varian data machines

V70 TOTAL

DATA BASE MANAGEMENT SYSTEM

REFERENCE MANUAL

varian data machines / a varian subsidiary
2722 michelson drive/p.o. box c-19504/irvine/california/92713

varian data machines

98 A 9952 410

DECEMBER 1975

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS (continued)

LIST OF TABLES

SECTION 1
INTRODUCTION

This manual describes the software, hardware requirements, programming, and operation of the Varian TOTAL Data Base Management System (DBMS). An understanding of basic computer concepts is assumed throughout this manual.

1.1 DATA BASE MANAGEMENT CONCEPTS

TOTAL is a software system that manages the storage and retrieval of data from a data base that resides on direct access devices. The advantage of a data base is that it can be created, maintained, and modified independently of application programs. Because the data required by the application programs resides separately on a common data base, redundancy of the same data being contained in different application programs is avoided; in addition, the need for recoding application programs when only the data changes is eliminated.

Thus a data base can be constructed as a separate program module, is available to all applications, yet remains unaffected by changes to various individual application programs. This is illustrated graphically in figure 1-1 which shows the advantages of a single data base containing data available to all application programs, compared with a system which has separate files for each application program, and in which some files may contain the same data.

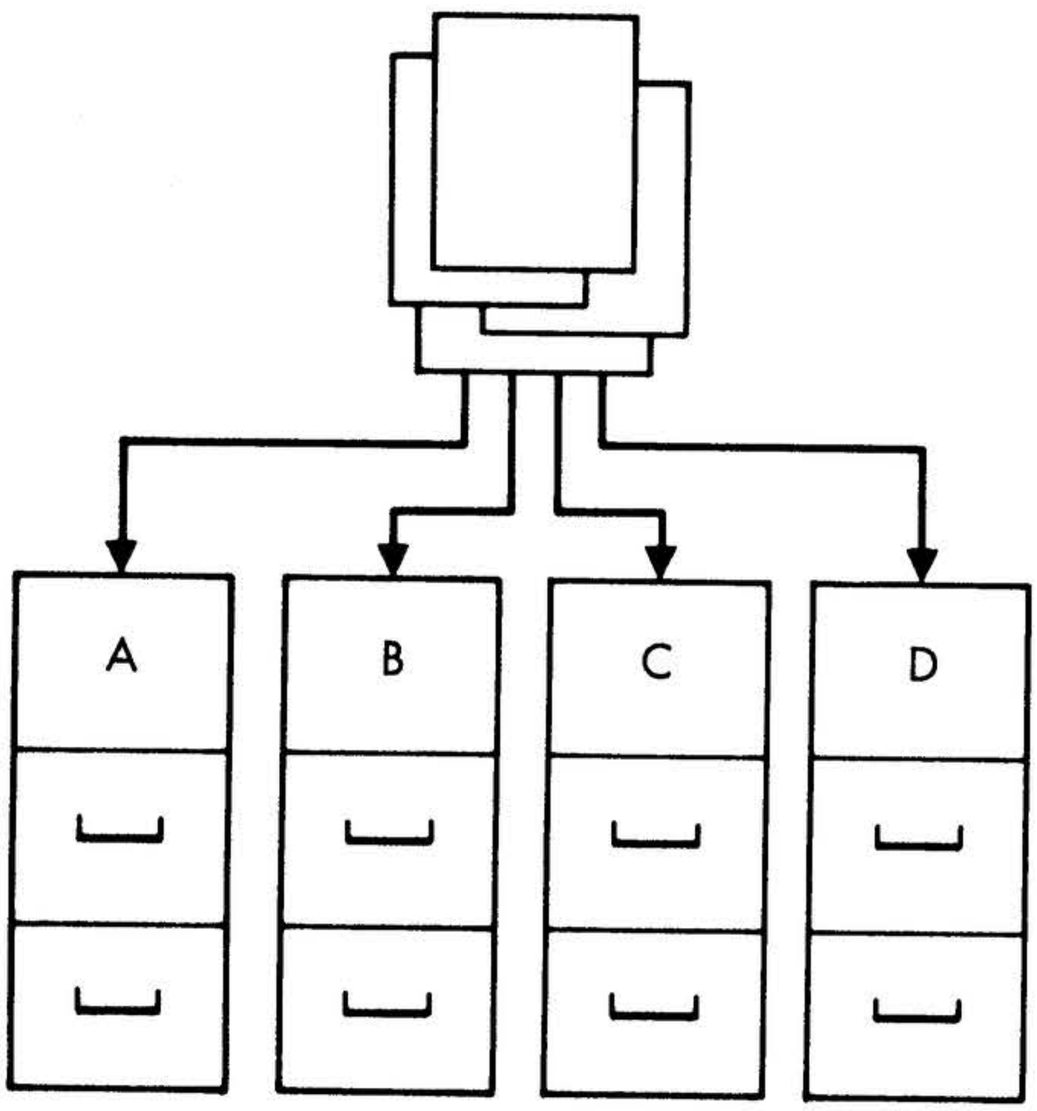
The TOTAL Data Base Management system has been created to manage the data base system, and does this by providing the link between the application programs using the data base, and the data residing in the data base itself. TOTAL is responsible for providing the control of the input and output of all data to and from the data base, and for maintaining the relationships between data files and records within these files. Data is entered only once, and logical relationships are coded into the data as it is entered. The use of a network structure provides direct access to data records and eliminates the need for directories and indexing functions.

In summary, a Data Base Management System has the following advantages:

- ADAPTABILITY - A Data Base Management System can handle all the information needed to operate an organization or business, in a manner that closely matches the organization's day-to-day activities.

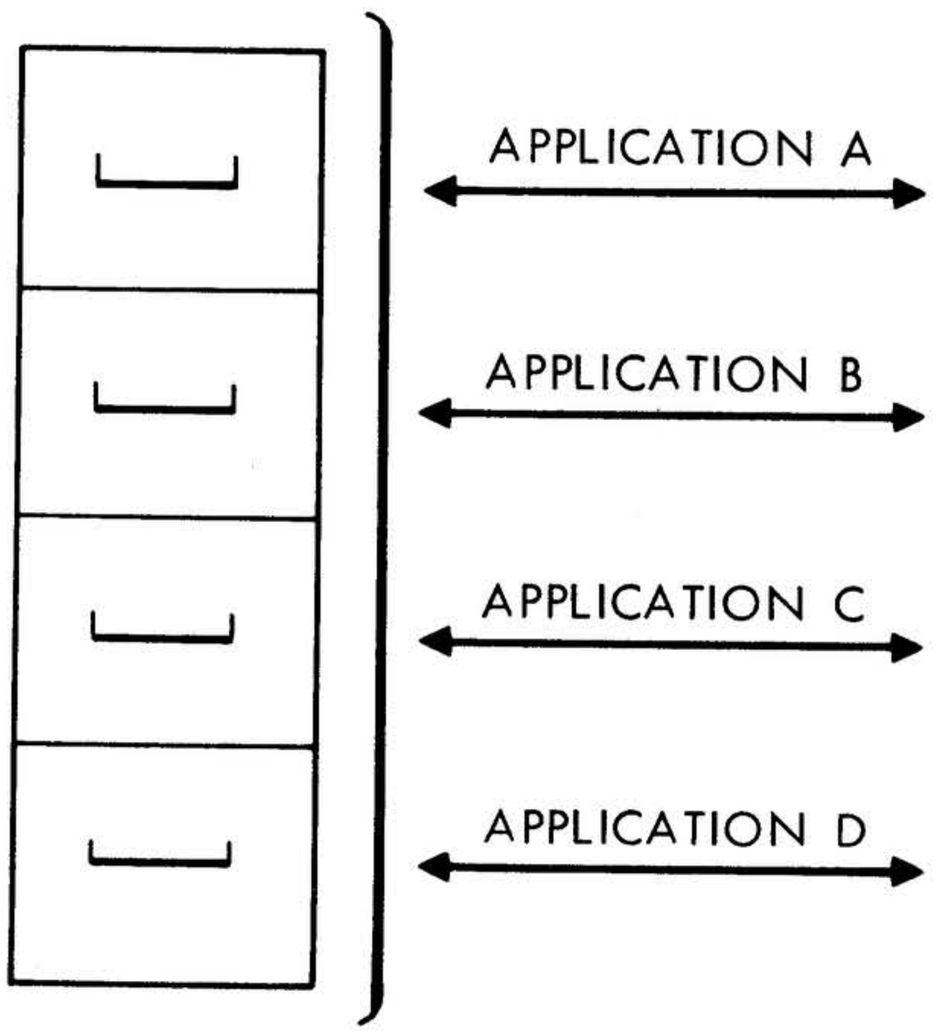
COMMON APPROACH

SEPARATE FILES FOR EACH APPLICATION PROGRAM



TOTAL APPROACH

SINGLE DATA BASE, SHARED BY ALL APPLICATION PROGRAMS



VTI1-3431

Figure 1-1. Advantages of a Single Data Base

- RELATABILITY - Every element of information is capable of being easily linked to every other related element.

- NON-REDUNDANCY - No information details are stored more than once, and linkage codes are non-ambiguous and brief.

- ACCESSIBILITY - All information is easily accessible, with minimum dependence on indexes or directories.

- DATA INDEPENDENCE - Changes in one part of the data base do not jeopardize the accessibility or integrity of any other information in the system which is being used at the time of existing application programs.

- EXPANDABILITY - New types of information and new data links are easy to add, without affecting the established data base system.

- PROGRAM TRANSPARENCY - The physical location of the data no longer need be of concern to the application programmer; he is able to communicate with the data base system in his customary assembly or higher-level language.

- SOFTWARE MODULARITY - Only the system modules required for the program being executed need occupy space in the computer's main memory.

- HARDWARE UTILIZATION - Both main and secondary storage can be used in an efficient manner, without wastage due to partially filled sectors or deleted data.

- COST SAVINGS - Each of the above advantages contribute directly to the dollar savings that result from the installation and implementation of a data base system.

- USER ORIENTED - A Data Base Management System is user-oriented and can be learned quickly, understood easily, and used conveniently for a wide range of applications.

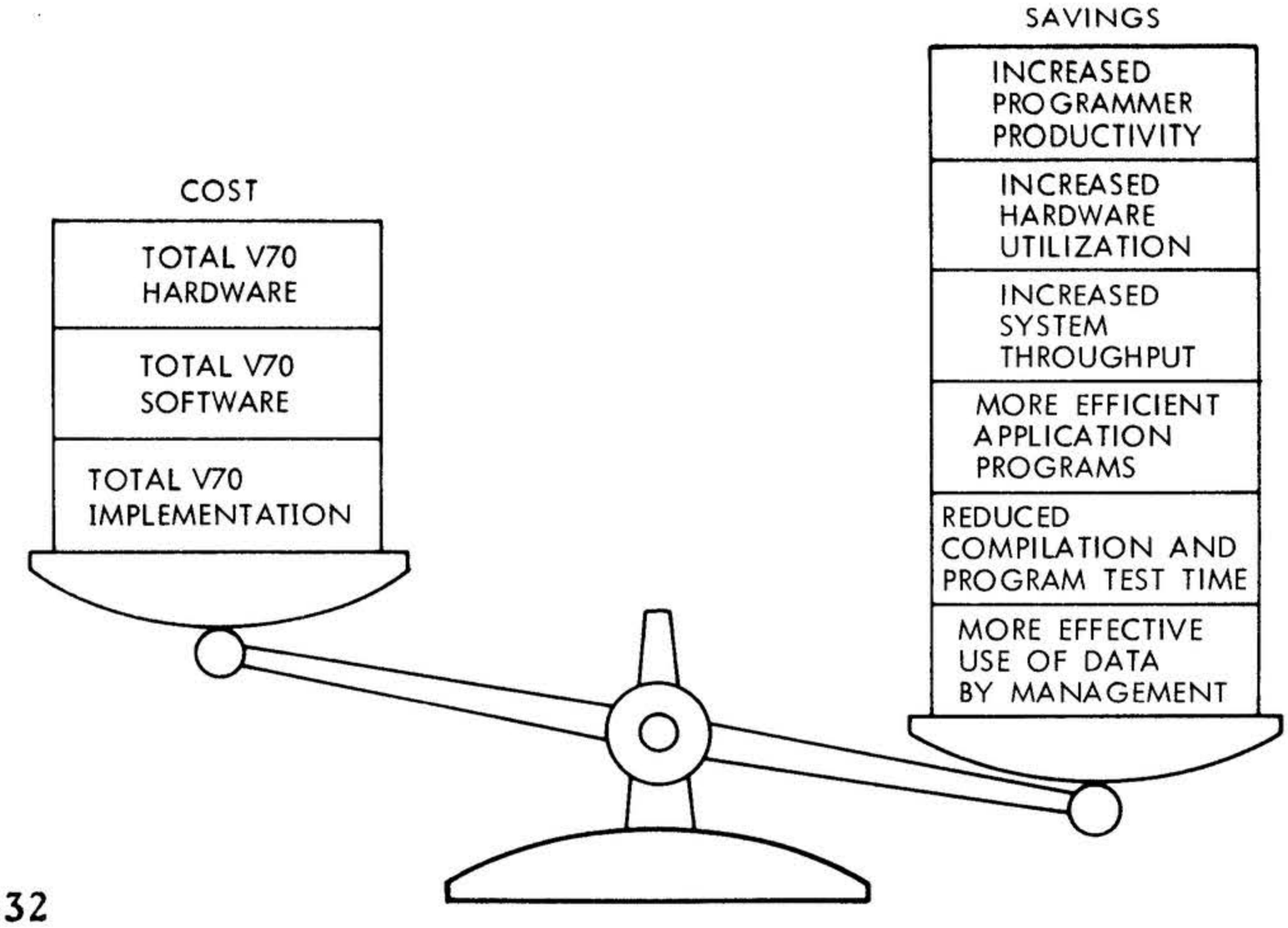
1.2 KEY FEATURES OF VORTEX TOTAL

VORTEX TOTAL is a host language Data Base Management System which provides an effective method for organizing and managing diverse data to make it both efficient and convenient for application programmers to maintain and retrieve the data for processing. It performs in both a batch and on-line environment. It is physically organized, through data chaining, as a network data base.

Key features of the TOTAL Data Base Management System are:

- An unlimited number of data files can be managed.
- Direct linkage between logical data groups is provided.
- Instead of using a rigid level-by-level pattern of access, only those qualifiers needed for each specific accessing operation are used.
- Users retain control of structuring the data and the files.
- TOTAL is designed for transaction-oriented systems.
- Duplication and redundancy of data is eliminated, because data is stored only once, regardless of the different criteria by which the information may be accessed.
- Changes needed in application programs can be made at minimum cost, because the data is separate from the program.
- Changes to data files can be made without having to modify programs that do not require the new data elements.
- TOTAL enables changes in hardware configurations to be made without affecting the data files.
- TOTAL can be used with programs written in FORTRAN, RPG II, COBOL, and DASMR (Varian assembly language).
- Integrity and security of data is assured by means of data set locking. Control of the data input and output by assigning a Data Base Administrator can additionally increase data security.

Figure 1-2 compares the cost of implementing a Varian Data Base Management System with the cost savings which result from its implementation.



VTI1-3432

Figure 1-2. Comparison of Cost and Savings

1.3 HARDWARE CONFIGURATION AND REQUIREMENTS

The size of the Varian computer and peripheral complement to support a TOTAL user varies considerably depending upon such factors as the size of the data base, the frequency of access and level of multiprogramming within VORTEX II. However, there is a physical minimum configuration for operation VORTEX II and TOTAL. Following is a definition of the various V70 computer systems for use with TOTAL.

1.3.1 Minimum Configuration

- Any V70 series processor with a least 64K words (128K bytes) of main memory and the extended instruction set.
- Memory map option - standard in V74 and V75 computers.
- 512 words of writable control store - standard in V74 and V75 computers.

- Priority interrupt module (PIM)
- 33/35 ASR Teletype (or compatible CRT) connected to a PIM.
- Rotating memory device (RMD) connected to a PIM with either a buffer interlace controller (BIC) or block transfer controller (BTC).
- One of the following connected to a PIM:
  - Card reader with a BIC
  - Magnetic tape unit with a BIC

1.3.2 Typical Configuration

Data base applications typically require large amounts of disc storage and moderate to high volume printed output. Disc backup is provided by periodic dumping of the data base. Supporting this type of user would require adding the following to the minimum configuration:

- Additional or larger capacity rotating memory devices
- Line printer
- Magnetic tape unit

1.3.3 Expanded Configuration

The minimum configuration for TOTAL utilizes the commercial firmware package in writable control store (WCS). In the event that a user wants to run FORTRAN IV also and utilize WCS, a second 512 word WCS for the scientific firmware (FORTRAN accelerator) must be added.

For a large scale data base application, a typical VORTEX II system would include the addition of:

- One or more magnetic tape units
- Data communications multiplexor with necessary line adapters
- One or more Teletype or compatible CRT terminals

A TOTAL Data Base Management System is shown in figure 1-3. Figure 1-4 shows schematically, the required and optional hardware and their connection to the I/O bus.

1.4 BIBLIOGRAPHY

The following manuals contain information on Varian hardware and software that would be helpful to the TOTAL user (the x at the end of each document number is the revision number and can be any digit 0 through 9):

Title	Manual Number
V72 System Handbook	98 A 9906 20x
V73 System Handbook	98 A 9906 01x
V74 System Handbook	98 A 9906 21x
V75 System Supplement	98 A 9906 22x
VORTEX II Reference Manual	98 A 9952 24x

1.5 DEFINITION OF TERMS

1.5.1 Logical Components

Logical components in a TOTAL data base are entities a user sees and deals with. The basic components are:

DATA ITEM: the smallest identifiable and accessible data entry.

DATA ELEMENT: a collection of one or more data fields or a collection of one or more data items.

DATA RECORD: a collection of data elements and data items.

DATA SET: a collection of data records. Same as a data file.

DATA BASE: a collection of data sets.

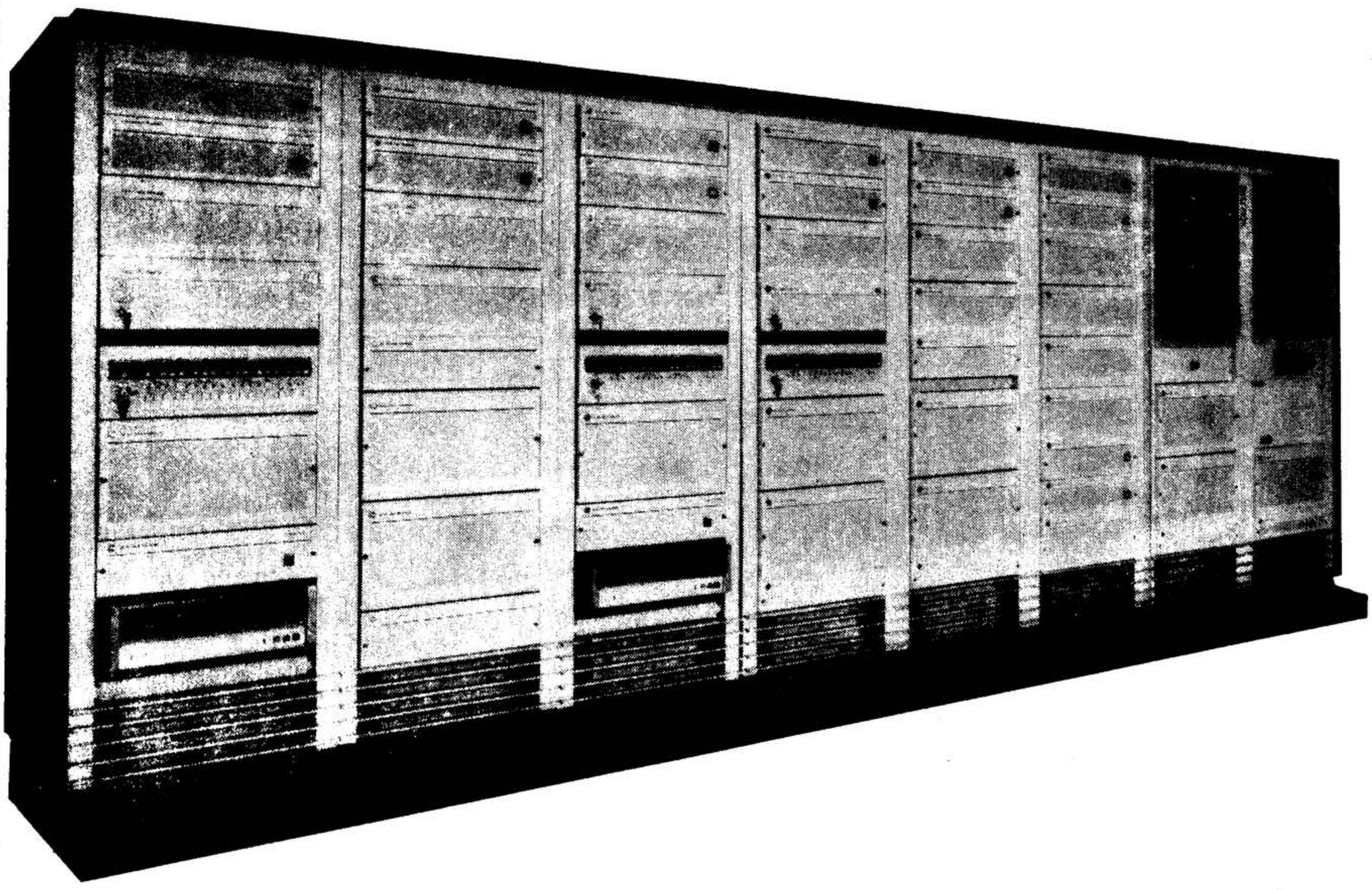
LINKAGE PATH: a special associative data element reserved by TOTAL to relate associated records.

MASTER DATA SET: an independent entity which can be stand-alone or have one or more dependent (variable) data sets attached to it.

MASTER SYNONYM RECORDS: master data set records with different control keys which randomize to the same "home" address.

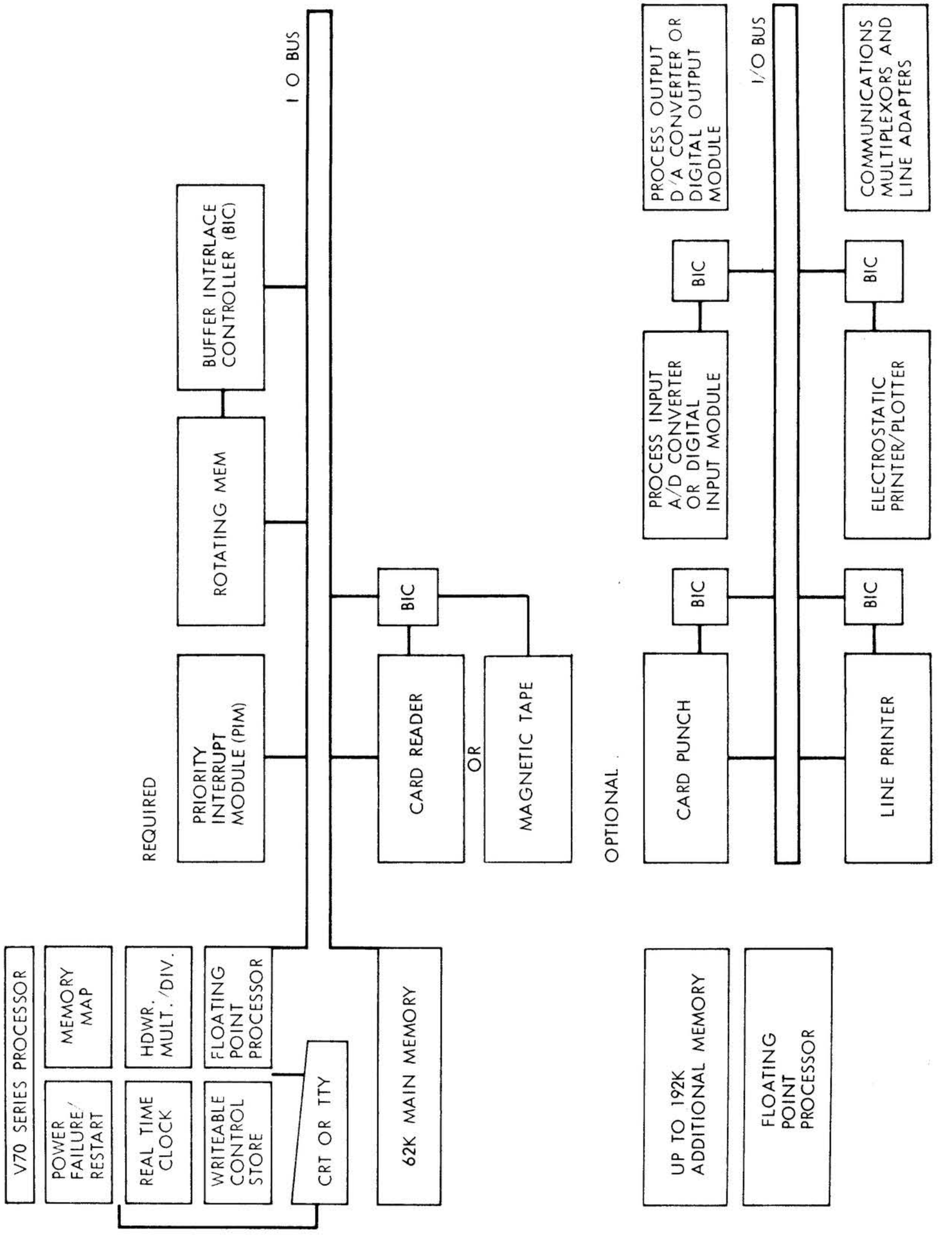
ROOT: a special associative data element reserved by TOTAL which relates master synonym records to their "home" record.

VARIABLE DATA SET: a data set containing records which are logically accessed through a specific master record.



VTI-3455

Figure 1-3. TOTAL Data Base Management System



VTI1-3434

Figure 1-4. Required and Optional Hardware

1.5.2 Special Names

TOTAL has some terms with special names which have a specific meaning. They are:

CONTROL KEY: a unique identifier which identifies a record in a single entry data set. It is used in a variable record to identify to which master record a variable is related.

CODED RECORDS: a facility of the TOTAL system which provides the variable entry file with the ability to contain records with a variable number of data formats.

DATBAS: TOTAL entry point from user call statement. Must be defined as an external.

DBDL: Data Base Definition Language - the language by means of which the user defines the TOTAL data base files, their contents, and their associations to each other.

DBFMT: Data Base Formattor - the TOTAL object module which accepts the data set format control cards, and creates and preformats the specified RMD data set areas.

DBGEN: Data Base Generator - the TOTAL program which accepts the Data Base Definition Language (DBDL) statements and generates the Data Base Descriptor Module (DBMOD).

DBMOD: Data Base Descriptor Module - the object module defining the TOTAL data base produced by the DASMR assembler from DBDL assembler language source statements.

DML: Data Management Language - the language provided by TOTAL allowing the user to access and manipulate the data base through calls in his application program.

INTERNAL REFERENCE POINT: the relative record number (rrn) of a record placed in the Reference Field of a DML command.

LOGICAL FILE: a TOTAL file which may contain one or more VORTEX physical files.

LOGICAL RECORD: a record as defined in the DBMOD; may or may not coincide with sector size (physical record).

LOGICAL RECORD BLOCK: a group of logical records within a data set.

LOGICAL UNIT: a VORTEX I/O device or RMD partition, referenced by a number.

RANDOMIZING: a hashing procedure involving 32-bit arithmetic, computed mostly by firmware.

RANDOMIZING ALGORITHM: the algorithm which is used to achieve the hashing procedure.

REDEFINED DATA AREA: that fixed length area of a variable data set record which may be used for different data elements. Each variable data set record with a redefined area is identified by a unique record code.

RELATIVE RECORD NUMBER (rrn): the relative record position in the file e.g. the 3rd record has a 'rrn' of 3, etc.

SERIAL PROCESSING: the method of retrieving records serially.
Master serial processing: get the next available record (not entry) in the file (RDNXT).
Variable serial processing: get next record in file (RDNXT) or next record in the linkpath (READV).

1.5.3 Data Management Language (DML) Functions

TOTAL provides the user with the capability to access and manipulate the data in the data base through various DML command functions which can be invoked by a CALL statement in the application program.

Example: CALL 'DATBAS' USING READM, STAT, CUST, KEY, ELEM-LIST, USER-AREA, ENDP.

The available DML command functions are:

a. Serial Processing Functions

RDNXT: serially read a master or variable entry data set.

b. Master Data Set Functions

READM: read a master record.

WRITM: write a master record.

ADD-M: add a master record.

DEL-M: delete a master record.

c. Variable Data Set Functions

READV: read a variable record along the forward direction of a variable record chain.

READR: read a variable record along the reverse direction of a variable record chain.

READD: read a variable record directly by specifying its position.

WRITV: write the variable record retrieved by the preceding read.

ADDVC: add a variable record to the end of a variable record chain.

ADDVB: add a variable record before the one retrieved by the preceding read.

ADDVA: add a variable record after the one retrieved by the preceding read.

DELVD: delete the variable record retrieved by the preceding read.

d. Special Functions

SINON: sign on a program.

SINOF: sign off program

RQLOC: request the home location of a master record.

1.5.4 VORTEX Definitions

DAS MR: Data Assembler System Macro Relocatable - a Varian macro assembler which produces relocatable object code that can be loaded into any area of memory.

DO: VORTEX debugging output logical unit.

FCB: File Control Block.

PI: Processor Input -a VORTEX logical unit assignment.

PIM: Priority Interrupt Module.

RMD: Rotating Memory Device

SNAPSHOT Dump Program (SNAP): a VORTEX dump program which provides both register displays and the contents of specified area of memory.

SS: VORTEX system scratch logical unit.

TEXT block: a portion of the SNAPSHOT dump which is used to interpret the dump.

SECTION 2
TOTAL DATA BASE MANAGEMENT SYSTEM DESCRIPTION

2.1 SYSTEM DESCRIPTION

VORTEX TOTAL is a Data Base Management System with a network structure design which enables one data record to be linked directly with any other of the total number of data records in the data base. This network structure approach produces cost and time savings by eliminating the necessity for accessing the required data record through a hierachal process of level-by-level qualification.

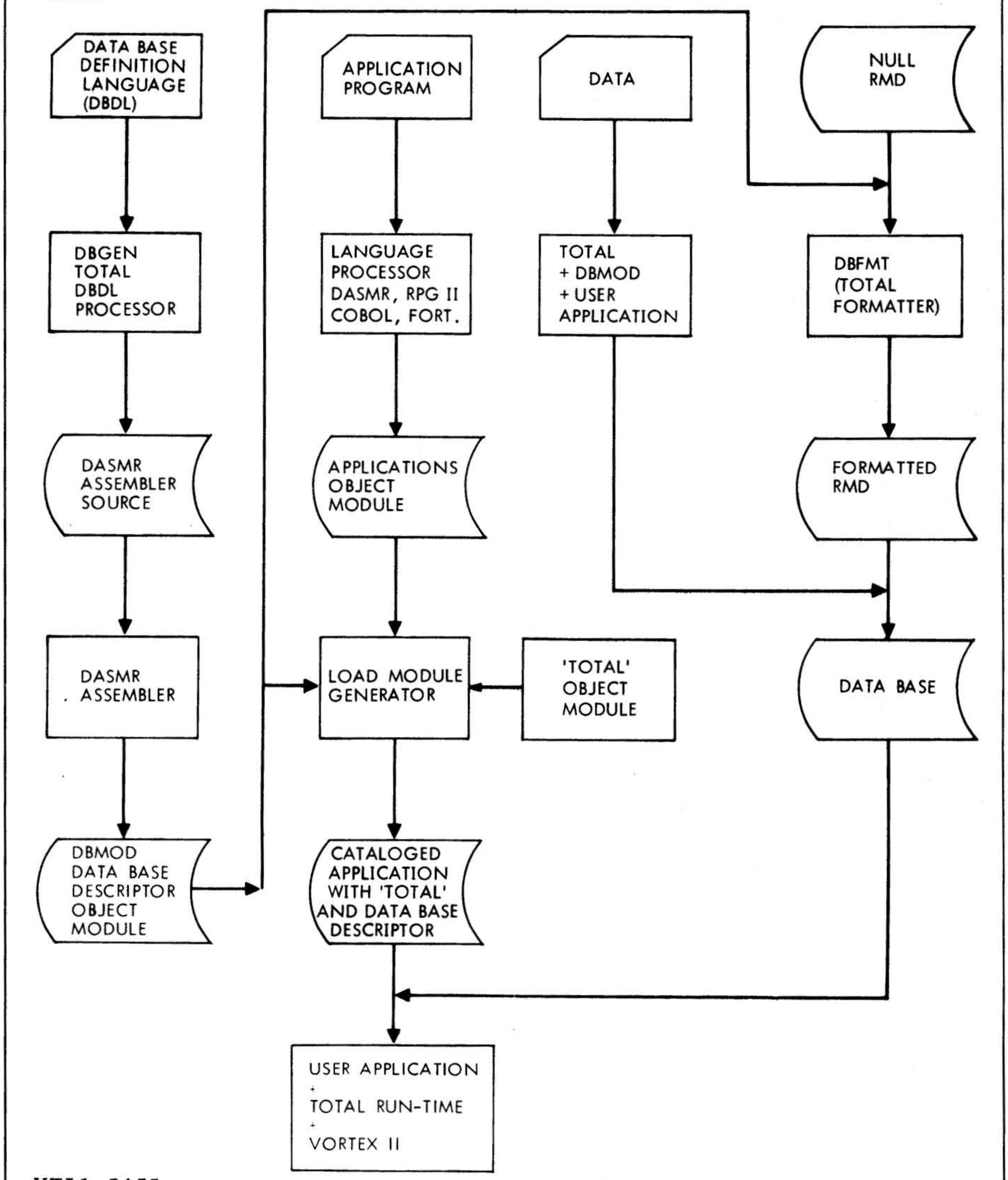
The user structures the data base to be managed by TOTAL by means of the Data Base Definition Language (DBDL). DBDL defines the data base files (data sets), their contents (data records and data elements) and their associations to each other (linkage paths).

After the DBDL statements are completed, the DBDL Processor is used to convert the DBDL statements into assembler language source statements. These, in turn, are assembled into an object Data Base Descriptor Module (DBMOD). The Descriptor module is then catalogued into the user program library. At the same time the Data Base Format program (DBMFT) is used to format the secondary storage area according to the physical requirement of the data base.

The user then uses the Data Management Language (DML) provided by TOTAL to access and manipulate the data base. DML commands are issued via CALL statements in user programs. The functions of the DML commands include the opening and closing of data sets, the accessing and manipulation of master and variable data sets, the serial processing of data sets, and special functions such as program sign-on and sign-off. A flow chart of the TOTAL Data Base Management System is shown in figure 2-1.

2.2 SYSTEM OPERATION

The run time application program consists of three modules, bound together (by LMGEN): TOTAL, the Data Base Descriptor module (DBMOD), and the user program, in that order. The entry point to TOTAL is via DATBAS. When access to the data base is required, the application program calls DATBAS which passes control to TOTAL. TOTAL analyzes the program statements and issues read/write commands. When the task has been accomplished control is returned to the user program. If the function fails to complete,



VTI1-3435

Figure 2-1. VORTEX II TOTAL Data Base Management System

the original data base condition prior to the execution of the call to TOTAL is restored, and a comprehensive diagnostic message to the user is generated.

When changes to the data base are made, the application program remains unchanged. Similarly, when changes to the application program are made, there is no need to re-define and regenerate the data base. A flow chart of the TOTAL DBMS operations is given in figure 2-2.

2.3 STRUCTURE OF THE DATA BASE

The TOTAL data base consists of five levels:

a. Data Base

b. Data Set or File

c. Record

d. Element and Subelement

e. Item

An example of a TOTAL Data Base for customer data is shown in figure 2-3.

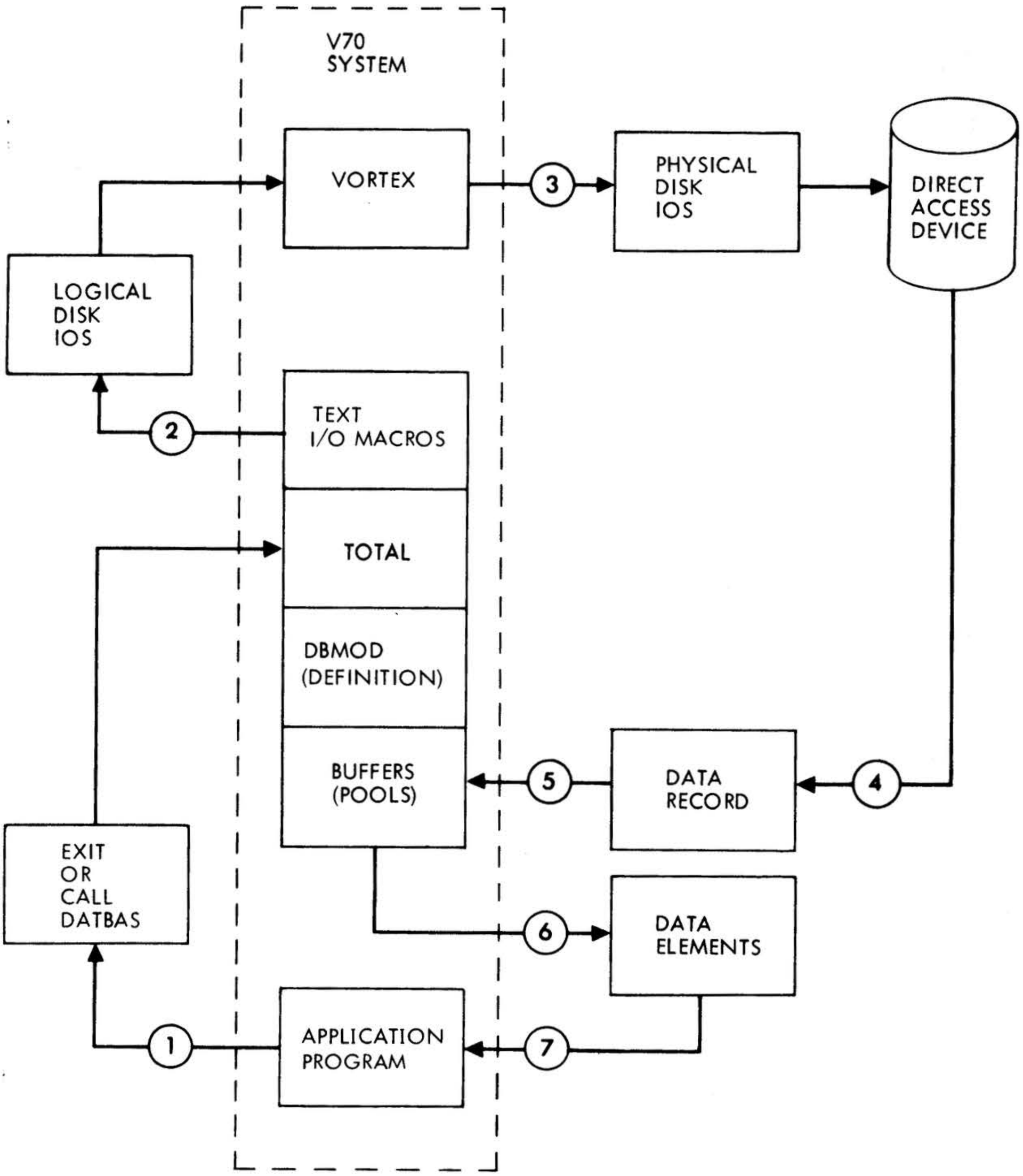
2.3.1 Data Base

A data base is a particular collection of data sets (files) usually (but not required) related and used by a family of application programs. Data bases are assigned 6-character names, such as CUSTMR.

TOTAL manages the data base by managing the relationships among records in the different data sets of the data base. For example, a customer record should be related to its open order records; a finished product record should be related to its component records; a work center record should be related to its production operation records.

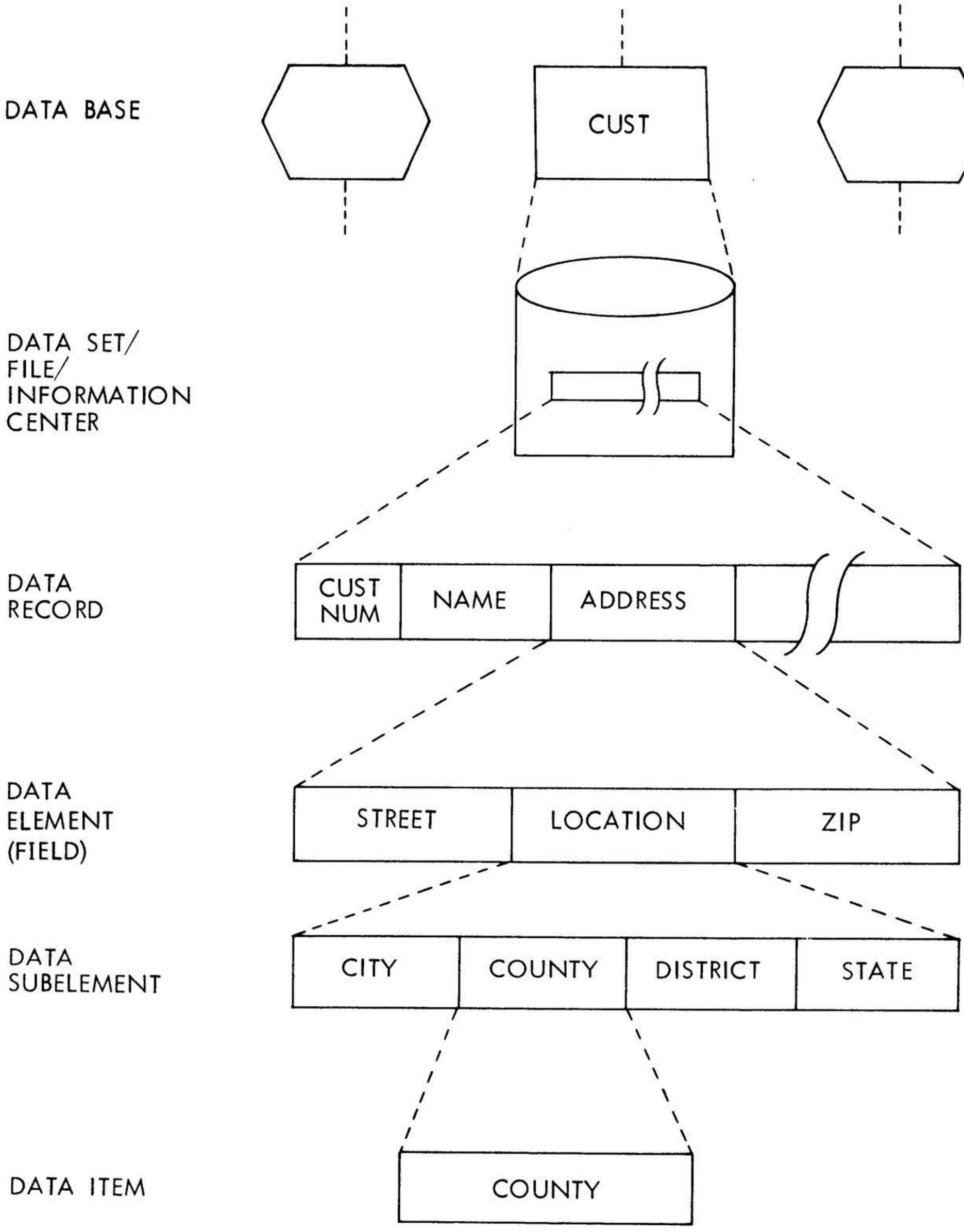
2.3.2 Data Set or Data File

A data set or data file is a collection of data records with the same structure (or collection) of data elements. There are two types of data sets: master (or a single) entry and variable entry (figure 2-4).



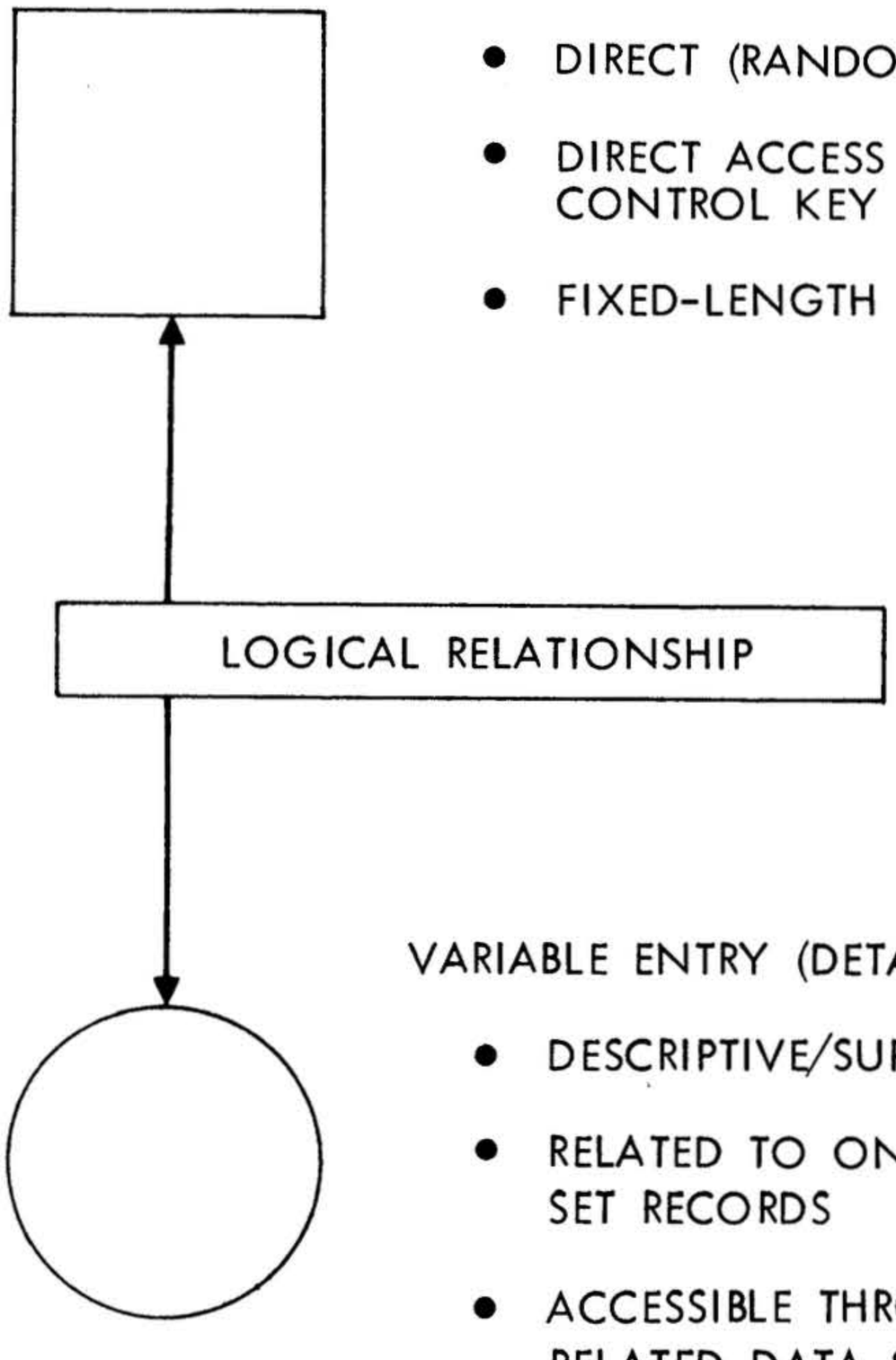
VTI1-3436

Figure 2-2. TOTAL DBMS Operational Flow Chart



VTI1-3437

Figure 2-3. TOTAL Data Base Components



VTI1-3438

Figure 2-4. TOTAL Data Sets

A master data set is an independent entity that can stand-alone or have one or more dependent (variable) data sets attached to it. Each record in a master data set has a unique control key and the record is to be accessed directly according to the value of this control key.

