VOICE STORAGE SYSTEM—INTERFACE SOFTWARE
SOFTWARE SUBSYSTEM DESCRIPTION
2-WIRE NO. 1/1A ELECTRONIC SWITCHING SYSTEM

CONTENTS PAGE

CONTENTS PAGE

CONTENTS PAGE

1. GENERAL

INTRODUCTION

1.01 The Voice Storage System (VSS) interface software provides the necessary interface between the No. 1/1A Electronic Switching System (ESS) and VSS. The VSS is a stand-alone system which interconnects with as many as 32 different central offices (COs) depending on capacity and service loads (Fig. 1).

1.02 When this section is reissued, the reason for reissue will be given in this paragraph.

1.03 Part 5 of this section provides a defined list of the abbreviations and acronyms as used herein.

PURPOSE OF THE VSS INTERFACE SOFTWARE

1.04 VSS interface software enables an ESS central office to interconnect with a VSS auxiliary subsystem and thereby offers VSS features to its customers. The primary functions performed are:

(a) Preliminary screening of service requests, signaling interface for the No. 1/1A ESS and VSS.

(b) Fundamental validity and consistency checks on the customer's identifying directory number (IDN) and his originating and/or terminating major class (OMAJ/TMAJ)

(c) Directory number (DN) and line equipment number (LEN) translations.

SCOPE OF SECTION

1.05 This section provides an introduction to the VSS interface software resident in a No. 1/1A ESS. Information unique to a specific system application is so noted.

1.06 This section is based on the 1E6 (No. 1 ESS) and 1AE6 (No. 1A ESS) versions of the generic program.

2. PIDENTS DESCRIBED IN THIS SECTION

2.01 Table A provides a PIDENT to program number cross reference for the VSS PIDENTs described in this document. Table A is not an exhaustive list of all PIDENTs containing VSS related software; rather, only those which constitute the core of the VSS interface software are listed.

2.02 A brief introduction to each of these VSS PIDENTs is given below. Detailed information is provided in subsequent parts of this document and in the program listings.

(a) The VSS data message handler program, PIDENT VSMH, deals with data messages and call messages sent to the ESS from the VSS. This PIDENT also contains routines to outpulse data messages to the VSS.

(b) The VSS local service controller program, PIDENT VSLS, processes all customer VSS service requests that do not require access to the VSS office.

(c) The VSS access controller program, PIDENT VSCA, processes all customer requests for

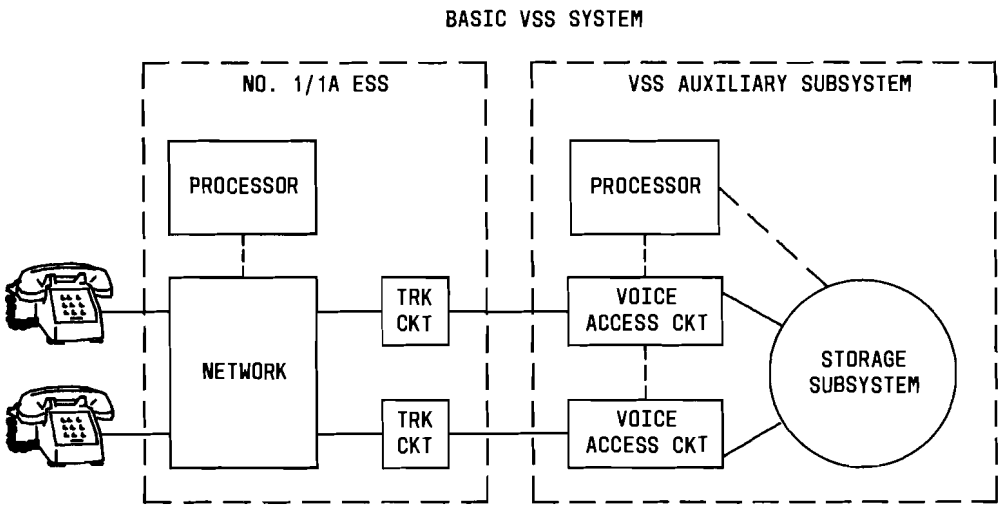


Fig. 1—VSS Block Diagram

TABLE A

VSS PIDENTS

PIDENT	TITLE	NO. 1 PR_	NO. 1A PR_
VSMH	VSS Data Message Handlers	1A466	6A466
VSLS	VSS Local Service Controller	1A467	6A467
VSCA	VSS Customer Access Controller	1A468	6A468
SAVS	VSS Audit Routines	1A469	6A469
TRVS	VSS Translation Routine	1A470	6A470
TNVS	ESS-VSS Trunk Diagnostic Program	1A481	6A481
RCVS	RC VSS Message Sender	1A615	6A615
SACO	Customer Originated Recent Change (CORC) Audits	1A637	6A637

VSS services that require access to the VSS office. It performs necessary screening, obtains the customer identifying information needed by the 1A VSS, routes the call to the appropriate VSS office, and passes the call to the normal isolation talking monitor (ITM) as appropriate.

(d) The VSS audit routines program, PIDENT SAVS, consists of the intrasystem audit routines for data reception buffers and data transmission buffers.

(e) The VSS translation routine program, PIDENT TRVS, forms the VSS data base and contains global translation routines, Advance Calling (AC) translation routines, and VSS screening routines.

(f) The ESS-VSS trunk diagnostic program, PIDENT TNVS, consists of the complete diagnostic for a 2-port VSS trunk circuit.

(g) The recent change (RC) VSS message sender, PIDENT RCVS, is the recent change message PIDENT.

(h) The customer originated recent change (CORC) audits program, PIDENT SACO, contains the CORC linkage audit routine together with the support routines.

3. FUNCTIONAL DESCRIPTION

SIGNAL DISPATCHER

3.01 The function of the signal dispatcher is to detect and dispatch signals to other abstract machines involved in call processing. The "abstract machines" are special purpose routines in that they process only certain portions of a call. Relative to VSS, the signal dispatcher detects line and trunk signals of interest to VSS routines and distributes them appropriately.

3.02 The signals of interest to the access controller are requests for VSS services that require access to the VSS.

3.03 The signals of interest to the local service controller are requests for VSS services that are provided directly by the ESS (ie, monitor/cut-through). The specific signals are a special service code and a subsequent switchhook flash.

3.04 The signals of interest to the intercept controller are "requests" for intercept. There are four events that generate such signals. These are:

(1) The recognition of a directory number of a customer with an immediate intercept service active.

(2) The detection of a busy condition for a customer with a busy intercept active and no call waiting feature.

(3) A time-out occurring 10 seconds after applying the first call waiting tone to the line of a customer with a busy intercept service active, when the customer has not answered.

(4) A time-out occurring a specified number of seconds after ringing has been applied to the line of a customer with a don't answer intercept service active, when the customer has not answered.

3.05 The signals of interest to the normal talking monitor (NTM) are disconnects and flashes from either party involved in the call being controlled. Its function is to pass all signals but disconnect onto existing programs. For disconnect signals, its function is to perform standard disconnect functions and to perform the special VSS disconnect functions.

3.06 The signals of interest to the ITM are disconnect, flash, call waiting attempts, and similar service requests that will result in switching the monitored call to a 3-port trunk circuit. The function of this machine is to deny such attempts to switch to a 3-port trunk, and to perform the VSS disconnect actions of releasing the VSS trunk and decrementing the customer's simultaneous VSS access count.

ACCESS CONTROLLER

3.07 In concept, the access controller, PIDENT VSCA, gets control from the signal dispatcher. VSCA is entered from either ORDL or CXOR after a VSS access code is recognized by either TRPACT (ORDL) or TRPAE (CXOR). The entry is via the subsubtype table. The subsubtypes for both centrex and noncentrex are the same.

3.08 There are two forms of service codes: VSS subtype = 26 and VSS subsubtype = 1, 2, 9.

They are special service codes (having the form *XX or 11XX) and remote access DNs assigned to the VSS office. A special service code can be used to access specific services associated with the line from which the code is dialed. A local service can be used to access to a VSS service from a DN which is or will be recorded by the VSS as having the service. Note that this DN must be serviced by an ESS directly connected to a VSS.

3.09 For each VSS special service code, there is an associated subsubtype code that identifies the particular service requested. The subsubtype is returned by the prefix access code translator (PACT) to PIDENT ORDL. ORDL then passes control to the access controller where the subtype given by PACT is used as an index into the subtype transfer table to get to the appropriate routine in PIDENT VSCA.

3.10 The subtypes that require full screening are those involving activations. Once the IDN is know, the IDN and the subtype are passed to an NXX translator. There are two returns from this translation: success and failure. On failure returns there is no route index (RI) for this subtype in the calling NXX, and the call is routed to reorder tone. On success an RI and an NXX screening code are returned.

3.11 Next the subtype, IDN, and the line equipment number primary translation word (LEN PTW) (taken from the originating register) are passed to a translations routine for screening by originating and terminating major class. There are two returns from this routine: access denied and access permitted. If access is denied, the call is routed to reorder tone. If access is permitted, a screening code and an RI are returned.

3.12 The NXX screening code is combined with the OMAJ/TMAJ screening code to obtain a final screening code. The final screening code has one of the values shown in Table B. This code is transmitted to the VSS; it is not used by ESS. The VSS OMAJ/TMAJ screening translation determines whether to allow or deny use of VSS services on the basis of a customer originating and/or terminating major class.

3.13 Next, feature dependent screening is performed to ensure proper feature interactions. In the first issue, the only such screening is as follows:

- Deny Call Answering (CA) and Announcement Service (AS) activation to all terminals in a multiline hunt group except terminal 1

TABLE B

VSS SCREENING CODES

CODE	MEANING
SC0	Unrestricted
SC1	Deny Casual Use
SC2	COBS Requested
SC3	COBS + Deny Casual

- Deny Advance Calling (AC) to hotel/motel lines.

The final check to be made is whether or not there is a conflicting service active. The IDN and RI are passed to VSSCDN, a screening routine provided by the data base manager. There are two returns from this routine: permit access or deny access.

