer table the application software routine that is to be given control. Progress marks are used both at base level and interrupt level.

2.12 Each TCR contains three progress marks: one for base level and two used during interrupt level. The base level progress mark must be present in an active TCR. The routine associated with the progress mark is invoked (1) when the TCR timer equals zero, (2) when the base level action bit in the TCR is set to one, or (3) when an input monitor routine reports a state change in a circuit contained in the TCR.

2.13 The interrupt level progress mark indicates whether peripheral action is needed or not and whether sending functions are required to be performed. The peripheral progress mark is the other progress mark used at interrupt level. It indicates the beginning of the peripheral sequence to be executed and also contains the sending progress marks which point to the sending routines to be executed during interrupt level.

B. Subroutines

2.14 Subroutines are used extensively in call processing software for transfer of control of processing to perform a particular function. A subroutine is a sequence of instructions which performs a well-defined function and is called by another section of instructions. Control of processing is passed from the calling program/subroutine to the called program/subroutine until the function is completed, at which time control is returned to a location given by the calling program. Translation data for trunks, lines, etc, is obtained by call processing routines via calling translation subroutines. Many of the digit translation functions are performed by subroutines. Errors are often handled by subroutines as well as many other call processing tasks.

C. Macros

2.15 Macros are often used in call processing to obtain access to other routines or subroutines. A macro is a sequence of instructions called by an abbreviated notation. A macro can generate different sequences of code depending on the parameters supplied in the macro call. For instance, the PATHUNT and PATHIDLE macros are used to obtain access to the path hunting and path idling routines in the program PATHNT. A PACT macro call is used to obtain peripheral action, providing access to the program POINT (peripheral order interpreter). There are many other macros used in call processing software.

D. Transfer of Control in the SO-2 Generic Base Level Loop

2.16 The base level TCR scanning routine (TCRSCN) is normally considered to be the first routine in the base level loop, and the audit routines are the last routines as shown in Fig. 11. However, when initialization occurs, the common base level monitor (CBLM) is given control first as shown in Fig. 12. Therefore, the following description of the base level loop starts with initialization and continues through two full base levels.

2.17 After initialization of the system, CBLM assumes control of processing. It passes control to the input monitor program (INPUT), which performs input processing functions. Input processing consists of:

- Distribution of service requests and supervisory state changes to the appropriate processing routines for service of the inputs
- Timing functions for hits and disconnects
- Dynamic service protection
- Base level scan control—scanning of lines, junctors, service circuits, and trunks (except immediate start and operator trunks) is done in SCANS, which is called by INPUT
- Processor overload control.

2.18 Because input processing is performed close to the end of the base level loop (Fig. 11), it is also in a strategic location to help provide stability in the cycle time of the base level loop. Depending on the time already spent in the base level loop, INPUT may bypass the processing of some trunk, junctor, and service circuit inputs, the processing of some or all line requests, and the scanning of lines for originations.

2.19 After input processing and scanning are complete, INPUT passes control to routines which perform audit functions (normally considered the last routines executed in the base level loop). The main store audit runs alternately (every other base level loop) with the audit monitor. The audit monitor in program AUDITS runs as many audits as possible (maybe none) until 100 ms have elapsed since the start of the base level loop, thus ensuring a minimum base level loop time. The audit monitor may sometimes force an audit if it has been too long since the last audit was allowed. Audit functions are described in Section 233-152-140.

2.20 The TCRSCN program is normally considered first in the base level loop. Control is passed to TCRSCN by the audit routines which are the last programs executed in the loop. It calculates the time since the last TCR scan (the time spent in the previous base level loop) by subtracting the start time of the last TCR scan from the present start time.

2.21 All of the TCRs are sequentially examined by TCRSCN. When the TCR is active, its timer word is decremented by the time elapsed since the last scan. When the TCR timer is zero, TCRSCN invokes the base level progress mark routine associated with the base level progress mark in the TCR. In addition, when the BACTION bit (which indicates base level action is needed) is set to one in the TCR, TCRSCN invokes the base level progress mark routine.

2.22 The value of the base level progress mark in the TCR is issued by TCRSCN to index into the base level progress mark branch table for transferring control to the proper routine. The base level progress mark routine performs the call processing function(s) (such as coin functions, terminating call functions, digit interpretation, outgoing call functions, disconnect, error handling, etc) needed for the call at that time, provides the progress mark for the next function for the call, and returns to TCRSCN. TCRSCN then processes the next TCR.

2.23 The base level progress mark, go to return address (GOTORA), is a special progress mark which causes a branch to the address stored in the TCR words RAD0 and RAD1. It is normally used after a real-time break for transferring control to the next function to be performed.

2.24 While processing each TCR, TCRSCN also keeps a count of the idle TCRs. To help preserve time and to protect the system from overloading, TCRSCN indicates to the input monitor (INPUT) that service of line originations should be skipped when only ten or less TCRs remain idle. Overloading might hamper the processing of inputs from immediate start and operator trunks which require immediate processing. When there are five or less idle TCRs found, service of trunks, junctors, and service circuits scanned at base level (the slow scan list) is also inhibited.

2.25 After TCRSCN processes all the TCRs, it passes control to the application portion of the base level monitor program (BLMMA). Since base level monitor functions and traffic functions are performed in alternate cycles of the base level loop, the base level monitor first determines which functions are to be performed during the present base level loop. Traffic functions are performed during the first time through the loop after initialization so BLMMA immediately transfers

control to the traffic and plant measurements program, TRAFIC. TRAFIC performs traffic and plant measurement functions which are described in Section 233-152-135.

2.26 Upon completion of its tasks, TRAFIC branches to INPUT which performs the input processing functions already described in paragraphs 2.17 and 2.18. Upon completion of input processing, INPUT passes control to the audit routines (the end of the loop) as described in paragraph 2.19. Control is passed to TCRSCN after audits to start the next base level loop as described in paragraphs 2.20 through 2.24. TCRSCN gives control to BLMMA after processing all the TCRs. BLMMA then determines that base level monitor functions must be done this cycle of the loop.

2.27 Program BLMMA continues by initiating the performance of such tasks as timing for audible alarms, alarm key interface, and linked TTY message processing. Control is then given to CBLM. CBLM contains such administrative functions as the system state detector, system status panel controller, multiscan function controller, and time monitor software. The system state detector includes several critical system audits.

2.28 Multiscan functions are functions which are not regularly scheduled and require real-time breaks. Any function which can operate under step or repeat control must be a multiscan function as well as all nonresident programs.

2.29 Included in the time monitor functions performed by CBLM is the updating of the software clock as well as the initiating of functions to be performed on a timed periodic basis. These timed periodic routines include routines such as the TMR timer routine, dynamic service protection lamp routine, call forwarding timers, path hunt preference walking routine, fault recognition, etc. Tables identifying the timed routines as well as multiscan functions to be executed by CBLM are contained in BLMMA.

2.30 After the monitors contained in CBLM are executed, CBLM initiates the execution of three other monitors which are independent common systems programs. These are the tape handler, the TTY handler, and the common system utilities handler.

2.31 When CBLM completes its administrative base level monitor functions, control is passed to INPUT for input processing (previously described in paragraphs 2.17 and 2.18). INPUT then passes control to the audit routines, thus ending two complete cycles of the base level loop. After the audits, another loop begins when control is passed to TCRSCN.

E. 3E3 Generic Base Level Loop

2.32 The basic program structure of the No. 3 ESS is a closed loop in which a set of major programs executes sequentially. This loop is the base level loop. Most call processing programs and those maintenance tasks which can be deferred are performed during base level. Time critical functions are performed during interrupts of the base level loop; interrupts are described in paragraphs 2.42 through 2.51. The CBLM controls the base level loop since it determines the sequencing of programs in the loop. Refer to Fig. 13 for a general diagram of the 3E3 generic base level loop.

2.33 The base level TCR scanning routine (TCRSCN) is normally considered to be the first routine in the base level loop and the dispatcher routines are the last routines. Control is passed to TCRSCN by CBLM. The TCRSCN program examines all of the TCRs sequentially. When the TCR is active, its timer word is decremented by the time elapsed since the last scan. When the TCR timer is zero or when the TCR BACTION bit (which indicates base level action is needed) is set to one, TCRSCN invokes the routine associated with base level progress mark in the TCR.

2.34 The TCRSCN program uses the value of the base level progress mark for indexing into the base level progress mark branch table to transfer control to the proper routine. The base level progress mark routine performs the call processing function(s) such as coin functions, terminating call functions, digit interpretation, outgoing call functions, disconnect, error handling etc, needed for the call at that time and returns to TCRSCN. The next TCR is then processed by TCRSCN.

2.35 The base level progress mark GOTORA is a special progress mark which causes a branch to the address stored in the TCR words RAD0 and RAD1. It is normally used after a

real-time break for transferring control to the next function to be performed.

2.36 After TCR scanning, control passes to the input monitor program (INPUT), which performs input processing functions. Input processing consists of:

- Distribution of service requests and supervisory state changes to the appropriate processing routines for service of the inputs
- Timing functions for hits and disconnects
- Dynamic service protection
- Base level scan control (scanning of lines and scanning of trunks, junctors, and service circuits except immediate start and operator trunks is done in SCANS, which is called by INPUT)
- Processor overload control.

Depending on the time already spent in the base level loop, INPUT may bypass the processing of some trunk, junctor, and service circuit inputs, the processing of some or all line requests, and the scanning of lines for originations.

2.37 The INPUT program gives control to CBLM after all input processing. Next, program BLMMA determines which application base level monitor functions are performed in this cycle of the loop.

2.38 The BLMMA program continues by initiating the performance of such tasks as timing for audible alarms, alarm key interface, and linked TTY message processing. Base level monitor functions and traffic functions are performed in alternate cycles of the base level loop, the base level monitor first determines which functions are to be performed during the present base level loop. Traffic functions are performed during the first time through the loop after initialization so BLMMA immediately transfers control to the traffic and plant measurements program, TRAFIC. TRAFIC performs traffic and plant measurement functions which are described in Section 233-152-135.

2.39 Control is then given to CBLM, the common base level monitor. Administrative functions such as the system state detector, system status panel controller, and time monitor software are contained in CBLM. After the monitors contained in CBLM are executed, CBLM initiates the execution of three other monitors, which are independent common system programs. They are the tape handler, the TTY handler, and the common system utilities handler.

2.40 When all of the above-described nondeferrable work has been completed in the base level loop, control is passed to the dispatcher in program CMMON. The function of the dispatcher is to allocate the remaining time of each base level loop to the deferrable jobs. In No. 3 ESS there are three types of deferrable jobs defined. These are:

(a) MSFC—Multiscan function controller

(b) AUDITS—Call processing audits

(c) MAS AUDIT—Main Store audit.

The dispatcher passes control between these three types of jobs according to a predefined priority schedule in program MMONA ensuring that no job falls below a minimum execution rate. In overload conditions, when an insufficient amount of time is available to maintain the above-mentioned minimum execution rate, the dispatcher will eventually enter a force mode to guarantee that the jobs will be executed.

2.41 A timer is used to ensure proper progression through the program system. The purpose of the program timer (bits 8 through 13 of the timing register) is to provide an initialization function if the timer is not periodically reset by software. Therefore, a reset of the program timer in various strategic points of code provides a means of checking software sanity. For example, CBLM resets the program timer (and increments the memory word SYSTIM) before passing control to each application monitor. When the software incorrectly branches around a reset of the timer or loops, the program timer will time out and an initialization will occur. For additional information, refer to Section 233-152-126.◀

F. Timed Interrupt Control Transfers

2.42 Base level is interrupted every 10 ms for the performance of frequently required tasks. See Fig. 14 for a flow diagram of the interrupt level. The interruption is not evident to base

level because all registers and system status are stored at the beginning of the interrupt and are restored at the end of the interrupt before control is returned to base level.

2.43 The DIGPRO program is the first program executed at interrupt level. Therefore, its first task is to store the system status and the registers. The next interrupt task performed by DIGPRO is to scan the receivers and store the results for subsequent digit-receiving functions.

2.44 In addition, all dial pulse receiving trunks in the process of receiving digits must be scanned. A directed scan is performed and receiving functions are performed for the call.

2.45 Control is transferred by DIGPRO to the network controller queue monitor (QMON) routine in the network queue and timing hopper monitor program (QTMON) after digit receiving functions are finished. QMON processes the network controller queues, which contain TCR numbers that need orders issued to the network controllers. One order (if needed) is issued to each controller each interrupt and is verified the next interrupt.

2.46 Upon completion of network controller queue processing, control is returned to DIGPRO which then performs digit-receiving tasks for the receivers already scanned. Digit-receiving tasks include such functions as counting dial pulses, translating tones into digits, storing digits in the TCR, and signaling base level when base level action is needed. DIGPRO looks for interdigital periods and abandonments periodically (when a specified number of interrupts have occurred since the last check).

2.47 Control is then passed by DIGPRO to the fast trunks scanning program, FASTTK. FASTTK performs directed scanning for stop dial and start signals. Scanning functions for immediate start and operator trunks are also performed by FASTTK at interrupt level because of the frequency of scanning necessary for these trunks. An additional task performed by FASTTK is the timing and operation of the ringing and tone plant relays.

2.48 Program FASTTK next passes control to the test vertical administration program (TVADM) which does a test vertical status block audit when required (every 640 ms). TVADM passes control to the timing hopper monitor (TMON) in the program QTMON. The timing hopper is used to store numbers of TCRs which have sending functions to be performed and to provide real-time breaks in peripheral order processing. The TMON routine decrements the timers of all active slots in the hopper. It sends TCR numbers in any slots that time out to POINT (the peripheral order interpreter) for further peripheral processing.

2.49 Program POINT examines the interrupt progress mark in the TCR to determine whether sending or peripheral work is required. When peripheral work is needed, POINT uses the peripheral progress mark in the TCR to address into the catalog of peripheral control sequences (PCAT) to determine the next peripheral functions that must be performed. It continues peripheral control functions for that TCR until another real-time break is required or peripheral work for that TCR is complete and then returns control to TMON, which processes the next hopper entry.

2.50 When the interrupt level progress mark in the TCR indicates sending functions are needed, POINT gives control to program DIGPRO. DIGPRO determines from the peripheral progress mark in the TCR the sending functions to be performed and then performs the required functions. DIGPRO returns control to TMON for further timing hopper processing.

2.51 After processing the timing hopper, TMON returns control to FASTTK which adds one to the system timer. Also, FASTTK (along with a common system subroutine) restores the system status and registers to complete interrupt processing. Control is returned to base level at the point it was interrupted.

A CALL FROM SYSTEM VIEW IN SUMMARY

2.52 Figure 15 (SO-2 generic) and Fig. 16 (3E3 generic) depict the base level loop and the timed 10-ms interrupt indicating the major call processing functions performed and the memory areas used in performing the functions. These illustrations give call processing from the system point of view.

2.53 Several base level loops are required to complete the call processing functions for a call. Likewise, call processing functions are performed for many calls during one base level

loop. This concept is explained in the following paragraphs.

2.54 A call begins with an off-hook detection at the scan point of a terminal by the scanning software. The input is reported in the appropriate hopper but is not processed until the following base level loop. During the following base level loops, the input in the hopper is processed by input processing software which does hit timing, obtains a TCR for the call, and prepares it for digit receiving. Digit receiving is performed during the 10-ms interrupts, and the digits are stored in the TCR for the call as they are received (performed over a period of many interrupts.)

2.55 The TCR is used to store information for a call in the transient state and is accessed by the call processing routines. The TCR, therefore, contains control information for the call including the progress marks and a timer (described in paragraph 2.02).

2.56 When further base level action is needed for the call, the base level action bit (BACTION) in the TCR is set or the TCR timer times out. The base level TCR scanning routine (TCRSCN) looks at all TCRs sequentially and checks for one of these conditions. If base level action is needed for a call, TCRSCN passes control to the routine associated with the base level progress mark in the TCR. The base level progress mark routine then performs the call processing function(s) needed for that call at that time and then returns to TCRSCN which processes the next TCR or call.

2.57 Because many functions require more time to be completed than can be allowed at a particular time for one call, a **real-time break** must be taken for the call until it is ready for additional tasks to be performed for it.

2.58 Several procedures are used to provide real-time breaks for a TCR or to wait for a task to be finished. The transient call record wait subroutine (TCRWAIT) in program TCRSCN may be called. It stores the address of the instruction following the call of the subroutine in the return address area of the TCR and sets the base level progress mark to GOTORA. It also sets the timer in the TCR for the time to be waited. Control is given back to TCRSCN or the input monitor for the processing of other calls. When the timer times out or the BACTION bit is set indicating the call is ready for more processing, TCRSCN (usually one or more base level loops later) transfers control to the address stored in the TCR so that processing of the call can continue.

2.59 In some cases, instead of the GOTORA progress mark, another base level progress mark is specified and the associated base level progress mark routine is invoked by TCRSCN or the input monitor as stated above.

2.60 A call to the PACT (peripheral action) macro to initiate peripheral work may result in a real-time break. Real-time breaks to wait for peripheral action are initiated by placing the TCR number and the time to be waited in the timing hopper. The timing hopper monitor (TMON) in program QTMON processes each hopper entry during the 10-ms interrupt when the timer times out. It passes the TCR number to the appropriate routine for processing. In addition, the queueing of network controller orders in the network queues is performed to provide the time needed by the controllers between orders.

2.61 As previously discussed, all processing functions for a call are performed in parts which may require several base level loops to complete. Similarly, there are call processing functions performed for many calls during one base level loop.

3. MAJOR CALL PROCESSING AREAS AND ASSOCIATED SOFTWARE SUBSYSTEM DESCRIPTIONS

3.01 Call processing has been divided into major areas for the purpose of documenting the software which perform call processing functions. These areas are described in the following paragraphs and the SSDs containing more detailed information about each area are identified in Fig. 17.

INPUT PROCESSING AND SCANNING (SECTION 233-151-125)

3.02 Scanning is performed for lines, trunks, junctors, and service circuits to find service requests and supervisory state changes. It is performed both at base level and at interrupt level. Scanning functions consist of monitoring the scan points and determining state changes by comparing the present state of the scan point with its state the last time it was scanned.

3.03 The categories of scan points interrogated during interrupt level are:

(a) Scan points of trunks placed in the interrupt hopper by OUTCAL (the outgoing call handling program) for directed scanning for stop dial and start signals

(b) Immediate start trunks and operator trunks

(c) Supervisory scan points of customer dial pulse receivers (CDPRs)

(d) Supervisory and tone present scan points of multifrequency (MF) and TOUCH-TONE® (TT) tone receivers

(e) Tone scan points of MF and TT receivers

(f) Supervisory scan points of incoming trunks when receiving dial pulses (DPs)

(g) Polarity scan points in transmitters (DP and MF) and outgoing E and M trunks.

3.04 The fast trunk scanning program (FASTTK) performs directed scanning to detect stop dial and start signals from trunks placed in the interrupt hopper by program OUTCAL. It also performs the scanning functions for immediate start and operator trunks. FASTTK scans one-fourth of the immediate start and operator trunks every 10 ms. This provides an effective rescan period of 40 ms for any given immediate start or operator trunk. Reports of detected scan point state changes are made in the proper hopper for processing. The other scan points listed in paragraph 3.03(c) through 3.03(g) are scanned in program DIGPRO. These scanning functions are described in Section 233-151-145 relating to digit processing functions.

