PROGRAM STORE AND CALL STORE EXPANDED MEMORY

DESCRIPTION

1A *ESS*™ SWITCH

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Figures

1. GENERAL INFORMATION

This practice describes the expansion of the memory spectrum or address range of the 1A processor as used in the 1A ESS switch. In addition, the attached processor system is introduced as a new backup medium for program store and translations.

This practice is reissued to include the HDCS (higher duplicated call store) optional feature available with the 1AE10.02 generic program.

2. BACKGROUND

2.1 Terms

Memory Expansion: Memory expansion for the 1AE7 generic program pertains to an expanded address range which approximately doubles the number of addresses in both program store and call store. This expansion does not imply that usable memory space has doubled. Backup capacity with file stores becomes a memory limiting item before the expanded memory spectrum can be fully realized. This memory limiting is eliminated when the attached processor system is used.

Address: The program store address in the 1AE7 generic program moves from its present (1AE6) 21-bit address spectrum or address range in K-codes 20 through 37 to a 22-bit address spectrum designated as program store K-codes 0 through 37. The LUCS (low unduplicated call store) in 1AE7 utilizes a 20-bit address spectrum and the HUCS (high unduplicated call store) utilizes a 21-bit spectrum (Fig. 1).

HUCS: The HUCS area utilizes a 21-bit spectrum and ranges from K-code 37 down to K-code 20. Translators designated as HUCS type reside in the HUCS area. Refer to Fig. 2 for a layout of the HUCS call store spectrum.

LUCS: The LUCS area utilizes a 20-bit address spectrum and ranges from K-code 17 down to K-code 4. All LUCS translators are restricted to the LUCS area, but HUCS translators may also reside in the LUCS area. Refer to Fig. 2 for a layout of the LUCS call store spectrum.

K-Code: Information is stored in program store and call store in 65,536-word address ranges called K-codes. One K-code equals one 64K memory unit or one-fourth 256K memory unit.

2.2 Address Ranges

With the expanded memory spectrum in the 1AE7 generic program, there are 30 K-codes for program store and 32 K-codes for call store. All program store memory is moved from its present 21-bit address spectrum (4,000,000 through 7,377,777) to a 22-bit address spectrum (10,000,000 through 17,377,777). The first 16 call store K-codes (0, 1, 2, ..., 16, 17) have a 20-bit

address spectrum (0 through 3,777,777); the second 16 K-codes (20, 21, ..., 36, 37) have a new 21-bit address spectrum (4,000,000 through 7,777,777). Refer to Fig. 3 for 1AE6 memory address ranges and to Figs. 4 and 5 for 1AE7 program store and call store address ranges.

2.3 Stores

64K Semiconductor Store: A 64K call store/program store is a high-speed (1400 nanosecond) semiconductor store. Each call store unit and each program store unit provides a storage capacity of 65,536 26-bit words (24 data bits and 2 parity bits) and is assigned as one K-code.

256K Semiconductor Store: A 256K call store/program store is a high-speed semiconductor store available with 1AE5 and later generic programs. There are two versions of the 256K store unit; the 28A memory unit, which runs at a 1400-nanosecond cycle time, and the 28B memory unit, which can run at a 1400-nanosecond cycle time or, in the **fast** mode, at a 700-nanosecond cycle time. Each 256K call store unit and each 256K program store unit provides a storage capacity of 262,144 26-bit words (24 data bits and 2 parity bits) and contains four K-codes.

3. MEMORY SPECTRUM (1AE6)

3.1 Program Store

In a 1A ESS switch office, the program store is used solely for storage of the generic program. The generic program contains the basic instructions used by central control to implement its day-to-day call processing, network connections, maintenance routines, etc.

The program store community may be equipped with 64K semiconductor stores or 256K semiconductor stores. The words in program store are grouped into ranges of memory made up of 65,536 words each. A particular range is accessed by a portion of the processor address referred to as the K-code. The total address spectrum for a program store community is 16 K-codes; 2 K-codes cover addresses used by internal processor registers, and the remaining 14 K-codes are available for storage of generic program words in physical program stores (Fig. 6).

All data stored in program store is duplicated on disk in the file store community, thus eliminating the need for duplicate program store units. However, in order to maintain continuous reliable operation, two additional units, called rover stores, are provided to replace any unit that might malfunction.

3.2 Duplicated Call Store

The duplicated call store community may be equipped with 64K semiconductor stores or 256K semiconductor stores. The words in duplicated call store are grouped into ranges of memory made up of 65,536 words each. A particular range is accessed by a portion of the processor address referred to as the K-code. The call store community (duplicated and unduplicated) can use up to a maximum of 16 K-codes for storing the **primary copies** of duplicated and UCS (unduplicated call store) data (Fig. 7).

The words in duplicated call store are organized into groups of predetermined size call blocks. Varying quantities of blocks make up tables depending on table type, i.e., fixed or variable.

Fixed duplicated call store tables are tables which are allocated a fixed (constant) size and fixed address. The fixed tables are organized contiguously in the lowest address range of duplicated call store. For example, if the first table loaded into duplicated call store requires 1000 words, the 1000 lowest numbered addresses would be used to accommodate this table.

Variable duplicated call store tables are tables where allocation is determined by set card values (other than those determining the generic program). The size of variable tables is determined from office characteristics and can generally be categorized as equipment dependent, traffic dependent, or translation dependent.

In order to insure that the system is able to continuously process calls in the event of a physical unit failure, an exact duplicate of the information contained in the duplicated call store primary unit (on-line) is kept in a **backup** unit (on standby) in the call store.

3.3 Unduplicated Call Store

The UCS community may be equipped with 64K semiconductor stores or 256K semiconductor stores. The words in UCS are grouped into ranges of memory made up of 65,536 words each. A particular range is accessed by a portion of the processor address referred to as the K-code. The call store community (unduplicated and duplicated) can use up to a maximum of 16 K-codes for storing the primary copies of unduplicated and duplicated call store data (Fig. 7).

The UCS address range is a maximum of 12 K-codes. The highest address ranges are contained in K-code 17. The K-code 17 contains areas loaded with generic and parameter data as well as fixed translation information.

Translation data is stored in the form of tables or lists which are linked according to a hierarchical pattern. Tables high in the hierarchy contain pointers to, or addresses of, the lower tables. The lowest tables in the hierarchy, such as auxiliary blocks, some subtranslators, or subauxiliary blocks, contain the actual translation data.

In order to insure that the system is able to continuously process calls in the event of a physical unit failure, a **backup** copy of the primary (on-line) UCS data is contained in the file store on disk type memory. When a physical unit containing UCS data fails, one of the backup physical units for duplicated call store is cleared of its duplicated call store data, is assigned as a UCS module, and is then loaded by reading from file store the information that was contained in the failed unit.

3.4 Fixed Disk Layout

A file store community of Burroughs disks provides disk space for the 1A processor. This disk space can be used as a **backup** for main memory (program store or call store), as storage for programs paged into main memory is needed, as a data base, or as a utility storage area. The 1AE6 generic program requires four duplicated disk files, capable of holding 26 K-codes of data (Fig. 8).

The disk space in a given office is assigned by generic, parameter, and translation tapes. The equipped disk space must be exactly accounted for by the combination of these three tapes. Currently, the process that generates the tapes is run independently. Each type of data occupies a fixed preassigned disk area regardless of usage. For example, about 11.2 K-codes of disk space are reserved in all 1AE6 offices for translation data, even though only a few offices require more than 8 K-codes. The major reason for such underutilization is that the tools that create each tape are run at different times and at different locations.