A variable data set must attach to at least one master data set. Records in a variable data set are logically accessed through a particular master record and then from one variable record to the next within the same variable record chain related to the master record.

In TOTAL, a 4-character name is given to the data set, such as CUST, ROUT, PART, or YARD. The general notation for a data set is ffff; occasionally it is indicated as mmmm or vvvv when a distinction between a master or variable data set is required.

The concept of data set corresponds to that of a traditional file. A data set is often referred to as an information center. However, the term data set and file is used interchangeably in this manual.

TOTAL manages data sets by managing the space allocated to each data set. TOTAL knows how much space is allocated to each data set and loads records directly into their prime location within the data set. Upon deletion of a record, TOTAL reuses the freed location to its best advantage through this optimization process.

2.3.3 Data Record

The Data record is a collection of data elements and data items. It conforms to the traditional concept of a record and is identified by a control field or logical key.

TOTAL manages the data records by transferring physical records between memory and the direct access device with the logical read and write. TOTAL supports only fixed length records, blocked or unblocked. The structural capabilities of variable entry data sets satisfy all situations for which variable length records were devised.

Within data records there are special associative data elements reserved for use by TOTAL to relate data records. They are linkage path and root.

Linkage path relates associated records. A master record can be linked to a variable record. A variable record can be linked to another variable record. It is permissible to have multiple linkage path fields in a record and thereby to either (1) relate a given record to many other records within the data base, or (2) relate two records in more than one way.

Root relates master synonym records to their "home" record. When randomly adding records to a data set, it is possible to have more than one record assigned to a specific physical location. When this occurs, TOTAL automatically finds a different unused physical location for the extra records and then uses the root element to relate these displaced records to their "home" locations.

2.3.4 Data Element

The data element is a collection of one or more data items. Data elements must be given a unique 8-character name; the name and the content of the element is determined by the analyst.

An element name is indicated by mmmmxxxx or vvvvxxxx e.g., CUSTCTRL, PARTDESC, ROUTMACH, or YARDNAME, where mmmm is the master data set name, vvvv is the variable data set name, and xxxx is the name of the data element.

TOTAL manages the data elements by selection and insertion of the elements from or to the logical record by means of the Data Management Language (DML) function specified by the application program. Under TOTAL the application program requests and offers data elements. These elements are specified to TOTAL via an element-list. This programmer-written list names the elements desired which have previously been described in the data definition statements (refer to section 3.3).

2.3.5 Data Item

Data item includes the conventional field of data; for example, customer's name, amount of sale, or department number.

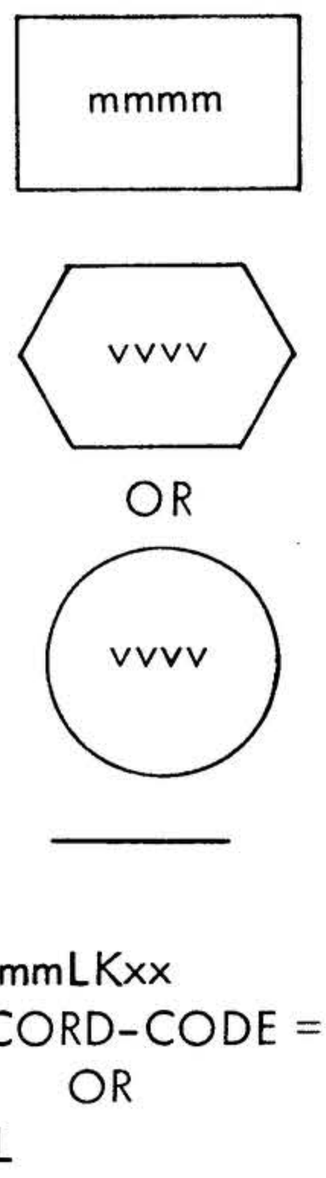
In effect, data item is the smallest identifiable and accessible data entry.

TOTAL manages the data items by documenting the structure of the data element with the Data Base Definition Language (DBDL). The flexibility of data element definition gives the system analyst the capability to define anything from the smallest item in a record to the entire record itself as an element.

2.4 DATA BASE SCHEMATIC

Since the TOTAL system provides the facilities and techniques for the creation of large, complex network data bases and the effective processing of these data bases, it follows that there should be an effective technique to graphically document and represent these data bases. The technique is called the Data Base Schematic.

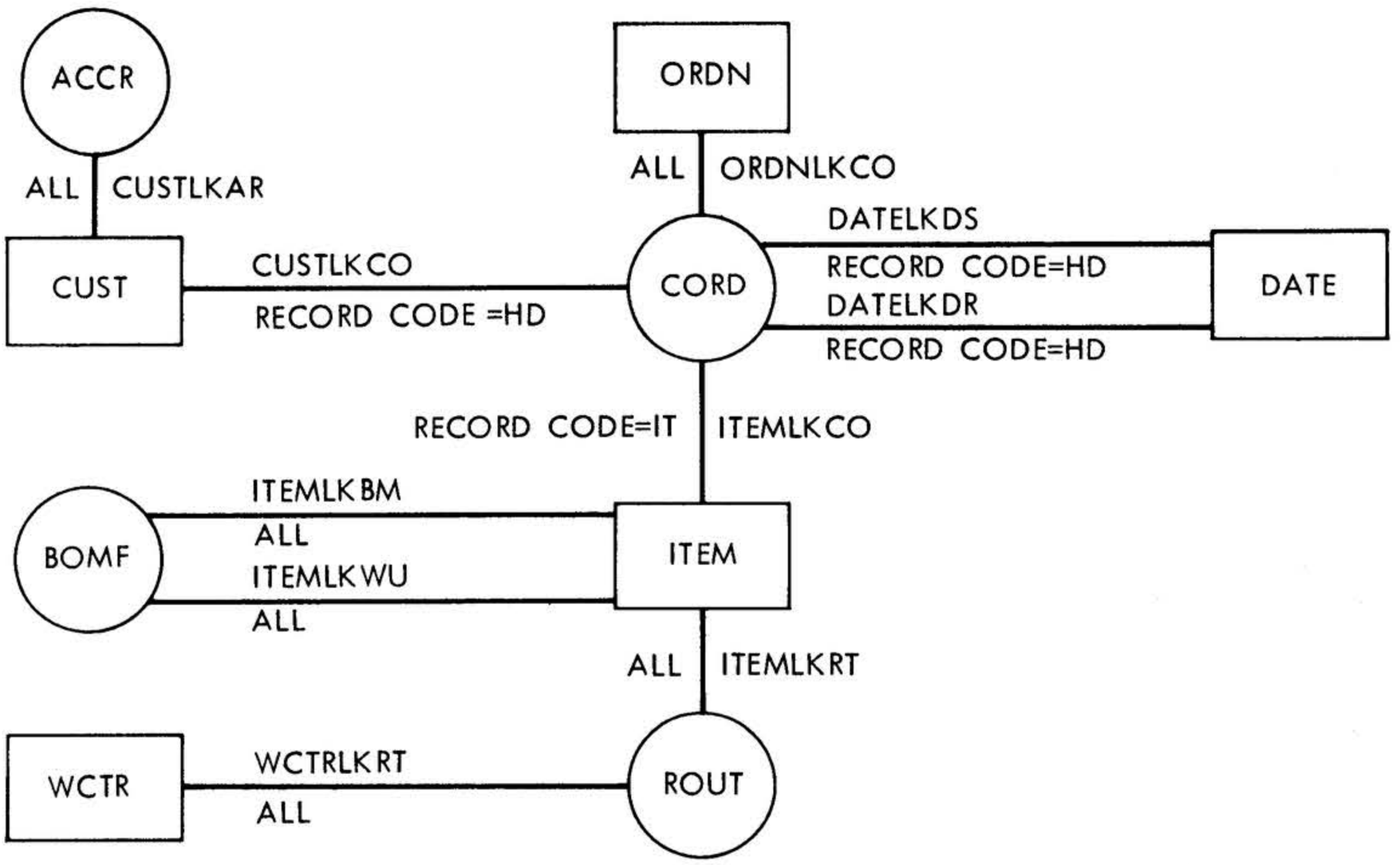
The data base schematic uses graphic symbols to represent the data base module and submodules. These symbols are shown in figure 2-5. A schematic of a data base using these symbols is shown in figure 2-6.



- rectangle represents single entry master file
- mmmm represents single entry master file name
- hexagon or a circle represents variable entry file
- vvvv represents variable entry file name
- ___ represents logical relationship between a single entry file and a variable entry file
- mmmmLKxx represents name of linkage path
- RECORD-CODE=xx represents types of records associated with the specified linkage path
- ALL specifies that the linkage path is linked to all records regardless of record code. (ALL usually is associated with base linkage path.)

VTI1-3439

Figure 2-5. Symbols Used to Form Schematic of the Data Base



VTI1-3440

Figure 2-6. Schematic of Data Base

2.5 DATA RELATABILITY

The direct relatability among different groups of data is the foundation of a TOTAL data base. If you examine various day-to-day applications, you can find many examples where one group of data is related to another group of data, which may relate to still another group, such as:

Customers and open orders

Open orders and inventory orders

Finished items and components

Production orders and labor tickets

Labor tickets and employees

Employees and skill classifications

Student and courses

Bank depositors and account balances

Insurance policyholders and policy coverages

Patients and medical history

Tax payers and tax payments

Authors and publications

In a typical business environment, you want to access information about any customer quickly. Since there are transactions involved with each customer, the efficient processing of transactions corresponding to respective customers is important. With TOTAL the logical approach to organize the two sets of information and their association is:

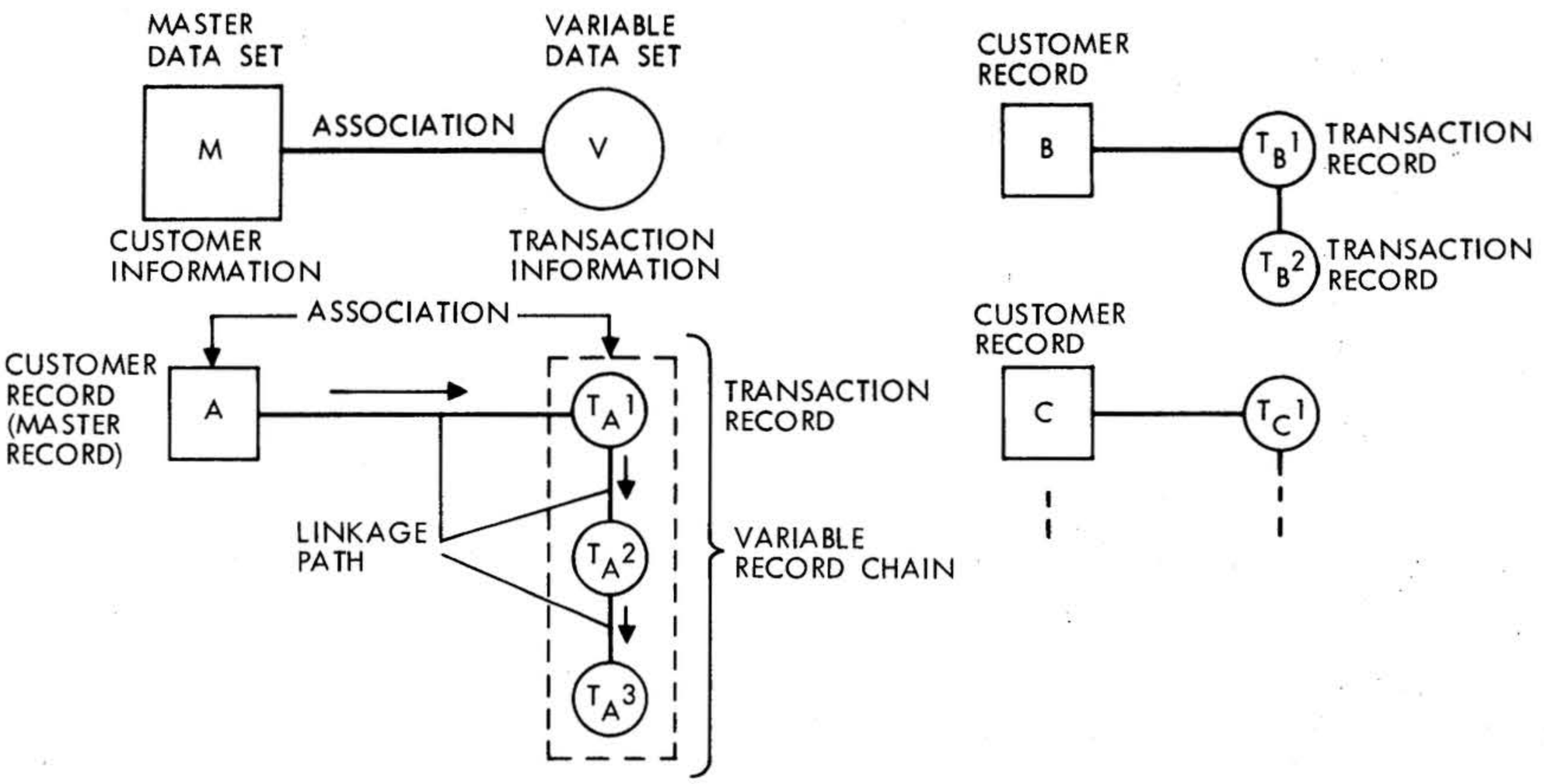
To have the information about each customer in a record directly accessible by customer number. All the customer records are grouped together to form a data set or file. Such a data set is called a master data set because of its independence. The records in it are considered master records.

Transactions corresponding to a particular customer are linked together in a chain, which, in turn, is linked to the associated customer record in the master data set. The transaction records collectively comprise a variable data set. A variable data set is dependent and must be attached to a master data set. The records in a variable data set are called variable records. Figure 2-7 illustrates two related data sets.

Figure 2-7 also illustrates that:

- Transaction records corresponding to a particular customer are chained together because of their association with that customer.
- A customer record is chained together with a group of transaction records because of its association with those transaction records.
- A customer record can be accessed directly by a customer number.
- From a customer record, the first associated transaction record in a chain can be accessed through an access path or linkage path: from the first transaction record, the second transaction record in the chain can be accessed, and so on.

NOTE: Linkage path information is directly stored within a data record.



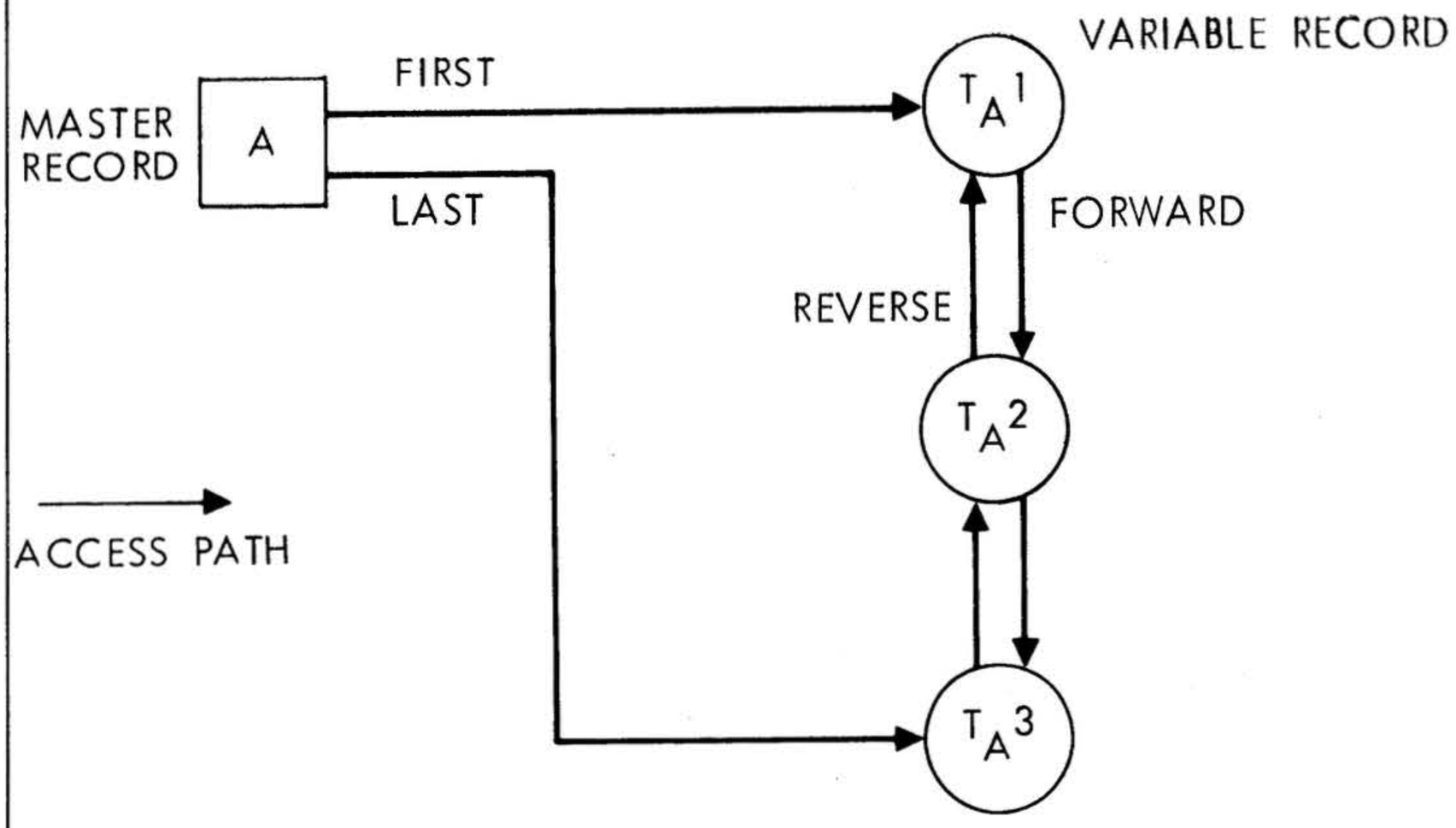
VTI1-3441

Figure 2-7. Two Related Data Sets

Figure 2-8 shows that when a chain of variable records is linked to a master record, a two way closed loop is formed.

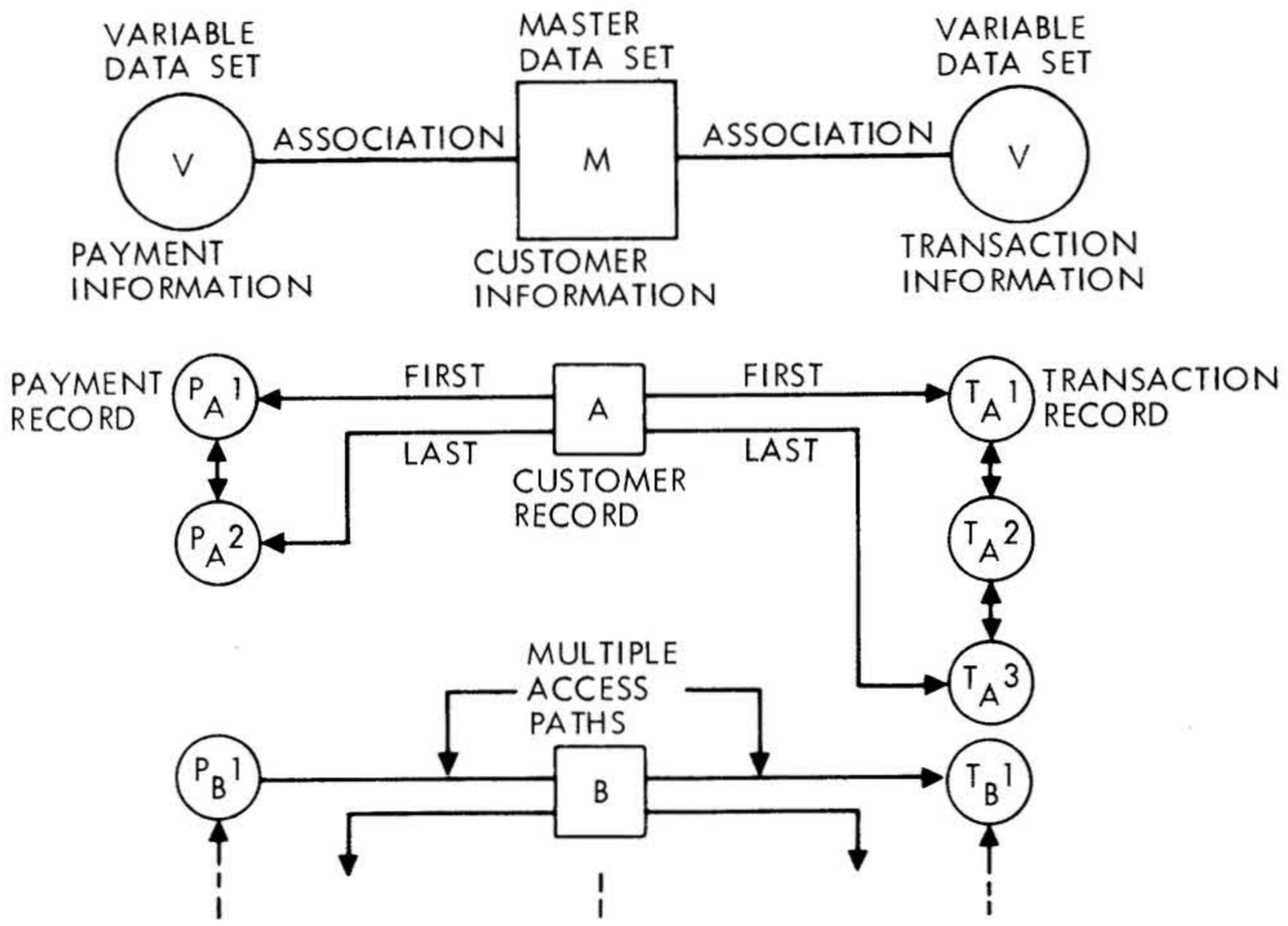
The master record stores information (or links) of two link paths: one to the first record of the variable record chain and the other to the last record of the variable record chain. Each variable record also stores information of two access (or link) paths: one to the next variable record in the chain and the other to the previous variable record in the chain (a forward link and backword link). Thus, the processing of a variable record chain can be started from one end or the other; and in forward or reverse direction, indicating the presence of multiple access paths.

The association can now be expanded beyond two data sets. Again, in a typical situation, a customer may make payments from time to time. If the information about each payment made by each customer is kept in a record, another variable data set can be established. Records of payments made by the same customer are linked to the corresponding customer record of the customer data set. Now there are two variable data sets associated with one master set as shown in figure 2-9. It is significant to note that by accessing a customer record, one can immediately reach the information of transactions and payments made by that customer. Thus, multiple access paths are again established.



VTI1-3442

Figure 2-8. Record Association



VTI1-3443

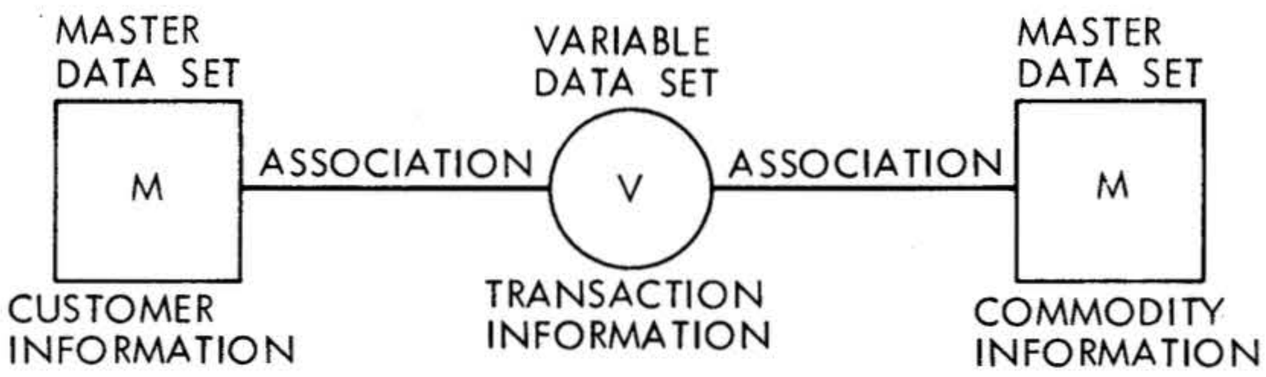
Figure 2-9. Two Variable Data Sets Related to One Master Data Set

However, each customer order transaction may be involved with a particular commodity. If a record is used to describe each commodity, a master data set can be established to include all such records. The master data set may simply be stand-alone. When a commodity number is encountered during the processing of a transaction record, the commodity number can be used as a control key to directly access the record describing that commodity from the commodity master data set.

2.6 TOTAL DATA SETS

TOTAL's data sets are logical direct access data sets. The most significant direct access characteristic of TOTAL is - records are fixed length, blocked or unblocked.

However, if it is important to know which transactions have requested a certain commodity, you can establish an association between the transaction data set and the commodity data set. Thus, transaction records have requested the same commodity link together to form a chain, which, in turn, links to the record describing that commodity. In this case, one variable data set associates with two master data sets as shown in figure 2-10. Records 1,2,3,4.... belong to the variable TRANSACTION



VTI1-3444

Figure 2-10. One Variable Data Set Related to Two Master Data Sets

data set. Records 1,2, and 4 are chained to Master record C1 of the Master Data Set "Commodity Information." Records 1 and 3 are chained to Master record CA of the Master Data Set "Customer Information."

Since there are no indexes to the TOTAL files, all logical records are retrieved directly; that is, with a typical maximum access operation of one seek and one read. In the case of blocked records, if the next record requested is in main storage, no physical operation is performed. TOTAL does not perform redundant operations.

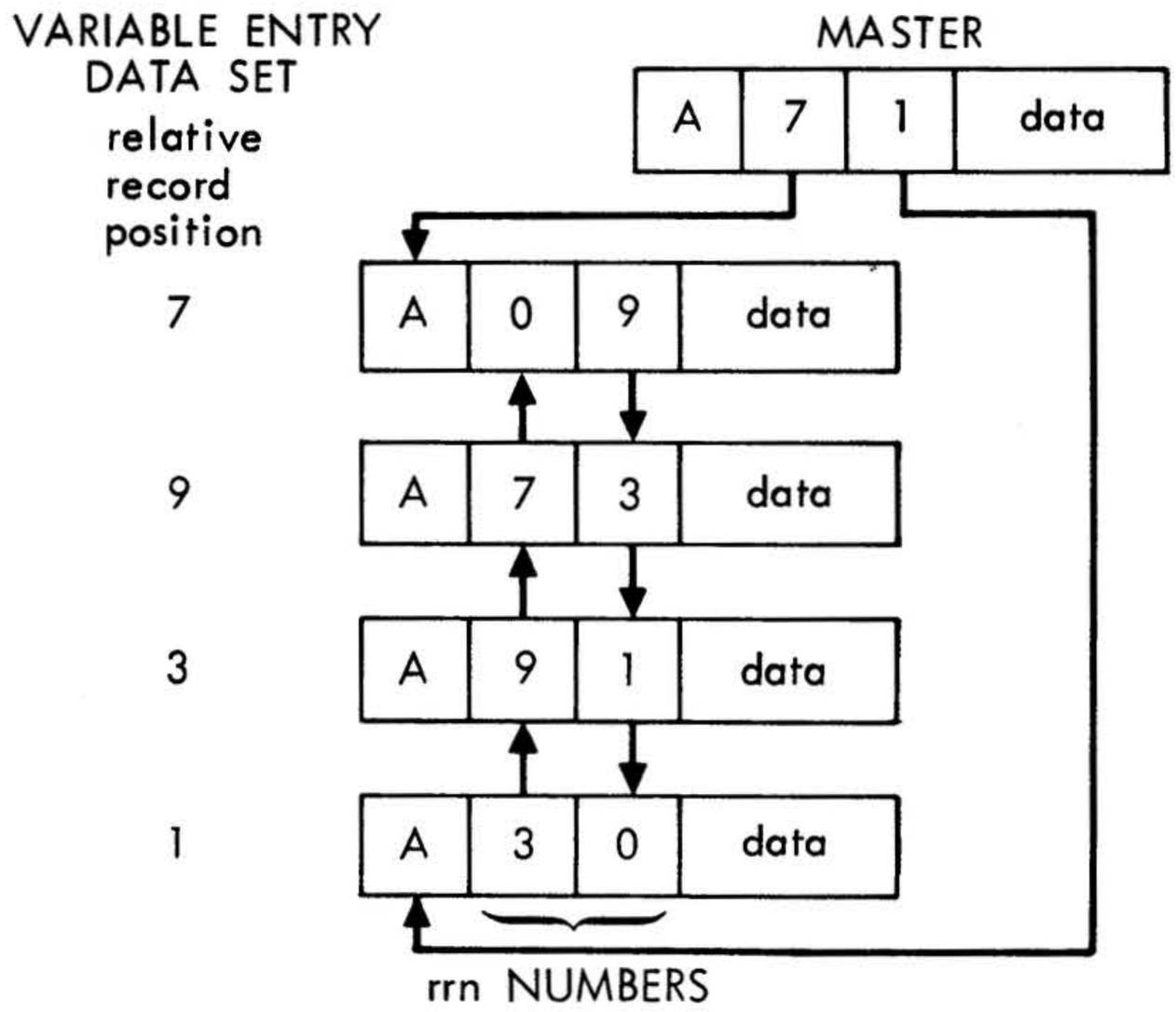
With no separate additional overflow areas available, all added records go into the prime data area's most optimum location according to TOTAL's space management techniques. Therefore, record addition to TOTAL files does not degrade performance.

All record deletions in TOTAL's files are physically removed, freeing the record location for immediate reuse by the TOTAL system. In fact, the freed location can be immediately used by the TOTAL system.

Since TOTAL files are not degraded by record additions and are optimized upon record deletions, TOTAL files do not need to be reorganized. However, a TOTAL file must be reloaded when a physical parameter is changed; for example, increased record length or increased number of records. Even in this case, neither related files nor existing application programs are affected.

TOTAL files can be processed serially but not sequentially; that is, there is no inherent logical serial/sequential nature among the logical records of a TOTAL file. TOTAL stores records randomly according to its internal space management techniques and retrieves records directly. To rearrange a TOTAL file into some desired logical sequence, the user must simply sort the file.

There are two function types of data sets in the TOTAL system: the single entry (master) data set and the variable entry data set. Figure 2-11 depicts the characteristics and relationships of these data sets. All links denote relative record number (rrn).



VTI1-3445

Figure 2-11. TOTAL Data Sets

It is permissible to have stand-alone master data sets, one variable data set associated with multiple master data sets, and one master data set associated with multiple variable data sets. However, it is not permitted to have a stand-alone variable data set, direct association between two master data sets, or between two variable data sets.

When a number of master data sets and variable data sets are meaningfully associated in a group, a data base is formed. Since data sets and their associations spread out horizontally and vertically like a net, the corresponding data base can be described as having network structure.

2.6.1 Single Entry (Master) Data Set Characteristics

Single entry data sets provide the following functions:

a. Store information for immediate direct retrieval by an application program

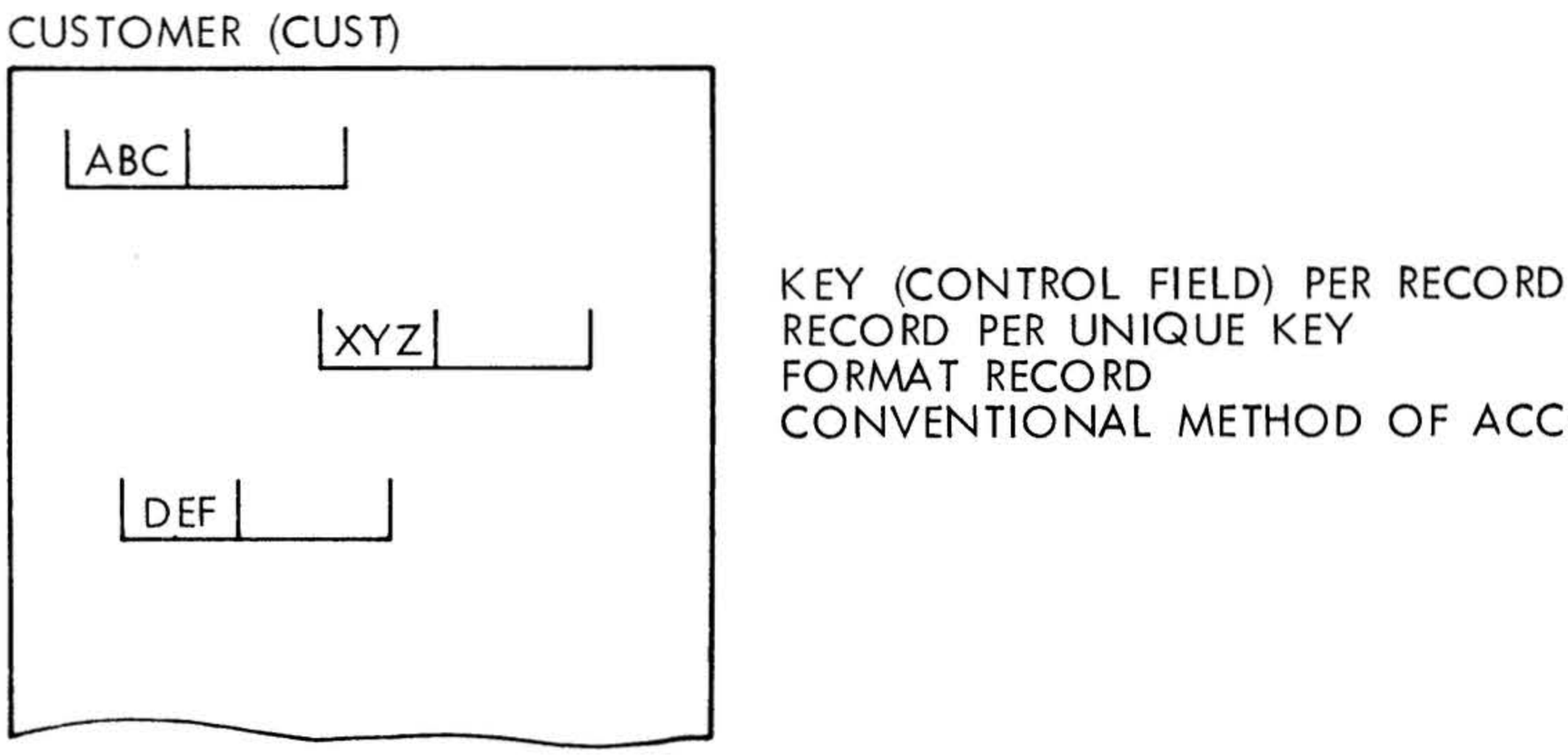
b. Serve as entries or masters to strings of related information, and

c. Edit the control and qualification of the data entering the data base.

Single entry (master) data set records are stored randomly and retrieved directly by the identification of the control field or logical key of each record (figure 2-12). Each single entry (master) data set record has only one key (each key has only one record) and each record is retrieved by requesting the record associated with a particular key.

Each single entry (master) data set record can "own" records of many variable entry data sets. This facility, call relatability, is accomplished by TOTAL's linkage path techniques and is discussed in detail later in this section.

To illustrate the characteristics of the single entry (master) data set, consider the example of a customer master file, such as a patient master file for hospitals. It contains all pertinent information about the customer: number, name, address, and other information unique to the specific business environment. Assume this information is stored on disc so that customer information can be retrieved directly. This is easily and quickly accomplished



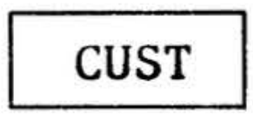
VTI1-3446

Figure 2-12. Single Entry (Master) Data Set Records Retrieval

with the TOTAL system. Using the statements of the TOTAL Data Base Definition Language (DBDL), the definition of the data base contains only one data set. The DBGEN program could be coded as follows:

```
BEGIN-DATA-BASE-GENERATION:
.
.
.
BEGIN-MASTER-DATA-SET
DATA-SET-NAME=CUST
IOAREA=POOL1
MASTER-DATA
CUSTROOT=8                      REQUIRED BY TOTAL
CUSTCTRL=6                      CUSTOMER  NUMBER  (control field; key)
CUSTNAME=30                     CUSTOMER  NAME
CUSTADDR=30                     CUSTOMER  ADDRESS
CUSTCTYS=20                     CUSTOMER  CITY-STATE
CUSTDATA=100                    CUSTOMER  INFORMATION
END-DATA
.
.
.
END-MASTER-DATA-SET
END-DATA-BASE-GENERATION
```

The schematic of this data base would be:



(Rectangle represents single-entry data set)

This data base now permits direct access to any element or list of elements within any customer record. The control field (or logical key) is the 6-character customer number.

2.6.2 Variable Entry Data Set Characteristics

Variable entry data set records are also stored randomly and retrieved directly, but not only by the identification of a unique control field. Variable entry records within the data set are stored serially. The identification of a control field directs TOTAL to relate variable entry records containing that same control field to each other in what is called a chain of records, each record being a member of a logical linkage path.

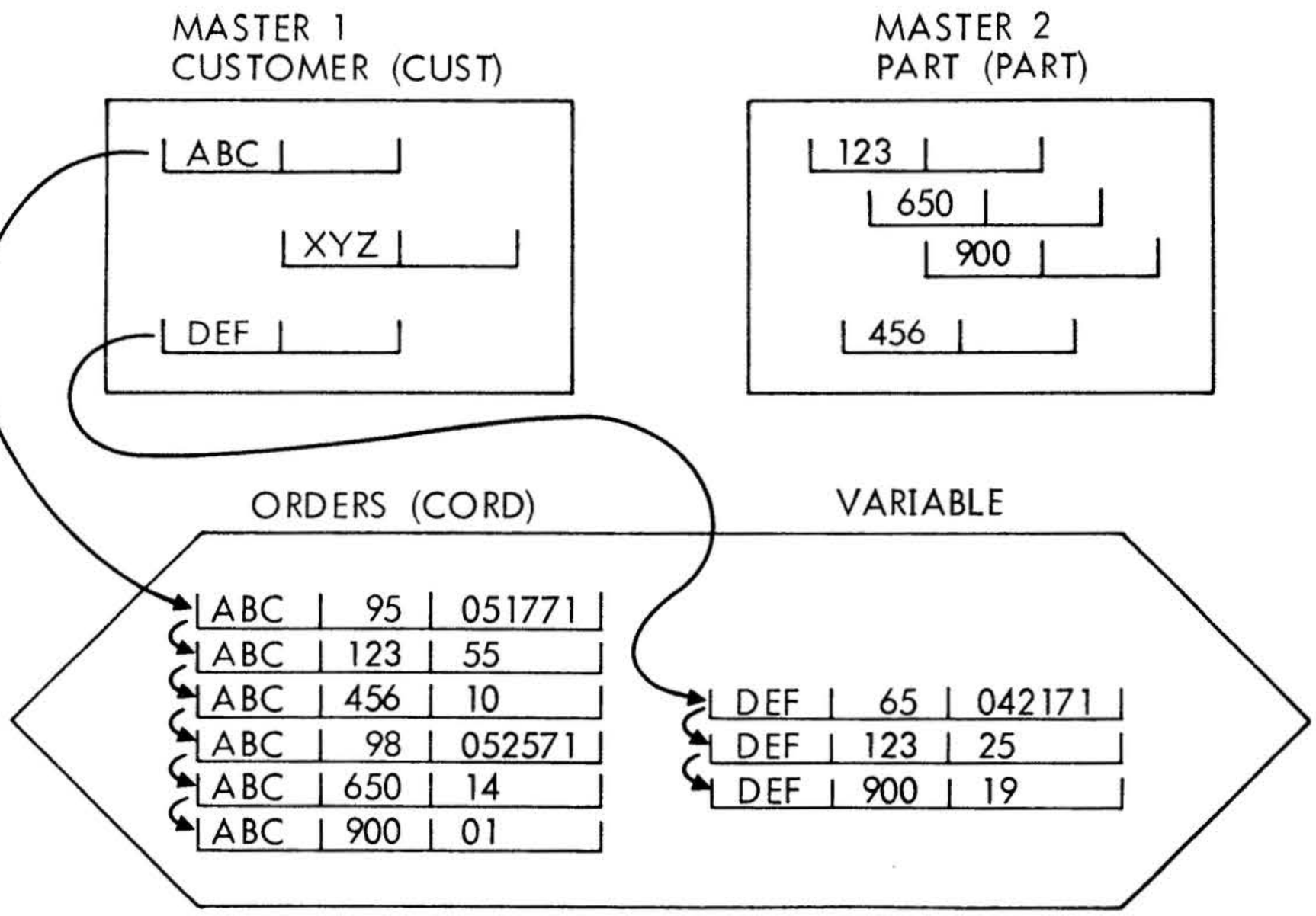
Each control field of a variable entry file must be defined as the logical key of an existing single entry (master) record. The single entry record for the unique key is linked to the first and last record in the linkage path of the variable entry record controlled by that key. Thus the single entry record "owns" all variable entry records that contain that unique control field.

In a variable entry file each record can have a variable number of control fields; therefore, each record can be a member of a variable number of linkage paths.

Each unique control field can have a variable number of records containing the control field, each record being linked to the next record in the chain and the previous record in the chain.

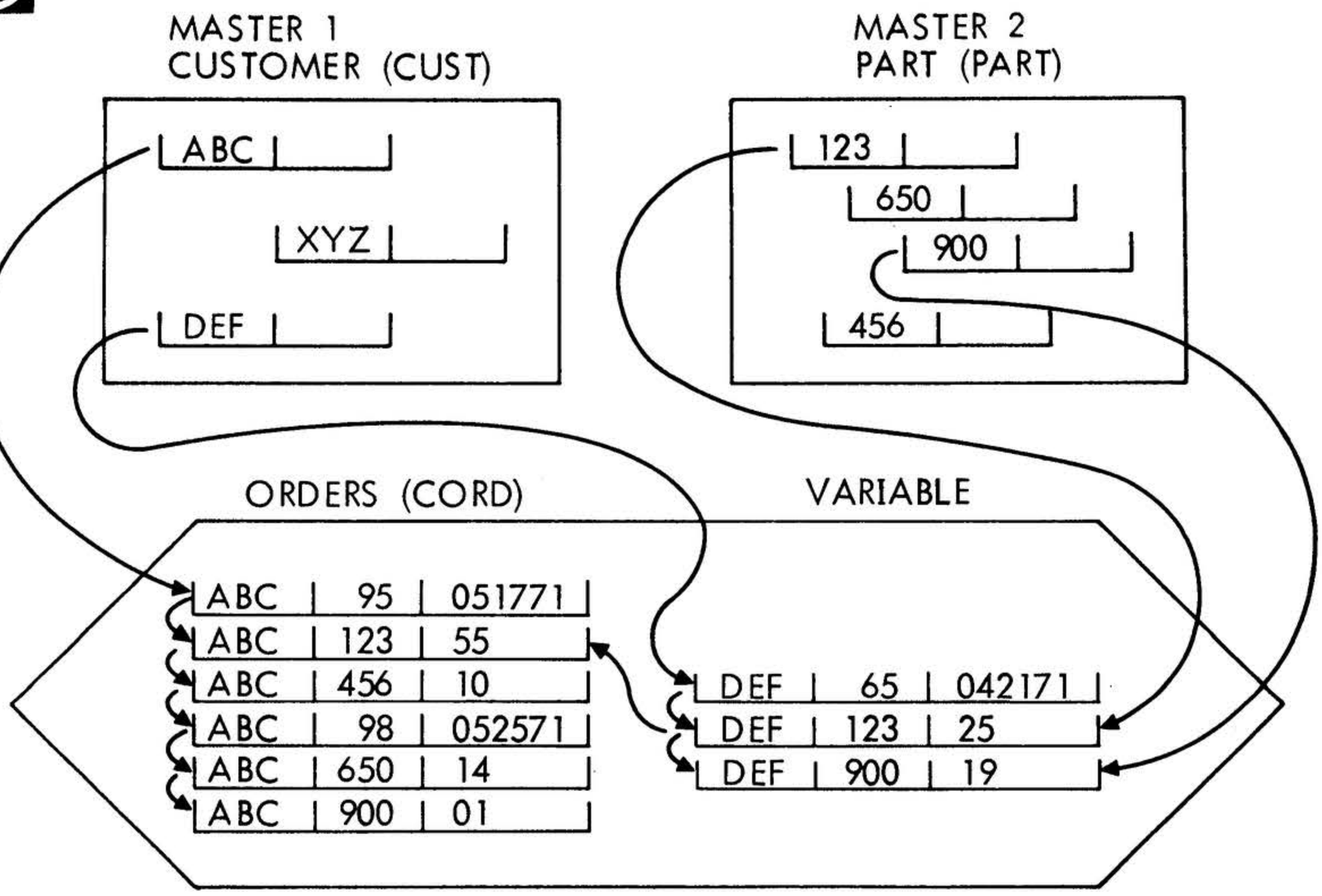
Each record can be retrieved by variable means; that is, each record may be retrieved as a member of a chain (or list) of records for each defined control field in the record as shown in figure 2-13.

The variable entry data set can have variable format records. Furthermore, these different "record types" can be linked to different control fields as shown in figure 2-14. Remember that even though the records may have different amounts of significant data, they are still fixed length.



VTI1-3447

Figure 2-13. Variable Number of Records Per Key



VTI1-3461

Figure 2-14. Variable Keys Per Record, Variable Conventional Method of Access, Variable Record Format

Each single entry (master) data set can be linked or related with up to 2,500 variable entry data sets; conversely, each variable entry data set can be linked to an unlimited number (up to 2,500) of single entry (master) data sets.

This linkage or relatability capability is completely maintained by the TOTAL system by the fact that certain fields are defined to the TOTAL system as linkage-control fields and the application program simply processes logical records that contain the control field data.

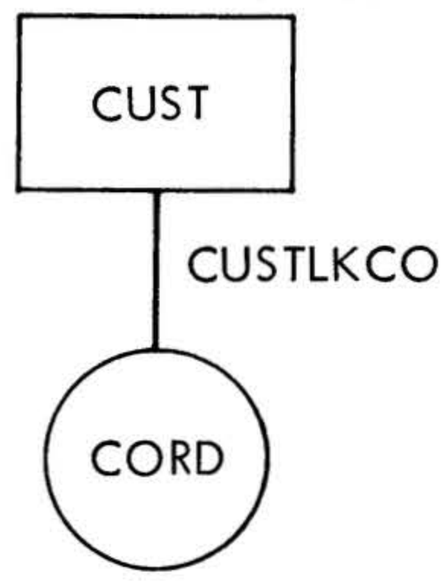
To illustrate a variable entry data set, consider the example of a customer open order file. This file essentially consists of a series of records for each customer containing order information for each order the customer has placed. A conventional technique for storing this information is to provide "buckets" within each customer master record into which the order information is placed. A severe limitation of this technique is that some customers exceed their number of buckets, thereby causing the problem of record overflow; while other customers do not use all of their buckets, thereby causing wasted space.

Another conventional technique is storing the customer order records in a serial file or perhaps an indexed-sequential file. In this technique the customer order file is usually volatile; therefore, file maintenance (additions and deletions) become a problem.

Another shortcoming of the conventional technique, explored later in this text, is that the customer orders may only relate to one control field. Furthermore, that relationship is influenced by the physical position of the record and by manipulation of a subfield of the control field (for example, order line number within order number within customer number).

The solution to the preceding problems is TOTAL's variable entry data set. The open order file has more than one record per control field and the open order file can have more than one control field. For example, the item number gives the ability to directly retrieve all open orders (for a given item number). The open order file can have different format records: the order header record, the order comment record, and the line item record. Figure 2-15 illustrates the schematic of the Customer-Customer Order data base.

