SWITCHING SYSTEMS MANAGEMENT
NO. 1 ELECTRONIC SWITCHING SYSTEM
MEMORY ADMINISTRATION
PROGRAM STORE DESCRIPTION

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1. GENERAL

1.01 The purpose of this section is to familiarize the network administrator with the No. 1 Electronic Switching System (ESS) program store (PS) hardware and to provide the network administrator with enough background on the translations software so that the recommended methods and procedures in other sections of Dial Facilities Management Practices, Division H, Section 6h, will be more understandable.

1.02 When this section is reissued, this paragraph will contain the reason for reissue.

1.03 Dial Facilities Management Practices, Division H, Section 6h, is divided into four subsections as follows: 6h(1), Description; 6h(2), Translation Area; 6h(3), Parameters; and 6h(4), Support Programs.

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

2. HARDWARE/SOFTWARE AND GENERAL PROGRAM STORE INFORMATION

2.01 This part of this section covers PS hardware and software descriptions and external software aids for analysis of the PS translations area. The hardware section briefly describes some of the basic PS features. The software section deals with the generic program and concentrates primarily on a description of the translations area and Western Electric support programs.

HARDWARE

2.02 This part of this section describes the hardware portion of the PSs of the No. 1 ESS. A PS (Fig. 1) is a semipermanent read-only memory unit that contains the program orders, office parameters, and translation information that central control uses to direct the operation of the No. 1 ESS. A No. 1 ESS office can contain a maximum of 6 (unduplicated) or 12 (duplicated) PSs (see note). The actual quantity provided depends upon the generic program used and the translation word requirements.

Note: The term "duplicated" means that there are two independently operable systems, one of which serves as a backup to the other for service protection. If trouble is encountered, the No. 1 ESS central control automatically switches the faulty unit out of service and activates the backup (duplicate) unit in its place. PS duplication is accomplished by splitting each PS frame into a G-half and an H-half; each half contains memory modules. Identical information is stored in memory modules in the H-half of one PS and the G-half of another PS.

2.03 Upon receipt of an address from central control, any PS word can be read into the buffer order word register of the central control during one 5.5-microsecond system cycle.

A. Memory Cards

2.04 A memory card is a rectangular aluminum card (11-1/4 inches by 6-5/8 inches). Information in the form of binary bits is stored in the card by magnetizing (binary 0) or demagnetizing (binary 1) small bar magnets that are bonded to the aluminum memory cards in 64 rows of 45 bar magnets. In each 45-bar row the first 44 bars represent a 44-bit PS word. There are therefore 64 PS words per card. The 45th bar is always magnetized and is used to magnetize the twistor wires when the card is inserted into the module. Information is recorded on the memory cards by the memory card writer before the cards are mounted in the PS. There are also 65 initializing magnets (32 initializing magnets row 1 and 33 initializing magnets row 0) which are also always magnetized. The 65 initializing magnets isolate adjacent words by applying the opposite magnetic polarity to the twistor wire areas on either side of the bit positions. The cards are contained in a memory module. There are two types of memory cards (Fig. 2). The type-1A memory card has magnets facing left and type-2A memory card has magnets facing right when the cards are in place in the PS memory module. A 1A memory module, shown in Figure 3, contains 65 type-1A memory cards and 64 type-2A memory cards. One complete PS contains 16 type-1A memory modules. The storage arrangement is as follows.

- One memory card stores 64 words.
- One memory module (128 cards) stores 8192 words.
- One PS (16 modules) stores 131,072 44-bit PS words.
- The PS is divided into two halves called the H-half and the G-half. Each half contains eight memory modules and has a storage capacity of 65,536 words.

Memory modules must be removed from the PS and external equipment must be used to input or change information on the modules.

B. Basic Memory Unit

2.05 As described previously, PS is divided into two parts called the H-half (left) and the G-half (right) as viewed from the card-inserting side of the PS frames (Fig. 1).

2.06 Each store half is assigned a binary name (the K-code). The K-code is established by means of cross-wiring at the time of installation. Each word to be read out of the PS is uniquely identified by the central control via the following:

(a) A 4-bit K-code which specifies the store half that contains the word

(b) A 16-bit address which identifies the desired word among the 65,536 words contained in the specified store half.

PS addresses are usually given as 7-digit octal numbers which are converted to binary and decoded as shown in Figure 4. A layout of PSs including starting and ending addresses is shown in Figure 5. (See IM-1A001 for a method for converting octal-to-binary and binary-to-octal numbers.)

SOFTWARE

2.07 The information contained in program store consists of instructions and data that guide the ESS through call processing and maintenance functions. There are three categories of information (which constitute the software areas) in program store. They are: the ***generic program area,*** the ***office parameter area,*** and the ***translation data area.***

A. Generic Area

2.08 The generic program area contains the program which controls the operation of the system. It controls actions such as line or trunk scanning, obtaining line equipment number (LEN) and directory number (DN) information, setting up connections between line and trunk circuits, making automatic message accounting entries, etc.

2.09 The program store module requirements in the generic area are fixed by the generic program and features used and are not dependent on office characteristics. A given generic program can serve any office within its generic class with the exception of the feature-loaded generic SP/CC-CTX-8. The differences between any two offices in a generic class are reflected only in the parameter and translation areas of the program store. Each generic program contains a particular combination of features, not all of which need be used in a particular office. There are presently two classes of generic programs: the central control type with centrex (CC-CTX) and the signal processor type with centrex (SP-CTX). Generic programs without centrex features included are no longer available; however, no centrex hardware need be provided in offices that do not plan to serve centrex customers. Programs are numbered to indicate the latest issue; for example, SP-CTX-4, CC-CTX-4.

2.10 ***It is important for the network administrator to be aware of the type and issue of the generic program used in the office.*** It is also important to know the amount of memory taken up by this area. Table A gives the present modules required per generic type. See Traffic Facilities Practices, Division D, Section 10g, Program Store, for the most up-to-date module requirements.

B. Parameters Area

2.11 The ***office parameters*** area contains data in the program store which inform the generic program about the size and makeup of the office. As a result, this information will vary from office to office and during the life cycle of an office. Parameter information includes such items as:

(a) Total number and type of frames

(b) Location and quantity of call processing registers, buffers, and hoppers in call store memory

(c) Office options.

Parameters are compiled and placed in memory by Western Electric and are usually changed when there are equipment additions and generic program updates.

C. Translation Area of Program Store

2.12 The PS translation area contains all the day-to-day changeable data associated with the office. The translations data provide information related to the following:

(a) LEN, DN, and trunk asignments

(b) Office codes

(c) Rate and route information

(d) Traffic measurement information

(e) Associated miscellaneous information for call processing and charging.

From an administrative point of view, the translations area is very important. (See Dial Facilities Management Practices Division H, Section 6h(2), Memory Administration Translation Area, for details on proper administration of the PS translation words.)

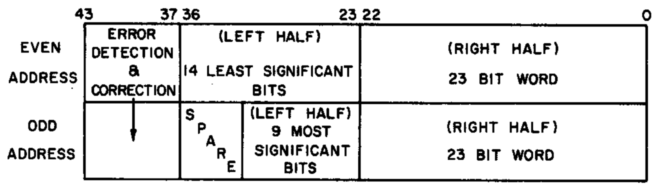
2.13 The translation information or data produced by the translator programs are usually in the form of tables or lists. The tables or lists are linked according to a hierarchal pattern. Tables high in the hierarchy contain pointers to, or addresses of, the lower tables. ***The lowest tables in the hierarchy, such as the auxiliary blocks, some subtranslators, or subauxiliary blocks, contain the actual translation data.***

Translation Words

2.14 The unit of stored data in a translator is the translation word. It consists of 23 bits which are contained either in the right-half (23 bits) of a 37-bit PS word or in the left-half (14 bits) of two consecutive PS words. In the latter case, the first word (even address) contains the 14 least significant and the second word (odd address) contains the 9 most significant bits of the translation word (see illustration below). Therefore one 16-module PS contains capacity for 131,072 right-half translation words and not more than 65,536 left-half translation words.

Note: Least significant bits are always the low-numbered (rightmost) bit positions. Most significant bits are always the high-numbered (leftmost) bit positions.

TRANSLATION WORDS
IN PROGRAM STORE



2.15 In some instances, as in the ***office code translation*** and in lists ***(eg, speed calling lists),*** 14-bit translation words are used. They usually occupy the left parts of the PS words, but may also appear in the right parts, thus wasting the unused nine bits.

2.16 Because of the separation of the PS word into the right-half and the left-half, there are two words at one address: a ***right-half word*** and a ***left-half word.*** The address is the same for both halves except that the address for the left-half word contains a binary one in bit position 20 (see Fig. 4). Therefore, the locations on the memory card of octal addresses of 1,300,000, 2,500,000, and 3,100,000 are equal to the location of the octal addresses of 5,300,000, 6,500,000, and 7,100,000 respectively. The only difference between the addresses is that the first set of addresses is for the right-half of the 44-bit PS word and the latter set of addresses is for the left-half of the 44-bit PS word.

Translators

2.17 A translator is all the data connected with a particular type of translation input. Because of growth considerations, most translators are broken into subtranslators linked together by a head table. In most cases, the head table is referenced to by a master head table (MHT). (See 2.19.) A subtranslator corresponds to a growth unit of the input. For instance, since the quantity of LENs in an office grows by ferreed line switch frames or remreed line switch circuits, an LEN subtranslator contains the data for 1024 LENs. In general, the input is divided into two parts, the subtranslator selector and the index. The selector is the number of the subtranslator; the index is the number of the item in the subtranslator. In some cases, the information required may not fit into the limited subtranslator space so auxiliary blocks and/or expansion tables may also be needed.

2.18 A full translator, therefore, can consist of a head table, subtranslators, scattered auxiliary blocks, abbreviated codes, subauxiliary blocks, and associated expansion tables. The Program Application Instruction PA-591003 (Translation Output Configuration) contains a full description of all the various types of translators and translation words.

Master Head Table

2.19 The address of all head and expansion tables is not fixed and therefore an MHT (formerly referred to as the head table) is used by the programs to locate nonfixed (floating) head tables and expansion tables. The MHT is 530 words long as shown in Figure 6. (Future generic program updates may change the characteristics of the MHT. Refer to PA-591003 for up-to-date MHT layouts.)

2.20 Certain items in the MHT point to the starting addresses of tables of data. Others point to head tables which, in turn, contain the addresses of subordinate tables of information known as subtranslators. The subtranslators, in turn, may provide pointers to auxiliary blocks of information. Auxiliary blocks for LENs and DNs are built only for data which cannot be made to fit conveniently in abbreviated code expansion tables. No other subtranslators use abbreviated codes.)

2.21 The MHT words are in a fixed sequence and can be considered as a fixed-location table. The generic program takes the starting address of this fixed-location table and by adding increments of one to this address can address any translation word in this table. For CTX-6 and later generic programs the fixed location table is no longer fixed in program store. These words are now known as the permanent table (permanent area) and will be pointed to by a word in the parameter area of PS.

Master Head Table Annex

2.22 Most generic programs have an additional MHT, referred to as the auxiliary MHT (or the MHT annex), which is located in the nonfixed

PS translation area. This nonfixed table was added to implement an improved cutover program (SACT) and in anticipation of future requirements. In all cases, the address of the auxiliary MHT is located in the 28th word (word number 27) of the fixed MHT (see Fig. 6). (With CC/SP-CTX-6 and later generic programs, the starting address location for the abbreviated code expansion tables is found in the MHT annex.)

Translator Types

2.23 Translation data exist in the PS as a collection of tables. The set of tables devoted to each type of input is called a ***translator.*** Corresponding to the various input types are line equipment translator, DN translator, 3/6-digit code translator, trunk network number translator, etc. Each set of tables (a translator) is linked according to a hierarchal pattern. Tables high in the hierarchy contain pointers to or addresses of lower tables. The lowest tables in the hierarchy (such as the subtranslator, the auxiliary block, or the abbreviated code expansion table) contain the actual translation data. Translators may be divided into two general types (types 1 and 2).

Translator Type 1

2.24 The type 1 translator consists of a maximum of six levels of information in a hierarchy. These levels are as follows:

Level	Name
1	Head table
2	Subtranslator
3	Primary translation word
4	Auxiliary block or expansion table
5	List
6	Subauxiliary block

2.25 The first level in the hierarchy is the head table. This head table serves as a directory for locating all translation data related to the input. This table usually contains an address of a subtranslator (the second level).

2.26 Each subtranslator corresponds to a growth unit of the central office. For instance, there is a subtranslator per line switch frame, per trunk switch frame, per 1000 DNs, etc.

2.27 The binary representation of the input to the type 1 translator is divided into two parts: the subtranslator ***selector*** and ***index.*** The selector and index can be visualized three different ways.

(a) The selector identifies the unit and the index identifies the item within the unit.

(b) The selector is the number of the subtranslator and the index is the number of the item within the subtranslator.

(c) The selector is the word number in the head table which contains the address of the subtranslator; the index is the word number in the subtranslator which contains the primary translation word.

2.28 For example, the master scanner translator (which has the master scanner number as its input) has the input divided into frame number as its selector and row and column number as its index. If information is desired on master scanner frame 3, row 4, and column 8, the address of the subtranslator in the fourth word of the head table and the primary translation word number in binary 0001001000 of the subtranslator is obtained. Figure 7 illustrates this example.