3.14 If access is denied, a conflicting service is active and the call is routed to reorder tone. If access is permitted, the subtype, RI, IDN, billing directory number (BDN), and screening code are passed to a call message sender routine that formats the VSS message. The outpulsing programs are then called, as in the case of remote access.

3.15 When a customer remotely uses a VSS service, the No. 1 ESS cannot perform any initial screening. Partial screening can be provided for local access in an attempt to reduce the traffic between the No. 1 ESS and the No. 1A VSS. This partial screening by the ESS cannot be performed on remote calls. For simplicity, all VSS accesses, either local or remote, will be treated uniformly employing the ESS/VSS data base as a read only memory unless a message from the VSS requests an update.

3.16 Whenever a customer's current status is such that it conflicts with any of the VSS features and this cannot be partially screened by the ESS, then the ESS will send a message to the No. 1A VSS indicating the type of VSS service to be denied. When the customer's status changes such that the VSS service denied no longer conflicts with the customer's status, the ESS will communicate this to the VSS. Using this message scheme, the VSS need not be concerned with feature interaction conflicts.

MESSAGE HANDLING

3.17 The call message sender and data message sender, PIDENT VSMH, are processes which are used by programs in the VSS feature for No. 1/1A ESS to send messages to the VSS.

3.18 There are two types of signaling between ESS and VSS: call-related signals and interprocessor data messages. Call-related signals are signals sent prior to the connection of a talking path between VSS and the customer. Interprocessor data messages are simply used to communicate data between the ESS and VSS, and do not result in the connection of a talking path between a customer and the VSS.

3.19 The call-related signals closely follow existing multifrequency (MF) signaling protocol. The difference between call-related signaling between ESS and VSS and the existing MF protocol is in the information digits which are sent. For ESS/VSS signaling, each message begins with a 2-digit prefix. This prefix indicates the type of call being initiated. Examples of the possible calls are intercepts, local access calls, remote access calls, and AC deliveries.

3.20 Following the 2-digit prefix, there are a series of digits identifying a directory number. These address digits follow the existing MF protocol. For most call types, either a 4-, 5-, or 7-digit DN is sent. As is the case for the existing MF protocol, the exact number of digits is determined on a trunk group basis. In the case of AC delivery, the digits will be transmitted by the VSS exactly as dialed by the customer.

3.21 MF transmission of interprocessor data messages will follow an extension of the existing MF protocol. The extensions are that a response will be required from the receiving end for every message sent, and a special start digit will be sent at the end of one message to indicate that another message will follow. Required responses from the receiving end are a wink, indicating successful action on the message received by the receiving program, and a steady off-hook indicating unsuccessful action. The off-hook persists until the end which sent the message initiates disconnect. Lack of a response within 4 to 8 seconds will indicate a transmission failure. An example of a data message is an activation of intercept sent from VSS. This message is acknowledged by a wink when the activation program within the ESS finds that it can activate intercept for the customer. If the intercept activation program is unable to activate intercept, then the ESS sends a continuous off-hook to the VSS until the VSS disconnects the call.

3.22 If multiple data messages are to be sent for a single seizure on an MF trunk, the start digit at the end of the first message is start prime (STP). The wink acknowledging the message initiates the transmission of the next message. This chaining of messages continues until a message is sent which ends in a standard start digit (ST). This message must be acknowledged but no more messages are sent. If a message is not acknowledged, message transmission resumes on another trunk with the retransmission of the unacknowledged message.

3.23 The format of the information sent in a data message follows that of the information digits in a call-related message. The message begins with a prefix indicating the type of message being sent. A series of digits identifying a DN may follow the prefix. Following the DN are a series of octal digits which represent the encoding of 16-bit words. The octal digits are read out from left to right with the leftmost bit encoded as a single digit. A maximum of five 16-bit words may follow the DN. If more than five words are required for the message, it is segmented into separate physical messages (Fig. 2 and 3).

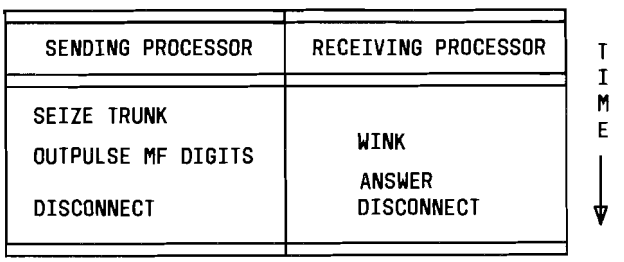


Fig. 2—Signaling Protocol—Call Messages

3.24 The first physical message follows the above format. Each additional physical message necessary to send the logical message has a prefix identifying it as a continuation of the current segmented message. The DN portion of the header is omitted for the continuation messages. Each such message contains the encoding of a maximum of

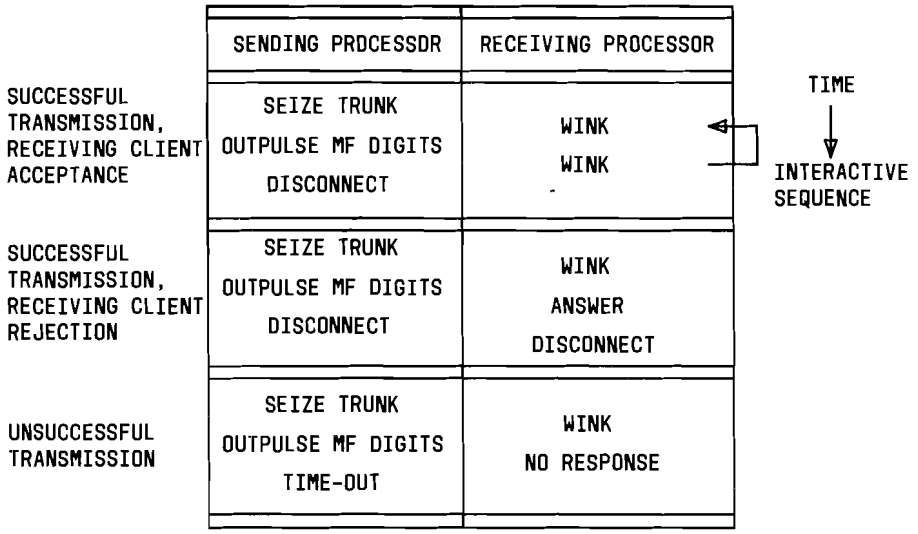


Fig. 3—Signaling Protocol—Data Messages

seven 16-bit words. The final continuation message has a prefix identifying it as such.

A. Call Message Sender Interface

3.25 The interface for the call message sender requires the calling program to fill the incoming digit slots of the call register with the DN which is to be outpulsed. It must also store the RI of the trunk group from which the trunk is to be chosen in the register. All clients except remote access clients must store a type code in the incoming register and set the VSS bit. When the billing DN is sent, it is stored in binary form in the register. A single RI will be used with a special bit pattern in the RI expansion. The pattern will indicate that the prefix to be sent before the DN is to be determined from the data stored in the incoming or call register.

3.26 In the case of intercepts and local accesses, the type code which determines the prefix is recorded in the call register. In the case of remote access, the directory number stored in the digit slots of the register will be retranslated to determine the type code which will then determine the prefix. A special routine is provided to store the type code in the register for intercepts and local accesses.

3.27 In the case of an activation by a customer with a billing DN, the billing DN will be transmitted after the normal DN has been transmitted. The special type code allocated to this form of local activation will trigger the reading of the billing DN from its normal location in the register and its conversion into a 7-digit number to be outpulsed after the normal DN has been outpulsed.

B. Data Message Sender Interface

3.28 The calling sequence for the data message sender involves passing several independent parameters. These are: (1) the directory number in binary, (2) the type code, (3) the route index from which the trunk is to be chosen, (4) the address of the block of 16-bit words containing the message, and (5) length in words of this block.

3.29 The data message sender will always return to the program which called it before taking a real-time break. The two possible immediate returns are one indicating transmission has been initiated and the second indicating that the data message sender was unable to obtain a buffer in which to store the information to be transmitted.

3.30 The data message sender will also make a return to the calling program after it has completed transmission. There are three possible delayed returns. One indicates that a positive acknowledgment has been received from the distant end. This positive acknowledgment indicates that the process which was to act upon a message was able to perform the necessary tasks.

3.31 A second possible delayed return is one indicating that a negative acknowledgment was

received from the distant end. The negative acknowledgment indicates that the process which was to act upon the message was unable to perform its actions.

3.32 A third possible return from the data message sender is one indicating that no acknowledgment was received from the distant end even after one retry. The no acknowledgment condition is recognized by a time-out. It indicates that some form of transmission failure occurred.

C. Message Format

3.33 The basic message format will consist of 16-bit words. Each physical message will consist of three parts—header or control information, the data field, and a trailer. The header will consist of the message type code and optionally the identifying customer DN. This DN will be encoded on a trunk group basis using the standard prefix and deletion scheme. The data field will contain any other information pertinent to a given message. The data will be encoded three bits at a time and sent in Bell System binary coded decimal (BCD). High order bits will be sent first and no partial words will be transmitted. This implies that six digits will be needed to encode one word and that the high order digit will either be a zero or a one. There will be a maximum of five words in the data field when a DN is included in the header. A maximum of seven words may be sent if the DN is omitted. The message handler will only analyze the control information. It will determine who the receiving client is and whether or not an identifying DN is present. If there is, it will decode the DN digits into the standard 17-bit form. The trailer is either a STP or ST depending on whether or not another physical message is going to follow.

AUDITS

3.34 The VSS feature requires a distributed data base between the No. 1/1A ESS and No. 1A VSS. Some of the information in each data base is redundant. Information in the No. 1A VSS will be considered to be correct; but the initial customer interface is with the ESS data base and must, therefore, rely on its integrity. The VSS will have duplicate copies of all VSS data backed up on disc storage. The VSS will also periodically audit its data using the duplicate copies as comparison tables. It is for these reasons that the VSS data is decidedly the correct data.