3.05 The categories of scan points that are interrogated during base level by the base level scanning program (SCANS) for service requests and supervisory state changes are:

(a) All line scan points

(b) All junctor scan points

(c) The slow scan list

(1) All trunks except immediate start and operator trunks

(2) Most service circuits

(3) Miscellaneous scan points.

SCANS reports the scan point state changes in the appropriate hopper for input processing by program INPUT.

3.06 Input processing consists of distribution of service requests and supervisory state changes to the appropriate processing routines which service the inputs and control of scanning for these requests and state changes. It includes timing functions such as timing for hits and disconnects. In addition, it includes dynamic service protection and processor overload protect functions. FASTTK performs some input processing functions for immediate start and operator trunks at interrupt level; however, most input processing functions are performed during base level by programs INPUT, TKPROC, and LNORIG.

3.07 Program FASTTK obtains a TCR for an immediate start trunk origination and initializes it for base level action and for digit reception. In addition, when FASTTK detects an operator trunk wink, it obtains and initializes a transient call record for multiple wink reception and base level action. Disconnects and operator trunk originations are reported in the trunk/junctor/service circuit input hopper for processing by INPUT. Protection against system overload is provided by FASTTK which limits the number of immediate start trunk originations and operator winks processed per interrupt.

3.08 Because INPUT (which does most input processing) is executed near the end of the base level loop, it is in a strategic location to assist in providing stability in the cycle time of the base level loop. Depending on the time already spent in the base level loop, INPUT may bypass the processing of some trunk, junctor, and service circuit inputs, the processing of some or all line requests, and the scanning of lines for originations.

3.09 In addition, INPUT performs another similar function to further preserve time and protect the system from overloading. When TCRSCN finds ten or less idle TCRs at the beginning of the base level loop, INPUT skips the processing of line originations. Also, if TCRSCN finds five or less idle TCRs, service of trunks, junctors, and

service circuits scanned at base level (slow scan list) is inhibited.

3.10 Program INPUT processes the trunk/junctor/service circuit input hopper (paragraph 2.05) and passes disconnects and originations to program TKPROC. Disconnects are sent to the disconnect program (DISCON) which performs disconnect functions for the call.

3.11 The trunk origination program (TKORIG) is called for trunk originations to select a TCR and to obtain trunk translation data. TKORIG starts the peripheral sequence to connect the trunk to a receiver, if needed, and to send the wink signal at the end of which the TCR is set up to receive digits and the base level progress mark is identified.

3.12 Any inputs associated with a transient call causes the base level progress mark routine to be invoked by the input monitor. In addition, inputs from miscellaneous scan points are sent to the power and alarm scanning program (PWSC) for processing.

3.13 The INPUT program processes the line origination hopper when time permits. INPUT orders the line rescanned to eliminate momentary hits. A TCR is selected and initialized for a valid line origination and line translation data is obtained. A receiver is selected, a network path is obtained, and the peripheral action order to set up a network connection from the line to the receiver is initiated (including false cross and ground, power cross, and party tests if required). The peripheral action macro call also causes the dial tone base level progress mark to be placed in the TCR so that the routine to issue dial tone is given control the following base level loop. The originating register(s) associated with the receiver scan point(s) is initialized for digit receiving.

3.14 ***Dynamic service protection (DSP)*** is an input processing function and is invoked automatically by INPUT when needed unless inhibited by the office. It is an automatic way of protecting the service of class A lines (as opposed to class B) during a traffic overload. Classes of lines are assigned by an office in the translation data. When DSP is in effect, the treatment of a class A line is not affected. A class B line, however, is serviced only if it is the first line origination hopper entry, while all other class B entries in the hopper are cleared without service. This results in a delay in the receipt of dial tone by those customers.

DIGIT PROCESSING (SECTION 233-151-145)

3.15 The major functions of digit processing are:

- Digit receiving and collecting
- Digit interpretation
- Digit sending.

Digit interpretation functions are performed at base level, while digit sending and receiving functions are performed at interrupt level. Program DIGPRO controls the receiving of digits at interrupt level. The receiving function includes such tasks as counting dial pulses, translating TT tones into digits, translating MF tones into digits, storing digits in the TCR, and signaling base level when base level action is needed.

3.16 Program DIGPRO interrogates the receiver scan points to obtain the present states of the scan points. The results of the scans are compared with the results of the previous scan of the receivers to detect changes in state. The originating register (paragraph 2.04) associated with the scan point that changed is accessed when a change in state is detected. The originating register is used to provide a link between the receiver scan point and the TCR, to accumulate the pulse count if dial pulses are being received, and to contain a receiver code which is used to access the needed receiving routines in DIGPRO.

3.17 To receive dial pulses from dial pulse receiving trunks, DIGPRO orders a directed scan of each trunk that is in the dial pulse receiving trunk hopper (paragraph 2.06). The hopper contains an entry for each trunk that is in the act of receiving dial pulses.

3.18 In DIGPRO, dial pulses are detected and counted and interdigital periods are measured so digits can be collected. The TT and MF tones are detected, verified, and decoded into digits using decoding tables. As the digits are detected, they are collected and stored in the TCR for the call. Dial tone is removed after the first digit is received. Permanent signal and partial dial timing is also initiated.

3.19 One of the major functions performed by DIGPRO is to signal base level via the BACTION bit in the TCR when base level action is needed. This is performed when the signal digit in the TCR (set by the various digit interpretation routines) and the incoming digit count in the TCR are equal. During the next execution of program TCRSCN at base level, control will thus be given to the routine indicated by the base level progress mark in the TCR.

3.20 Digit interpretation is performed at base level by the trunk origination program (TKORIG), the terminating program (TERM), and the digit interpretation program (DNTRP) with the aid of various translation subroutines such as 1DIGIT, 3DIGIT, and 4DIGIT. Upon completion of digit interpretation, these programs route the calls to the appropriate software for further processing.

3.21 Digit interpretation must be accomplished on each incoming call (trunk origination) and on each line origination in the office, whether terminating locally or outgoing to another office.

3.22 Digit interpretation functions include:

(a) Obtaining trunk or line translation data to determine the type of services allowed

(b) Obtaining information such as the number of digits to expect

(c) Setting the signal digit to tell the digit receiving routines when to signal base level

(d) Routing calls once sufficient interpretation has been completed to determine the next call processing functions to be performed.

3.23 Program TKORIG handles digit interpretation for trunk originations. Trunk translation data is obtained to determine the number of digits expected. Terminating calls are sent to the terminating program (TERM) for 4-digit translation and terminating functions. When 3-digit translation is needed, the call is given to the digit interpretation program (DNTRP) for translation and call routing. When a variable number of digits is expected, each digit is translated until the type of call can be determined. Locally terminating calls are handled by TERM while tandem calls are sent to OUTCAL.

3.24 Digit interpretation for line originations is performed by DNTRP. DNTRP is a set of routines which interprets the customer digits until sufficient information is available to define the call as terminating or outgoing. Once the type of call is known, control is passed to the program OUTCAL for outgoing call completion, to TERM for terminating call completion, to CUSTOM (SO-2 generic only) for custom calling feature uses, to OPER for operator functions, or to CUSTER for error handling. ▶Control is passed to SPDCAL (Speed Calling Activation and Initiation) or CL4WRD (Call Forwarding Activation and Initiation) in the 3E3 generic for custom calling features.◀

3.25 Sending is the other major digit processing function. The sending function consists of outpulsing digits, sending MF tones, and other related functions. OUTCAL, which processes outgoing calls, stores in the timing hopper (paragraph 2.07) the TCR numbers which have sending functions to be performed. The sending progress mark, indicating which sending routine in DIGPRO should be given control, is stored in the peripheral progress mark area of the TCR and the interrupt progress mark indicates that sending functions must be done. Control is thus passed to the appropriate sending routine in DIGPRO when the timing hopper is being processed during the 10-ms interrupt.

3.26 Multifrequency sending requires the sending of the MF keypulse as well as the digits. DIGPRO must do timing functions for sending and also set the necessary relays to send the tones. After all digits are sent, the start signal is sent so that the processing of the call at the receiving office can be started.

3.27 For dial pulse sending, DIGPRO must turn on and off the dial pulse transmitter or operate and release the relays of a trunk (if an E&M trunk). It must also time the pulses, the interpulse periods, and the interdigital periods.

NETWORK PATH HUNTING, IDLING, AND AUDITS (SECTION 233-151-140)

3.28 The functions of hunting a path through the network, path idling, and auditing of the network are described in the following paragraphs.

3.29 The No. 3 ESS switching network consists of five stages of switching. A switched connection uses the first and second stage of one

concentrator group plus a third-stage switch and the second and first stage of the same, or another, concentrator group. Access paths called A-links connect the first- and second-stage switches. Access paths between the second- and third-stage switches are called B-links. There are two types of B-links: wire and junctor. A full network path connects from terminal X, through an X A-link, through a junctor circuit B-link, through a wire B-link, and through a Y A-link to terminal Y. The network topology is such that only one third-stage switch is possible per path. The third-stage switch number (or junctor switch number), the reverse bit, and the two terminal equipment numbers (TEN) completely specify the path.

3.30 One of the major functions of network path hunting software is maintaining the status bits of the network links. The ***network map*** is accessed in an attempt to find an idle path through the network since it contains the status bits of all the network A-links and B-links. The network path hunt, busy, and idle program (PATHNT) performs network path hunting and idling functions. PATHNT is entered by the use of the PATHUNT and PATHIDLE macros. The macros are called by programs needing paths through the network to be hunted or idled.

3.31 Network path hunting consists of hunting for an idle path between two terminals and maintaining the proper busy/idle status of the network links by means of correct updating of status bits in the network map in call store. In addition, the terminal memory record (TMR) associated with the selected junctor is supplied with necessary information, and path information is placed in the TCR for the call.

3.32 Path idling consists of changing the correct status bits in the network map for the links used in the path to be idled to show an idle status. The TMR associated with the junctor of the idled path is also cleared.

3.33 Auditing of the network map is performed for the purpose of ensuring the validity of the network map and correcting and reporting any errors detected during the audit. The network audit program (AUDNET) provides the means to (1) perform a routine network map audit and (2) perform a network map regeneration. For map regeneration, AUDNET is accessed like a called subroutine. Map regeneration is usually called by initialization software. AUDNET uses the TMRs and the link out-of-service list as sources of information to audit, correct, and regenerate the network map. Errors are reported and a TTY message is printed. Regular audits of the network are scheduled by the audit monitor, AUDITS. AUDITS obtains control once each base level loop to do auditing work. However, an audit of the network is not necessarily performed each time, depending on the time remaining in the loop.

OPERATOR FUNCTIONS (SECTION 233-151-115)

3.34 Operator functions consist of the processing of all outgoing calls which do not require outpulsing, generally referred to as operator calls. This includes 0, X11, 11X, intercept, and permanent signal operator calls. The processing of calls, which do not require called number outpulsing but do require automatic number identification and are completed to traffic service position (TSP) or traffic service position system (TSPS) trunks, is included as an operator function. In addition, the processing of multiple winks and inband signals from operator trunks requesting action is an operator function. ▶Expanded inband signaling is a 3E3 operator function that adds the "operator release" and "attach operator" signals to the regular inband signals. Multiwink signalling will continue to be the standard signalling method for implementing TOUCH-TONE, enablement of auto bill calling in particular, and end-to-end signalling in general.◀

3.35 The operator program (OPER) performs most of these tasks at base level. Control is given to OPER through a branch table in program DNTRP for those calls to be completed to nonoutpulsing outgoing trunks. OPER performs the following tasks:

(a) Obtains a trunk for completing the call

(b) Sends calls completing to TSP or TSPS trunks to OUTCAL which obtains a talk path, a transmitter, a transmitter path, and prepares for outpulsing

(c) Obtains a network path from customer to trunk via program PATHNT

(d) Obtains a tone service circuit, hunts a path from the tone circuit to the trunk, and makes connection to give the tone (when a class-of-service tone is required)

(e) Seizes the outgoing trunk

(f) Orders the network connection from the customer to the operator trunk

(g) Gives audible ringing if answer is expected

(h) Returns permanent signal operator connections to program CUSTER after the connections have been made (for generic issues prior to 3E3), while all other operator calls are sent to program RING which stabilizes the call.

3.36 An operator uses either multiple wink or inband signaling to request action. Program FASTTK detects the initial wink when scanning operator trunks during interrupt level, and obtains and initializes a TCR for the call. OPER gets control of the call through the base level progress mark and obtains a translation of the operator trunk scan point number. When an inband signal is expected, OPER obtains a receiver and a path from the receiver to the operator. The signal is received by program DIGPRO at interrupt level and is placed in the TCR. OPER (when it receives control again) examines the signal received to determine the action requested—release operator (-48 volts), attach operator (+48 volts), coin collect, coin return, or ringback. Control is given by OPER to the appropriate routines to handle the above functions.

CHARGING FUNCTIONS (SECTION 233-151-120)

3.37 Call charging areas include:

- Automatic Message Accounting Recording Service (AMARS)
- Centralized Automatic Message Accounting (CAMA)
- Traffic Service Position (System)—TSP(S)
- Call forwarding activations and deactivations
- Local charging—includes coin charging and message rate service.

A. Automatic Message Accounting Recording Service

3.38 When an office has the AMARS option, AMARS is provided at a local central office. Billing information for calls originating through the No. 3 ESS is compiled by the No. 3 ESS and stored in an Automatic Message Accounting (AMA) buffer. Periodically, the billing data is transmitted via a 4-wire data link to a remote Automatic Message Accounting Recording Center (AMARC) where the data is assembled and recorded on a 9-track magnetic tape.

3.39 During the normal progression of calls, the call processing programs determine which calls require AMA recording. The AMA program assembles the data to be recorded for these AMA-related calls and prepares it for storage in the AMA buffer which resides in temporary storage. The AMA Buffer Management (ABM) program is responsible for controlling the flow of data into and out of the buffer. The Data Administration (DATADM) program controls the flow of data to and from the AMARC via the data link.

3.40 Included in the types of billable calls which may be recorded by AMARS are:

- OUTWATS—full business day and measured-rate
- Local measured-rate (bulk or detail billed)
- Station paid (toll)
- Directory assistance.

In cases where Usage Sensitive Pricing (USP) is in effect, AMARS is also capable of recording charges for all local calls. This includes charges for calls made using the custom calling features such as threeway calling, call waiting, and call forwarding. Call information for nonbillable calls may also be recorded. Call types in this category include:

- Coin station-prepay and dial-tone-first (DTF)
- INWATS calls originating from within the No. 3 ESS service area
- Call forwarding activations and deactivations
- Calls made using call forwarding, call waiting, and threeway calling but charged on a flat rate basis.

Provisions are also available to provide capability for recording call information on all locally originated calls to be used in studies such as subscriber line

usage (SLU), conference trunk usage, and other traffic studies. Additionally, records may be maintained for purposes such as complaint observing and call tracing.

B. Centralized Automatic Message Accounting

3.41 The CAMA is a means of recording telephone call information for all direct distance dialing (DDD) calls. The DDD calls are routed to a CAMA office in another location which performs the charging. If the No. 3 ESS office cannot identify the calling number because the call requires operator identification (multiparty lines, special toll billing lines, etc), a CAMA operator performs the identification. Dial "0" calls are routed to an operator position (3CL board) or to a TSPS operator. An outgoing call to a CAMA office is performed by the call processing software in the same manner as a normal outgoing call except the called party number, the billing number, and an information digit must be outpulsed.

C. Traffic Service Position (System)

3.42 There are special toll calls (such as person-to-person, collect, credit card, and charge-to-third-party) for which the CAMA office cannot automatically perform the charging. These calls are routed to a TSPS operator who performs the charging. TSPS also provides for coin station, 0 (dial 0), manual line calls, and calls requiring special toll billing (formerly known as QZ billing). Additionally, this arrangement aids in the completing and recording of local and toll dial assistance calls.

D. Local Charging

3.43 There are two types of local charging: coin and message rate. Each of these types can be either untimed or timed according to the local office options. Coin telephone charging is performed for a telephone which accepts coin deposits at some time during a call. Message rate charging is performed via software message registers in memory of the No. 3 ESS and/or optional hardware message registers on the customer premises. Hardware message registers are used by the subscriber (eg, a hotel, motel, hospital, etc) to calculate the call charge immediately upon disconnect. The software message registers are used to accumulate the total number of message units used per charging period.

3.44 The local charging program (LCLCHG) performs initial charging for local calls, message rate service charging, and overtime charging functions during base level. OUTCAL and RING branch to LCLCHG (DLYTIM in 3E3) after the called party answers. After verifying the answer condition, LCLCHG obtains a translation expansion on the charge index for the initial charge, length of initial period, overtime charge, and the length of the overtime period. Timing for overtime charging is done in the TMR. LCLCHG performs the function of incrementing hardware and software message registers when necessary. (When a No. 3 ESS office is equipped with the AMARS option, message rate charging is controlled by the AMA program.)

3.45 When overtime charging is done on a coin line, LCLCHG collects the coin for the previous period by connecting the coin line to a coin control circuit which applies the collect voltage to the line. LCLCHG then waits 30 seconds and checks for the presence of a coin for the next period. When a coin is not deposited 30 seconds after a coin announcement, the call is torn down and the line is given a dial tone. LCLCHG (COIN in 3E3) also has an entry point for an operator request to collect or return a coin on an incoming toll switch (an incoming collect call to a coin line). The operator program (OPER) gives control to LCLCHG (COIN in 3E3) which connects a coin control circuit to the line to collect and return coin(s).

3.46 Other coin functions are performed by the coin program (COIN) including collection and return of coins before connection to the operator for 0 or 0+ calls is established. A path to a CDPR may exist, in which case it is torn down. COIN obtains a coin control circuit and a network path from the line to the circuit. The coin is collected or returned by setting the coin control circuit in the appropriate state to apply collect or return voltage to the line.

3.47 In addition, coin clean-up functions are done by COIN after being passed control by DISCON. This includes coin collection and return functions, idling the lines and any associated auxiliary line circuits, and clearing the TCR. Stuck coin checks are performed by COIN which initiates reports of stuck coin situations.

TRANSLATIONS (SECTION 233-151-150)

3.48 Translation routines are described in Section 233-151-150. The translation data, which the routines access, is described in Section 233-152-105 which describes recent change processing and data layouts.

3.49 Translation data defines a particular office to the system programs. Translation routines are used to locate specific office data and provide it to requesting programs.

3.50 Translation data is furnished by the operating company for the office. It provides information pertaining to directory numbers, office codes, line and trunk equipment, service circuits, and routing and charging procedures for the office. It is stored in the translation store area of memory and is write protected. Certain translations such as call forwarding, message register, coin status, and group status change frequently, so temporary store is used for this type of data.

3.51 A translator consists of a group of tables which contain data pertinent to a specific translation process. Access to a translator is gained by locating its address in the Master Table Index (MTI). A typical translator consists of a table in the MTI, subtranslators, and expansion tables. The MTI is a quick reference table used by the system to locate the address in translation store where data pertinent to a specific type of translation process is stored. A subtranslator contains either detailed information that the programs require for specific translations, or the addresses and index information which points to detailed information. When some translation data requires more storage than is available in the translation table of a subtranslator, expansion tables are used to provide additional area.

3.52 Call processing programs call particular translation routines when translation data is needed. Translation routines access the translation data area to obtain the data and pass it back to the calling program.

3.53 The following are typical types of translations used during the processing of a call:

- Line origination and trunk translations
- 3-digit translations
- 4-digit translations.