2.29 A subtranslator is a table which consists of one translation word per index. This word, the primary translation word, is the third level in the hierarchy and contains either the complete data associated with the input, or if one word is insufficient, an auxiliary address to an auxiliary block or expansion table (which is the fourth level). When the primary translation word contains an auxiliary address, the complete data associated with the input are contained in the auxiliary block words. To make the recognition of an auxiliary address possible, the first three bits of the subtranslator word contain zero. Therefore, ***any subtranslator primary translation word for which three leading bits are zero is interpreted as an auxiliary address.***

2.30 Another level, the fifth level of the translator, is the list (eg, speed calling list). The list is used when additional information other than the standard found in the auxiliary block is needed. The list, like the subtranslator, has an associated index. The address of the list may be found in one of the data words of the auxiliary block.

2.31 The last level is the subauxiliary block. The subauxiliary block is used if one word is insufficient to contain the information found in the list (eg, a 10-digit number for a speed call list is contained in a subauxiliary block). Therefore, like the subtranslator, the list may contain a subauxiliary address instead of the data usually found in the list.

Translator Type 2

2.32 The type 2 translator has only one table, called an expansion table or simply a table. This type of translator has only an index as its input. The translator is no more than a list of words. Like the subtranslator in the type 1 translator, it may or may not have auxiliary blocks associated with it.

2.33 An example of the type 2 translator is the unit type block length table (Fig. 8). The unit-type block length table is a list of words containing the quantity of subtranslator words per unit type. The input is the unit type. Therefore, to find the quantity of subtranslator words for any unit type, the unit type is used as the index. For example, for unit-type 3, the quantity of units is found in the fourth word of the table.

Subtranslators

2.34 The starting address of a subtranslator is found in the corresponding head table. The head table has entries for all of the units expected to be added during the engineered period. (At one time, head table lengths were built based on the ultimate size of an office. This method was determined to be wasteful and now most head tables are built based on an engineering period. The head tables are now based on engineering periods because they can always be expanded at the beginning of the next engineering period.) The subtranslator provides for one translation word per index, the ***primary translation word (PTW).*** Whenever the data associated with an input cannot be fitted into the primary translation word, auxiliary blocks or expansion tables are built. In this case, the primary translation word contains an auxiliary address referring to the auxiliary block or expansion table in order to obtain the desired information. The auxiliary address is the address of the word which contains the word number (WRDN) in its five most significant bits. This word is usually the first word of the auxiliary block.

> ***Note: When accessing primary translation words for DNs, the No. 1 ESS counts from one to zero instead of zero to one.*** This method of counting results in an unusual numerical sequence for the numbers. This sequence may require an adjustment period on the part of the user. Figure 9 provides a table of the numbering sequence. ***It is very important to understand the sequence especially when assigning sequential DNs.***

Abbreviated Class Codes (POTS)

2.35 In order to conserve space, short abbreviated codes are used to denote frequently occurring data which would require more space in their detailed form. For class codes, route indexes, etc, expansion tables are provided to obtain the detailed version of the abbreviated code.

2.36 An abbreviated class code is a method which stores frequently occurring common class-of-service information only once in memory. Each line or number fitting that class of service is referenced from the subtranslator to an appropriate abbreviated code expansion block. "Plain old telephone service" (POTS) abbreviated class codes are assigned on the 1502A (originating LEN) and 1502B (terminating DN) translation forms (see Translation Guide TG-1A). By using the abbreviated class codes method the requirement for redundant auxiliary blocks can be avoided and significant amounts of PS memory can be saved. At least 95 percent or more of all the lines and directory numbers which can be abbreviated should have abbreviated codes. ***The translations area should never have less than 80 percent of all POTS lines and numbers abbreviated (including those which cannot be abbreviated) and a 95 percent abbreviation level should be the goal.*** The following cannot be abbreviated:

(a) Speed calling

(b) Sleeve lead

(c) Four- and 8-party

(d) Combined special billing number and call forwarding

(e) Nonconsecutive series completion

(f) Call pickup.

2.37 Originating and terminating classes are automatically associated with the established 1502A and 1502B abbreviated class codes by the generic's recent change program. Upon entry and acceptance of a service order, the recent change program tries to match the equipment, features, options, and major class with existing codes. If a match is made, that abbreviated class code is assigned to the primary translation word. If there is or can be no match, an auxiliary block is built.

> ***Note: The network administrator is responsible for PS utilization, including effective use of abbreviated class codes.*** Refer to Dial Facilities Management Practices, Division H, Section 6h(2), Translation Area, for additional information on PS utilization.

Abbreviated Class Codes (Centrex)

2.38 An extremely critical area of PS administration is the abbreviation of centrex lines, especially when centrex customers are added to an in-service machine. Variations in the services provided to individual centrex lines can cause large amounts of memory to be used unless proper care is taken to establish the abbreviated classes. LEN (originating) abbreviation of centrex classes is accomplished by using an entry in the abbreviated class code record (1502A) to point to a supplementary abbreviated class code record (1503 series). Each 1503 form has a capacity of 128 abbreviated classes. Examination of the 1503 form and its instructions reveals the almost infinite variations of centrex lines and the memory which can be consumed if proper judgment is not exercised in abbreviation. ***Once the 1503 forms are initiated, all of the 128 supplementary abbreviated class codes should be used before adding another pointer from the abbreviated class code record to a new set of 1503 forms.*** (The only exception applies when code 127 is the only one left and a 2-line [5 word] code is required [eg, for centrex multiline hunt]. Code 127 should be used on the next opportunity.) Centrex DN abbreviation matching is accomplished in the same manner as it is for POTS (2.37). Centrex abbreviation goals are the same as the goals for POTS (2.36).

Updating Translations

2.39 Translations may be changed via messages typed into the system over TTY channels. These changes are stored temporarily in the recent change area of call store. Periodically, the program store translation cards are removed from the program store (one module at a time) and processed through the memory card writer which updates the PS. Translations and generic/parameter updates can also be effected by using Western Electric programs and updating methods (see 2.68).

Translation Sequence For Directory Numbers and Line Equipment Numbers

2.40 As described in 2.23 through 2.33, the generic program uses the translation data as a dictionary while peforming its call processing and other functions. The program is first directed to the MHT in translations to determine where it must look in memory to find the information it is seeking. The MHT in turn directs the program to a head table for a particular translation. The head table then directs the program to a subtranslator for the translation data. In most cases the subtranslator does not have enough space for all of the information required and the subtranslator in turn directs the program to auxiliary blocks for additional information.

2.41 In order to illustrate the translation sequence, the DN and LEN translators are discussed in 2.42 through 2.56. Both translators are type 1 translators.

Directory Number Translator

2.42 The DN translator is used for incoming or intraoffice calls. The following is an example of an intraoffice call. The raw input to the No. 1 ESS is the telephone number (for example, 727-6530) or the called party (see Fig. 10). The NNX or NXX digits (the first three digits of the number) are directly coverted to a 2-digit normalized office code (NOC) from the data supplied by the ESS 1501 input form. The NOC plus the last four digits are considered as the raw input to the translator. (For instance, NNX code 727 in the example above may have an NOC of 01.) The NOC is multiplied by ten and the fourth (thousanths) digit of the called number is added to the result. (When the fourth digit is zero, the number ten is added instead.) In the example, the transaction would be: 10 x 01 +6 = 16. This addition provides the translator with an index into the NOC-to-number-group-number (NGN) table (as shown in Fig. 10) in order to obtain the number group number.

2.43 The number group number is used as the selector to the DN head table (DNHT). Assuming that the number group number for the above example was three, the program would index to word three (fourth word) of the DN head table in order to obtain the starting address (selector) of the thousands block DN subtranslator for the number dialed. After going to that address, the program uses the last three digits of the dialed number (530) as the index to the proper primary translation word (the 380th word per Fig. 9) for that 1000-block number group.

2.44 The primary translation word will contain one of the following basic types of information:

(a) An abbreviated class code and LEN (individual and centrex lines)

(b) An abbreviated class code and route index

(c) An auxiliary address (individual and centrex lines)

(d) A start hunt (terminal) and multiline hunt group number

(e) An abbreviated class code and centrex number (for unassigned centrex lines).

2.45 The abbreviated class code (and its expansion table) and LEN provide the terminating class of service and equipment location for the line. The actual class of service is shown in the DN class (DNCL) word of the abbreviated class code expansion table. Other data on the DN class word include the presence or absence of either equipment or special feature options and the type of ringing required.

2.46 A route index is given when the particular DN has a major class of "intercept," "disconnected number", or "route to trunk group".

2.47 An auxiliary block is used when the terminating class has no abbreviated class code expansion table. A minimum of two auxiliary block words is required to give the LEN and class of service.

2.48 The fourth type of primary translation word in 2.44 is used for multiline hunt group arrangements.

2.49 PA-591003 (Translation Output Configuration) contains details on the various types of DN subtranslators, auxiliary blocks, and types of primary translation words. Section 466 of PA-591003 provides an explanation for terminating abbreviated class code for CTX-5 and earlier generics and Section 617 covers CTX-6 and later generics. Translation Guide TG-1A is also a helpful source of information.

Line Equipment Number Translator

2.50 The LEN translator provides originating class-of-service information for call processing purposes and the DN for charging purposes. The sequence of the LEN translator is shown in Figure 11. Each line switch frame has an entry on the LEN head table. When a party goes off-hook the LEN is obtained (for example, 02-2-1-2-1-02). The line link network and line switch frame numbers of the LEN (02-2) are used as the selector to find the proper subtranslator starting address for the LEN. The bay, concentrator, switch, and level part of the LEN (1-2-1-02) are used as the index in order to find the proper primary translation word of the possible 1024 words in the subtranslator. The primary translation word could point to an auxiliary block or could contain the associated DN and abbreviated class code. Unassigned LENs contain all zeros in the primary translation word.

2.51 The LEN subtranslator contains the following type of primary translation words:

(a) Type 1 containing all zeros for unassigned lines

(b) Type 2 containing the calling DN and the abbreviated class code

(c) Types 3 and 4 containing an abbreviated class code, terminal number, and multiline hunting group number

(d) Type 5 containing an auxiliary address

(e) Type 6 containing an abbreviated class code for centrex

(f) Types 7 and 8 containing an abbreviated class code and terminal number for centrex multiline hunting.

2.52 The resultant information of the LEN translator consists of the calling DN and the originating class of service. Class-of-service information includes the originating major class, equipment and special feature options, and the chart column. For its detailed form, class-of-service information occupies two translation words designated LENCL1 and LENCL2 (LENCL=LEN class word). The LENCL words, plus any optional words, provide the generic program with the features that a subscriber or main station has.

2.53 In the type 2 primary translation word, 17 bits are used for the DN (ten bits for the last three digits of a DN and seven bits for the number group number). The remaining six bits of the 23-bit translation word are used for abbreviated class codes for those classes of service which are not complex. The 6-bit binary coding would normally allow 64 binary combinations. However, since the first three bits (000---) in the translation word are used to represent auxiliary addresses (see 2.29) and all zeros designate unassigned lines, this reduces the number of possible abbreviated class codes per office. (Codes 000 through 007 cannot be used for this reason.)

2.54 Thirteen codes (8 through 20) are preassigned abbreviated class codes or are for other uses (see PA-591003). The remaining 43 may be assigned to service most frequently occurring in a particular office. (These restrictions apply to both the 1502A and 1502B forms.) The abbreviated class code expansion table contains two translation words (LENCL1, LENCL2) which provide the class-of-service information. Consequently, for many lines the primary translation word is sufficient for originating service and the translation data are stored only once in an abbreviated class code expansion table. All customers having identical service require one primary translation word for originating service translation. Lines which require specific information related only to a particular line, as is the case for abbreviated dialing, cannot use this arrangement.

2.55 Lines for which no abbreviated class code exists need a minimum of four translation words: one for auxiliary address, one for DNs, and two for the class-of-service information. If speed calling lists are involved, an additional auxiliary block (see 2.30) is required. Some numbers on the list are too large for the allotted area; therefore, an address reference to a subauxiliary block (see 2.31) is provided so that the number can be reached.

2.56 Sections 001 and 338 of PA-591003 should be used to obtain more information on the LEN translator and originating abbreviated class codes for CTX-5 and earlier generics. Section 001 and 616 should be used for CTX-6 and later generics. Also see Translation Guide TG-1A.

D. Spare Translation Words (Holes)

2.57 When an office is first cut over, the translations area is packed very tightly by the translations data asembler (TDA) process with few or no "holes" in memory. A hole is an area of PS where a translation word or a series of words is not currently used for data storage; at the same time, memory space on either side of the unused words is either used or not available.

2.58 The size of a hole depends upon the number of adjacent unused words that creates the hole. A hole can be created when an auxiliary block for a translation item is taken out. Most holes are created by DN and LEN changes. The area which formerly contained data is deactivated by a card write and should no longer be referenced. Adjacent holes can therefore be created; for example, if a DN or LEN auxiliary block is located adjacent to an existing hole, is taken out of service, and is not reused. (Two or more holes of the same or varying sizes may be adjacent. The generic program, on its own, is not capable of linking adjacent holes to make a larger hole.)

Link List Tables

2.59 Link list tables are used to keep track of available space (holes) in the translation area. The recent change program requires the locations of available space in order to input new data into translations (such as service order data for line and directory numbers). There are separate link list tables for right-half and left-half PS translation words. One difference between the right and left link list tables is that the right represents holes with 23-bit words while the left represents holes with 14-bit words.