4. MEMORY SPECTRUM (1AE7)

4.1 Program Store

Program store memory moves from its present (1AE6) 21-bit address spectrum or address range in K-code 20 through K-code 37 to a 22-bit address spectrum designated as program store K-code 0 through K-code 37 (Fig. 2).

The generic program begins loading at program store K-code 20 and continues through K-code 33. Then the generic program wraps around to program store K-code 0 and continues to the last address in K-code 17 if required (Fig. 9 and 10). This nonconsecutive assignment scheme facilitates data mapping from previous generic programs.

The wrap around from K-code 33 to K-code 0 increases the utilization of equipment in 256K offices because K-codes must be consecutive within a store unit. If K-codes 34 and 35 were loaded, the other half of the unit designated for K-codes 36 and 37 could not be used because addresses in that range are internal to the processor and cannot be assigned generic program storage.

In the 1AE6 generic program, the starting address for K-code 20 was 4 million (octal). With the 1AE7 generic program, the starting address for program store K-code 20 is 14 million (octal). Thus, only the most significant bit is affected. Refer to 3.1 for additional program store information.

4.2 Duplicated Call Store

The duplicated call processing software area of call store is not increased by memory expansion. The first four K-codes remain restricted and the maximum number of duplicated call processing software K-codes is limited to eight (Fig. 11 and 12). Previously, the duplicated call processing software limit was specified as 12 K-codes.

Due to the generic growth in 1AE7, the related compool area also increases. Compool is a computerized dictionary of symbolic references associated with a generic program. Compool is located in the duplicated call processing software area and will require an additional 8,192 words (unduplicated). Because compool resides in the address restricted area of duplicated call store (K-codes 0 through 3), fewer words are available for restricted call processing registers than in previous generic programs. Refer to 3.2 for additional duplicated call store information.

4.3 Higher Duplicated Call Store (1AE10.02)

The HDCS (higher duplicated call store) optional feature is available in the 1AE10.02 generic creating a new duplicated CS area in the high memory spectrum. The HDCS is used to store the LHBs (line history blocks) used by the LASS (Local Area Signaling Services) LH (line history) primitive. One 2-, 3-, or 5-word LHB is built for each LEN in the office and is located in DCS unless the HDCS feature is loaded. Thus, in a large office a very large amount of DCS is required to hold all the LHBs and without the HDCS feature the DCS area could be exhausted if the office allocates LHBs in the normal DCS area. The HDCS area is located in the portion of memory now desginated as the HUCS growth area (Fig. 13 and 14) and is primarily used to store the LHBs for the LASS LH primitive. See COEES (Central Office Equipment Engineering Systems) Information Systems engineering document Index 38. By using the HUCS area, the most critical memory spectrum (DCS) is relieved and the most available spectrum (HUCS) is used.

4.4 Unduplicated Call Store

Unduplicated call store (UCS) translation software in the 1AE7 generic program is separated into low unduplicated call store (LUCS) translation software and high unduplicated call store (HUCS) translation software. The LUCS area utilizes a 20-bit address spectrum and ranges from UCS K-code 17 down to K-code 4. The HUCS area utilizes a 21-bit address spectrum and ranges from UCS K-code 37 down to K-code 20 (Fig. 11).

With the 1AE7 generic program, translators are designated as LUCS-type or HUCS-type (but not both). All LUCS-type translators must reside in the LUCS area of UCS. The HUCS-type translators, by virtue of their address spectrums, are considered unrestricted and may reside in either the HUCS or the LUCS area. A complete list of LUCS-type translators is shown in Fig. 15.

The expansion of UCS also requires reassignment of the master head table. The master head table must always reside in the last half K-code of UCS. The master head table is moved from K-code 17 (the last K-code in 1AE6) to K-code 37 (the last K-code in 1AE7). An extra store unit must be provided in every office to store the master head table in UCS K-code 37. The first half of K-code 17 which contained the generic code is reassigned to program store. Consequently, when the transition to the 1AE7 generic program is complete, UCS K-code 17 is left vacant and available for LUCS assignments. Refer to 3.3 for additional UCS information.

4.5 Variable Disk Allocation

The existing single file store community of Burroughs disks will continue to be used by offices restarting or retrofitting to the 1AE7 generic program. Prior generic programs had fixed disk assignments based on the maximum number of program store and UCS K-codes permitted. Refer to 3.4 for additional fixed disk file store community information.

In order to accommodate the increase of both program store and UCS in 1AE7, the variable disk allocation scheme is being used. This scheme allows the file store to have the capability to provide backup for 3 to 16 UCS K-codes and 12 to 15 program store K-codes. The maximum backup capacity for program store and UCS on file store with variable disk allocation is 28 K-codes, two more than with prior generic programs. Also, an additional K-code (the 29th) containing temporary recent change data from duplicated call store is also backed up on file store (Fig. 8).

The portion of the disk file providing backup for the minimum office requirements of 12 program store K-codes and 3 UCS K-codes are fixed assigned. The remaining 13 K-codes of file store backup are assigned to either program store or UCS. Thus, an office rich in features or translations is able to operate using one file store community with variable disk allocation. If the 28 K-code backup limit is exceeded, however, either program store or UCS must be reduced to meet the file store limitations until the office can convert to the attached processor system as the backup medium.

4.6 Attached Processor System

The attached processor system is a package of hardware and software which connects a 1A processor with the 3B20D Model 2 processor complex. The attached processor system provides an optional vehicle for replacing the 1A processor file store community with a high-capacity 3B processor disk system. This added capability allows the 1A ESS switch to fully utilize the expansion of the memory spectrum.

The attached processor system has the capability to back up 26 UCS K-codes and 28 program store K-codes for a total of 54 K-codes (Fig. 16). With the attached processor system, the backup medium is not a limiting capacity item as with file store.

In offices using the attached processor system, variable disk allocation allows the larger disk address spectrum of the attached processor system to be utilized with a minimum impact on the affected software areas.

Some generic data occupies attached processor system disk space which does not exist in 4-disk file store offices. The net effect will be to create two fixed areas and two variable areas of disk space for attached processor system offices.

The first fixed area contains backup for program store K-code 20 and all other generic programs assigned disk spaces except for the temporary recent change backup block. The second fixed area contains the temporary recent change backup block and the 6 plus K-codes of backup disk space for generic program store K-code 21 through K-code 27 and call store K-code 0 and K-code 37. This second area is allocated from the additional disk space provided by the

attached processor system.

The first variable area follows the second fixed area. This area contains all backup for additional K-codes needed for optional feature packages. The second variable area is for translation backup. This area occupies space identical to the translation area for file store, except that the six K-codes of the relocated generic program are also available for translations. Any unused K-codes in either variable area is generic-owned unassigned space.