3.54 ***Scan point number translations*** provide conversion from a scan point number to a terminal equipment number and/or group and member numbers for nonline terminals. The originating class of service, equipment features, and telephone numbers for line terminals are included. Class-of-service information includes major class, screening class used in routing and charging, type of dialing, and service priority. Routines in the translate SPN program (XSLSPN) provide the above translations. The scan point number translations are used mainly to determine originating treatment.

3.55 ***Three-digit translation*** routines are used to check the validity of a dialed office code, determine whether a call is to be permitted, provide routing information for completing the call, and provide charging information applicable to the call. The 3-digit translator program (XSL3DG) contains the routines to perform these translations. Also included in XSL3DG is a ***1-digit translation*** routine. When a variable number of digits is expected from an incoming trunk, a 1-digit translation is used to individually examine each digit received until the destination of the incoming call or the number of digits expected can be determined.

3.56 ***Four-digit translations*** are used to obtain the terminal equipment number of the called line and to provide terminating major class or other information necessary for completion of a call. Four-digit translations are performed by the XSL4DG program.

CALL TRACE FOR THE SO-2 GENERIC (SECTION 233-151-110)

3.57 The call tracing program identifies calling and called lines in a No. 3 ESS office to determine the source of nuisance and threatening calls and to identify lines in emergency situations. It consists of a resident segment, CTRACR, and a nonresident segment, CTRACN, and is capable of handling the following call situations:

- In-progress calls
- Incoming calls
- Outgoing calls.

A. In-Progress Calls

3.58 An in-progress trace is normally requested by an operator or law enforcement agencies to identify a line in an emergency situation. This type of trace is a one time effort and requires that the call be in a stable (talking) state. It is invoked by a teletype input message which indicates either the directory number or the terminal equipment number of one side of the connection. The teletype output message states whether the other party is a line or a trunk. The group and member number is printed for a trunk. A telephone number is printed for a 1-party line or a PBX. An originating expansion is printed for a multiparty line.

B. Incoming Calls

3.59 When a customer in the office has received several nuisance calls, the source of these calls may be discovered by tracing all calls to the customer telephone number. This type of trace is activated through a teletype input message which modifies the line translation data. Whenever a call to the line is attempted, a teletype output message identifies the calling and called parties. If the calling party is a trunk, it is identified by a group and member number. A 1- or 2-party line or a PBX is identified by a telephone number. A 4- or 8-party line is identified by an originating expansion.

3.60 The called party is always a line in the office. A 1-party line or a PBX is identified by a telephone number. A 2-, 4-, or 8-party line is identified by an originating expansion. This type of trace may be terminated by a teletype input message.

C. Outgoing Calls

3.61 When the operating company has been notified that a No. 3 ESS office is a source of nuisance calls to particular lines in other offices, all outgoing calls to these lines can be traced. A trace is initiated by a teletype input message which causes a 7- or 10-digit telephone number to be placed in the calling line identification table. Whenever a call is made to a number in the table, a teletype message results indicating the time of the call and identifying the parties. The called party is always identified by a telephone number. When the calling party is a 1- or 2-party line or a member of a PBX, it is identified by a telephone number. Otherwise, it is identified by an originating expansion.

3.62 The calling line identification table may contain up to three different telephone numbers at once; that is, calls to three different numbers may be traced at the same time. An entry may consist of a 7- or 10-digit number but may not be prefixed by a 0 or 1. A teletype message causes the contents of the table to be printed for inspection. A number may be removed from the table by teletype input message.

CALL TRACE FOR THE 3E3 GENERIC (SECTION 233-151-111)

3.63 ▶Several improvements included in the 3E3 generic program for call trace are:

(a) For a successful call trace of an outgoing call, the corresponding junctor number is included in the trace message. The junctor number can be used in trouble analysis of calls which are left in an improper state.

(b) When the traced party for an in-progress call trace is involved in a stable call waiting connection, an additional message is printed to provide information on the third party involved if any.

(c) An optional major or minor alarm can be enabled by a craft person for incoming and outgoing call traces. When a trace is successful, the office alarm is activated. The type of alarm is indicated by data entered in the input message.

(d) Outgoing international direct distance dialing calls (15 digits) can be traced up to the first nine digits.

(e) The outgoing call trace can be performed on the first three or six digits of a telephone number (area code, area code + office code, or office code).

(f) Outgoing 911, 411, and 611 calls can be traced by treating the three digits as an area code.

(g) All call trace requests are now handled by resident code, since program CTRACN

(PR-3H079) has been made resident. A call trace can now be invoked more rapidly.◀

PERIPHERAL CONTROL (SECTION 233-151-155)

3.64 Peripheral control functions consist of processing orders to the periphery. Programs that must initiate sequences of peripheral orders issue a PACT (peripheral action) macro call which transfers control to the peripheral order interpreter program (POINT). The macro provides the address of the TCR containing terminal information, a peripheral progress mark, and information about the destination of the TCR after the sequence has been completed. The peripheral progress mark indicates the beginning location of the peripheral sequence in the peripheral catalog (PCAT) which is to be executed.

3.65 The PCAT program contains sequences of data words which are interpreted by POINT. The data words contain an index which indicates the action to be taken and information to be used in performing the task. Sometimes an auxiliary function may also be indicated in the word. Some of the auxiliary functions are to connect/release the false cross and ground circuit, connect/release the power cross test circuit, scan a service circuit for continuity, etc. Examples of peripheral sequences which might be requested are connect a coin line to a coin control circuit, connect a customer dial pulse receiver or TT receiver to a line, connect an incoming trunk to an MF receiver, test for continuity, etc. These sequences result in the issuance of orders to the peripheral devices in the No. 3 ESS office.

3.66 When POINT receives control, it begins executing a catalog sequence, interpreting and performing the various peripheral actions required in the sequence until (1) a real-time break is needed, (2) a network order must be sent, or (3) a stop word is encountered.

3.67 Real-time breaks are taken whenever necessary by placing the TCR number and time required for the break in the timing hopper (paragraph 2.07), which is processed during 10-ms interrupts by the timing hopper monitor (TMON) in the network queue and timing hopper monitor (QTMON). The timing hopper monitor decrements the timer of each entry every 10-ms interrupt and passes the TCR numbers of any entries that time out back to POINT for more peripheral processing in the sequence.

3.68 Scan orders and distribute orders can be sent directly to the scanners and peripheral pulse distributor since no break is necessary for these orders. However, the network orders to the network controllers must be queued since a 10-ms break must be taken between orders. Thus, when a network order must be sent, POINT places the TCR number in the network queue (paragraph 2.08) for that controller. The network queue monitor (QMON) in the program QTMON is given control during each 10-ms interrupt to process the network queues. It sends one network order to each network controller during each 10-ms interrupt when there are entries in the queues. It also verifies the orders during the next interrupt period after which control is given to POINT for more processing of the peripheral sequence.

3.69 When a stop word in the peripheral catalog sequence is encountered, POINT sets the BACTION bit in the TCR to indicate that execution of the peripheral sequence has been completed and that processing of the call can be continued.

3.70 Also doing peripheral work are the programs PSUBS and POPS. PSUBS is a collection of subroutines which are called by POINT and other programs to do some peripheral functions. POPS is also a collection of subroutines which are called by call processing routines and may also issue PACT macro calls. For instance, a function needed often may be performed by calling one of these routines, which issues several PACT macro calls and then performs some other functions while waiting.

3.71 Peripheral ***hardware*** error recovery is processed by the program PURC (peripheral unit recovery) which is described in Section 233-153-140. Peripheral ***software*** error recovery can be done either by the calling program or by peripheral error routines in POPS.

3.72 The TVADM program administers the test vertical status bits. The test vertical is a part of the network fabric which makes it possible for an operator to make a connection to a stable call, to help perform various diagnostics, and to make ongoing tests of the network as involved in a call such as false cross and ground tests, power cross tests, and restore verify tests. Any program

needing a test vertical accesses the program TVADM.

CUSTOM CALLING FOR SO-2 GENERIC (SECTION 233-151-135) AND 3E3 GENERIC (SECTION 233-151-136)

A. General

3.73 A No. 3 ESS customer can subscribe to one or a combination of custom calling services. The custom calling services available are:

- Speed calling
- Call forwarding
- Call waiting
- Threeway calling.

Translation data for the customer line indicates the presence of these features for the line. The SO-2 generic custom calling program (CUSTOM) and the threeway calling program (TREWAY) process calls from customers who have these features and are attempting to invoke them. ⏵The CUSTOM program has been redesigned and replaced in the 3E3 generic program. The 3E3 generic custom calling programs are speed calling activation and initiation (SPDCAL-PR3H188), call forwarding activation and initiation (CL4WRD-PR3H189), call waiting tone application (CALLW8-PR3H190), and the stable call waiting monitor (CW8STB-PR3H191).⏴ Control is passed to custom calling routines from various call processing programs including DNTRP, TERM, OUTCAL, and DISCON upon detection of a custom calling feature being invoked.

B. Speed Calling

3.74 Speed calling is a service that enables a subscriber to call a number of selected directory numbers by dialing abbreviated codes. The customer may subscribe to 1-digit speed calling which allows up to eight stored codes (2 through 9), or 2-digit speed calling with thirty codes (20 through 49). ⏵The present SO-2 capacities for speed call 8 and speed call 30 are 1024 and 364, respectively. In the 3E3 generic, customer capacity has been increased to 2048 for speed call 8 and 546 for speed call 30.⏴

3.74 The speed calling routine in CUSTOM for SO-2 generic or SPDCAL for 3E3 generic is entered when the customer dials an abbreviated code. The abbreviated code is used to access the directory number stored in the speed calling list for that customer in translations. The directory number is placed in the TCR and control is returned to DNTRP which uses the new number for interpretation. The call is then processed as a normal call.

3.76 A customer may change the speed calling list by dialing special access codes (a "74" for an 8-code list and "75" for a 30-code list) which are detected by DNTRP. Following time-out, dial tone is reissued to the customer so that the 1-digit or 2-digit code associated with the entry to be changed or added may continue to be dialed, followed immediately by the complete number with which that code is to be associated (including the prefix and area code, if any). The code and number are received and stored in the digit storage area of the TCR. When the number is valid, control is transferred to CUSTOM which changes the list and issues a confirmation tone to the customer. ⏵Recent change TTY messages are also available which allow service order access to the speed call list. An option that inhibits a customer from changing the speed calling list is available in the 3E3 generic. When the keyword CSL1/CSL2 in the recent change message that establishes the speed call feature is not specified, the keyword is defaulted to the office specified option (to allow or inhibit customer changes). The option to inhibit customer changeable speed call lists permits operation of the speed calling feature under certain tariffs that allow only telephone company changed numbers.⏴

C. Call Forwarding

3.77 Call forwarding enables a customer to receive calls at a number other than his own. The customer can activate or deactivate the service at any time.

3.78 Call forwarding is activated when a customer dials a "72" (detected and interpreted by DNTRP). Dial tone is then reissued. The number to which calls are to be forwarded is dialed, including the prefix "1" and area code if needed. The number is stored in the digit storage area of the TCR when it is received by DIGPRO. When the called number is valid, the call is completed to the number dialed via the appropriate routines (OUTCAL, TERM, etc). If the number answers, the forwarding option is automatically put into

effect by placing the number in the translation area of the line which invoked call forwarding. If the called number is not answered or is busy, the customer may still have calls forwarded to that number by hanging up and repeating the procedure within 2 minutes. Once call forwarding is activated, the customer receives a confirmation tone indicating that calls will be forwarded until the option is deactivated. (Calls cannot be forwarded over trunk groups that require ANI outpulsing). ▶The present SO-2 generic limit on the number of call forwarding services that can be sold is 1024. The limit on the amount of call forwarding services has increased to 4096 in the 3E3 generic. Call forwarding activations in the 3E3 generic are printed on the TTY. If a memory reload occurs, the call forwarding activations of the past 24 hours must be recent changed into translations.◀

3.79 The CUSTOM program ▶in the SO-2 generic or CL4WRD program in 3E3 generic◀ are given control when the termination program (TERM) recognizes that a call is being placed to a line with call forwarding in effect. The directory number to which the call is to be forwarded is obtained from translation data for the called line and is loaded into the digit storage area of the TCR. Control of the call is returned to the digit interpretation routines (DNTRP) so that the call can be completed. In addition, the customer line (if not busy) is rung briefly to indicate that call forwarding is active.

3.80 The customer may terminate call forwarding by dialing a cancellation code of "73". Translation area for the line is changed to deactivate the service. Confirmation tone is returned to the customer indicating that call forwarding has been canceled.

D. Call Waiting

3.81 Call waiting service enables the customer to receive a second call while talking to another party. The service is in effect regardless of whether the customer was the calling or called party in the original connection.

3.82 A customer (party A) having the service and engaged in a telephone conversation with another customer (party B) is given a call waiting tone when another party (party C) is trying to call. When party A does not respond to the first tone within 10 seconds, another tone is issued. Party C hears audible ring until the call is answered. Party A can respond to the call waiting tone in two ways: by going on-hook or with a switchhook flash. If party A responds by going on-hook, the telephone rings and when answer occurs, a talking connection will be established with party C. The connection between parties A and B is then released. If party A responds by flashing the switchhook, party B is held in a silent termination and a talking connection is established between parties A and C. In this case, party A can alternate between talking to parties B and C by subsequent flashes.

3.83 The CUSTOM program handles most of the call waiting functions ▶in the SO-2 generic while CALLW8 and CW8STB handle those in the 3E3 generic.◀ The call remains in a transient state with two TCRs associated with it ▶(only in the SO-2 generic).◀ CUSTOM monitors the call with control being transferred to needed routines by using progress marks in the TCR. ▶In the 3E3 generic program, no TCRs are used once the call waiting group is stable. When the called customer is determined to be in a stable connection, a call waiting group is established. Also in the 3E3 generic program, supervision is reported to the CWTMR_ progress mark in the stable call waiting monitor program (CW8STB).◀

E. Threeway Calling

3.84 Threeway calling service enables a customer to add a third party into an existing connection, thereby creating a connection in which the three parties can talk at the same time. The customer (party A) with threeway calling service is engaged in a telephone conversation with another customer (party B). To add a third party, party A flashes the switchhook which is seen and timed by the disconnect program DISCON. DISCON then gives control of the call to the conference program (TREWAY). TREWAY obtains a 3-port conference circuit and paths to the circuit for the call, as well as initializes the TCR for the receipt of digits. Party B is held in silent termination until party A flashes again. Party A then receives special dial tone and dials the number of the party to be added on (party C). Party A may then flash again before or after party C answers to establish the threeway connection. If party C does not answer or party A wishes to reestablish a 2-way connection with party B (dropping party C), it may be done by flashing once more. When party A goes on-hook at any point, all connections associated with the

call are dropped. When party B or C goes on-hook after the threeway connection is established, the remaining parties are retained in a 2-way connection. ⧫The 3-way operator 110 recall is a 3E3 generic feature that allows customer with 3-way calling service to recall the operator by flashing and dialing 110. To invoke the feature, the 3-way customer must be in a stable line-to-trunk connection.⧫

EMERGENCY SERVICE BUREAU (SECTION 233-151-160)

A. Definition

3.85 Nine-one-one (911) is the 3-digit telephone number that has been designated for public use throughout the United States in reporting an emergency and requesting emergency assistance. It is intended as a nationwide telephone number giving the public direct access to an emergency service bureau. The emergency service bureau receives all calls for emergency assistance and either dispatches emergency vehicles directly or transfers or relays calls to participating agencies for dispatch. The 911 bureau frequently is located within a police department although some communities locate the center in a fire department or in an independent agency which serves as a communications center.

3.86 The circuit used for the 911 bureau trunk is an incoming loop trunk. The trunks are placed in a trunk group that is designated as outgoing by translation data for the trunk group.

B. Calls Terminating to the 911 Bureau

3.87 The operating company has the option of providing 911 or a 7-digit code for accessing the emergency service bureau. When the customer dials 911, the digit interpretation program (DNTRP) will receive a special route index from the 3-digit translation. The result is that the call is routed to the outgoing trunk program (OUTCAL), as though it were an outgoing call, or to the operator program (OPER). When the customer dials the 7-digit number, the call will be in the local termination program (TERM) when dialing completes. The 4-digit translation will provide the special route index in this case, and the call is again sent to OPER/OUTCAL as though it were an outgoing call. The only task performed by OUTCAL is trunk selection. The trunk is selected, pertinent data is stored in the TCR, and the call is sent to the 911 service program (EMERG). EMERG prepares the TCR so that control can be given to the programs TERM and RING for talk path, ringing circuit, and ringing path selection. The RING program monitors the ringing of the 911 trunk. The call is made stable when answer occurs.

3.88 When the 911 bureau goes on-hook, a service-hold condition causes the call to be disconnected immediately. The calling customer will be given dial tone 10 seconds later or whenever an on-hook and then an off-hook occurs. When the calling customer is on an incoming trunk and goes on-hook, the service-hold condition does not apply. Reorder tone will be issued to the 911 bureau just as though it were trying to originate.

3.89 When the calling customer is a locally originating line and goes on-hook, the service-hold condition does apply. The 911 bureau is optionally given a tip/ring reversal by changing the trunk state, and low tone is issued to the bureau from a line busy circuit. This condition persists until one of three situations occur.

(a) If the 911 bureau goes on-hook, the connection is dropped.

(b) If the customer goes off-hook, the talk connection is reestablished.

(c) If the 911 bureau flashes (0.2 to 1.2 seconds of on-hook), EMERG modifies the TCR for entry into the operator program (OPER) as though the trunk is an operator trunk requesting ring back. If the customer remains on-hook, the customer line will be rung for 4 seconds. The call is then made stable as though the customer reanswered. If the customer has not gone off-hook, the entire process of calling party disconnect will again occur, and the 911 bureau will again be given busy tone.

C. Originations From the 911 Bureau

3.90 An off-hook from an idle 911 trunk is given to the trunk origination program (TKORIG) via the usual process of being scanned by the slow trunk scan, being placed in the input hopper, and being reported after hit timing. TKORIG selects a TCR, puts the trunk in the ignore state (supervision not reported), requests trunk data, makes the trunk busy, and discovers that the trunk is a 911 trunk. Now control of the call is transferred from TKORIG to EMERG.

3.91 The EMERG program selects a half path from the 911 trunk to a junctor and gives the trunk reorder for 6 minutes. If the trunk goes on-hook before the 6-minute time-out, the path and circuit are idled. However, if reorder is given for 6 minutes and the 911 trunk is still off-hook, a minor alarm is given and a message is printed on the maintenance TTY. After the initial time-out, the 911 trunk is put into the high and wet state.

BASIC CALL PROCESSING (SECTION 233-151-130)

3.92 The types of functions and the associated software in this area are:

- Trunk origination handling (TKORIG)
  - (a) Obtains trunk translation data
  - (b) Selects a receiver and a connection to the receiver
- Line origination handling (LNORIG)
  - (a) Obtains line originating translations
  - (b) Selects a receiver and a path connection to the receiver
- Digit interpretation (DNTRP)
  - (a) Issues dial tone
  - (b) Interprets digits
  - (c) Routes call to appropriate routines
- Terminating functions (TERM)
  - (a) Obtains the called line terminal equipment number
  - (b) Determines if the called number is idle
  - (c) Obtains a talking path
  - (d) Selects a ringing circuit to ring the called line and a ringing path
  - (e) Determines the type of ringing to apply to the called line
  - (f) Performs reverting call functions
  - (g) Performs series completion and multiline hunt functions
- Ring and answer supervision (RING)
- Disconnect functions (DISCON)
- Outgoing call functions (OUTCAL)
  - (a) Selects trunk
  - (b) Determines alternate routing
  - (c) Selects talk path
  - (d) Selects transmitter
  - (e) Selects outpulsing path
  - (f) Manipulates outpulsing digit
  - (g) Performs glare checks and continuity checks
  - (h) Attaches the information digit to the billing number if necessary
  - (i) Waits for answer
- Ringing and tone plant control (FASTTK)
- No test connections functions (NTCONN)
- Equipment selection (EQPSEL)
- Customer error handling (CUSTER, FALTCR)
- TCR scanning (TCRSCN).