2.60 The link list table consists of lists of the starting address of the first hole for each hole size. See Figures 12 and 13 for pictorial representations of the right- and left-half hole tables. The first word in the table is always a zero since there is no such thing as a hole with no length (ie, size=zero). The next 32 words are the starting addresses of available right-half (if right-half hole table) or left-half (if left-half hole table) holes starting with holes of size one and proceeding in steps of one up to the hole size of 32-or-greater. Holes of a particular size are linked by a chain of pointers to the next available hole of the same size. (All hole sizes 32-or-greater are considered to be the same size.) The linking is accomplished on the right half when the first hole is accessed by its address on the link list table (see Fig. 14). The first word of that hole will contain the address of the next hole of the same size. This procedure is continued until there are no more holes of the same size available, in which case the first word will be all zeros. If there are no holes of a given size, then the link list table will contain all zeros instead of an address. The second word of a right hole (if there is a second word) contains the number of words in the hole.

2.61 Left-half hole linking is slightly different from right-half hole linking (see Fig. 15). A full 23-bit translation word is required in order to specify an address. Therefore, for the left half two consecutive words are needed to specify an address. The first word of the hole contains the 14 least significant bits of the address and the second word contains the 9 most significant bits. The third and fourth words (if they exist) contain the number of words in the hole.

2.62 In the left-half link list table, all the words for the address of odd-sized holes will contain zeros since there can be no odd-sized left-half hole. There are no odd-sized left-half holes because all translators using 14-bit words always use even numbers of 14-bit left-half words. Therefore, when a 14-bit word translator or table is deactivated, it must leave an even-sized hole.

Hole Table Printout

2.63 The network administrator can obtain a listing of available right- or left-half holes by using a ***verify space*** (VFY-SPACE) TTY message. This listing, called the ***hole table printout,*** lists all the hole sizes and indicates the quantity available (in octal) for each size. (See Dial Facilities Management Practices, Division H, Section 6h(2), Memory Administration, Translation Area, for an explanation of the method for verifying space.)

2.64 The hole table for the left half represents available 14-bit words. Therefore, a left-half hole size of two represents two consecutive 14-bit words or one 23-bit left-half translation word.

2.65 The hole table for the right half represents available 23-bit words. Therefore, a right-half hole size of two represents two consecutive 23-bit words or two 23-bit translation words.

2.66 To determine the total spare ***translation words*** for both left and right halves, the hole table printout results are totaled separately for each half. The left-half total is divided by two to equate the result to translation words. The right-half total needs no adjustment.

Subtranslator Sizes

2.67 Sizes of selected head tables, subtranslators, lists, and auxiliary blocks are shown in Division H, Section 6h(2), Translation Area. The list also shows the half of the program store word to which each applies.

SUPPORT PROGRAMS

2.68 There are support programs for the translations area of PS. These are the translation area analysis (TAA), translation retrofit repack (TRR), translation repack to implement memory savings (TRIMS), and auxiliary test programs (APT-01 through APT-06). The first three programs above are run at the Western Electric regional centers and are a part of the Translation Data Recovery and Reprocessing System Service (TDRSS). Auxiliary test programs (commonly referred to as the mod 5 program series) are run on-site.

2.69 The E-8086 forms are used for requesting runs for TAA, TRR, and TRIMS. The forms enable the user to specify the options that are required for a particular office.

A. Translation Area Analysis

2.70 The TAA program will accept translations data copied from the PS of an in-service or precut No. 1 ESS office. TAA will locate and list the structural defects that exist in the translation area. The defects are as follows:

(1) Out of range addresses

(2) Invalid block sizes

(3) Duplicate pointers

(4) Invalid pointers

(5) Overlapping tables

(6) Broken link lists

(7) Link list loops

(8) Lost memory locations

(9) Invalid LEN shared speed calling lists.

2.71 In addition to the list of defects, the system will produce a set of magnetic and functional listings. The magnetic listing shows the actual contents (in octal) of all the translation data just as they appear address by address. The functional listing shows how the various translators and subtranslators are linked together and allows for decoding auxiliary blocks or other required information.

2.72 The last part of the TAA listing provides a summary of the abbreviated codes in the office and provides a tabulation of their use and the percentage of abbreviation of the office. This part of the TAA also provides recovered copies of the equivalent translation forms 1500A, 1502A, 1502B, and appropriate 1503 forms. The recovered abbreviated class code forms contain the individual major class in the remarks column.

2.73 Together, all of the listings discussed in 2.70 through 2.72 provide a complete picture of the office translations at the time that they were copied.

2.74 Some of the basic reasons for an analysis of a No. 1 ESS office translation area using TAA are as follows:

(1) To verify that link list entries do not overlap or duplicate areas of program store assigned to tables of valid translation data

(2) To verify that a table of translation data from one translator does not overlap with a different table, or tables, of translation data from the same or a different translator

(3) To identify all PS locations that are not assigned to translators or link lists (eg, lost space)

(4) To obtain a summary of office abbreviation.

B. Translation Retrofit Repack

2.75 The TRR is a program that will produce a memory card magnetization tape which contains a complete repack of translation data recovered from an in-service or precut No. 1 ESS office. The fragmented and lost link list space is recovered and consolidated by the program. Except for reassignment of addresses the translation data are identical to the data recovered from the office.

2.76 A repack is the relocation of translation data. It provides additional PS space for the following purposes:

(a) A generic program retrofit

(b) Translation growth for DN translators, special services, etc.

C. Translation Repack to Implement Memory Savings

2.77 The TRIMS program is designed to recover No. 1 ESS PS space from the translation data area.

2.78 TRIMS uses data files which are created by the TAA. These data files are changed by TRIMS to provide more efficient use of the PS space.

2.79 The primary area where PS spare is recovered is auxiliary block data. Auxiliary block data usually require from two to five words. There are larger auxiliary blocks but these are usually impossible to abbreviate. Some of the data represented by auxiliary blocks can be represented by an abbreviated code. The abbreviated code data are stored in a fixed-length table which is kept in every office. By a process of converting the data represented by auxiliary blocks to abbreviated codes the auxiliary block space is recovered.

2.80 TRIMS also has the capability to convert abbreviated code data back to auxiliary block data. This means that an abbreviated code, which is infrequently referenced, can be converted to an auxiliary block. New data, which make better use of the abbreviated code, can then be substituted.

2.81 A second translation data area where space can be recovered is the head table sizes. Each office has an MHT which contains, among other features, pointers to the various head tables. These head tables have fixed and variable lengths. Some of the variable-length tables have been built two or three times larger than the office could reasonably be expected to use. The head table lengths can now be built on an engineering period basis. Previously, these tables were built to reflect the life of the office. It is recommended that the head tables be built for the engineered period only.

2.82 TRIMS can produce additional economies which are not quantifiable. This would include possibly extending intervals between translation updates of recent change service orders. It can also reduce the number of modules written on each update. The changes to head tables can reduce the amount of related call store space required.

2.83 A TRIMS can be run for analysis only without actually implementing the results in a repack. The advantage of such a run would be to discover if additional abbreviated codes are required or are no longer needed. The actual implementation of the TRIMS could be inputted via ESS 1502 and 1503 forms if abbreviation of existing auxiliary blocks is not desired or required. This method, however, is not normally advantageous.

D. Auxiliary Test Programs

2.84 The auxiliary test programs (offices having this feature may refer to PA-1A500 for the most up-to-date information on features applicable to auxiliary test programs) consist of software information on PS memory cards in a memory module called the auxiliary test module. These programs are loaded in PS only when required. The programs enable the No. 1 ESS central processor to perform specialized low-priority tests. The programs available are numbered APT-01 through APT-06 (these numbers are called auxiliary program package numbers). ***The network administrator is primarily interested in programs APT-02 and APT-03.***

2.85 An auxiliary test module usually contains several distinct programs or options. When a test module is in a PS, the individual program or option desired is requested via TTY input messages at the master control center. Auxiliary test modules are always loaded into physical module 05 (H-half) of PS0 or its duplicate module 15 (G-half) of PS1. Hence, the name ***mod 5 program*** is sometimes used in place of ***auxiliary test programs.***

2.86 A synopsis of the features provided by each auxiliary test program contained in each auxiliary test program package is given in 2.87 through 2.91.

Features of APT-02 and APT-03

APT-02 Package

2.87 Auxiliary program package APT-02 contains the following auxiliary test programs.

(a) the automatic message accounting data retrieval and insertion program, XDRI, is used to record PS data on the automatic message accounting tape in a standard tape format. The program can also record call store data on automatic message accounting tape in a nonstandard tape format designed to be read by the automatic message accounting unit and, under control of XDRI, reinserted into call store. This facility will be used to expedite the translation repack procedure and provide a recent change protection feature.

(b) The data link transmission program, XDLT, is to be used with the No. 1 ESS data link circuit and its associated hardware and data set. This program will permit PS and call store data to be transmitted to or received from other facilities capable of receiving or sending such data. The data link facility will be used, primarily, to improve the translation repack procedure for No. 1 ESS. The data link consists of a data link circuit, a data set, and a data auxiliary set.

(c) The data link diagnostic program, XDLD, will diagnose the data link circuit with all of its hardware and will test the data set.

(d) The data mapping program, XMAP, has been designed to eliminate the principal service interruptions caused by planned office restarts. This program is used when any of the following changes are made:

(1) Generic program replacement

(2) Office parameter data changes

(3) Translation data regeneration.

XMAP limits service interruptions to subscriber lines which are in the process of being set up. These lines are simply restored to idle and treated as originations following the restart.

(e) Auxiliary program package APT-02 also contains program XBUS.

APT-03 Package

2.88 Auxiliary program package APT-03 contains the following auxiliary programs.

(a) The translation check program, XLCK, is used to detect certain irregularities in an office's translation data, primarily in its allocation of memory. The program is designed to detect the following errors:

(1) Lost memory; that is, memory that is not on any idle linked list nor a part of any translation

(2) Overlapping memory invalidly shared by two or more translations

(3) Idle linked lists that loop or point outside the translation area of PS

(4) Auxiliary blocks longer than 2050 words.

(b) The PS copy, compare, and dump program, XCMP, allows a block of PS data to be relocated via the recent change area. The need for such a capability often arises during retrofit and growth activities. This program has features which make it an alternative to the use of the T-PATTERN input message sometimes used for verification of the contents of PS.

(c) Auxiliary program packages APT-03 also contains XBUS for testing the peripheral, call store, and PS buses.

(d) Newer versions of APT-03 also contain a translations search program called XTRS. XTRS is a general-purpose program for searching translators. Its basic function permits a user to select an octal number and search certain translators for matching bits. When a match is found, the program will print the associated translation information or optional information if selected. The program permits the user to select specific translators, types of matches, and printing programs as needed. It is possible, for instance, to determine DN and LEN abbreviation percentages using XTRS.

Other APT Programs
APT-04 Package

2.89 Auxiliary program package APT-04 contains auxiliary program XBBT. This board-to-board test program (XBBT) is used in conducting tests on lines that are being transferred from an old office to be removed from service or a working office on an area transfer basis to a new or growth No. 1 ESS office. The purpose of XBBT is to ensure that the connection of these lines to the new office is correct with respect to the existing connections in the older office. XBBT, under program control, connects to lines in the old office effectively simulating the test actions manually done by test desk maintenance personnel at the test desk using "no-test" trunks.

APT-05 Package

2.90 Auxiliary program package APT-05 contains the following auxiliary programs.

(a) The XLVF program is used to test the fabric of ferreed junctor switching frames or remreed junctor switch circuits. Fabric means all of the B-links, C-links, junctors, and crosspoints associated with a junctor switch frame or a junctor switch circuit. Tests are made for:

(1) Intrapath shorts, grounds, continuity, and up-ring reversals

(2) Interpath shorts (crosses)

(3) Crosspoints which are stuck open or closed.

(b) The SXCN program is used for testing scanner circuits. Input messages allow the option of testing all scanners in an office, of selecting either line, master, junctor or universal trunk scanners, or of selecting a particular frame. Test results, either passing or failing, are printed. A manual loop mode aids in troubleshooting scanner faults.

(c) Auxiliary program package APT-05 also contains program XBUS.

APT-06 Package

2.91 Auxiliary program package APT-06 contains the following auxiliary programs.

(a) The parameter/translation verification program, XPTV, is used to compare new parameter data with existing parameter data before the office begins using the new data. Set card value differences are found and printed. In addition, certain consistency checks are made between information found in both parameters and translations; for example, central pulse distributor enables found in the parameters compared with central pulse distributor enables found in the unit type translator. Consistency checks are also made on the quantity of members as specified in parameters and in translations.

(b) Auxiliary program package APT-06 also contains program XMAP.

3. REFERENCES

3.01 Additional information on PS hardware or software may be found in the following references:

(a) Dial Facilities Management Practices, Division H, Section 6h.

(b) PA-1A500, PA-591001, PA-591003, and PA-591092

(c) Bell System Practices

(d) The No. 1 ESS Translation Guide, TG-1A

(e) Traffic Facilities Practices

TABLE A

PROGRAM STORE

MODULES REQUIRED FOR GENERIC PROGRAM AND OFFICE PARAMETERS

GENERIC PROGRAM	UNDUPLICATED MODULES FOR PROGRAMS PLUS PARAMETERS	MAXIMUM PROGRAM STORES IN CONTROL GROUP
CC – 1	18	6
CC – 2	19	6
CC – 3	20	6
SP – 1	24	6
CC – CTX – 1	22	6
CC – CTX – 2	24	12
CC – CTX – 4	26	12
CC – CTX – 6	30	12
CC – CTX – 7	33	12
CC – CTX – 8*	33–37	12
SP – CTX – 1	26	6
SP – CTX – 3	29	12
SP – CTX – 4	30	12
SP – CTX – 5	31	12
SP – CTX – 6	35	12
SP – CTX – 7	37	12
SP – CTX – 8*	37–41	12

*Number of modules estimated

Note: This table identifies the quantity of unduplicated program store modules required for generic program and office parameters. The number of modules depends upon the generic program used and, except for CTX-8, is the same for all offices using that generic, regardless of size or features. See Traffic Facilities Practices, Division D, Section 10g, for up-to-date module requirements.