TRANSLATIONS

A. VSS PTW

3.35 The VSS PTW (primary translation word) is used to indicate that a customer has VSS service and that special action may be required. The VSS bit in the DNCL2 word indicates that the customer is on a monthly basis rather than usage sensitive. The recent change area contains information and links to CORC.

B. Detection of VSS

DN Routine

3.36 When trying to terminate to a DN, the basic directory number routine does an RC hunt, which retrieves a temporary RC on the DN tag if one exists. The abbreviated class code extracted from this recent change, or from a permanent recent change or a PTW from program store, is used to index the terminating abbreviated class code table to obtain a major class. The major class indicates the type of service the line has (eg, call forwarding variable, individual line, subscriber line overflow, 2-party, etc).

3.37 If VSS is indicated, a special routine is entered which sets the VSS bit in DN control word two and checks for the type of intercept service the customer has: (1) intercept immediately; (2) intercept on don't answer; or (3) intercept on busy.

3.38 The routine goes on to get the permanent PTW and continues processing using it. A check is made for inactive/suspended lines which receive intercept. If the DN is found to be idle, the special line bit is set for use during disconnect to check if any messages are currently stored. Then the type of intercept is checked again. If the customer has intercept on don't answer, the call forwarding don't answer (CFDA) bit is set in the output and the call continues through the idle leg. If the call is not answered within a specified number of rings, it will be intercepted by VSS.

3.39 If the DN is found to be busy, the intercept type is checked to see if it has intercept on busy. If it does, VSS intercepts the call; if not, a busy signal is given.

LEN Routine

3.40 Upon origination, a recent change hunt is performed, which finds a temporary RC if one

exists. An abbreviated class code is extracted from the RC or from program store (PS) if an RC does not exist for this line. Using the abbreviated class code found, an originating major class is retrieved from the originating abbreviated class code table. This major class, like the terminating major class, indicates the type of service the line has. If the type of service is VSS or VSS/Complaint Observing (COB), a special routine is entered. This routine sets the VSS bit and the stuttered dial tone bit, if it applies in the LEN control word, and adjusts the return for a regular exit back to the client program.

3.41 Upon disconnect, the special line bit initiates a series of checks to determine if it is necessary to give the customer ringback.

C. VSS Access

Activation

3.42 To activate service, the customer dials an activation code. After successful screening and various checks, the translation routine TRACDN in PIDENT TRBL is called to activate the VSS PTW on the directory number. Certain temporary recent changes are allowed to coexist with VSS but are inactive while VSS is present. The TRACDN activation routine, therefore, checks other recent changes existing on this tag (the program store address for the DN PTW).

3.43 A permanent, deleted, or delayed RC is ignored. The only temporary recent change which is allowed to coexist on the DN tag with VSS at this time is subscriber line overflow (SLOV). If no temporary RC exists except SLOV, VSS will be activated. Otherwise, the request for VSS will be rejected. If the existing temporary recent change is VSS, the VSS PTW will be returned to the client program, indicating that the request was for a change and not an activation. Upon acceptance of the request, the abbreviated class code is added to the VSS PTW and inserted into the recent change buffer.

3.44 Upon successful completion of this routine, the routine TRACLN in PIDENT TRBL is called to activate the VSS PTW on the LEN. The TRACLN routine also checks for temporary recent changes on the LEN tag (the program store address of the LEN PTW).

Deactivation

3.45 A deactivation code is dialed by a customer who wishes to terminate his service. The routine TRDNVS in PIDENT TRBL is called to make sure the VSS service is active on the DN. This routine does an RC hunt, and upon finding a recent change further checks the entry (by means of status and abbreviated class code) to see if it is VSS. If VSS is active, the routine TRDADN in PIDENT TRBL is called. The TRDADN routine deactivates the VSS PTW by changing its status to deleted. Upon finding a VSS PTW, the routine TRDALN in PIDENT TRBL is called. The TRDALN routine first attempts to delete the VSS PTW, using status and an abbreviated class code of 12 (VSS alone) as criteria. If this attempt fails (ie, there is no RC of that description), the procedure is attempted again using an abbreviated class code of 13 (a combination of VSS and COB). If a temporary RC of this description is found, the VSS/COB PTW is replaced by a COB PTW.

MEMORY REQUIREMENTS

A. Call Store Requirements

3.46 Some of the VSS related data items must be accessed on every origination, termination, and disconnect in an office. These particular items need to be stored directly in the RC register. This register is not large enough to store all the necessary VSS information. Therefore, an index will be placed in each RC register linking it to another area in call store called the Customer Originated RC (CORC) auxiliary area.

3.47 The CORC area will be maintained in a phase-protected area of the No. 1/1A ESS call store. It will be partitioned into fixed size block areas. Each block area will be further partitioned into blocks of a fixed word length. All blocks in these areas will be of the same size, ie, occupy the same number of words (Fig. 4).

3.48 Memory management of the block area requires real-time considerations. The more general and flexible the management scheme, the more costly in terms of real time and space. The No. 1/1A ESS cannot afford much additional overhead in either; therefore, the management scheme for the CORC area is simple.

3.49 The management scheme is to assign each block in the fixed word size block area a type. Each block will be either reserved or available depending on whether it is currently in use. A VSS reserved block will contain customer intercept data. A

linked list of available space is kept by using the available block itself.

3.50 Each available block will contain an index which can be used to locate the next available block in the area. A linked list is constructed by placing an index back to the list head in the last available block. The list head is a fixed memory location in each block area which contains the index to the first available block (Fig. 5).

3.51 To handle the possibility of an empty list, each time the available list is accessed to retrieve another block, a check must be made to ensure the index in the list head is not an index to itself.

3.52 All primitive functions (eg, the routine TRGTBK, TRFRBK, and TRFIBK in PIDENT TRBL) must be done via the list head. TRGTBK is a primitive function provided to reserve an available block of memory. TRFRBK takes a reserved block of memory and puts it back on the available list. TRFIBK uses the block size and relative index to determine an absolute pointer to a block.

3.53 TRGTBK uses block size as input and returns an index on success. TRGTBK requires that the index in the list head be replaced by the index in the first available block. This block is reserved for use by the calling program and the second available block becomes the first available block on the list.

3.54 For the reverse operation, TRFRBK uses block size and an index as inputs. TRFRBK places the index in the list head in the block to be freed and places the index of the block to be freed in the list head. The block is now in the first position on the available linked list.

3.55 TRFIBK uses block size and index as parameters to calculate an absolute address of the

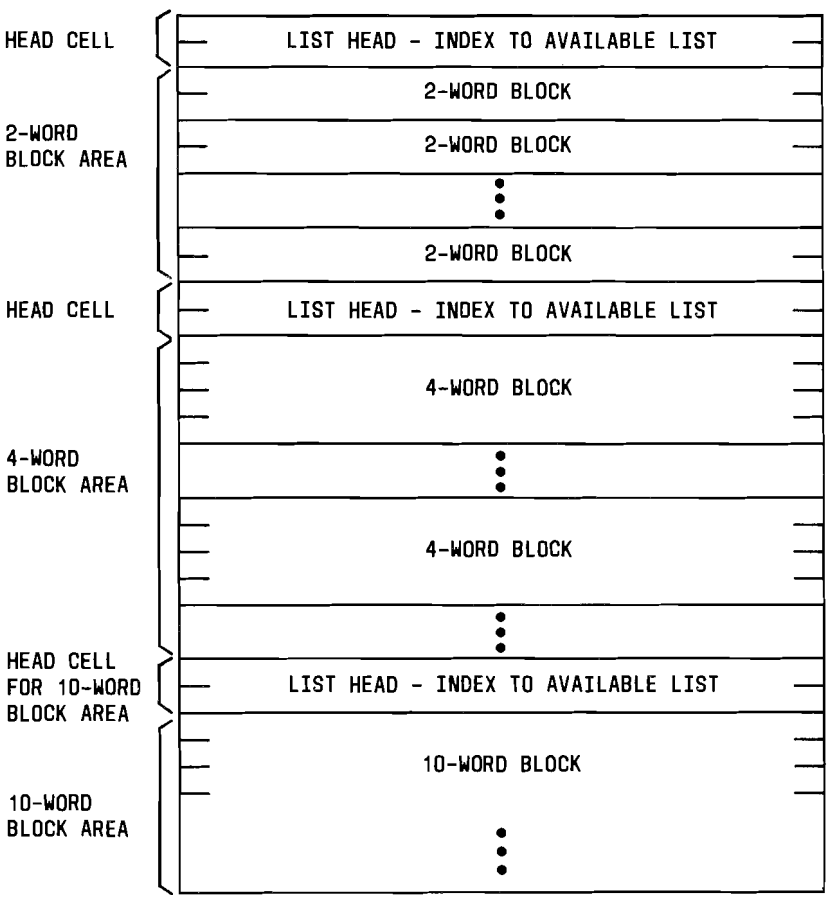


Fig. 4—CORC Area Layout

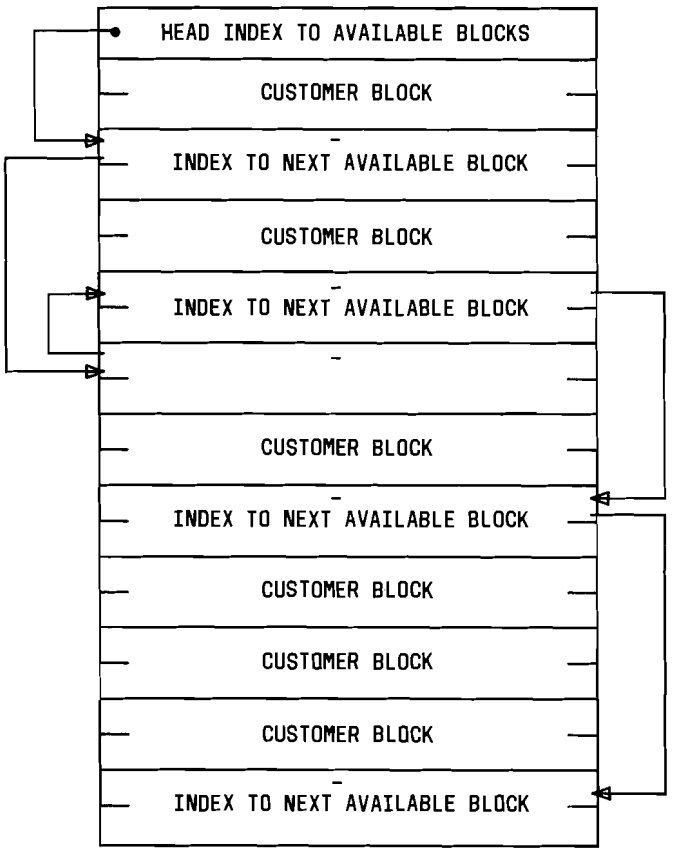


Fig. 5—CORC Block Area Layout

block. TRFIBK adds the CORC head address from the call store head table to the relative index of the block area associated with that size and then adds the index which specifies a particular block in that block size area. This total represents an absolute pointer to a particular block.