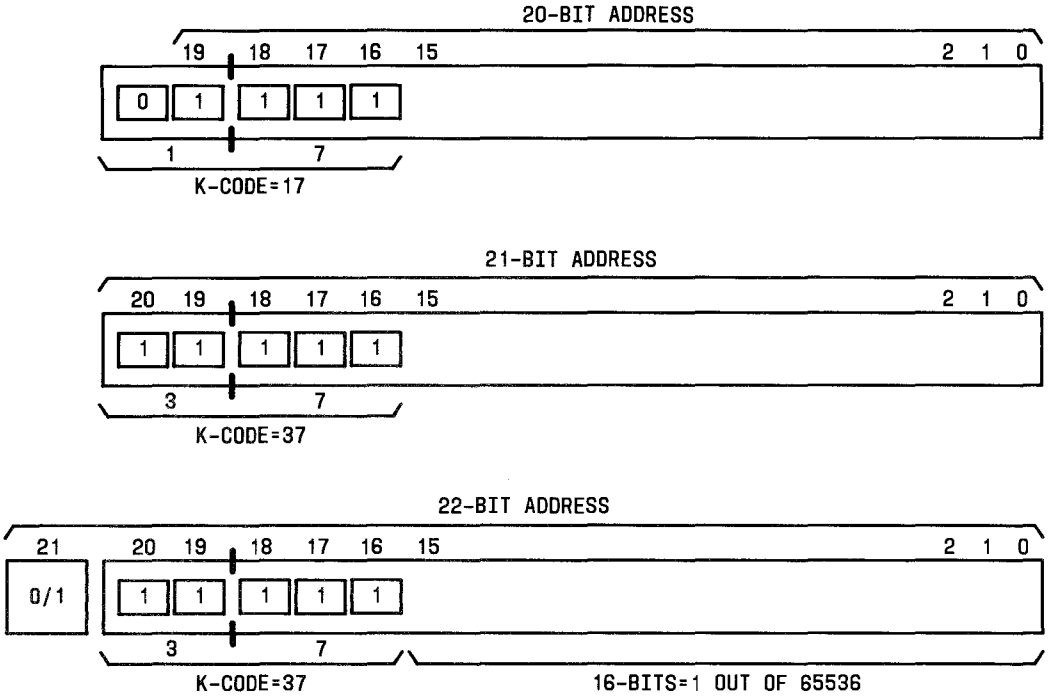


Fig. 1 — Address Spectrum

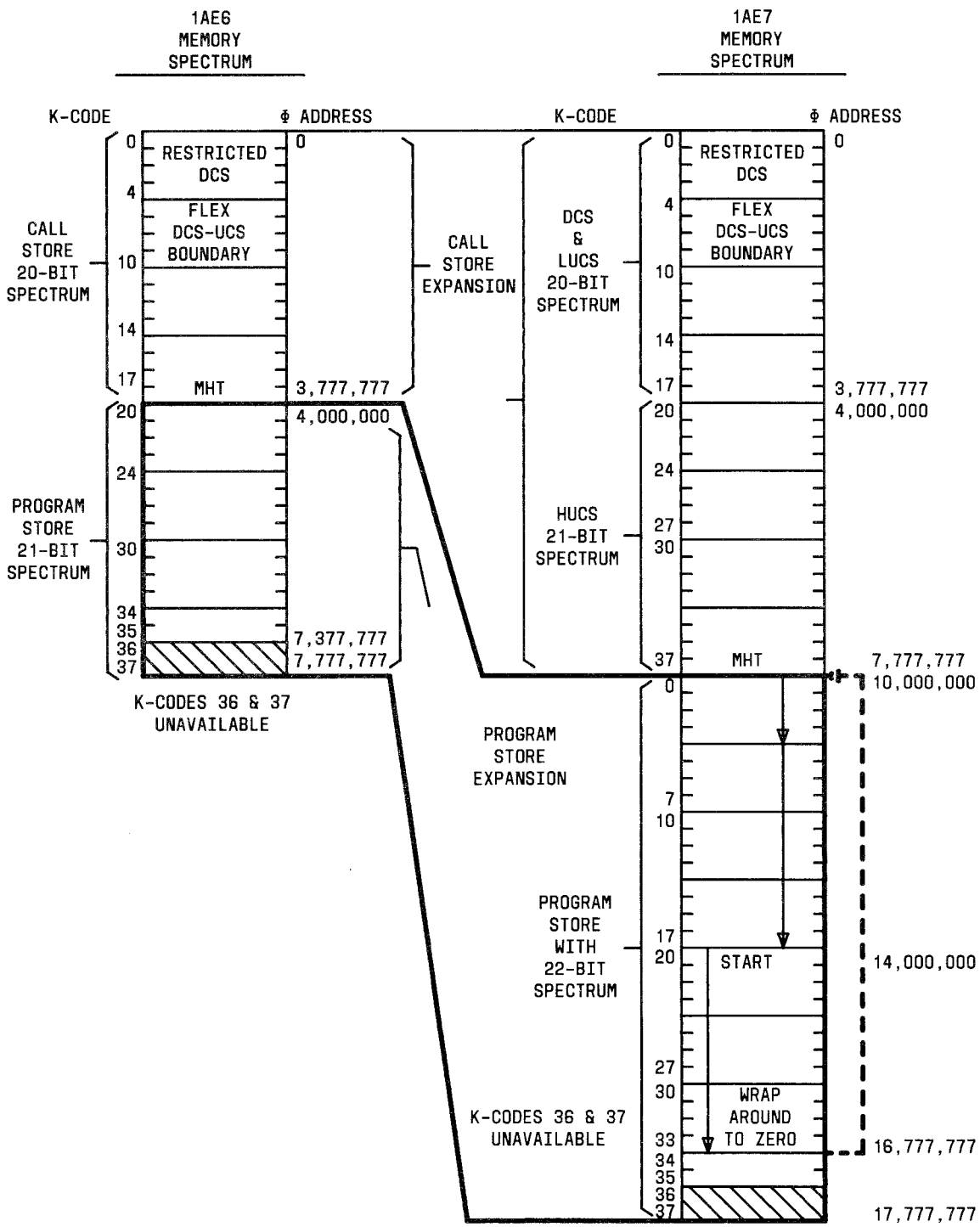


Fig. 2 — Memory Expansion

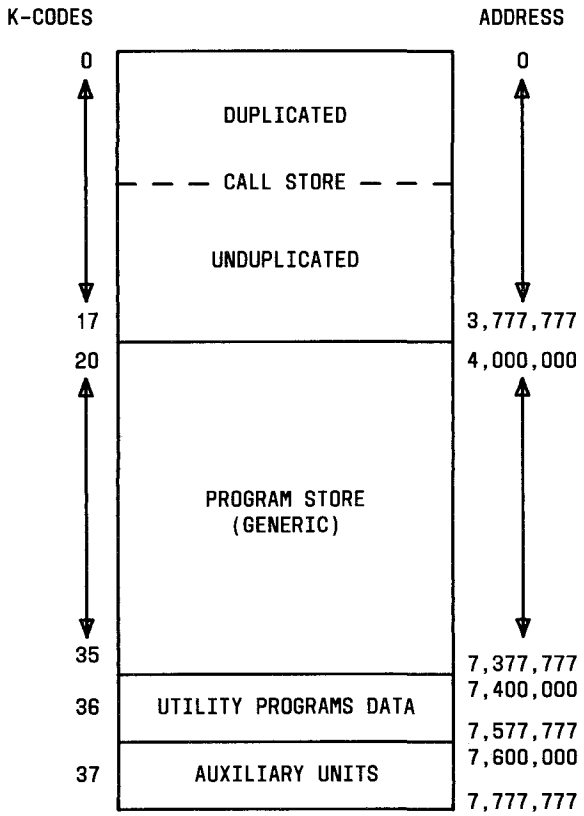


Fig. 3 — Memory Address and K-Code Spectrum (1AE6)