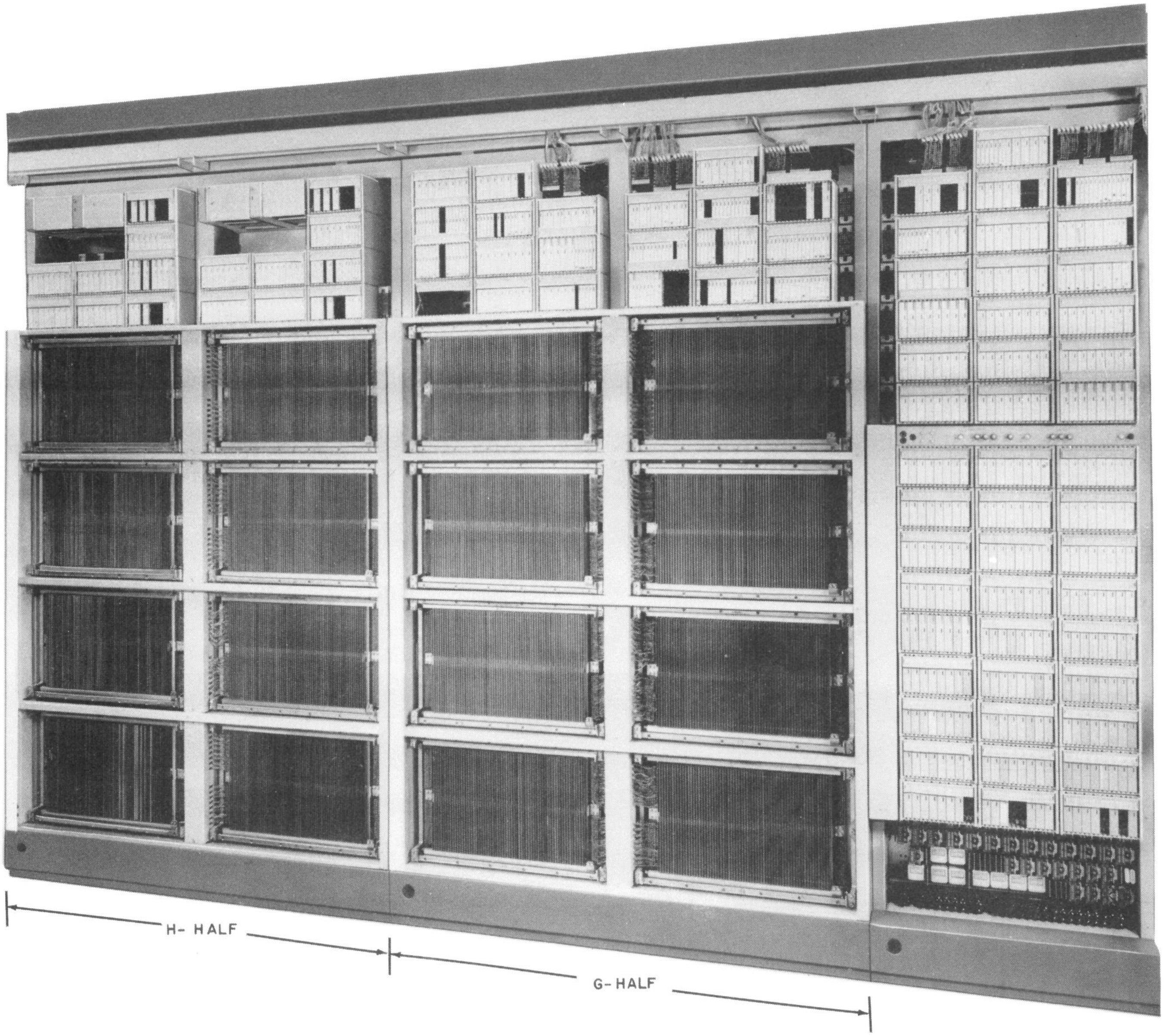


Fig. 1—PS Frame (2.02, 2.05)

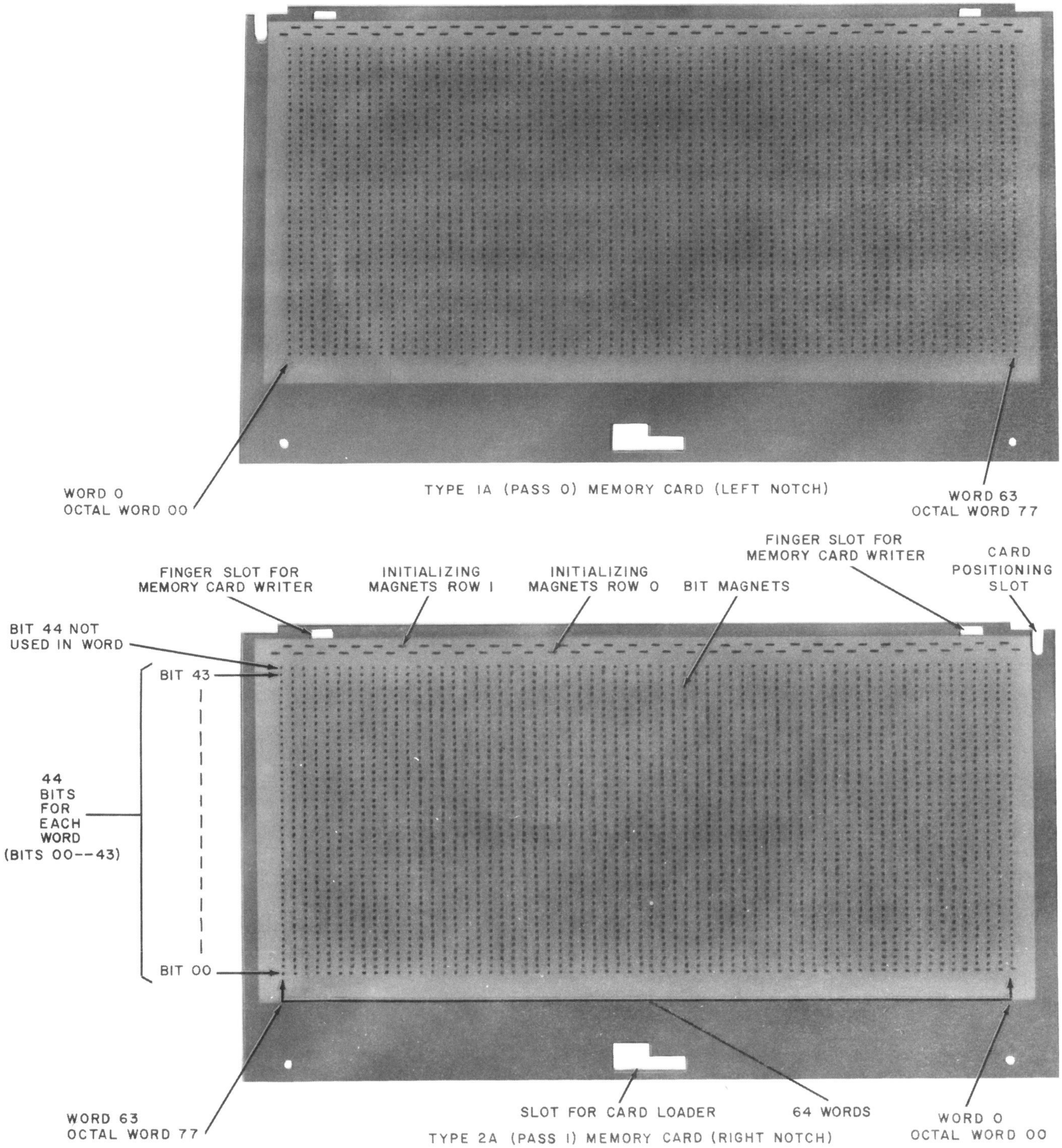


Fig. 2—Memory Cards (2.04)

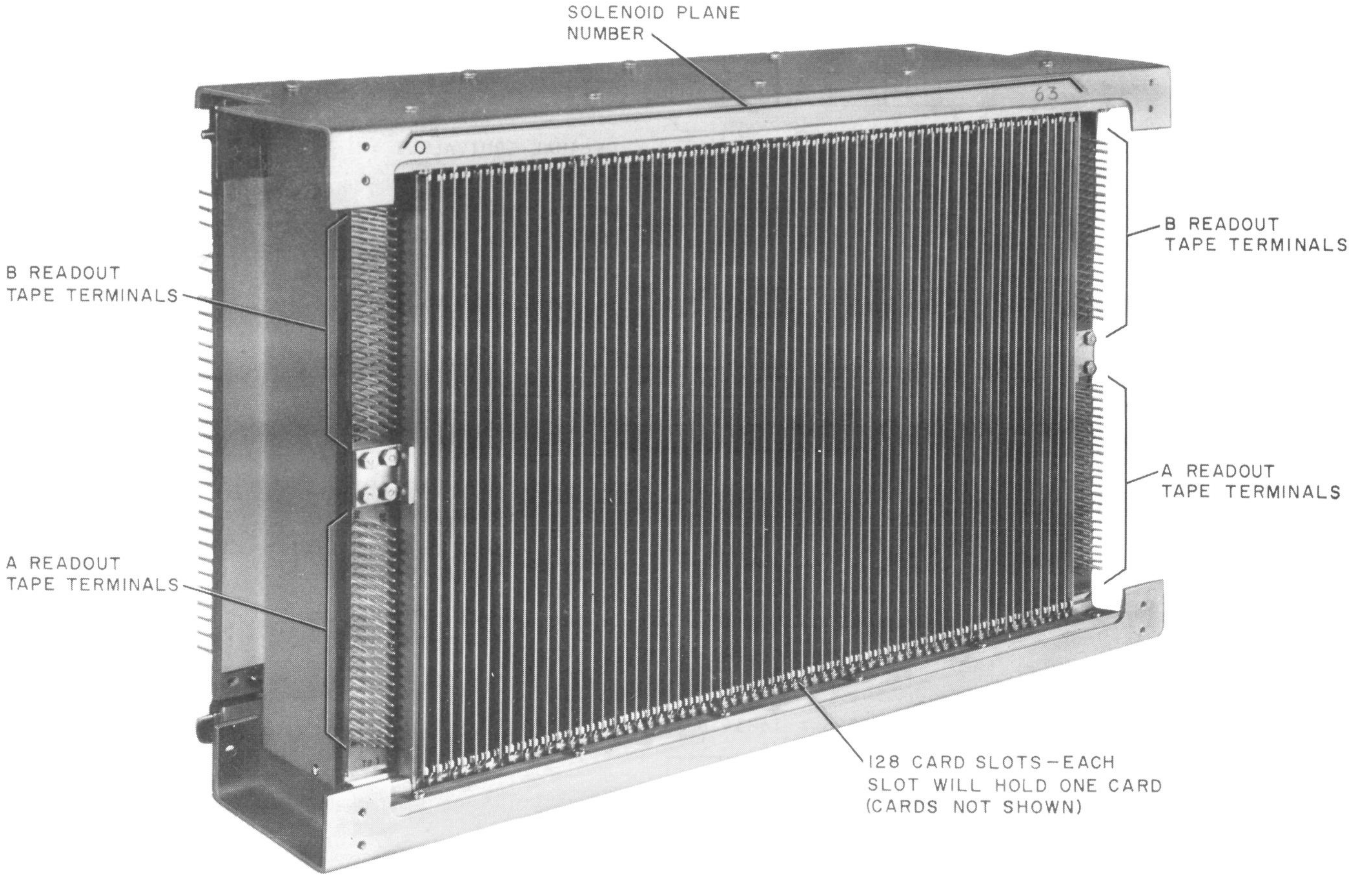
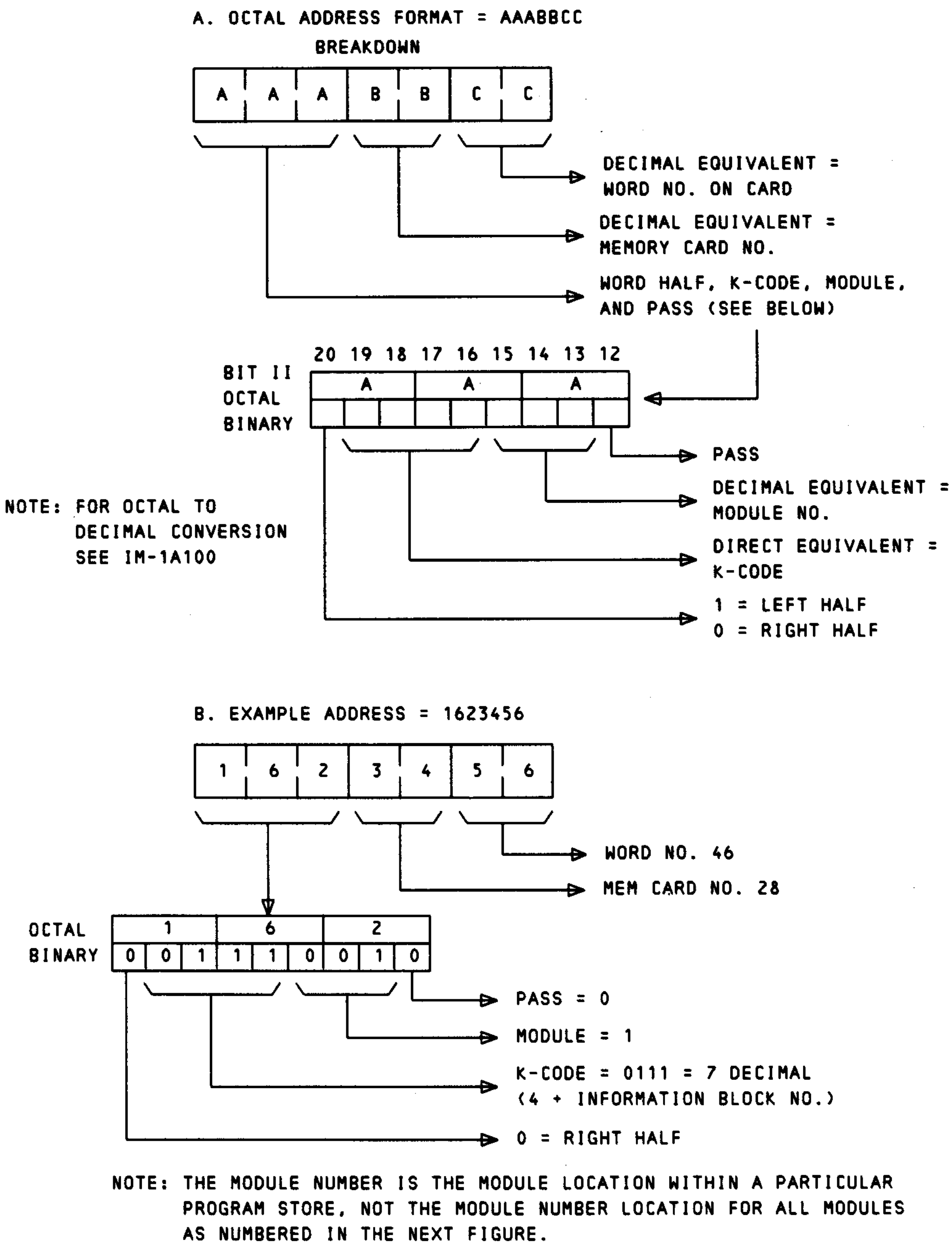