3.56 The available blocks will contain indexes rather than absolute pointers to enable the auxiliary area to be relocatable. All that is required in moving the auxiliary area is to physically move it into another area in memory and change the base address in the call store head table.

DN/LEN Recent Change Entry

3.57 Each RC entry will contain the following information to be used for the associating purposes. Refer to Fig. 6 for data layout.

Status Bits

3.58 The two status bits (STA) are used to indicate the status of the register as either permanent, temporary, delayed, or deleted. A deleted RC register is simply an idle register. All VSS RC registers will be of temporary status.

TAG

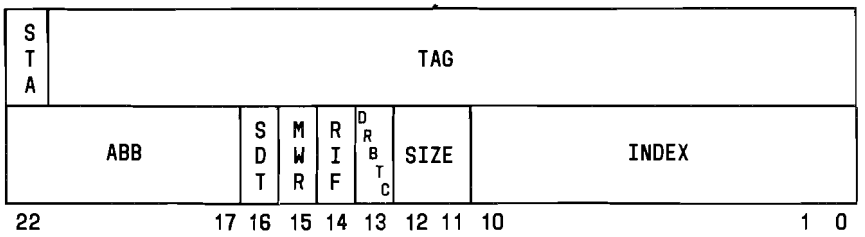
3.59 TAG is used by the RC hunt mechanism to locate a particular register.

Abbreviated Class Code

3.60 The abbreviated class code (ABB) is currently used by the No. 1/1A ESS RC mechanism to distinguish between the types of registers. VSS will introduce three ABBs: one for the DN entry (12), one for the LEN entry (12), and a third for the LEN RC register with the customer observing feature while VSS is active (13).

Message Waiting Tone Indicator

3.61 The stuttered dial tone bit (SDT) is used to indicate whether the VSS customer has a mes-



STA - STATUS OF A RECENT CHANGE REGISTER

TAG - ADDRESS OF PTW IN PROGRAM STORE

ABB - TRANSLATION ABBREVIATED CODE

SDT - STUTTERED DIAL TONE INDICATOR

MWR - MESSAGE WAITING RING INDICATOR

RIF - ROUTE INDEX FLAG

SIZE - CORC BLOCK SIZE

INDEX - INDEX INTO CORC BLOCK AREA

DRBTC - DON'T RING BACK THIS CALL

Fig. 6—DN/LEN RC Entry Layout

sage(s) waiting. It also is used to indicate a VSS customer has AS active.

Message Waiting Ring Indicator

3.62 This bit (MWR) is used to indicate whether the customer should receive ringback indicating messages waiting. Note that stuttered dial tone and ringback are independent options.

Don't Ring Back This Call

3.63 Don't ring back this call bit (DRBTC) on call answering (CA) message retrieval and deactivation prevents a misleading ringback (RB), setting don't ring back this call.

CORC Block Size

3.64 CORC block size bit (SIZE) indicates the size of the CORC block associated with the DN.

VSS Block Index

3.65 This item (INDEX) contains an index into the VSS CORC block area.

Customer Block

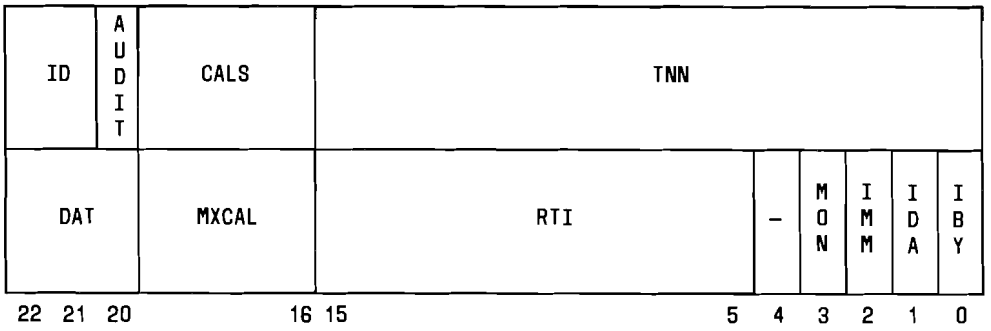
3.66 The VSS customer block is a type of reserved block in the 2-word block area in the CORC area. There will be at least one RC register which contains an index to this customer block. Each active customer will require a reserved VSS customer block. The VSS customer block will contain the following information to be used for the associating purposes. Refer to Fig. 7 for the specific data layout.

Identifier

3.67 The identifier (ID) will be used to distinguish a VSS customer block from other types of blocks that may use the 2-word block area in the CORC area.

Current Number of Intercepted Calls

3.68 The current number of intercepted calls (CALS) is used to limit the current number of simultaneous calls intercepted for a customer. CALS is a running count of the number of intercepted calls associated with a particular DN.



ID - BLOCK IDENTIFIER

AUDIT - AUDIT BIT

CALS - CURRENT NUMBER OF SIMULTANEOUS CALLS

TNN - TRUNK NETWORK NUMBER

DAT - DON'T ANSWER TIMING

MXCAL - MAXIMUM NUMBER OF SIMULTANEOUS CALLS ALLOWED

RTI - ROUTE INDEX OF INTERCEPT SYSTEM

MON - MONITOR/CUT-THROUGH INDICATOR

IMM - INTERCEPT IMMEDIATE INDICATOR

IDA - INTERCEPT ON DON'T ANSWER INDICATOR

IBY - INTERCEPT ON BUSY INDICATOR

Fig. 7—VSS Customer Block

Trunk Network Number

3.69 The trunk network number (TNN) is used to obtain the network appearance of the monitor port of the trunk currently intercepting the most recent entry in the system for monthly subscribers with the monitor option.

Audit

3.70 This bit (AUDIT) is used for auditing purposes to ensure consistency in the ESS data bases.

Don't Answer Timing

3.71 The don't answer timing (DAT) data item indicates the number of rings that a phone should ring before intercepting the call. This field is used in conjunction with the intercept on don't answer (IDA) option. The mapping from the number stored in the data item field to the actual number of rings it represents is consistent with that corresponding to call forwarding.

Maximum Simultaneous Calls

3.72 The maximum number of simultaneous intercepted calls (MXCAL) reflects the maximum number of calls to be simultaneously intercepted for that customer.

Route Index

3.73 The route index (RI) corresponds to the active intercept service for that customer. This is

needed to route intercepted calls to the appropriate intercept service because there may be more than one intercept service connected to a single ESS. The route index is also used in processing intersystem messages to guard against fraud.

Monitor

3.74 The monitor bit (MON) reflects whether the customer has the monitor/cut-through option.

Intercept Immediate

3.75 The intercept immediate bit (IMM) reflects whether the customer has the intercept immediate option.

Intercept on Don't Answer

3.76 This bit (IDA) indicates whether the customer has the intercept on don't answer option.

Intercept on Busy

3.77 The intercept on busy (IBY) bit indicates whether the customer has the intercept on busy option.

B. Program Store Requirements

3.78 A single bit of program store per customer is required to indicate monthly subscription to one or more intercept services. If a VSS related service order is input and the bit is set, all necessary service order information will be forwarded to all possible intercept systems which might contain data on this customer. Note that if either party on a 2-party line or any member of a multiline hunt group is a monthly subscriber, the bit in program store will be set.

3.79 Path memory for trunks monitor/cut-through requirements are paraphrased below:

- Monitor is the ability of a CA customer to listen to a message while it is being recorded. Cut-through enables the CA customer to be directly connected (via a talking path) with the calling party who is being intercepted and monitored by the customer.

- The monitor phase is initiated by a customer going off-hook and dialing the monitor code. If more than one terminating call is being answered for a customer by a CA monitor facility, a monitor request acts on the most recent entry into the system. If the monitor code is dialed, but no calls are being handled for that customer, reorder is returned.

- Cut-through is effective only during the monitor phase and is initiated by a flash. If there is no available path between the monitored party and the customer, reorder is returned.

3.80 Each network appearance (including the monitor port) has a path memory for trunks (PMTs) associated with it. For each intercepted call, the monitor port PMT stores the called DN (ie, the DN of the customer with the active intercept service). The monitor port TNN corresponding to the most recently intercepted call is stored in the VSS customer block associated with the intercepted customer. The TNN in the customer block is used as an indirect link to the network appearance of the customer's most recently intercepted call in the system. Each time a new call is intercepted, the monitor port TNN is recorded in the customer block. If the previous intercepted call is still in the system, the TNN is overwritten.

3.81 Any time the most recently intercepted call disconnects, the data item in the VSS customer block specifying the TNN is zeroed.

> ***Note:*** Requirements state that CA is capable of handling multiple calls to the same CA customer simultaneously. The maximum number of simultaneous calls (MXCAL) is a customer specified parameter. If this limit has been reached and another terminating call is encountered, normal busy treatment is given.