3.93 Part 4 is an explanation of call processing from the call viewpoint and includes a more detailed explanation of the preceding functions.

4. CALL PROCESSING (CALL VIEWPOINT)

GENERAL

4.01 The material in this section is organized as follows:

- Intraoffice calls—calls from one terminal in a No. 3 ESS office to another terminal in the same office
- Interoffice calls—calls originating in the No. 3 ESS office but terminating in another office
- Incoming calls (terminating)—calls originating in another office but terminating in this No. 3 ESS office
- Incoming calls (tandem)—calls which come into the No. 3 ESS via a trunk and are outgoing on a trunk
- Partial dial and permanent signal treatment.

4.02 Typical intraoffice connections are depicted in Fig. 18, interoffice connections in Fig. 19, multifrequency incoming call connections in Fig. 20, and dial pulse incoming call connections in Fig. 21.

INTRAOFFICE CALLS

4.03 See Fig. 22A for the major functions performed for intraoffice calls.

A. Dial Tone Connection

4.04 Dial tone connection is depicted in Fig. 23. The subcriber going off-hook saturates the line ferrod (scan point) which is detected by the base level scanning program, SCANS. SCANS "looks" at all line scan points at base level and reports originations by placing the line scan point number (SPN) into the line origination hopper.

4.05 During a subsequent base level loop, after all trunk and junctor requests for service have been processed, the input monitor program (INPUT) processes the service request entry for the line in the line origination hopper. INPUT checks to see if dynamic service protection (DSP) should be invoked. DSP operation is described in paragraph 3.14. When the system is not in a DSP state, INPUT passes valid originations to the line originations program (LNORIG) which performs the following:

(a) Orders the line to be rescanned to eliminate momentary hits

(b) Selects and initializes an idle TCR for the origination

(c) Obtains an originating translation (via XSLSPN) to determine the type of receiver, whether the line is allowed originating service, whether the line is a manual line, etc.

(d) Routes manual line and hot line originations to the proper call processing routines

(e) Selects an appropriate type of receiver

(f) Obtains a path to the receiver via the path hunting program PATHNT

(g) Issues a peripheral action order to set up a network connection from the subscriber line to the idle receiver (including false cross and ground, power cross, and party tests if required).

Path hunting functions are described in paragraphs 3.28 through 3.31, and peripheral control functions are described in paragraphs 3.64 through 3.72. The peripheral action macro call also results in the initialization of the originating register(s) associated with the receiver scan point(s) for digit receiving and the placing of the dial tone progress mark into the TCR.

4.06 After the peripheral orders to connect an originating customer to a receiver are completed, the dial tone progress mark routine in DNTRP is given control. Assuming successful completion of the peripheral order, additional originating translation and tests may be done on 2-party lines after which the TCR is readied for receiving digits. The distribute order is issued for dial tone to be given to the customer by the receiver. A real-time break to wait for the receiving of the first digit is taken.

B. Digit Receiving and Interpretation

4.07 See Fig. 23 for digit receiving and interpretation functions. DIGPRO detects and receives digits during the timed 10-ms interrupt. It scans the busy receivers to obtain the present

states of the scan points. The results of the scan are compared with the results of the previous scan of the receivers to detect changes in state. When a change in state is detected, the originating register (OR) associated with the scan point that changed is accessed. The OR (paragraph 2.04) is used to provide a link between the receiver scan point and the TCR, to accumulate the pulse count if dial pulses are being received, and to contain a receiver code which is used to access the needed receiving routines in DIGPRO.

4.08 Dial pulses are detected by timing and counting the on-hook and off-hook periods. The TT tones are decoded into digits by using a decoding table. As the digits are detected, they are collected and stored in the TCR for the call. Dial tone is removed for calls originating in the office after the first digit is received. The BACTION bit in the TCR is set by DIGPRO to indicate base level action is needed whenever the signal digit (supplied by digit interpretation routines) and the incoming digit count in the TCR are equal.

4.09 The digit interpretation functions for line originations are performed by the program DNTRP during base level. It contains a set of routines which interpret the customer digits until sufficient information is available to define the call as a terminating or outgoing call.

4.10 The first digit received is examined to determine the number of digits needed for translation, the possible type of call, and call treatment (ie, 1+, 0, 0+, invocation of a custom calling feature, possible 11X code, abbreviated area code use, etc). Custom calling service attempts are sent to CUSTOM ▶for the SO-2 generic or SPDCAL or CL4WRD for the 3E3 generic◀ for further processing as described in paragraphs 3.73 through 3.84, while requests for an operator are sent to OPER for processing (paragraphs 3.34 through 3.36).

4.11 By using the 3-digit translation subroutine or a route index expansion, DNTRP determines the proper routing for other calls. Terminating calls are routed to the program TERM via the terminating base level progress mark in the TCR, while outgoing calls are sent to program OUTCAL for further processing. The call is failed if an error is detected. Terminating functions are described next.

C. Terminating Functions

4.12 See Fig. 24 for terminating functions. When a call has been analyzed as terminating in the same office (intraoffice), TERM calls the 4-digit translation subroutine to translate the last four digits of the dialed directory number. The 4-digit translation is used to obtain the terminal equipment number of the called line and to provide terminating major class and other information necessary for completion of a call.

4.13 The following are the possible results of the 4-digit translation and the actions taken:

- Error—the call is failed, the line is given permanent signal treatment (paragraphs 4.65 and 4.66), and a trouble printout is made.

- Calls needing special routing—unassigned lines, lines denied terminating service, and calls to another office sharing the same office code, etc, are routed via the route index branch table in DNTRP.

- Call to PBX—PBX information is stored in the TCR. TERM, using this information, selects an idle line from the group and places the terminal equipment number in the TCR as the line to which the call is to complete.

- Series completion—the terminal equipment number of the called line is placed in the TCR and the next directory number in the series is saved for possible use. A maximum of 16 series completion numbers are allowed. When the called line is found busy, the next number in the series completion is chosen. When the new series completion number is also busy, another is chosen and so on. When all numbers in the series are busy, the calling party is given a busy tone.

- Key scan point number—when the called line has a key scan point, it must be scanned. When it is set, the calling party is given a busy tone or reorder as specified by the operating company; otherwise, the call is treated by TERM as an assigned line.

- Regular assigned line—call processing continues as described next.

4.14 When the call is made to an assigned line, TERM checks for custom calling features in effect. Most of those are sent to CUSTOM ▶(SO-2 generic) or CL4WRD (3E3 generic)◀ for further processing (paragraphs 3.73 through 3.84), otherwise the called line is tested to determine its busy/idle status. Disposition of calls to idle lines is described starting with paragraph 4.25. Calls to busy lines are described next.

Calls to Busy Lines

4.15 A called line which is busy may be in the maintenance busy state or the service busy state. For lines in the maintenance busy state, TERM checks the plug-up list to see if it is a plugged-up line. Calls to plugged-up lines are sent to trouble intercept; calls to maintenance busy lines are given busy tones.

4.16 When the called line is service-busy, several possible actions may be taken. When the calling party is a no-test trunk, control is passed to the no-test routine for processing. Control of the call is given to the custom calling program when the called line has call waiting service. When the called line has the series-completion feature, TERM selects the next line in the series and attempts to complete the call to it. When the call is not a reverting call and has none of the above features, control of the call is given to the customer error program (CUSTER) which gives the calling line a busy tone.

Reverting Calls

4.17 The call is a reverting attempt when the calling line is trying to reach another party on the same 2-party or multiparty line. Both customers have the same terminal equipment number which indicates the reverting attempt.

4.18 The reverting call is handled in one of the following ways depending upon the option selected by the telephone company:

- 2-Party Selective, 4-Party Semiselective, and Divided Code Ringing
- 4-Party Full Selective and 8-Party Semiselective Ringing.

2-Party Selective, 4-Party Semiselective, and Divided Code Ringing

4.19 The TERM program selects a busy tone circuit to return busy tone until the calling customer hangs up. The busy tone is removed and reverting ringing is connected. Ringing is removed and a talking connection is established when any customer on the party line removes the receiver from the switchhook. When both customers hang up and the disconnect is detected, disconnect timing is completed and the connection is released.

4.20 With 2-party lines, regular ringing is applied for the called customer; special reverting ringing (1/2 second on and 2-1/2 seconds off) is applied for the calling customer.

4.21 With 4-party lines, the dialed number translation for the called line indicates that the ringing code should be applied on the called side. Reverting ringing is applied to the other side of the line.

4-Party Full Selective and 8-Party Semiselective Ringing

4.22 When the office has superimposed ringing, the calling subscriber must dial a single digit (2 through 9) after dialing the called number to identify the calling line for ringing during the revertive ringing procedure. Superimposed ringing implies 4-party full-selective or 8-party semiselective ringing. To alert the calling party when the called party has answered, the calling party must be rung by its own ringing code and superimposed voltage; thus the identification digit is required. Dial tone is returned to the calling party by the customer dial pulse receiver for the identification digit to be dialed. The signal digit in the TCR is set for one digit to be received and the digit is received in the normal manner by DIGPRO during interrupt level. When the identification digit has been dialed, the major class of the calling party is determined, and the line is given busy tone as a signal to go on-hook so ringing can begin. Ringing is connected to the called and calling customers to begin the ringing procedure when the customer goes on-hook. Control of ringing is performed by the ring and answer program (RING). When the calling and called stations are on the same side of the line and have the same polarity, only the called line ringing code is applied. In other cases, the calling party is rung with its own ringing code.

4.23 Ringing is released and the talking connection is established when any customer on the line removes the receiver from the switchhook.

4.24 For any of the reverting call arrangements previously described, the network connections are released if:

(a) The calling party fails to hang up within a specified time after receiving the busy tone signal,

(b) The calling party fails to dial the station digit after receiving dial tone, or

(c) Neither the called nor calling party removes the receiver after ringing has been applied for a specified time.

Calls to Idle Lines

4.25 When a called line is idle, some preliminary work must be done by TERM. TERM sets any associated auxiliary line circuit and examines the major class of the called line to determine if it is a free line. If the called line is free and the calling party is not a trunk or a line required to charge on calls to free lines, the charge index in the TCR is changed to free. If the called line is not free, a coin presence test must be made on a calling coin line. The calling line is set up to a coin announcement when the coin is not present. Also, a 2-party test must be made on 2-party calling lines. All called lines are tested to determine whether call tracing is in effect; in this case, a trace message is printed on the TTY.

Paths and Ringing Circuit Selection

4.26 Having determined that the call can be completed, TERM issues a macro call to hunt a network path for connecting the calling and called parties for talking (performed by the program PATHNT). Next, TERM determines whether a special (superimposed ringing) or regular ringing circuit is required. A special ringing circuit is required for ringing a line with 4-party full-selective or 8-party semiselective ringing. An appropriate type of ringing circuit and a network path to connect the ringing circuit to the called line are then selected. ◗Unless a special ringing code is required, a regular ringer is used to ring an individual or 2-party line.◖

Ringing and Audible Connection

4.27 After obtaining the ringing circuit and ringing and talk paths, TERM issues a peripheral action macro call to release the A party to A-service circuit (receiver) connection if one exists (there will not be one for incoming dial pulse trunks). In addition, the ringing circuit to called party connection and the calling party to talk junctor connection are established. A power cross test is made on the called party, a false cross and ground test is made on both parties, and a continuity test is made on the calling party.

4.28 When a continuity or false cross and ground failure occurs, TERM will call the FAIL macro which will result in the calling party being given reorder tone. A power cross failure results in the called party being set to the maintenance busy state and the calling party being given permanent signal treatment.

4.29 When the peripheral work is successfully completed, the customer dial pulse receiver path and circuit are marked idle. The called line is checked by TERM for an immediate answer condition (called party goes off-hook after ringer is connected but before ringing voltage is applied to the line). In the case of an immediate answer condition, one of the following actions is taken:

(1) If the called party is a coin line, the calling party is given busy tone

(2) If the called party is a PBX line, the line is released and another line is selected

(3) If the called party is neither (1) or (2) above, the off-hook is treated as an answer condition.

4.30 If an immediate answer condition does not exist, the ringing circuit is set to ring the line. The ringer is tested for ac continuity to the line after ringing is switched on. When the continuity test fails, another ringer is selected and the first ringer and path are idled. The connection is then attempted even if another continuity failure occurs. When ringing has been applied to the called line, TERM sets the talking junctor to the state to return audible to the calling party. The TCR is initialized for ringing control to be done by the program RING.

Ringing and Answer Supervision

4.31 The RING program has control of a call terminating in a No. 3 ESS office from the time ringing is initiated until answer or abandonment. Ringing is controlled by RING by setting the ringing circuit to its proper state and loading the TCR timer with the appropriate timing period determined by the ringing state code of the customer in the TCR. When the TCR timer times out, control is returned to RING to change the state of the ringing circuit for the next period. In this way, ringing is turned on and off.

4.32 Ringing continues until a supervisory change is detected during input processing or a time-out occurs. A calling party on-hook is considered an abandonment. RING idles the ringing circuit, the ringing path, and the called party. Control of the call reverts to DISCON (TCRDSC in 3E3) which disposes of the call by idling the calling party and the talk path and clearing the TCR.

4.33 The other valid supervisory state change is an off-hook from the called party or an answer. RING idles the ringing circuit and path, sets up the talk path, and releases audible ringing from the calling party. Next the charge index is examined. If the call is free, the TMR is set to stable, the TCR is cleared, and supervision of the call is performed by the scanning and input processing software which look for state changes of the talk junctor. If the call is not free, control of the call is transferred to program LCLCHG (DLYTIM in 3E3) for any charging functions that might be required (see paragraphs 3.37 through 3.47).

D. Disconnect Functions

4.34 See paragraphs 4.57 through 4.63 for disconnect functions for an intraoffice call.

INTEROFFICE (OUTGOING) CALLS

4.35 See Fig. 22B for the major functions performed for interoffice calls.

A. Dial Tone Connection

4.36 Scanning, input processing, and dial tone connection functions are the same as described in paragraphs 4.04 through 4.06 for calls originating in this office but outgoing to another office (Fig. 23).

B. Digit Receiving and Interpretation

4.37 The same digit receiving and interpretation functions are performed as described in paragraphs 4.07 through 4.11 with the following exceptions (Fig. 23). The 3-digit translation called by DNTRP returns a code and the appropriate trunk group number to be used to route the call. The code for an interoffice call indicates either a 7-digit or 10-digit interoffice call with or without overlap outpulsing.

4.38 Overlap outpulsing is the outpulsing of the digits as they are received rather than outpulsing the digits only after all digits are received. When overlap outpulsing is being used, control of the call is routed directly to program OUTCAL for outpulsing and outgoing functions. However, when overlap outpulsing is not being used, DNTRP initiates a real-time break to wait for all digits to be received before control of the call is given to OUTCAL for the performance of outgoing functions.

C. Outgoing Functions

4.39 See Fig. 25 for outgoing functions. OUTCAL obtains control of an outgoing call via the base level progress mark in the TCR for the call. OUTCAL calls a translation routine to select an idle trunk in the appropriate trunk group. When all trunks in the group are busy, alternate routing may be attempted. The calling party is given a reorder tone when no route is found.

4.40 After the trunk selection is made, a talk path from the calling party to the trunk is reserved (via a call to the PATHUNT macro). The next major task is to select an appropriate type of transmitter (dial pulse or multifrequency) and a path from the outgoing trunk to the transmitter. (For E&M trunks, no dial pulse transmitter is needed.) When multifrequency outpulsing is used, the required start code is generated and stored in the TCR. Any needed prefixing or deletion of digits in the TCR is done. The trunk is then connected to the transmitter path and continuity is tested. When overlap outpulsing is not being used, the receiver and receiver path are no longer needed and therefore are idled, and the calling line to talk path junctor half path is established. The TCR is then prepared for sending.

4.41 When the call is to a TSP(S) office and automatic number identification (ANI)

outpulsing is required, OUTCAL waits for the go signal (continuous off-hook) from the far-end and prefixes the proper information digit used for billing to the billing number to be outpulsed.

4.42 Digit sending is performed during 10-ms interrupts by routines in program DIGPRO. For dial pulse sending, DIGPRO turns the dial pulse transmitter on and off at appropriate intervals to send the pulses. For multifrequency sending, DIGPRO sets the tone relays in the multifrequency transmitter to the appropriate states to send the proper MF tones.

4.43 When sending is complete, OUTCAL regains control of the call at base level. The transmitter path is torn down and the transmitter is idled. The talk path is established. The call is placed in a stable state (unless the local office gives audible to the line) and answer is awaited. When answer is detected, the call is sent to program LCLCHG for charging supervision, if required.

D. Disconnect Functions

4.44 Disconnect functions are discussed in paragraphs 4.57 through 4.63.

INCOMING CALL

4.45 Fig. 22C depicts the major functions performed for incoming calls.

A. Trunk Scanning and Input Processing

4.46 See Fig. 26 for trunk scanning and input processing. One-quarter of the scan points for immediate start trunks and operator trunks are scanned each 10-ms interrupt by the program FASTTK. This provides an effective rescan period of 40 ms for any given immediate start or operator trunk. An off-hook detected for a specified period of time is interpreted as an attempted origination.

4.47 A TCR for an origination from an immediate start trunk is obtained and readied by FASTTK for digit reception. Immediate start trunks use only dial pulse sending and the pulses are detected at the trunk scan point; therefore, no receiver is needed for the call. The SPN of the trunk is placed in the dial pulse sending trunk hopper for digit processing.

4.48 An entry is placed by FASTTK in the trunk/junctor/service circuit input hopper for operator trunk originations to be processed by the input processing software.

4.49 Scan points of all other trunks are interrogated at base level for originations by program SCANS. When an origination is detected, SCANS makes an entry for the trunk in the trunk/junctor/service circuit input hopper to be processed by INPUT.

4.50 Program INPUT processes the trunk/junctor/service circuit input hopper and passes originations to TKPROC. TKPROC calls program TKORIG which obtains a TCR for the call and the trunk translation data. In addition, TKORIG starts the peripheral sequence to connect the trunk to a receiver if necessary. Dial pulse trunks do not use a receiver since pulses are detected at the scan point of the trunk.

4.51 The TCR is initialized to receive digits and the SPN of the dial pulse receiving trunk is placed in the dial pulsing receiving trunk hopper for digit processing. Start dial signals are sent to the other office for both the MF receiving trunks and for dial pulse receiving trunks except immediate start trunks.

B. Digit Receiving and Interpretation

4.52 See Fig. 26 for digit receiving and interpretation for incoming calls. During the 10-ms interrupts, program DIGPRO orders a directed scan of each trunk that is in the dial pulse receiving trunk hopper. By counting and timing on-hook periods and off-hook periods, DIGPRO counts the pulses and collects digits which are stored in the TCR.