K-CODE- Φ	Φ ADDRESS RANGE	
0	10,000,000	10,177,777
1	10,200,000	10,377,777
2	10,400,000	10,577,777
3	10,600,000	10,777,777
4	11,000,000	11,177,777
5	11,200,000	11,377,777
6	11,400,000	11,577,777
7	11,600,000	11,777,777
10	12,000,000	12,177,777
11	12,200,000	12,377,777
12	12,400,000	12,577,777
13	12,600,000	12,777,777
14	13,000,000	13,177,777
15	13,200,000	13,377,777
16	13,400,000	13,577,777
17	13,600,000	13,777,777
20	14,000,000	14,177,777
21	14,200,000	14,377,777
22	14,400,000	14,577,777
23	14,600,000	14,777,777
24	15,000,000	15,177,777
25	15,200,000	15,377,777
26	15,400,000	15,577,777
27	15,600,000	15,777,777
30	16,000,000	16,177,777
31	16,200,000	16,377,777
32	16,400,000	16,577,777
33	16,600,000	16,777,777
34	17,000,000	17,177,777
35	17,200,000	17,377,777
36	17,400,000	17,577,777
37	17,600,000	17,777,777

NOT AVAILABLE FOR GENERIC PROGRAM

Fig. 4 — Program Store Addresses (1AE7)

K-CODE-ϕ	ϕ ADDRESS RANGE	
0	0,000,000	0,177,777
1	0,200,000	0,377,777
2	0,400,000	0,577,777
3	0,600,000	0,777,777
4	1,000,000	1,177,777
5	1,200,000	1,377,777
6	1,400,000	1,577,777
7	1,600,000	1,777,777
10	2,000,000	2,177,777
11	2,200,000	2,377,777
12	2,400,000	2,577,777
13	2,600,000	2,777,777
14	3,000,000	3,177,777
15	3,200,000	3,377,777
16	3,400,000	3,577,777
17	3,600,000	3,777,777
20	4,000,000	4,177,777
21	4,200,000	4,377,777
22	4,400,000	4,577,777
23	4,600,000	4,777,777
24	5,000,000	5,177,777
25	5,200,000	5,377,777
26	5,400,000	5,577,777
27	5,600,000	5,777,777
30	6,000,000	6,177,777
31	6,200,000	6,377,777
32	6,400,000	6,577,777
33	6,600,000	6,777,777
34	7,000,000	7,177,777
35	7,200,000	7,377,777
36	7,400,000	7,577,777
37	7,600,000	7,777,777

Fig. 5 — Call Store Addresses (1AE7)

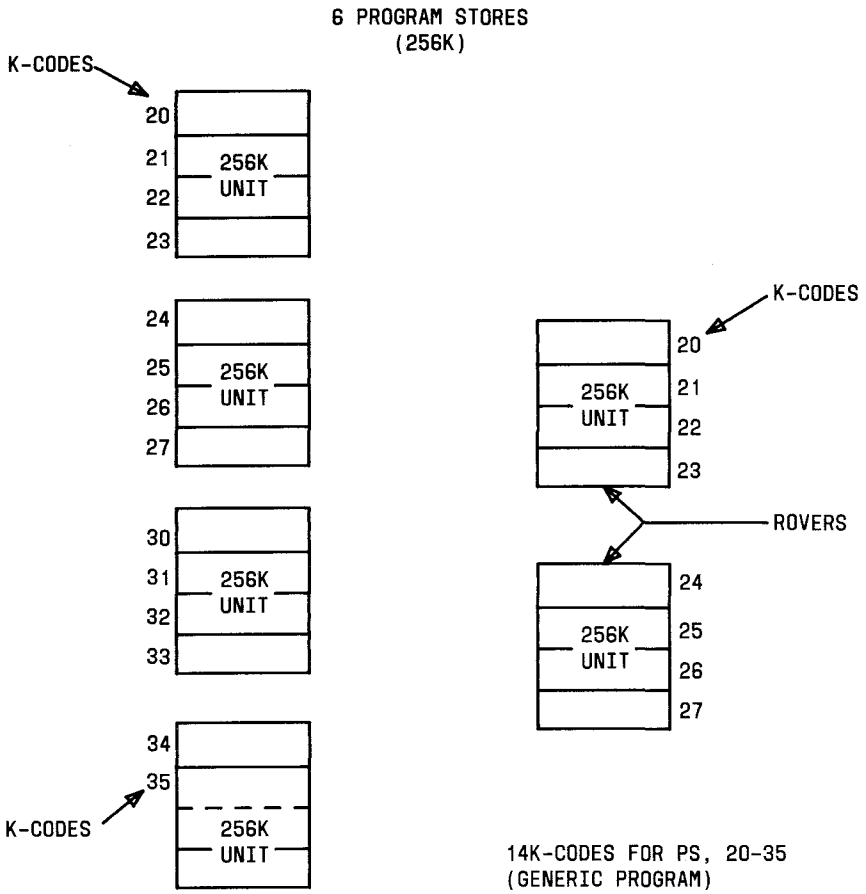


Fig. 6 — Program Store K-Code Spectrum (1AE6)

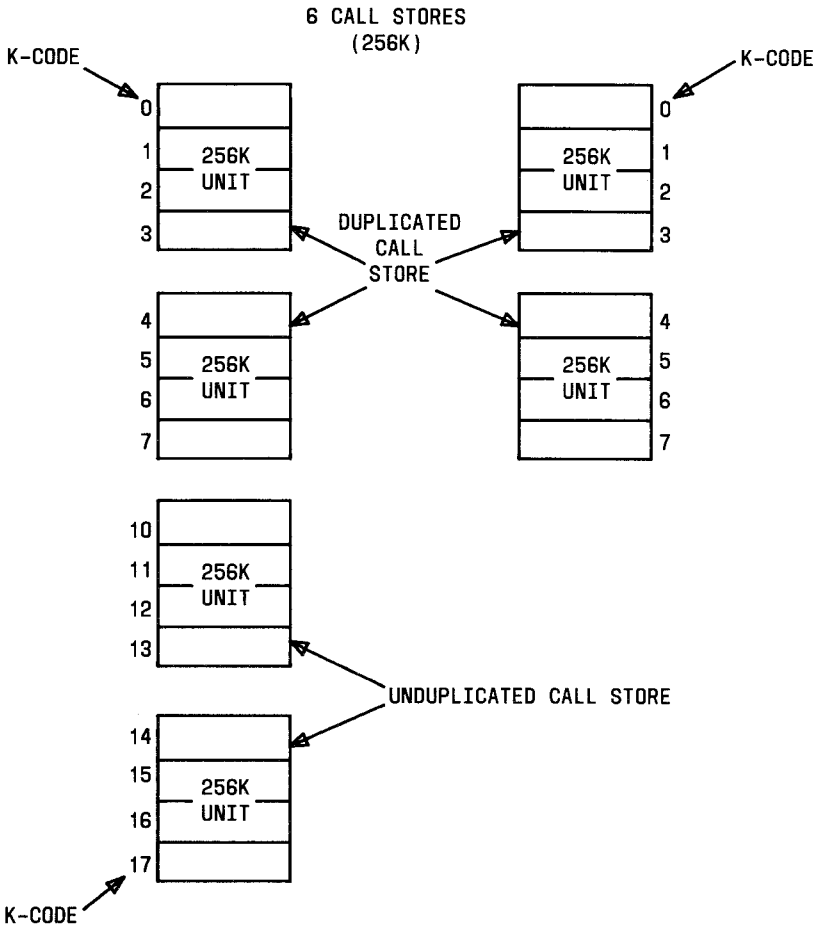


Fig. 7 — Call Store K-Code Spectrum (1AE6)