Fig. 3—Memory Module (2.04)



WHERE:

BIN	DEC
0000	0
0001	1
0010	2
0011	3
0100	4
0101	5
0110	6
0111	7
1000	8
1001	9
1010	10
1011	11
1100	12
1101	13
1110	14
1111	15

Fig. 4—Analysis of PS Address (2.06, 2.16)

PS NUMBER	PS-1		PS-0		PS-2		PS-3		PS-4		PS-5		PS-6		PS-7		PS-8		PS-9		PS-10		PS-11	
PS HALF	H	G	H	G	H	G	H	G	H	G	H	G	H	G	H	G	H	G	H	G	H	G	H	G
	VARIABLE	03 07	03 07	13 17	13 17	23 27	23 27	33 37	33 37	43 47	43 47	53 57	53 57	63 67	63 67	73 77	73 77	103 107	103 107	113 117	113 117	123 127	123 127	133 137
VARIABLE — SAME AS G HALF		02 06	02 06	12 16	12 16	22 26	22 26	32 36	32 36	42 46	42 46	52 56	52 56	62 66	62 66	72 76	72 76	102 106	102 106	112 116	112 116	122 126	122 126	132 136
OF HIGHEST		01 05	01 05	11 15	11 15	21 25	21 25	31 35	31 35	41 45	41 45	51 55	51 55	61 65	61 65	71 75	71 75	101 105	101 105	111 115	111 115	121 125	121 125	131 135
STORE		00 04	00 04	10 14	10 14	20 24	20 24	30 34	30 34	40 44	40 44	50 54	50 54	60 64	60 64	70 74	70 74	100 104	100 104	110 114	110 114	120 124	120 124	130 134
PS BAY NO.	0 1	2 3	0 1	2 3	0 1	2 3	0 1	2 3	0 1	2 3	0 1	2 3	0 1	2 3	0 1	2 3	0 1	2 3	0 1	2 3	0 1	2 3	0 1	2 3

PROGRAM INFORMATION BLOCK — VARIABLE | ← 0 → | ← 1 → | ← 2 → | ← 3 → | ← 4 → | ← 5 → | ← 6 → | ← 7 → | ← 8 → | ← 9 → | ← 10 → | ← 11 → |

LAST ADDRESS OF MEMORY BLOCK — 1177777, 1377777, 1577777, 1777777, 2177777, 2377777, 2577777, 2777777, 3177777, 3377777, 3577777, 3777777

START ADDRESS OF MEMORY BLOCK — 1000000, 1200000, 1400000, 1600000, 2000000, 2200000, 2400000, 2600000, 3000000, 3200000, 3400000, 3600000

PROGRAM MOD. NO.	STARTING ADDRESS	ENDING ADDRESS	PROGRAM MOD. NO.	STARTING ADDRESS	ENDING ADDRESS	PROGRAM MOD. NO.	STARTING ADDRESS	ENDING ADDRESS	PROGRAM MOD. NO.	STARTING ADDRESS	ENDING ADDRESS
00	1000000	1017777	30	1600000	1617777	60	2400000	2417777	110	3200000	3217777
01	1020000	1037777	31	1620000	1637777	61	2420000	2437777	111	3220000	3237777
02	1040000	1057777	32	1640000	1657777	62	2440000	2457777	112	3240000	3257777
03	1060000	1077777	33	1660000	1677777	63	2460000	2477777	113	3260000	3277777
04	1100000	1117777	34	1700000	1717777	64	2500000	2517777	114	3300000	3317777
05	1120000	1137777	35	1720000	1737777	65	2520000	2537777	115	3320000	3337777
06	1140000	1157777	36	1740000	1757777	66	2540000	2557777	116	3340000	3357777
07	1160000	1177777	37	1760000	1777777	67	2560000	2577777	117	3360000	3377777
10	1200000	1217777	40	2000000	2017777	70	2600000	2617777	120	3400000	3417777
11	1220000	1237777	41	2020000	2037777	71	2620000	2637777	121	3420000	3437777
12	1240000	1257777	42	2040000	2057777	72	2640000	2657777	122	3440000	3457777
13	1260000	1277777	43	2060000	2077777	73	2660000	2677777	123	3460000	3477777
14	1300000	1317777	44	2100000	2117777	74	2700000	2717777	124	3500000	3517777
15	1320000	1337777	45	2120000	2137777	75	2720000	2737777	125	3520000	3537777
16	1340000	1357777	46	2140000	2157777	76	2740000	2757777	126	3540000	3557777
17	1360000	1377777	47	2160000	2177777	77	2760000	2777777	127	3560000	3577777
20	1400000	1417777	50	2200000	2217777	100	3000000	3017777	130	3600000	3617777
21	1420000	1437777	51	2220000	2237777	101	3020000	3037777	131	3620000	3637777
22	1440000	1457777	52	2240000	2257777	102	3040000	3057777	132	3640000	3657777
23	1460000	1477777	53	2260000	2277777	103	3060000	3077777	133	3660000	3677777
24	1500000	1517777	54	2300000	2317777	104	3100000	3117777	134	3700000	3717777
25	1520000	1537777	55	2320000	2337777	105	3120000	3137777	135	3720000	3737777
26	1540000	1557777	56	2340000	2357777	106	3140000	3157777	136	3740000	3757777
27	1560000	1577777	57	2360000	2377777	107	3160000	3177777	137	3760000	3777777

Note 1: All values are octal except PS numbers and program information blocks.

Note 2: The ***program modules*** are numbered above with octal values of 00 to 137 to facilitate location within the offices entire PS complement; however, when a PS address is specified, the ***PS module number*** derived from this address is always an absolute octal value of 0 to 7. The following is a layout of a PS showing the absolute octal value of each module within each PS half:

H		G	
03	07	03	07
02	06	02	06
01	05	01	05
00	04	00	04

Fig. 5—Physical Location of PS Modules and Addresses (2.06)

MASTER HEAD TABLE STARTING VARIABLE ADDRESS FOUND BY T-READING ADDRESS 1105615

INDEX NO. DECIMAL	INDEX NO. OCTAL	22 — 0
0	0	ADDRESS OF HEAD TABLE FOR TN OR DN
1	1	ADDRESS OF HEAD TABLE FOR OE OR LEN
2	2	ADDRESS OF HEAD TABLE FOR RAC AND FAT
3	3	ADDRESS OF HEAD TABLE FOR TNN TO PEN
4	4	ADDRESS OF HEAD TABLE FOR TNN TO TGN
5	5	ADDRESS OF HEAD TABLE FOR UTSN TO TNN
6	6	ADDRESS OF TGN SUPPLEMENTARY TRANSLATOR
7	7	ADDRESS OF HEAD TABLE FOR MSN
8	10	ADDRESS OF TGN PRIMARY TRANSLATOR
9	11	ADDRESS OF TRUNK CLASS EXPANSION TABLE
10	12	ADDRESS OF NOC TO NO. GROUP NO. TABLE
11	13	ADDRESS OF HEAD TABLE FOR MLH GROUPS
12	14	ADDRESS OF HEAD TABLE OF CHART COLUMN
13	15	ADDRESS OF ROUTE INDEX EXPANSION TABLE
14	16	ADDRESS OF CHARGE INDEX EXPANSION TABLE
15	17	ADDRESS OF HEAD TABLE FOR CENTREX COMMON BLOCK
16	20	UNASSIGNED
17	21	ADDRESS OF HEAD TABLE FOR CPDN
18	22	ADDRESS OF USOC TRANSLATOR
19	23	ADDRESS OF AUTOMATIC TRUNK TEST TABLE
20	24	ADDRESS OF INCOMING TRUNK CHART TABLE
21	25	ADDRESS OF HEAD TABLE FOR RATE AND ROUTE PATTERN
22	26	ADDRESS OF HEAD TABLE FOR TRAFFIC LIST: H SCHEDULE
23	27	ADDRESS OF HEAD TABLE FOR TRAFFIC LIST: C SCHEDULE
24	30	ADDRESS OF TRAFFIC LIST: SELECTED CONCENTRATOR TABLE
25	31	ADDRESS OF TRAFFIC LIST: SELECTED LINES TABLE
26	32	ADDRESS OF HEAD TABLE FOR TANDEM SWITCHING
27	33	ADDRESS OF MASTER HEAD TABLE ANNEX
28	34	ADDRESS OF HEAD TABLE FOR SFGN
29	35	ADDRESS OF NOGR TO RAC TABLE
30 – 93	36 – 135	UNIT TYPE TRANSLATOR (64 WORDS) (SEE TABLE B)
94	136	OFFICE OPTION TABLE (20 WORDS)
114 – 143	162 – 217	HEADTABLE LENGTHS (30 WORDS) (SEE TABLE A)
144 – 207	220 – 317	UNIT TYPE TABLE LENGTHS (64 WORDS) (SEE TABLE C)
208	320	RIGHT HALF LINK LIST (33 WORDS)
241	361	LEFT HALF LINK LIST (33 WORDS)
274	422	JUNCTOR CIRCUIT NO. TO JNN (32 WORDS)
306	462	JUNCTOR NETWORK NUMBER TO JUNCTOR NETWORK OR SCANNER NUMBER (16 WORDS)
322	502	JNN TO JUNCTOR SCANNER NUMBER (16 WORDS)
338	522	
466	722	

MASTER HEAD TABLE ANNEX

INDEX NO. DECIMAL	INDEX NO. OCTAL	22 — 0
-1	-1	LENGTH OF ANNEX TABLE + 2 *
0	0	ADDRESS OF R/A PHASE AND RCVR MASK HEAD TABLE
1	1	ADDRESS OF JNNL TO SJN HEAD TABLE
2	2	ADDRESS OF TNN TO SJN HEAD TABLE
3	3	ADDRESS OF RAC AND FAT STATUS TABLE
4	4	ADDRESS OF DN TO CTXN TRANSLATOR
5	5	ADDRESS OF ALTERNATE DN HEAD TABLE
6	6	ADDRESS OF SPECIAL DN LIST
7	7	ADDRESS OF IDDD TRANSLATOR
8	10	ADDRESS OF AIOD TALKING PATH ASSIGNMENT TABLE
9	11	ADDRESS OF ATG TO TGN TRANSLATOR
10	12	ADDRESS OF PLANT MEASUREMENTS TRANSLATOR
11	13	ADDRESS OF CAMA TRANSLATOR
12	14	ADDRESS OF ROUTE SEQUENCE NUMBER TRANSLATOR
13	15	ADDRESS OF 3/6 DIGIT TRANSLATOR FOR FRS
14	16	ADDRESS OF ROUTE DESCRIPTION NUMBER TRANSLATOR
15	17	RESERVED FOR FAT TRANSLATOR ADDRESS
16	20	ADDRESS OF LEN ABBREVIATED CODE EXPANSION TABLE
17	21	ADDRESS OF DN ABBREVIATED CODE EXPANSION TABLE
18	22	ADDRESS OF TOLL DIGIT-BY-DIGIT TRANSLATOR FOR TOLL TRUNKS
19	23	ADDRESS OF TOLL 3/6 DIGIT TRANSLATOR FOR TOLL TRUNKS †
20	24	ADDRESS OF CUSTOMER TRAFFIC GROUP TRANSLATOR
21	25	ADDRESS OF TRAFFIC LIST: SELECTED Q SCHEDULE
22	26	RESERVED FOR ESB EXPANSION TABLE ADDRESS
23	27	RESERVED FOR 911 DN ESB HEAD TABLE ADDRESS
24	30	ADDRESS OF DATA GROUP TRANSLATOR
25	31	ADDRESS OF PSEUDO ROUTE INDEX TRANSLATOR
26	32	ADDRESS OF ALTERNATE SERVICE POOL TRANSLATOR
27	33	ADDRESS OF MASK BLOCK TRANSLATOR
28	34	ADDRESS OF SIGNAL DIGIT ANALYSIS TRANSLATOR
29	35	ADDRESS OF NON-USAGE TRUNK SCAN TRANSLATOR
30	36	ADDRESS OF CUSTOMER TRAFFIC LABEL TRANSLATOR
31	37	ADDRESS OF CLAM MASK BLOCK TRANSLATOR
32	40	ADDRESS OF CENTREX SUPPLEMENTARY TRANSLATOR
33	41	UNASSIGNED
34	42	UNASSIGNED
35	43	UNASSIGNED
36	44	UNASSIGNED
37	45	UNASSIGNED
38	46	UNASSIGNED
39	47	UNASSIGNED