4.53 Multifrequency tones are received through a multifrequency receiver. The tones are decoded by DIGPRO into digits and the digits are stored in the TCR for the call.

4.54 Program TKORIG performs most of the digit interpretation for incoming trunk calls. It interprets digits until the number of digits expected and the proper routing can be determined. When the call is a tandem call (trunk-to-trunk), control of the call is passed to the program OUTCAL for outgoing call functions. For tandem calls, see paragraph 4.56.

C. Terminating Calls

4.55 If TKORIG determines the call is terminating in the No. 3 ESS office, control of the call is given to TERM which does a 4-digit translation and performs the terminating functions described in paragraphs 4.12 through 4.33.

D. Tandem Calls

4.56 Tandem calls are calls which come into the No. 3 ESS office on a trunk but do not terminate in the office and are to be routed through the office to an outgoing trunk. A tandem call is processed similarly to incoming calls except that TKORIG, while doing digit interpretation, determines that the call is outgoing. The call is then passed to the program OUTCAL for outgoing functions (paragraphs 4.39 through 4.43).

DISCONNECT FUNCTIONS

4.57 Figure 27 depicts disconnect functions. A stable call has a talk path with a talk junctor and has a stable TMR associated with the talk junctor. The TMR contains information associated with the stable call. A disconnect (probably many base level loops after stabilizing the call) is detected by scanning software and is placed in the appropriate hopper. Input processing software processes the input by obtaining a TCR for the action.

4.58 Supervision of lines for disconnect in a stable call is performed by program SCANS interrogating talk junctor scan points once every base level loop. On-hooks are entered in the trunk/junctor/service circuit input hopper for processing by program INPUT.

4.59 Supervision of immediate start and operator trunks for disconnect is performed by interrogating the trunk scan point during the 10-ms interrupts. Each scan point is examined once every fourth interrupt by program FASTTK. When an on-hook is detected, it is placed in the interrupt portion of the trunk/junctor/service circuit input hopper for processing by INPUT.

4.60 All other trunks are supervised by program SCANS at base level. SCANS interrogates each scan point in the slow scan list and reports state changes in the trunk/junctor/service circuit input hopper for processing by INPUT.

4.61 Program INPUT processes the hopper entries during a later base level loop. It times the on-hooks to eliminate hits. Valid disconnects are passed to program TKPROC which obtains a TCR for each call and then passes control of the call to the disconnect program (DISCON) by setting the base level progress mark in the TCR for disconnect processing.

4.62 Disconnect functions include the following:

- Performs disconnect timing functions
- Provides calling line control of the call (but does not permit the calling line to keep a called line tied up)
- Recognizes flashes for 3-way from lines
- Signals disconnect to a distant office over an incoming or outgoing trunk (interoffice call or incoming call)
- Removes the talking connection at disconnect
- Idles any lines, circuits, or trunks involved in the call (trunks in interoffice calls)
- Idles the network paths involved in the call
- Passes control to COIN program via a progress mark for coin clean-up
- COIN software idles those lines which are not coin lines. For coin lines, the deposits are returned/collected as a function of the charge index
- COIN releases the TCR.

4.63 To determine the treatment for a disconnecting call, the following must be determined:

- Type of call to be disconnected
- Paths and circuits in use
- Party (calling or called) providing the supervision
- Line having custom calling services

- Line being a coin line.

Different actions are taken depending on the above factors.

ERROR CHECKING, RECOVERY, AND TREATMENT

A. General

4.64 Refer to Section 233-151-130 for more details on error checking and treatment in call processing. Error checking in call processing routines is abundant. When errors are detected, the call failure program (FALTCR) is invoked to disconnect calls and dispose of TCRs. Many failures result in a TTY message being printed. Failures to obtain circuits and paths in many cases result in additional attempts to complete the call. Treatment varies depending on the type of call and failure. Customer error treatment is summarized in the following paragraphs.

B. Permanent Signal

4.65 Permanent signal treatment is given to a line or a trunk which fails to disconnect after the called party has disconnected, or, if originating a new call, remains off-hook for a specified interval after receiving dial tone without transmitting a digit. In addition, this condition can be caused by a line or trunk failure.

4.66 The permanent signal treatment received depends on the type of line or trunk involved and is administered by the customer error program (CUSTER). The following treatment is provided for a permanent signal condition.

(a) If a line is not a PBX line or a ground start coin line, it may be routed through several steps of permanent signal treatment. The following sequence is provided:

(1) An announcement (optionally).

(2) One second of open interval (for PBX only).

(3) A receiver off-hook (ROH) tone (optional). ▶A high tone is given to a carrier or PBX line in the 3E3 generic if the line is marked inhibit ROH tone.◀

(4) Routed to an operator (optional) in issues of the generic prior to 3E3; in the 3E3 generic, there is no operator step.

(5) Set high and wet.

(b) If the line is a PBX line, it may receive an announcement if provided. One second of open interval is then given. ▶If specified, the 3E3 generic feature inhibit ROH tone prevents the ROH tone from being sent to a PBX line. The ROH tone is replaced with a high tone. If the line remains off-hook after the high tone is applied, the line is set high and wet. In the SO-2 generic, the line is set high and wet if the line is still off-hook after the open interval.◀

(c) If the line is a ground start coin line, it may receive only one step of permanent signal treatment, possibly an announcement. If the treatment fails or no treatment is given, the coin will be returned before the line is set high and wet.

(d) If the trunk is from a step-by-step office, it will be given reorder tone. When the tone fails to get an on-hook signal, the trunk is set high and wet.

(e) Any other type of trunk receives no special treatment and is immediately set high and wet.

4.67 If all permanent signal treatment fails, the line or trunk is immediately set high and wet. All previously assigned switching network paths and memory areas are released and the line or trunk is scanned for an on-hook condition only. Service is returned automatically when the customer goes on-hook.

C. Partial Dial

4.68 Partial dial treatment is given to calls that are not completely dialed. After the first digit has been dialed, the interval between digits is timed. When the interval exceeds the allowable limit, the call is given partial dial treatment by CUSTER.

4.69 Partial dial treatment is similar to, and in most cases the same as, those described in paragraphs 4.66 and 4.67 for permanent signal treatment.

5. GLOSSARY

5.01 Terms, abbreviations, and definitions used frequently in this document follow.

AMA—Automatic Message Accounting

AMARC—Automatic Message Accounting Recording Service

ANI—Automatic Number Identification

BACTION Bit—Bit in TCR which is set to indicate base level action is needed

Base Level—Major software loop including all functions not done during interrupt level

Bit—The binary unit of information which is represented by one of two possible conditions, such as the digits 0 and 1, high potential or low potential, on or off

CDPR—Customer dial pulse receiver

Clear—To restore a storage device to the "Zero" state

DDD—Direct distance dialing

DP—Dial pulse

DSP—Dynamic service position

DTF—Dial tone first

Dynamic Service Protection (DSP)—An automatic way of protecting the service of class A lines during a traffic overload

ESS—Electronic Switching System

High and Wet—State in which the trunk or line is monitored for an on-hook only

Hoppers—Dedicated areas of writable memory into which entries with a fixed format are made

Hot Line—A line with direct access to a party for which no dialing must be done

Immediate Start Trunk—A trunk which does not wait for a signal before beginning to send dial pulses (usually from a step-by-step office)

Interoffice Call—A call switched between different central offices

Intraoffice Call—A call from one subscriber assigned to a central office to another subscriber within the same office

10-ms Interrupt—A hardware-initiated interrupt for a period of time necessary to perform frequently required functions

Junctor—A circuit associated with the switching network which provides a path for a call through the network

Line—Anything that connects to a network terminal that is not classified as a trunk or service circuit. Usually a pair of wires that serves to connect a customer telephone to a terminal on the network.

Macro—A sequence of operations called by an abbreviated notation

MF—Multifrequency

MIT—Master table index

Network Map—Storage area assigned to contain the status bits of network links

O+—Direct dialing with operator assistance

Operator Trunk—One of five types of trunks (TSP, TSPS, toll switching, recording completing, operator office trunk)

OR—Originating register

Outpulsing—Generation of pulses to match the stored digit information and of the proper type to be used by the distant switching office

Plugged-up Line—A line which is busied for maintenance purposes

Program—A set of instructions assembled as one unit under a program name

Progress Marks—Areas in TCR which indicate next software routines to be executed for the call

ROH—Receiver off-hook

Scan Point—Ferrod sensor used in scanners for supervisory purposes

Signal Digit—Area in the TCR to indicate the location of the digit to be received before base level is alerted for more base level action

Series Completion—Allows calls to be routed to any designated directory number within the same office code if the original number is busy

SLU—Subscriber line usage

SPN—Scan point number

SSD—Software Subsystem Description

Subroutine—A sequence of instructions which performs a well-defined function and is called by another section of instructions

Tandem—Trunk-to-trunk call

TCR—Transient call record (see paragraph 2.02)

TEN—Terminal equipment number

TMR—Terminal memory record (see paragraph 2.03)

TT—TOUCH-TONE

TSPS—Traffic Service Position System

USP—Usage sensitive pricing

Word—A set of characters which occupies one location in storage and is treated by the system as a unit.

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	ACTIVE	PERTN							SPM				DISCRTN	CC	INTPM	
1	SPLTONE	2NDTRY	SPLAUD	TPTH	BPTH	APTH	BACTION	PERM	BASEPM							
2	TIMER															
3	SNDRDATA															
4	XMIT_DTA															
5	LKSRA	LLA	LINEA	APARTY												
6	RVRSA	AJCTR							ASVC							
7	**LKSRB	**LLB	**LINEB	** BPARTY					*TTONE	*SCREENING CLASS						
8	RVRSB	BJCTR							BSVC							
9	RVRST	TJCTR							TIPTY	TOPTY	CN	OVOP	EM	MFSND	2WAY	LLOOP
10	INCDIGCT				SPARE	CDPR_DTA										
11																
12	DIGSTR				DIGSTR				DIGSTR				DIGSTR			
13	DIGSTR				DIGSTR				DIGSTR				DIGSTR			
14	DIGSTR				DIGSTR				DIGSTR				DIGSTR			
15	DIGSTR				DIGSTR				DIGSTR				SIGDIG			

INTPM	INTERRUPT PROGRESS MARK	LINEA	A-PARTY IS LINE	TOPTY	2-PARTY
CC	CUSTOM CALLING BIT	LLA	LONG LOOP LINE	TIPTY	TIP PARTY
DISCRTN	DISCONNECT RETURN	LKSRA	"A" IS LINK SHARED	TJCTR	TALK JUNCTOR SWITCH NUMBER
SPM	SENDER PROGRESS MARK	ASVC	A-PARTY SVC NUMBER	RVRST	TALKING PATH REVERSAL
PERTN	PERIPHERAL ERROR RETURN	AJCTR	A-PARTY JUNCTOR SWITCH NUMBER	CDPR_DTA	CDPR DISTRIBUTE TRIPLET ADDR.
ACTIVE	TCR ACTIVE	RVRSA	A-PARTY REVERSAL	INCDIGCT	INCOMING DIGIT COUNT
BASEPM	BASE LEVEL PROGRESS MARK	TTONE	TOUCH-TONE	DIGSTR	DIGIT STORAGE AREA
PERM	PERMANENT SIGNAL	BPARTY	B-PARTY SPN OR TEN	SIGDIG	SIGNAL DIGIT-RETURN TO BASE LEVEL
BACTION	BASE LEVEL ACTION NEEDED	LINEB	B-PARTY IS LINE		
APTH	ASVC PATH	LLB	LONG LOOP LINE		
BPTH	BSVC PATH	LKSRB	"B" IS LINK SHARED		
TPTH	TALK PATH	BSVC	B-PARTY SVC NUMBER		
SPLAUD	SPECIAL AUDIT	BJCTR	B-PARTY JUNCTOR SWITCH NUMBER		
2NDTRY	BASE LEVEL SECOND TRY BIT	RVRSB	B-PARTY REVERSAL		
SPLTONE	SPECIAL TONE PRESENT	LLOOP	LONG LOOP LINE		
TIMER	UNIT = 10 MS	2WAY	2-WAY TRUNK		
SNDRDATA	SENDING DATA	MFSND	MF SENDING		
XMIT_DTA	TRANSMITTER DISTRIBUTE TRIPLET ADDR.	EM	E AND M TRUNK		
APARTY	A-PARTY SPN OR TEN	OVOP	OVERLAP OUTPULSING		
		CN	COIN LINE		

** SO-2 GENERIC ONLY (BPARTY CONSISTS OF BITS 0-12)
* 3E3 GENERIC ONLY

Fig. 1—TCR Format During Digit Processing

STABLE

WORD	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	ACTIVE 1	ANI OR MB	LINE A	CALLING CALLING-PARTY SCAN POINT NUMBER												
1	RVRS	STABL 1	LINE B	CALLED CALLED-PARTY SCAN POINT NUMBER												
2	TIM	TIPTY	CHARGE INDEX (CHARG I)					TIMER (IF TIM = 1)								
3	TMRPM	CALL4	CWA	ASPLIT	CWB	BSPLIT	ANSW *	AMAINIT *	CONHOOK *	CCPM			APORT		BPORT		CUSTOM CALLING INFORMATION

TRANSIENT

WORD	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	ACTIVE 1	ANI OR MB	LINE A	CALLING CALLING-PARTY SCAN POINT NUMBER												
1	RVRS	STABL 0	LINE B	CALLED CALLED-PARTY SCAN POINT NUMBER												
2			CHARG I					2PTSVC	TCR NUMBER							
3	TMRPM	CALL4	CWA	ASPLIT	CWB	BSPLIT	ANSW *	AMAINIT *	CONHOOK *	CCPM			APORT		BPORT		CUSTOM CALLING INFORMATION

* 3E3 GENERIC ONLY

Fig. 2—Terminal Memory Record

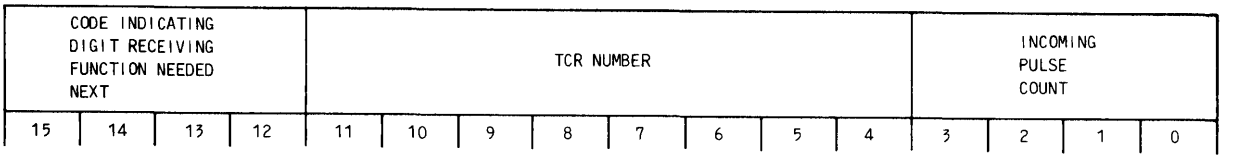
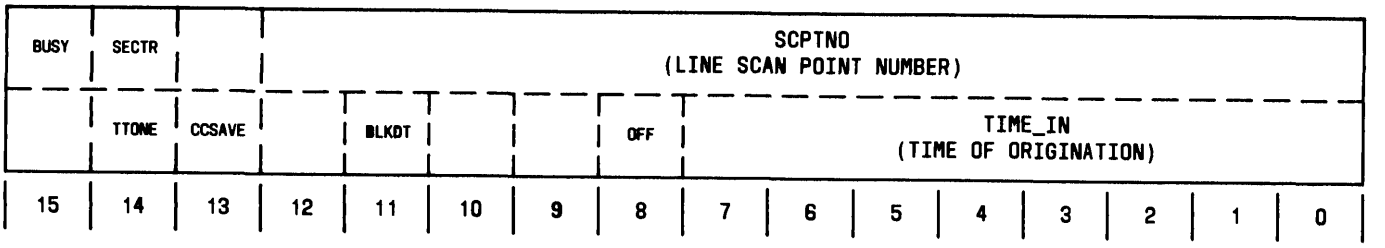


Fig. 3—Originating Register



SCPTNO Line Scan Point Number

SECTR Second time the SPN has been rescanned

BUSY Set when this slot of hopper is in use

TIME_IN Time of origination (for Dial Tone Speed measurement). 8 bits of SYSTIME to 80 ms accuracy on entry to hopper.

OFF 1 = off-hook. Always set = 1 so a line entry looks like a trunk entry

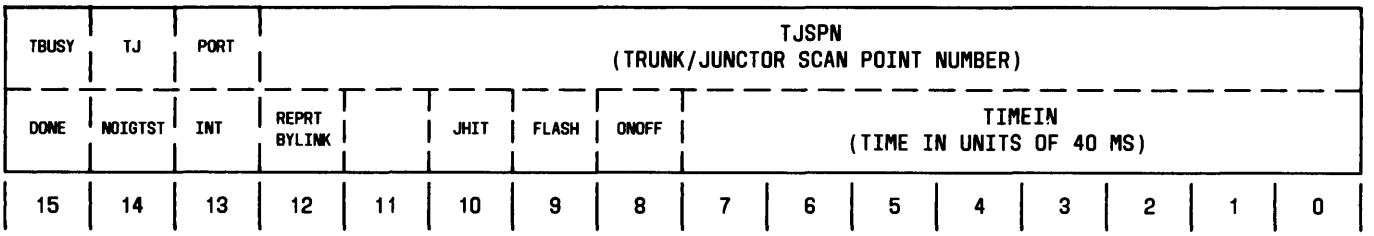
HITBT Set by the Input Monitor when hit timing is completed

BLKDT Set when a dial tone blockage has occurred

CCSAVE Indicates that this is a custom calling origination.

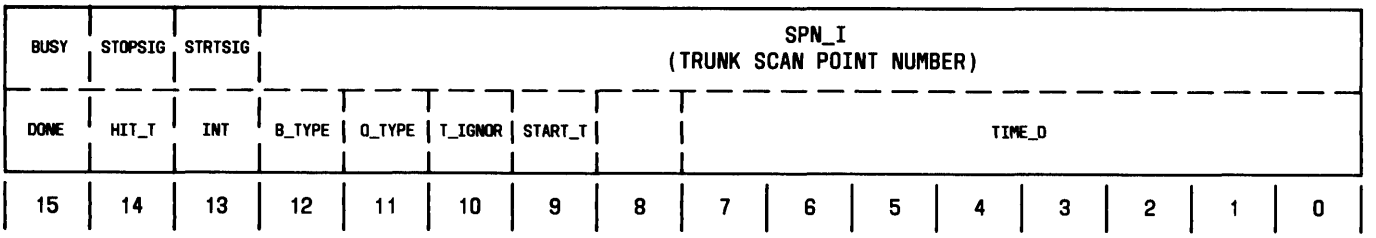
TTONE 1=YES. A TOUCH-TONE receiver is attached to this line

Fig. 4—Line Origination Hopper Entry



TJSPN	Circuit scan point number.
PORT	Indicates which port of a conference circuit is in use.
TJ	1=TK, 0=J
TBUSY	1 Set when this slot of hopper is in use.
TIMEIN	Time in units of 40 ms.
ONOFF	0=On, 1=off
FLASH	Used by Input Monitor only.
JHIT	Set when hit timing is completed.
REPRT	Set when input is no longer timing entry.
BYLINK	Also indicates a bylink trunk disconnect in INTHOP.
INT	Entry is from the interrupt hopper.
NOIGTST	Do not test for ignored SPN – used by FASTTK & TKPROC.
DONE	Used to indicate if a bylink trunk was idled.