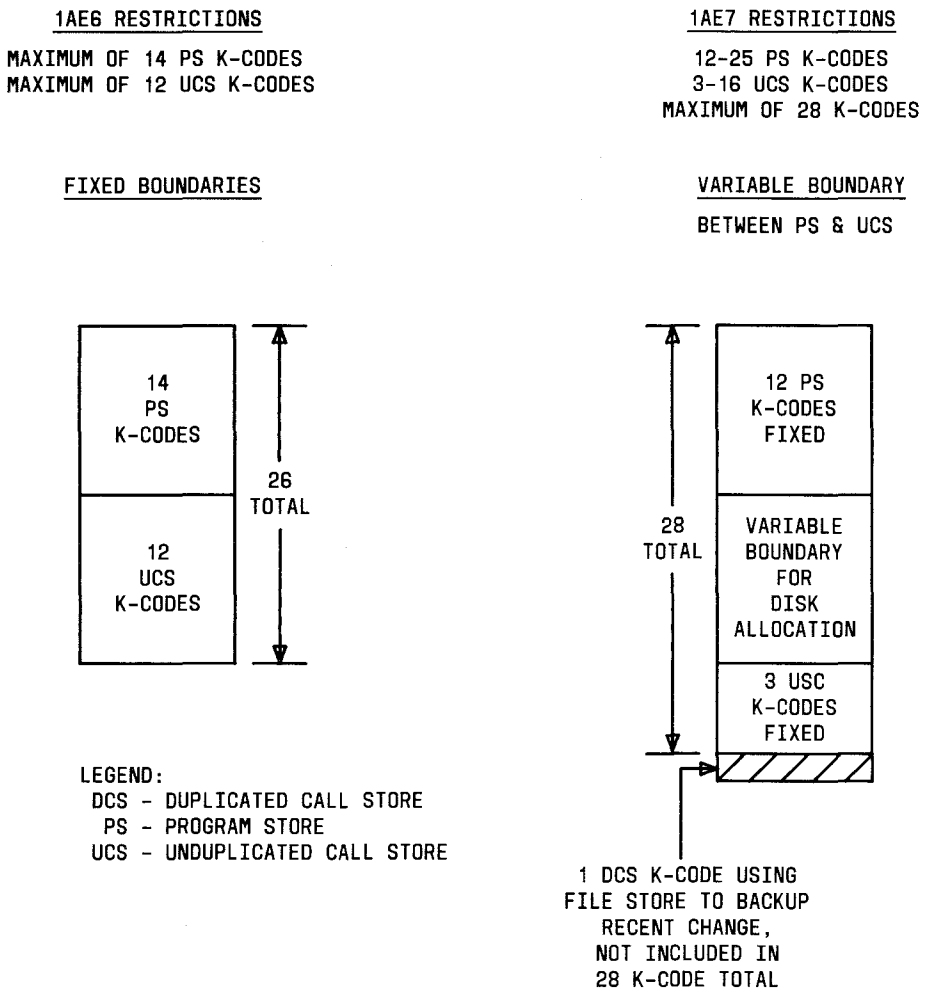


Fig. 8 — File Store K-Code Spectrum

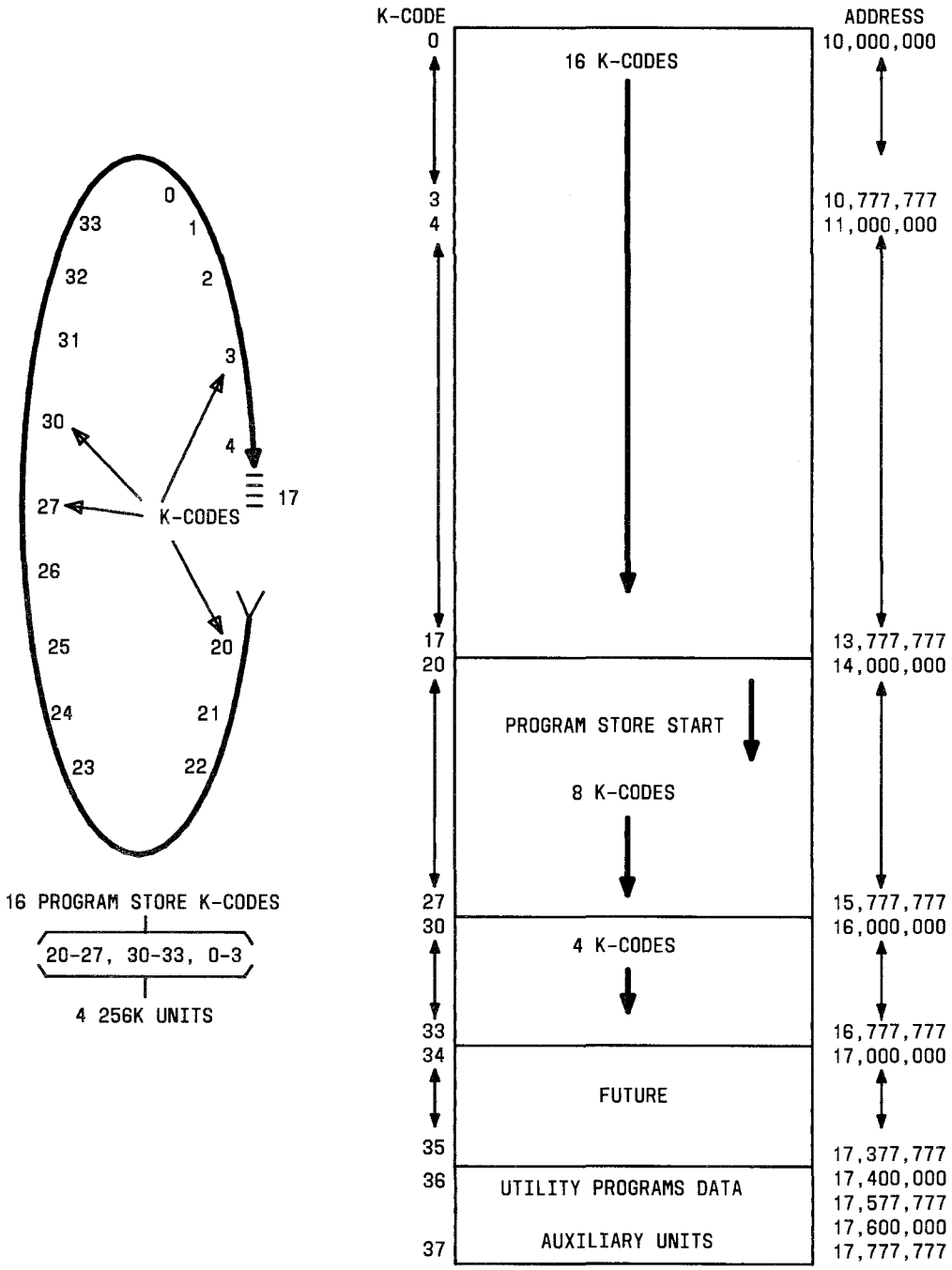
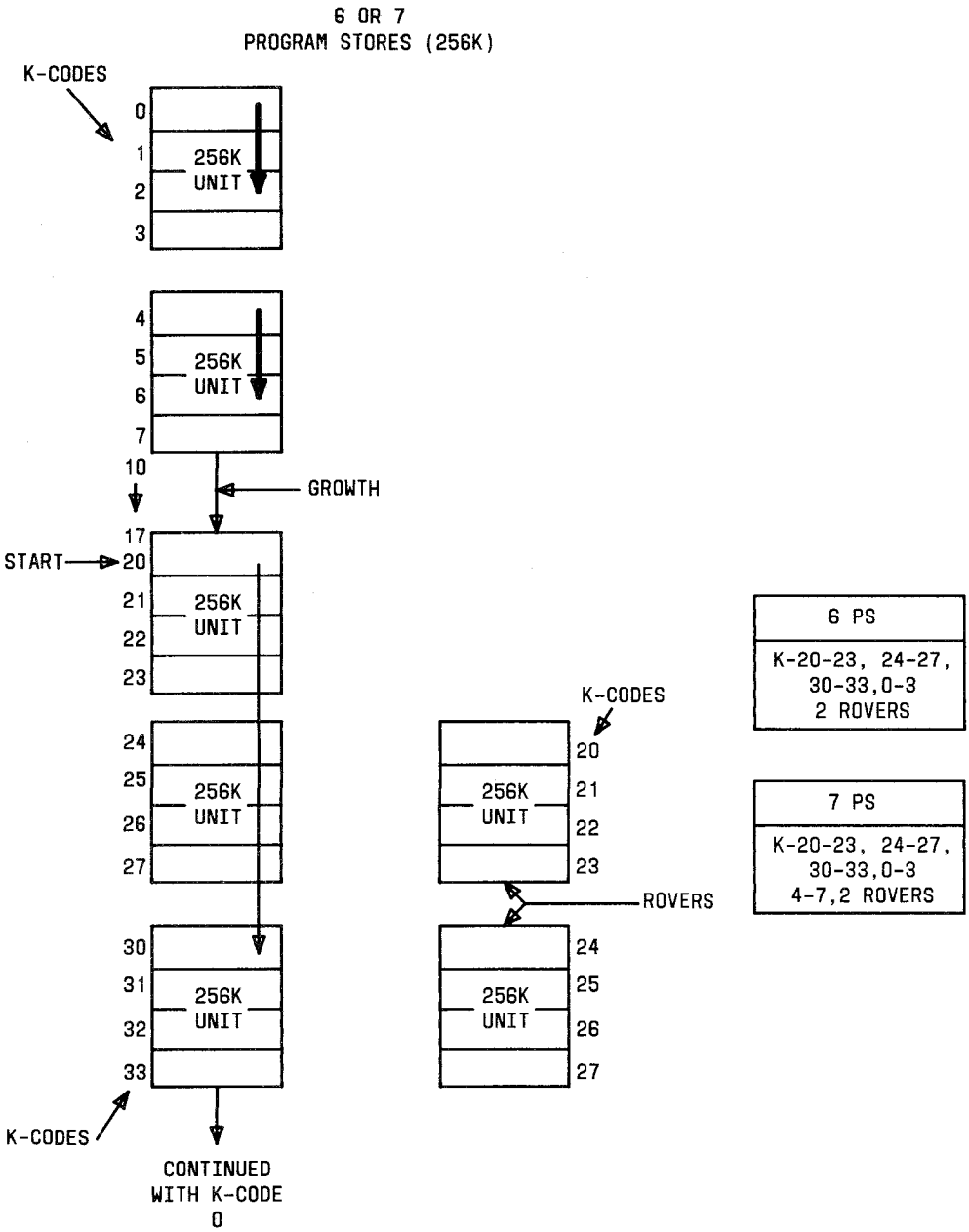