The DBGEN program could now be written to include the variable entry data set CORD in the data base, and can be coded as follows:



(CIRCLE REPRESENTS VARIABLE ENTRY DATA SET)

VTI1-3448

Figure 2-15. Schematic of the Customer-Customer Order Data Base

The data base would be defined as:

```
BEGIN-DATA-BASE-GENERATION
.
.
.
BEGIN-MASTER-DATA-SET
DATA-SET-NAME=CUST
MASTER-DATA
CUSTROOT=8
CUSTCTRL=6
CUSTLKCO=8                          LINK TO CUSTOMER ORDERS
CUSTNAME=30
CUSTADDR=30
CUSTCTYS=20
CUSTDATA=100
END-DATA
.
.
.
END-MASTER-DATA-SET
BEGIN-VARIABLE-ENTRY-DATA-SET
DATA-SET-NAME=CORD
BASE-DATA
CORDCUST=6=                         CUSTOMER NUMBER
CUSTLKCO=8=CORDCUST                 LINK FROM CUSTOMER MASTER
CORDORDN=2                          ORDER NUMBER
CORDITEM=5                          ITEM NUMBER
CORDQTYP=3                          ORDER QUANTITY
END-DATA
.
.
.
END-VARIABLE-ENTRY-DATA-SET
END-DATA-BASE-GENERATION
```

Assume now that the open order records are related to the item master (single entry) data set. This enables direct retrieval of all open order records for any particular item number.

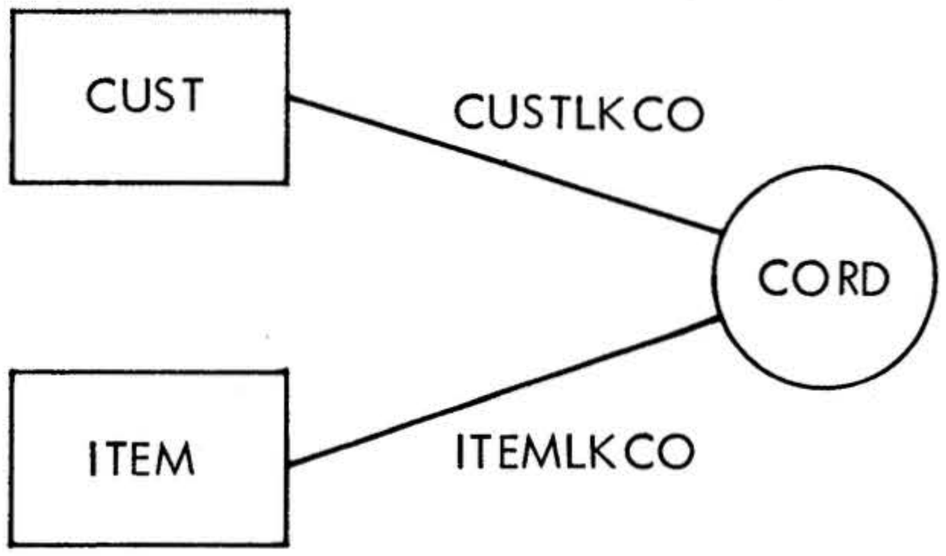
To illustrate the use of linkage paths, assume that in addition to the customer order file being related to the customer file, the customer order file is also related to the item master file. To enable direct retrieval of all customer orders for any particular item, a linkage path is established between the customer order file and the item master file.

This is accomplished by including the master data set ITEM and the linkage path ITEMLKO in the DBGEN program coding as follows:

The data base would be defined as:

```
BEGIN-DATA-BASE-GENERATION
.
.
.
BEGIN-MASTER-DATA-SET
DATA-SET-NAME=CUST
IOAREA=MAS1
MASTER-DATA
CUSTROOT=8
CUSTCTRL=6                          CUSTOMER NUMBER
CUSTLKCO=8                          LINK TO CUSTOMER ORDER
CUSTNAME=30
CUSTCTYS=20
CUSTDATA=100
END-DATA
.
.
.
END-MASTER-DATA-SET
BEGIN-MASTER-DATA-SET
DATA-SET-NAME=ITEM
IOAREA=MAS2
MASTER-DATA
ITEMROOT=8                          REQUIRED BY TOTAL
ITEMCTRL=5                          ITEM NUMBER
ITEMLKCO=8                          LINK TO CUSTOMER ORDERS
ITEMDESC=30                         ITEM DESCRIPTION
ITEMCOST=4                          ITEM COST
ITEMPRIC=4                          ITEM PRICE
ITEMONHD=4                          QUANTITY ON HAND
ITEMONOR=4                          QUANTITY ON ORDER
END-DATA
.
.
.
END-MASTER-DATA-SET
BEGIN-VARIABLE-ENTRY-DATA-SET
DATA-SET-NAME=CORD
IOAREA=VAR1
BASE-DATA
CORDCUST=6
CUSTLKCO=8=CORDCUST
CORDORDN=2
CORDITEM=5
ITEMLKCO=8=CORDITEM                 LINK FROM ITEM MASTER
CORDQTYP=3
END-DATA
.
.
.
END-VARIABLE-ENTRY-DATA-SET
END-DATA-BASE-GENERATION
```

The schematic of the customer-customer order and inventory data base is illustrated in figure 2-16.



VTI1-3449

Figure 2-16. Schematic of the Customer-Customer Order and Inventory Data Base

The user now has the ability to retrieve the same open order records as members of the two linkage paths, the customer linkage and the item linkage. Similarly, this technique can be applied to enable retrieval of the open order records by order number, date received, date shipped, or any other linkage path desired.

2.6.3 Coded Record Concepts (Reformatting)

The coded-record facility of the TOTAL system provides the variable entry data set with the capability to contain different data format records. The records are the same length, but are formatted differently. Of course, if all records are of the same format, the coded-record facility is not needed; therefore, coded records are optionally defined by the system analyst as the technique is needed.

Why would the coded-record technique be needed? Because the variable entry data set can be thought of in a new way, that of a "pool" of records. In the pool of records, it is quite conceivable that different records will have different functions. Some records might be for linkage only, that is, to link different single entry files together; while other records may be for data only - data that will support the linked single entry files as well as logical data. Since different records can have different functions, it is probable that these different records would also be linked to different single entry records according to their function.

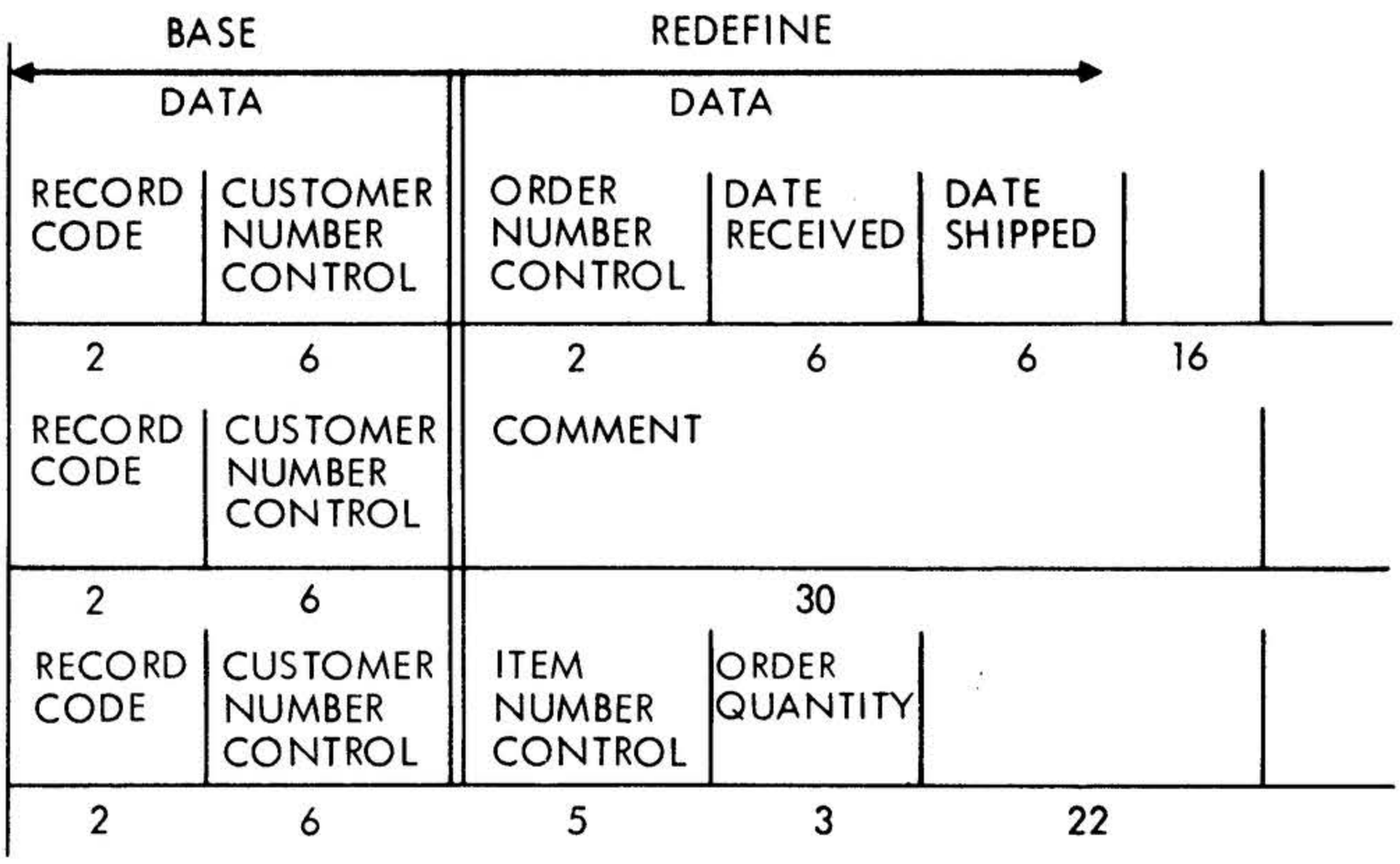
Re-examine the customer open order file. Three functional types of records have been identified: the order header record with data applying to entire order, the order comment record to appear anywhere on the order, and the line item record with data pertinent to the individual ordered item. In addition to the differing data format requirements, the records can be linked to different single entry files according to function.

Figure 2-17 illustrates the use of coded records to link information concerning a particular customer order to related master data sets. The first record is linked to both a customer master data set and an order number master data set and therefore can be accessed by either customer number or order number. Once accessed, data in both the base data portion and the redefined data portion (redefined in the Data Base Descriptor module) is available to the application program. Through further redefinition, a second record type is formatted. The second record contains a comment pertaining to the particular customer order. It is linked to only the customer master data set. The third record type has two links: one to the customer master data set and another to an item number master data set.

The logical record length would be determined by the longest of the different record definitions. It is likely that some records will be shorter than others, leaving zeroed, unused portions. If the data requirements of the different record types are widely divergent, the system analyst should then consider putting the different record types into different variable entry files.

Coded records enable the user to store data in variable entry records without linkage. Linkage at some later date can be achieved by changing the the record code into a code whose format identifies the stored fields as linkage control fields.

The redefine data record portion will be passed to the user program with data fields left-justified in the record. The linkage path fields are not passed but are defined in the user area, right-justified, for alignment purposes only.



VTI1-3450

Figure 2-17. Format of Record Types in a Variable Entry File

The variable entry data set would be defined as:

```
BEGIN-VARIABLE-ENTRY-DATA-SET
DATA-SET-NAME=CORD
BASE-DATA
CORDCODE=2                          RECORD CODE
CUSTLKCO=8
CORDDATA=30                         REDEFINE FORMAT ELEMENT
RECORD-CODE=HD                      ORDER HEADER
ORDNLKCO=(8)
CORDDREC=(6)
CORDDSHP=(6)
RECORD-CODE=CM                      ORDER COMMENT
CORDCMNT=(30)                       ITEMS
RECORD-CODE=IT                      ORDER ITEM
ITEMLKCO=(8)
CORDQTYP=(3)
END-DATA
.
.
.
END-VARIABLE-ENTRY-DATA-SET
```

NOTE: Coded records with linkage paths defined in the redefine data record portion give the ability to link the different records to different single entry files without the needless

overhead of redundant control fields carried in records for the purpose of linkage only. They also give the ability to add new record definitions to the variable entry file merely by defining the new format to the TOTAL system and inserting the records into their logical position.

2.7 DATA INDEPENDENCE

One of the key capabilities provided by the TOTAL system is data independence. This means that the application program is not affected by physical changes to the data base or any data set within the data base.

This capability is achieved by defining the data record as a collection of data elements. A data element can be defined as a single data item or the entire record. In other words, the data elements are defined by the system analyst as the logical or functional parts of the data record that are to be processed by the different application programs.

The application program requests the elements data record via the element list. This element list is defined as a literal constant in the application program. It specifies the 8-character names of all elements that are to be processed by the application program. Data independence is therefore achieved because each application program has the opportunity to specifically request only the data elements pertinent to that program, changes to other nonpertinent data elements, or addition of new data elements into the data record.

The application program does not have to read or write whole records as in non-data base applications; it receives and passes elements of the record to and from TOTAL. TOTAL reads and writes the data record; TOTAL selects the elements of the record according to the element list as defined by the application program, and passes the selected elements of data to the application program.

Since the application programs are independent of data, they do not have to be reprogrammed, recompiled, or relinked due to changes to nonpertinent data elements or additions of new data elements to data records. Since programs process only data elements required, core requirements for record areas are reduced. With data independence, programs can request data elements in any sequence without regard to actual record format. Data integrity is introduced, since programs do not have the opportunity to inadvertently destroy associated data files.

2.8 TOTAL's PROGRAMMING LANGUAGES

Conventional programming languages support various techniques for file and record definition and various input and output commands for accessing defined records and files. TOTAL's two languages, Data Base Definition and Data Base Management, do the same.

- Data Base Definition Language (DBDL) is an English-like language that provides for initial generation of a data base module and all subsequent modifications and expansions to this data base.

- Data Base Management Language (DML) interacts with the data base, the operating system, or supervisor and the application programmer. It allows TOTAL to function with the host language (DASMR, COBOL, RPG II, FORTRAN) for all communication with the data base.

Utilizing the facilities of the DBDL and the DML, TOTAL provides a completely integrated data base available to any application programmer using supported most language processors. TOTAL provides data elements to application programs so that new elements, new data sets, and new data relationships can be added to the data base without adversely affecting the current operational programs.

2.8.1 Data Base Definition Language

TOTAL DBDL is a high-level, independent, key-phrase language that defines the data base, i.e., data sets, data records, data elements, data set relationships, and data items within the data base.

The data base need be defined only once for all programs to have access to it. The data base does not have to be defined for and within each program that will use it as with conventional file definition techniques.

After the DBDL statements describing a data base are prepared, they are converted into Assembler Language source statements by the DBGEN program (a part of the TOTAL system).

The resulting Assembler source statements are assembled to produce an object Data Base Descriptor Module (DBMOD). When the application program requests access to the data base, the corresponding Data Base Descriptor Module is loaded and referenced by TOTAL to locate data sets and their components by name (section 3).

2.8.2 Data Management Language

After the data base is compiled and cataloged, application programming can be started using host-language processors and the TOTAL Data Management Language. DML communicates between the program and the data base. DML is not a complete language by itself; it relies on a host language at the CALL level to furnish a framework and to provide the procedural capabilities required to manipulate data in primary storage.

All calls to and from the data base to retrieve data, to add new data or data relationships, to delete data or data relationships, or to modify data or data relationships, reside in DML. Diagnostics and messages indicate the successful operation of a function, or the status in case of an unsuccessful execution. For example, DML indicates that a duplicate record already exists if you attempt to add such a duplicate record to the data base.

TOTAL functions at the element level, an element being one or more of the items that comprise a logical record. Upon the execution of a TOTAL DML command, one or more elements, as specified by an element list, are passed to or from the host program in the stated sequence of that element list. It is not required to do any further manipulation such as sequencing, positioning, including, or omitting of elements. Subsequent expansions of the record for additional elements or relationships have no adverse effect on programs that use the originally defined record. Old programs do not require recompilation when new elements are added to records. After the host-language program has received the data, the host language is used for whatever logical, arithmetic, or manipulative processing desired. The host language, then, is the language of specific data "policy" manipulation. This manipulation is application-oriented and very specific.

2.9 CREATING, FORMATTING, AND OPERATING THE DATA BASE

The TOTAL Data Base Management System consists of the programs:

- DBGEN - the data base generator program. DBGEN accepts the Data Base Definition Language (DBDL) statements which define the data base and generates the assembly language Data Base Descriptor Module DBMOD. For full details, refer to section 3.

- DBFMT - the data base format program. DBFMT accepts the data set format control card(s), creates and preformats the specified RMD data set areas. For full details, refer to section 4.

- TOTAL - the Data Base Management program. It is activated when initiated by the CALL DATBAS statements given in the application program. These CALL instructions are written in Data Management Language (section 5). TOTAL accesses the data base, performs the necessary retrieval, add, or change operations, and issues read/write instructions as required.

  For full details on operating the data base, refer to section 7.

Both DBGEN and DBFMT are non re-entrant background tasks (DBFMT can be run as a foreground task) which are run rarely. The sequence of events for TOTAL Data Base generation is shown in figure 2-18.

The TOTAL program is a general access method of getting at data files easily, and is bound with the application program. It acts upon the data sets defined in the data base object module according to the parameter lists given by the application program CALL statements.

2.10 MEMORY REQUIREMENTS

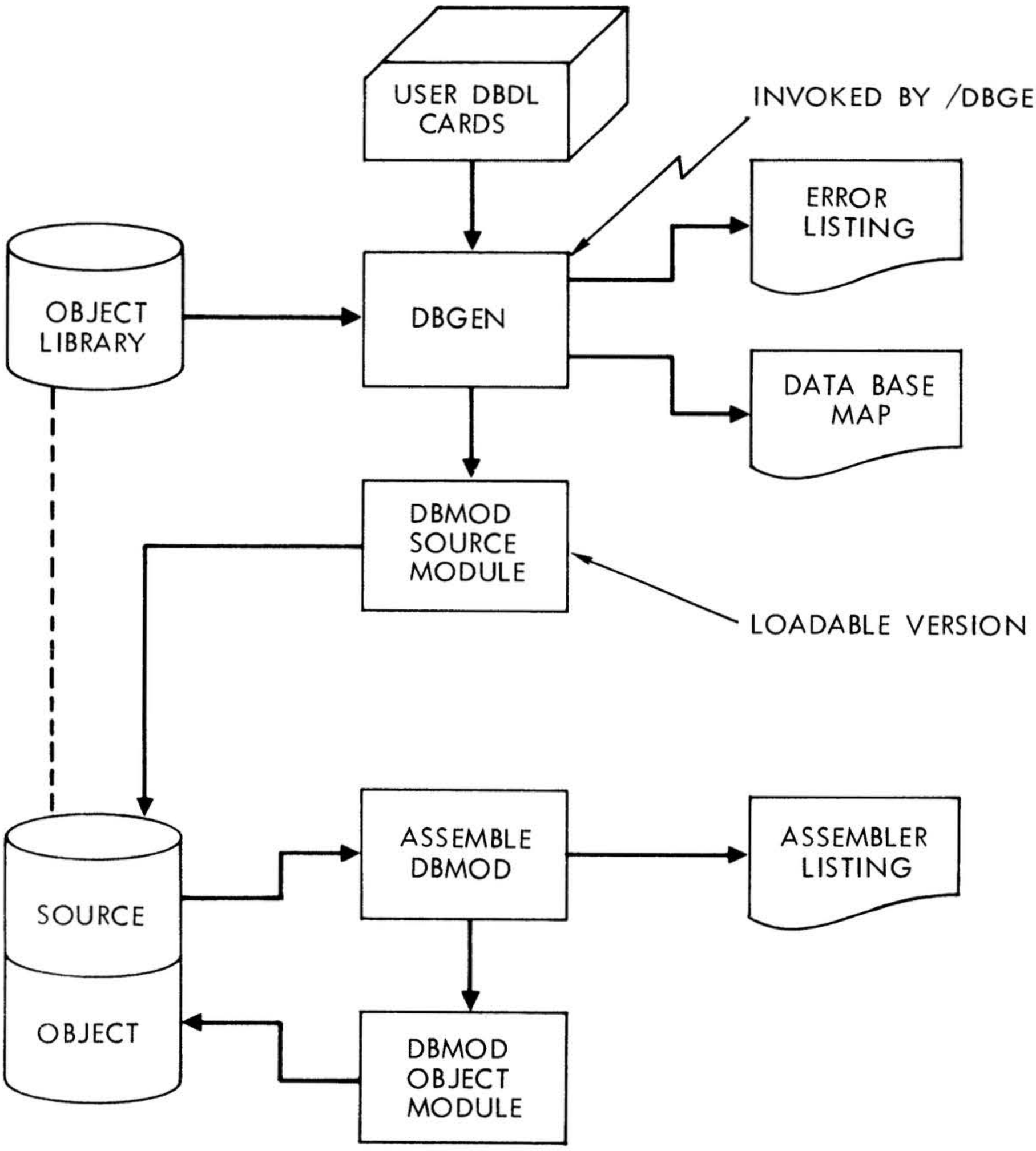
TOTAL enables a considerable savings in main memory because:

a. TOTAL extracts and passes to the application program only the data elements required, using direct access via control keys and linkage paths, resulting in a network type data base. An example of a TOTAL network structure is shown in figure 2-19.

b. TOTAL allows many application programs to access the same data base, resulting in memory savings as each application program does not have to store data. This concept of a data base management system is shown in figure 2-20, in which four application programs are shown accessing a data base comprised of two master data sets and two variable data sets, linked together.

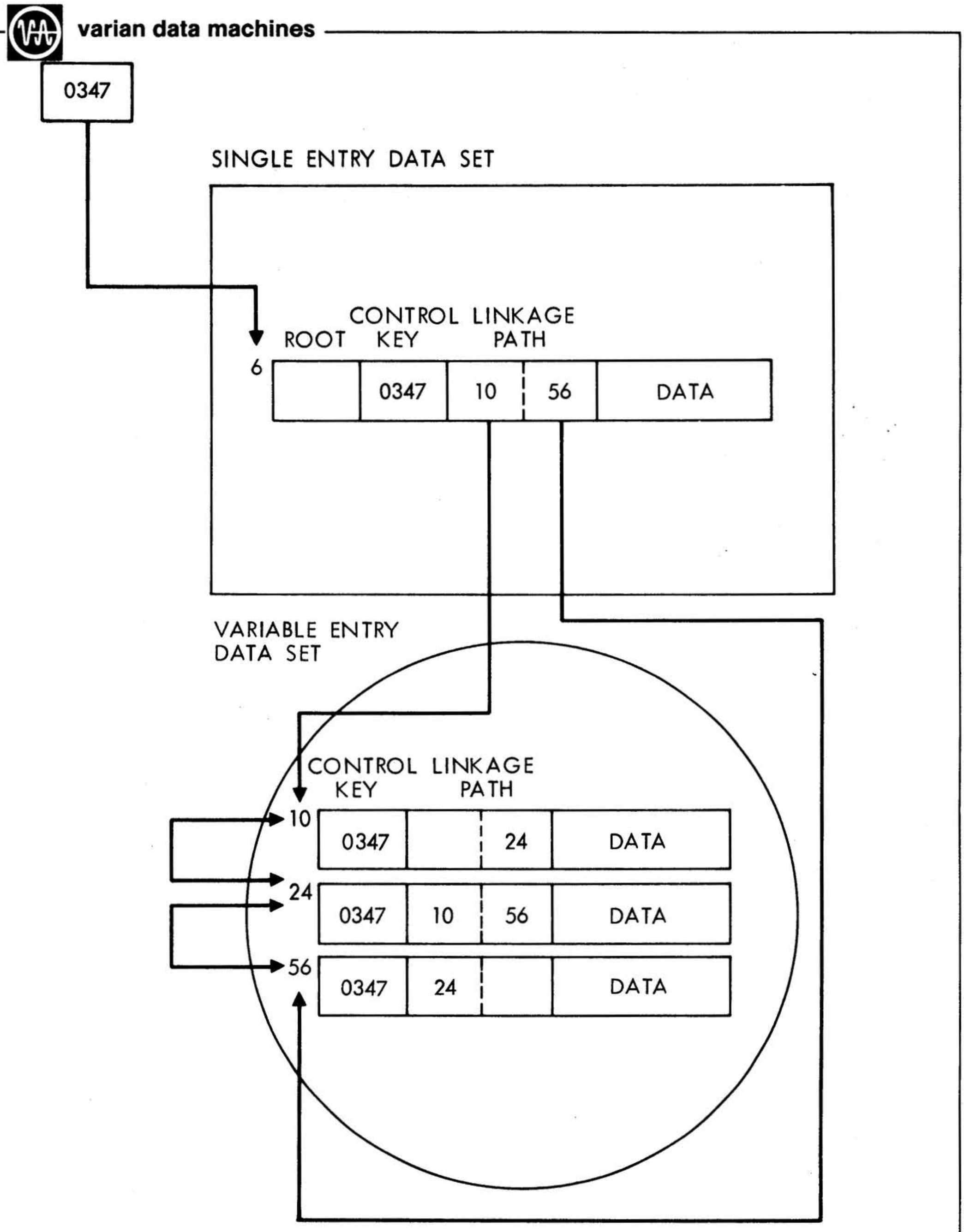
2.10.1 Economic Computer Resource Utilization

The computer resources under consideration are computing time, main and secondary memory, and I/O utilization. Considerable effort is taken in TOTAL to optimize their use. The structure of a TOTAL data base inherently allows the elimination of redundant data, index areas and overflow areas. Deleted records space is immediately reusable and hence there is no need to



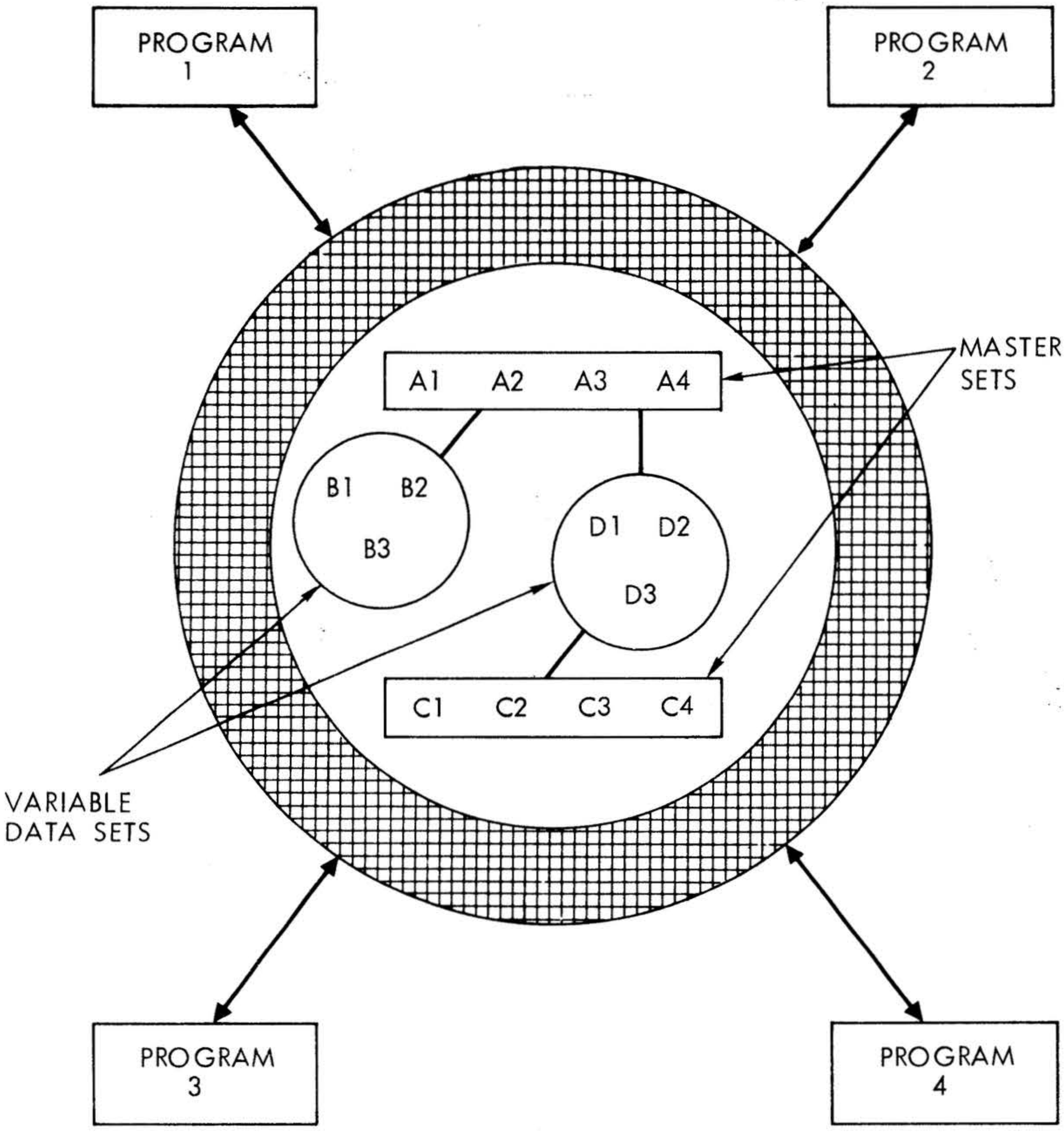
VTI1-3451

Figure 2-18. TOTAL Data Base Generation



VTI1-3452

Figure 2-19. TOTAL Network Structure Example



DBMS

- CAPABLE OF ESTABLISHING AND PROCESSING USER-DEFINED DATA RELATIONSHIPS
- CAPABLE OF EVOLVING EASILY AS THE STYLE OF MANAGEMENT CHANGES
- TRUE INDEPENDENCE
- PERFORMANCE AND EFFICIENCY

VTI1-3453

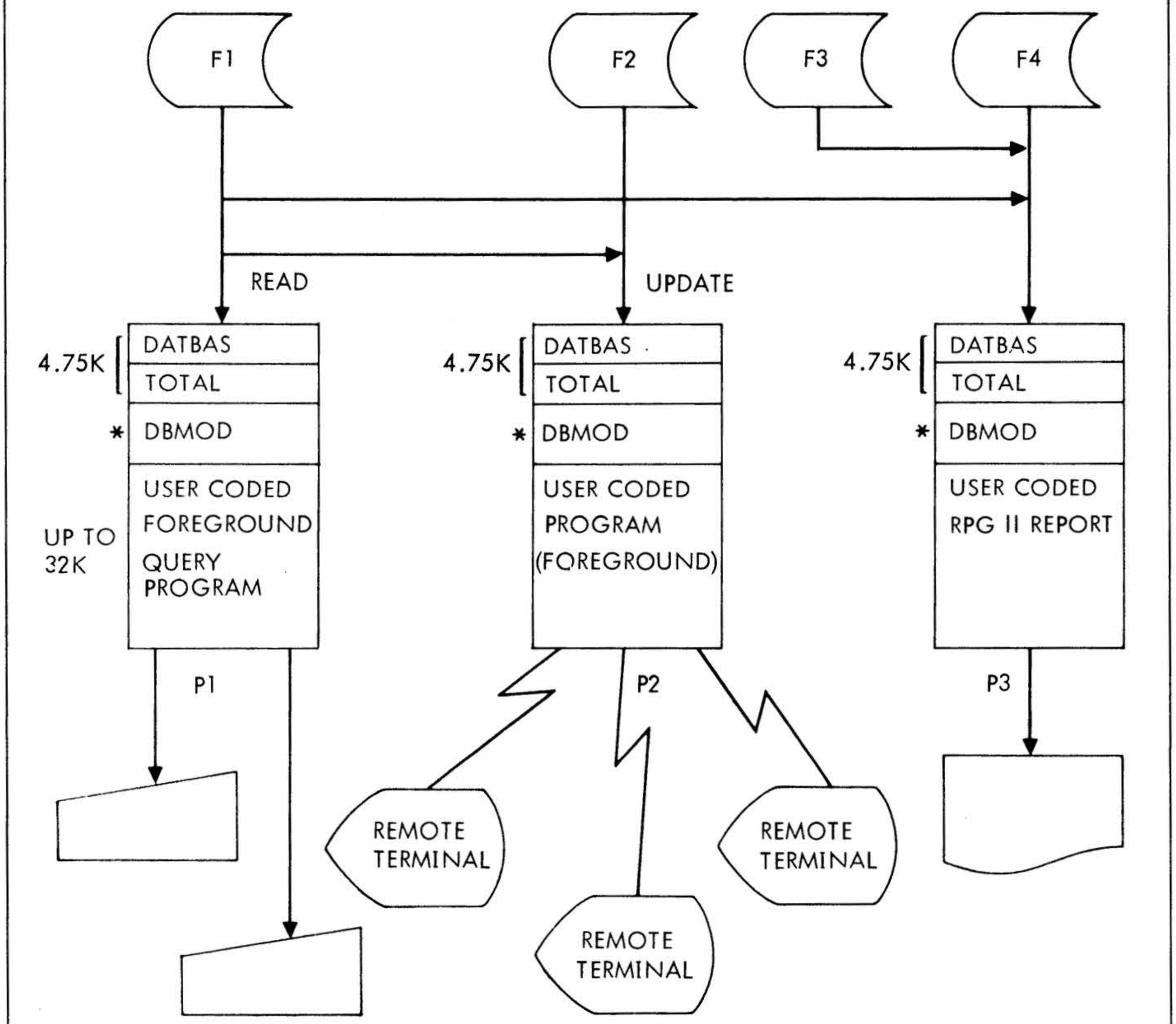
Figure 2-20. Data Base Management System

reorganize records in a data base in order to eliminate dead records. Associated records tend to be physically placed together, resulting in the reduction of data access time. An I/O buffer can be unique to a data set or shared by multiple data sets, thereby conserving main memory buffer requirements. During information retrieval, a block which may contain a multiple number of records will be brought into main memory. The block will be written back to the data base only when it has been modified and the next request record is not in it. Since the probability of processing a record next to the one just processed is very high, this scheme effectively reduces the number of I/O operations.

2.10.2 Run-Time Memory Utilization

The run-time portion of TOTAL (about 4.7K), including the Data Base interface module DATBAS (0.5K) and the Data Base definition module DBMOD, are bound together to the user program and run in the same user logical memory space.

The size of the DBMOD depends on the user specifications (see table 3-1, section 3.5 as a guide to determine the size of the DBMOD). As an example, an average program utilizing a data base composed of five master files and three variable files requires about 2600 words for the DBMOD. Figure 2-21 illustrates a typical TOTAL memory layout and the use of TOTAL data base by three user programs. P1 a user coded foreground query program which reads file F1 and F4. P2 is an on-line program that serves three remote terminals. P2 updates F2 and hence this file is locked and may be used by P2 only. P2 also reads F1 and F3. P3 is an RPG background program which reads files F1, F3, and F4. TOTAL allows multiple tasks to concurrently read from the same file. However, a file that is being updated may be accessed only by the updating task.



*DEPENDENT ON USER DATA BASE DEFINITION. A "TYPICAL" DATA BASE DEFINING FIVE MASTER FILES AND THREE VARIABLE FILES IS LESS THAN 3K WORDS.

VTI1-3454

Figure 2-21. Typical TOTAL Memory Layout

2.11 PRIVACY AND SECURITY

2.11.1 Internal Privacy and Security

A file locking facility to prevent concurrent file updating is provided by the SCHEMA parameter of the Data Management Language Sign-On function.

The SCHEMA parameter contains a SHRE or PRIV option. If SHRE is coded, the file called for by the application program may be shared among concurrent programs in the Read Only mode. If PRIV is coded, the file called for is exclusively assigned to the application program requesting it, and no other program may have access to it during any program run. The file is unlocked by the Sign-Off function.

For details of the SCHEMA parameter, refer to section 5.2.13.

In addition, when an attempt to execute a TOTAL command fails to complete, the original condition of the data base prior to the request is restored and a diagnostic message is returned to the user indicating the possible cause of failure.

2.11.2 External Privacy and Security

External privacy and security should be maintained by a Data Base Administrator, who should have the responsibility of controlling access to the data base files and logical unit codes.

SECTION 3
DATA BASE DEFINITION LANGUAGE

3.1 GENERAL DESCRIPTION

The Data Base Definition Language (DBDL) is a structured set of English-like statements which declares and describes a data base or any subset of a data base. These statements use a keyword format through which the user may name his own data sets, record segments and data fields, as well as declare any environmental characteristics.

The Data Base Generation program (DBGEN) accepts the DBDL statements and generates assembly language statements, creating the Data Base Descriptor Module (DBDM). The DBDL entries are made for four categories of information:

- o General data base specifications
- o Single entry (master) data set specifications
- o Variable entry data set specifications
- o User comments and notes

3.1.1 Logical Unit Convention

All input statements are input via the PI logical unit. DBMOD is output on the SS logical unit. All diagnostic and listings are output on the LO logical unit. For a detailed explanation of the VORTEX logical unit concept, refer to the VORTEX II Reference Manual.

3.1.2 Execution of DBGEN

DBGEN executes as a priority level 1 background task. The following jobstream is an example of the job control language required to execute DBGEN and to assemble the output of DBGEN into an object module.

```
/JOB,DBGEN
/ASSIGN,PI,SI
/DBGEN
BEGIN-DATA-BASE-GENERATION
      .
      .                    Data Base definition statements
```

```
      .
      .
END-DATA-BASE-GENERATION
/ASSIGN,PI,,SS
/MEM,10
/DASMR
/ENDJOB
```

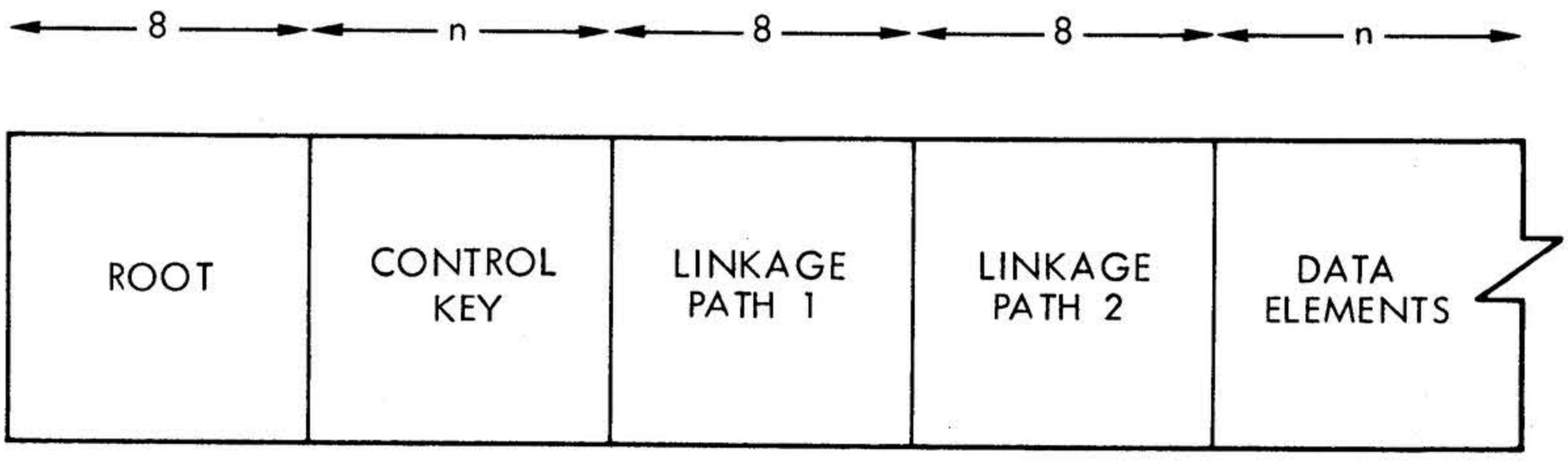
3.1.3 TOTAL Record Formats

When designing the data base and writing the DBDL statements, one should be aware of some basic facts about the data records used.

a. Single entry (master) file records. Each record must have the following (figure 3-1):

1. A ROOT. 8-byte field used by TOTAL to link synonyms. 4 bytes - backward pointer; 4 bytes - forward pointer.

2. A Control Key. n-byte field to contain the key by which linking to a variable file is accomplished



n =USER DEFINED

VTI1-3355

Figure 3-1. TOTAL Single-Entry Data-Set Record Format

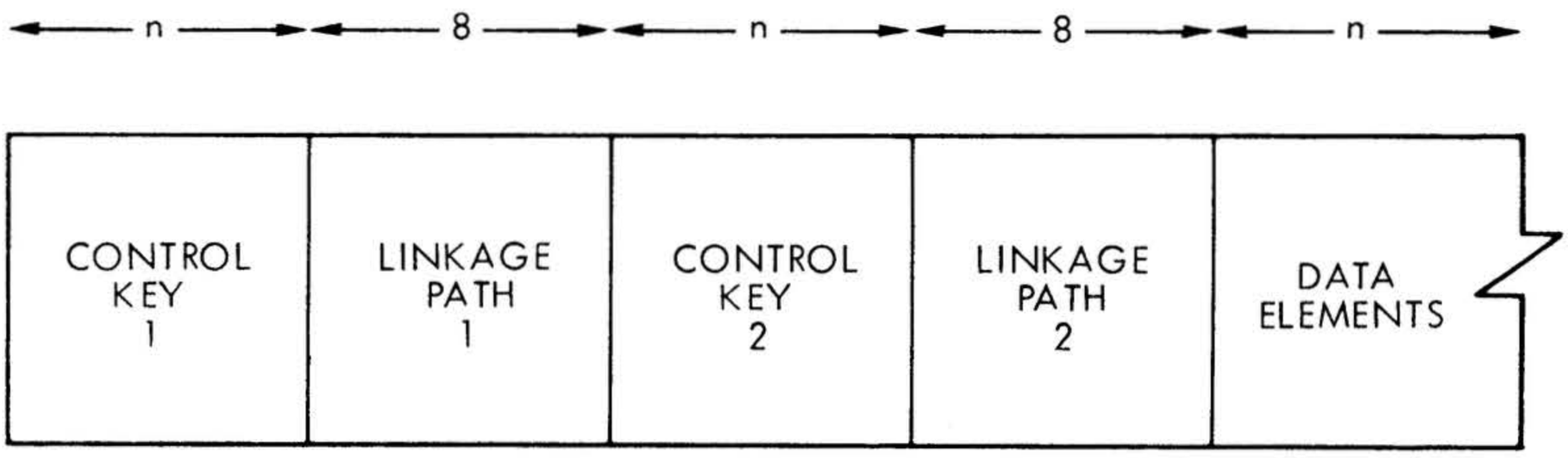
3. A linkage path. At least one. Eight-byte field(s) maintained by TOTAL to link to a variable file record containing the control key. There can be as many of these 8-byte fields as required.

b. Variable Entry file records. This record must have the following (figure 3-2):

1. Control key.

2. Linkage path. As many as there are links to master records.

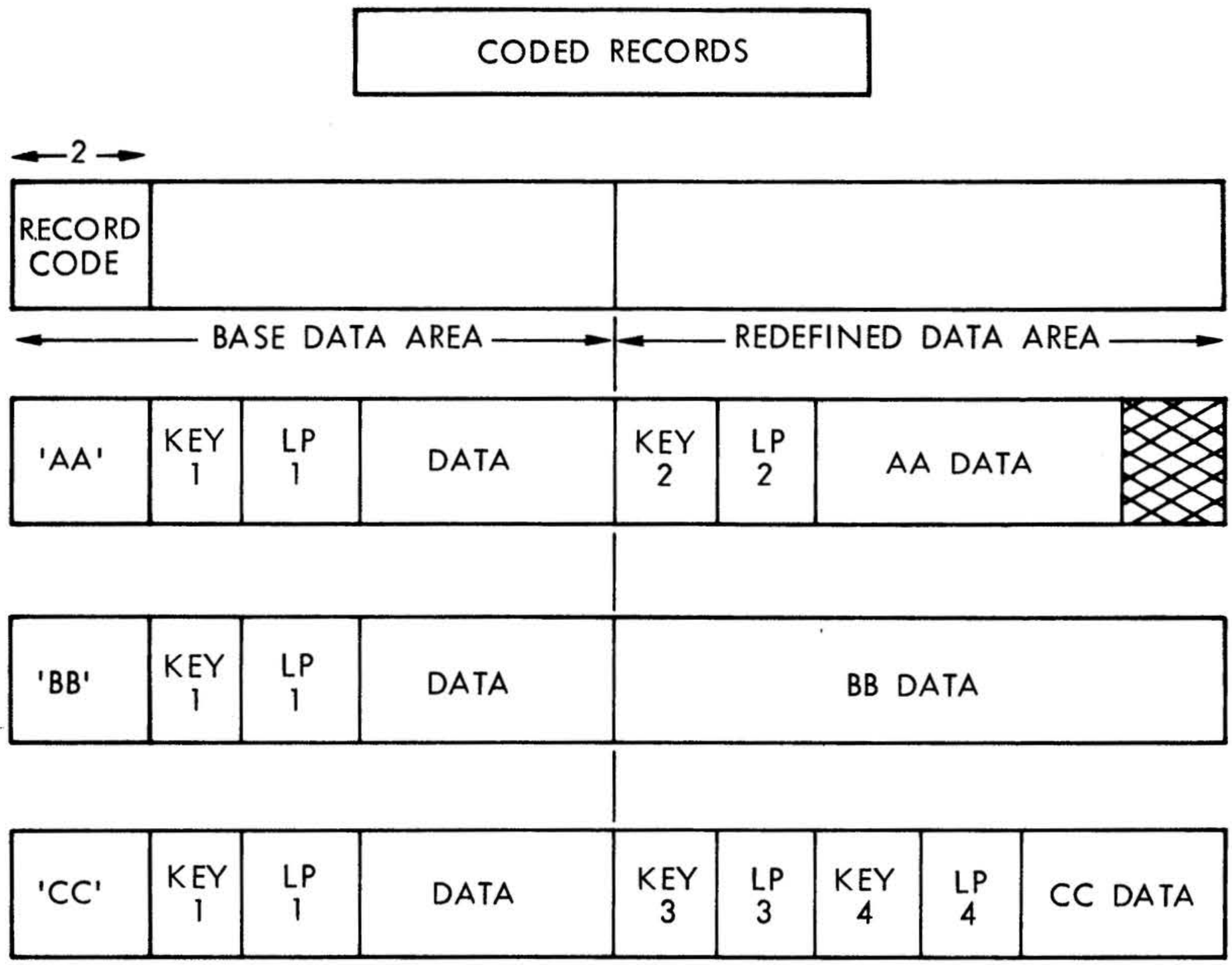
When coded records are used, the record is divided into two parts: the base data area and the redefined data area. The base data area must have at least a record code which is a 2-byte code containing the record code type. The rest of the record format is shown in figure 3-3.



n = USER DEFINED

VTI1-3456

Figure 3-2. TOTAL Variable Entry Data Set Record Format



- FIXED LENGTH RECORDS
- VARIABLE FORMATS IDENTIFIED BY RECORD CODE
- SELECTIVE LINKAGE

NOTE LP = LINKAGE PATH

VTI1-3457

Figure 3-3. TOTAL Variable Entry Data Set Record Format

3.1.4 Data Set (File) Organization

A TOTAL file, is considered to be a logical file and as such it may consist of one or more VORTEX (physical) files. The number of VORTEX files in a TOTAL file is determined by the number of DRIVE statements for the TOTAL file. Each VORTEX file is located on the logical unit number (LUN) specified in the DRIVE statement. This means that a TOTAL file can be stored on many different RMD partitions, some of which may be located on a different RMD device.

TOTAL names the TOTAL file as the name given in the DATA-SET-NAME directive e.g., a 4-letter word, mmmm for master or vvvv for variable. Each VORTEX file name (six characters) is derived from the TOTAL file name by (TOTAL) adding a 2-digit ordinal number e.g., mmmm01, mmmm02,... etc. (for master).