LEGEND

AIOD - AUTOMATIC IDENTIFIED OUTWARD DIALING
ATG - AUTOVON TRUNK GROUP
CAMA - CENTRALIZED AUTOMATIC MESSAGE ACCOUNTING
CLAM - COIN LINE ACTIVITY MONITORING
CPDN - CENTRAL PULSE DISTRIBUTOR NUMBER
CTXN - CENTREX GROUP NUMBER
DN - DIRECTORY NUMBER
ESB - EMERGENCY SERVICE BUREAU
FAT - FOREIGN AREA TRANSLATOR
FRS - FLEXIBLE ROUTE SELECTION
IDDD - INTERNATIONAL DIRECT DISTANCE DIALING
JNNL - JUNCTOR NETWORK NUMBER (LINE SIDE)
LEN - LINE EQUIPMENT NUMBER
MLH - MULTILINE HUNTING
MSN - MASTER SCANNER NUMBER
NOC - NORMALIZED OFFICE CODE
NOGR - NUMBER GROUP
PEN - PERIPHERAL EQUIPMENT NUMBER
R/A - RINGING/AUDIBLE
RAC - RATE CENTER
RCVR - RECEIVER
SFGN - SIMULATED FACILITIES GROUP NUMBER
SJN - SERVICE JUNCTOR NUMBER
TGN - TRUNK GROUP NUMBER
TNN - TRUNK NETWORK NUMBER
TSN - TRUNK SCANNER NUMBER
USOC - UNIVERSAL SERVICE ORDER CODE
UTSN - UNIVERSAL TRUNK SCANNER NUMBER

* USED FOR CTX-7 AND LATER GENERICS ONLY.
† STARTING WITH CTX-6 AND CTX-7 ISSUE 8 AND CTX-8 ISSUE 3 GENERIC PROGRAMS, THE 3/6 DIGIT TRANSLATOR FOR TOLL TRUNKS WILL BE COMBINED WITH MASTER HEAD TABLE +2 TRANSLATOR.

Fig. 6—Master Head Table and Master Head Table Annex (2.19, 2.22)

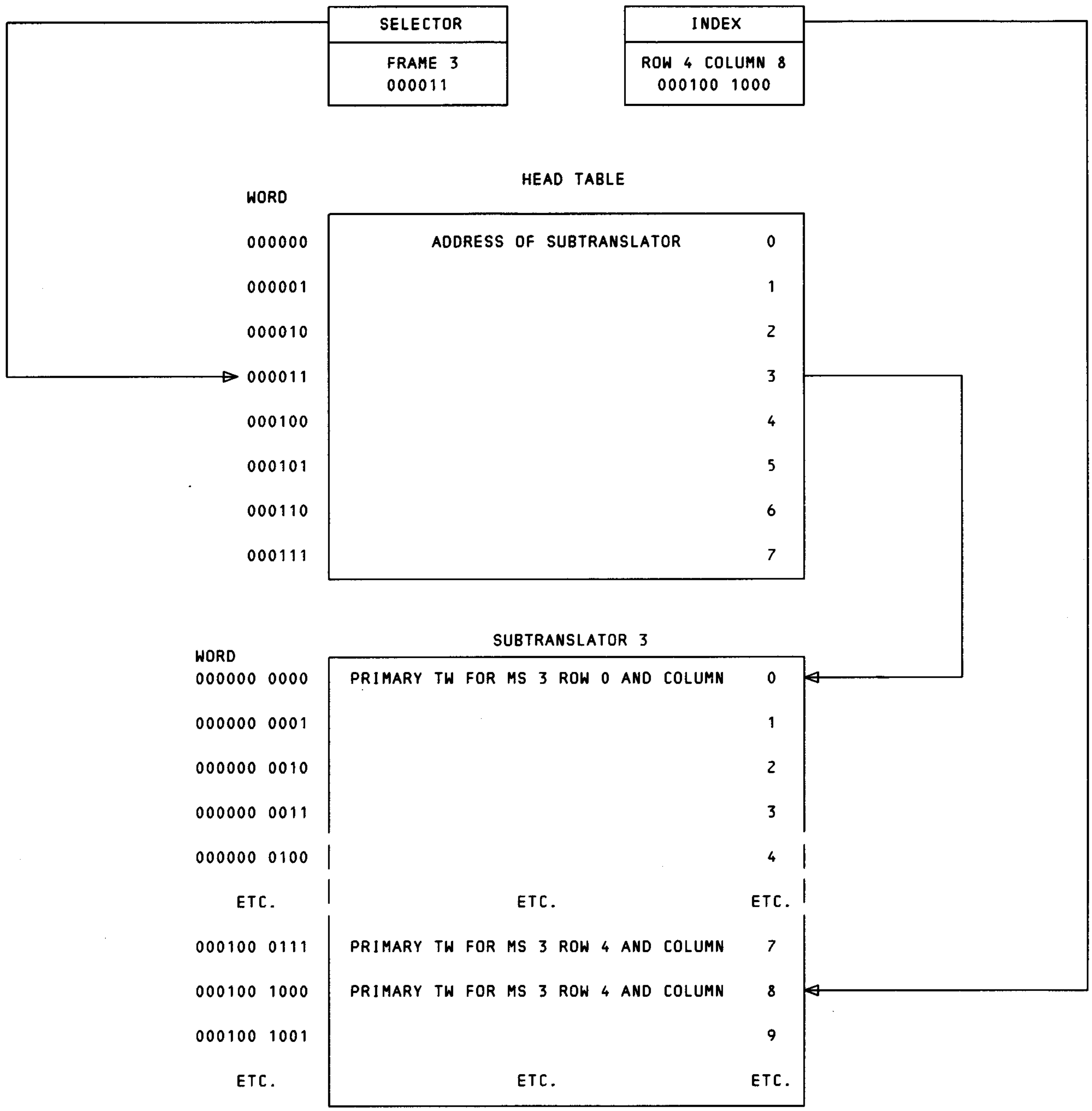


Fig. 7—Type 1 Translator (2.28)

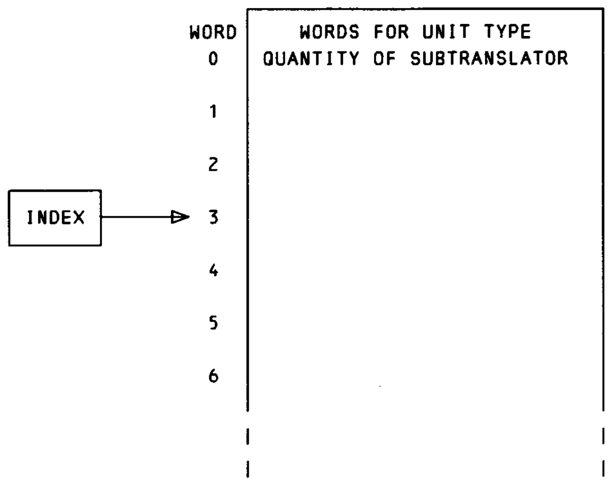
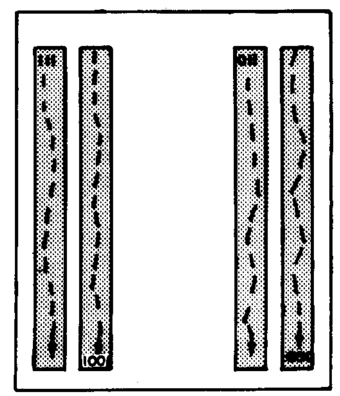


Fig. 8—Type 2 Translator (2.32)

Note: 111 is the first DN in a subtranslator, $\overline{161}$ is the 51st DN, and 000 is the last (1000th) DN. The table is read one column at a time, top to bottom, and then across to the next column. Two columns equal 100 number locations. See inset below.