Fig. 9 — Program Store Memory Address and K-Code Spectrum (1AE7)



NOTE:

1. THE GENERIC PROGRAM STARTS AT K-20 THROUGH K-33. K-CODES 34, 35, 36, 37 ARE SKIPPED. THE GENERIC PROGRAM THEN WRAPS AROUND AND CONTINUES WITH K 0, 1, 2, 3. HENCE 16 PS K-CODES FOR FOUR 256K UNITS

Fig. 10 — Program Store K-Code Spectrum (1AE7)

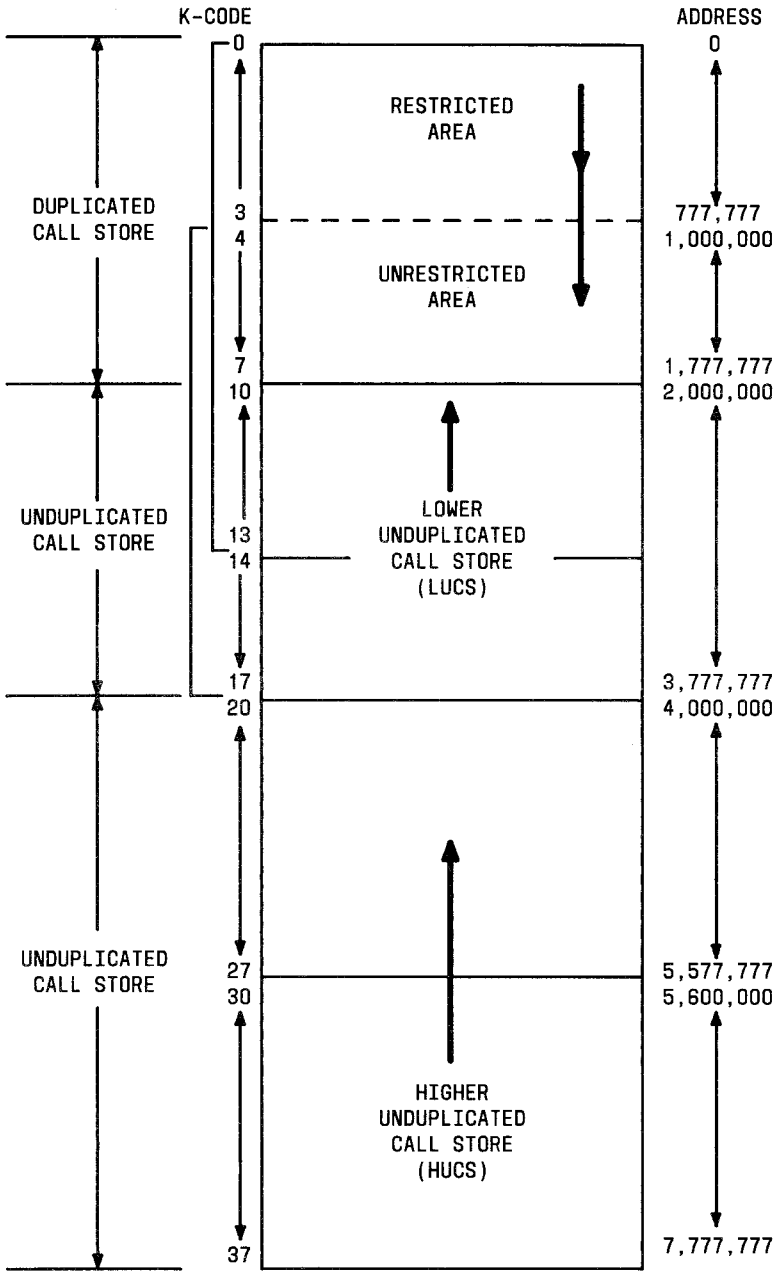


Fig. 11 — Call Store Memory Address and K-Code Specification (1AE7)