3.1.4.1 Master File

All RMD addresses are computed and maintained as relative record numbers (rrn). Each TOTAL master file has two control records one at the front and one at the rear. To allocate a master record, its key is randomized (a hashing procedure involving 32-bit arithmetic computed mostly by firmware) and an rrn is obtained. This number is called the "home address." If the home address is empty, the master record is stored there. If the home address is already occupied, the record occupying it can be either a synonym (e.g., a different control key randomized to the same place) or not a synonym. If it is a synonym, then the new record is stored closest (physically) to its synonym and linked to it via the ROOT field. If the occupying record was not a synonym, the new record is replacing the old one, and the old record is allocated elsewhere (closest to its home address).

3.1.4.2 Variable Entry Files

Variable file management requires a series of control records inserted at regular intervals throughout the TOTAL logical file. The control interval is 480 sectors long (approximately 1 cylinder, e.g., 24 sectors per track, 20 tracks per cylinder).

Each TOTAL file starting point coincides with the control interval starting point.

Example:

```
TOTAL file name (variable entry) is:

DATA-SET-NAME=FILE

VORTEX files are defined by:

DRIVE=031,200
DRIVE=032,100
DRIVE=033,400

There are three VORTEX files:

FILE01 on LUN 31     200 sectors
FILE02 on LUN 32     100 sectors
FILE03 on LUN 33     400 sectors
```

The control records are allocated at the beginning of the logical file and at the beginning of each logical interval of 480 sectors. For the above example, control record at FILE01 is record one; control record at FILE03 is record 181 (481st).

The LOAD-LIMIT (in percent) is computed and maintained for each control interval.

3.2 SYNTAX RULES

DBDL statement entries are made up of 80-character records, using the following rules:

a. All entries must begin at character position 1.

b. A blank terminates an entry.

c. Capitalized entries and punctuation must be coded as shown.

d. Square brackets ([ ]) enclose an optional parameter.

e. Braces ({ }) mean a choice between parameters.

f. "mmmm" is to be replaced by a single entry data set name.

f. "vvvv" is to be replaced by a variable entry data set name.

g. "xxxx" is to be replaced by any valid characters (A thru Z, 0 thru 9).

h. "n" is to be replaced by any valid natural number, or zero.

i. Comments are recommended as additional documentation throughout the definition language. They may begin after termination of any entry, or may be entered on separate statements simply by leaving position 1 blank.

3.3 SUMMARY OF DATA BASE DEFINITION STATEMENTS

Unless otherwise specified, all numbers are in decimal and bytes (not words).

3.3.1 Prologue Statements

```
BEGIN-DATA-BASE-GENERATION
DATA-BASE-NAME=xxxxxx
OPTIONS=OUTPUT={Y}
               {N}

SHARE-IO
IOAREA=xxxx[=n] (n = number of buffers, default n=1)
END-IO
```

3.3.2 Master Data Set Statements

```
BEGIN-MASTER-DATA-SET
DATA-SET-NAME=mmmm
IOAREA=xxxx
MASTER-DATA
mmmmROOT=8
mmmmCTRL=n
mmmmLKxx=8
mmmmxxxx=n
[.p.] mmmmxxxx=n
END-DATA
[TOTAL-LOGICAL-RECORDS=n]
[LOGICAL-RECORD-LENGTH=n]
[LOGICAL-RECORDS-PER-BLOCK=n]
DRIVE=nnn,nnnnn
END-MASTER-DATA-SET
```

3.3.3 Variable Entry Data Set Statements

```
BEGIN-VARIABLE-ENTRY-DATA-SET
DATA-SET-NAME=vvvv
IOAREA=xxxx
BASE-DATA
[vvvvCODE=2]
vvvvxxxx=n
[.p.] vvvvxxxx=n
mmmmLKxx=8=vvvvxxxx
[RECORD-CODE=xx]
[.p.vvvvxxxx=n]
mmmmLKxx=8=vvvvxxxx
END-DATA
[TOTAL-LOGICAL-RECORDS=n]
[LOGICAL-RECORD-LENGTH=n]
[LOGICAL-RECORDS-PER-BLOCK=n]
DRIVE=nnn,nnnnn
[LOAD-LIMIT=n] n is in percent
END-VARIABLE-ENTRY-DATA-SET
```

3.3.4 Epilogue Statement

```
END-DATA-BASE-GENERATION
```

3.4 DATA BASE DEFINITION STATEMENTS

In the following subsections, each statement is followed by a description of the statement.

3.4.1 Prologue Statements

```
BEGIN-DATA-BASE-GENERATION
```

Description: This statement must be the first statement of the data base definition, and the first statement in the deck. No comment statements are allowed before this statement.

```
DATA-BASE-NAME=xxxxxx
```

Entry: xxxxxx is a 6-character alphanumeric name.

Description: This name will be used as the data base identifier throughout the system. The use of meaningful names is recommended throughout the definition process.

OPTIONS-OUTPUT=$\begin{Bmatrix} Y \\ N \end{Bmatrix}$

Description: Y means yes, generate DBMOD and print. N means print only and suppress generation of DBMOD.

```
SHARE-IO
```

Description: This statement and subsequent "IOAREA=" entries indicate the names of I/O areas that will be specifically used in data-set definitions within this Data Base Descriptor.

```
IOAREA=xxxx[= n]
```

Entries: xxxx is a 4-character alphanumeric name
n is the number of buffers contained in the pool

Description: Each occurrence of this statement enters a name into a list of named I/O areas.

a. No duplicate names are allowed.

b. Each data set may have one and only one I/O assigned to it when the data set is defined.

c. The same area can be used by several data sets.

d. An I/O area assigned to only one data set must be listed and is regarded as a private I/O area.

e. Each occurrence of this statement will reserve an area whether or not it is ever referenced in a data set definition.

f. There is no limit to the number of I/O areas which can be defined.

g. If "=n" is omitted, the default value for n is 1.

```
END-IO
```

Description: This required statement terminates the definition of "IOAREA=" entries.

3.4.2 Master Data Set Statements

```
BEGIN-MASTER-DATA-SET
```

Description: This must be the first statement to begin definition of the master data set.

```
DATA-SET-NAME=mmmm
```

Entry: mmmm is a 4-character alphanumeric name.

Description: This name will be used as the data set identifier throughout the system.

```
IOAREA=xxxx
```

Entry: xxxx is a 4-character alphanumeric name.

Description: This statement designates the I/O area to be used by the master data set. The I/O area named in this statement must have been defined in the prologue.

a. Only one I/O area may be assigned to a data set.

b. This I/O area may be shared with other data sets.

MASTER-DATA

Description: This statement precedes the definition of logical data elements for a master data set.

```
mmmmROOT=8
```

Entries: mmmm is the 4-character master data set name.

8 is the required length. It states the length of the ROOT field. This length is included in the length of the record.

Description: This field is for internal use to manage synonyms. This statement must be the first data element definition of a master data set.

```
mmmmCTRL=n
```

Entries: mmmm is the master data set name.

n is the control key length

Description: This statement defines the record control key. The record control key must fall immediately after the ROOT statement.

```
mmmmLKxx=8
```

Entries: mmmm is the master data set name.
xx is a 2-character linkage code.
8 is the required length of eight bytes.

Description: This statement defines a linkage path from a master data set based on the record control key. It is called the LINKAGE-PATH statement (LP) or (LK). There must be as many LK statements as links used.

a. A master data set may have any number of linkages.

b. A variable entry data set may be linked from multiple master data sets and may have multiple linkages from the same master data set.

c. Linkage paths are never given a level number.

d. Statement must be given for each link.

```
[.p.] mmmmxxxx=n
```

Entries: mmmm is the master data set name.

xxxx is any four valid characters which with the preceding four character entry comprises a unique element identification.

p is a level number (1, 2, or 3).

n is the length of the element.

Description: This statement defines a data element. Any data element may be subdefined:

a. The values which may be used to specify level range from 1 through 3. The level number zero (0) is reserved. Any element with no prefix to specify its level number will be assigned level number zero (0).

b. The level number is specified as an integer preceded and followed by a single dot (e.g., ".3.").

c. The length entry for a "parent" element will be the sum of the lengths of the "child" elements.

d. A unique name must be used for every element of the data set.

```
END-DATA
```

Description: This statement ends the definition of logical data elements for the data set.

```
[TOTAL-LOGICAL-RECORDS=n]
```

Entry n is a numerical value.

Description: This optional statement specifies the total logical record capacity of the data set.

This entry is optional. When this statement is omitted, the TOTAL logical record capacity for the data set will be calculated. DBGEN uses TOTAL sectors available (Drive Statement) and the logical record length. The DBGEN program provides an informative message if this value is calculated.

```
[LOGICAL-RECORD-LENGTH=n ]
```

Entry: n is a numerical value.

Description: This optional statement specifies the length of logical records in a data set. This includes all data fields, linkages, and the ROOT field of a master data set.

NOTE: Sector length (S) is 240 bytes. Record length (n) must be chosen in such a way that either n = 0 mod S, or S = 0 mod n.

There are two ways to accomplish this:

a. If the actual record size is 110, add 10 blank bytes at the end and let TOTAL compute the length, or

b. Force the record length to 120 bytes by writing:

LOGICAL-RECORD-LENGTH = 120

Length of 28 becomes 30
Length of 80 is okay
Length of 110 becomes 120
Length of 400 becomes 480

It is advisable to let TOTAL compute the record length.

This entry is optional. When this statement is omitted, the logical record length will be calculated as the summation of all element length entries. The DBGEN provides an informative message if this value is calculated.

```
[LOGICAL-RECORDS-PER-BLOCK=n]
```

Entry: n is a numerical value.

Description: This optional statement specifies the blocking factor or number of records within each block in this data set.

```
DRIVE=nnn,nnnnn
```

Entries:

nnn is a logical unit number (partition). This is a number, not a name.

nnnn is the number of physical sectors available within the logical unit (partition).

Description: This statement specifies the RMD area required for the data set. As many drive statements as needed should be included.

a. Multiple drive statements must be specified if the data set requires more than one partition.

b. Each DRIVE statement may require a different logical unit number as well as a different RMD unit.

The drive statement is the only required physical specification entry. This entry to the DBGEN program will compute the TOTAL record capacity. In addition, an unused sector count will be provided to indicate the logical unit block and number of sectors not used in that block.

These calculations will be notated on the DBDL listing.

```
END-MASTER-DATA-SET
```

Description: This must be the last statement to end definition of a master data set.

3.4.3 Variable Data Set Statements

BEGIN-VARIABLE-ENTRY-DATA-SET

Description: This must be the first statement to begin definition of the variable data set.

```
DATA-SET-NAME=vvvv
```

Entry: vvvv is a 4-character alphanumeric name.

Description: This name will be used as the data set identifier throughout the system.

```
IOAREA=xxxx
```

Entry: xxxx is a 4-character alphanumeric name.

Description: This statement designates the I/O area to be used by the variable data set. This I/O area must have been defined in the prologue.

a. Only one I/O area may be assigned to a data set.

b. This I/O area may be shared with other data sets.

```
BASE-DATA
```

Description: This required statement precedes the definition of logical data elements for the variable data set.

```
[vvvvCODE=2]
```

Entry: vvvv is the 4-character variable entry data set name.

Description: This statement is required to reserve space in a record for a record code if coded records are used. If this variable entry data set has multiple record codes, then this is a required entry. This entry indicates that two characters are to be reserved for the record code.

```
[.p.] vvvvxxxx=n
```

Entries: vvvv is the 4-character variable data set name.

xxxx is any four valid characters which, with the preceding four character entry comprises a unique element identification.

p is the level number (p can equal 1, 2, or 3)

n is the length of the element.

Description: This statement defines a data element which may be a data item or a control field. This statement may occur anywhere within the record definition. If this is the last element in the Base-Data portion of the variable record, it is the element redefined by "RECORD-CODE=" groups.

Any data element may be subdefined:

a. The values which may be used to specify level range from 1 through 3. The level number zero (0) is reserved. An element with no prefix to specify its level number will be assigned level number zero (0).

b. The level number is specified:

   As an integer preceded and followed by a single dot (e.g., ".3.").

c. The length entry for a "parent" element will be the sum of the lengths of the "child" elements.

d. A unique name must be used for every element of the data set.

```
mmmmLKxx=8=vvvvxxxx
```

Entries: mmmm is the master data set name.

xx is a 2-character linkage code.

8 is the required length of eight.

vvvvxxxx is the element name containing the key.

Description: This statement defines a linkage path from a master data set based on the record control key. The definition of the element containing this key (vvvvxxxx) must precede this statement.

a. "mmmmLKxx" is the linkage path as defined in the master data set which links to this variable data set. This entry must be specified exactly as in the master data set in order to establish the required linkage.

b. A variable entry data set may be linked from multiple master data sets and may have multiple linkages from the same master data set.

c. Linkage paths are never given a level number.

```
RECORD-CODE=xx
```

Entry: xx is a 2-character alphanumeric name.

Description: This optional statement identifies the beginning of a set of data element definition statements which redefine the last data element specified in the base data portion of the variable record. The 2-character code identifies the specific record.

a. The redefined portion of the record may differ from one coded record to another in the same data set, as opposed to the base portion which is identical throughout the data set.

b. The coded or redefined portion of the record may be redefined as many times as necessary but each redefinition must be identified by a different record code.

c. Record codes must not be given a level number.

[.p.] vvvvxxxx=n

See previous explanation of the [.p.] vvvvxxxx=n statement following the [vvvvCODE=2] statement. Since element entries under the "RECORD-CODE" specification are actually redefining the last element in the Base Data portion of the record, a level number is always required for these entries.

mmmmLKxx=8=vvvvxxxx

See previous explanation of the mmmmLKxx=8=vvvvxxxx statement following the [vvvvCODE=2] statement.

END-DATA

Description: This statement ends the definition of logical data elements for the data set.

[TOTAL-LOGICAL-RECORDS=n]

Entry: n is a numerical value.

Description: Optional entry. See previous explanation of the same statement in the master data set statements (section 3.4.2).

[LOGICAL-RECORD-LENGTH=n]

Entry: n is a numerical value.

Description: Optional entry. See previous explanation of the same statement in the master data set statements (section 3.4.2).

```
[LOGICAL-RECORDS-PER-BLOCK=n]
```

Entry: n is a numerical value.

Description: Optional entry. See previous explanation of the same statement in the master data set statements (section 3.4.2).

```
DRIVE=nnn,nnnnn
```

See previous explanation of the same statement in the master data set statements (section 3.4.2).

```
[LOAD-LIMIT=n]
```

Entry: n is a percentage, expressed as an integer value.

Description: This statement specifies a percentage used to create a threshold for space management. Additions to existing chains may occupy space above the threshold. Additions which start a new chain exceeding the threshold are spread across the remaining file space (see figure 3-4). If n is omitted or its value is 0 or 100, a default value of 80 is used (e.g., 80 percent).

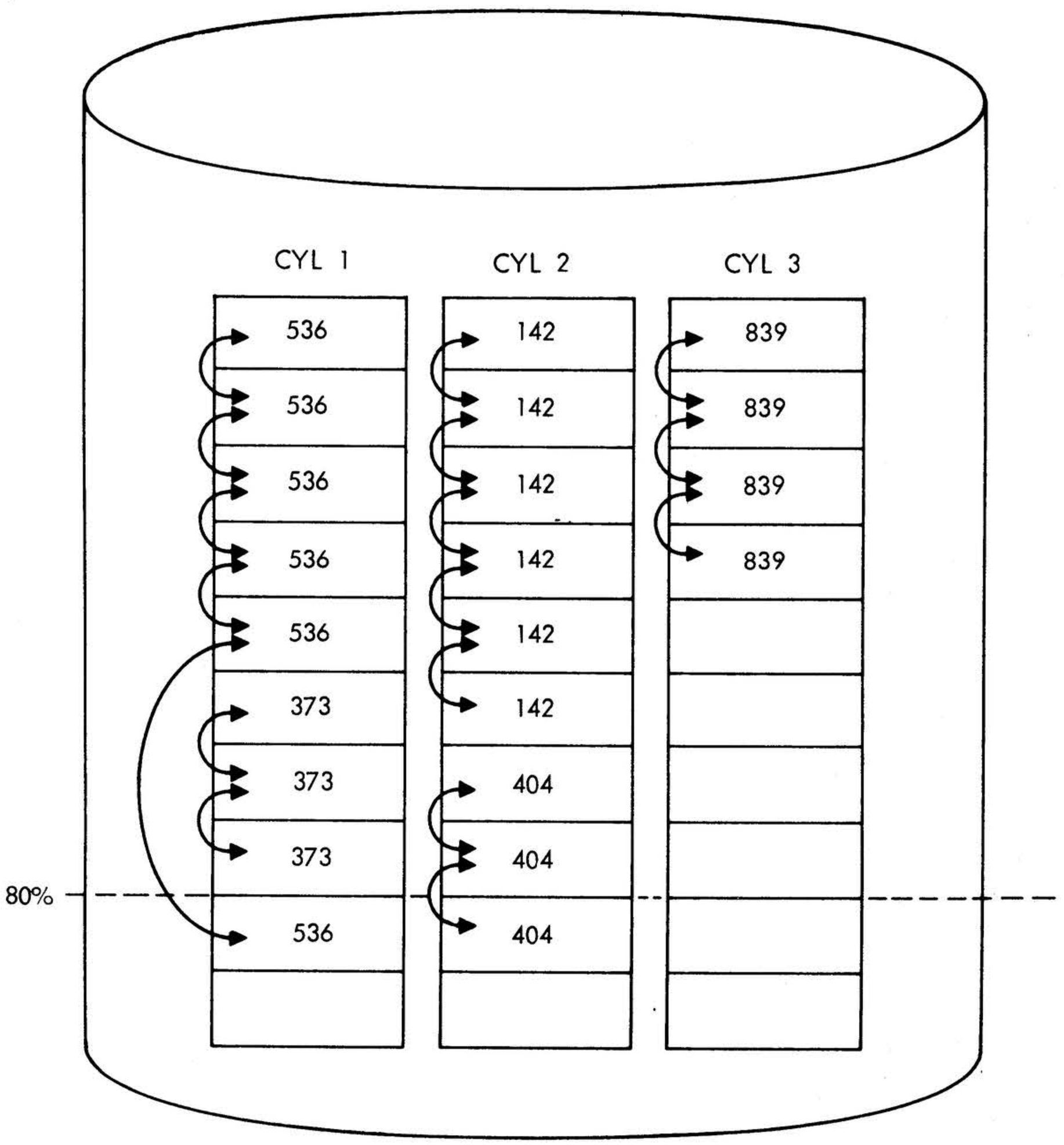
```
END-VARIABLE-ENTRY-DATA-SET
```

Description: This must be the last statement to end definition of a variable data set.

3.4.4 Epilogue Statements

```
END-DATA-BASE-GENERATION
```

Description: This statement must be the last statement of a data base definition.



VTI1-3458

Figure 3-4. Cylinder Load Limit for Variable Entry Data Sets

3.5 DATA BASE DESCRIPTOR MODULE (DBMOD)

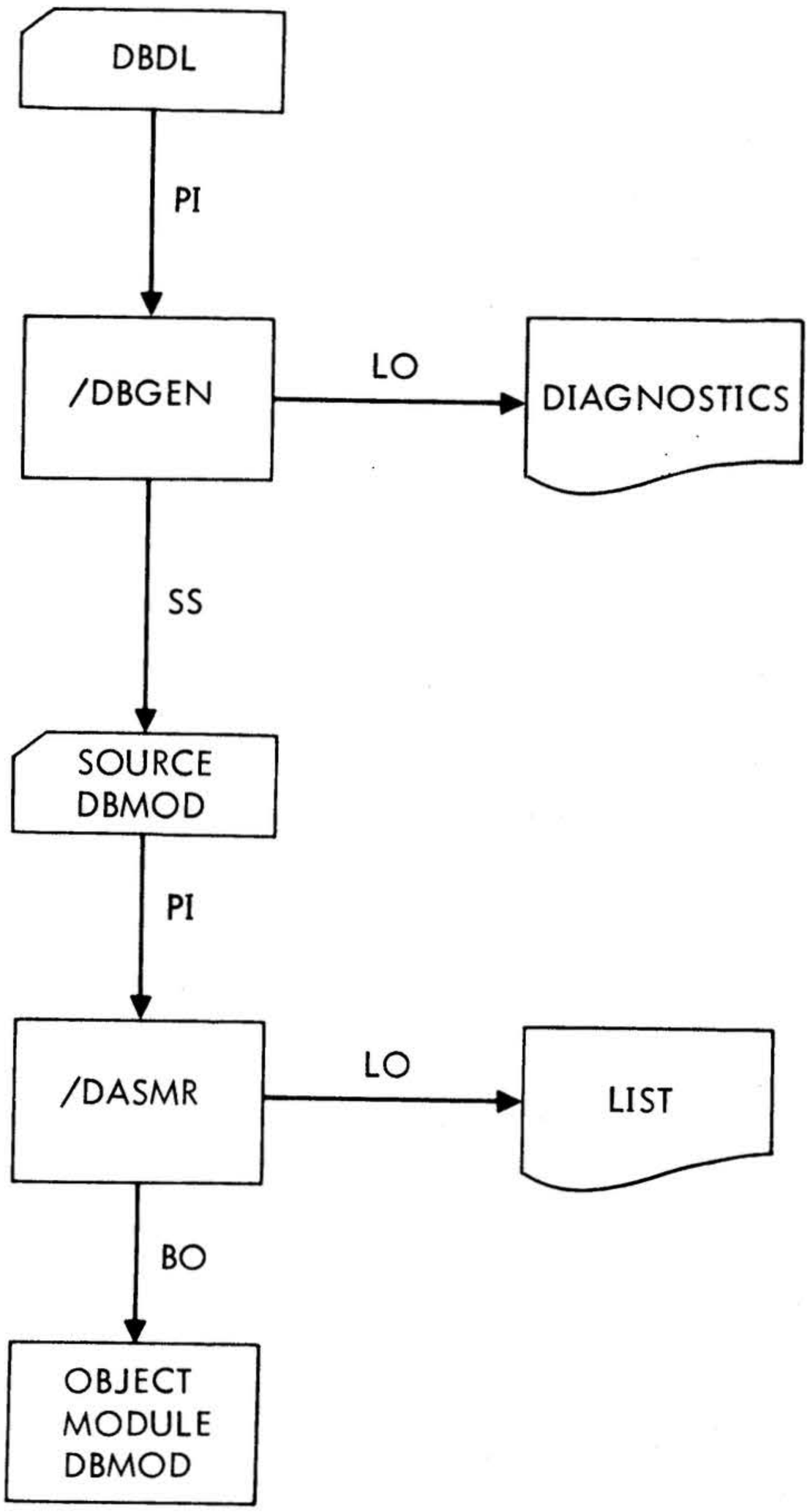
The DBDL statements describing a data base are input via the PI logical unit to DBGEN and are converted into assembler language source statements on the SS logical unit. Diagnostic messages on the LO logical unit indicate possible problems or errors.

The resulting assembler source statements are assembled by the DASMR assembler to produce an object data base descriptor module DBMOD. A flow chart showing the creation of the DBMOD module from the DBDL statements is given in figure 3-5.

The memory requirements for the Data Base Descriptor Module may be calculated from the number of words required for each element of the module, as listed in table 3-1.

Table 3-1. Data Base Descriptor (DBMOD) Memory Requirements

DBMOD Element	Words Required
General overhead	19 words
Overhead per file	6 words
Save area (once per DBMOD)	Largest logical record size or sector size, whichever is larger
Each Master File (Basic)	31 words
Each Variable File (Basic)	36 words
Each Master element (including Root)	6 words
Each Variable element	6 words
Each linkage (Master or Variable)	8 words
I/O area	4 words per pool plus buffer size
Buffer size (per buffer)	11 words plus the largest of sector size or logical record size
For each Logical Unit (LUN) i.e., for each DRIVE statement	17 words



VTI1-3459

Figure 3-5. Object Module DBMOD Flow Chart

3.6 EXAMPLE OF THE USE OF THE DATA BASE DEFINITION LANGUAGE

An example of a set of DBDL statements required to generate a DBMOD module using the DBGEN program is shown in figure 3-6.

The example shows the statements required to create a data base SUBRPE containing a personel master data set PERS linked to a skills inventory variable data set SKIV.

3.6.1 Computation of DBMOD

The computation which follows is taken from the example in appendix A.

EXAMPLE:

5 Master Files
3 Variable Files
8 Files (total)

Master File CUST	Size (words)
Basic Master File overhead	31
6 elements	36
2 links	16
	83

Master File DATE	
Basic Master File overhead	31
2 elements	12
2 links	16
	59

Master File INVT	
Basic Master File overhead	31
9 elements	54
2 links	16
	101

Master File ORNM	
Basic Master File overhead	31
2 elements	12
1 link	8
	51

EXAMPLE: (continued)

Master File VEND	Size (words)
Basic Master File overhead	31
7 elements	42
1 link	8
	81

Variable File CORD	
Basic Variable File overhead	36
15 elements	90
5 links	40
	166

Variable File ACCR	
Basic Variable File overhead	36
14 elements	84
1 link	8
	128

Variable File PORD	
Basic Variable File overhead	36
10 elements	60
2 links	16
	112

I/O AREAS		Buffer Size
MAS1	2 buffers	120
VAR1	4 buffers	120
MAS2	6 buffers	120
MAS3	1 buffer	120
	13 buffers	

NOTE: The sizes of all logical records are less than the sector size.

4(#areas)+(#buffers)(11 + sector size)

= 4(4) + 13(11 + 120)

= 1719 words

LOGICAL UNIT BLOCKS

8 files x 17 = 136 words

Based on the preceding, the number of words required for the DBMOD is:

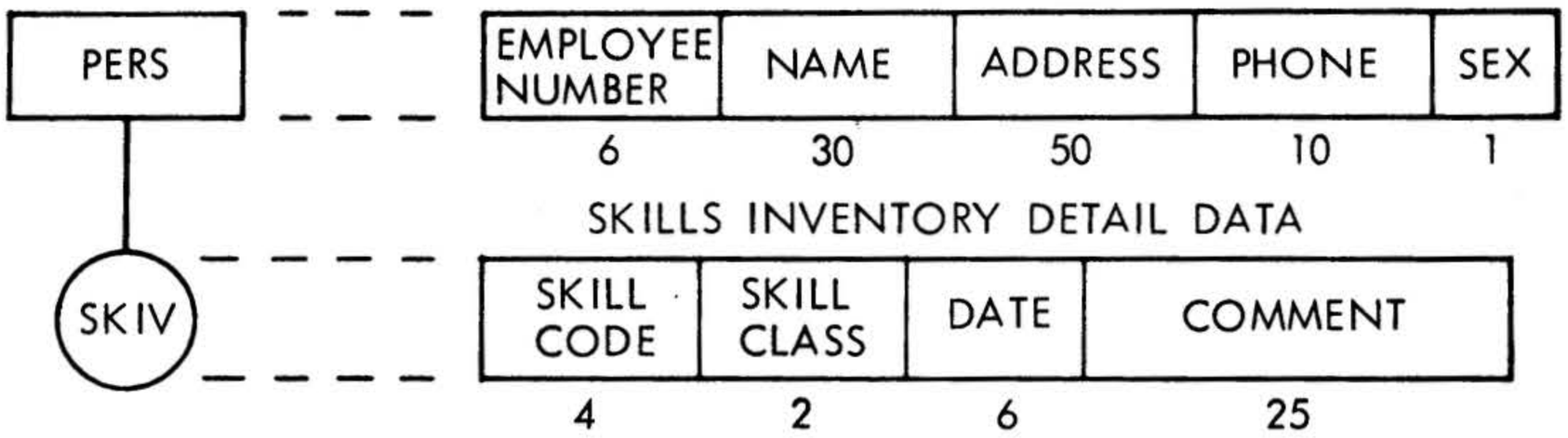
General overhead	19
File overhead 6 x 8	48
Save Area	120
Master File CUST	83
Master File DATE	59
Master File INVT	101
Master File ORNM	51
Master File VEND	81
Variable File CORD	166
Variable File ACCR	128
Variable File PORD	112
I/O Areas	1719
Logical Unit Blocks	136

DBMOD size = 2823 words

(approximately 3K)

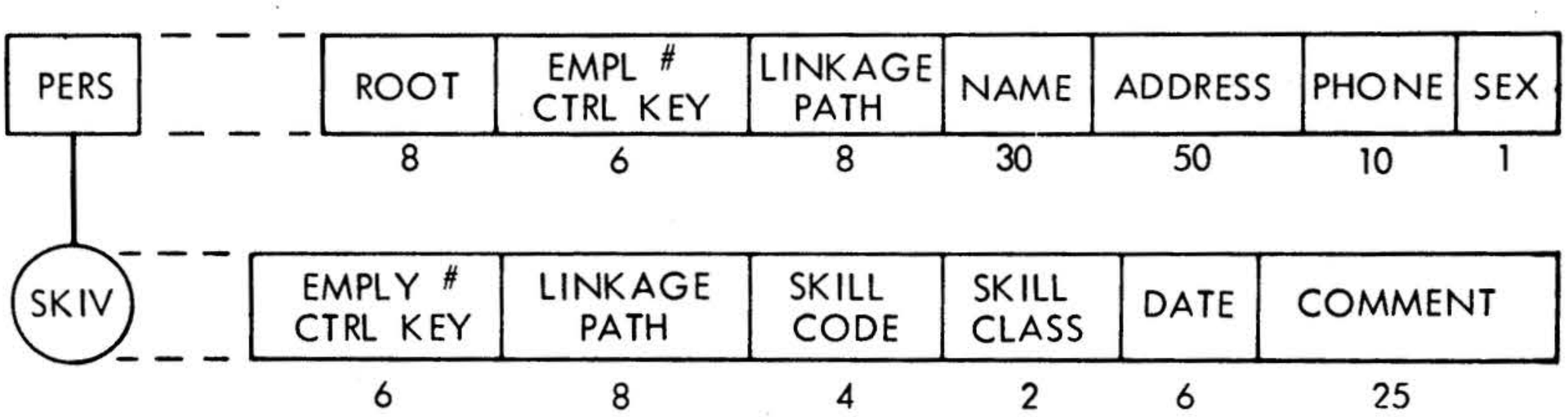
SAMPLE DBGEN

PERSONNEL MASTER DATA




```
BEGIN-DATA-BASE-GENERATION
DATA-BASE-NAME = SUBRPE
OPTIONS  OUTPUT = Y
SHARE-IO
IOAREA = MAS1
IOAREA = VAR1
END-IO
BEGIN-MASTER-DATA-SET
DATA-SET-NAME = PERS
IOAREA = MAS1
MASTER-DATA
PERSROOT = 8
PERSCTRL = 6
PERSLKSK = 8
PERSNAME = 30
PERSADDR = 50
PERSPHON = 10
PERSSEXX = 1
END-DATA
DRIVE = 26,500
END-MASTER-DATA-SET
```

```
BEGIN-VARIABLE-ENTRY-DATA-SET
DATA-SET-NAME = SKIV
IOAREA = VAR1
BASE-DATA
SKIVPERS = 6
PERSLKSK = 8 = SKIVPERS
SKIVCODE = 4
SKIVCLAS = 2
SKIVDATE = 6
SKIVCOMM = 25
END-DATA
DRIVE = 30, 1000
END-VARIABLE-ENTRY-DATA-SET
END-DATA-BASE-GENERATION
```



VTI1-3460

Figure 3-6. Example of Using the DBDL to Create a Data Base

SECTION 4
DATA BASE FORMATTOR

It is necessary to create the files and format the disc area before data can be written on the data base. This is achieved by means of the user FORMAT program which reads data set control cards and outputs a serial disc file according to physical parameters.

4.1 THE USER FORMATTOR

Part of the TOTAL package is a formattor program which resides on the OM library under the name DBFMT. DBFMT and the data base DBMOD object modules are LMGENed together (in that order) to form the (load module) user formattor.

Example: Assume that DBFMT is on the OM library and the user's DBMOD is on partition LV with protection code P. The following job stream will catalog the user formattor, called FORMAT, into the BL library.

```
/JOB,DBFORM
/LMGEN
TIDB,FORMAT,1,0
LD,OM,D,DBFMT
LD,LV,P,DBMOD
LIB
END,BL,E
/FINI
```

The user formattor may execute as a foreground or priority 1 background task. In the preceding example, FORMAT is catalogued as a priority 1 task on the BL library. To execute FORMAT, the JCP "/PLOAD,FORMAT" directive is used. FORMAT could have been catalogued as a foreground task and executed via a SCHED request.

FORMAT reads data base control directives from the PI logical unit, and creates and formats the requested data sets on the RMD devices. Diagnostics are printed out on the LO logical unit. Control directives are 80-character records.

The control directive format is:

bFORMAT xxxxxx file1, [file2,.....,] END.

where:

b	is a required blank in character position 1.
FORMAT	is the directive name and must start at character position 2.
xxxxxx	is the data base name

file1...filen are data set (file) names

The last parameter must be END.

Continuation records may be used if there is not enough space on one record for all the file names that are required. However, FORMAT xxxxxx must be duplicated for each record. As each file is successfully formatted, FORMAT outputs a message on LO which includes the file name and the number of sectors formatted.

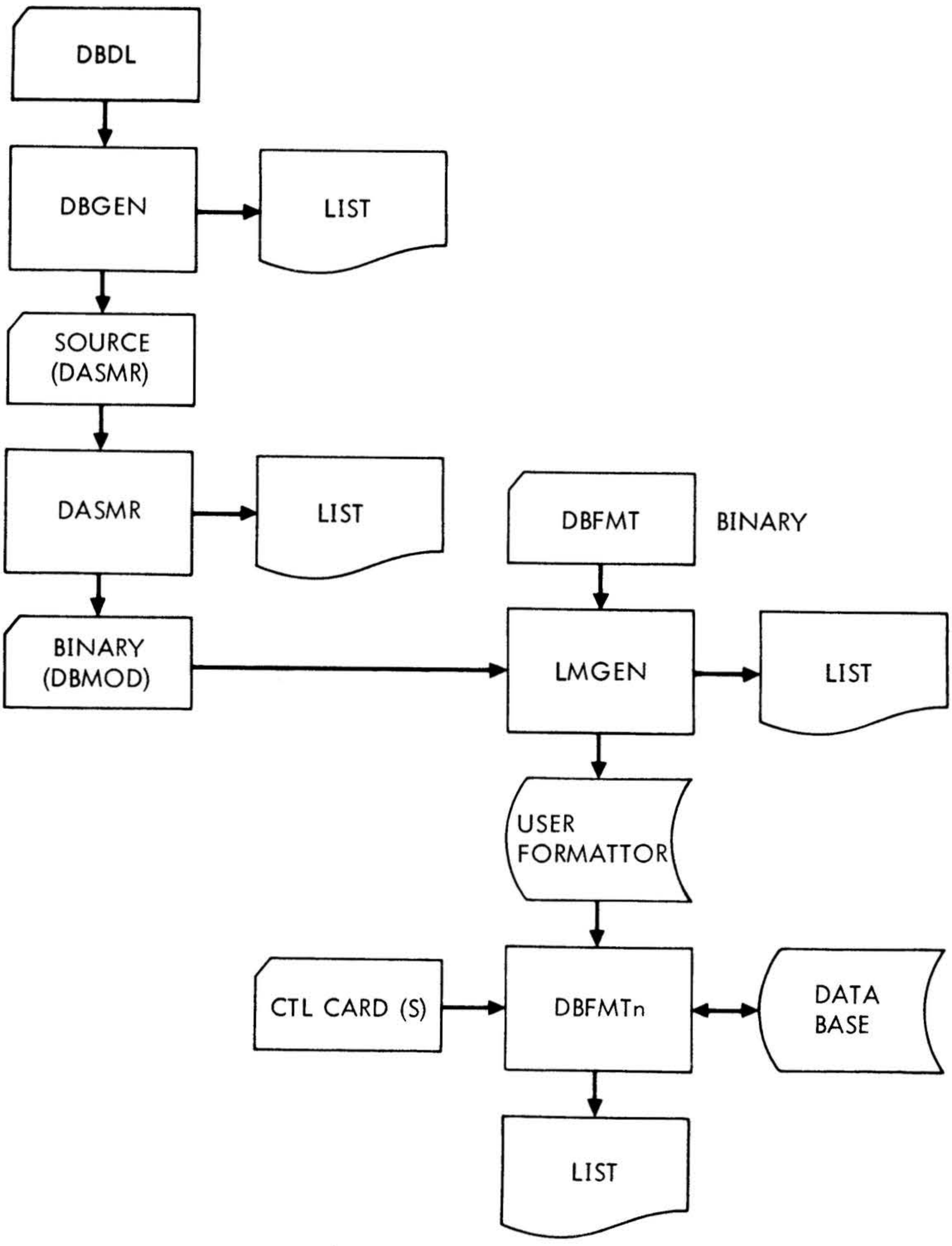
Example 1: Format data base MFGDBS with files PART,BILL,WCTR, and ROUT, all written in one line. Note that the first character in the FORMAT control directive is a blank.

```
/JOB,DBFORM
/ASSIGN,PI,SI
/PLOAD,FORMAT
 FORMAT MFGDBS PART,BILL,WCTR,ROUT,END.
/ENDJOB
```

Example 2: Format the same data base with example 1, utilizing multiple control directives.

```
/JOB,DBFORM
/ASSIGN,PI,SI
/PLOAD,FORMAT
 FORMAT MFGDBS PART
 FORMAT MFGDBS BILL
 FORMAT MFGDBS ROUT
 FORMAT MFGDBS WCTR
 FORMAT MFGDBS END.
/ENDJOB
```

A flow chart showing the Data Base formatting sequence of events is shown in figure 4-1.



VTI1-3483

Figure 4-1. Data Base Formatting Flow Chart

4.2 ADDING FILES TO THE DATA BASE

It is not necessary to format all of the data base at once. Each application can format only those files in the data base which were not previously formatted. Where a file is to be added to an existing data base, only the new file need be formatted, not the complete data base. If the new file is to be linked to an existing file and the logical record size of the existing file can accomodate a new link (four words per link), reformatting of the existing file is not necessary. Otherwise the existing file must be dumped, reformatted, and reloaded. The user can reduce the reformatting of existing files by anticipating their growth and establishing longer logical records when initially formatting the files.

4.3 FORMAT ERRORS

Refer to appendix B for a description of error messages output by DBFMT.

SECTION 5
DATA MANAGEMENT LANGUAGE

The Data Management Language (DML) is a means of accessing and manipulating a defined data base. The language operates by invoking TOTAL through the CALL facility of the host programming language. When such a CALL is encountered, control is passed to TOTAL, which analyzes a parameter list to determine the function (i.e., "command") to be performed and the data to be acted upon. Communication between the application program and TOTAL is affected through work areas referenced in the parameter list. When control returns to the application program from TOTAL, a status code is also returned to indicate the result of the operation. If the operation is completed successfully, a code of "****" is returned. If the operation was unsuccessful, the data base is restored to its condition before the operation, if necessary, and an appropriate status code is returned to indicate the cause of failure.

5.1 COMMAND PARAMETERS

The parameter list in the CALL statement is the medium of communication between TOTAL and the user's program. The parameters themselves are the names of areas defined elsewhere in the user's program. As might be expected of any called subprogram, TOTAL demands that the parameter list be in a certain order; the order shown in the examples throughout this manual must be strictly followed.

5.1.1 Functional Usage

Functions are provided to:

SIGN ON the data base

SIGN OFF the data base

ADD RECORDS to the data base

DELETE RECORDS from the data base

READ DATA ELEMENTS from the data base

WRITE DATA ELEMENTS to the data base

Of the fifteen different parameters which are available, some are used in every CALL to TOTAL, some depend on the particular type of data set being accessed (i.e., master versus variable), and a few are used only in certain specialized functions.

The following parameters are used in all but a few special functions:

OPERATION

STATUS

DATA-SET

REFERENCE

LINKAGE-PATH

CONTROL-KEY

DATA-LIST or ELEMENT-LIST

DATA-AREA

ENDP

The parameters can be used for serial functions, master data set functions, or variable data set functions, as shown in table 5-1.

Table 5-1. Parameters Available for Functional Usage

PARAMETER	SERIAL FUNCTIONS	MASTER DATA-SET FUNCTIONS	VARIABLE DATA-SET FUNCTIONS
OPERATION	x	x	x
STATUS	x	x	x
DATA-SET	x	x	x
REFERENCE	x		x
LINKAGE-PATH			x
CONTROL-KEY		x	x
DATA-LIST	x	x	x
DATA-AREA	x	x	x
END.	x	x	x

5.1.2 Notation Conventions

In the descriptions and definitions which follow, certain notation conventions are used to express the format of a statement or a parameter. These may be simply explained by the following rules:

a. Lower case letters are to be replaced by a symbol of the user's choosing.

b. Upper case letters are to be inserted as they appear.

c. Square brackets ([ ]) enclose a choice of options of which none, one, or several may be chosen.

d. Braces ({ }) enclose a choice of options of which one and only one must be chosen.

5.1.3 Detailed Descriptions of Parameters

The nine "standard" parameters are described in the paragraphs which follow, before the discussion of the individual commands. There they will be shown where they occur, but described only to the extent that they vary from the discussion below. The only exception is the parameter OPERATION which will be shown as the operation code of the function to be performed.

OPERATION:

This parameter is the name of (points to) a 5-character field defined by the user into which he must place the operation code of the function to be performed, e.g., READM - read a master data set randomly.

STATUS:

This parameter is the name of (points to) a 4-character field defined by the user into which TOTAL places a code indicating the result of the operation, e.g., "****" (the function has successfully completed), "FNTF" (File Note Found and the function has not been performed). THIS FIELD SHOULD BE EXAMINED AFTER EVERY COMMAND. A complete list of status codes and their meanings may be found in the Diagnostic section.

DATA-SET:

This parameter is the name of (points to) a 4-character field defined by the user into which the user must place the name of the data set to be operated upon as defined in a data base generation (DBMOD). The DATA-SET parameter is shown graphically in figure 5-1.

REFERENCE:

This parameter is the name of (points to) a 4-character field defined by the user which is used to maintain the internal reference point of the current variable record or a position in either a master or variable using the RDNXT function. This field is used by both TOTAL and the user to communicate information about processing along a relationship within a variable data set or along a serial retrieval of a data set. As such, each performs a specific role by inserting appropriate values into the reference field and expecting certain values to be present under certain conditions. This may be best described by listing the acceptable contents of the reference field, qualified by the role of the participant:

a. LKxx

   This is the last four characters of a linkage path name (mmmmLKxx) as defined in the Data Base Descriptor Module. The user places this value into the reference field to indicate that TOTAL is to retrieve a chain (depending on the operation code) and that processing is expected to continue along the specified linkage path.

   TOTAL places this value into the reference field to indicate that the first record of a chain has been deleted.

b. rrrr

   This is the Internal Reference Point (relative record number) of the record currently being processed.

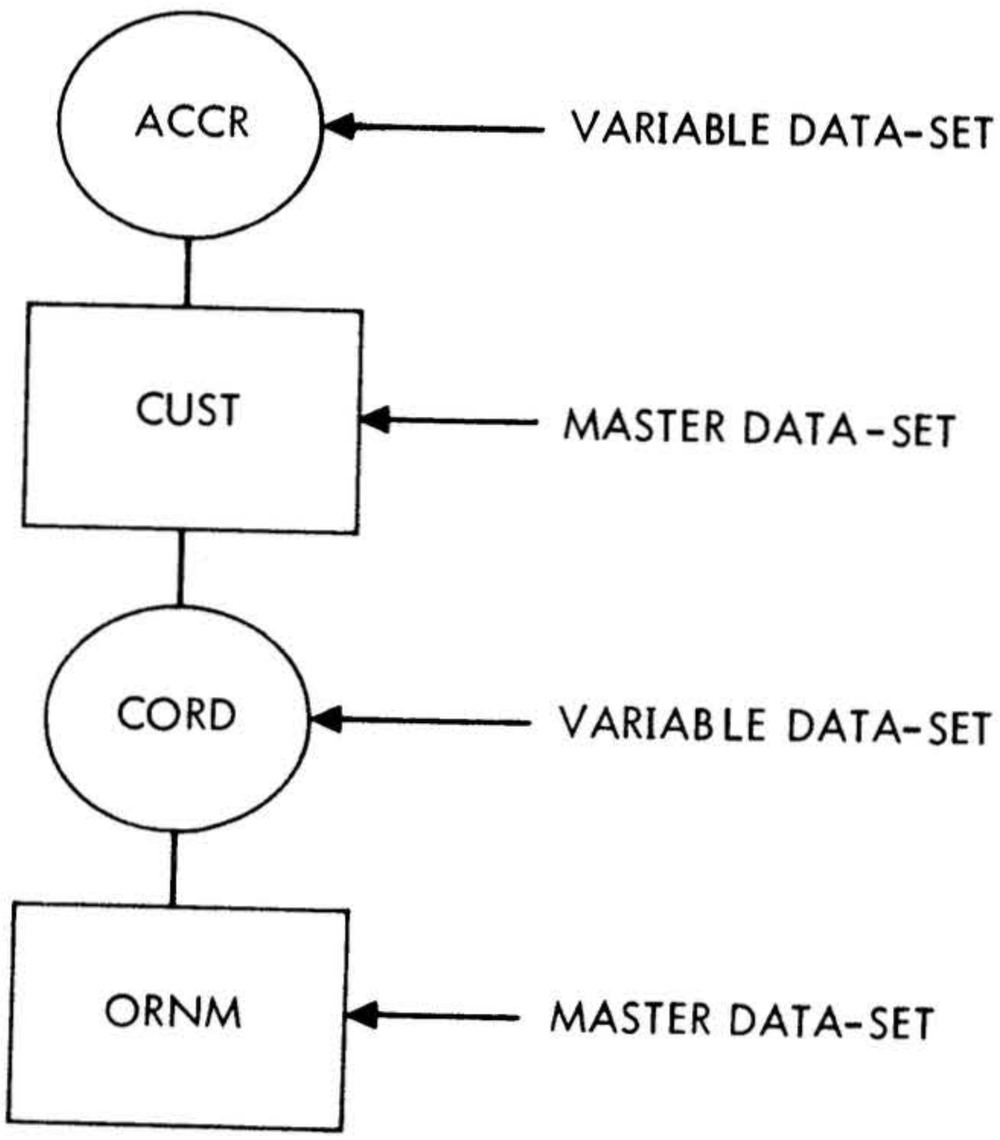
   The user places such a value into the reference field to directly retrieve a specific record whose Reference Point was previously known.

   The user also may place into the reference field a value which he previously saved upon interrupting continuous processing along a chain or reset a serial retrieval to some point in a data set.

DATA MANAGEMENT LANGUAGE
PARAMETER

DATA-SET

- 4-CHARACTER AREA
- IDENTIFIES THE DATA SET TO BE OPERATED ON



VTI1-3463

Figure 5-1. DATA-SET Parameter

TOTAL places into the reference field the Internal Reference Point of the record just read, added, or written, or the "back pointer" from a deleted record (unless the deleted record was the first of a chain).

The effect of placing appropriate values into the reference field prior to execution of a TOTAL command is given in table 5-2. The contents of the reference field after execution of a TOTAL command is shown in table 5-3.

Table 5-2. Effect of Values in Reference Field Before Execution

FUNCTION	CONTENT		
	LKxx	rrrr	END.
ADDVA	The operation is not performed and a status code of IVRP is returned.	The record in the user's data area is added logically after the record addressed by reference.	IVRP
ADDVB	The operation is not performed and a status code of IVRP is returned.	The record in the user's data area is added logically before the record addressed by reference.	IVRP
ADDVC	The record in the user's data area is added logically to the end of all chains controlled by keys within the record.	The record in the user's data area is added logically to the end of all chains controlled by keys within the record.	IVRP
DELVD	The operation is not performed, and a status code of IVRP is returned.	The record addressed by reference is deleted.	IVRP
READD	The operation is not performed, and a status code of IVRP is returned.	The record addressed by reference is retrieved.	IVRP
READR	The record at the end of the chain is retrieved.	The record logically before the one addressed by reference is retrieved.	IVRP

Table 5-2. Effect of Values in Reference Field Before Execution (continued)

FUNCTION	CONTENT		
	LKxx	rrrr	END.
READV	The first record in the chain is retrieved.	The record logically after the one addressed by reference is retrieved.	IVRP
WRITV	The operation is not performed, and a status code of IVRP is returned.	The record addressed by reference is processed.	IVRP

Table 5-3. Content of Reference Field After Execution

FUNCTION	CONTENT
ADDVA ADDVB ADDVC	Internal Reference Point of the record just added.
DELVD	"Back pointer" from the record just deleted (e.g., the reference point of the record logically before the record just deleted) or LKxx if the first record in the chain was deleted.
READD	Internal Reference Point of the record just read.
READR READV	Internal Reference Point of the record just read or "END." (if the read attempted to go off the end or beginning of the chain).
WRITV	Internal Reference Point of the record just written.

c. END.