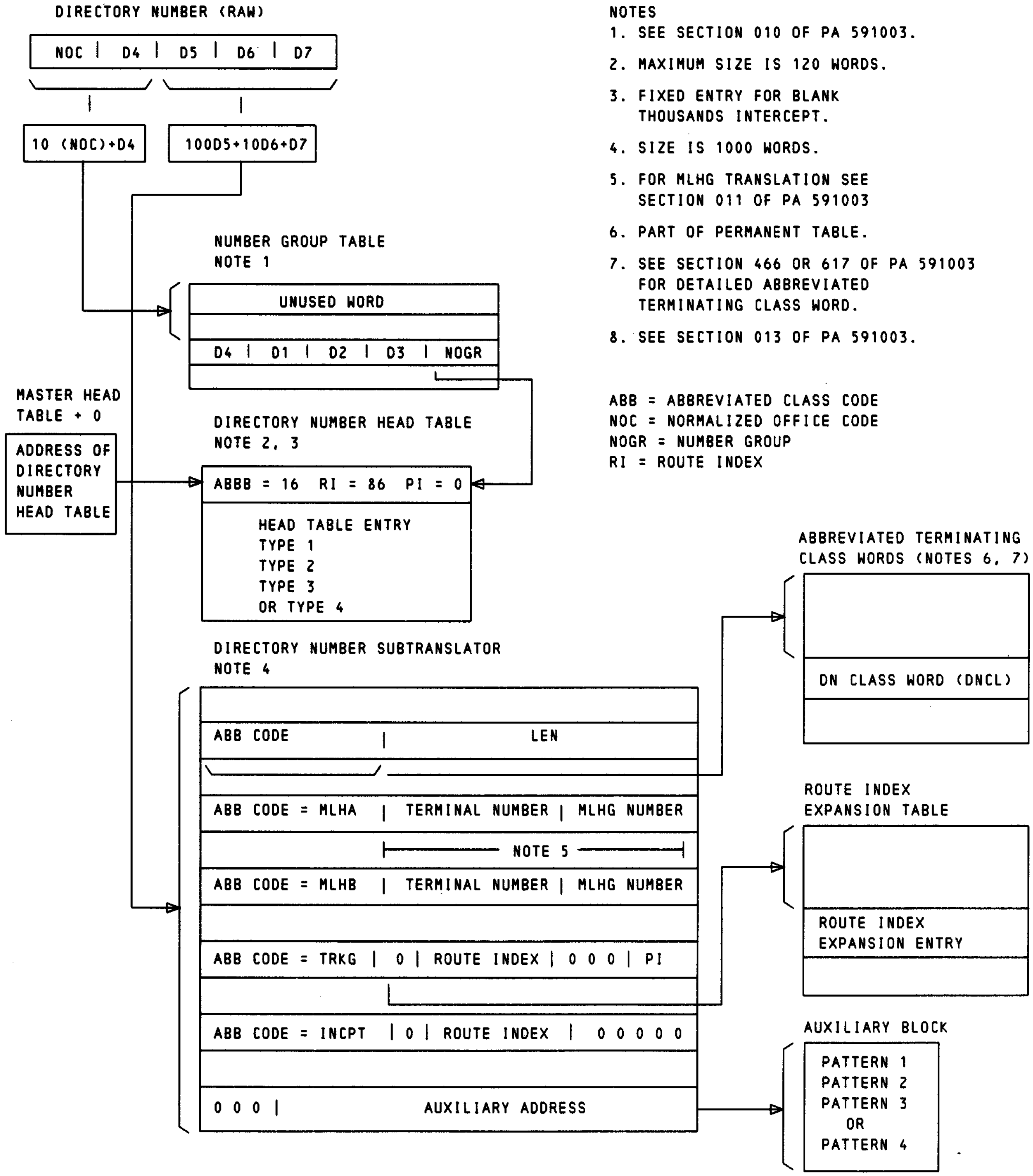


D5 D6 D7

7-DIGIT DN = D1 D2 D3 D4 D5 D6 D7

111	161	211	261	311	361	411	461	511	561	611	661	711	761	811	861	911	961	011	061
112	162	212	262	312	362	412	462	512	562	612	662	712	762	812	862	912	962	012	062
113	163	213	263	313	363	413	463	513	563	613	663	713	763	813	863	913	963	013	063
114	164	214	264	314	364	414	464	514	564	614	664	714	764	814	864	914	964	014	064
115	165	215	265	315	365	415	465	515	565	615	665	715	765	815	865	915	965	015	065
116	166	216	266	316	366	416	466	516	566	616	666	716	766	816	866	916	966	016	066
117	167	217	267	317	367	417	467	517	567	617	667	717	767	817	867	917	967	017	067
118	168	218	268	318	368	418	468	518	568	618	668	718	768	818	868	918	968	018	068
119	169	219	269	319	369	419	469	519	569	619	669	719	769	819	869	919	969	019	069
110	160	210	260	310	360	410	460	510	560	610	660	710	760	810	860	910	960	010	060
121	171	221	271	321	371	421	471	521	571	621	671	721	771	821	871	921	971	021	071
122	172	222	272	322	372	422	472	522	572	622	672	722	772	822	872	922	972	022	072
123	173	223	273	323	373	423	473	523	573	623	673	723	773	823	873	923	973	023	073
124	174	224	274	324	374	424	474	524	574	624	674	724	774	824	874	924	974	024	074
125	175	225	275	325	375	425	475	525	575	625	675	725	775	825	875	925	975	025	075
126	176	226	276	326	376	426	476	526	576	626	676	726	776	826	876	926	976	026	076
127	177	227	277	327	377	427	477	527	577	627	677	727	777	827	877	927	977	027	077
128	178	228	278	328	378	428	478	528	578	628	678	728	778	828	878	928	978	028	078
129	179	229	279	329	379	429	479	529	579	629	679	729	779	829	879	929	979	029	079
120	170	220	270	320	370	420	470	520	570	620	670	720	770	820	870	920	970	020	070
131	181	231	281	331	381	431	481	531	581	631	681	731	781	831	881	931	981	031	081
132	182	232	282	332	382	432	482	532	582	632	682	732	782	832	882	932	982	032	082
133	183	233	283	333	383	433	483	533	583	633	683	733	783	833	883	933	983	033	083
134	184	234	284	334	384	434	484	534	584	634	684	734	784	834	884	934	984	034	084
135	185	235	285	335	385	435	485	535	585	635	685	735	785	835	885	935	985	035	085
136	186	236	286	336	386	436	486	536	586	636	686	736	786	836	886	936	986	036	086
137	187	237	287	337	387	437	487	537	587	637	687	737	787	837	887	937	987	037	087
138	188	238	288	338	388	438	488	538	588	638	688	738	788	838	888	938	988	038	088
139	189	239	289	339	389	439	489	539	589	639	689	739	789	839	889	939	989	039	089
130	180	230	280	330	380	430	480	530	580	630	680	730	780	830	880	930	980	030	080
141	191	241	291	341	391	441	491	541	591	641	691	741	791	841	891	941	991	041	091
142	192	242	292	342	392	442	492	542	592	642	692	742	792	842	892	942	992	042	092
143	193	243	293	343	393	443	493	543	593	643	693	743	793	843	893	943	993	043	093
144	194	244	294	344	394	444	494	544	594	644	694	744	794	844	894	944	994	044	094
145	195	245	295	345	395	445	495	545	595	645	695	745	795	845	895	945	995	045	095
146	196	246	296	346	396	446	496	546	596	646	696	746	796	846	896	946	996	046	096
147	197	247	297	347	397	447	497	547	597	647	697	747	797	847	897	947	997	047	097
148	198	248	298	348	398	448	498	548	598	648	698	748	798	848	898	948	998	048	098
149	199	249	299	349	399	449	499	549	599	649	699	749	799	849	899	949	999	049	099
140	190	240	290	340	390	440	490	540	590	640	690	740	790	840	890	940	990	040	090
151	101	251	201	351	301	451	401	551	501	651	601	751	701	851	801	951	901	051	001
152	102	252	202	352	302	452	402	552	502	652	602	752	702	852	802	952	902	052	002
153	103	253	203	353	303	453	403	553	503	653	603	753	703	853	803	953	903	053	003
154	104	254	204	354	304	454	404	554	504	654	604	754	704	854	804	954	904	054	004
155	105	255	205	355	305	455	405	555	505	655	605	755	705	855	805	955	905	055	005
156	106	256	206	356	306	456	406	556	506	656	606	756	706	856	806	956	906	056	006
157	107	257	207	357	307	457	407	557	507	657	607	757	707	857	807	957	907	057	007
158	108	258	208	358	308	458	408	558	508	658	608	758	708	858	808	958	908	058	008
159	109	259	209	359	309	459	409	559	509	659	609	759	709	859	809	959	909	059	009
150	100	250	200	350	300	450	400	550	500	650	600	750	700	850	800	950	900	050	000

Fig. 9—Location or Sequence of Primary Translation Words for DNs in a DN Subtranslator (1000 Words) (2.34, 2.43)

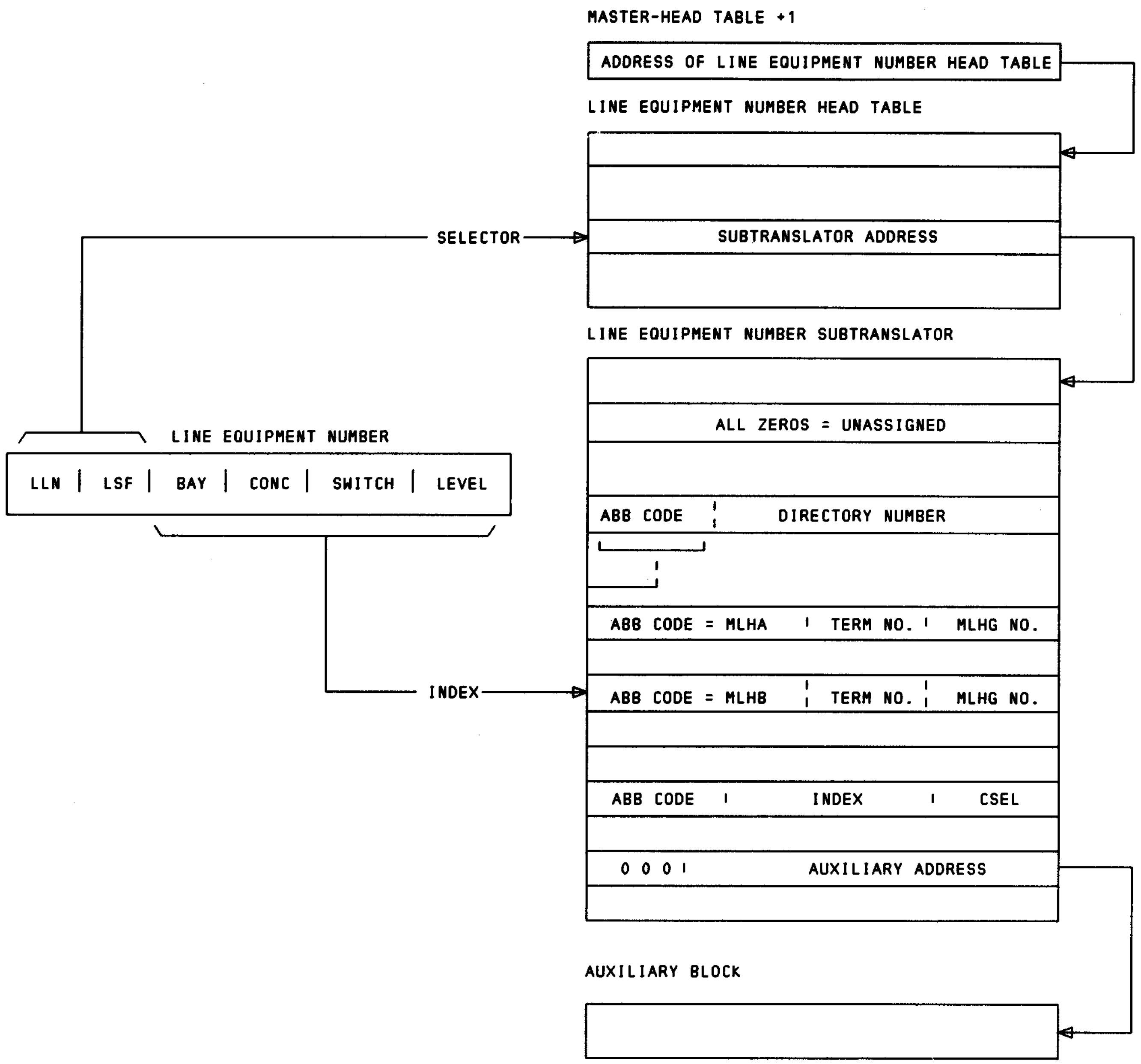


NOTES
1. SEE SECTION 010 OF PA 591003.
2. MAXIMUM SIZE IS 120 WORDS.
3. FIXED ENTRY FOR BLANK THOUSANDS INTERCEPT.
4. SIZE IS 1000 WORDS.
5. FOR MLHG TRANSLATION SEE SECTION 011 OF PA 591003
6. PART OF PERMANENT TABLE.
7. SEE SECTION 466 OR 617 OF PA 591003 FOR DETAILED ABBREVIATED TERMINATING CLASS WORD.
8. SEE SECTION 013 OF PA 591003.

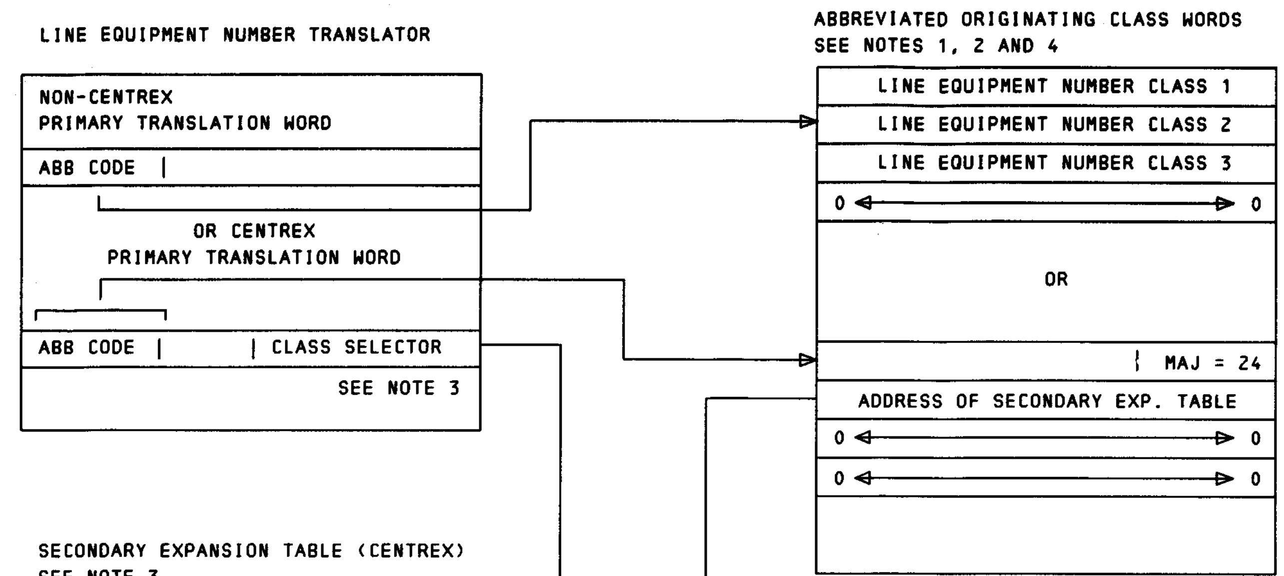
ABB = ABBREVIATED CLASS CODE
NOC = NORMALIZED OFFICE CODE
NOGR = NUMBER GROUP
RI = ROUTE INDEX

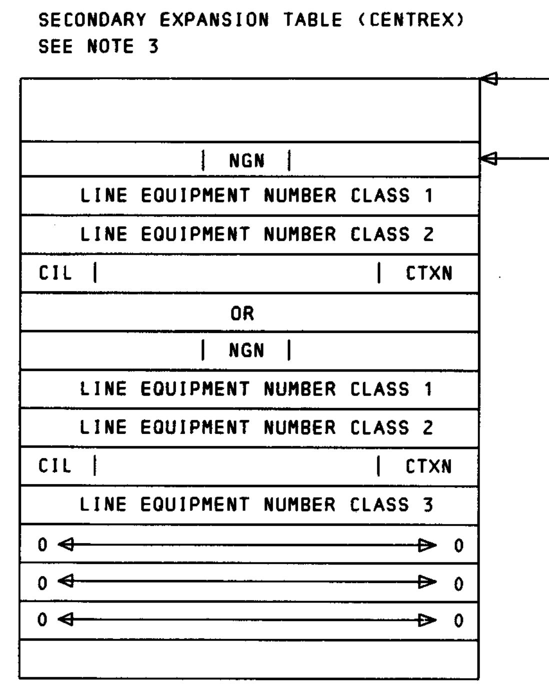
Fig. 10—DN Translator (2.42)

A. LEN TRANSLATION



B - ABBREVIATION SCHEME (CENTREX AND NON-CENTREX)