Fig. 5—Trunk/Junctor/Service Circuit Input Hopper Entry



SPN_I	Scan Point Number of Trunk.
STRTSIG	Set when start signal is detected.
STOPSIG	Set when stop signal is detected.
BUSY	1 means this 2-word entry is in use.
TIME_D	Timer.
START_T	Set to 1 for start signal entry.
T_IGNOR	Set to 1 for timed ignore entry.
O_TYPE	Set to 1 for operator trunk on-hook entry.
B_TYPE	Set to 1 for bylink trunk on-hook entry.
INT	Set to 0 since interrupt is using entry.
HIT_T	Set to 1 when an operator trunk passes wink hit timing.
DONE	Set to 1 after operator trunk hit timing has been done.

Fig. 6—Interrupt Hopper Entry

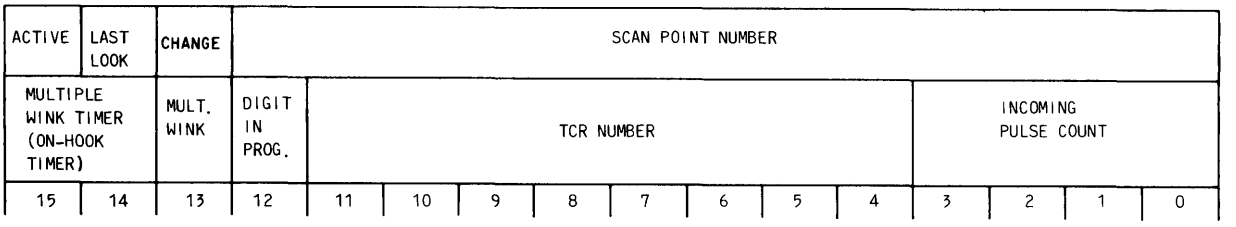


Fig. 7—Dial Pulse Receiving Trunk Hopper Entry

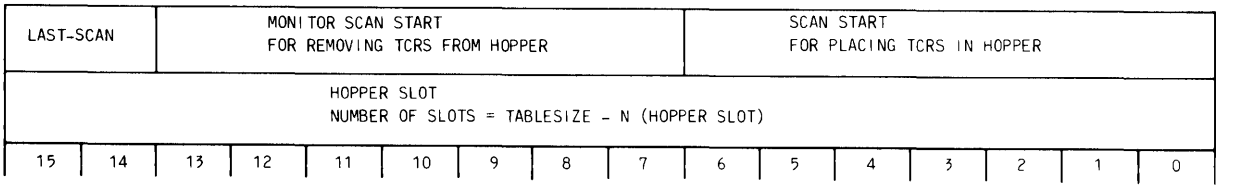


Fig. 8—Control Words for Timing Hopper

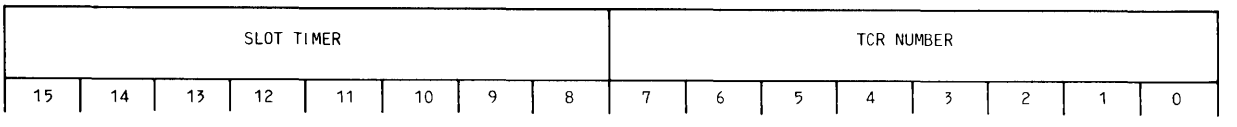


Fig. 9—Timing Hopper Slot

NETQ -005- 01 #

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
00	QACTV	QSKIP	QEMPTY	QFULL	QHEAD				QACTV	QSKIP	QEMPTY	QFULL	QHEAD NEXT AVAILABLE SLOT			
01		QVRFY	QRTRY		QTAIL					QVRFY	QRTRY		QTAIL OLDEST ENTRY			
02	VERIFY SLOT								VERIFY-SLOT NETWORK VERIFY SLOT							
03	QUEUE SLOT								QUEUE-SLOT 16 SLOTS							
04	QUEUE SLOT								QUEUE SLOT							
05	QUEUE SLOT								QUEUE SLOT							
06	QUEUE SLOT								QUEUE SLOT							
07	QUEUE SLOT								QUEUE SLOT							
08	QUEUE SLOT								QUEUE SLOT							
09	QUEUE SLOT								QUEUE SLOT							
10	QUEUE SLOT								QUEUE SLOT							
11	QUEUE SLOT								QUEUE SLOT							
12	QUEUE SLOT								QUEUE SLOT							
13	QUEUE SLOT								QUEUE SLOT							
14	QUEUE SLOT								QUEUE SLOT							
15	QUEUE SLOT								QUEUE SLOT							
16	QUEUE SLOT								QUEUE SLOT							
17	QUEUE SLOT								QUEUE SLOT							
18	QUEUE SLOT								QUEUE SLOT							

Fig. 10—Network Controller Queue

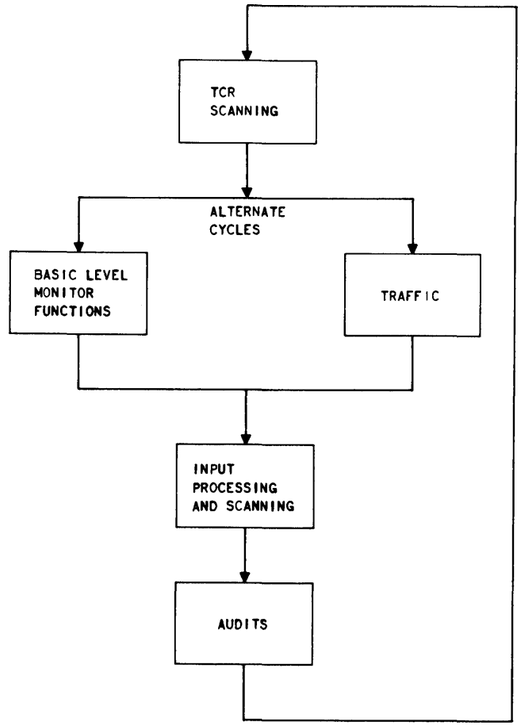


Fig. 11—Base Level Loop

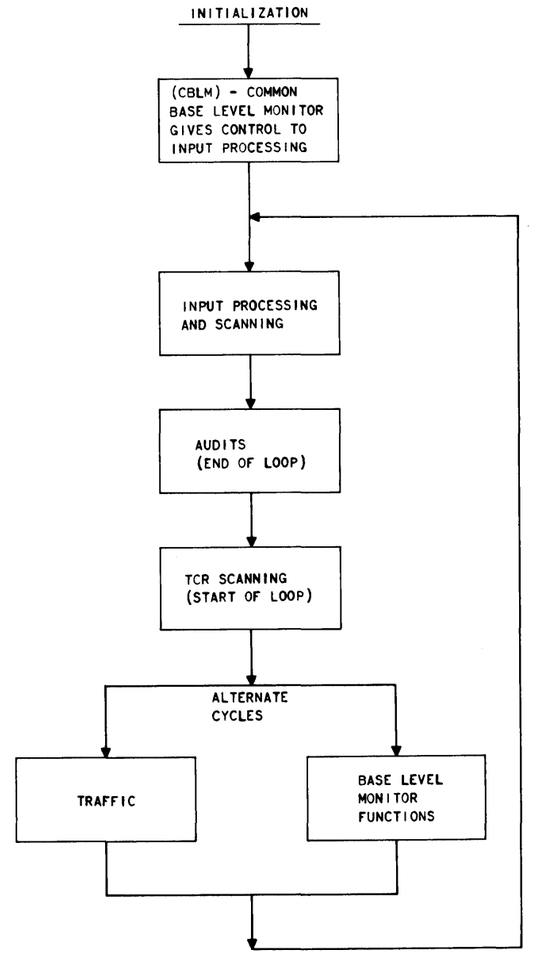


Fig. 12—Base Level Loop
Beginning With Initialization

Fig. 11 and 12

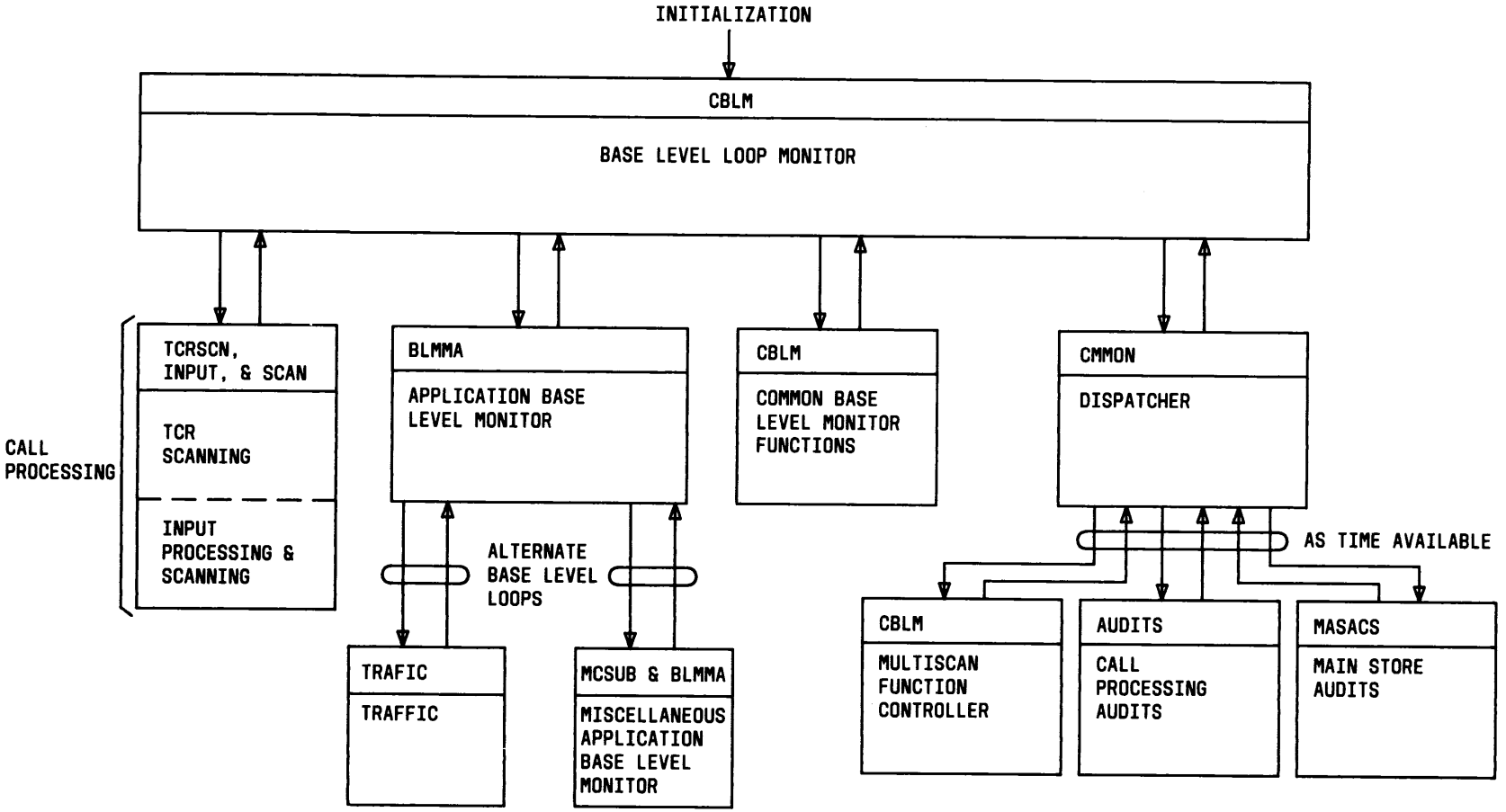


Fig. 13—3E3 Generic Base Level Loop

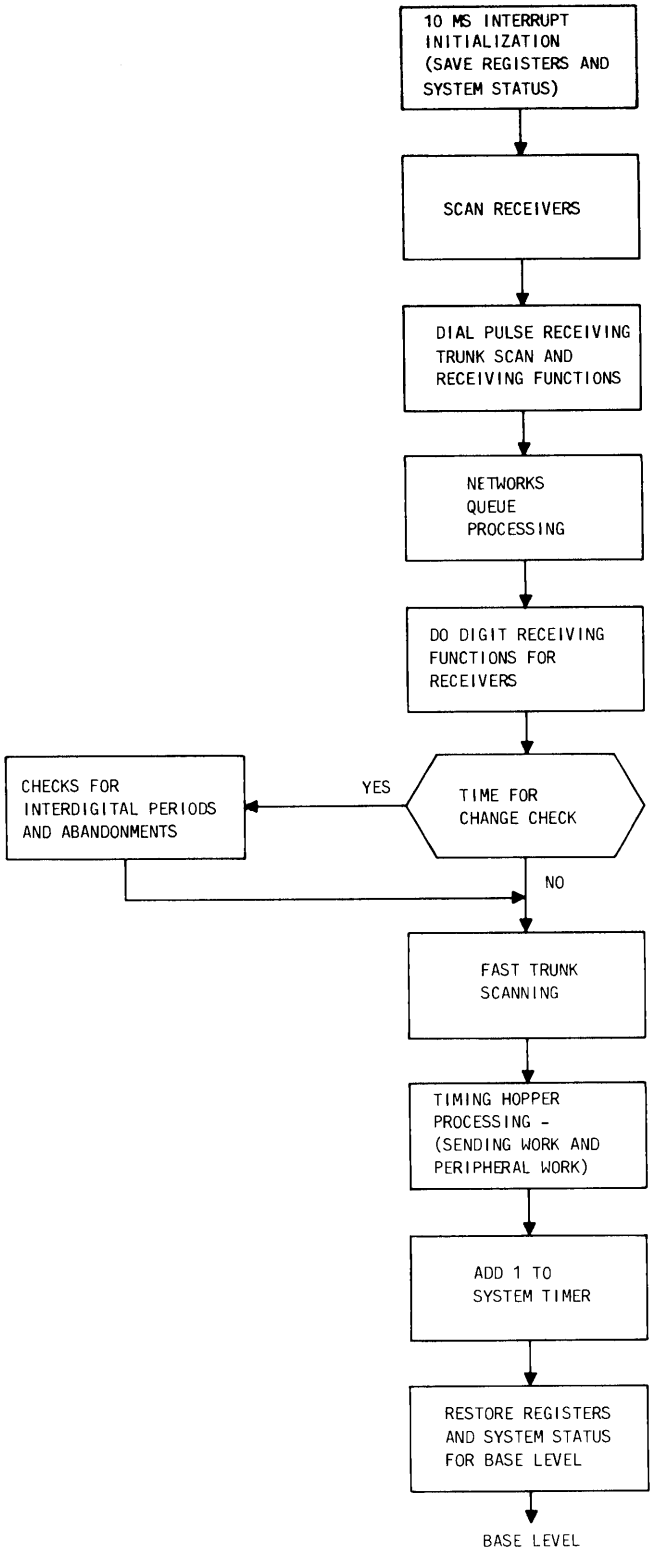


Fig. 14—Timed Interrupt

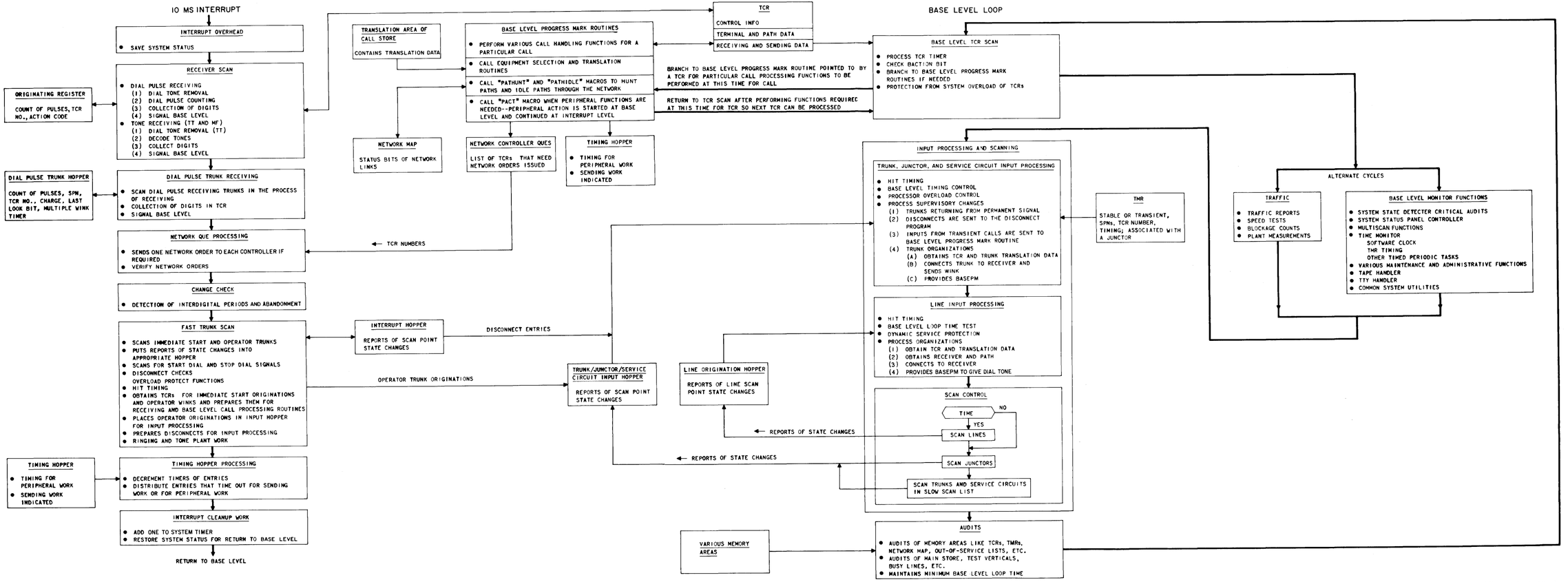


Fig. 15—Call Processing (System Viewpoint) With Associated Memory Areas (SO-2 Generic)

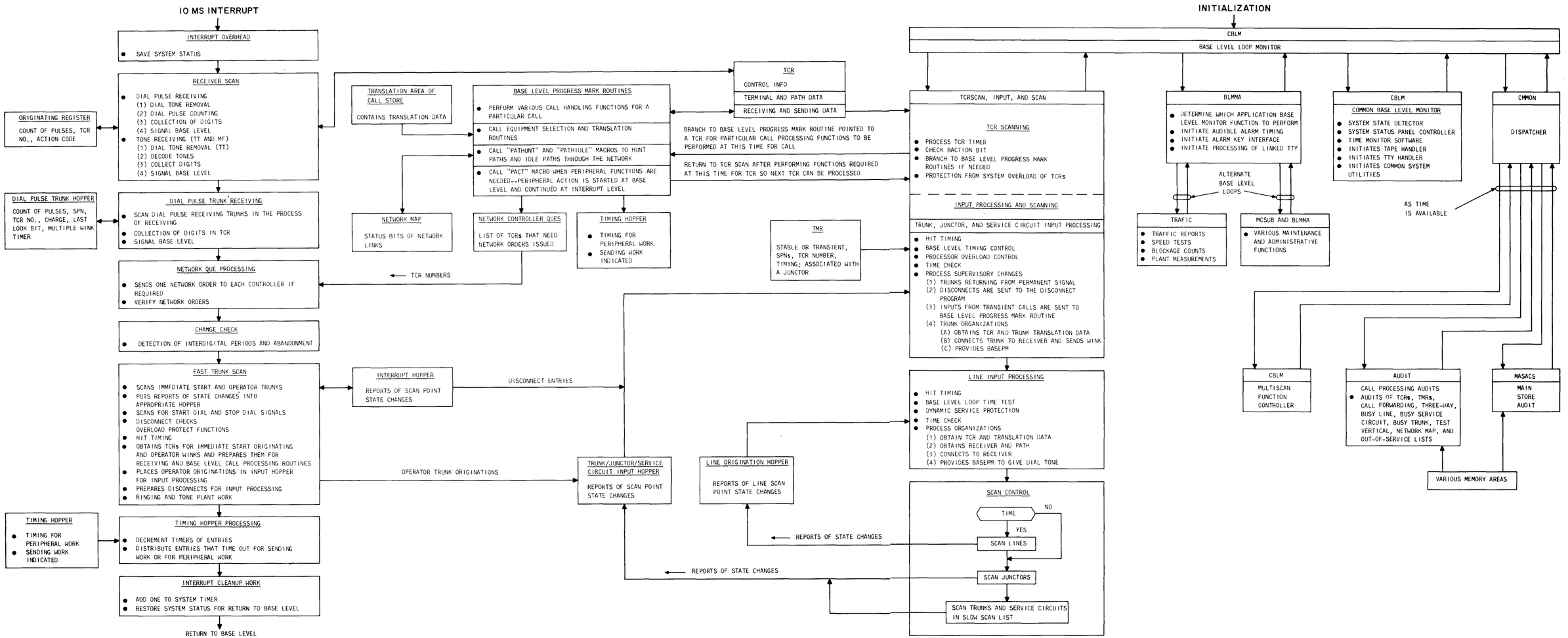


Fig. 16—Call Processing (System Viewpoint) With Associated Memory Areas (3E3 Generic)