3.82 The DN stored in the monitor port PMT serves the purpose of an indirect point back to the customer block to decrement the current simultaneous call count (CALS). This is done as a part of disconnect. It is also necessary at this time to compare the TNN in the customer block against the TNN associated with the disconnection. If they are identical, the TNN in the customer block must be zeroed, indicating the most recent intercepted call has disconnected.

4. PIDENT FUNCTIONAL DESCRIPTIONS

VSS DATA MESSAGE HANDLERS—VSMH

4.01 This PIDENT contains the routines necessary to accept incoming messages from VSS (data messages and call messages) and to outpulse messages to the VSS system.

4.02 Global entry VSACAD gets control from PIDENT ICAL (digit analysis for trunks) when the digits accepted indicate an incoming message. The dispatch code or 2-digit prefix is used as an index into the actual message handling code. The initial phase analyzes the dispatch code to determine whether or not a legal type code has been received and, if so, whether or not an identifying directory number and/or data field will follow. If the dispatch code indicates a data message, then a VSS data reception buffer is seized.

4.03 At this point 04PHIND (phase indicator) should be set to 1, 2, or 3 indicating whether an identifying DN, data field, or END OF MESSAGE digit is to be collected next, respectively. The receiving client address should be placed in word 7 of the buffer. 04DFIND (data field indicator) should be set if a data field will be processed for this type code and reset if not. 04DC (digit count) should be zeroed and 04DCA (digit count accepted) should be set as follows:

If 04PHIND = 1 SET 04DCA = C(04NDGT)

= 2 SET 04DCA = 6

= 3 SET 04DCA = 1

4.04 The identifying DN will be sent in normalized form with the standard prefix and deletion being done. Hence, 04NDGT will contain the number of digits expected for this trunk group originally obtained from the second word of the TCC (trunk class code) expansion table. The data field will be collected 6 digits at a time to form 16-bit words. The PT should also be changed at this time to 106 octal. This new VSS PT is needed so that (1) the VSS data reception buffer can be released properly on VSS abandon, and (2) POBS that generated WINK between data messages can be queued for. RETURN then should be made.

4.05 Routine IDENT_DN_COL is the second message phase. It is responsible for the collection and conversion of the IDN. If an identifying DN exists for a given TYPE CODE, then it will follow the TYPE CODE and be sent in "normalized" form containing either 4, 5, or 7 digits depending on the trunk group. VSS will store a customer's DN in the normalized form that ESS sends to them. Since receiving clients need the DN in its 17-bit binary form and also to save intermediate storage space, the message handler will convert the normalized DN into its binary form. The decoding will depend on the DN length which is specified by 04NDGT in the incoming register (IR). After the DN is in binary form, it should be stored in word 6 of the data reception buffer. 04DFIND should be tested and if set then 04DC should be zeroed, 04PHIND set to 2, and 04DCA set to 6. A transfer to RETURN is then made. If a data field does not exist (indicated by 04DFIND=0) then 04DC should be zeroed, 04PHIND set to 3, and 04DCA set to 1, followed by a transfer to RETURN. In this case an ST or STP is expected as the next digit. If some other digit arrives, then control will be received via the VSS action address (AADD) with 04PHIND set to 3. If this happens a transmission error is assumed. The END bit should be set in word 6 of the IR causing any further digits to be ignored. Eventually VSS will recognize a problem, hang up, and seize another trunk for retransmission.

4.06 Routine DATA_WORD_COL is the third message phase. Its function is to collect the data field. Data will be collected six digits at a time. Each digit will encode three bits of information and 16-bit words will be formed. Hence, the first digit must be 0 (encoded as a binary 1010) or a 1. The digits 8 or 9 will be considered to be illegal if occurring in the data field. When it is determined, via VSS AADD and 04PHIND, that six data words have been collected in digit word 1 and 2, a decoding of these digits into a 16-bit word needs to be done. The data word will then be stored in the VSS data reception buffer. The next available word (NXWD) field found in the first word of the buffer will indicate in which word of the buffer to store the data word. The message handler will not know how many data words to expect in a given data field. It does know that no more than five words may be collected if an identifying DN exists (indicated by a 1 in the sign bit of word 6 of the buffer) or seven words if it does not. Hence, when the maximum number of data words has not been collected, it will assume another one exists by (1) incrementing NXWD, (2) setting 04DC to 0, and (3) setting 04DCA to 6. If the maximum number of data words has already been collected, 04PHIND should be set to 3, 04DC to

0, and 04DCA to 1. In either case, a transfer to RETURN should then be made.

4.07 Routine VSMEND is referenced from PIDENT DCNT (dialing connection). Its function is to collect the end digit, either ST or STP. Either an ST or STP (1700, 900 Hz) digit will be used as an END OF MESSAGE indicator for VSS data messages. An STP digit implies that another data message is going to follow. ICAL.ICMFNG will treat a STP digit—not as invalid—but as an ST for VSS calls, using the AADD=60 as the VSS indicator. Since the SICK bit will have been set, transfer to VSMEND will occur along with the setting of the END bit in the IR. Indication as to which digit was received should be saved in 04EDI of the IR. The VSMEND routine will check 04PHIND to ensure that it is either set to waiting for END OF MESSAGE or data field collection. Since the message handler will not know how many data words are going to be sent, an END OF MESSAGE digit received between data words will be accepted. Hence, if the phase indicator is set to data field collection, then a check should be made to ensure that no partial data word has been received. This is accomplished simply by checking 04DC for zero. If it is not zero a transfer to RETURN should be made, eventually causing VSS to abandon and retransmit. If the END OF MESSAGE digit is found to be syntactically correct, then an indication as to whether an ST or STP digit has been received is saved in the sign bit of word 3 of the IR (0=STP,1= ST). When the task is completed, VSMH.VSMEND passes control to VSMH.DELIVER_ MESSAGE.

4.08 ***Routine SEND—WINK:*** If the data message was successfully received then either a WINK or ANSWER needs to be sent to VSS—indicated by the clients return to the message handler. If a WINK is to be sent, then a POB should be seized with the queuing option. Supervision should then be checked to make sure a disconnect has not been sent and is in the process of being reported via RI-PT. If a disconnect has been sent, then the POB should be released and a transfer to RETURN made. If not, supervision should be turned off and the POB loaded with the appropriate relay orders and activated. Upon POB success, supervision is turned on and the 04EDI of the IR tested to see if another data message is going to follow; the END bit is reset, the digit count set to 0, 04DCA to 2, and 04DFIND and 04PHIND to 0. The buffer is cleared except for the activity bit, the route index, and the CRA. If no data message is going to follow, then a transfer to RETURN is made, waiting for VSS to abandon. If the POB should fail then the data reception buffer is released and transfer made to DCNI.DCFB1A to release the IR.

4.09 ***Routine SEND—ANSWER:*** If ANSWER is to be sent, a new PT value of 112 octal should be set. This will be necessary because ESS must send disconnect to VSS after their WINK timing times out and they disconnect. Normally ESS is already in the disconnect state. The same actions for sending WINK should be followed for sending ANSWER except only those orders necessary to "start" the WINK should be loaded in the POB. Upon POB success a real-time break is made after turning supervision back on.

4.10 Routine VSSZRB is referenced from PIDENT DCNT. Its function is to seize a VSS data reception buffer. When a buffer is seized, it is zeroed, and its activity bit set to one. The buffer address is saved in word 10 of the IR. A trunk group number (TGN) to trunk group supplementary AUX block translation is performed and the RI retrieved from option word 0—the VSS word. The RI is restored in bits 4 through 14 of the tenth word of the buffer. Since the number of reception buffers equals the maximum number of VSS trunks being used to receive data messages, failure to seize a buffer indicates an error situation. A routine is called in this case to search all active buffers and free any buffers which are not linked to an IR being used by VSS. The action address field will identify those IRs being used for VSS data reception. It is possible that, because of a VSS error or transmission error, all buffers would be legally active. If this is the case, the END bit in the IR is set causing further digits to be ignored and finally abandonment by VSS.

4.11 Routine VSSZLB is referenced from VSMH. VSSLMA, the logical message assembler. Its function is to find an active long data reception buffer which is currently being used for a particular route index or seize an idle buffer for use by that route index.

4.12 Routine VSRLLB is referenced from VSMH. VSSLMA. Its function is to release VSS long data reception buffers. The buffer to be released is taken off the busy linked list and added to the idle buffer linked list.

4.13 Routine VSSLMA is referenced from VSMH.DELIVER_MESSAGE. Its function is to concatenate physical messages into logical mes-

sages. Data messages must be assembled into VSS long data reception buffers before being delivered to the client.

4.14 Only one long message may be sent by a particular VSS at a time. The RI passed to the physical to logical message concatenator (PLMC) is used to identify VSS. All PLMC buffers need to be searched to determine if any buffer is currently active for a given VSS. If not, one is seized and initialized, saving the RI. These buffers will be 56 words long to accommodate the maximum of 8 physical messages constituting a logical message. If a PLMC buffer is already active for the RI given, then the present data message is part of the one contained in that buffer. The PLMC is able to accept physical messages out of order—in other words part 2 received before part 1. All control information is extracted from the data message—buffering only the data used by the client in 16-bit words. Only the last physical message may contain a data field which does not contain the maximum number of words (five words for part 1 and seven words thereafter). The PLMC will reject the entire message if this rule is violated. Because control information is being extracted from within the data field of each physical message, the last word of the logical message may not be "full" and any trailing bits should be zeroed.

4.15 The client will call the PLMC providing the following information:

Z REG: RI of Receiving Trunk Group

4.16 The PLMC will return to the client 0, J if it did not accept the physical message. This will occur only when there is a conflict found with the control information in the data field. The control information is essentially an X out of Y code which will allow the PLMC to piece together the data message. If the PLMC receives the same piece twice or, for instance, the third piece of two, the entire logical message will be "thrown away" and an error return made. The responsibility of the client in this case will be to return 0,J to the message handler resulting in the data message not accepted acknowledgment (ANSWER) being sent to VSS.