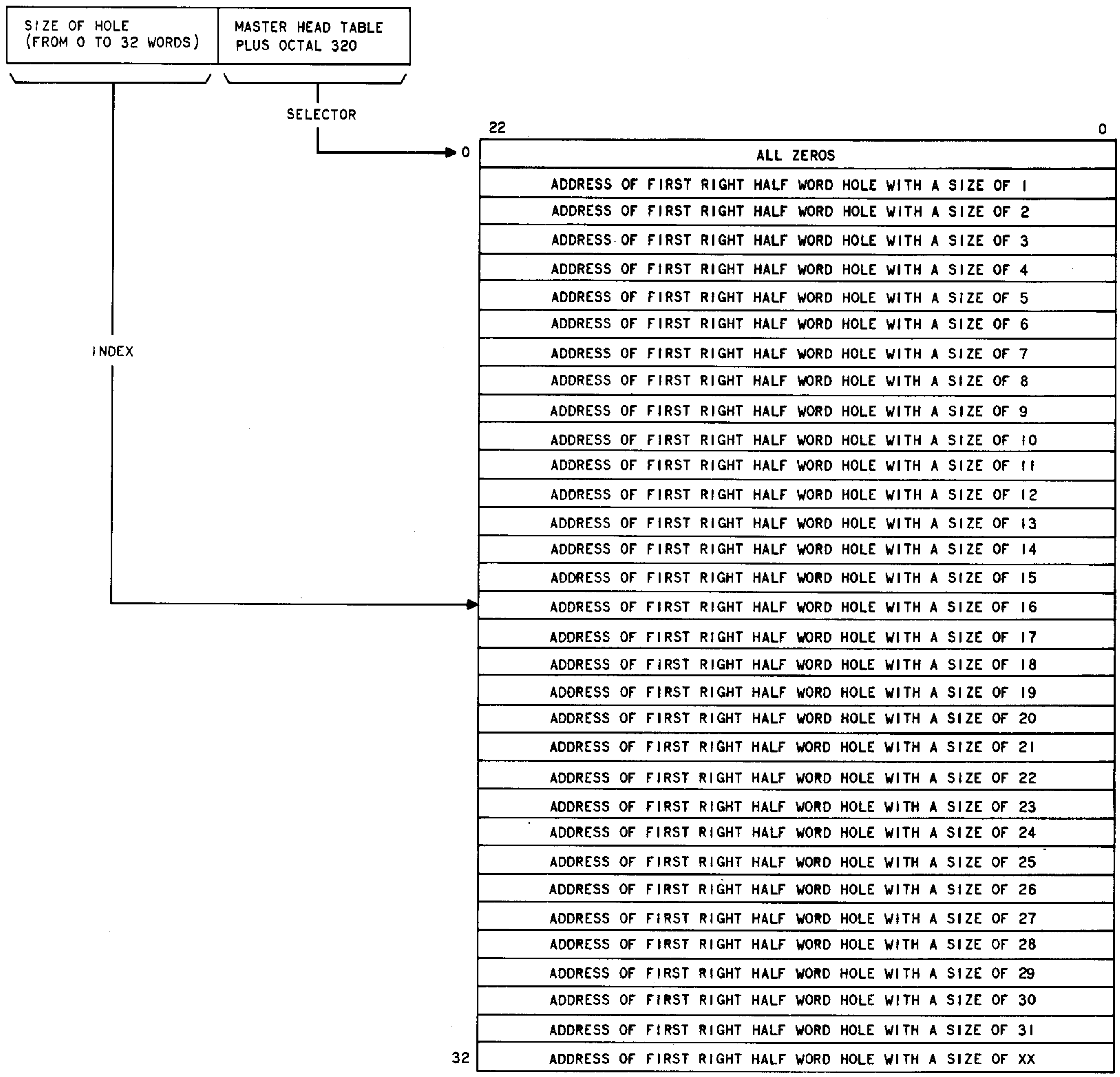
LEGEND

ABB = ABBREVIATED CLASS CODE
CSEL = CLASS SELECTOR
CTXN = CENTREX NUMBER
MAJ = MAJOR CLASS
MLHG = MULTI-LINE HUNT GROUP
NGN = NUMBER GROUP NUMBER

NOTES

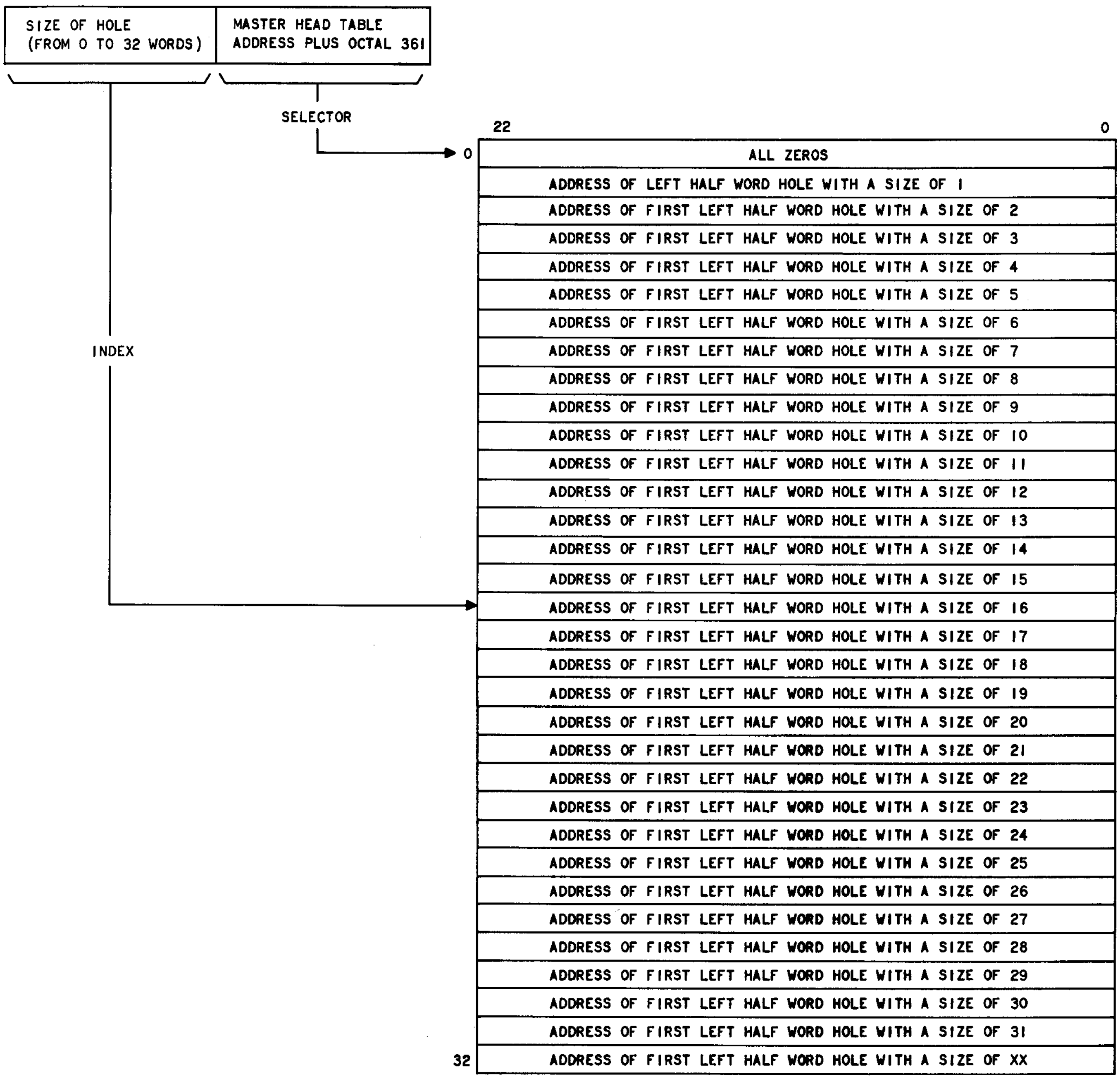
1. PRIOR TO CENTREX 6, THE STARTING ADDRESS FOR THE ABBREVIATED ORIGINATING (LEN) CLASS WORDS TABLE WAS MASTER HEAD TABLE PLUS 338. WITH CENTREX 6 AND LATER, THE ADDRESS FOR THE TABLE IS NOT FIXED AND IS LOCATED IN AUX + 16 OF THE AUXILIARY MASTER HEAD TABLE
2. PRIOR TO CENTREX 6, THE LENGTH OF THE NON-CENTREX EXPANSION WAS 128 WORDS IN TWO-WORD BLOCKS (64 SETS). WITH CENTREX 6 AND LATER THE LENGTH IS 256 WORDS IN FOUR WORD BLOCKS (64 SETS)
3. THE "CLASS SELECTOR" IS THE ABBREVIATED CODE NUMBER FROM ESS 1503, COLUMNS 21 TO 23. THIS VALUE, TIMES FOUR, IS USED TO INDEX THE SECONDARY EXPANSION TABLES
4. PRIOR TO CENTREX 6, SECONDARY EXPANSION TABLES ARE 512 WORDS LONG AND ALWAYS IN FOUR WORD BLOCKS. (128 SETS). WITH CENTREX 6 AND LATER, THE LENGTH CONTINUES TO BE 512 WORDS, BUT MAY CONTAIN FOUR WORD BLOCKS (IF LEN CLASS 3 IS PRESENT), THUS IF A CLASS SELECTOR REQUIRES A LENCL3 WORD, SELECTOR N + 1 CANNOT EXIST.

Fig. 11—LEN Translator (2.50)



NOTE:
THE LAST WORD IN THE LINK LIST CONTAINS THE ADDRESS OF THE FIRST HOLE WHICH IS 32 WORDS OR GREATER IN SIZE.

Fig. 12—Right-Half Link List (2.60)



NOTE:
THE LAST WORD IN THE LINK LIST CONTAINS THE ADDRESS OF THE FIRST LEFT HALF HOLE WHICH IS 32 WORDS OR GREATER IN SIZE.

Fig. 13—Left-Half Link List (2.60)

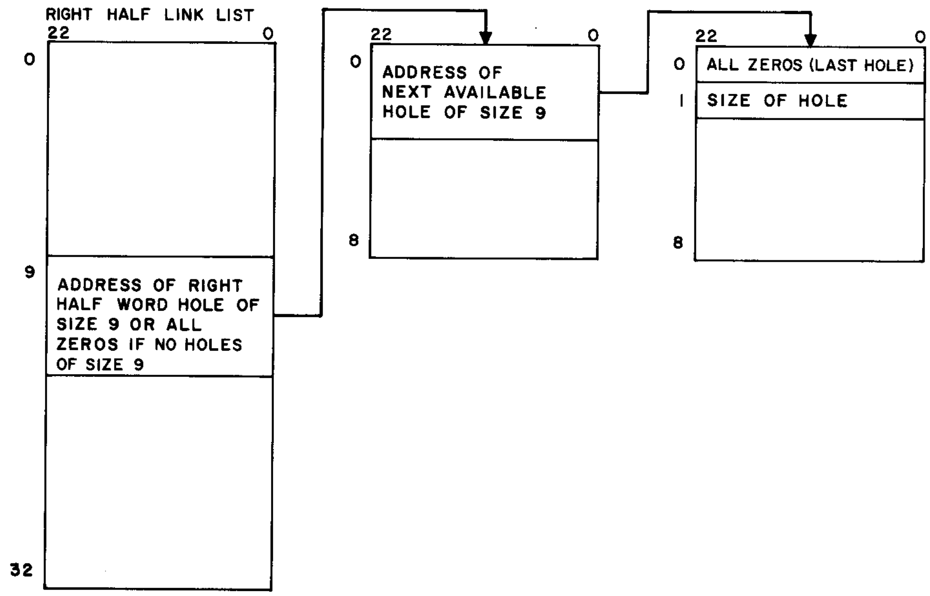


Fig. 14—Right-Half Link List Hole Section (2.60)

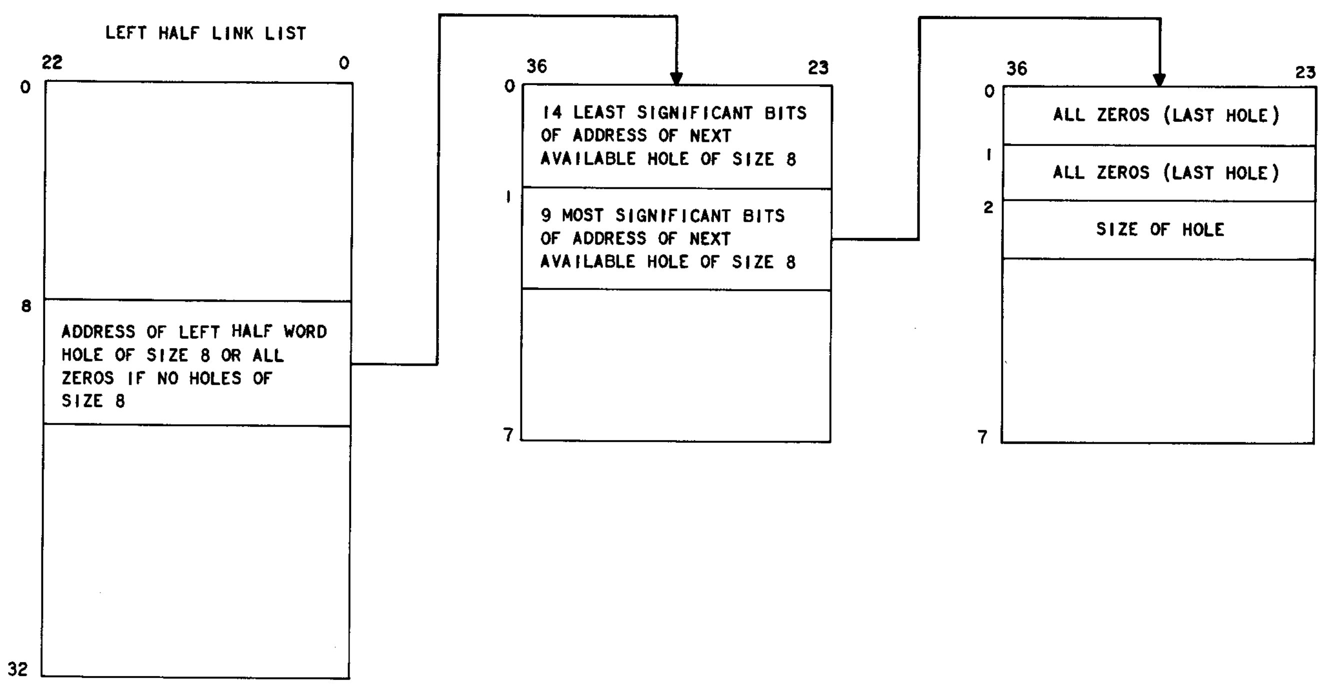


Fig. 15—Left-Half Link List Hole Selection (2.61)