This value is placed into the reference field by TOTAL when the user, while continuously processing along a chain of records, attempts to go beyond the end of the chain if reading forward or beyond the beginning if reading reverse.

d. BEGN

This value placed into the reference field by the user and used in conjunction with the "RDNXT" function will cause the "RDNXT" to start serially reading a specific data set at the absolute beginning of that file. Upon reaching the end of a file, "END." is placed in the reference by TOTAL.

LINKAGE-PATH:

This parameter is the name of (points to) an 8-character field defined by the user into which he must place the 8-character name of the linkage path (mmmmLKxx) as defined in the Data Base Descriptor Module. This is the vehicle through which the user dynamically names a specific relationship between a chain of variable records and a master record by the record control key.

The terms "primary linkage path" and "controlling linkage path" refer to the linkage path named by the LINKAGE-PATH parameter. The term "secondary linkage-path" refers to any other linkage path defined for this record in the Data Base Descriptor. The LINKAGE-PATH is shown graphically in figures 5-2 and 5-3.

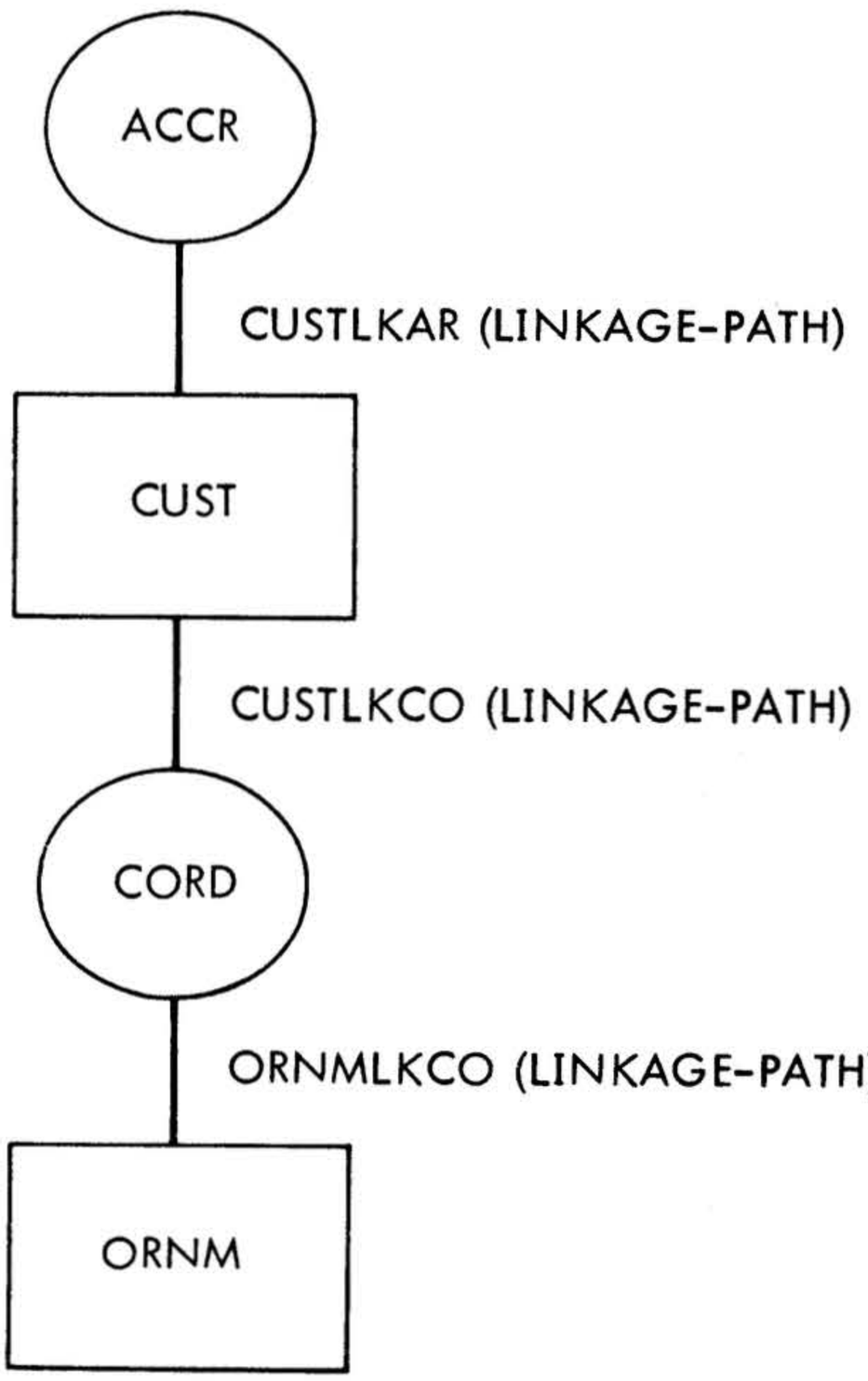
CONTROL-KEY:

This parameter is the name of (points to) a field defined by the user into which he places the record control key. TOTAL will "randomize" on this data, whether to locate a master record or to link from a master record to a variable record. If, during further processing of this command, it is found that the CONTROL KEY does not agree with the corresponding field in the user's data area, a status code of UCTL will be returned. To avoid this, it is recommended that the user name the control key field in the data area rather than define a separate field. The length of the CONTROL KEY is taken to be that defined in the Data Base Descriptor Module. The CONTROL-KEY is shown graphically in figure 5-4.

DATA MANAGEMENT LANGUAGE
PARAMETER

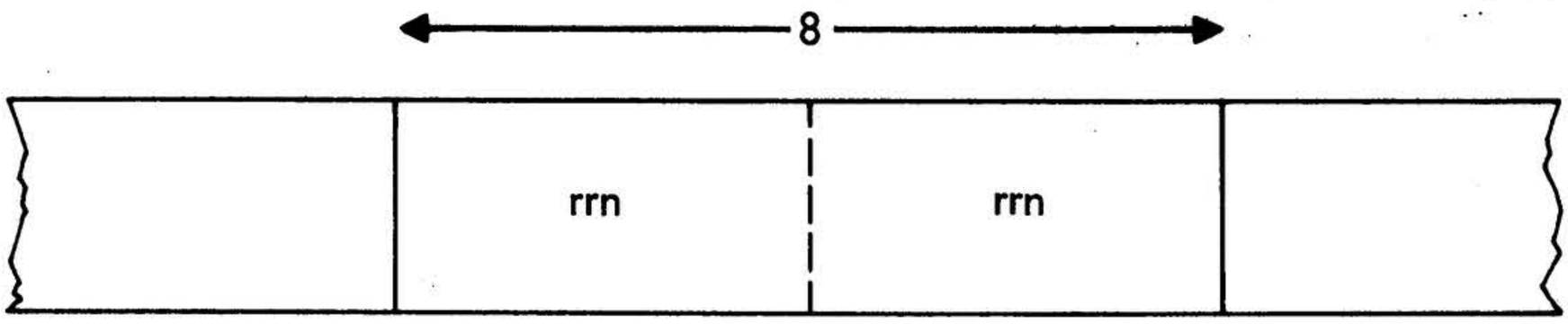
LINKAGE-PATH

- 8-CHARACTER AREA
- IDENTIFIES THE LINKAGE KPA PATH BY A 2-CHARACTER VALUE TO BE PROCESSED



VTI1-3464

Figure 5-2. LINKAGE-PATH Parameter



A field used by TOTAL to maintain logical relationships between records

- 8 byte (character)
  - binary pointers (rrn)
- Contents automatically managed by TOTAL

SINGLE ENTRY LINKAGE PATH

first rrn in related VE chain	last rrn in related VE chain

- Establishes relatability from SE record to VE record chain

VARIABLE ENTRY LINKAGE PATH

previous rrn in this VE chain	next rrn in this VE chain

- Establishes bi-directional relatability in a chain of VE records

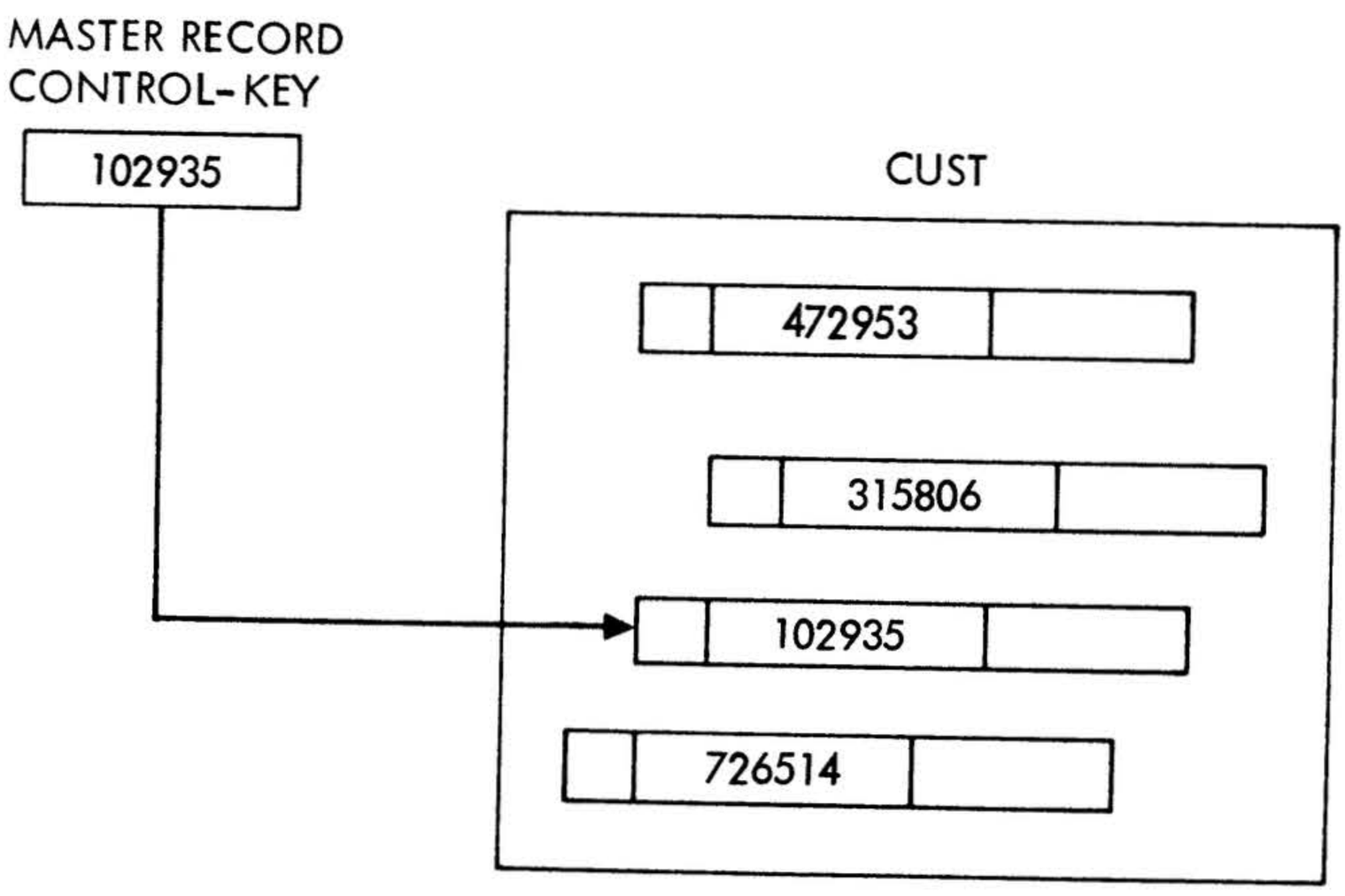
VTI1-3465

Figure 5-3. Linkage Path

DATA MANAGEMENT LANGUAGE
PARAMETER

CONTROL-KEY

- AREA DEFINED TO CONTAIN CONTROL KEYS FOR SINGLE ENTRY DATA SETS
- IDENTIFIES A MASTER RECORD IN THE SINGLE ENTRY DATA SET



VTI1-3466

Figure 5-4. CONTROL-KEY Parameter

DATA-LIST or ELEMENT-LIST:

This parameter is the name of (points to) a list of data names. The list is a character string defined by the user which is composed of 8-character data names declared in the data base generation. This list must conform to the following format:

```
elem1elem2......elem(n)END.
```

The data names in the list may include:

data elements
data items
control keys
record codes

The list may not include:

the ROOT field (master records only)
linkage fields

The data names in the list appear in any order, but the data elements they name will be processed in the order listed. Thus, the data list is ordered in the same manner as the user's data area, not necessarily as the record on the data set. Only the data elements named in the data list will be processed, i.e., transferred to or from the user's data area. It is suggested that the order of element names coincide with the generated order from DBGEN. A DATA-LIST is shown graphically in figure 5-5.

One very significant feature of TOTAL is what is referred to as a CODE DIRECTED READ. This is the ability, when processing Variable Entry Data Sets that contain coded-records, to only retrieve into your program, data elements that pertain to one or more coded-records, not every record.

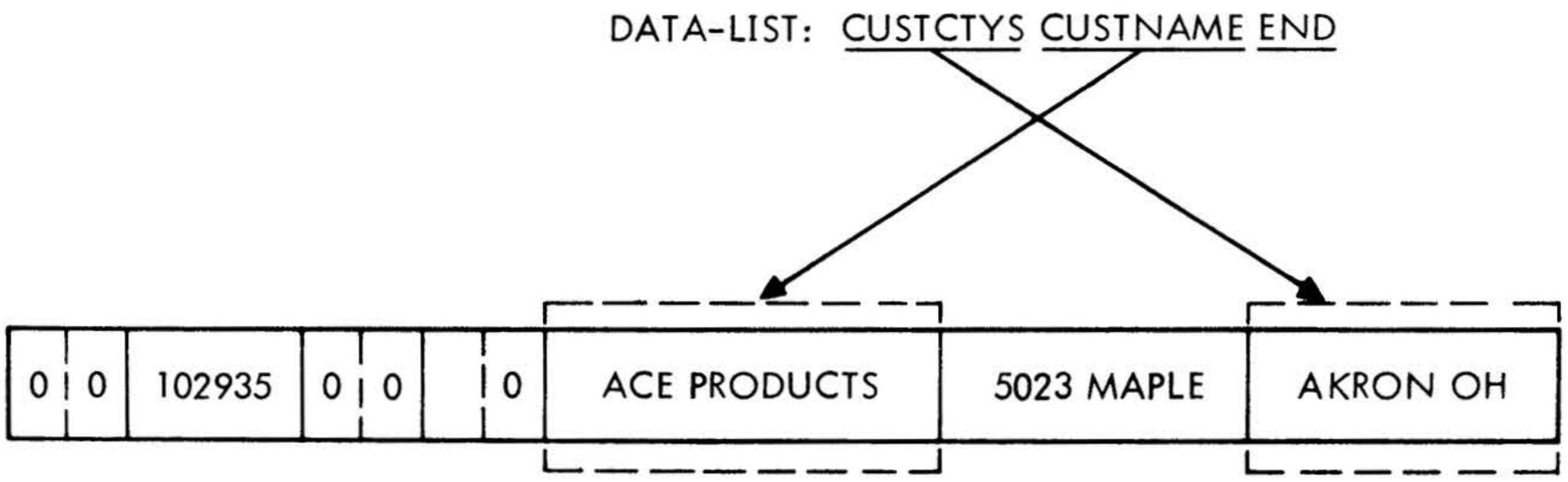
In order to achieve this CODE DIRECTED read capability, a slight variation in the presentation of the data-list is required.

In our example above, the inclusion at the immediate beginning of the data-list of one or more entries which follow will allow this feature.

DATA MANAGEMENT LANGUAGE PARAMETER

DATA-LIST

- AREA CONTAINING A LIST OF DATA ELEMENTS
- LIST IS TERMINATED BY 'END.'
- LIST IDENTIFIES THE DATA ELEMENTS TO BE REFERENCED



VTI1-3467

Figure 5-5. DATA-LIST Parameter

Example:

Read only variable entry data set records with CODES SR and CM.

```
*CODE=SR*CODE=CM elem1elem2.....elem(n)END
```

The entry *CODE=xx at the beginning of the data list will cause TOTAL to only retrieve and pass back elements for these type of records.

NOTE: When constructing element lists for variable entry file processing when coded records are defined, the "VVVVCODE" element name must always be the first one presented.

DATA-AREA:

This parameter is the name of (points to) an area of memory defined by the user which is used as an input/output area for the data elements named in the Data List. The structure and characteristics of this area must conform exactly to the data elements as named in the Data List and in the same order. The DATA-AREA is shown graphically in figure 5-6.

ENDP:

This parameter is the name of (points to) a 4-character field defined by the user which must contain the value 'END.' This parameter serves as the delimiter to the parameter list. As noted earlier, the parameter will not be passed for any function requiring nine parameters (variable functions only) and will not appear in the descriptions of the Variable Entry commands.

5.2 DESCRIPTION OF DML COMMANDS

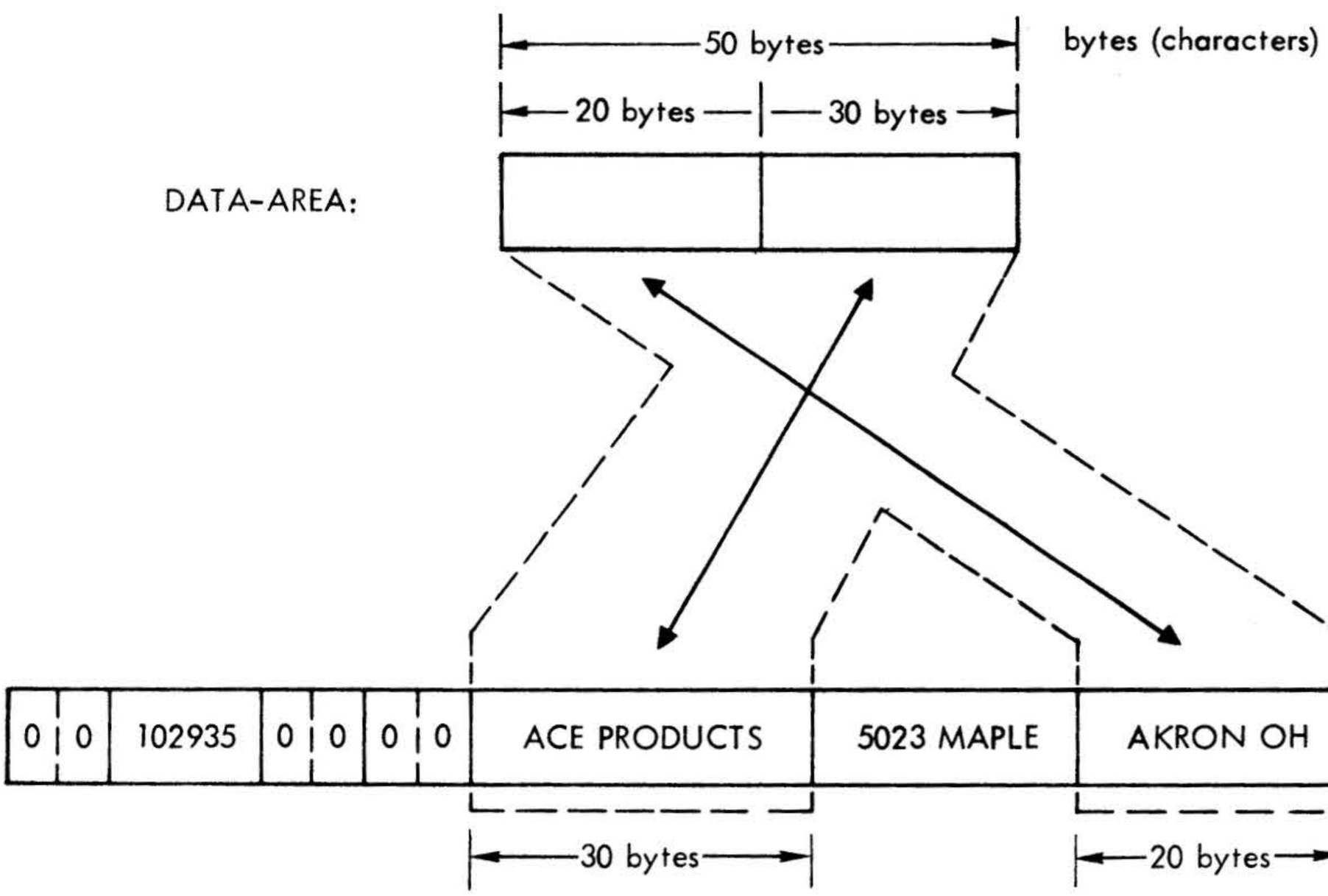
The following pages list in alphabetic order all of the Data Management Language commands with a detailed description of each. The commands are summarized in table 5-4, and the calling sequences for various languages are given in table 5-5.

An attempt has been made to make each description as complete as possible to avoid the need to consult several sources. The assumption is made however, that the user has read section 5.1, which discussed each of the standard parameters from a general functional point of view. In the following descriptions, therefore, some of the parameters will not be described at all (e.g.,

DATA MANAGEMENT LANGUAGE
PARAMETER

DATA-AREA

- AREA DEFINED TO HOLD THE DATA OF THE ELEMENTS IDENTIFIED IDENTIFIED IN DATA-LIST
- MUST BE AS LARGE AS THE SUM OF THE LENGTHS OF THE DATA ELEMENTS INDICATED



VTI1-3468

Figure 5-6. DATA-AREA Parameter

ENDP, DATA-SET, etc.), while others may be described only where they depart from the standard or need enhancement. Also instead of using the standard parameter OPERATION, the function mnemonic itself will be shown.

The status code list in each description is not intended to be all-inclusive, but rather should serve to point out some of the more common errors made in using a particular function. See appendix B for the repertoire of the status codes.

Each command with its required parameters is shown in table 5-6.

Table 5-4. Alphabetic List of DML Commands

1. ADD-M
2. ADDVA
3. ADDVB
4. ADDVC
5. DEL-M
6. DELVD
7. RDNXT
8. READD
9. READM
10. READR
11. READV
12. RQLOC
13. SINOF
14. SINON
15. WRITM
16. WRITV

Table 5-5. Calling Sequences to TOTAL for Various Languages

1. DASMR

```
        EXT     DATBAS
        CALL    DATBAS, param1, param2,...,paramn

        or

        EXT     DATBAS
        JMPM    DATBAS
        DATA    param1
        DATA    param2
        .
        .
        .
        DATA    paramn
```

Table 5-5. Calling Sequences to TOTAL for Various Languages (continued)

2. FORTRAN

```
        CALL    DATBAS (param1, param2, ..., paramn)
```

3. RPG II

```
        EXIT    DATBAS
        RLABL   param1
        RLABL   param2
        .
        .
        .
        RLABL   paramn
```

4. COBOL

```
        ENTER   ASSEMBLER.
        CALL    'DATBAS' USING param-1, param-2,...param-n
        ENTER   COBOL
```

NOTE: The appropriate language manual should be referred to for the exact meaning and procedure of CALL. Sample programs in FORTRAN, RPG II, and COBOL are given in appendix A.

Table 5-6. DML Commands with Required Parameters

5 Bytes	4 Bytes	4 Bytes	4 Bytes	8 Bytes	User Defined	8n+4 Bytes	User Defined	4 Bytes
Function	Status	File	Reference	Linkpath	Control	Elements	Area	END.
READM WRITM ADD-M DEL-M	X	X			X	X	X	X
RDNXT	X	X	X			X	X	X
READV READR READD WRITV DELVD ADDVC ADDVA ADDVB	X	X	X	X	X	X	X	X
							4-Char. Location	
RQLOC	X	X			X		X	X
		26+12n* SCHEMA						
SINON SINOF	X	X						X

Note: X indicates function or functions on the left have the parameters listed at the top of column.

* n is the number of files in the SCHEMA.

5.2.1 The Add Master Function

This function operates by randomizing on the contents of the Control Key to locate space, selecting data elements specified by the Data List, and writing the new record into the master data set.

Required Parameters:

```
ADD-M, STATUS, DATA-SET, CONTROL-KEY, DATA-LIST,
DATA-AREA, ENDP
```

ADD-M: Add Master Function Mnemonic

The user must place this mnemonic into the Operation Field.

STATUS: Status Code

Significant status codes which may be returned are:

BCTL:	The Control Key Field contains blanks or zero.
DUPM:	A master record with the same Control Key already exists on the data set.
FULL:	There is no space available for this record.
UCTL:	The Control Key Field does not match the corresponding field in the Data Area.

Programming Considerations:

a. The record control key must be included in the data list; TOTAL does not move it from the Control Key Field to the Data Area.

b. Any data fields not specified in the Data List will be zeros in the new record.

An example of coding the Add Master function and a graphic illustration of the randomizing of the contents of the control key is given in figure 5-7. It should be noted that the control-key record contents ('102935' in the example) should be the same as in the control key field in the Data-Area record.

DATA MANAGEMENT LANGUAGE

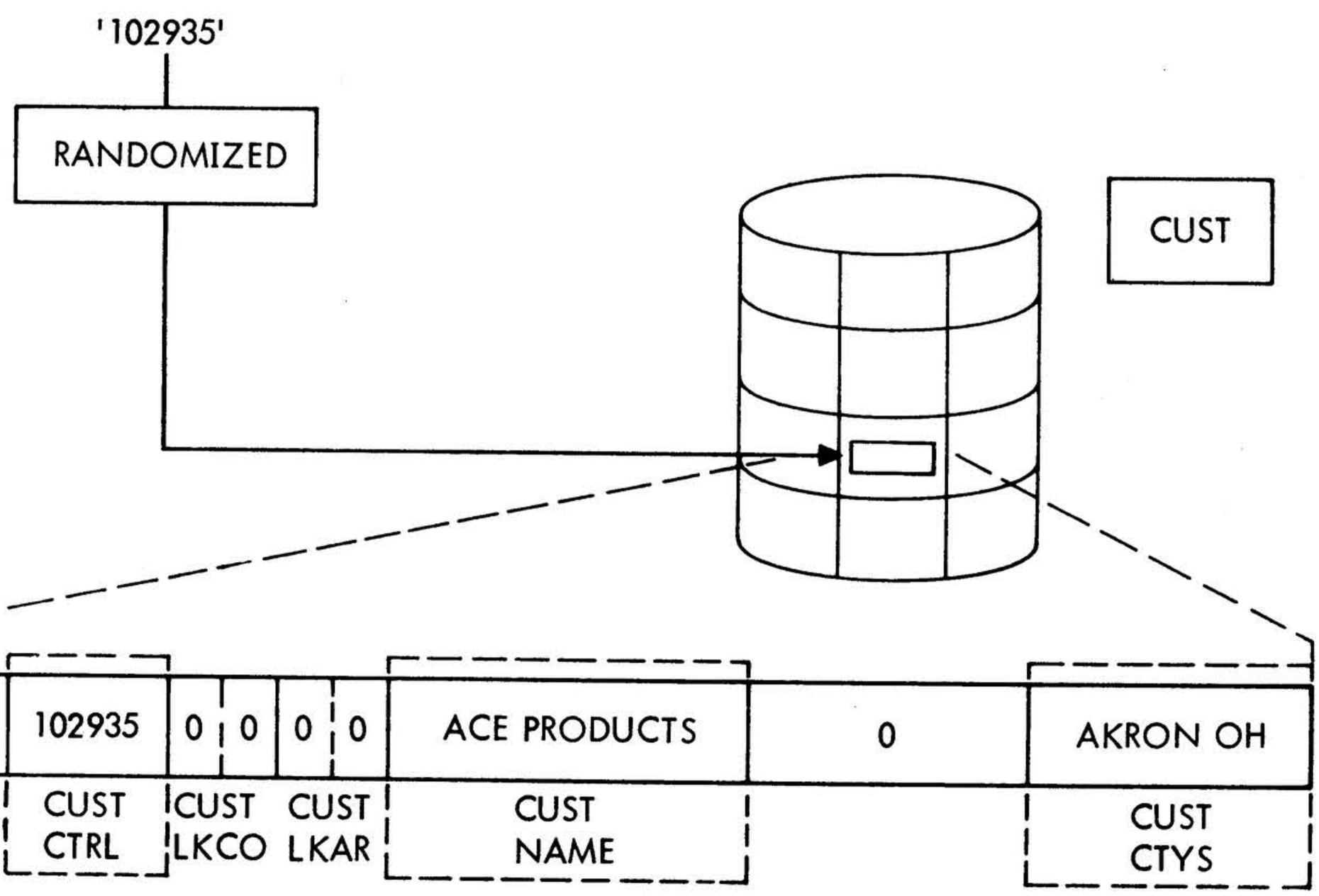
ADD-M	ADD MASTER FUNCTION

EXAMPLE:*

```
FUNCTION = 'ADD-M'
STATUS = blanks
DATA-SET = 'CUST'
CONTROL-KEY = '102935'
DATA-LIST = 'CUSTCTRL CUSTNAMECUSTCTYSEND.
DATA-AREA = '102935 ACE PRODUCTS  AKRON OH
ENDP = 'END.'
```

AFTER THE FUNCTION COMPLETES

*All parameters are pointers to areas which contain the above data



VTI1-3469

Figure 5-7. The ADD MASTER Function

5.2.2 The Add Variable After Function

This function operates by logically adding the record in the Data Area after the record whose Internal Reference Point is in the Reference Field. This logical "insertion" is made only on the linkage path specified by the Linkage-Path parameter. On all other linkage paths defined for this record, the addition is made to the end of the respective chains.

Required Parameters:

```
ADDVA, STATUS, DATA-SET, REFERENCE, LINKAGE-PATH,
CONTROL KEY, DATA-LIST, DATA-AREA, ENDP
```

ADDVA: Add Variable After Function Mnemonic

The user must insert this mnemonic into the Operation Field.

STATUS: Status Code

Significant status codes which may be returned are:

BCTL: A control field contains blanks or zeros
FULL: The data set has no room for this record.
IVRC: The record code in a record pointed to on a coded linkage path has not been defined in the DBMOD.
MLNF: The linkage path name is invalid for either the file or the record code.
MRNF: A master record does not exist for a control field (primary).
UCTL: The Control-Key Field does not match the corresponding field in the Data Area.

REFERENCE: Internal Reference Point

This parameter normally specifies the Internal Reference Point (relative record number) of the record after which the user's record is to be added.

If the Reference Field contains any other value, the function will not be performed and a status code of IVRP will be returned.

When the function has successfully completed, the Reference Field contains the Internal Reference Point (relative record number) of the added record.

Programming Considerations:

a. Addition of the record on secondary linkage paths requires retrieving a master record for each Control Key defined for this record. Therefore, these Control Keys must be present in the Data Area and must be valid, i.e., they must represent records which actually exist in the respective master data sets.

b. Data elements not named in the Data List will be zeros in the new record. Examples of coding the Add Variable After function are given in figures 5-8 and 5-9. Note that in figure 5-8 the new record C is added after record B because the relative record number of record B is 0002, and this is the value given in the Reference field. Note similiarly that in figure 5-9, the new record B is added after record A because its Internal Reference Point value is 0010, and this is the value given in the Reference field. The new record is added to the two Master Data Sets BOOK and BORW.

5.2.3 The Add Variable Before Function

This function operates by logically adding the record in the Data Area before the record whose Internal Reference Point is in the Reference Field. This logical "insertion" is made only on the linkage path specified by the Linkage-Path parameter. On all other linkage paths defined for this record, the addition is made to the end of the respective chains.

Required Parameters:

```
ADDVB, STATUS, DATA-SET, REFERENCE, LINKAGE-PATH,
CONTROL-KEY, DATA-LIST, DATA-AREA, ENDP
```

ADDVB: Add Variable Before Function Mnemonic

The user must insert this mnemonic into the Operation Field.

STATUS: Status Code

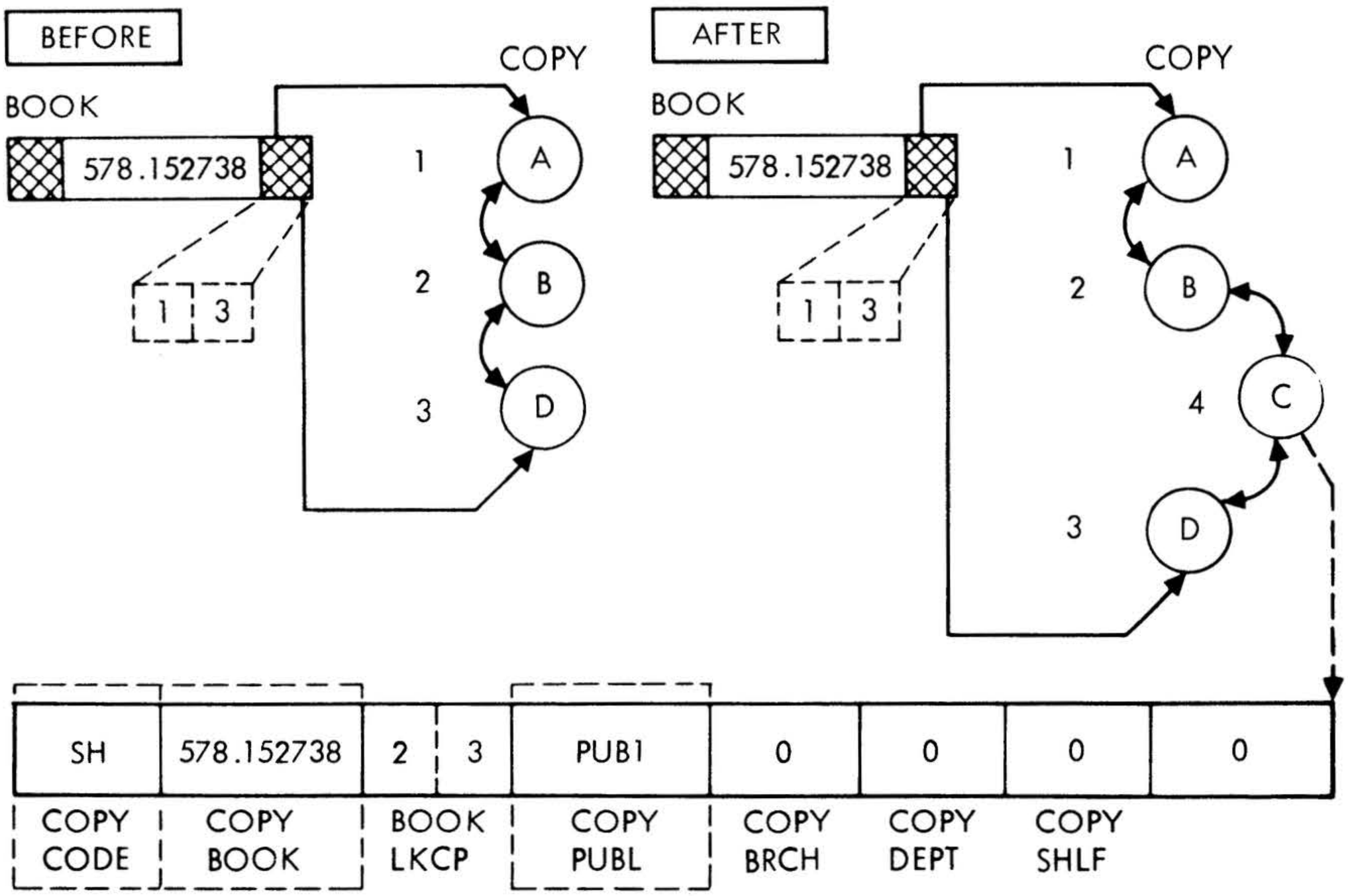
Significant status codes which may be returned are:

DATA MANAGEMENT LANGUAGE

ADDVA	ADD VARIABLE AFTER FUNCTION

EXAMPLE:

```
FUNCTION = 'ADDVA'
STATUS = blanks
DATA-SET = 'COPY'
REFERENCE ='0002' (binary)
LINKAGE-PATH = 'BOOKLKCP'
CONTROL-KEY = '578.152738'
DATA-LIST = 'COPYCODECOPYBOOKCOPYPUBLEND.'
DATA-AREA = '578.152738PUB1                                    SH'
ENDP = 'END.'
```

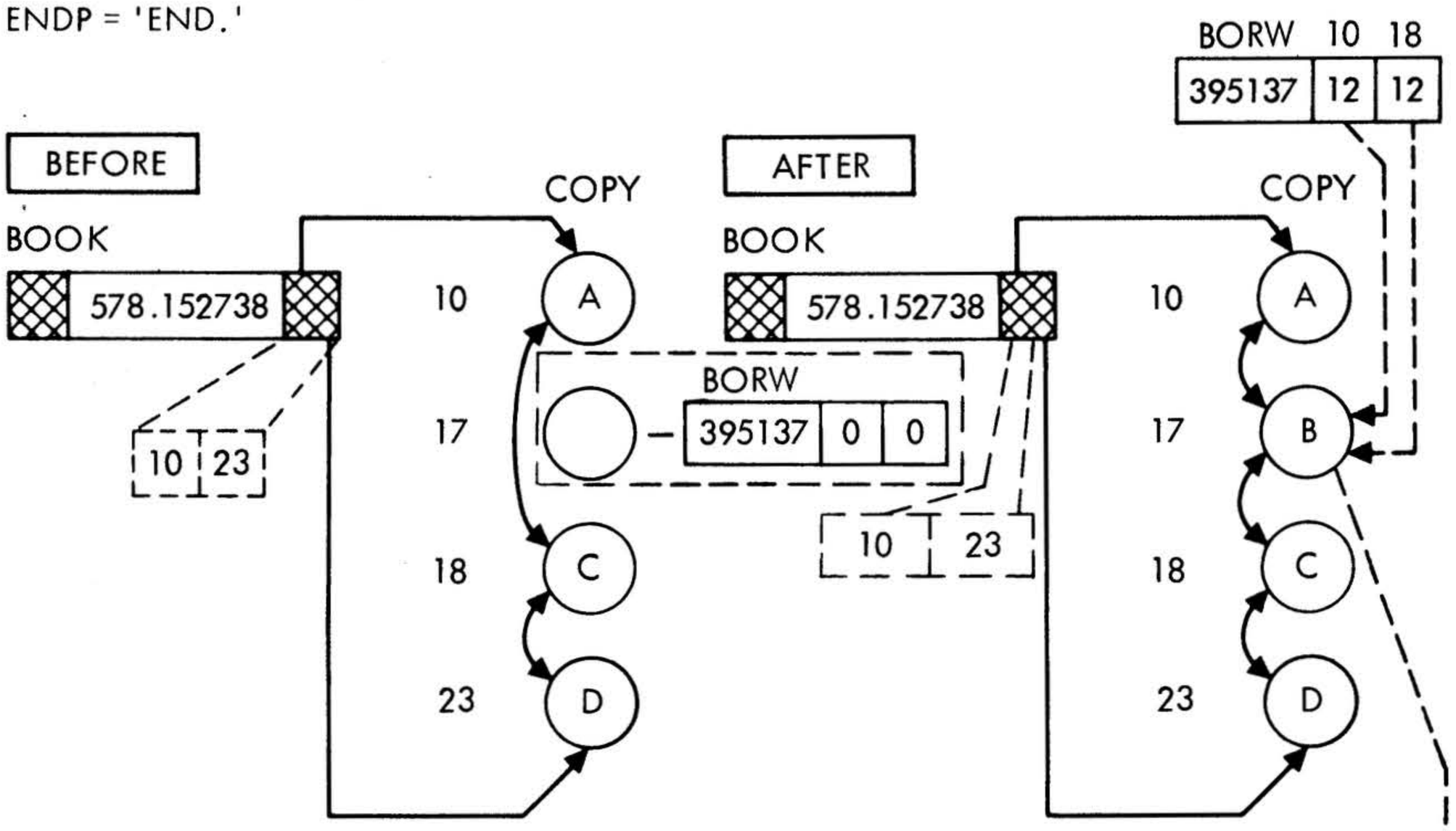


VTI1-3470

Figure 5-8. The ADD VARIABLE AFTER Function

ADDVA - TWO MASTERS

```
FUNCTION = 'ADDVA'
STATUS = blanks
DATA-SET = 'COPY '
REFERENCE = '0010' (binary)
LINKAGE-PATH = BOO KLKCP
CONTROL-KEY = '578.152738'
DATA-LIST = 'COPYCODECOPYBOOKCOPYBORWCOPYDLENDCOPYDDUECOPYPUBLEND.
            COPYBLEND.'
DATA-AREA = '578.152738395137LNO31873033173PUB1'
ENDP = 'END.'
```



LN	578.152738	10	18	PUB1	395137	0	0	031873	033173	
COPY CODE	COPY BOOK	BOOK LKCP		COPY PUBL	COPY BORW	BORW LKCP		COPY DLND	COPY DDUE	

VTI1-3471

Figure 5-9. The ADD VARIABLE AFTER Function for Two Master Data Sets

BCTL: A control field contains blanks or zeros.
FULL: The data set has no room for this record.
IVRC: The record code in a record pointed to on a coded linkage path has not been defined in the DBMOD.
MLNF: The linkage path name is invalid for either the data set or the record code.
MRNF: A master record does not exist for a control field.
UCTL: The Control-Key does not match the corresponding field in the Data Area.

REFERENCE: Internal Reference Point

This parameter normally specifies the Internal Reference Point of the record before which the user's record is to be added.

If the Reference Field contains any other value, the function will not be performed and a status code of IVRP will be returned.

When the function has successfully completed, the Reference Field contains the Internal Reference Point of the added record.

Programming Considerations:

a. Addition of the record along secondary linkage paths requires retrieving a master record for each Control Key defined for this record. Therefore, these Control Keys must be present in the Data Area and must be valid, i.e., they must represent records which actually exist in the respective master data sets.

b. Data elements not named in the Data List will be zeros in the record.

An example of the Add Variable Before function is given in figure 5-10. Note that the new record B is added before record C, because its Internal Reference Point is 0002, and this is the value given in the Reference Field.

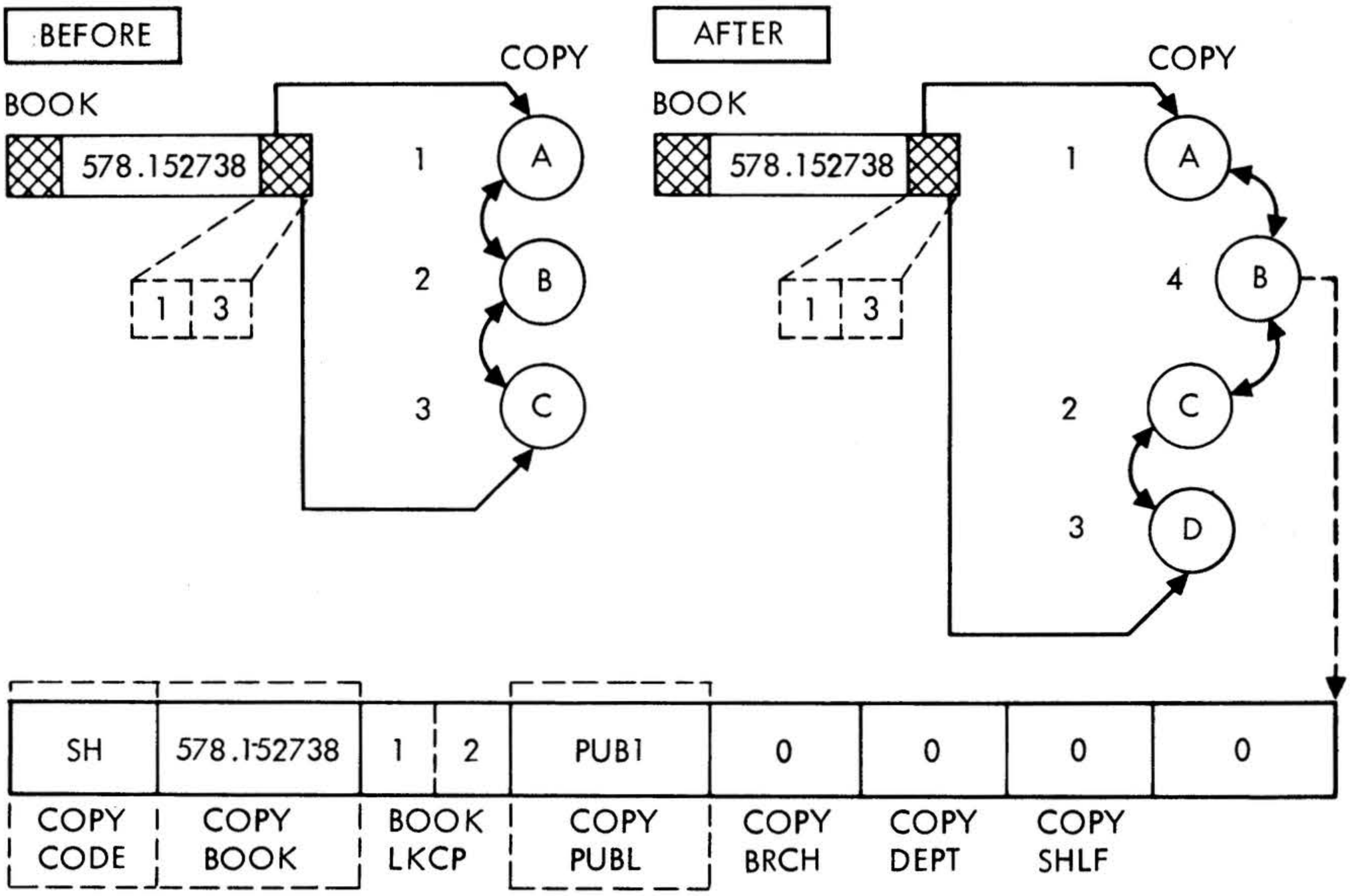
5.2.4 The Add Variable Continue Function

This function operates by logically adding the record in the Data Area to the end of all linkage paths defined for the record in the Data Base Descriptor.

ADDVB	ADD VARIABLE BEFORE FUNCTION

EXAMPLE:

```
FUNCTION = 'ADDVB'
STATUS = blanks
DATA-SET = 'COPY'
REFERENCE ='0002' (binary)
LINKAGE-PATH = 'BOOKLKCP'
CONTROL-KEY = '578.152738'
DATA-LIST = 'COPYCODECOPYBOOKCOPYPUBLEND.'
DATA-AREA = '578.152738PUB1                                    SH'
ENDP = 'END.'
```



VTI1-3472

Figure 5-10. The ADD VARIABLE BEFORE Function

Required Parameters:

```
ADDVC, STATUS, DATA-SET, REFERENCE, LINKAGE-PATH,
CONTROL-KEY, DATA-LIST, DATA-AREA, ENDP
```

ADDVC: Add Variable Continue Function Mnemonic

The user must insert this mnemonic into the Operation Field.

STATUS: Status Codes

Significant status codes which may be returned are:

BCTL: A control field contains blanks.
FULL: The data set has no room for this record.
IVRC: The record code in a record pointed to on a coded linkage path has not been defined in the DBMOD.
MLNF: The linkage path name is invalid for either the data set or the record code.
MRNF: A master record does not exist for a control field.
UCTL: The Control-Key Field does not match the corresponding field in the Data area.

REFERENCE: Internal Reference Point

The contents of the Reference Field are not used to perform the function, but are edited for validity.

If the Reference Field contains anything but LKxx or an Internal Reference Point, the function will not be performed and a status code of IVRP will be returned.