4.17 The PLMC will return 1,J to the client if it accepted the data message but the logical message is not yet complete. The client will simply return success to the message handler in this case. When the entire data message is complete, the PLMC will return 2,J to the client providing the same interface the message handler normally provides the client.

4.18 Routine CALL_MESSAGE is referenced from VSMH.DISPATCH_CODE_COL. It is called when a service code is received by the ESS which indicates that a call is being placed by VSS (AC delivery). For AC deliveries, VSS will send the VMS TYPECODE followed by (1) the "normalized" DN of the originating party, and (2) the actual digits of the terminating DN as dialed by the customer when leaving the AC message. The originating DN is needed to perform normal screening. Once the VMS TYPECODE has been received, the incoming register is set up to receive an identifying directory number. Bit 5 of word 17 of the IR is also set to indicate that this is an AC delivery. The message phase indicator is set to one indicating that a DN will be collected, and the data field exists indicator is set to indicate that no data field exists. The number of digits to be received over the trunk is stored in the digit count accepted field of the IR.

4.19 When the normalized DN has been received, the standard conversion to a 17-bit binary number is performed. The conversion is accomplished via the algorithms shown in Fig. 8. The DN EXISTS indicator is also set.

4.20 A DN to LEN translation should now be performed and the resulting LEN stored in 04IPLEN of the IR. This field normally contains a screening LEN associated with the ICT (incoming trunk) group for calls where digit analysis on trunks is being performed as if the digits were being received over a customer loop. To prevent customers from making calls via AC that they would ordinarily not be able to make, the actual LEN of the customer will be saved.

4.21 The IR is now initialized for call delivery. The digit count (DC) is set to zero and the digit count accepted (DCA) set to one. The action address is set to dial 9—9 absorbed and the call will be treated as noncentrex dial 9. Since it is noncentrex, no charging will be performed at this time; it will be accomplished later via a separate VSS→ESS data message.

4.22 Routine VSODMS is the outpulsing data message sender routine; its function is to send messages to the VSS which will not be followed by a talking connection. It is referenced from PIDENT AMAC (automatic message accounting data accumu-

```
4 DIGITS:   TGN ⟹ TCC; TCC WD2 ⟹ NOC
            10 x NOL + DY ⟹ NGN
            NGN + (D5 + D6 + D7 - 111) ⟹ 17-BIT DN

5 DIGITS:   TGN ⟹ TCC; TCC WD2 ⟹ STEERING DIGIT
            STEERING DIGIT ⟹ INC. TR. SELEC. TABLE
            INC. TR. SELEC. TABLE ⟹ NOC
            10 x NOC + DY ⟹ NGN
            NGN + (D5 + D6 + D7 - 111) ⟹ 17-BIT DN

7 DIGITS:   D1 + D2 + D3 ⟹ NOC
            10 x NOC + DY ⟹ NGN
            NGN + (D5 + D6 + D7 - 111) ⟹ 17-BIT DN

NOC - NORMALIZED OFFICE CODE
TGN - TRUNK GROUP NUMBER
TCC - TRUNK CLASS CODE
NGN - NO. GROUP NO.
WD2 - WORD 2
```

Fig. 8—Normalized DN Conversion

lation), PIDENT RCVS (RC VSS message sender), and PIDENT TBVL (verify basic line and directory number).

4.23 Routine VSMPDM is the main program entry for data message transmission. Its function is to initiate data message transmission to all VSSs which have messages pending but none being transmitted. This routine is referenced from PIDENT ECMP (executive control main program).

4.24 The last section of PIDENT VSMH consists of the routines to handle OGTC returns for the data message sender. The routines are accessed via an index table.

(a) Routine VSDMSR—Processes wink detection report.

(b) Routine POS_ACK and routine NEG_ACK—Process acknowledgment received returns.

(c) Routine WINK_OUT—Processes a non-POB failure.

(d) Routine POBF_DMS—Processes a POB failure return.

(e) Routine UDMSHC—Updates data message sender head cell.

(f) Routine IDLE_BUF—Idles a data message sender buffer.

VSS LOCAL SERVICE CONTROLLER—VSLS

4.25 This PIDENT contains the local service controller routines to process all customer VSS service requests that do not require access to the VSS office. It receives control from the signal dispatcher after such requests are detected. The three major sections of the PIDENT include the isolation talking monitor, the normal talking monitor, and the monitor controller which provides the VSS monitor feature. This PIDENT also contains the program tag (PT) tables for the VSS register. PT is an item in the first word of the call register which indicates the state of the call and is used to index through a table containing return addresses to the program.

4.26 Routine VSLPTV is the global entry point to the PT tables. It is referenced from PIDENT YMRG (queue and general purpose). The tables are divided into two groups of two each: Group 0 major port, Group 0 minor port; Group 1 major port, and Group 1 minor port. The appropriate PT routine is accessed via double indexing through the PT and report tables (refer to the program listing for more detail).

4.27 Routine VSLPTS is the Set-PT routine. It is referenced from PIDENT CORP (queue and general purpose) when an abandon occurs during answer timing. This routine uses table lookup on the current PT to return to the client a corresponding program tag.

4.28 Miscellaneous Common Set-PT Routines:

(a) Routine VSABN1—Marks PBAO bit and passes control to COPR.COABN1.

(b) Routine VSABDN—Releases all registers connected to a particular call.

(c) Routine VSANSW—Sets PBAO bit and passes control to COPR.ANSWER.

(d) Routine PASOUT—Drops the VSS register and gets off the call.

(e) Routine PASSON—Passes report on if it is a nonmaster register.

(f) Routine VSDISQ—Gets off the POB queue during abandon before answer timing.

(g) Routine VSDISF—Initials disconnect report.

(h) Routine VSHWF—Processes a hardware failure report.

(i) Routine VSDONE—Releases VSS register.

(j) Routine VSRTONE—Gives control to the tone subroutine.

4.29 Routine VSLITM is the routine to attach the isolation talking monitor. Its function is to seize a VSS register, initialize it as a VSS register ITM function and link it to the originating register (OR). Call waiting and monitor/cut-through features are prohibited. This routine is referenced from PIDENT VSCA.

4.30 Isolation Talking Monitor PT Routines:

(a) ITM_FLASH_A—Provides line flash before answer and turn-on supervision.

(b) ITM_FLASH_D—Clears PBAO (POB active or similar unstable condition) and turns on supervision.

(c) ITM_ANSWER—Sets PT to wait for disconnect, clears PBAO, and marks ANS received.

(d) ITM_CHK_ANS—Checks to see if answer needs to be reported and report it if necessary.

(e) ITM_TLKRS—Clears PBAO and reports answer if necessary.

4.31 Routine VSLNTM is the routine to attach the normal talking monitor. Its function is to seize a VSS register, initialize VSS register ITM function and link it to the outpulsing register (OP). The NTM keeps track of the state of an intercepted call should the monitor service be requested. This routine is referenced from PIDENT MFPR (multifrequency outpulsing).

4.32 Normal Talking Monitor PT Routines:

(a) NTM_FLASH_A—Resets PT to wait for answer, clears PBAO, flashes to set up conference.

(b) NTM_FLASH_D—Clears PBAO, turns on supervision, sets PT, and reports answer.

(c) NTM_ANSWER—Sets DT to wait for disconnect, clears PBAO, and marks ANS received.

(d) NTM_TLKRS—Clears PBAO and reports answer if necessary.

4.33 Routine VSLMON is the monitor controller routine which provides the VSS monitor service. It is referenced from PIDENT ORDL (digit analysis for lines). This routine takes the following steps to complete its function:

(1) Get minor port TNN

(2) Get major port TNN

(3) Call GET_VSO—Using major TNN, find an associated VSS register

(4) If monitor inhibited then reorder, else inhibit monitor

(5) Check to ensure the PTs are correct

(6) To ECMP.RETURN.

4.34 Monitor Controller Support Routines:

(a) SCREEN_MON—Prevents dial 9 access and add-on calls.

(b) GET_IDN—Gets customer's IDN and LEN PTW.

(c) GET_VSO—Locates the VSS register associated with a particular call.

VSS CUSTOMER ACCESS CONTROLLER—VSCA

4.35 The access controller is responsible for processing all customer requests for voice storage services that require access to the VSS office. It performs necessary screening, obtains the customer identifying information required by the VSS system, routes the call to the appropriate VSS office, and passes the call to the normal or isolation talking monitor as required.

4.36 PIDENT VSCA is entered through global entry point VSCA.VSCODT from either ORDL or CXOR (digit analysis-centrex) via the subtype transfer table. VSCA.VSCODT is a subsubtype table used by the special service access

code analysis routines to transfer to the appropriate local interface routine. The local routines are:

(a) ACTIVATION 1: Main routine used for activations of call answering (CA) or customer announcement service (CAS)

(b) ACTIVATION 2: Main routine used for activation of advance calling (AC)

(c) ACCESS 1: Main routine for deactivation of CA or CAS or a change in privacy code change (PCC)

(d) ACCESS 2: Main routine for an AC status check

(e) MSG_RETRIEVAL: Main routine for message retrieval requests.

A. VSCA.ACTIVATION1

4.37 This routine handles activations of CA and CAS. Its primary function is to perform full screening on the originating DN after outpulsing control is passed to the isolation talking monitor. This is accomplished by means of the following steps. Those steps which are common to all VSCA local routines are so noted by an asterisk.

(1) *SAVE_ACCESS_TYPE: Save the subsubtype, which specifies the type of access requested, in the VSSTYP field of the call register.

(2) Deny-Dial-9: Check for centrex dial 9; if CTX dial 9 access, route call to special service error announcement.

(3) *Mark call as VSS: Set the VSS indicator flag in word 18 of the call register to indicate that VSS outpulsing is needed.

(4) MAKE_CALL_FREE: Zero the charge bit.

(5) TEST_ACTIVATION_INHIBITED: Check for available resources; if necessary resources are unavailable, then reorder (ORDL.ORENF3).

(6) Attach isolation talking monitor (ITM) unless add-on (deny access if add-on): If none available then reorder.