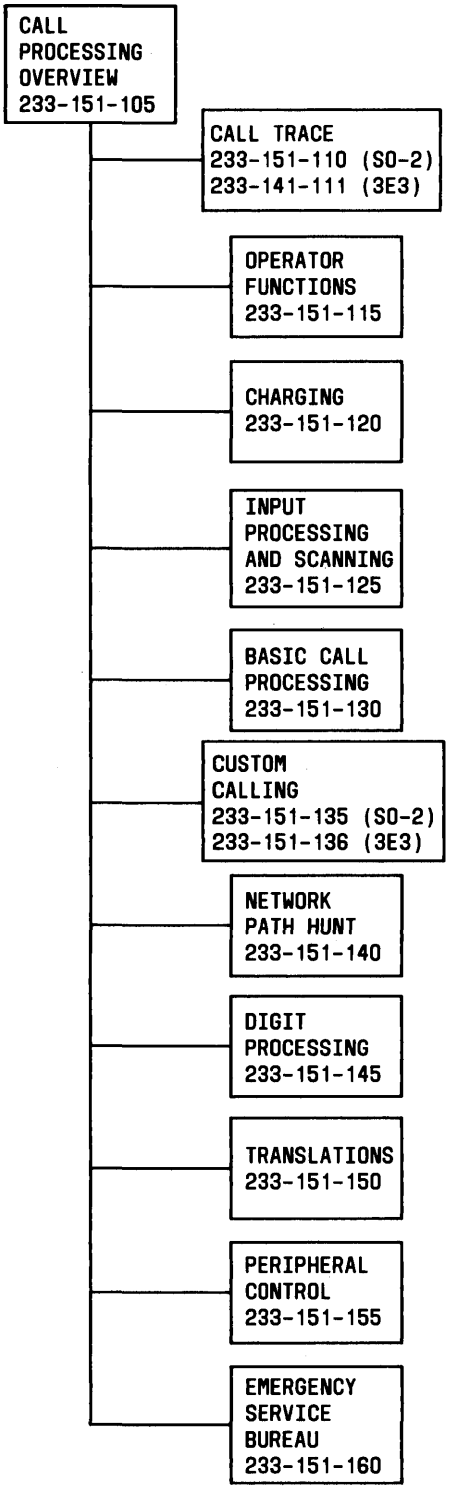


Fig. 17—Major Call Processing Software Areas

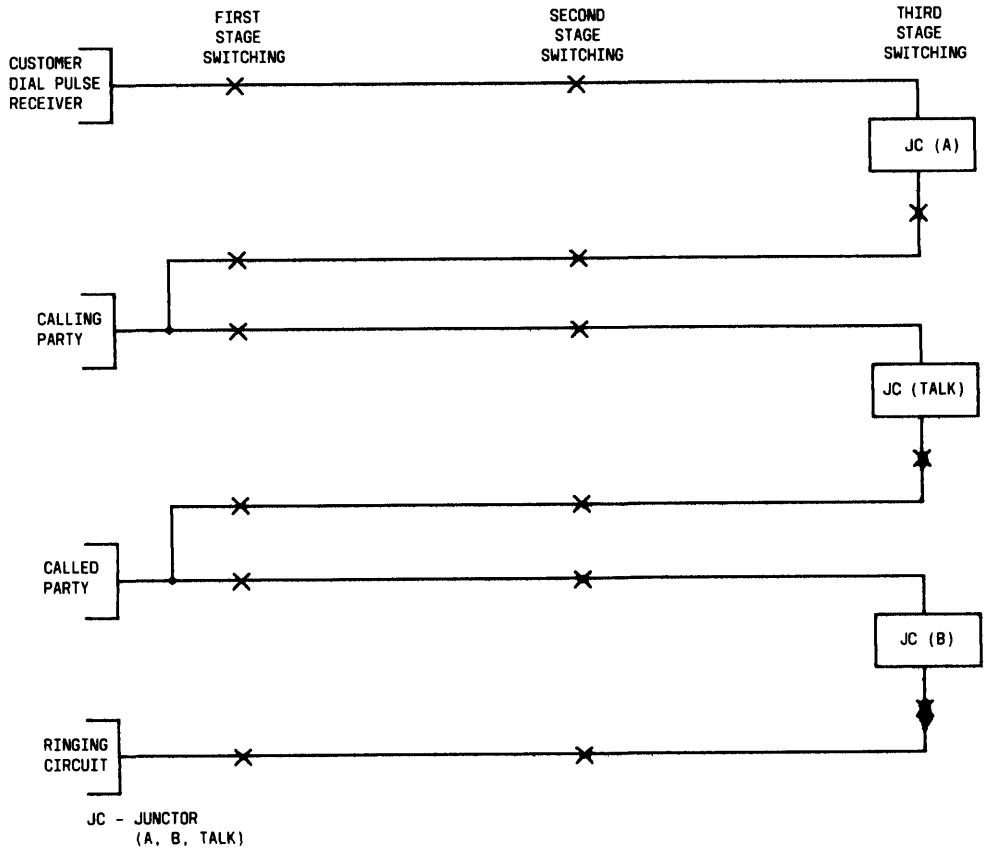


Fig. 18—Typical Intraoffice Call Connections

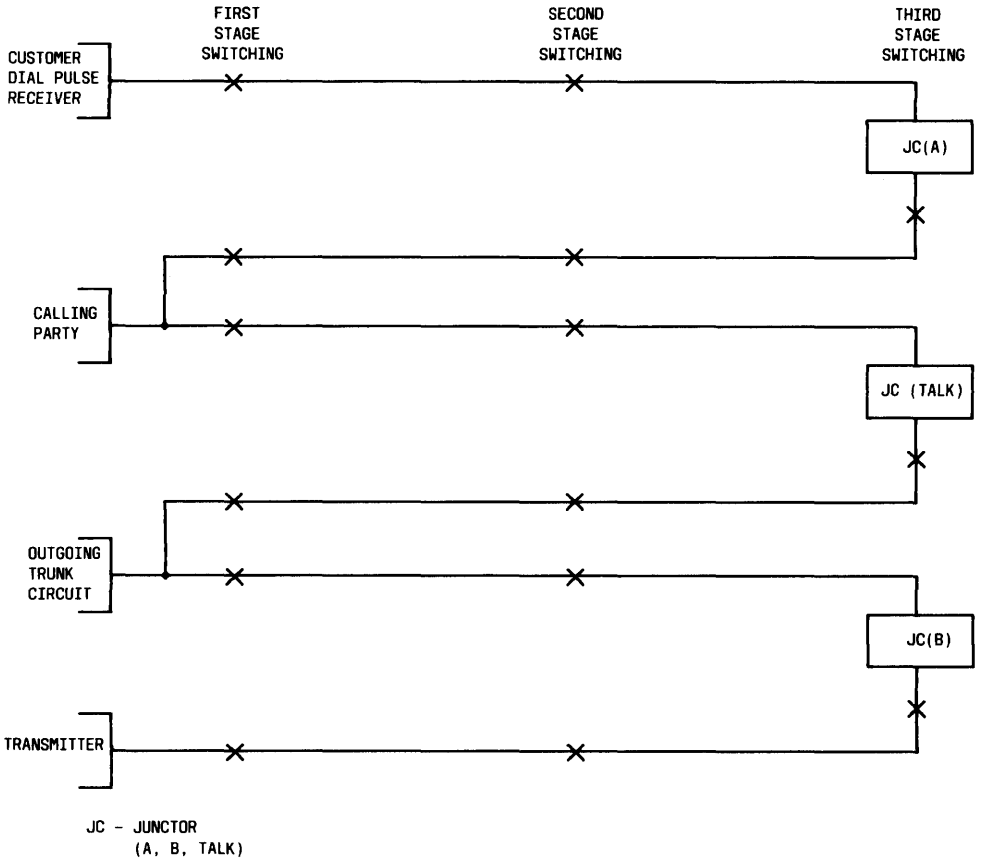


Fig. 19—Typical Interoffice Call Connections

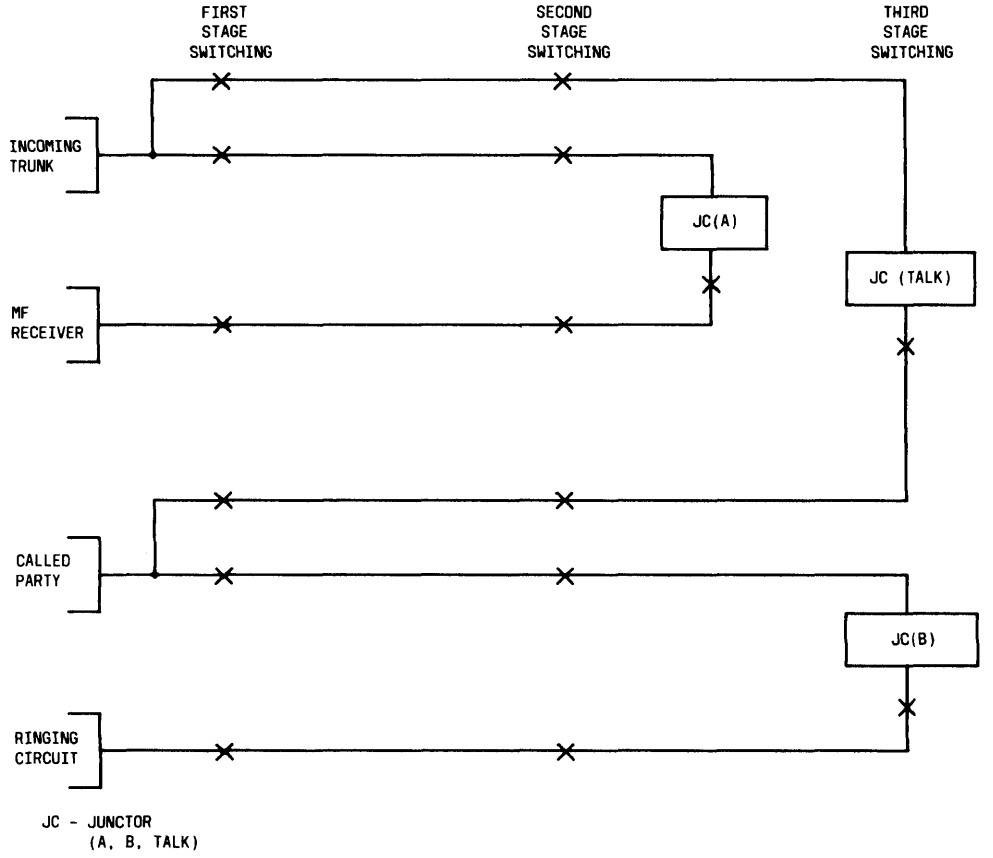


Fig. 20—MF Incoming Call Connections

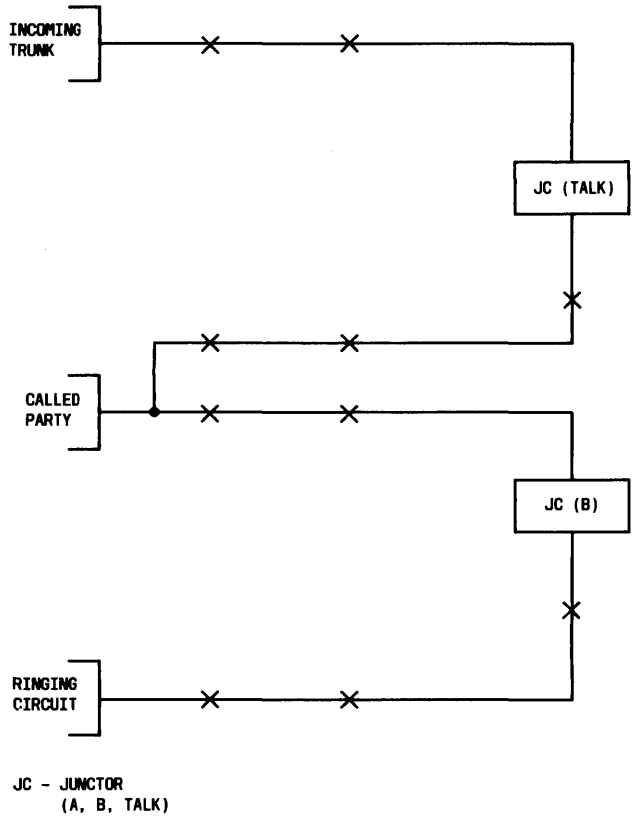
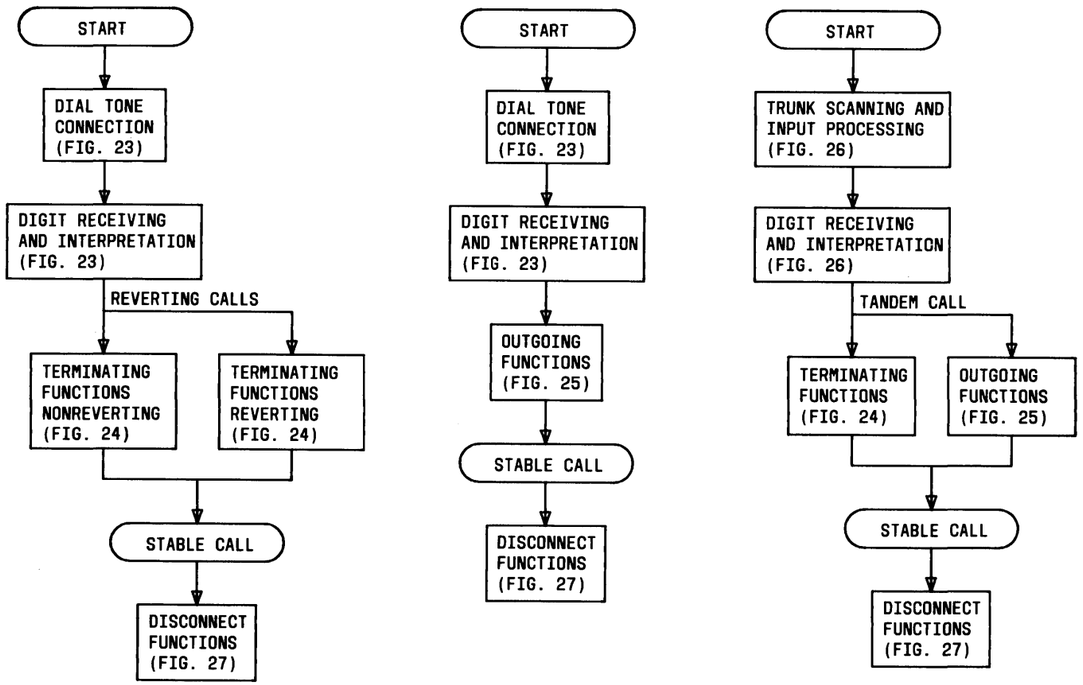


Fig. 21—Dial Pulse Incoming Call Connections



A. INTRAOFFICE CALL

B. CALL ORIGINATING THIS OFFICE TERMINATING IN ANOTHER OFFICE (INTEROFFICE)

C. INCOMING CALL FROM ANOTHER OFFICE

Fig. 22—Call Processing

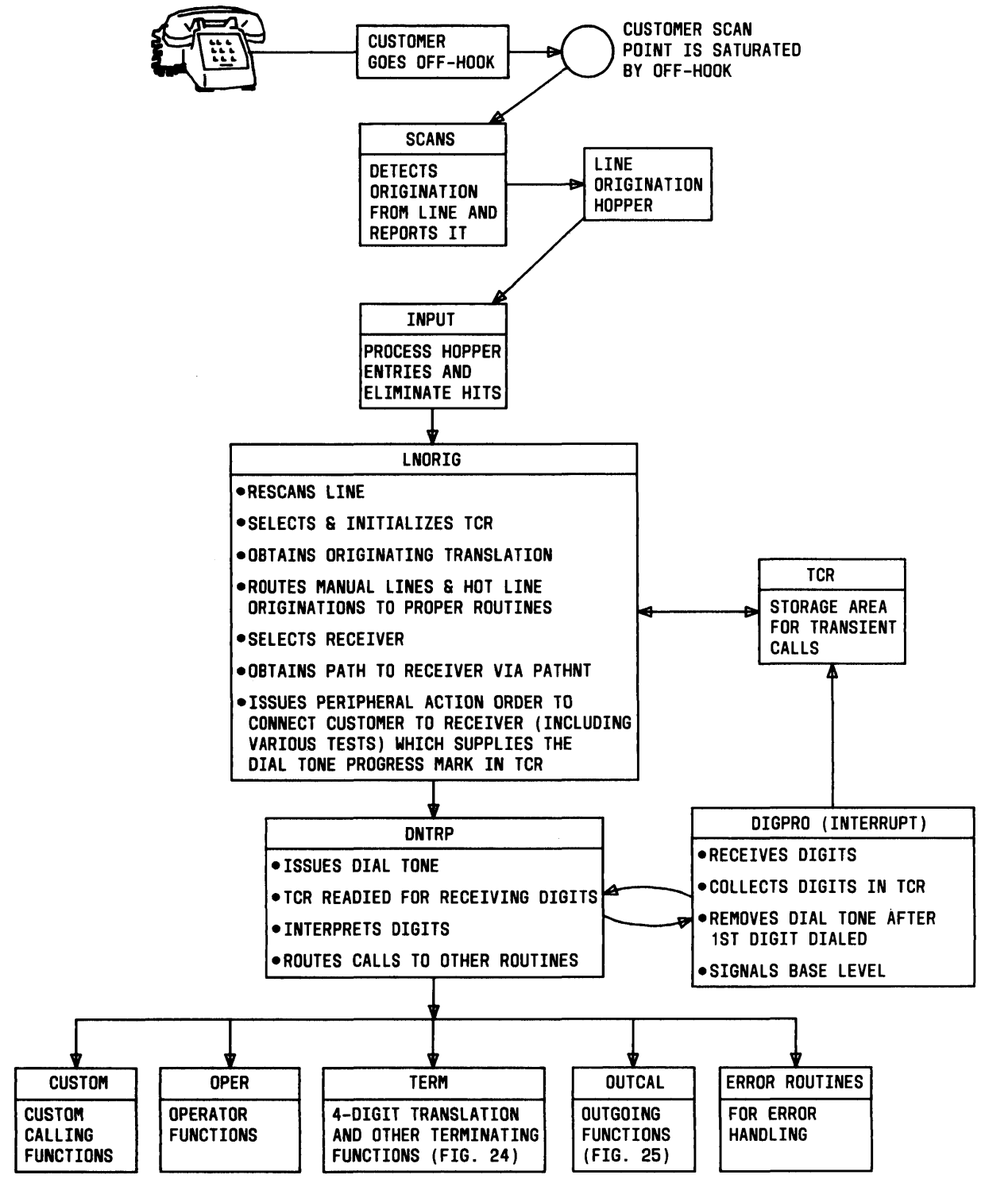


Fig. 23—Dial Tone Connection and Digit Processing for Intraoffice Calls and Outgoing Calls Originating in This Office