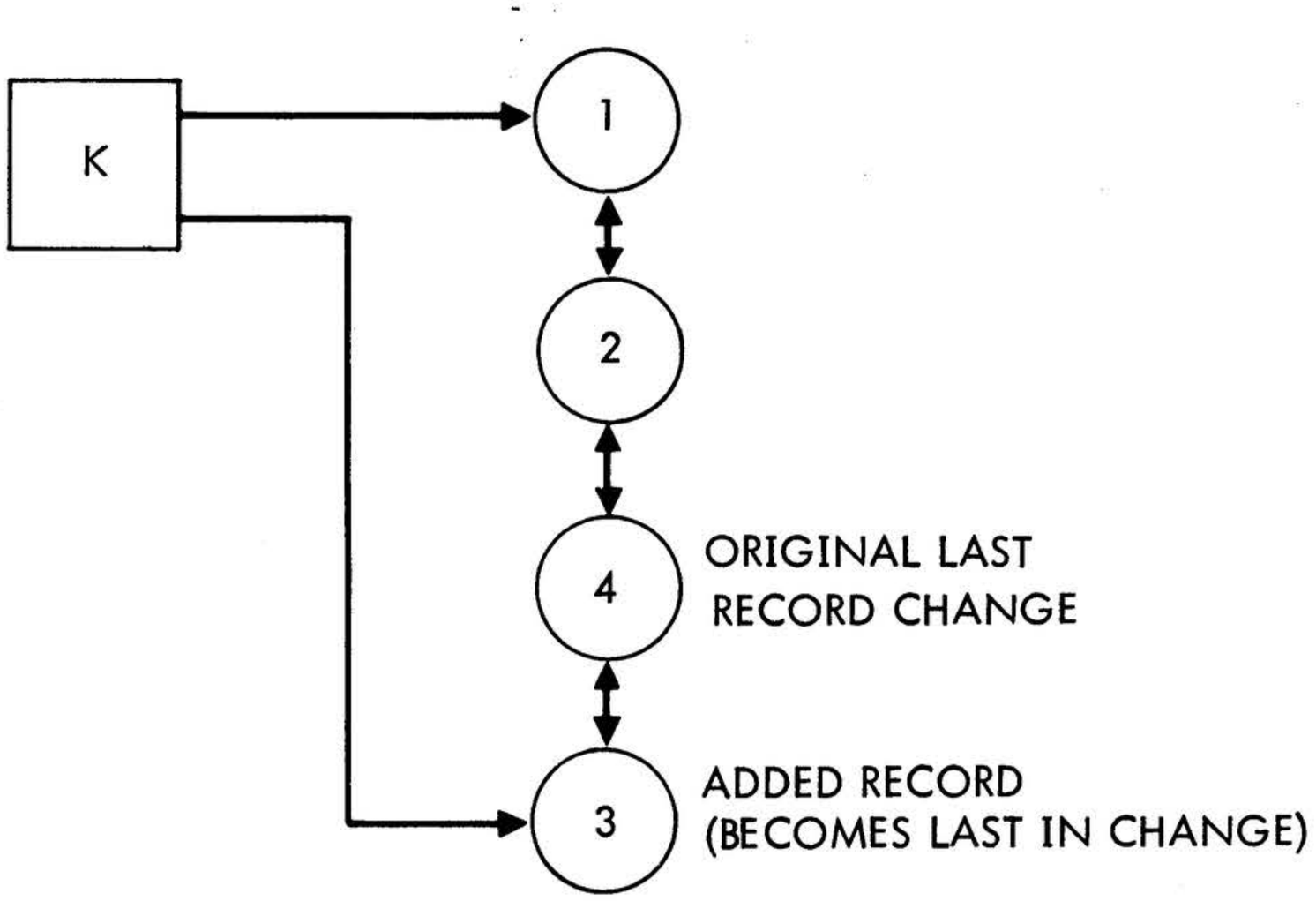
When the function has successfully completed, the Reference Field contains the Internal Reference Point of the added record.

Programming Considerations:

a. Addition of the record along secondary linkage paths requires retrieving a master record for each Control Key defined for this record. Therefore, these Control Keys must be present in the Data Area and must be valid, i.e., they must represent records which actually exist in the respective master data sets.

b. Data elements not named in the Data List will be zeros in the record.

The Add Variable Continue function is shown schematically in figure 5-11.



VTI1-3489

Figure 5-11. The ADD VARIABLE CONTINUE Function

5.2.5 The Delete Master Function

This function operates by randomizing on the contents of the Control-Key Field to find the specified record. The record is deleted by setting it to zeros. The space thus freed is made immediately available to be re-used.

Required Parameters:

```
DEL-M, STATUS, DATA-SET, CONTROL-KEY, DATA-LIST,
DATA-AREA, ENDP
```

DEL-M: Delete Master Function Mnemonic

The user must place this mnemonic into the Operation Field.

STATUS: Status Code

Significant status codes which may be returned are:

BCTL: The Control-Key Field contains blanks.
IMDL: Variable records are still linked to this master record.
MRNF: The requested record is not on the data set.

Programming Considerations:

a. Although not necessary, the record to be deleted should be read and verified against user criteria before actually deleting.

b. TOTAL will not delete a master record if any variable records remain linked to it. The user must first physically delete each variable record.

An example of the Delete Master function and a graphic illustration of randomizing of the contents of the Control Key field to find the specified record is given in figure 5-12.

5.2.6 The Delete Variable Direct Function

This function operates by deleting the variable record whose Internal Reference Point is in the Reference Field. The Record is deleted by setting it to zeros.

DATA MANAGEMENT LANGUAGE

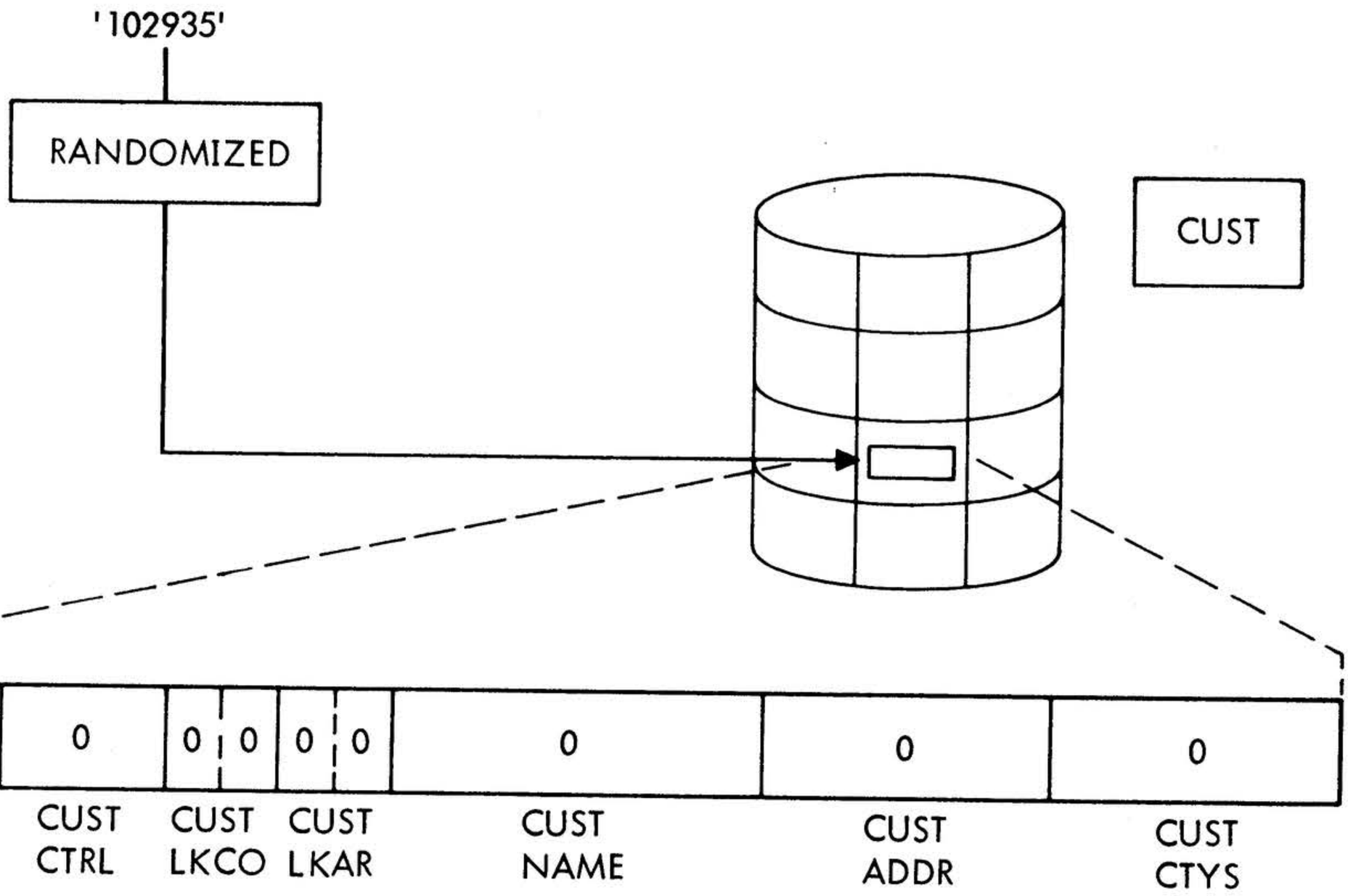
DEL-M	DELETE MASTER FUNCTION

EXAMPLE:

FUNCTION ='DEL-M'
STATUS = blanks
DATA-SET = 'CUST'
CONTROL-KEY = '102935'
DATA-LIST = 'END.'
DATA-AREA = zero
ENDP = 'END.'

AFTER THE FUNCTION COMPLETES

RECORD HAS BEEN ZEROED OUT



VTI1-3473

Figure 5-12. The DELETE MASTER Function

Required Parameters:

```
DELVD, STATUS, DATA-SET, REFERENCE, LINKAGE-PATH,
CONTROL-KEY, DATA-LIST, DATA-AREA, ENDP
```

DELVD: Delete Variable Direct Function Mnemonic

The user must insert this mnemonic into the Operation Field.

STATUS: Status Code

Significant status codes which may be returned are:

IVRC: The record code in a record pointed to on a coded linkage path has not been defined in the DBMOD.
MLNF: The linkage path name is invalid for the file or record code.

REFERENCE: Internal Reference Point

The contents of the Reference Field are used to point to the specific record to be deleted. Therefore, it may contain only an Internal Reference Point.

When the function has successfully completed, the Reference Field will contain the "back pointer" from the deleted record.

Programming Considerations:

If the DELVD command is followed immediately by a READV command, the record logically after the deleted record is retrieved. If the DELVD command is followed immediately by a READR command, the record logically before the deleted record is skipped and the next preceding record is retrieved.

An example of the Delete Variable Direct function is given in figure 5-13. Note that record B is deleted and is set to zeros, because its Internal Reference Point is 0017, and this is the value given in the Reference Field.

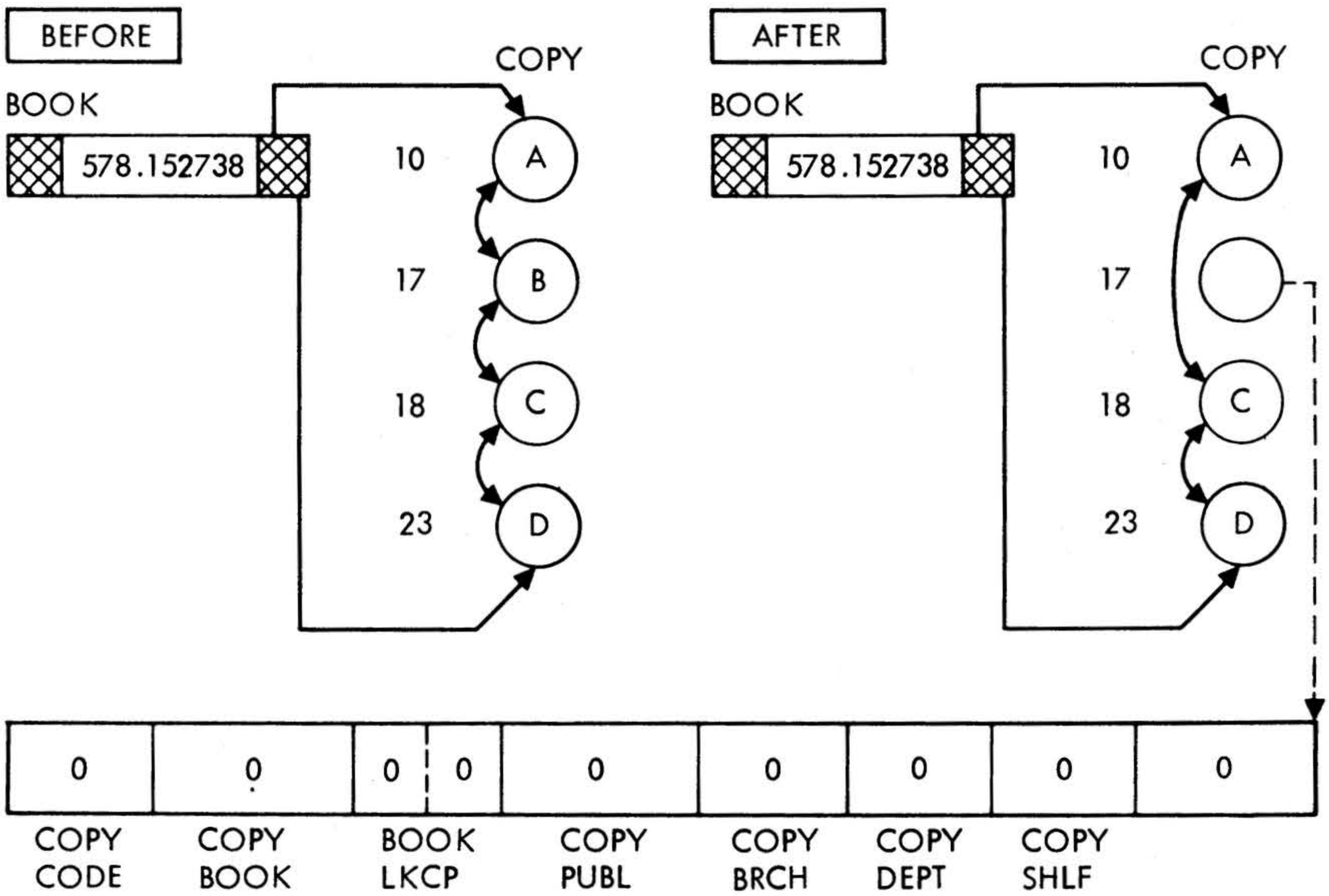
5.2.7 The Read Next Function

This function operates as a generalized serial retrieval method. The retrieval may be directed to a specific point in the data set, namely, to the beginning or to a specific record location.

DELVD	DELETE VARIABLE DIRECT FUNCTION

EXAMPLE:

```
FUNCTION = 'DELVD'
STATUS = blanks
DATA-SET = 'COPY'
REFERENCE = '0017' (binary)
LINKAGE-PATH = 'BOOKLKCP'
CONTROL-KEY = '578.152738'
DATA-LIST = 'END.'
DATA-AREA = zero
ENDP = 'END.'
```



0	0	0	0	0	0	0	0	0
COPY CODE	COPY BOOK	BOOK LKCP		COPY PUBL	COPY BRCH	COPY DEPT	COPY SHLF	

VTI1-3474

Figure 5-13. The DELETE VARIABLE DIRECT Function

Each record thus retrieved is placed in the Data Area and retrieval may continue by simply re-executing the Read Next Command until the end of the data set is reached. Only data records are returned to the user; blank records and control records are bypassed. The specific method of retrieval is described in more detail within the discussion of the function.

Required Parameters:

```
RDNXT, STATUS, DATA-SET, QUALIFIER, DATA-LIST,
DATA-AREA, ENDP
```

RDNXT: Read Next Function Mnemonic

The user must place this mnemonic into the Operation Field.

QUALIFIER: Relative Record Number Field

This parameter is the name of (points to) a field defined by the user which is used to maintain the current position in the data set being processed. The Qualifier Field function is similar to the Reference field in other operations.

The size and content of the Qualifier Field is always four bytes in length.

The Qualifier Field may contain:

```
[ BEGN ]
[ rrrr ]
[ END. ]
```

BEGN:

If the user places "BEGN" into the Qualifier Field, the Read Next Function retrieves the record physically first in the data set and places it into the Data Area according to the Data List. The Internal Reference Point (relative record number) replaces "BEGN" in the Qualifier Field. Subsequent executions of the Read Next Command will then continue processing serially from that point.

rrrr: Binary Relative Record Number (rrn)

The Qualifier Field may contain an Internal Reference Point as the result of a prior execution of the Read Next Command, or the user may place an Internal Reference Point into the Qualifier Field to resume the retrieval from some specific location. Since it is the Internal Reference Point of the last record read, it is incremented by one to retrieve the next record.

END.: "END." is placed in the Qualifier Field at end-of-file.

Programming Considerations:

a. The "WRITM" Command may be executed while processing master data sets with the Read Next Function.

b. The "WRITV" and "DELVD" Commands may be executed while processing variable data sets with the Read Next Function. The Reference Numbers for these commands may be found in the Qualifier Field.

c. At end-of-file, "END." is placed in the Qualifier Field.

d. The code-directed read feature does not apply to this function.

An example of the Read Next function is given in figure 5-14. In this example, seven logical records with Internal Reference Point (relative record number) values of 58, 95, 147, 196, 197, 201, 213 are retrieved from the data base, and their contents are placed in the data area specified by the application program.

5.2.8 The Read Direct Function

This function operates by directly retrieving the logical record specified by the Internal Reference Point in the Reference Field. Processing may then continue along any linkage path valid for that record with whatever function is appropriate.

DATA MANAGEMENT LANGUAGE

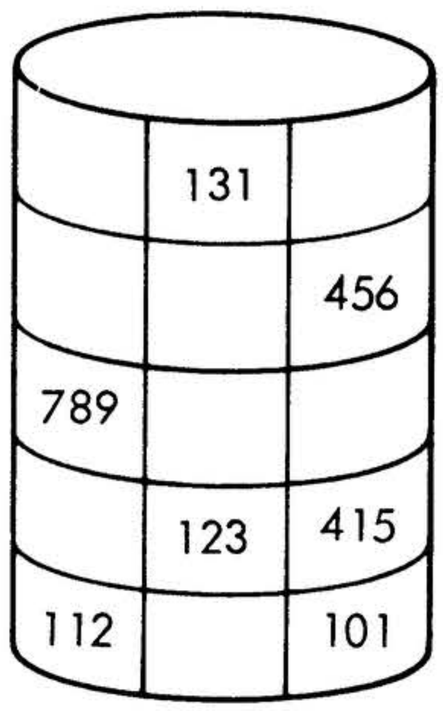
RDNXT	READ NEXT FUNCTION

EXAMPLE:

FUNCTION = 'RDNXT'
STATUS = blanks
DATA-SET = 'BOOK'
QUALIFIER = '00581' (binary)
DATA-LIST = 'BOOKCTRLBOOKDATAEND.'
DATA-AREA = zero
ENDP = 'END.'

EXAMPLE:

		KEY FIELD	
rrn	58	131	DATA
rrn	95	456	DATA
rrn	147	789	DATA
rrn	196	123	DATA
rrn	197	415	DATA
rrn	201	112	DATA
rrn	213	101	DATA
	END		



SINGLE ENTRY
OR
VARIABLE ENTRY

- ELEMENTS EXTRACTED ONLY FROM ACTIVE RECORDS
- RECORDS ARE EXTRACTED IN PHYSICAL SEQUENCE WITHOUT REGARD FOR KEY OR LINKAGES

VTI1-3475

Figure 5-14. The READ NEXT Function

Required Parameters:

READD, STATUS, DATA-SET, REFERENCE, LINKAGE-PATH, CONTROL-KEY, DATA-LIST, DATA-AREA, ENDP

READD: Read Direct Function Mnemonic

The user must insert this mnemonic into the Operation Field.

STATUS: Status Code

Significant status codes which may be returned are:

IVRP: The contents of the Reference Field are invalid.
IVRC: The Data-List contains element names invalid for the record code.

REFERENCE: Internal Reference Point

The Internal Reference Point in the Reference Field is used to retrieve a specific record from the variable data set; therefore, it may contain only an Internal Reference Point.

When the function has successfully completed, the Reference Field will still contain the Internal Reference Point of the retrieved record.

Programming Considerations:

It is not anticipated that the user will be able to programmatically compute the Internal Reference Point of a specific record. An Internal Reference Point supplied to the READD function is likely to have come from one of two sources:

a. the currently executing program which saved the Internal Reference Point when interrupting continuous processing along a chain and is now preparing to resume processing by retrieving the last record read.

b. another program, through some input medium.

An example of coding the Read Direct function is given in figure 5-15. In this example, the contents of record B are transferred to the Data Area specified by the application program, because the Internal Reference Point value of record B is 0017 and this is the value given in the Reference field.

DATA MANAGEMENT LANGUAGE

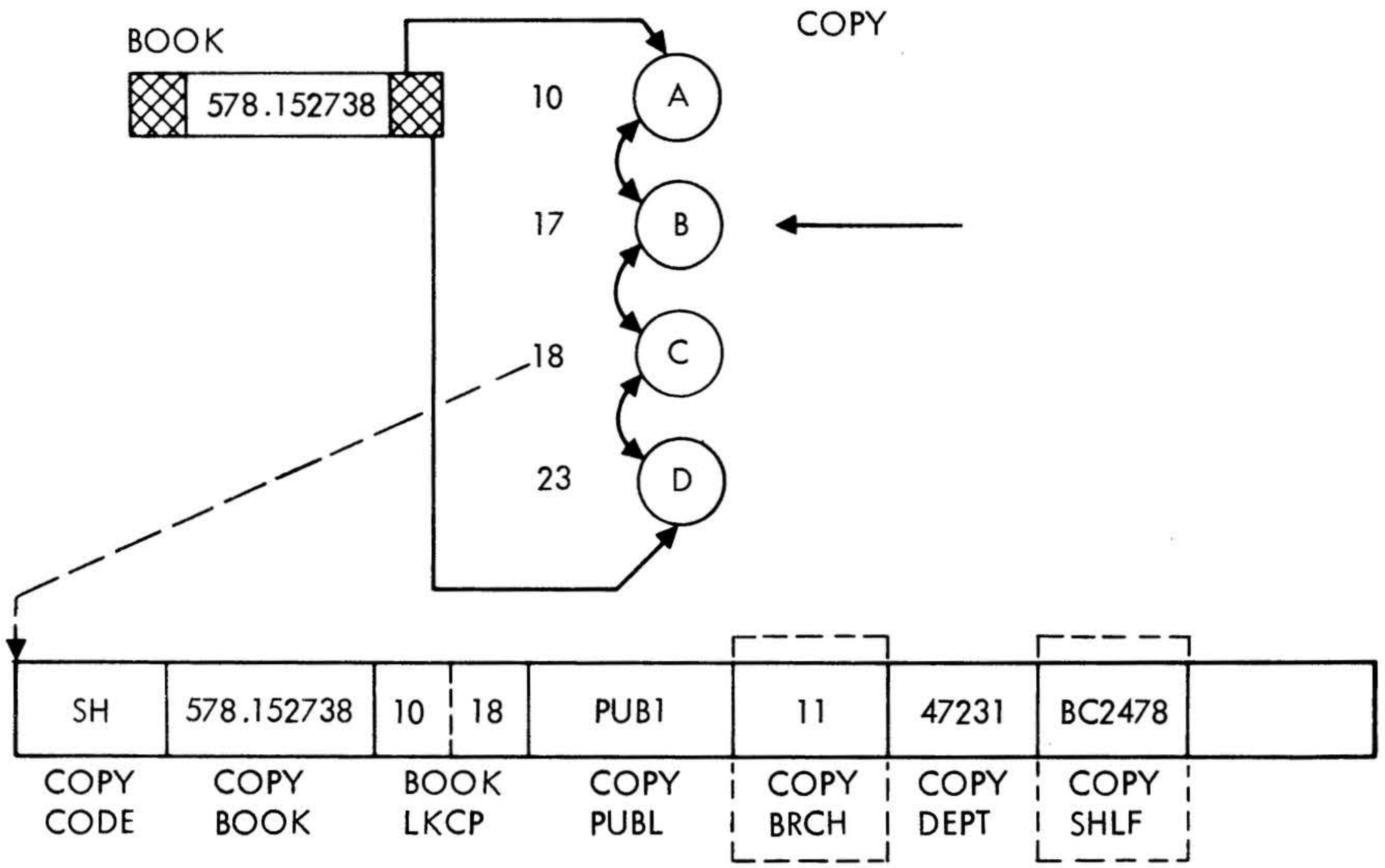
READD	READ VARIABLE DIRECT FUNCTION

EXAMPLE:

```
FUNCTION = 'READD'
STATUS = blanks
DATA-SET = 'COPY'
REFERENCE = '0017' (binary)
LINKAGE-PATH =  'BOOKLKCP'
CONTROL-KEY = '578.152738'
DATA-LIST = 'COPYBRCHCOPYSHLFEND.'
DATA-AREA = zero
ENDP = 'END.'
```

AFTER THE CALL COMPLETES

```
DATA-AREA = '11BC2478'
```



VTI1-3476

Figure 5-15. The READ DIRECT Function

5.2.9 The Read Master Function

This function operates by randomizing on the contents of the Control Key Field to find the specific record and place it into the Data Area according to the Data List.

Required Parameters:

```
READM, STATUS, DATA-SET, CONTROL-KEY, DATA-LIST,
DATA-AREA, ENDP
```

READM: Read Master Function Mnemonic

The user must place this mnemonic into the Operation Field.

STATUS: Status Code

Significant status codes which may be returned are:

BCTL: The control Key Field contains blanks.
MRNF: The requested record is not on the data set.

An example of coding the Read Master function is given in figure 5-16. In this example, the record with the Control Key value 102935 is found. The fields CUSTNAME, CUSTADDR, and CUSTCTY are transferrred to the Data Area specified by the application program.

5.2.10 The Read Reverse Function

This function operates by logically following backpointers along a specified linkage path. To read an entire chain, processing is initiated by placing LKxx into the Reference Field and issuing the READR command. TOTAL uses the Control Key to access a master record from which the pointer to the logical end of the chain is obtained. This last record of the chain is then returned to the user. Thereafter, processing continues by re-issuing the READR command; since the Reference Field contains an Internal Reference Point, the back chain is followed and records are retrieved in reverse order until the first record in the chain has been processed. When the READR command is issued for the record before the first, the code "END." is returned in the Reference Field to indicate that the chain has been completely processed.

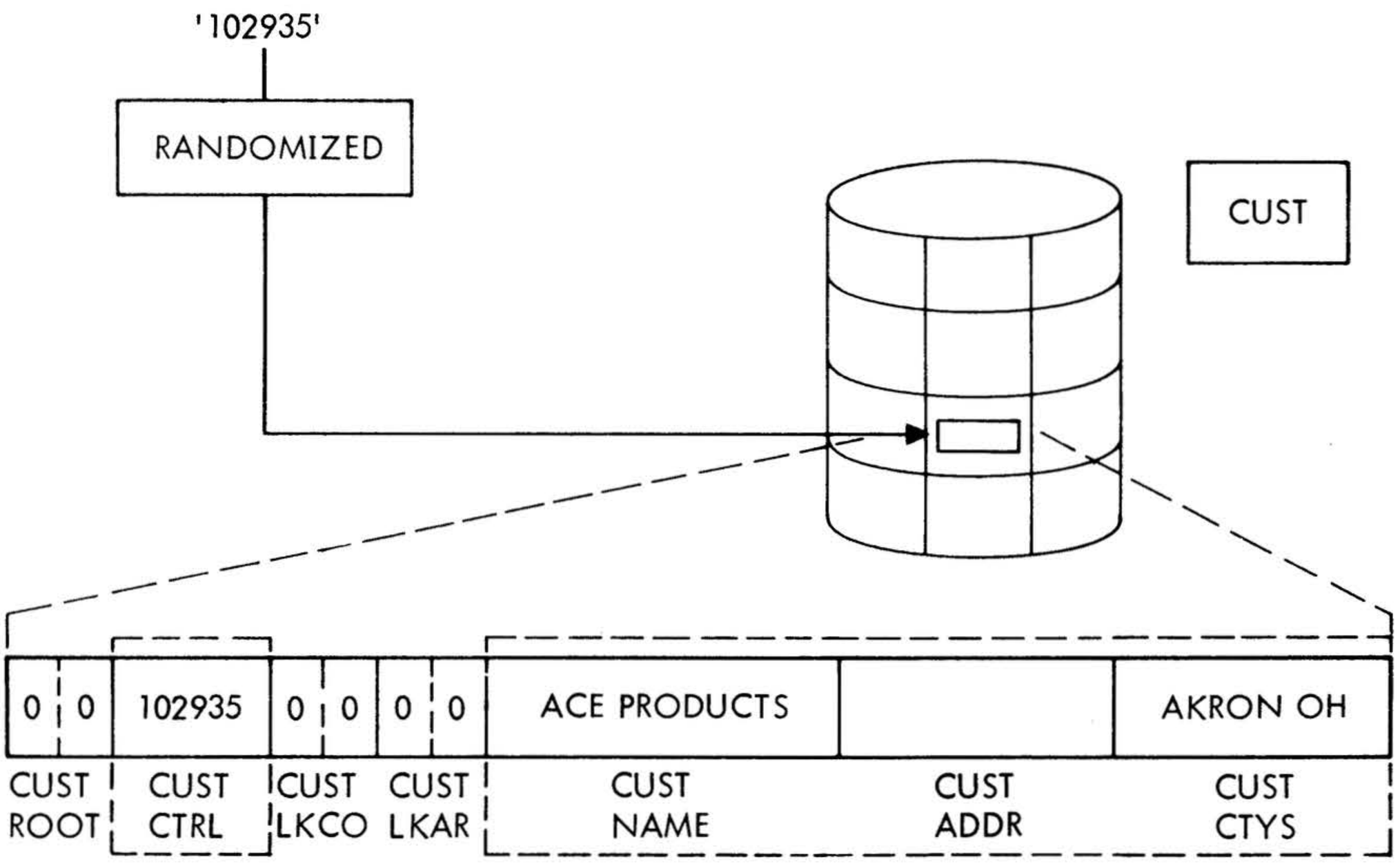
READM	READ MASTER FUNCTION

EXAMPLE:

```
FUNCTION = 'READM'
STATUS = blanks
DATA-SET = 'CUST'
CONTROL-KEY = '102935'
DATA-LIST = 'CUSTNAMECUSTADDRCUSTCTYSEND.'
DATA-AREA = zero
ENDP = 'END.'
```

AFTER THE FUNCTION COMPLETES

```
DATA-AREA = 'ACE PRODUCTS          AKRON OHIO'
```



VTI1-3477

Figure 5-16. The READ MASTER Function

Required Parameters:

```
READR, STATUS, DATA-SET, REFERENCE, LINKAGE-PATH,
CONTROL-KEY, DATA-LIST, DATA-AREA, ENDP
```

READR: Read Reverse Function Mnemonic

The user must insert this mnemonic into the Operation Field.

STATUS: Status Code

Significant status codes which may be returned are:

BCTL: A Control Field contains blanks.
MLNF: The specified linkage path name is invalid for the file or the record code.
MRNF: The related master record cannot be found.

REFERENCE: Internal Reference Point

If the Reference Field contains LKxx, TOTAL retrieves the record logically last in the chain. If the Reference Field contains an Internal Reference Point, TOTAL uses it to point to the record from which to obtain the back pointer to the next record.

When the function has successfully completed, the Reference Field contains the Internal Reference Point of the record just read.

When the logical beginning of the chain has been processed, "END." is contained in the Reference Field.

Programming Considerations:

a. Care must be exercised in performing deletes when processing along a chain in reverse. Since the Reference Field contains the back pointer from the deleted record after the delete is executed, the next READR command will skip the deleted record after the delete is executed, the next READR command will skip the deleted record in the chain.

b. When the chain has been completely processed and the Reference Field contains "END.", it should be cleared before executing another variable function to avoid getting the IRLC status code.

An example of the Read Variable Reverse function is given in figure 5-17. In this example, the value LKCP in the Reference Field enables TOTAL to use the Control Key 578.152738 to access the Master Record BOOK, from which the pointer to the logical end of the chain record D is obtained. The data in record D is then read into the Data Area specified by the application program and is followed by the data in records C, B, and A.

5.2.11 The Read Variable Function

This function operates by logically following forward pointers along a specified linkage path. To read an entire chain, processing is initiated by placing LKxx into the Reference Field and issuing the READV command. TOTAL uses the Control Key to access a master record from which the pointer to the logical beginning of the chain is obtained. This first record of the chain is then returned to the user. Thereafter, processing continues by reissuing the READV command; since the Reference Field contains an Internal Reference Point, the forward chain is followed and records are retrieved in forward order until the last record in the chain has been processed. When the READV command is issued for the record after the last, TOTAL returns END. in the Reference Field to indicate that the chain has been completely processed.

Required Parameters:

```
READV, STATUS, DATA-SET, REFERENCE, LINKAGE-PATH,
CONTROL-KEY, DATA-LIST, DATA-AREA, ENDP
```

READV: Read Variable Function Mnemonic

The user must insert this mnemonic into the Operation Field.

STATUS: Status Code

Significant status codes which may be returned are:

BCTL: A Control Field contains blanks.
MLNF: The specified linkage path name is invalid for the file or the record code.
IVRC: The record code in a record pointed to on a coded linkage path has not been defined in the DBMOD.
MRNF: The related master record cannot be found.

REFERENCE: Internal Reference Point

DATA MANAGEMENT LANGUAGE

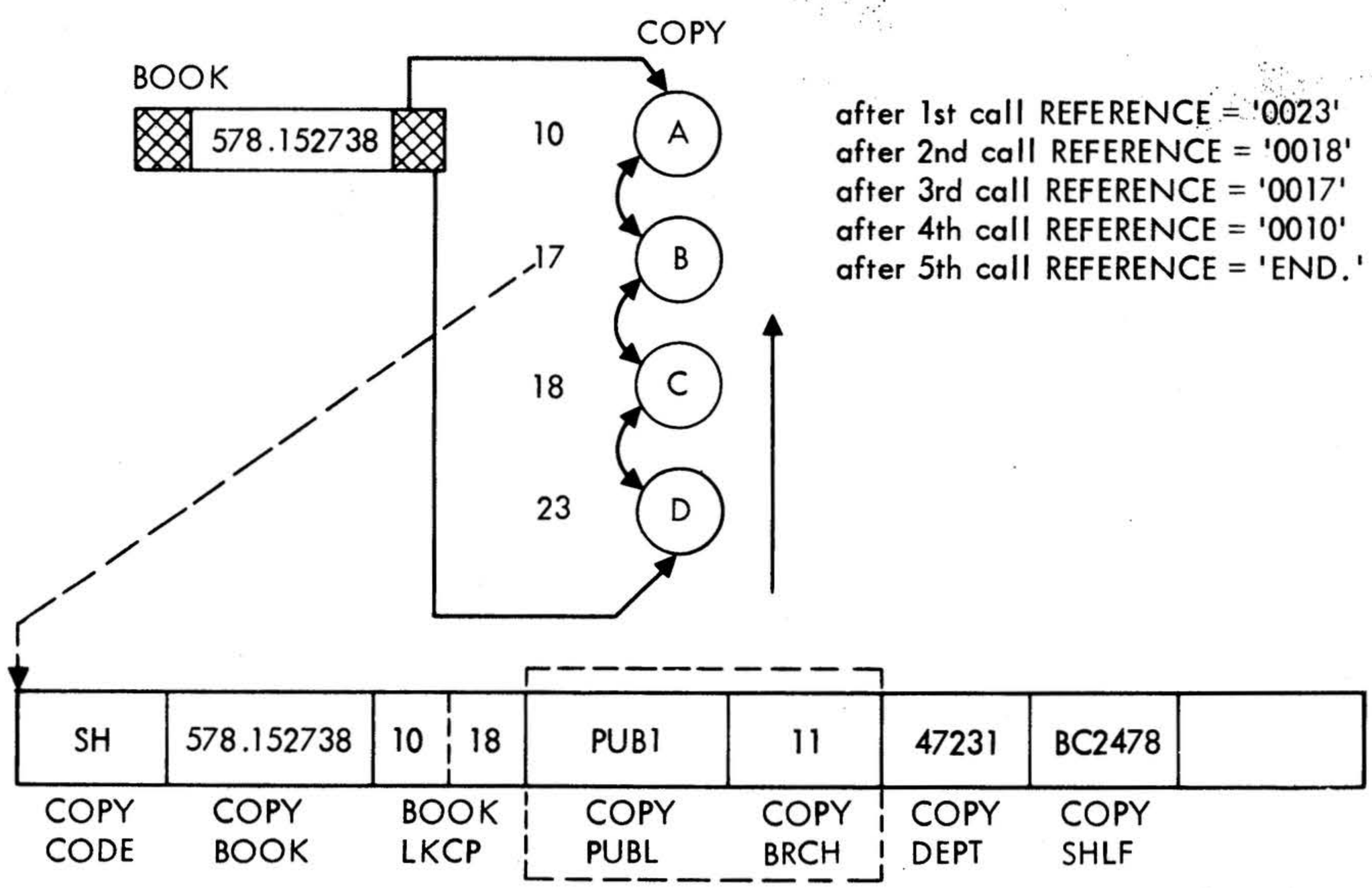
READR	READ VARIABLE REVERSE FUNCTION

EXAMPLE:

```
FUNCTION = 'READR'
STATUS = blanks
DATA-SET = 'COPY'
REFERENCE = 'LKCP'
LINKAGE-PATH = 'BOOKLKCP'
CONTROL-KEY = '578.152738'
DATA-LIST = 'COPYBRCHCOPYPUBLEND.'
DATA-AREA = zero
ENDP = 'END.'
```

AFTER THE THIRD CALL COMPLETES

```
DATA-AREA = '11 PUBL'
```



VTI1-3478

Figure 5-17. The READ VARIABLE REVERSE Function

If the Reference Field contains LKxx, TOTAL retrieves the record logically first in the chain. If the Reference Field contains an Internal Reference Point, TOTAL uses it to point to the record from which to obtain the forward pointer to the next record.

When the function has successfully complted, the Reference Field contains the Internal Reference Point of the record just read.

When the logical end of the chain has been processed, "END." is contained in the Reference Field.

Programming Considerations:

When the chain has been completely processed and the Reference Field contains "END.", it should be cleared before executing another variable function to avoid getting the IVRP status code.

An example of coding the Read Variable function is given in figure 5-18. In this example, the value LKCP in the Reference Field enables TOTAL to use the Control Key 578.152738 to access the Master Record BOOK, from which the pointer to the logical beginning of the chain record A is obtained. The data in record A is then read into the Data Area specified by the application program and is followed by the data in record B, C, and D.

5.2.12 The Request Location Function

This function operates by randomizing on the contents of the Control Key Field for the specified master data set, and places the resultant Internal Reference Point in the Data Area. No I/O operations are performed.

Using this function, the user may, among other things, build a file of Control Keys and their respective Internal Reference Points. This file may be sorted on internal Reference Point and the data then processed at maximum speed against the data set.

Required Parameters:

```
RQLOC, STATUS, DATA-SET, CONTROL-KEY, DATA-AREA,
ENDP
```

DATA MANAGEMENT LANGUAGE

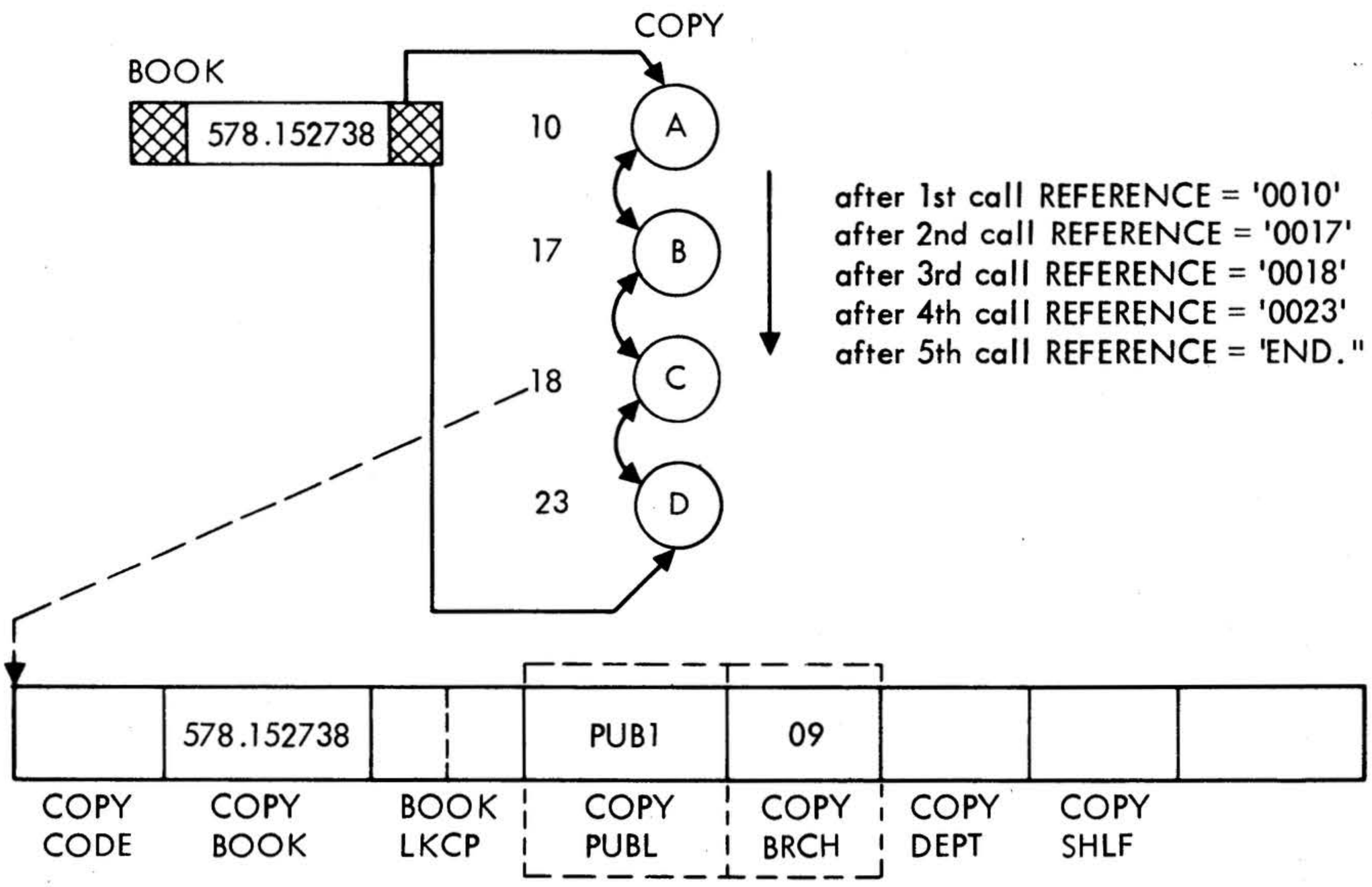
READV	READ VARIABLE FUNCTION

EXAMPLE:

```
FUNCTION = 'READV'
STATUS = blanks
DATA-SET = 'COPY'
REFERENCE = 'LKCP'
LINKAGE-PATH = 'BOOKLKCP'
CONTROL-KEY = '578.152738'
DATA-LIST = 'COPYBRCHCOPYPUBLEND.'
DATA-AREA = zero
```

AFTER THE THIRD CALL COMPLETES

```
DATA-AREA = '09PUB1'
```



VTI1-3479

Figure 5-18. The READ VARIABLE Function

RQLOC: Request Location Function Mnemonic

The user must place this mnemonic into the Operation Field.

STATUS: Status Code

Significant status codes which may be returned are:

FNTF: The requested file cannot be found in the Data Base Descriptor.

Programming Considerations:

a. The specified data set must be a master data set.

b. The data set need not be opened.

c. The data area is defined as four bytes in length.

5.2.13 The Sign-Off Function

This function operates by physically closing any data sets which remain open.

Required Parameters:

SINOF, STATUS, SCHEMA, ENDP

SINOF: Sign-Off Function Mnemonic

The user must place this mnemonic into the Operation Field.

Programming Considerations:

a. All subsequent commands except a Sign-On will return a status code of NOSO.

b. A new Sign-On Command may specify the same or different options than the previous Sign-On.

c. The SINOF format is identical to SINON except for the function.

d. This should be the last statement, logically, in a user program prior to termination.

e. For an explanation of SCHEMA, refer to the SINON function.

f. Since SINOF will be the last logical TOTAL function performed in an application program, any decision process involving a new "****" status return would be limited to a message displaying the error status along with the individual status for each file within the SCHEMA.

g. SINOF automatically signs off for all files opened for this run.

5.2.14 The Sign-On Function

This function must be the first CALL to the TOTAL System presented by a user program. It also allows the user program to state what data sets this program is to process, what mode of access this program has, and the type of file needed by the program.

Required Parameters:

```
SINON, STATUS, SCHEMA, ENDP
```

SINON: Sign-On Function Mnemonic

The user must place this mnemonic into the Operation Field.

STATUS: Status Code

Significant status codes which may be returned are:

EXSO: This sign-on was preceeded by another sign-on without an interim SINOF.

DUPO: This file has already been opened. Fatal Condition.

SCHEMA: Explicit options and files needed for this program run.

This parameter "points to" a field defined by the user in the following format and containing all below stated values:

a. Program Name: 8-character program name of this program (not to be confused with VORTEX task name).

b. Data Base:
Descriptor Name: 6-character DBMOD name

c. Access Mode: 6-character field containing general intention of this program:

[RDONLY]
[UPDATE]

RDONLY: Only read functions will be permitted.
UPDATE: Entire set of DML functions available.

d. Logging option: 2-character field containing option to log or not to log

{NL}
{LG}

Only NL can be coded.

e. Realm: A group of 12-character entries for each data set in the data base required for this program and terminated by "END." literal.

1. File name: 4-character field containing a name of a data set as in the DBMOD.

2. File mode: 4-character field containing the mode of file sharing needed.

[SHRE]
[PRIV]
[OPEN]

SHRE: This file may be shared among concurrent programs. (read only).
PRIV: This file is exclusively assigned to this program and no other program may have access to it during any program run. (UPDATE).
OPEN: This option is for debug only. This option ignores the file status if already opened, i.e., it allows to reopen already locked files.

Note: This option must be used very caustiously because files may be locked by other tasks.

3. File status: 4-character field used for unique file status at OPEN time. The file status value is put in by TOTAL.

Programming Considerations:

a. A Sign-On must be the first TOTAL command executed.

b. A second Sign-On may be issued after a Sign-Off, e.g., to change access mode, etc.

c. If any of the status fields used in the REALM entry are not '****', then the general status will contain the proper error indicator. Checking of each REALM status is not required.

An example of the SINON function is given in figure 5-19, showing typical entries for the SCHEMA and REALM parameters. In the example, the RDONLY entry in the SCHEMA parameter ensures that only read functions will be permitted for the program INVOICES, and the three SHRE entries in the REALM field allow the datasets CUST, ORNM, and CORD to be shared among concurrent programs in the Read Only mode.

5.2.15 The Write Master Function

This update function operates by randomizing on the contents of the Control Key Field to retrieve the record to be updated. The data elements in the Data Area are moved to the record which is then rewritten.