(7) *GET_IDENTIFYING_DN: Determine the directory number used by VSS to identify the caller.

(8) IDN_TO_VSO: Save identifying directory members (IDNs) in VSS originating register.

(9) VSS NXX translation (TRBL.TRNXXT): If return failure, release ITM and exit to special service error announcement (ORDL.ORGETR).

(10) Save info digit: Save the information digit for transmission to VSS (ITEM VSSINFO of the call register).

(11) OMAJ/TMAJ screening (TRVS.TRVOTS): Determine whether to allow or deny use of VSS services based on the customer's originating and/or terminating major class (OMAJ/TMAJ); if service is denied, exit to special service error.

(12) SCREEN_HOTEL_MOTEL: Check hotel-motel flag; these lines are denied VSS special service error announcement.

(13) *CHECK_MLHG/SCREEN_MLHG: Determine if requesting line is from a multiline hunt group (MLHG); only terminal 1 of an MLHG is allowed access.

(13a) If MLHG, check office option table to set information digit accordingly for MLHG. If not MLHG, check for series completion (SC). If SC, set information digit accordingly to office option tables, else combine information digits.

(14) Conflicting service screening (TRVS. TRVSSC): Reorder screen VSS activation requests for conflicting services active at the time of the request.

(15) SET_COMPLAINT_INFO: If complaint observing is requested, set the CMPL bit in word 11 of the call register to indicate such.

(16) *Dial complete/outpulsing required: Set the call type field (CTYP) of the call register to indicate that dialing has been completed and outpulsing is required.

(17) *Convert IDN (TRBD.TRDNBC): Convert the IDN from binary form to binary coded decimal (BCD).

(18) *Store the BCD IDN: Store the BCD form of the IDN in words 7 and 8 of the call register.

(19) Proceed as a normal interoffice call (ORDL. INTER).

B. VSCA.ACTIVATION2

4.38 This routine handles AC activations. Its function is to perform full screening after outpulsing control goes to the ITM. The steps executed are the same as in routine ACTIVATION1 with the exception of Steps 4 and 13, which are not required here. Also, note that no MLHG line is allowed to activate AC.

C. VSCA.ACCESS1

4.39 This routine processes deactivation requests for CA and AS. It also handles PIN changes. These VSS access requests do not require screening. The steps executed are as follows:

(1) *SAVE_ACCESS_TYPE.

(2) DENY_DIAL_9: Centrex dial 9 access is prohibited and such an attempt results in a special service error.

(3) *Mark call as VSS.

(4) MAKE_CALL_FREE.

(5) *GET_IDENTIFYING_DN.

(6) VSS NXX Translation.

(7) *Dial complete/outpulsing required.

(8) *Check_MLHG/SCREEN_MLHG.

(9) *Convert IDN.

(10) *Store the BCD IDN.

(11) *Proceed as a normal interoffice call.

D. VSCA.ACCESS2

4.40 This routine processes requests for AC status checks. This type access request does not require screening. The steps executed are the same as in ACCESS1 with the addition of the following step.

.5) Save route index: The route index for an outgoing VSS trunk, which is an output of the VSS NXX translation, is stored in word 9 of the call register.

Note that no MLHG line is allowed to request an AC status check.

E. VSCA.MSG_RETRIEVAL

4.41 This routine handles message retrieval requests. The steps executed are listed below. Note that centrex dial 9 access is prohibited.

(1) *SAVE_ACCESS_TYPE

(2) DENY_DIAL_9

(3) *Mark call as VSS

(4) *GET_IDENTIFYING_DN

(5) Get route index (TRVS.TRVSRI): get the route index of the intercept system for retrieval requests

(6) Store route index

(7) *Dial complete/outpulsing required

(8) *Convert IDN

(9) *Store BCD IDN

(10) *Proceed as a normal interoffice call.

VSS AUDIT ROUTINES—SAVS

4.42 This PIDENT consists of three direct entry routines to audit VSS data buffers. Each buffer is connected to either an idle buffer linked list or a busy buffer linked list. The audit routines ensure that each buffer is properly linked and, if it is on the busy list, that it is currently busy. The last block in each routine rebuilds the idle buffer linked list with all idle data buffers.

4.43 Routine SAVSBR is the VSS audit subroutine to audit data reception buffers. It is referenced from PIDENT SAHO (hopper and queue audit program). If the VSS indicator bit in the originating register associated with the particular buffer is not set, then the active buffer bit in the data reception buffer is zeroed. The idled buffer is then added to the idle buffer linked list. The pointer to the current buffer is incremented and the next data reception buffer is audited.

4.44 Routine SAVSRL is the VSS audit subroutine to audit long reception buffers. It is referenced from PIDENT SARG (call register audit program).

The purpose of the audit is to check that all buffers on the busy list are currently busy and have valid links. As each buffer is audited, if the time-out bit is not already set, the audit bit and the time-out bits are set. Setting the audit bit indicates that the buffer is busy. Next, the routine verifies that all links from the buffer are within the range of the busy buffer linked list. After all buffers have been audited, idle buffers are linked to the idle buffer linked list. If the time-out bit had been previously set, the buffer is considered idle.

4.45 Routine SAVSBT is the VSS audit subroutine to audit data transmission buffers. It is referenced from PIDENT SAHO. This audit performs validity checks on both the head cell route indexes (RTI) and the buffer links. The RTI for each head cell is compared against the RTI table for a match. No match indicates a bad index. All the buffers in a given linked list are audited. A check is made to ensure that the buffer is properly linked to a call register and that the list links are not out of range.

VSS TRANSLATION ROUTINES—TRVS

4.46 This PIDENT consists of the translation routines that comprise the VSS data base. These routines fall into four categories:

(a) Global routines called by VSS routines

(b) Intersystem routines

(c) VMS translation routines

(d) VSS screening and audit translations.

A. Global Routines

4.47 Routine TRVSCK is referenced from PIDENT TXFR. Its function is to check the current number of simultaneous calls against the maximum number of simultaneous calls allowed and to return the route index of the intercept system if CALS< MXCALS.

4.48 Routine TRVSDC is referenced from PIDENT TRBT. Its function is to decrement the current number of simultaneous intercepted calls (CALS) by one. Then, if the TNN in the CORC block equals the input TNN, the TNN in the customer block is zeroed.

4.49 Routine TRVSGT is referenced from PIDENTs VSLS and ORDL. Its function is to return the monitor TNN if a call is intercepted and the monitor feature is set.

4.50 Routine TRVSIN is referenced from PIDENT TRBL. Its function is to return the intercept information for an intercepted call; that is, whether the call was intercepted immediately, on don't answer, or on busy.

4.51 Routine TRVSLO is currently not referenced from any PIDENT. Its function will be to idle a VSS customer for a service order line out or a change message request.

4.52 Routine TRVSRI is referenced from PIDENT VSCA. Its function is to supply the route index of the intercept system, stored in the VSS PTW, for message retrieval requests.

4.53 Routine TRVSSC is referenced from PIDENT VSCA. Its function is to screen VSS activation requests for active conflicting services by checking the abbreviated class code.

4.54 Routine TRVSSD is referenced from PIDENT TRBL. Its function is to check the stuttered dial tone bit in the message buffer head cell to determine whether to give SDT.

4.55 Routine TRVSST is referenced from PIDENT MFPR. Its function is to increment the current number of simultaneous intercepted calls. If an overflow did not occur, the monitor TNN is stored in the VSS customer RC block and the IDN is stored in the path memory word of the monitor port.

4.56 Routine TRVSTR is referenced from PIDENT TRBL. Its function is to supply don't answer timing and the route index necessary for intercept.

B. Intersystem Routines

4.57 Routine TRVSOT is referenced from PIDENT VSMH. It is also referenced locally from TRVS.TRVSLO. Its function is to idle a VSS intercept customer. This involves deactivating the DN, LEN RCs, and CORC block. If the line is a 2-party line, a check should be made to ensure that the other party has no active VSS services before deactivating the LEN RC and CORC block. This routine uses several direct entry routines from PIDENT TRBL to complete its task.

4.58 Routine TRVSNW is referenced from PIDENT VSMH. Its function is to insert,

change, or delete a VSS customer profile in the RC and CORC area. Several direct entry routines from PIDENT TRBL are used to complete the task. From the route index and the directory number, a LEN can be calculated and a pointer to the CORC block can be obtained.

C. VMS Translation Routines

4.59 Routine TRVSSR is referenced from PIDENT VSMH. Its function is to perform validity screening for AC. TRVSSR saves the clients return address and relies on routine TRVSSB to perform the actual screening.

4.60 Routine TRVSSB is referenced from PIDENT AMAC. Its function is to perform AC screening and to return billing information for AMA billing. TRVSSB is also referenced locally by routine TRVSSR.

D. VSS Screening and Audit Routines

4.61 Routine TRVOTS is referenced from PIDENT VSCA. Its function is to determine whether to allow or deny use of VSS services on the basis of the customer originating and/or terminating major class.

4.62 Routine TRISTG is referenced from PIDENT SACO. Its function is to provide a list of unique trunk groups associated with the intercept systems using data in the NXX translator.

4.63 Routine TRISRI is referenced from PIDENT SAVS. Its function is to provide a list of unique route indexes to intercept systems using data in the NXX translator.

ESS-VSS TRUNK DIAGNOSTICS—TNVS

4.64 This program is a package of 29 VSS trunk diagnostic tests. It is entered through the global entry TND462 from PIDENT TNKC (trunk and service circuit maintenance control). The VSS trunk is a 2-port trunk circuit. Each port has its own trunk network number (TNN), trunk class code (TCC), and circuit path index (CPI), etc. The complete diagnostic, consisting of testing both ports and outpulsing to VSS, is run whenever the diagnostic is requested, regardless of which TNN is used in the request. When trouble in a trunk circuit is detected by the program, an appropriate message is printed on the TTY. These messages do not point to specific component failures but do indicate that the hardware failed to perform a specified function.