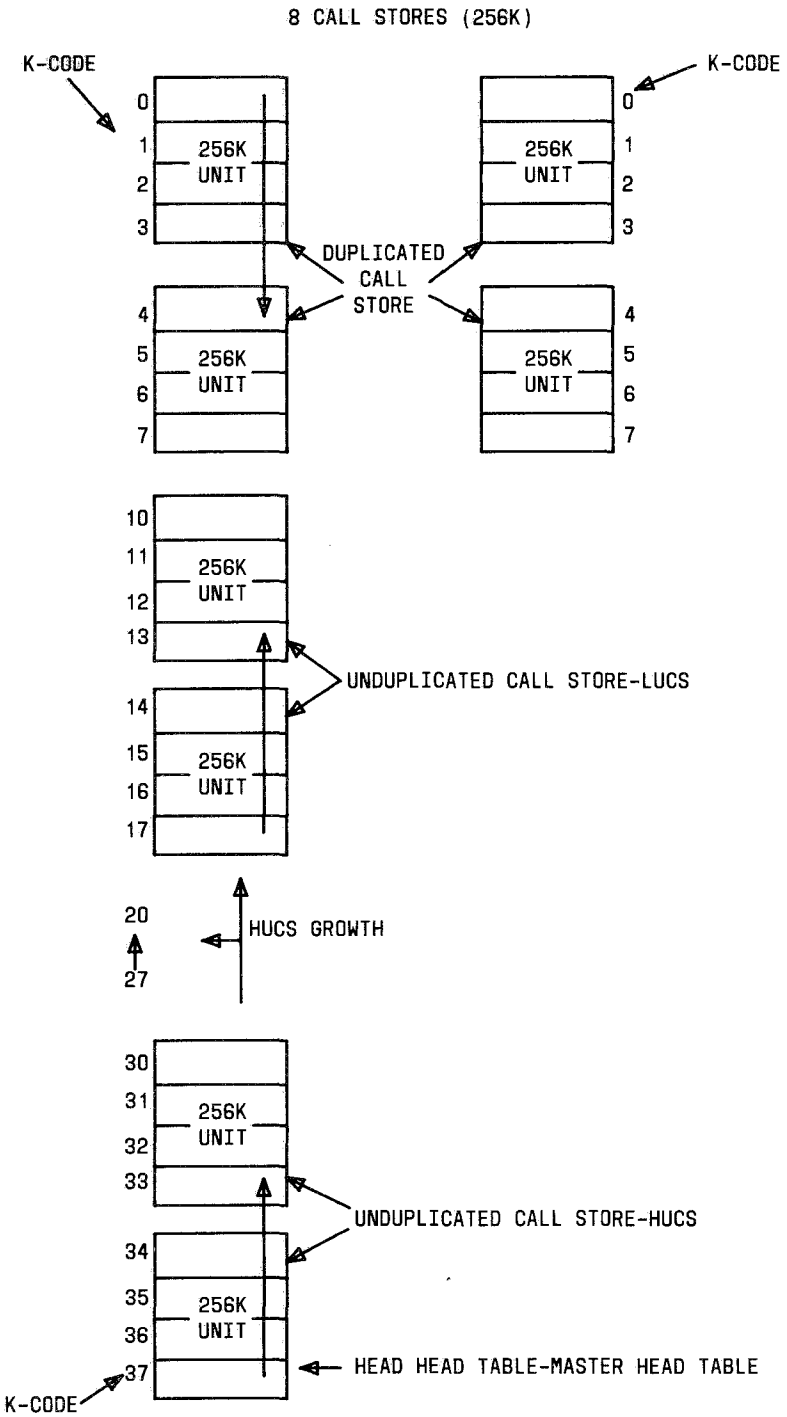


Fig. 12 — Call Store K-Code Spectrum (1AE7)

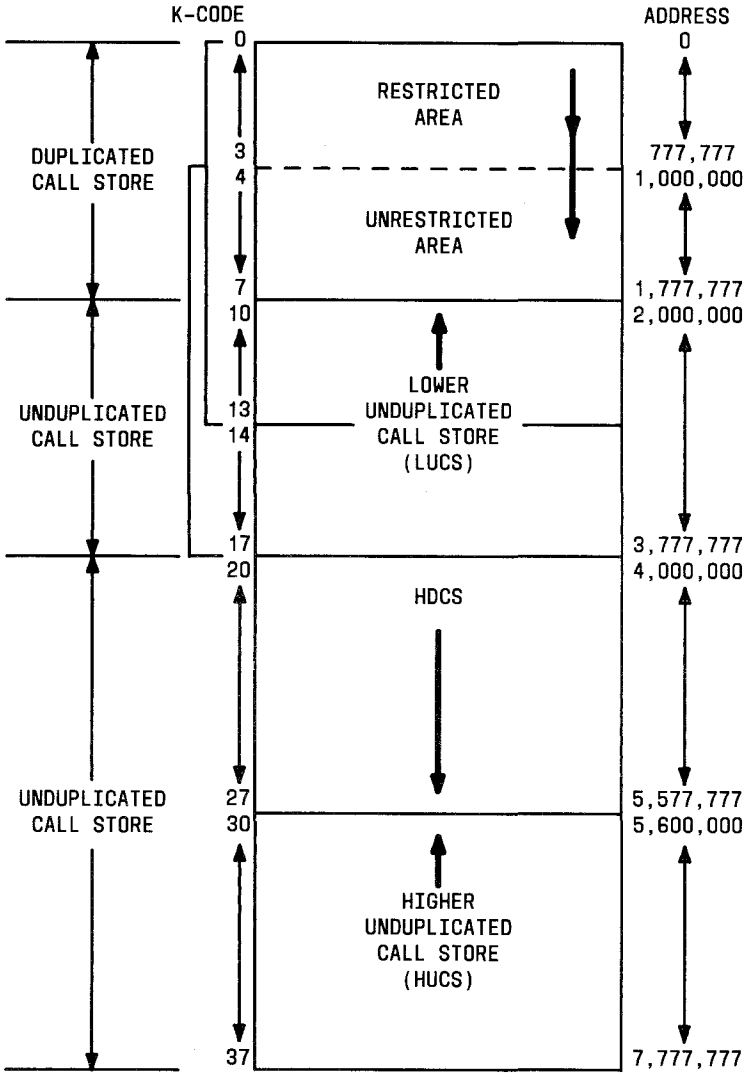


Fig. 13 — Call Store Memory Address and K-Code Specification (1AE10.02)