Required Parameters:

```
WRITM, STATUS, DATA-SET, CONTROL-KEY, DATA-LIST,
DATA-AREA, ENDP
```

WRITM: Write Master Function Mnemonic

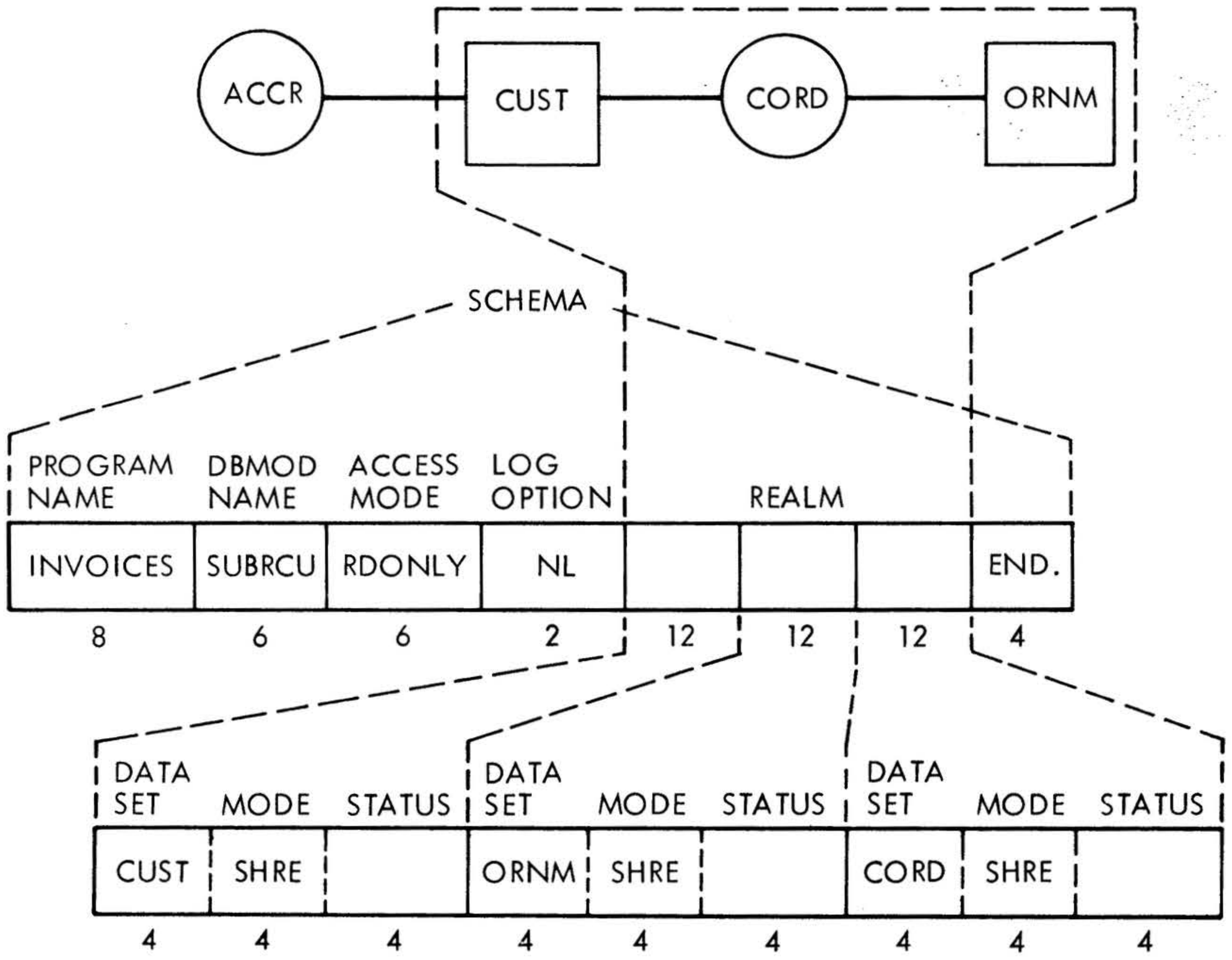
The user must place this mnemonic into the Operation Field.

DATA MANAGEMENT LANGUAGE

SINON	SIGN-ON FUNCTION

EXAMPLE:

PROGRAM NAME=INVOICES
DBMOD NAME=SUBRCU
NO UPDATING WILL BE MADE DURING THE RUN
WILL ONLY USE DATA SETS: CUST, CORD, AND ORNM
THE LAYOUT OF THE AREA WOULD BE AS SHOWN.



VTI1-3480

Figure 5-19. The SIGN-ON Function, showing the use of the SCHEMA and REALM Parameters

STATUS: Status Code

Significant status codes which may be returned are:

BCTL: The Control Key Field contains blanks.
MRNF: The specified record is not on the data set.
UCTL: The contents of the Control Key Field do not match the corresponding field in the Data.Area.

Programming Considerations:

The Control Key Field may not be changed.

An example of the coding for the Write Master function is given in figure 5-20. In the example shown, TOTAL randomizes on the contents of the Control Key field 102935 to retrieve the record CUST. The data 5023 MAPLE from the application program's Data-Area is then written into the data element field CUSTADDR in the record CUST, as specified by the parameter DATA-LIST.

5.2.16 The Write Variable Function

This update function operates by rewriting the record whose Internal Reference Point is in the Reference Field to update the record.

Required Parameters:

```
WRITV, STATUS, DATA-SET, REFERENCE, LINKAGE-PATH,
CONTROL-KEY, DATA-LIST, DATA-AREA, ENDP
```

WRITV: Write Variable Function Mnemonic

The user must insert this mnemonic into the Operation Field.

STATUS: Status Code

Significant status codes which may be returned are:

IVRC: The Data-List contains element names not valid for the record code.

REFERENCE: (An Internal Reference Point)

DATA MANAGEMENT LANGUAGE

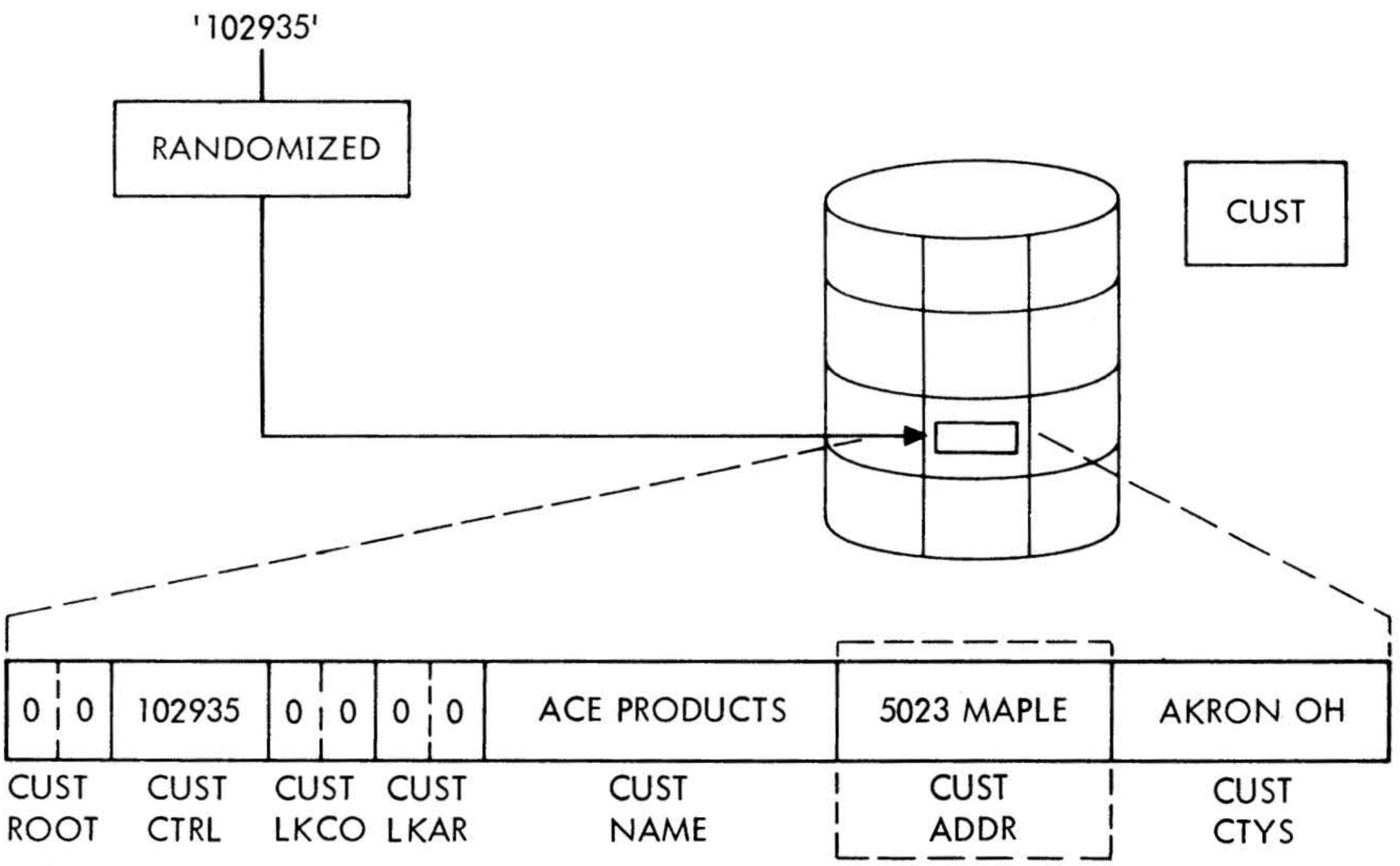
WRITM	WRITE MASTER FUNCTION

EXAMPLE:

```
FUNCTION = 'WRITM'
STATUS = blanks
DATA-SET = 'CUST'
CONTROL-KEY = '102935'
DATA- LIST = 'CUSTADDREND.'
DATA-AREA = '5023 MAPLE'
ENDP = 'END.'
```

AFTER THE FUNCTION COMPLETES

'5023 MAPLE' has been written to the record



VTI1-3481

Figure 5-20. The WRITE MASTER Function

The contents of the Reference Field are used to point to the specific record to be updated. Therefore, it may contain only an Internal Reference Point.

When the function has successfully completed, the Reference Field will still contain the Internal Reference Point of the record.

Programming Considerations:

Linkage control fields and record codes cannot be modified since the WRITV will not permit linkage maintenance.

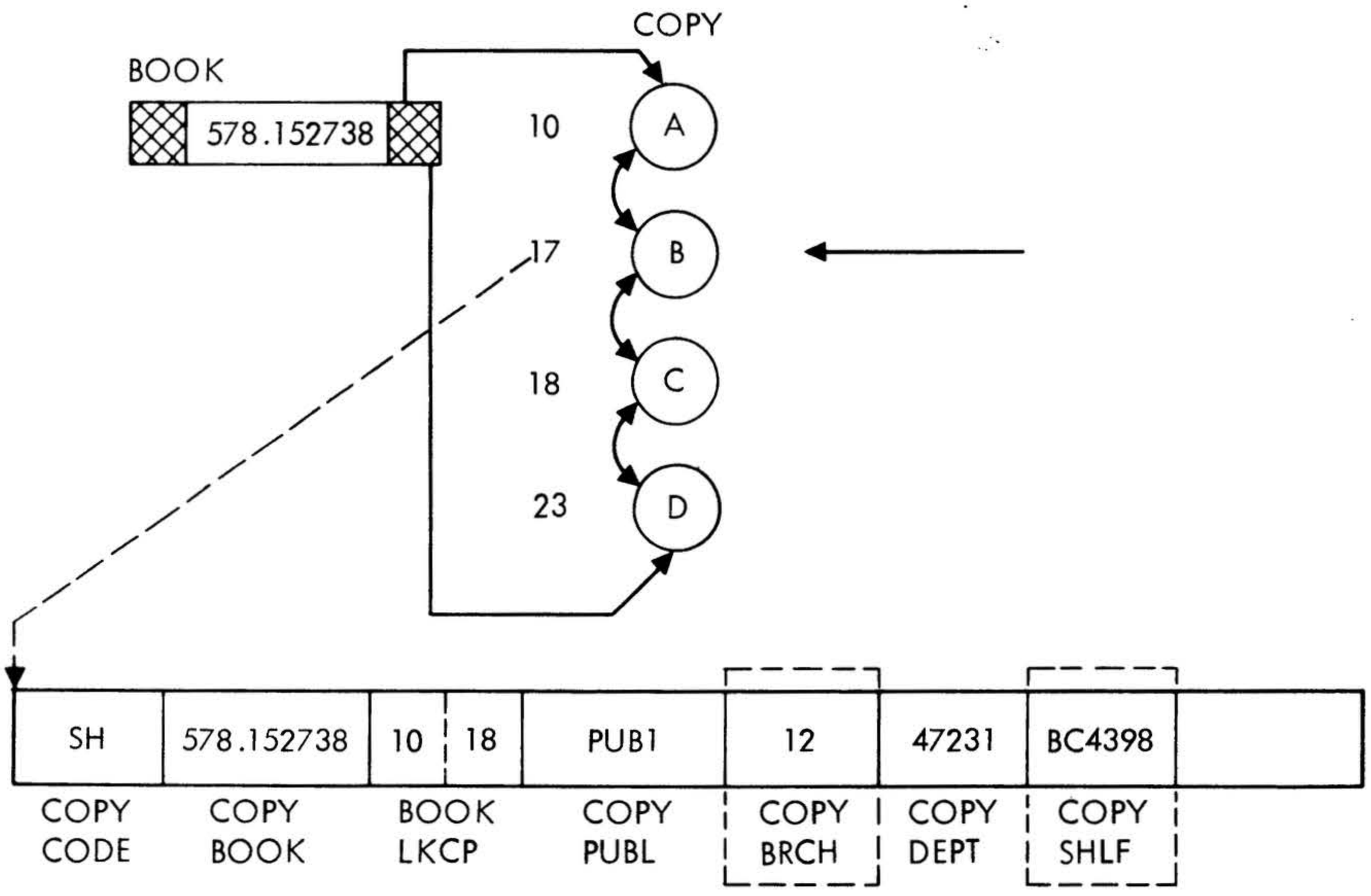
An example of the coding for the Write Variable function is given in figure 5-21. In the example, the contents of the COPYBRCH and COPYSHLF elements of record B in Data-Set COPY are rewritten, because the Internal Reference Point value of record B is 0017 and this is the value given in the Reference Field.

DATA MANAGEMENT LANGUAGE

WRITV	WRITE VARIABLE FUNCTION

EXAMPLE:

```
FUNCTION = 'WRITV'
STATUS = blanks
DATA-SET = ' COPY'
REFERENCE = '0017' (BINARY)
LINKAGE-PATH = 'BOOKLKCP'
CONTROL-KEY = '578.152738'
DATA-LIST = 'COPYBRCHCOPYSHLFEND.'
DATA-AREA = '12BC4398'
ENDP = 'END.'
```



VTI1-3482

Figure 5-21. The WRITE VARIABLE Function

SECTION 6
PROGRAMMING GUIDELINES

The TOTAL user is not only concerned with the correct and efficient use of the Data Management Language (DML), but also with the Data Base Definition Language (DBDL).

This section attempts to summarize for the programmer certain common methods and pitfalls that have tended to recur in many data base system environments. Its use should assist programmers and programmer/analysts in the development of reasonably correct and efficient programs, in the shortest possible time.

Familiarity with TOTAL terminology with DML functions and formats is assumed during the following discussions. Ideally, the reader will have participated in a basic TOTAL education class, prior to using these guidelines.

6.1 LOGICAL UNIT CONVENTION

Input to DBGEN and DBFMT is via the PI logical unit. Printed output is written on the LO logical unit. Error SNAPSHOT dumps are given on the DO logical unit. Output from DBGEN (the DBMOD source) is given on the SS logical unit. All the above logical units may be reassigned by the operator. For a detailed explanation of VORTEX logical-units refer to the VORTEX II Reference Manual.

6.2 GENERAL PROGRAMMING GUIDELINES

Because all program communication with TOTAL is accomplished with the use of the CALL statement, programming guidelines can be discussed in terms of the CALL statement and CALL parameters.

6.2.1 The CALL Statement

While coding the CALL statement the in-line method is acceptable. It is suggested that TOTAL CALL's be placed into executable subroutines. This method has the advantage of reducing the number of CALL statements that must be coded, permits the CALL statement to be more general in nature, and aids in the 'debugging' process. In most cases, any program could be designed with the following six CALLS:

a. one "CALL" statement for all master functions

b. one "CALL" statement for all variable functions

c. one "CALL" for SIGN-ON

d. one "CALL" for SIGN-OFF

e. one "CALL" for Serial (RDNXT) processing

f. one "CALL" for 'RQLOC' function

In other words no more than six CALLS should have to be coded into a program. In most cases, e an f are used only in special programs.

Example:

Prepare to execute a "CALL" to Read Variable (READV)

Step 1: Move the CALL parameters into the proper areas pointed to by the (fixed) CALL pointers.

e.g.,

```
Move 'READY' to FUNC            (FUNCTION)
Move "LKXY' to REFER            (REFER)
Move 'MOODLKXY' to LNKPTH       (LINK PATH)
Move key to CTRFLD              (CONTROL FIELD)
```

Also assume that:

```
STAT      is a pointer to Status field
FNAME     is a pointer to File name
ELEMTS    is a pointer to the DATA elements
BUF       is a pointer to the data buffer
ENDP      is a pointer to 'END.'
```

then:

Step 2: CALL DATBAS,FUNC,STAT,FNAME,REFER,LNKPTH,CTRFLD, ELEMTS,BUF,ENDP

Step 3: Check STAT, if other than "****" go to error routine. If STAT = "****", continue processing.

6.2.2 CALL Statement Parameters

It is recommended that standard parameter names be used by ALL TOTAL programmers in their CALL statement. This is, of course, to ease program maintenance problems by making programs more easily understood by others, and to permit the increased use of the source statement library and other general techniques. While any set of names is acceptable, the following are meaningful, concise, and somewhat standard for the most used parameters.

Name	Size (in bytes)	
FUNC	(5)	
STAT	(4)	
SCHEMA	(M)	
FNAME	(4)	
REFER	(4)	
QUAL	(M)	
LKPATH	(8)	
CTRLFD	(M)	
FFFFEL	(M)	Where FFFF is the file name involed (Element List)
FFFFBF	(M)	Where FFFF is the file name involed (Buffer)
ENDP	(4)	Where ENDP is a pointer to "END."

(M is assumed to be a variable data length).

6.3 PROGRAMMING LANGUAGES

TOTAL supports DML calls from the following languages: DASMR, FORTRAN, COBOL, and RPG II.

Refer to section 5.2 as to the proper call format.

6.4 COMMON PROGRAMMING CONSIDERATIONS

6.4.1 Initialization, File Sharing, and Termination Requirements

a. Initialization:

In order to access a TOTAL data base, one required stage must precede any issuance of DML commands that reference the data base. The program must SINON to TOTAL, activating the TOTAL nucleus and data base descriptor module and OPENing of files specified in the REALM clause.

If a successful SINON (STATUS="****") does not occur for some reason, no other commands will be accepted (STATUS="NOSO" or 'FNOP').

Files must be logically requested for use via the SINON, prior to the issuance of any DML functions that reference these files. Note that if variable entry files only appear to be referenced, TOTAL requires that the associated single entry files may also have to be requested by the program, since TOTAL will perform "hidden" accesses to these files, if this becomes necessary.

b. File Sharing:

Each program, via the REALM component of the SINON parameter, may designate some (or all) files as shared (SHRE) with other programs or private (PRIV) to the exclusive use (and possible update) by that program alone.

A file must be designated as private if its contents may be altered by some updating operation. It is recommended that a file be designated as private even in the case in which a file is not altered by the program but may be altered by some other program. Consider the following example:

Program A declares file x as shared because it intends to use it for READ only. After some time, program B signs on and declares file x as private. Program A reads records which may be changed by program B. However, as long as B is still signed on, no other program may sign on and designate file x for use. To prevent this occurring, program A could have designated file x as private and by doing so, blocking any sharing attempts by program B.

c. Termination:

All that is required for termination from the TOTAL system, is the issuance of the SINOF function. This will not only release all DML facilities, but it will also logically and physically close all active data files.

6.4.2 Checking the STATUS Parameter

It should be emphasized that the contents of the STATUS parameter must be verified after each and every DML "CALL" statement. This is the primary communication cell between TOTAL and user programs, and any contents other than "****" in this parameter has definite significance.

There are two classes of STATUS values other than "****" (good status), with which the programmer must be concerned:

a. Informative:

These returns are usable as indicators, in that they normally show input errors or file status information, rather than permanent errors. Among these are "MRNF", "DUPM", IMDL", "LOAD" (on close only).

b. Fatal Errors

Any returns other than those outlined above indicate some severe error in either the parameters themselves, or the execution of this DML CALL. The problem program will normally be terminated for analysis. TOTAL will automatically close the data base and then return to the user program.

TOTAL produces a SNAPSHOT dump (see 7.10.3) of the TEXT area (see appendix C) on logical unit DO in case the error was FUNC or IPAR. In all other cases the user should obtain a memory dump; the TEXT block should be examined to determine the cause of the error.

In test situations, there is a possiblility that coding errors may generate some of the status values bypassed by this type of check, on every transaction. For this reason, it is good practice to assure that if bad status is returned repeatedly (no matter what its classification), the program is terminated. For example, if 'MRNF' is returned 50 times in a row, there is a good chance that some coding or file is not correct in some way.

6.4.3 Parameter List Definitions

It is usually wise to conform to minimum conventions, in identifying the parameters in TOTAL DML calls, for example:

```
SINON       DATA        'SINON'
READM       DATA        'READM'
ENDP        DATA        'END.'
STAT        DATA        '****'
```

This will help insure program readability, and make debugging a little easier. In many installations, the ELEMENT LIST and I/O parameters, which identify the data elements to be used from a data base by a problem program, is also standardized.

Example:

```
ELEMENT LIST

  NAME     DATA       'CUSTCTRL'
  ADDR     DATA       'CUSTADDR'
  END      DATA       'END.'

I/O

  NAME     BSS        20
  ADDR     BSS        30
```

It is then possible to keep such definitions in a source statement library (under centralized control), and thus ensure that problem programs in a given system reference the same data by the same names. This can be invaluable in program maintenance.

6.5 STANDARD SINGLE-ENTRY FILE PROCESSING

The various master data-set commands have been described in sufficient detail in the previous sections to make them usable by the programmer. The following sections describe various techniques which can be used to increase overall efficiency in single-entry file processing, and to assist the programmer in avoiding common pitfalls.

6.5.1 The RQLOC Function

In cases where a large portion of any single-entry file will be involved in a given process, there may be significant advantages to be gained by ordering the input transactions, wherever possible, e.g., for loading of data base (section 6.9).

Since single-entry file records are randomized in storage, the only ordering that can be meaningful is the order of physical relative locations occupied by given keys.

For this reason, the RQLOC function was provided to allow the programmer to determine the physical location of a record, given its key, through a direct "port" into TOTAL's randomizing routines. By pre-determining the set of values for a given input transaction stream, a pre-sort of transactions in RQLOC value sequence will ensure minimum RMD self-contention, and

maximum buffer usage in any given program situation.

The following should be considered when using the RQLOC function:

a. The transaction volume is a factor in determining whether the time taken for the pre-sort and RQLOC processing becomes greater than the arm contention time. Each situation should be judged separately.

b. Single-entry file accesses are made in variable-entry file processing, even if they are hidden (as they are in ADDVC's, for example). This accessing should also be taken into account, along with the explicit single-entry file CALLS's (ADD-M, DEL-M, etc.).

c. It may be advantageous to sort keys in descending RQLOC value sequence, whenever synonyms are present in the single-entry file.

d. RQLOC does not require any I/O.

6.5.2 Data Elements that Should not be Referenced

The following data elements should never appear in application program DML CALL's:

----ROOT, ----LKXX

The ROOT element is used only by TOTAL for internal purposes. ROOT can only be read, and cannot be written by the application program.

The linkage fields are automatically updated and maintained by TOTAL, and should not be referenced or updated in the solution of application problems. Usually such a reference will be disallowed, and will produce a status of ENTF.

Linkage paths to a master file may be both written and read by the application program. Linkage paths to a variable file cannot be written or read by the application program.

6.5.3 Special Note on the ADD-M Function

The most frequent coding errors that occur in the issuance of this important DML function are usually generated by a bad correlation between the data value in the CONTROL FIELD parameter (used for record location) and the value in the mmmmCTRL data element I/O area (used to write the imbedded data key into the data record, and required for this function).

To avoid any problems, always define these two values as the same location within the program. This will guarantee correlation, and ensure that the key is always written on the physical record.

Example (COBOL FORMAT):

```
     ENTER ASSEMBLER.
     CALL 'DATBAS' USING ADD-M, STAT, FILE, CTRL, ELEM, IO, ENDP
```

Where:

```
     01   IO.
          02        CTRL      PICTURE X(5)
          02        DATA      PICTURE X(100).
     01   ELEM.
          02        XXXX      PICTURE X(8)   VALUE IS 'CUSTCTRL'.
          02        YYYY      PICTURE X(8)   VALUE IS 'CUSTDATA'.
          02        ENDX      PICTURE X(4)   VALUE IS 'END.'.
```

6.5.4 Structural Maintenance During Serial Processing

In some instances, a user may wish to perform ADD/DELETE logic to a single-entry file, while processing it serially.

Caution should be exercised in performing this maintenance function due to the fact that the program may not subsequently have serial access to certain records, after the operation is performed. For example, the current record (retrieved serially) may be an anchor record of some synonym, which has not yet been read. If the current record is deleted, TOTAL will automatically optimize the file, and may move the synonym physically, so that it is unavailable for the next or a subsequent serial access. In fact, a reset of the serial marker must be made in order to retrieve it.

To avoid this situation occurring, it is suggested that structural maintenance be performed after the serial processing is complete, to ensure that all records will be available for program analysis.

Update in place logic (WRITM) executes correctly, since no record movement ever takes place.

6.6 STANDARD VARIABLE-ENTRY FILE PROCESSING

If any portion of the TOTAL DML can be said to be complex, it will be associated with variable-entry file commands. For this reason, this section will cover this type of processing in more detail than was outlined for single-entry files.

6.6.1 Basic Considerations

Certain misconceptions about the basic functioning and structure of variable-entry files tend to surface rather frequently, even among experienced TOTAL users, so a list of facts is presented here that should be remembered:

a. All linkages are updated when an ADD type function is performed, and this is handled automatically by TOTAL. The LINKAGE PATH parameter in the DML call is simply used as the first point of reference for TOTAL's internal processing and is assumed to be the primary path.

b. Variable-entry records carry the symbolic pointer (control field) of every master record to which they are linked, along with linkage fields. The pointer is symbolic (i.e., of the same format in every respect to its attached single-entry master key), to eliminate re-organizations when files are moved on RMD devices.

c. Variable-entry record for a given file all have the same length, even though they may differ in format (see CODED RECORDS, discussed later). Variable length records are not supported in any TOTAL architecture, for reasons of efficiency.

d. If a given variable-entry record is linked to say, 2 other files, the control field value and definition for these other files must be presented in the I/O area and the element list parameters on any ADD function request. Failure to do this will force a "BCTL" (blank or unidentified control field specification) STATUS return.

e. Records should be read before they are written or deleted.

6.6.2 The REFER Parameter

In order to provide flexibility in manipulating linked records in variable-entry files, TOTAL DML requires that a second communication cell be provided, called REFER. It is essentially a positional indicator for list processing.

The parameter may have several values, some provided by the program, and some by TOTAL. In order to clarify the use of this parameter, these values, and how they change is described below: (Note that "LKXX" will be used to denote the last four characters of some user linkage path parameter.)

REFER Values

"LKXX" This indicates that the first (or last) record of a list is to be processed. This value is inserted by a user program with only one exception, described later. The literal consists of the last four characters of the current linkage path data element name.

This value is valid only for READV, READR, and ADDVC functions.

"END." This literal is inserted by TOTAL to indicate that the last access to this list, exceeded the bounds of the list (i.e., that no more records exist on the given linkage path for this control field).

Only TOTAL may place this value in REFER.

This value must be cleared from REFER before another function CALL is issued.

This value type can only be returned from the issuance of READV or READR functions.

Table 6-1 illustrates the use of REFER in relation to other associated parameters.

Table 6-1. Relationship of REFER to Other Parameters

Condition	Function	Set REFER To	REFER returned by TOTAL
Read first record in chain	READV	LKXX	RRLOC Current Rec
Read next record in chain	READV	(do not disturb)	RRLOC Current Rec
Read next (end of chain)	READV	(do not disturb)	END.
Read next (after end of chain)	READV	END.	END.
Read last record in chain	READR	LKXX	RRLOC Current Rec
Read previous record	READR	(do not disturb)	RRLOC Current Rec
Read previous (end of chain)	READR	(do not disturb)	END.
Read directly a record	READD	RRLOC desired rec	RRLOC Current Rec
Update Current Rec	WRITV	(do not disturb)	no change
Update Current Rec	WRITV	disturbed	no change
Add before Current	ADDVB	RRLOC Current	RRLOC new record
Add record after Current	ADDVA	RRLOC Current	RRLOC new record
Add record at end of chain	ADDVC	ignored	RRLOC new record
Delete a variable record	DELVD	(do not disturb)	RRLOC previous record
Delete first record in chain	DELVD	(do not disturb)	LXKK

After every READV or READR, first the programmer checks STAT for "****" then checks REFER for END.

COBOL Example:

```
CALL 'DATBAS' USING FUNCTION        STAT            FILE-NAME
                    REFER           LINKAGE PATH    CTRL-FIELD
                    FFF-ELEMENT     FFF-DATA        ENDP.
IF STAT NOT="****"  GO TO ERROR-END-OF-JOB.
IF REFER = 'END."   GO TO END-OF-CHAIN.
```

REFER Changes

It is important to reiterate the conditions under which the value of REFER is modified by TOTAL, so that program logic can be produced accordingly. The following list indicates the significant REFER value changes after the execution of DML variable-entry functions:

a. READV with REFER = "LKXX"
   If the STATUS value is "****", then REFER will now contain the relative address of the current record in this variable-entry file, or "END." if no records exist for this control field value. If bad STATUS was returned, REFER will be unchanged.

b. READV with REFER is a binary number
   For good STATUS returns, the value may be another binary number (corresponding to the address of a new record), or "END." if an end-of-list condition has been reached.

c. ADDVC with REFER is "LKXX"
   For good STATUS returns, REFER will now contain the address of the record just added.

d. ADDVA, ADDVB with REFER is a binary number
   For good STATUS, REFER will be modified to point to the record just added.

e. DELVD with REFER is binary number
   After a successful deletion, REFER will point to the previous record in this list, i.e., the record prior in the list to one just deleted. If the record just deleted was the first in this list, REFER will contain "LKXX."

f. Note that TOTAL modifies REFER in the above ways, within the user's working storage area. It is therefore important to ensure that this field is not modified unnecessarily.

g. The address value in REFER is a 4 byte binary number that corresponds to a relative record number from the start of this file. It is not an absolute device address.

h. When attempting DELVD's in the reverse direction (i.e., issuing READR, DELVD, READR, DELVD, etc.), recognize that every second record will be skipped, due to the value of REFER. The user, in this case, should issue READR, DELVD, READD, DELVD, READD, etc., to effect a full list reverse delete.

i. Under no circumstances issue the following sequence of commands: READV, READV, DELVD, DELVD, DELVD, --; nor READR, DELVD, DELVD, etc. A record must alwasy be read prior to deleting it.

6.6.3 Efficiency Considerations in Variable-Entry File Processing

The majority of programs written to use the TOTAL DML are reasonably efficient, even when written with only a basic knowledge of the DML functions and their workings.

The more sophisticated programmer, however, will want to concern himself with the most optimum methods of utilizing the DML to meet a system requirement. For this reason, the following collection of hints and facts are presented as guides to efficient programming.

a. VARIABLE ADDS (ADDVC, ADDVB, ADDVA):
The ADDVB and ADDVA functions allow records to be accessed in some logical sequence on one given linkage path. In order to use these, however, the program must read records in a list just to determine the position from which the ADD is to be performed, and then issue the appropriate function. TOTAL itself provides no built-in data sequencing, other than that of chronology.

These functions, then, are far less efficient, in overall time, than the ADDVC function.

b. SPACE MANAGEMENT:
Whenever possible, TOTAL attempts to keep all records within a list as physically close together as it can in secondary storage.

Since multiple lists within one variable-entry file are allowed, it is obvious that this optimization cannot be maintained for all such lists at the same time.

So that TOTAL may optimize lists for its storage allocation, TOTAL always assumes that the linkage path specified in a given ADD function identifies the link list to optimize upon for that given ADD (ADDVC, ADDVB, ADDVA). It is to the user's advantage to assure that the linkage path specified in any ADD is always the same.

In order to optimize retrieval times, programs should also specify this same linkage path in the DML READ command.

c. FUNCTION EQUIVALENCE:
Due to the flexibility of the DML, and of TOTAL's internal processing, it is possible to equate certain function CALL's to other combinations of CALL's. In other words, the same effect can be achieved in different ways, at almost no additional cost in time.

The most usable equivalences are the following:

1. An ADDVC is functionally equivalent to a READM followed by an ADDVC.

2. A READV is functionally equivalent to a READM followed by a READV.

Depending on the given programming situation, it may be advantageous to use one or the other of these possible forms.

6.6.4 Coded Variable-Entry Records

The facility to redefine variant formats in variable-entry records provides a powerful means of storing logically related data elements together in a data base. It also allows certain record formats to be selectively linked to given relationships.

The implementation of this facility involves the use and specification of a 2-byte record code, which must physically appear in each record of the variable-entry file, and furthermore be defined at DBGEN time.

The following is a list of guidelines to the use of this record code facility.

a. When ADDing a coded record, the record code must be provided in the I/O area, and the "----CODE" element name must be provided as a component of the ELEMENT-LIST parameter in the DML CALL as the first name given.

b. When READing along a linkage path that connects multiple record types, the user program must determine the format of the retrieved records, by verifying the contents of the "----CODE" element, or by utilizing the code-directed READ feature which may be utilized to retrieve only specific record code types.

   Record codes on a variable-entry file cannot be modified using the WRITV function.

6.6.5 List Maintenance in the Batch Mode

Whenever data base files are to be processed primarily in the batch mode, there are certain steps the programmer may take in optimizing the execution times of such processes. Some of these steps are:

a. Sequence transaction input in RQLOC sequence first (refer to the RQLOC function). This should be done as a matter of course.

b. Sequence transactions within key in RQLOC sequence, when variable-entry affected transactions will be input (to minimize variable-entry data set access contention).

c. Consider logically sequencing data during update, in heavily accessed variable-entry files, so that input transactions may also be sequenced in this way. This will require the use of the ADDVB and ADDVA functions. Even though, as mentioned previously, this may impact the execution time of initial update processing, it may be worthwhile particularly when data element values change often (WRITV processing) in major update cycles.

d. Whenever possible, attempt to group all pending changes on a given list, so that one pass of the list (using READV, READR) will be sufficient to complete this list's processing activities. This will help alleviate situations in which a list is completely read each time a new transaction enters the system, thus forcing redundant data accesses against unmodified data records.

6.7 TESTING DATA BASE PROGRAMS

As is true of other programs, tasks that use the TOTAL DML must be tested prior to becoming productive, in order to insure their structural and logical integrity to the best degree possible.

Program testing in the data base environment is perhaps a little more complex than in, say, a sequential tape or disc environment, due to the inter-relationships inherent in a data base and the fact that a program's actions may affect multiple data sets in only one CALL statement. Furthermore, there is always a temptation to test the program on the "live" or productive data base, but it should be obvious that severe repercussions can result from uncontrolled testing of this nature.

However, with the proper precautions and some simple guidelines, the testing of programs can be simplified, while maintaining the integrity of a live or productive data base.

Some guidelines to program testing are noted here:

a. Whenever possible, construct a small data base for testing purposes, with the same logical characteristics (file names, DBD names, elements) as the live data base, but containing only a subset of its data (i.e., 5 to 10 percent). This base can be updated periodically to reflect most recent data relationships, through a user-written utility (strongly recommended).

   After a test run against this base, a user utility should exist to sample the data that should have been affected, for verification purposes. The test base may then be "reset" to its original condition by restoring it from its original backup copy.

b. Anytime a program in test is to be active against any data base, it should be guaranteed that a current backup of possibly affected files exists prior to the run.

6.8 BUFFERING TOTAL DATA SETS

All data sets require memory storage for physical records obtained from or transferred to them. In many situations, it is required that a permanent allocation of storage be made, and this can be wasteful, when relatively few or cyclic references are made.

For this reason, TOTAL allows the shared allocation of data sets to buffer areas, to minimize storage.

Single-Task Buffering

Perhaps one of the most pressing questions in the specification of a Data Base description, is: Which files should be shared together in the same buffer areas? Some hints on this will be provided below. One fact should be remembered however, and this is, if main storage is a problem, shared buffers minimize the use of storage, but may trade this off for processing speed. It is unreasonable to expect the ultimate buffer assignments.

a. Do not share buffers among files with vastly different blocking factors. TOTAL will force the buffer to be as large as the largest block size of all shared files.

b. Do not share a buffer among single entry files associated with a variable entry file that is subject to structural maintenance (ADD's, DELETES).

c. The order of priority by which TOTAL fills buffers within a buffer pool is as follows:

   1. If a record is already in the buffer, no I/O operation is performed.

   2. If a record is not found and there is a buffer not used yet, a READ is performed.

   3. If a record is not found and all buffers are used but there is a buffer that does not contain updated data, a READ is performed.

   4. If a record is not found and all buffers contain updated data, a WRITE to save the buffer contents is performed followed by a READ.

6.9 DATA BASE LOADING

One important aspect of data base construction will be the initial loading of the TOTAL data base files. In may cases, due to data volumes and/or the linkage requirements, the speed at which the data base load occurs becomes an important consideration. Obviously, long loading times increase the chance that some malfunction will destroy whatever has been accomplished, and require restart of the process.

Several techniques have therefore been developed that assist the user in minimizing data base loading times, and they are discussed here:

Basic Techniques:

General Comments:

a. Load single-entry files first, prior to loading the variable-entry files with which they are associated.

b. Use a special "load mode" Data Base Description module, that minimizes data element definitions for the loading process, (i.e., define all data parts under one element name).

c. Avoid sharing I/O areas between files during the loading process.

d. Sequence the loading of files so as to ensure that during any particular loading process, the load routines will not be accessing data sets on the same physical volume. (i.e., avoid arm self-contention of the RMD during loading.)

e. Once files are loaded they should be immediately backed up with a file copy to guarantee their integrity, and to avoid re-loading in the case of failure.

Single-Entry Loading:

a. Sort the data in RQLOC sequence before adding to the file (RMD), to avoid RMD self-contention (refer to section 6.5.1).

b. Allocate about 5 to 10 percent more record space on the file than will actually be used. This will help ensure that synonym space can be found within the home address block, and further minimize synonym processing.

Variable-Entry File Loading:

a. Sort the input records in the RQLOC sequence and then the control field value on which these records will primarily be accessed in productive processing. This will help minimize single-entry file I/O involvement, while also ensuring physical proximity of related records.

b. Select a proper load limit value, so as to guarantee a proper list distribution, and to avoid cluttering at load time.

6.10 SERIAL PROCESSING

The serial processing DML function in TOTAL is designed as a method for large scale file or list access when the retrieved records are not known uniquely by key, and when only data that actually exists on the file(s) is to be processed.

The user is cautioned, however, that this facility may be misused, and that trade-offs do exist, particularly with respect to processing time, in its use. In order to comply with these trade-offs, a brief look at the uses of this function and some basic considerations is initially offered here:

Typical Uses of the RDNXT Function:

a. To scan a single-entry file, in order to set or reset a status element for all, or most records.

b. To scan a single or variable-entry file in order to produce a data set suitable for report processing.

c. To access all single-entry records in order to reformat linkage data only (during variable-entry file expansion or logical modification).

d. To retrieve all "live" data from data base files for the purposes of backup.

Basic Consideration:

a. The serial function operates serially (not sequentially), and, therefore, do not use sequential access methods.

b. The serial function will automatically read all records, even though it returns control to the problem program only when records contain data.

c. The serial function provides full data independence in its operation.

Serial Processing Alternatives:

a. Sequential type access to TOTAL data sets using normal sequential file definitions.

   In this method, TOTAL files are read as normal data sets, and logical records, in their entirety, are accessed. It will be the user's responsibility to bypass unused records, and to capture only the data portion of 'live' data records, by avoiding all control information.

b. Modified SORT access to TOTAL data sets.

   Particularly when report processing is to be performed, TOTAL data sets may be input to a sort program and an exit may be used to avoid unused records and/or control information for the acutal sort phase.

   These alternatives will allow extremely fast access to all records in TOTAL files, but as was mentioned earlier, do cause a heavy reliance on physical data formats, which are subject to change, and bypass the data independence feature of the TOTAL Data Base Management System.

   It is suggested that the user of small to medium size data bases may find that the serial function provides the performance levels required, while users with large data files that require large scale access, may wish to consider the alternatives if attempting to minimize execution times.

It should be easy to see, therefore, that using the serial function in TOTAL will result in execution times for its use much less than random access times, through somewhat greater than sequential access techniques. This difference is primarily caused by the need for data independence, and TOTAL's one buffer per file mechanism.

There are other techniques that may be used in lieu of the serial function, depending on a user's particular needs. These techniques accomplish a savings in time only at the expense of data independence, and require an awareness of the physical file organization which is subject to change.

SECTION 7
OPERATING VORTEX TOTAL DBMS

Operation of the VORTEX TOTAL Data Base Management System consists of the successful generation and formatting of the data base and loading of the data files. In addition, efficient operation of the system requires adequate provision for data base back up and recovery. Provision must also be made for maintenance of the data base to enable data file changes to be incorporated, and the correction of errors through diagnostic error messages and debugging aids.

7.1 CATALOG OF APPLICATION PROGRAM

The application program's OM (Object Module) is bound together with TOTAL and DBMOD by LMGEN to create the run time (Load Module) application program. This program may be cataloged either on the background or foreground library. The order of a cataloging should be: TOTAL,DBMOD,application OM.

Example:

```
/JOB,CREATE
/LMGEN
TIDB,PROGDB,1,0
LD,OM,D,TOTAL          TOTAL module on OM library
LD,25,,DBMOD1          DBMOD on LUN 25
LD,25,,PROG            User OM on LUN 25
LIB
END,BL,E               Background library
/FINI
```

7.2 TOTAL FILES

There are two functional types of Data Sets or files in the TOTAL DBMS: the single entry Master data set and the Variable entry data set.

The Master data set is an independent entity which can stand alone or have one or more dependent (variable) data sets attached to it. Each data set consists of records, and in the Master data set each record has a unique control key which enables the record to be accessed directly according to the value of this control key.

The Variable data set must be linked to at least one Master data set. Records in a Variable data set are logically accessed through a particular master record and then from one variable record to the next via the linkage path related to the master

record. A sample data base for a business application showing typical Master data sets and Variable data sets and the links between the data sets and the records contained in the data sets is given in figure 7-1.

7.2.1 TOTAL Logical Files and VORTEX Files

The difference between TOTAL Logical Files and VORTEX physical files is that a VORTEX file is limited to one partition (logical unit) while the TOTAL Logical File may extend on one or more logical units (partitions). Thus, one TOTAL file may contain more than one VORTEX file. Furthermore it is not necessary that all VORTEX files reside on the same RMD. For each DBDL Drive Statement a VORTEX file is generated.

Variable-file space management requires a series of control records inserted at regular intervals throughout the TOTAL program. One control record is placed in front and one behind the file which needs to be segmented. They are used to define the control intervals for the VORTEX files. The control interval is 480 sectors long. The load limit in percent is computed and maintained for each control interval (see LOAD-LIMIT directive). Each variable logical TOTAL file starts a control interval.

The following is an example of TOTAL coding using the Drive Statement:

Example:

TOTAL FILE: BASE

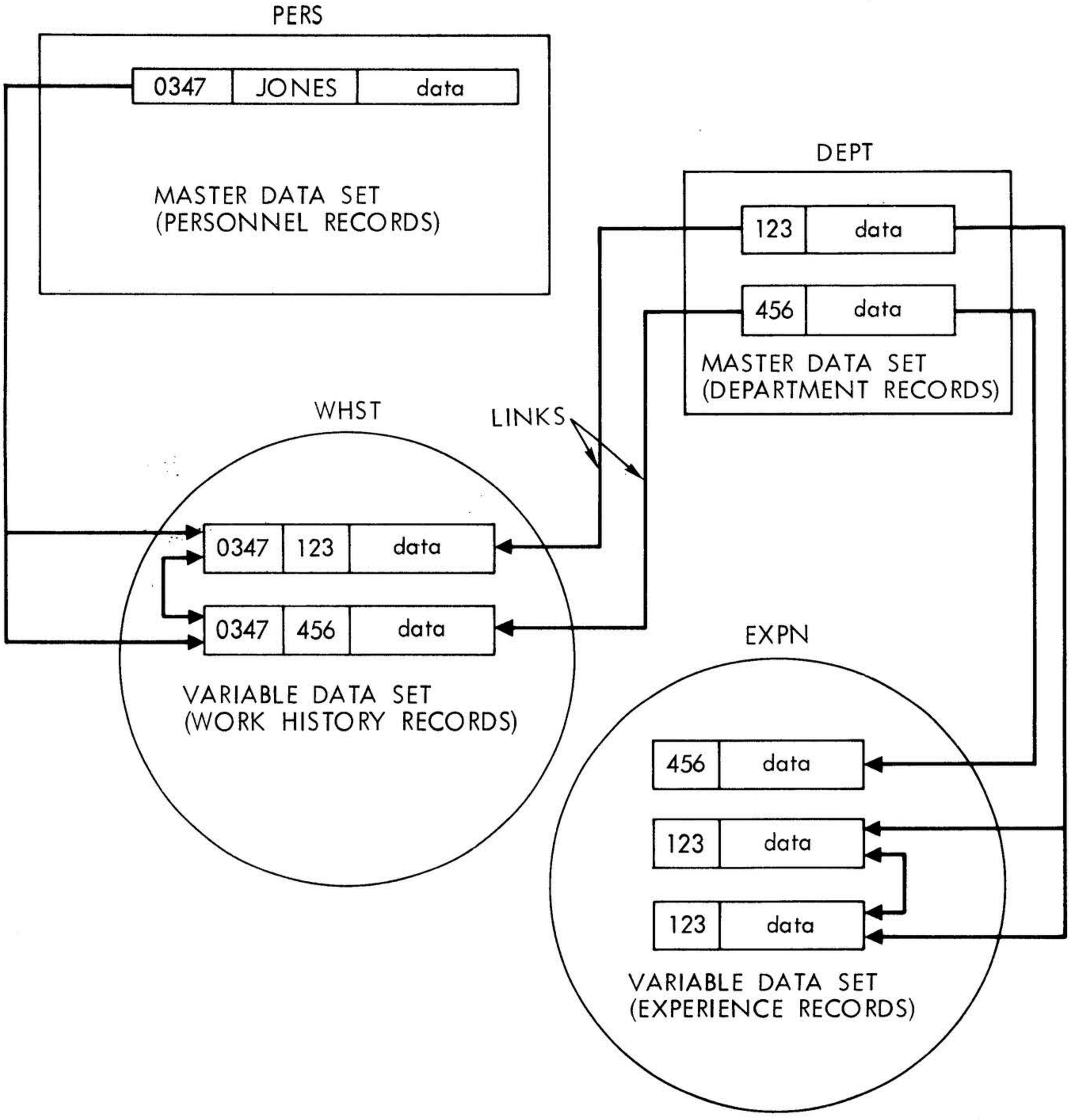
Corresponding VORTEX File	Drive Statement
BASE01	13,200
BASE02	14,100
BASE03	15,400

The first control record of the TOTAL file is the first physical record of BASE01.

The second control record is logically the 481st record and is the 181st record of BASE03.

7.2.2 Disc Utilization

Master files: In order to minimize the number of synonyms, file growth should be anticipated by declaring the file at least 20 to 25 percent larger than its initial capacity.



VTI1-3484

Figure 7-1. TOTAL Data Set Relationships

Variable files: The size of variable files is controlled by the LOAD-LIMIT directive. If more than 80 percent of threshold is required (default), the required number should be supplied. This is important if variable chains are very long and tend to overflow the control interval boundary.