RC VSS MESSAGE SENDER—RCVS

4.65 RCVS is the recent change message PIDENT for VSS. It consists of the head tables, keyword tables, and validity tables (etc) comprising a standard RC message PIDENT. RCVS provides the RC message handling programs with a data base for VSS RC message processing. For further information refer to Section 231-045-150.

CORC AUDITS—SACO

4.66 This PIDENT contains some of the routines necessary to audit CORC blocks and the RC area of call store (CS). Also, included is a routine to test whether it is time to segment a given procedure. These routines are described below.

4.67 Routine SACRCA is the driver routine to audit the linkage of CORC blocks and the RC area. It employs the following resident routines to complete its function (Fig. 9):

(1) SACO.CRCZER

(2) SACO.CFVLIM

(3) SACO.VSLIMB

(4) SACO.TIMSEG

(5) SACO.CRCLNK.

This routine is referenced from PIDENT SALT (translations and RC audit). This audit will step through all DNs in the office using the DN primary translation word pointer. Each DN pointing to its respective VSS customer block (CORC area) will be examined. (Fig. 10). It will require several segment breaks before completely sequencing through all the DNs. All corresponding audit flags in the recent change registers and VSS customer blocks will be set as each DN is examined.

4.68 Routine CRCFLG sets the CORC block audit bit if an audit is in progress. It is referenced from PIDENT TRVS. The audit in progress word (V4CRCAU) is first checked. An immediate return is taken if no audit is in progress. Next, the DN

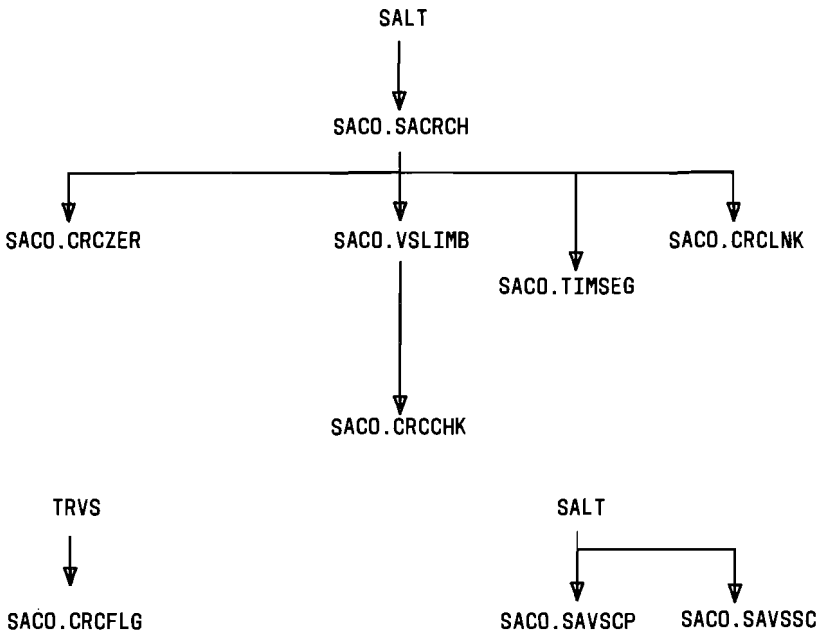


Fig. 9—PIDENT SACO Routine References

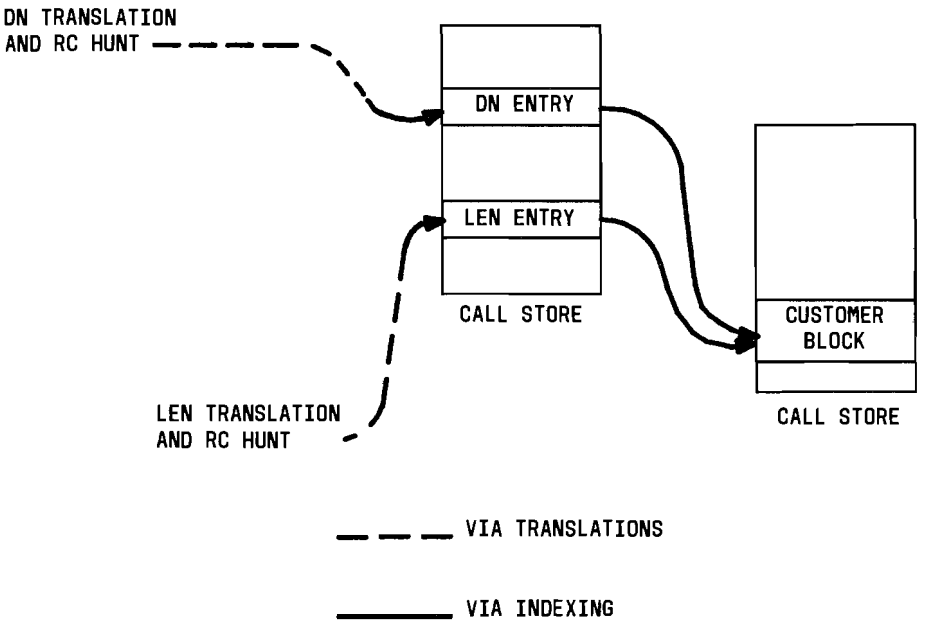


Fig. 10—VSS Data Layout

subtranslator index is checked. If the DN has already been audited, then the audit bit in the CORC block is set.

4.69 Routine CRCZER zeros the audit bits in each CORC subarea. It is referenced from SACO.SACRCA. This routine simply steps through variable sized CORC blocks and zeros the audit bit of each block. The pointer to the CORC table and the range table for indexes (M4GS70 through M4GS89 in call store) are used.

4.70 Routine CRCCHK performs range checks on the CORC block links. The CORC block pointers are compared with the start and end addresses of the CORC block. It also runs a validity check on the CORC block ID. This routine is referenced from SACO.CFVLIM and SACO.VSLIMB.

4.71 Routine CRCLNK rebuilds the idle linked list in each CORC subarea. It is referenced from SACO.SACRCA. This routine steps through each CORC block and links idle blocks to the idle linked list. The last link is zero to signal the end of the list (ie, the idle linked list is not circular).

4.72 Routine TIMSEG tests whether it is time to segment a given procedure. It is referenced from SACO.SACRCA. Registers J, X, Y, Z, F, and K are saved in call store (M4GS94 through M4GS99). The decision to segment is made by SADT.SASEGT. When SADT.SASEGT decides whether or not to segment, control is returned to SACO.TIMSEG where the registers are restored.

4.73 Routine SAVSCP audits the linkage between CORC blocks and path memory for trunks (PMT) words. It is referenced from PIDENT SALT. Using the point-to-point back technique, this routine will audit the pointers interrelating the monitor trunks with the VSS customer blocks. The PMT word associated with a 2-port trunk will contain a DN from which the VSS customer block (CORC block) can be derived. The block will contain a TNNA from which the corresponding PMT can be derived. These two temporarily related blocks will periodically be audited to verify that the linkage is correct.

4.74 Routine SAVSSC audits the current simultaneous intercepts. It is referenced from PIDENT SALT. This routine ensures that no particular customer has more simultaneous interceptions than the maximum number allowed that customer. By stepping through PMT via the trunk network number and trunk group number, it is possible to count the number of times a given DN appears in path memory, which indicates the number of simultaneous intercepts for that customer.

4.75 Routine VSLIMB locates VSS CORC blocks from an index value in the DN RC. It is referenced from SACO.SACRCA. Each VSS CORC block in the No. 1/1A ESS is audited for possible limbo conditions by routine SACO.VSLIMBO or routine SACO.CRCCHK. If any block is found to be in error, then the VSS CORC block, along with DN and LEN RCs are idled.

5. ABBREVIATIONS AND ACRONYMS

AADO	Action Address
ABB	Abbreviated Class Code
AC	Advance Calling
AMAC	Automatic Message Accounting Data Accumulation
AS	Announcement Service
BCD	Binary Coded Decimal
BDN	Binary Directory Number
CA	Call Answering
CALS	Current Number of Intercepted Calls
CAR	Centralized Answer and Record
CAS	Customer Announcement Service
CCIS	Common Channel Interoffice Signaling
CFDA	Call Forwarding Don't Answer
CFPF	Call Forwarding Over Private Facilities
CFV	Call Forwarding Variable
COB	Complaint Observing
CPI	Circuit Path Index

CO	Central Office
CORC	Customer Originated Recent Change
CS	Call Store
DAT	Don't Answer Timing
DC	Digit Count
DCA	Digit Count Accepted
DN	Directory Number
DND	Do Not Disturb
ESS	Electronic Switching System
IBY	Intercept on Busy
ICT	Incoming Trunk
IDA	Intercepted on Don't Answer
IDN	Identifying Directory Numbers
IR	Incoming Register
ITM	Isolation Talking Monitor
LEN	Line Equipment Number
LENPTW	Line Equipment Number Primary Intercepted Calls
MF	Multifrequency
MLHG	Multiline Hunt Group
MXCAL	Maximum Number of Simultaneous Intercepted Calls
NTM	Normal Talking Monitor
NXWD	Next Word
NXX	Office Code
OMAJ/TMAJ	Originating/Terminating Major Class
OP	Outpulsing Register
OR	Originating Registers
PACT	Prefixed Access Code Translator
PHIND	Phase Indicator
PIN	Personal Identification Code
PLMC	Physical to Logical Message Concatenator
PMT	Path Memory for Trunks
POB	Peripheral Order Buffer
PS	Program Store
PT	Program Tag
PTW	Primary Translation Word
RC	Recent Change
RI	Route Index
RIT	Route Index Table
SC	Series Completion
SDT	Stuttered Dial Tone
SLOV	Subscriber Line Overflow
ST	Start Digit
STP	Start Prime
TCC	Trunk Class Code
TGN	Trunk Group Number
TNN	Trunk Network Number
VMS	Voice Message Service
VSS	Voice Storage Service

6. REFERENCES

- Section 231-045-150 - Recent Changes
- VSS PIDENTs (See Table A)