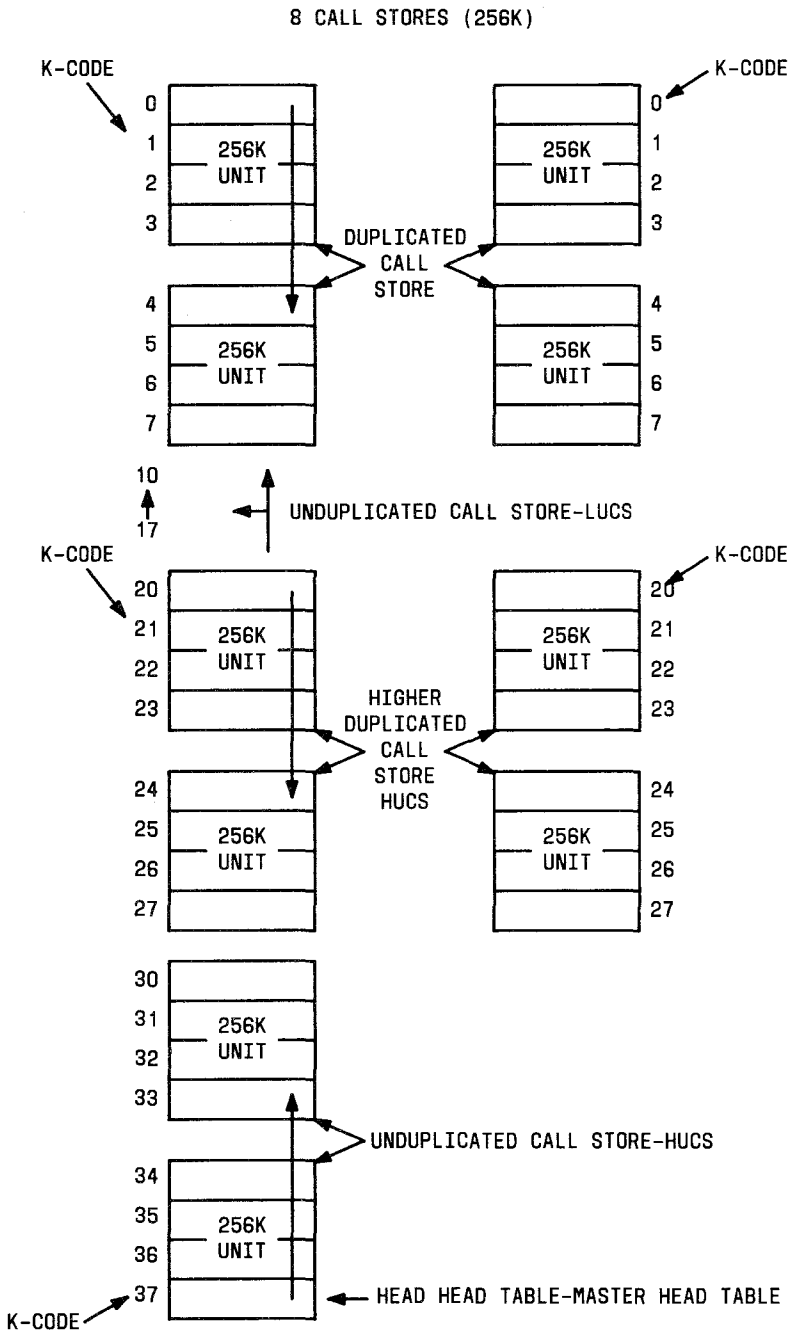


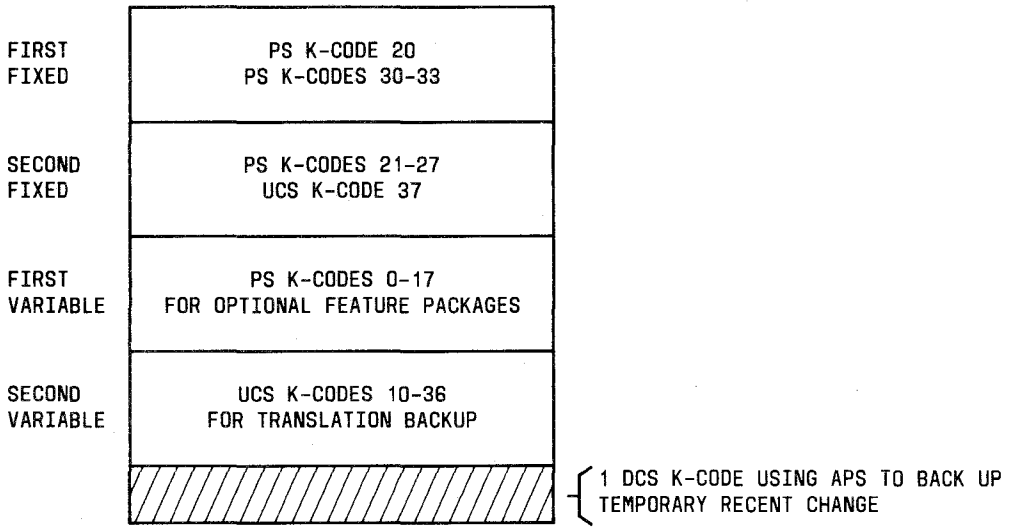
Fig. 14 — Call Store K-Code Spectrum (1AE10.02)

PA-6A002

SECTION 0002:	LOCAL/TOLL 3/6-DIGIT SUBTRANSLATOR LOCAL/TOLL 3-DIGIT SUBTRANSLATOR LOCAL/TOLL 6-DIGIT SUBTRANSLATOR
SECTION 0011:	MULTILINE HUNT GROUP COMMON BLOCKS HUNT LIST HEAD TABLE & OUTDIAL LIST HEAD TABLE HUNTING LIST & OUTDIAL LIST
SECTION 0015:	CENTREX COMMON BLOCKS DIGIT INTERPRETER TABLES SPEED CALL DIAL LIST ADDRESS BLOCKS WORDS
SECTION 0026:	TANDEM COMMOM BLOCK TANDEM DIGIT INTERPRETER TABLE
SECTION 0034:	DN-CTX GROUP NUMBER TRANSLATOR D5 INTERPRETER TABLE D6 INTERPRETER TABLE D7 INTERPRETER TABLE
SECTION 0037:	IDDD DIGIT INTERPRETER TABLE
SECTION 0048:	TOLL DIGIT-BY-DIGIT HEAD TABLE TOLL DIGIT-BY-DIGIT INTERPRETER TABLE
SECTION 0066:	RDI KEY SIGNAL SUBTRANSLATOR
SECTION 0075:	RSS COMMON BLOCK
SECTION 0076:	CCIS BAND SUBTRANSLATOR
SECTION 0081:	AC-TRTG DIGIT INTERPRETER TABLE AC-TRTG 1000'S BLOCK SUBTRANSLATOR AC-TRTG 100'S BLOCK SUBTRANSLATOR AC-TRTG ORDERED LIST SUBTRANSLATOR
SECTION 0099:	TRAVELING CLASS MARK SUBTRANSLATOR
SECTION 0101:	*GNPO/T TRANSLATOR GNPO/T SUBTRANSLATOR 1ST LEVEL NODE TABLE 2ND LEVEL NODE TABLE
SECTION 0102:	*GNP TERM TRANSLATOR NODE TABLE (ALL LEVELS)
SECTION 0103:	*NGN EXTERNAL DN TRANSLATOR TYPE E SUBTRANSLATOR TYPE D SUBTRANSLATOR TYPE S SUBTRANSLATOR
SECTION 0106:	*GNPSNI TRANSLATOR LEVEL TABLES (ALL LEVELS)
SECTION ALL:	AUXILIARY BLOCKS

*INTERNATIONAL USE ONLY

Fig. 15 — LUCS-Type Translation Blocks



NOTE:
1. The APS has the capacity to back up 26 UCS K-Codes and 28 PS K-Codes.

LEGEND

APS - ATTACHED PROCESSOR SYSTEM
DCS - DUPLICATED CALL STORE
PS - PROGRAM STORE
UCS - UNDUPLICATED CALL STORE

Fig. 16 — APS Backup K-Code Spectrum