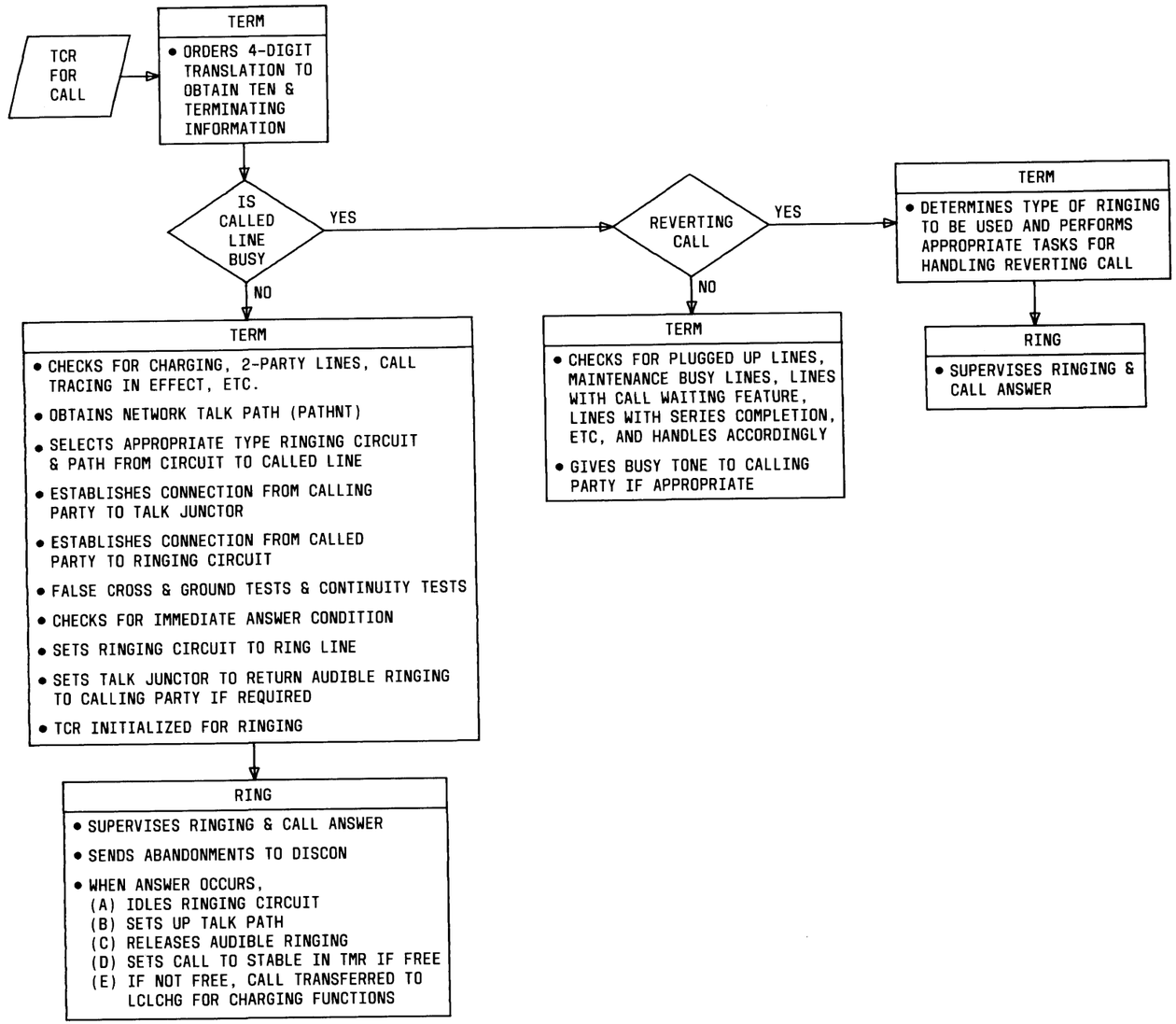


Fig. 24—Terminating Functions

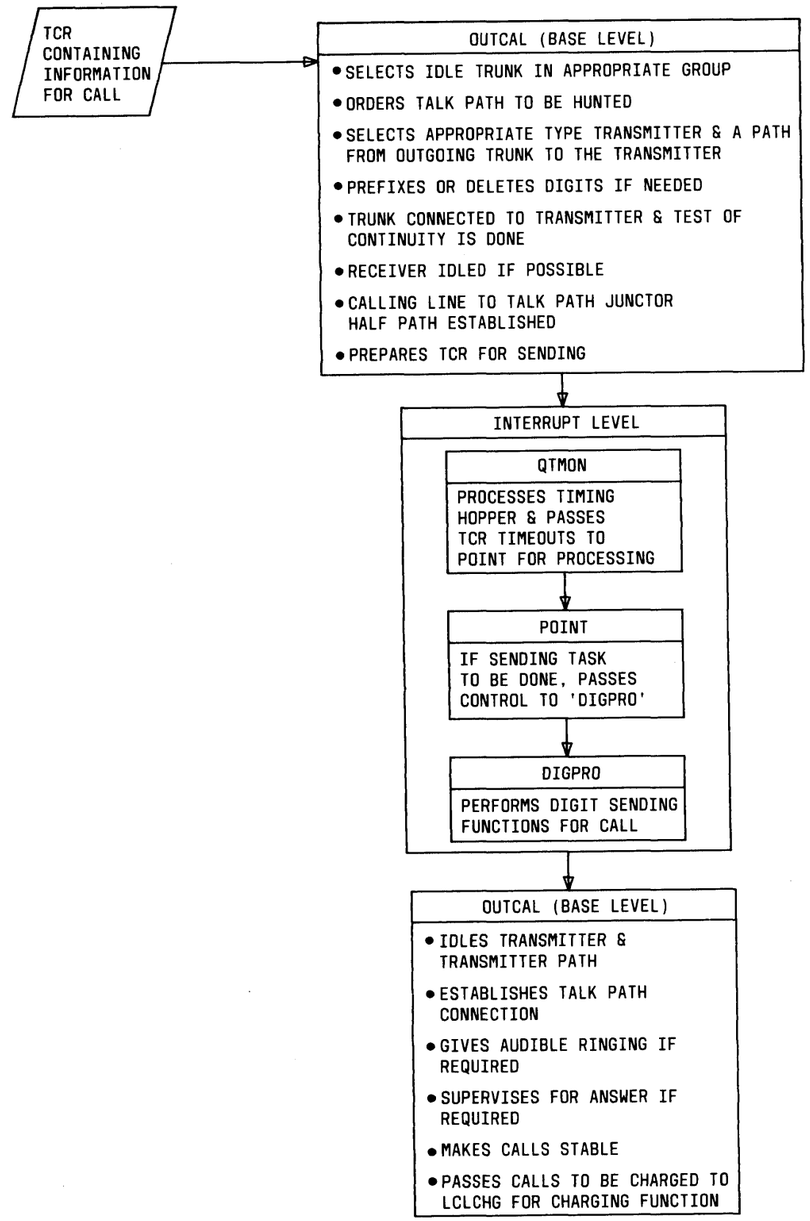


Fig. 25—Outgoing Functions

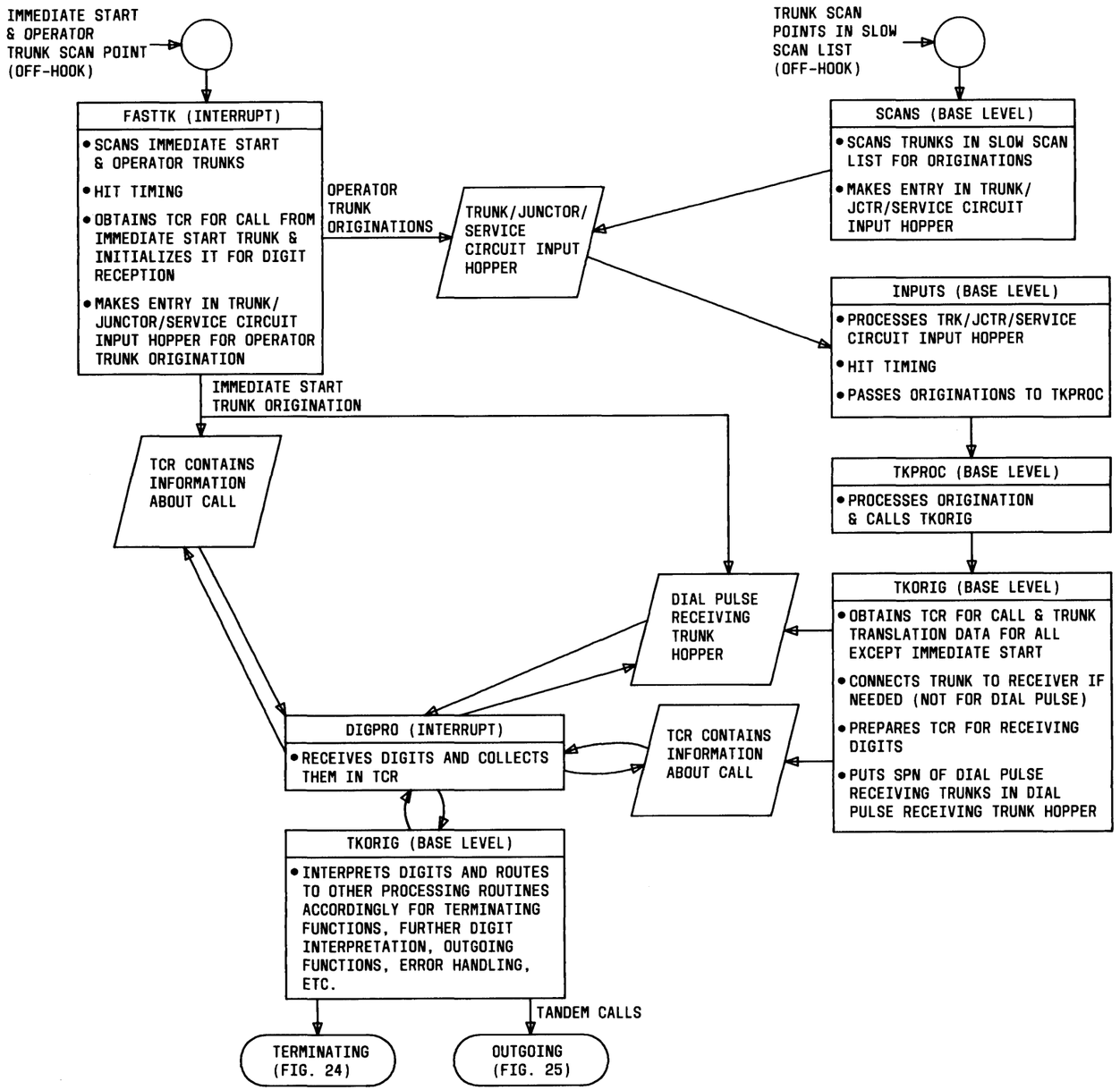


Fig. 26—Trunk Scanning and Input Processing for Originations From Incoming Trunks and Digit Processing

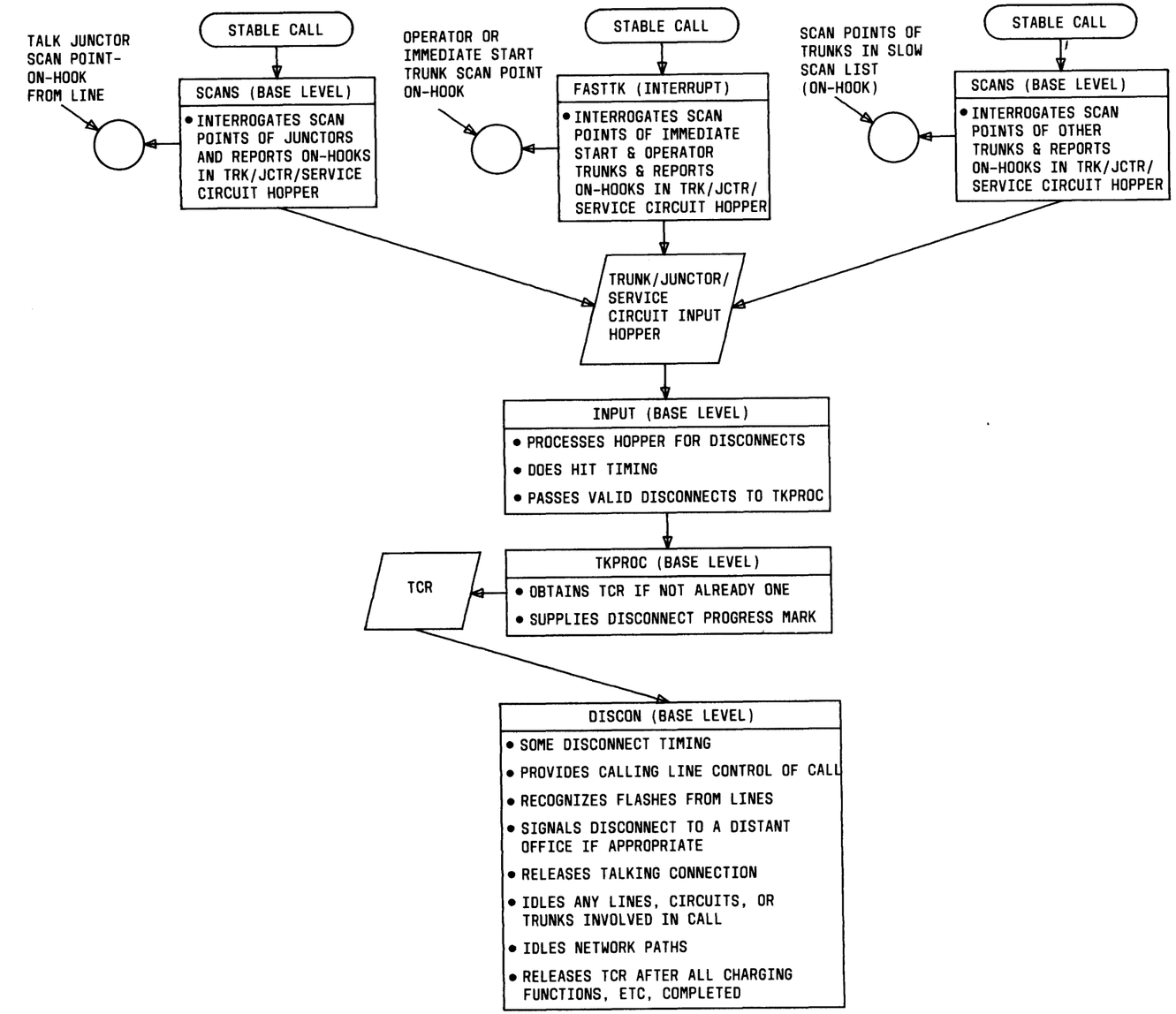


Fig. 27—Disconnect Functions

TABLE A

PROGRAM IDENTIFICATION

PROGRAM NAMES	PROGRAM TITLES	PROGRAM NUMBERS
AMA	Automatic Message Accounting Program	PR-3H187
ABM	AMA Buffer Management Program	PR-3H186
AUDITS	Audit Monitor, Audit Subroutines, and Some Audit Programs	PR-3H002
AUDNET	Network Audit Program	PR-3H003
BLMMA	Application Portion of the Base Level Monitor Program	PR-3H004
*CALLW8	Call Waiting Tone Application	PR-3H190
CBLM	Common Base Level Monitor	PR-1C950
*CL4WRD	Call Forwarding Activation and Initiation	PR-3H189
COIN	Coin Clean-Up Routine	PR-3H150
CTRACN	Call Trace Program (Nonresident in SO-2, Resident in 3E3)	PR-3H079
CTRACR	Resident Portion of the Call Trace Program	PR-3H005
CUSTER	Customer Error Program	PR-3H151
**CUSTOM	Custom Calling Programs	PR-3H152
*CW8STB	Stable Call Waiting Monitor	PR-3H191
DATADM	Data Administration Program	PR-3H262
*DCSUB1	Disconnect Subroutines — Part 1	PR-3H192
*DCSUB2	Disconnect Subroutines — Part 2	PR-3H193
DIGPRO	10-Millisecond Interrupt Program — Digit Receiving and Sending	PR-3H153
DISCON	Disconnect Progress Marks	PR-3H154
*DLYTIM	Charge Delay Timing Routine	PR-3H195
DNTRP	Digit Interpretation Progress Marks	PR-3H155
EMERG	911 Service Program	PR-3H156
EQPSEL	Equipment Selection Subroutines	PR-3H157
FALTCR	Call Failure Program	PR-3H158
FASTTK	Fast Trunk Scanning Program	PR-3H159
INPUT	Input Monitor Program	PR-3H160
LCLCHG	Local Charging-Coin and Message Register	PR-3H161
LNORIG	Line Originating Program	PR-3H162
NTCONN	No-Test Trace Connection Program	PR-3H163
*NTSUBS	No Test Connection Subroutines	PR-3H196
OPER	Operator Calls Program	PR-3H164
OUTCALL	Outgoing Call Program	PR-3H165
PATHNT	Network Patch Hunt, Busy and Idle	PR-3H166
PCAT	Catalog of Peripheral Control Sequences	PR-3H167
POINT	Peripheral Order Interpreter	PR-3H168
POPS	Peripheral Operation Subroutines	PR-3H169
PSUBS	Peripheral Work Subroutine	PR-3H170
QTMON	Network Queue and Timing Hopper Monitor	PR-3H171
RING	Ring and Answer-Completion of Intraoffice Calls	PR-3H172
SCANS	Base Level Scanning Program	PR-3H173
*SPDCAL	Speed Calling Activation and Initiation	PR-3H188
STATIM	Stable Timing of TCRs and TMRs	PR-3H183
*TCRDSC	Transient Call Record Disconnect Routine	PR-3H194
TCRSCN	Base Level TCR Scan	PR-3H174
TERM	Completion of Incoming and Intraoffice Calls	PR-3H175
TKORIG	Trunk Origination Program	PR-3H176
TKPROC	Trunk/Junctor/Service Circuit Input Processing	PR-3H177
TRAFIC	Traffic and Plant Measurements	PR-3H008
TREWAY	Conference Calling Program	PR-3H184
TRUNKS	Initialize Status of Incoming Trunks	PR-3H185
TVADM	Test Vertical Status Administration	PR-3H178
XSL3DG	Three-Digit Translation Program	PR-3H181
XSL4DG	Four-Digit Translation Program	PR-3H182
XSLSPN	Scan Point Number Translation	PR-3H179
XSLSUB	Basic Translation Subroutines	PR-3H180

* 3E3 Generic Only
** SO-2 Generic Only