7.3 BUFFER SHARING

A general discussion of buffering TOTAL Data Sets is given in section 6.8. Program efficiency may be increased by the planned use of buffer sharing which minimizes the use of storage, however there may be some sacrifice of processing speed. Buffer sharing is accomplished by specifying the same IOAREA for all files that are to share the same buffer pool. Refer to section 6.8 for the priority for buffer selection. It should be noted that an actual I/O WRITE operation is performed only if the buffer is required and some data in it has been updated. In all other cases a WRITE request only sets the update flag.

7.4 CREATING THE DATA BASE

The TOTAL system consists of three distinct programs:

a. DBGEN - the Data Base Generator program

b. DBFMT - the Data Set Format program

c. TOTAL - the Data Base Management program

DBGEN accepts the Data Base Definition Language (DBDL) statements and generates an assembly language Data Base Descriptor Module (DBMOD). DBFMT accepts the data set format control card(s), creates the data sets, and preformats the specified RMD areas according to the physical parameters.

TOTAL is initiated by CALL instructions from the application program, communicates with the Data Base Descriptor Module, and acts on the preformated disc area.

7.4.1 Data Base Generation

Generation of the data base is accomplished by means of the Data Base Generation program DBGEN. DBGEN reads user prepared DBDL statements and generates source statements which in turn (after assembly) produce the Data Base Descriptor Module (DBMOD).

To produce the assembly language Data Base Descriptor Module using the DBGEN program, proceed as follows:

a. Complete and keypunch Data Base Definition Language (DBDL) specification cards.

b. Execute the DBGEN program via the DBGEN directive. The program reads the DBDL specifications from the PI logical unit, writes onto the SS logical unit assembly language source program statements, and prints the data base documentation listing on the LO logical unit.

c. The assembly language source program statements are input to the DASMR Assembler and an object Data Base Descriptor Module is created on the BO logical unit.

d. DBFMT object module is LMGENed together with the user DBMOD object module and is catalogued as the data base formattor program (see section 4.1).

The above steps are shown in flow chart form in figure 2-1.

7.4.2 Parameter Card Format

The parameter card format is described in section 3.1.3.

7.5 FORMATTING THE DATA BASE

Formatting is accomplished by means of the Data Set Format program DBFMT. DBFMT reads format parameter statements and preformats the data sets, utilizing a Data Base Descriptor Module.

In use, DBFMT creates and initializes the data sets and establishes all necessary control records. DBFMT is a parameter statement driven program; these parameters name the Data Base Descriptor Module and the data sets to be formatted. DBFMT uses the foreground file maintenance program V$FGFM to create the files. LMGEN then links DBFMT and the user's DBMOD to create the user formattor program.

The formattor reads data base control directives from the PI logical unit, and creates and formats the requested data sets on the RMD. Diagnostics are printed out on the LO logical unit.

```
bFORMAT dbname file1,file2,.....,filen,END.
```

where

b is a space; FORMAT starts in column 2

dbname is the data base name

file1....filen are data set (file) names

The last parameter must be END.

Continuation cards may be used if there is not enough space on one card for all the file names that are required. However FORMAT dbname must be duplicated for each card.

Data Base Formatting is shown schematically in figure 7-2. A detailed flow chart is given in figure 4-1. Examples of the use of FORMAT control directives are given in section 4.

7.6 DATA BASE EXECUTION

Execution of the application programs is accomplished using the Data Base Interface Module (DATBAS) and the TOTAL Data Base Management Module.

DATBAS serves as an interface between the user application program and the TOTAL and Data Base Descriptor modules.

TOTAL provides the data management capability of the system, interpreting and executing the various DML commands from the user application program.

A flow chart showing the TOTAL DBMS operation is given in figure 2-2. TOTAL can be used to load data on to files already formatted by means of CALL statements from the application program, or through a TOTAL utility program. See section 5.2 for a description of the TOTAL calling sequence.

7.7 DATA BASE RECOVERY

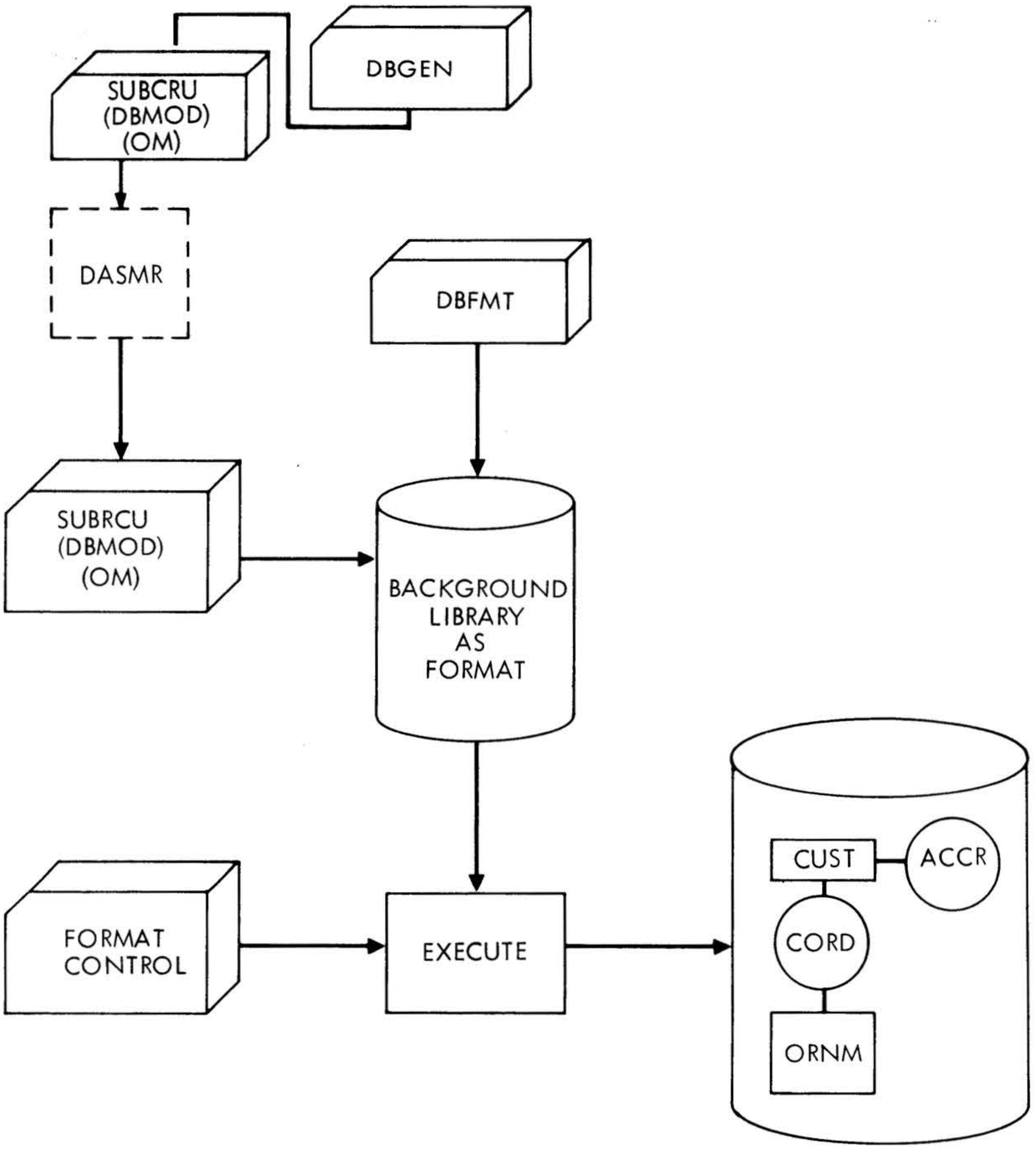
Recovery of the Data Base is accomplished by:

a. Unloading the files to be backed up.

b. Restoring the files.

c. Re-running the transactions.

It is recommended that a back-up or history file be maintained, so that the data base can be recovered in the case of a catastrophic error. The history file can be on magnetic tape. FMUTIL can be used to dump files.



- PRE-FORMATS ALL RECORDS
- CREATES AND INITIALIZES SPACE MANAGEMENT RECORDS
- CREATES AND INITIALIZES FILE CONTROL RECORDS

VTI1-3485

Figure 7-2. Formatting TOTAL Data Sets

7.8 DATA SET CHANGES

7.8.1 Single Entry Data Set Changes

When physical changes to a single entry data set occur, such as an increase in TOTAL logical records and expansions in record length, the user must:

a. Unload the affected data set

b. Define the physical changes to the DBGEN

c. Reload the data

The following procedures are necessary to accomplish these changes:

a. "RDNXT" through the single entry file requesting all elements (including the links) except for the ROOT; i.e., "mmmmROOT".

b. Write each record to a sequential file.

c. Redefine the DBGEN for your data base with the necessary changes.

NOTE: Be sure to change the physical entries within the DBGEN for this file.

d. Reformat the data set changing FORMAT input to reflect the changes to the data set.

e. Write a program to read the sequential file created in step b, pass the control field (key) to RQLOC, append the relative disc address to the record, and write the record to another sequential file.

f. Sort the output of step e by relative disc address (4-character binary field) and the control field.

g. Input the sorted file to a load program. This load program should use the identical element list and I/O areas as defined in step a.

The single entry data set can be reloaded with or without the RQLOC technique.

7.8.2 Variable Entry Data Set Changes

When physical changes to a variable entry data set occur, such as an increase in TOTAL logical records and expansions in record length, the user must:

a. Unload the affected data set

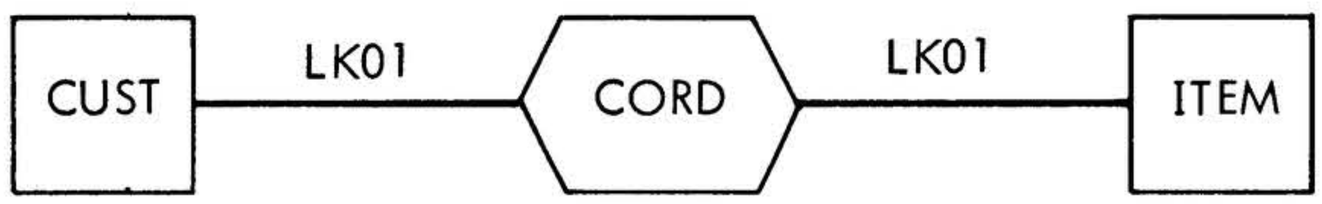
b. Define the physical changes to the DBGEN

c. Reload the data

The following procedures are necessary to accomplish these changes:

a. "RDNXT" the variable entry file requesting the control fields and all data portions of the record. Do not request the linkage fields. Write each record to a sequential file.

b. Zero out the linkage path to this variable entry file from the single entry file(s) to which it links. For example:



You would "RDNXT" through the CUST file requesting the elements CUSTCTRL and CUSTLK01, move zeros to this 8-character linkage path, and issue a WRITM. This would also be done for the ITEMLK01 element of the ITEM file.

c. Redefine the DBGEN with the new changes to the variable entry file.

NOTE: Be sure to change the physical entries within the DBGEN for this file.

d. Reformat the data set changing FORMAT input to reflect the changes to the data set.

e. Read the sequential file created in step a and issue an ADDVC; this relinks the variable entry records to the single entry data set(s). The ADDVC should be issued using the same base control as was used to originally load the file. This ensures that the records within a chain are maintained in the same sequence as they were prior to the reload.

7.9 USING THE UTILITY PROGRAMS

TOTAL files can be copied between RMD and magnetic tape using either one of the following utility routines:

IOUTIL
FMUTIL

IOUTIL is a general purpose utility program that allows the user to dump files from one media to another e.g., tape-to-disc, disc-to-disc, etc. FMUTIL is a file maintenance utility program which may be used to dump or load files, singly or by entire partition, to or from a magnetic tape. Both these programs handle multi-reel files. For details as to the usage of these routines, refer to the VORTEX II reference manual.

7.10 DEBUGGING TOTAL DBMS

TOTAL permits a large degree of flexibility for the program to manipulate and handle its own data, but when an obvious mistake has occurred, TOTAL will not allow the invalid command on the erroneous data to change the data base. The command will be terminated, its effect nullified if partially completed, and an error status returned to the program. Some of the specific error checks include:

a. An attempt to add a record with an invalid blank control key

b. An attempt to add a duplicate master

c. A requested file or element does not exist in the data base

d. An incorrect file type has been specified

e. A master delete has been attempted before all variable records are deleted.

There are also numerous internal checks to ensure that files are opened properly, locked correctly, and that all network linkage paths are maintained in the proper manner.

In nearly all situations, TOTAL will trap a user error or oversight, stop the command, and return an appropriate error status code. These status returns are a very useful debugging tool, and they are covered again under that topic.

7.10.1 Status Codes

After execution of any DML command, a status code is moved to the user's status field to indicate the result of the operation.

The status codes fall into three categories:

a. Successful completion.

b. Informative; some user action may be required.

c. Fatal; the requested function has not been completed.

The status codes thus aid the programmer in debugging and indicate the action to be taken if there is a problem. A detailed explanation of the interpretation of the status codes and a complete list is given in appendix B.

7.10.2 Diagnostics

If there are errors in the Data Base Definition Language statements which would cause an erroneous Data Base Descriptor Module, the DBGEN program will print appropriate diagnostic messages along with the DBDL statement listing, and the output of source statements will be suppressed.

Certain error conditions will cause immediate termination of the DBGEN program, while other conditions allow further processing of the DBDL input. All output messages are output to the LO logical unit. The programmer can use these diagnostics to debug the input to the DBGEN program. A complete list of the diagnostic error messages is given in appendix B.

7.10.3 Automatic SNAPSHOT (SNAP) Dump

Another method of diagnosing errors in the TOTAL DBMS is by using the SNAPSHOT dump. This dump is output on the DO logical unit automatically by TOTAL when certain FATAL errors occur. The dump will contain the TEXT block which includes a complete parameter, file, and record list as well as some other TOTAL pointers and indicators. By searching the TEXT block for clues to errors in the program, the programmer will be able to determine which statements have caused the program malfunction to occur.

A description and sample of the TEXT block is given in appendix C.

APPENDIX A
SAMPLE APPLICATION PROGRAM

A.1 PROBLEM DESCRIPTION

The following example will demonstrate the use of the TOTAL data management system. Assume we are to design a data base for a distributor, named X Company which purchases items in large quantities from large manufacturers and sells them in smaller quantities to local companies.

The X Company wants to develop a TOTAL information system to accommodate the following applications:

a. Order Acknowledgement, Writing and Control.

b. Invoicing

c. Finished Inventory Control

d. Purchase Order Writing and Control

e. Accounts Receivable

We will follow the recommended steps in designing the data base module and the resulting applications. The steps are as follows:

a. Determine the data sets required by the application to be developed.

b. Categorize the data sets as to Single Entry or Variable Entry.

c. Determine the data elements and data fields required in the established data sets.

d. Develop a data base schematic using squares to represent single entry data sets and circles for variable entry data sets.

e. Indicate the desired relationships by drawing connectors from single entry to variable entry data sets. Qualify the relationships as to ALL or selected record codes.

f. Code the TOTAL Data Base Generation statements.

g. Generate the data base module.

h. Develop application programs.

A.2 DATA SET DEFINITION AND CLASSIFICATION

A.2.1 Determining the Required Data Sets

Using the sample applications, we determine that the following data sets are required:

a. Customers

b. Vendors

c. Inventory Items

d. Order Numbers

e. Dates

f. Open Customer Orders

g. Open Purchase Orders

h. Open Accounts Receivable

A.2.2 Categorizing Data Sets as to Single Entry or Variable Entry

Single Entry data sets are created to reflect the company's assets, to serve as entries into a pool of information, and to automatically edit identifying information.

Variable Entry data sets are created as a result of the recognition of business transactions. They indicate and monitor the effect of transactions on the single entry data sets while a business function is being performed. For example, a customer order is a transaction which inter-acts with customer and inventory information as the physical functions of allocating stock and shipping the order take place within the company. Eventually, the customer order generates another variable entry data set (Accounts Receivable) which shows the interaction of customer, invoices, and cash payments.

Using the sample X Company, we categorize the data sets as follows:

Single entry:

a. Customer (CUST)

b. Vendor (VEND)

c. Inventory Item (INVT)

d. Order Numbers (ORNM)

e. Dates (DATE)

Variable Entry:

a. Customer Orders (CORD)

b. Purchase Orders (PORD)

c. Accounts Receivable (ACCR)

A.3 DEVELOPING DATA BASE RELATIONSHIP SCHEMATICS

To determine the data base relationships required in the data base, we must set the objectives of the TOTAL information system for Company X. We want to use the computer for more than record keeping and document preparation. We want the system to process orders from our customers as they are received and to assist us in proper allocation of our inventories. We want the system to present management, immediately, with all information pertinent to solving business exceptions. For example, if orders for an item exceed its availability, we want to know all inhouse and unshipped demands against that particular item so that we can allocate according to the importance of the customer demands.

We want to be able to identify immediately all open purchase orders outstanding for a particular item in the event of excessive demands on our on hand stock.

The following is a summary of the relationships we will require:

a. Customers to their orders to us

b. Vendors to our orders to them

c. All orders received on a particular day

d. All orders to ship on a particular day

e. Detail to all orders

f. Customers to their open invoices and cash payments

g. Items to open customer orders

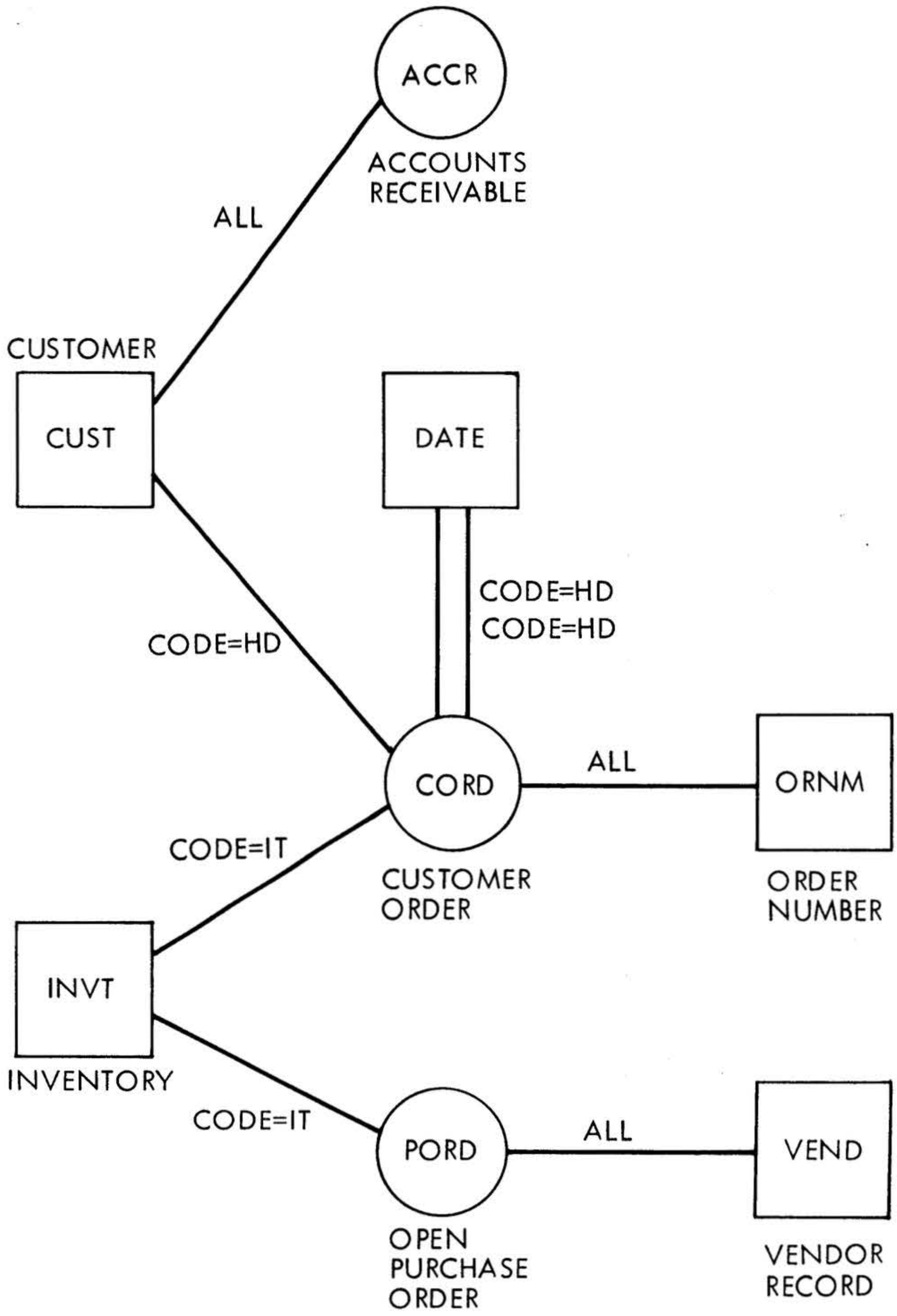
h. Items to open purchase orders

A.4 DATA BASE SAMPLE PROBLEM SCHEMATIC

A schematic of a data base sample problem is shown in figure A-1.

A.5 DETERMINING THE DATA RECORDS AND DATA ELEMENTS REQUIRED

Using the data sets developed and the information obtained by studying the business functions of Company X, the information requirements presented in figure A-2 are developed.



VTI1-3486

Figure A-1. Data Base Sample Problem

1. CUSTOMER RECORD - SINGLE ENTRY

CUST — CUSTDATA

	CUSTROOT	CUSTCTRL	CUSTLKCO	CUSTLKAR	CUSTNAME	CUSTADDR	CUSTCTYS
data:		customer number	link to CORD	link to ACCR	name	address	city/state
bytes:	8	6	8	8	30	30	20

2. VENDOR RECORD - SINGLE ENTRY

VEND — VENDDATA

	VENDROOT	VENDCTRL	VENDLKPO	VENDNAME	VENDADDR	VENDCTYS	VENDLTME
data:		vendor number	Link open purchase order	vendor name	vendor address	city/state	vendor lead time
bytes:	8	7	8	25	30	30	5

VTI1-3487

Figure A-2. Information Requirements (Sheet 1 of 5)

VTI2-455

3. INVENTORY ITEM RECORD - SINGLE ENTRY INVT

						INVTDAT1 40		INVTDAT2 8	
	INVTROOT	INVTCTRL	INVTLKCO	INVTLKPT	INVTDESC	INVTCOST	INVTPRIC	INVTONHD	INVTORDR
data:		Inventory item number	Link to customer items CORD	Link to open vendor items VEND	Item description	Item cost	Item price	Item on hand	Item on order
bytes:	8	8	8	8	30	5	5	4	4

4. ORDER NUMBER RECORD - SINGLE ENTRY ORNM

	ORNMROOT	ORNMCTRL	ORNMLKCO
data:		order number	Line to order records CORD
bytes:	8	12	8

5. DATE RECORD - SINGLE ENTRY DATE

	DATEROOT	DATECTRL	DATELKDR	DATELKDS
data:		date	Line to date received	Line to date to ship
bytes:	8	4	8	8

Figure A-2. Information Requirements (Sheet 2 of 5)

VTI2-456

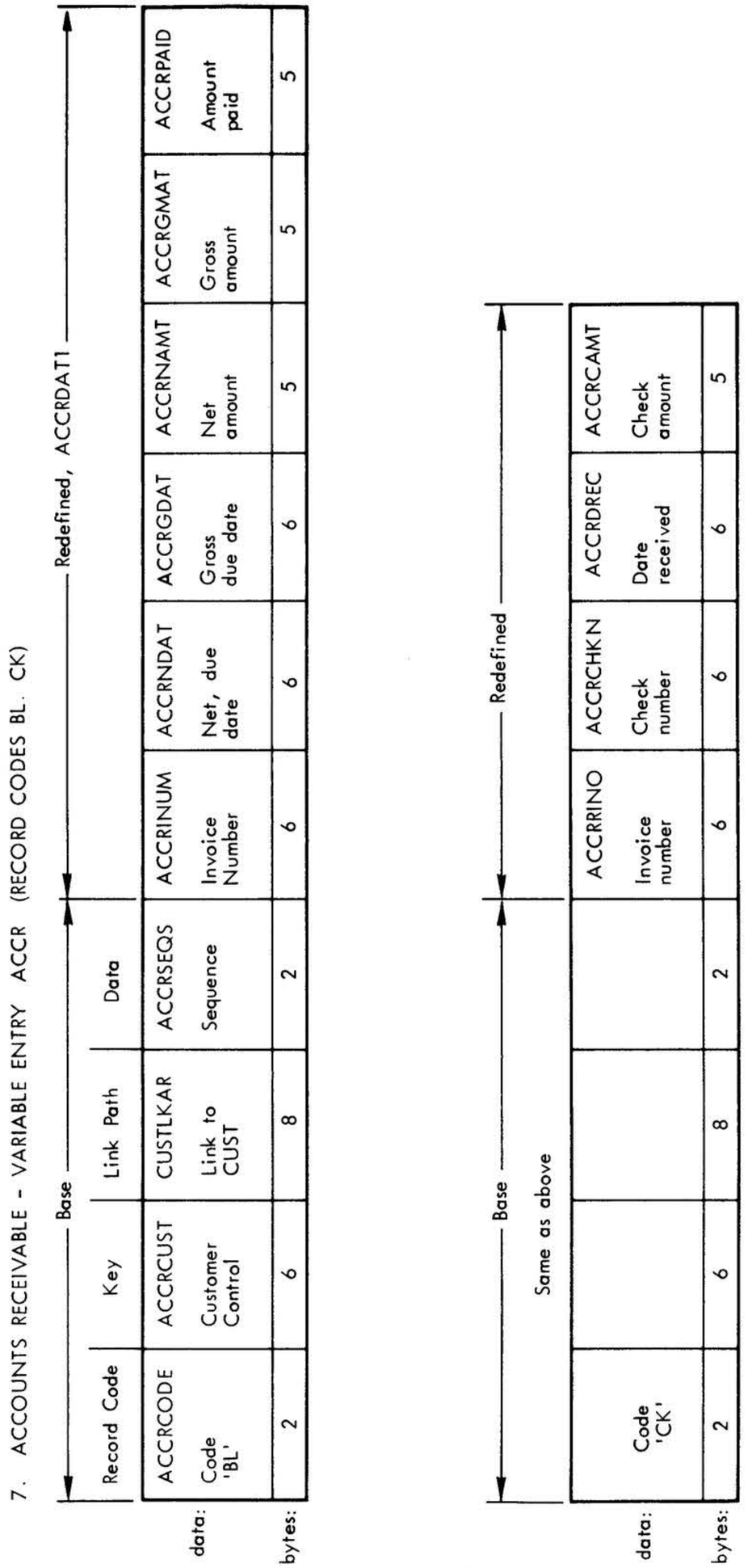
Figure A-2. Information Requirements (Sheet 3 of 5)

6. CUSTOMER ORDER - VARIABLE ENTRY CORD (RECORD CODES HD, IT, CM)

	BASE				REDEFINED								
	Record Code	Key 1	Link Path	Data	Key 2	Key 2	Key 3	LP1	LP2	LP3		Data	
data:	CORDCODE 'HD'	CORDORNM order number	to ORNM	CORDLINE line on order	CORDCUST customer record	CORDDATR date received	CORDDATS date to ship	CUSTLKCO via key 1	DATEUKDR via key 2	DATELKDS via key 3	CORDVALE value	CORDTOTI total	total # of items
bytes:	2	12	8	2	6	4	4	8	8	8	5	2	10

	Base				Redefined				
	Record Code	Key	Link Path	Data	Key 2	LP2			
data:	record code 'IT'				CORDITEM	INVTLKCO	CORDQTYX quantity	CORDPRCE price	CORDSLBS shipping weight
bytes:	2	12	8	2	8	8	4	5	4

	Base				Redefined
data:	record code CM				CORDCOMT comment record
bytes:	2	12	8	2	55



VTI2-457

Figure A-2. Information Requirements (Sheet 4 of 5)

8. PURCHASE ORDER - VARIABLE ENTRY PORD (RECORD CODES HD. IT)

	Record Code	Key	LP			Redefined → PORDDAT1		
data:	PORDCODE 'HD'	PORDVEND Order Vendor	VENDLKPO Link to VEND	PORDPNUM Purchase Order No.	PORDLINE Purchase Order Line No.	PORDRDAT Released date	PORDDUDT Due date	PORDCARR Order carrier
bytes:	2	7	8	5	2	6	6	15

	Same as above					Redefined → Key 2	LP2	Data
data:	Code 'IT'			PORDPNUM Purchase Order No.	PORDLINE Purchase Order Line No.	PORDITEM Item number	INVTLKPT Link to ITEM	PORDIQTY Item quantity
bytes:	2	7	8	5	2	8	8	5

Figure A-2. Information Requirements (Sheet 5 of 5)

VTI1-3491

A.6 DATA BASE GENERATION

The following is an output listing from the data base generation program:

```
                                                              PAGE  1

CINCOM SYSTEMS, INC.        DATA BASE GENERATION

BEGIN-DATA-BASE-GENERATION
DATA-BASE-NAME=ORDRDB
OPTIONS=OUTPUT=Y
SHARE-IO
IUAREA=MAS1=2
IUAREA=VAR1=4
IUAREA=MAS2=6
IUAREA=MAS3
END-IO
```

```
                                                              PAGE  2

CINCOM SYSTEMS, INC.        DATA BASE GENERATION

BEGIN-MASTER-DATA-SET
DATA-SET-NAME=CUST
IUAREA=MAS1
MASTER-DATA
CUSTROOT=8
CUSTCTRL=6                          CUSTOMER NUMB ER
CUSTLKCO=8                          LINK TO CUSTO MER ORDER HEADER RECORDS
CUSTLKAR=8                          LINK TO INVOICES AND PAYMENTS    ;
CUSTDATA=80
.1.CUSTNAME=30                      NAME
.1.CUSTADDR=30                      ADDRESS
.1.CUSTCTYS=20                      CITY AND STATE
END-DATA
LUGICAL-RECORD-LENGTH=120
TUTAL-LOGICAL-RECORDS=1118
DRIVE=11,600
END-MASTER-DATA-SET
     LOGICAL-RECORDS-PER-SECTOR=       2          * CALCULATED *
     TOTAL-SECTORS=                    559        * CALCULATED *
     UNUSED SECTORS IN                 LUN        SECTORS

                                       11         41
```

CINCOM SYSTEMS, INC. DATA BASE GENERATION

```
BEGIN-MASTER-DATA-SET
DATA-SET-NAME=VEND
IOAREA=MAS2
MASTER-DATA
VENDROOT=8
VENDCTRL=7                          VENDOR NUMBER
VENOLKPO=8                          LINK TO OPEN PURCHASE ORDER
VENDDATA=90
.1.VENDNAME=25
.1.VENDADDR=30
.1.VENDCTYS=30
.1.VENDLTME=5
END-DATA
LOGICAL-RECORD-LENGTH=120
TOTAL-LOGICAL-RECORDS=5586
DRIVE=56,2800
END-MASTER-DATA-SET
     LOGICAL-RECORDS-PER-SECTOR=      2          * CALCULATED *
     TOTAL-SECTORS=                   2793       * CALCULATED *
     UNUSED SECTORS IN                LUN        SECTORS

                                      56         7
```

```
CINCOM SYSTEMS, INC.        DATA BASE GENERATION

BEGIN-MASTER-DATA-SET
DATA-SET-NAME=INVT
IOAREA=MAS1
MASTER-DATA
INVTROOT=8
INVTCTRL=8                              INVENTORY ITEM NUMBER
INVTLKPT=8
INVTLKCO=8
INVTDAT1=40
.1.INVTDESC=30
.1.INVTCOST=5
.1.INVTPRIC=5
INVTDAT2=8
.1.INVTONHD=4
.1.INVTORDR=4
END-DATA
LOGICAL-RECORD-LENGTH=80
TOTAL-LOGICAL-RECORDS=3198
DRIVE=56,1200
END-MASTER-DATA-SET
     LOGICAL-RECORDS-PER-SECTOR=      3          * CALCULATED *
     TOTAL-SECTORS=                   1066       * CALCULATED *
     UNUSED SECTORS IN                LUN        SECTORS

                                      56         134
```



```
CINCOM SYSTEMS, INC.        DATA BASE GENERATION

BEGIN-MASTER-DATA-SET
DATA-SET-NAME=ORNM
IOAREA=MAS3
MASTER-DATA
ORNMROOT=8
ORNMCTRL=12                             ORDER NUMBER
ORNMLKCO=8                              LINK TO ORDER RECORDS
END-DATA
LOGICAL-RECORD-LENGTH=30
TOTAL-LOGICAL-RECORDS=4611
DRIVE=56,600
END-MASTER-DATA-SET
     LOGICAL-RECORDS-PER-SECTOR=      8          * CALCULATED *
     TOTAL-LOGICAL-RECORDS=           4616       * CALCULATED *
     TOTAL-SECTORS=                   577        * CALCULATED *
     UNUSED SECTORS IN                LUN        SECTORS

                                      56         23
```

```
CINCOM SYSTEMS, INC.        DATA BASE GENERATION

BEGIN-MASTER-DATA-SET
DATA-SET-NAME=DATE
IUAREA=MAS2
MASTER-DATA
DATEROOT=8
DATECTRL=4                          DATE YYMMDDS PACKED
DATELKDR=8                          LINK TO DATE RECEIVED
DATELKDS=8                          LINK TO DATE TO SHIP
END-DATA
LUGICAL-RECORD-LENGTH=30        .
TUTAL-LOGICAL-RECORDS=1755
DRIVE=133,300
END-MASTER-DATA-SET
     LOGICAL-RECORDS-PER-SECTOR=      8          * CALCULATED *
     TOTAL-LOGICAL-RECORDS=           1760       * CALCULATED *
     TOTAL-SECTORS=                   220        * CALCULATED *
     UNUSED SECTORS IN                LUN        SECTORS

                                      133        80
```

CINCOM SYSTEMS, INC, DATA BASE GENERATION

```
BEGIN-VARIABLE-ENTRY-DATA-SET
DATA-SET-NAME=PORD
IOAREA=VAR1
BASE=DATA
PURDCODE=2                          RECORD CODES HD,IT
PURDVEND=7                          BASE VENDOR NUMBER
VENDLKPO=8=PORDVEND                 LINK TO VEND
PURDPNUM=5                          PO NUMBER
PURDLINE=2                          LINE NUMBER
PURDDAT1=27                         VARIABLE DATA
RECORD-CODE=HD                      REDEFINITION PART STATS HERE
.1.PORDRDAT=6
.1.PORDDUDT=6
.1.PORDCARR=15
RECORD-CODE=IT
.1.PORDITEM=8
INVTLKPT=8=PORDITEM
.1.PORDTQTY=5
END-DATA
LOGICAL-RECORD-LENGTH=60
TOTAL-LOGICAL-RECORDS=20000
DRIVE=133,5200
END-VARIABLE-ENTRY-DATA-SET
     LOGICAL-RECORDS-PER-SECTOR=      4          * CALCULATED *
     TOTAL-SECTORS=                   5000       * CALCULATED *
     UNUSED SECTORS IN                LUN        SECTORS

                                      133        200
```

```
CINCOM SYSTEMS, INC.      DATA BASE GENERATION

BEGIN-VARIABLE-ENTRY-DATA-SET
DATA-SET-NAME=CORD
IOAREA=VAR1
BASE-DATA
CORDCODE=2                          RECORD CODES HD,CM,IT
CORDORNM=12                         BASE ORDER NUMBER
CORDLINE=2                          LINE ON ORDER
ORNMLKCO=8=CORDORNM
CORDDATA=55                         VARIABLE DATA AREA
RECORD-CODE=HD                      ONE PER ORDER
.1.CORDCUST=6                       CUSTOMER
.1.CORDDATR=4                       DATE RECEIVED
.1.CORDDATS=4                       DATE TO SHIP
CUSTLKCO=8=CORDCUST
DATELKDR=8=CORDDATR
DATELKDS=8=CORDDATS
.1.CORDVALE=5                       TOTAL VALUE OF ORDER
.1.CORDTOT1=2                       TOTAL NUMBER OF ITEMS
.1.CORDTERM=10                      TERMS OF ORDER
RECORD-CODE=IT
.1.CORDITEM=8                       ITEM REQUIRED
INVTLKCO=8=CORDITEM
.1.CORDQTYX=4                       QUANTITY
.1.CORDPRCE=5                       SPECIAL PRICE
.1.CORDSLBS=4                       SHIPPING WEIGHT
RECORD-CODE=CM                      COMMENT
.1.CORDCOMT=55
END-DATA
LOGICAL-RECORD-LENGTH=80
TOTAL-LOGICAL-RECORDS=98000
DRIVE=132,32000
DRIVE=133,1000
END-VARIABLE-ENTRY-DATA-SET
     LOGICAL-RECORDS-PER-SECTOR=      3          * CALCULATED *
     TOTAL-LOGICAL-RECORDS=           98001      * CALCULATED *
     TOTAL-SECTORS=                   32667      * CALCULATED *
     UNUSED SECTORS IN                LUN        SECTORS

                                      133        333
```

```
CINCOM SYSTEMS, INC.        DATA BASE GENERATION

BEGIN-VARIABLE-ENTRY-DATA-SET
DATA-SET-NAME=ACCR
IUAREA=VAR1
BASE-DATA
ACCRCODE=2                          RECORD CODES BL,CK
ACCRCUST=6                          BASE CUSTOMER CONTROL
CUSTLKAR=8=ACCRCUST
ACCRSEQS=2
ACCRDAT1=33
RECORD-CODE=BL
.1.ACCRINUM=6
.1.ACCRNDAT=6
.1.ACCRGDAT=6
.1.ACCRNMAT=5
.1.ACCRGMAT=5
.1.ACCRPATD=5
RECORD-CODE=CK                      CHECKS
.1.ACCRRINO=6
.1.ACCRCHKN=6
.1.ACCRDREC=6
.1.ACCRCAMT=5
END-DATA
LOGICAL-RECORD-LENGTH=60
TOTAL-LOGICAL-RECORDS=37737
DRIVE=56,10000
END-VARIABLE-ENTRY-DATA-SET
     LOGICAL-RECORDS-PER-SECTOR=      4          * CALCULATED *
     TOTAL-LOGICAL-RECORDS=           37740      * CALCULATED *
     TOTAL-SECTORS=                   9435       * CALCULATED *
     UNUSED SECTORS IN                LUN        SECTORS

                                      56         565

              EPILOGUE

END-DATA-BASE-GENERATION
```

A.7 RPG II SAMPLE PROGRAM ORDPRO

The RPG II program listed on the following pages shows how TOTAL is used to add order transactions into an order entry system using "ORDRDB" as its DBMOD. The order transactions are input in no sequence. This program (a) inserts transactions in sequence using the READV, ADDVB, and ADDVC commands, (b) updates transactions using the READV and WRITV commands, and (c) creates a new order number master record using the ADD-M command.

A customer order record can be one of three types. It may be a header record, record code = HD; an item record, record code = IT; or a comment record, record code = CM. The order transaction are input through the card reader. The Input Specifications define the layout for the three types of transaction records. The first two columns of each input record contain the record code. However, the first record will contain "SINON" in columns 1-5, and columns 6-27 will contain some of the data necessary to "sign-on" the data base. The last card must contain "SINOF" in columns 1-5 which indicates that the data base should be "signed-off."

The first task this program performs is to execute the subroutine "INIT." This builds the proper schema in order that the SINON function may be executed. It also builds all data-lists that will be needed in this program. This subroutine will be executed only once. This program uses five of the files defined in the data base - CUST, INVT, DATE, CORD, and ORNM. Since these data sets will be updated, each data set must use "PRIV" as its usage mode. The data, which TOTAL uses to "sign-on" the data base, is established by source statements 143-149 of this program. Since the result fields are defined one after the other, the "sign-on" data will be contained in a contiguous area of core storage which is a requirement. Once all files have been opened by TOTAL, transaction processing may begin. All input transaction records are added to the variable entry CORD file which will be linked to all associated single entry files. The data-area which contains the input data as defined by the data-list is defined in this program in the Input Specifications by the field ORDREC. The data-area, in which TOTAL places the data it retrieves from a particular record, is a 4-byte area which is defined in this program in statement numbers 138-139. Also included in this "dummy section," statement numbers 136-139, is where the Data Base Descriptor Module for this program is defined. This section of the program should never be executed.

```
          H                                                                                                ORDPRO
RG 004
 0001     FCDFL     IPF F   80   80              READ42
 0002     FPRFL     O   F      132               PRINTER
          C*************************************************************************************
          C********** THE INPUT SPECIFICATIONS DEFINE THE POSSIBLE   **********
          C****************  CARD FORMATS THAT MAY BE INPUTTED ****************
 0003     ICDFL     AA  01   1 CH   2 CD
 0004     I                                                      1   2 RECCD
 0005     I                                                      3  14 ORDNUM
 0006     I                                                     15  16 LNNUM
 0007     I                                                     17  22 CUSNUM
 0008     I                                                     23  26 DATREC
 0009     I                                                     27  30 DATSHP
 0010     I                                                     31  35 ORDVAL
 0011     I                                                     36  37 TOTITM
 0012     I                                                     38  47 OTERMS
 0013     I                                                      1  79 ORDREC
 0014     I          BB  02   1 CI   2 CT
 0015     I                                                      1   2 RECCD
 0016     I                                                      3  14 ORDNUM
 0017     I                                                     15  16 LNNUM
 0018     I                                                     17  24 ITMNUM
 0019     I                                                     25  28 ITMQNT
 0020     I                                                     29  33 ITMPRI
 0021     I                                                     34  37 ITMWGT
 0022     I                                                      1  79 ORDREC
 0023     I          CC  03   1 CC   2 CM
 0024     I                                                      1   2 RECCD
 0025     I                                                      3  14 ORDNUM
 0026     I                                                     15  16 LNNUM
 0027     I                                                     17  71 COMM
 0028     I                                                      1  79 ORDREC
 0029     I          DD  04   1 CS   2 CI   3 CN
 0030     I         AND       4 CO   5 CN
 0031     I          OR  05   1 CS   2 CI   3 CN
 0032     I         AND       4 CO   5 CF
 0033     I                                                      1   5 CDCD
 0034     I                                                      6  27 SCHEMA
 0035     I                                                      1  79 ORDREC
          C*************************************************************************************
          C*************************************************************************************
          C********** THE FOLLOWING SECTION PRINTS EACH INPUT CARD   **********
          C****************  AND DETERMINES, BY THE INDICATOR  ****************
          C**********************  SETTINGS, WHICH FUNCTION  **********************
          C************************** IS TO BE PREFORMED ***************************
 0036     C                    SETOF                                        21
 0037     C                    SETOF                                        98
 0038     C                    SETOF                                        99
 0039     C                    EXSR CDPRNT
 0040     C                    MOVE '    '     STATS    4
 0041     C    04              GOTO SINON
 0042     C    05              GOTO SINOF
 0043     C                    MOVE 'LKCO'     REFER    4
 0044     C                    GOTO FNDPOS
          C*************************************************************************************
          C*************************************************************************************
```

```
                C********** THE FOLLOWING SECTION EITHER SIGNS-ON   OR        ********
                C********************  SIGNS-OFF THE DATA BASE.  ************************
0045            C             SINON     TAG
0046            C                       EXSR INIT
0047            C             SINOF     TAG
0048            C                       EXIT DATBAS
0049            C                       RLABL           CDCD
0050            C                       RLABL           STATS
0051            C                       RLABL           REALM
0052            C                       RLABL           ENDP
0053            C             STATS     COMP '*****'                      21
0054            C   21                  GOTO END
0055            C                       SETON                             LR
0056            C                       GOTO END
                C*****************************************************************
                C*****************************************************************
                C********** THE FOLLOWING SECTION READS THE VARIABLE 'CORD' *********
                C*************** FILE.  IT ALSO DETERMINES WHETHER THE ***************
                C*************** CARD INPUT SHOULD MODIFY, ADD ***********************
                C****************  BEFORE, OR ADD AFTER THE   ************************
                C********************  RECORD READ FROM 'CORD'. **********************
0057            C             FNDPOS    TAG
0058            C                       MOVE 'READV'    FUNCT   5
0059            C                       EXIT DATBAS
0060            C                       RLABL           FUNCT
0061            C                       RLABL           STATS
0062            C                       RLABL           CORD
0063            C                       RLABL           REFER
0064            C                       RLABL           ORNMLK
0065            C                       RLABL           ORDNUM
0066            C                       RLABL           ELEM1
0067            C                       RLABL           LINENO
0068            C                       RLABL           ENDP
0069            C                       MOVE CORD       DATAST  4
0070            C             STATS     COMP 'MRNF'                       20
0071            C   20                  GOTO ADDMAS
0072            C             STATS     COMP '****'                       21
0073            C  N21                  SETON                             99
0074            C  N21                  GOTO FND
0075            C             REFER     COMP 'END.'                       22
0076            C   22                  MOVE 'LKCO'     REFER
0077            C   22                  MOVE 'ADDVC'    FUNCT
0078            C   22                  GOTO ADDVAR
0079            C             LINENO    COMP LNNUM                  23
0080            C   23                  MOVE 'ADDVB'    FUNCT
0081            C   23                  GOTO ADDVAR
0082            C             LINENO    COMP LNNUM                        24
0083            C   24                  MOVE 'WRITV'    FUNCT
0084            C   24                  GOTO MODIFY
0085            C                       GOTO FNDPOS
                C*****************************************************************
                C*****************************************************************
                C********** THE FOLLOWING SECTION EITHER EXECUTES THE ***************
                C************  'ADDVA', 'ADDVB', OR 'ADDVC'  ************************
                C**********************  TOTAL COMMAND. ******************************
0086            C             ADDVAR    TAG
0087            C                       EXIT DATBAS
0088            C                       RLABL           FUNCT
0089            C                       RLABL           STATS
0090            C                       RLABL           CORD
0091            C                       RLABL           REFER
```

```
0092        C                       RLABL           ORNMLK
0093        C                       RLABL           ORDNUM
0094        C                       RLABL           ECORCD
0095        C                       RLABL           ORDREC
0096        C                       RLABL           ENDP
0097        C                       MOVE CORD       DATAST
0098        C             STATS     COMP '*****'                    21
0099        C   N21                 SETON                           99
0100        C                       GOTO END
            C*************************************************************************
            C*************************************************************************
            C********** THE FOLLOWING SECTION MODIFIES THE RECORD READ **********
            C************ FROM 'CORD' BY USING THE 'WRITV' COMMAND. ************
0101        C             MODIFY    TAG
0102        C             CODEND    COMP RECCD                      25
0103        C   N25                 SETON                           98
0104        C   N25                 GOTO END
0105        C                       EXIT DATBAS
0106        C                       RLABL           FUNCT
0107        C                       RLABL           STATS
0108        C                       RLABL           CORD
0109        C                       RLABL           REFER
0110        C                       RLABL           ORNMLK
0111        C                       RLABL           ORDNUM
0112        C                       RLABL           ECORCD
0113        C                       RLABL           ORDREC
0114        C                       RLABL           ENDP
0115        C                       MOVE CORD       DATAST
0116        C             STATS     COMP '*****'                    21
0117        C   N21                 SETON                           99
0118        C                       GOTO END
            C*************************************************************************
            C*************************************************************************
            C********** THE FOLLOWING SECTION ADDS A NEW 'ORNM' MASTER **********
            C************ RECORD IF ONE DOES NOT EXIST  FOR THE ******************
            C*************** VARIABLE 'CORD' RECORD TO BE ADDED. *****************
0119        C             ADDMAS    TAG
0120        C                       MOVE 'ADD-M'    FUNCT
0121        C                       EXIT DATBAS
0122        C                       RLABL           FUNCT
0123        C                       RLABL           STATS
0124        C                       RLABL           ORNM
0125        C                       RLABL           ORDNUM
0126        C                       RLABL           EORNCT
0127        C                       RLABL           ORDNUM
0128        C                       RLABL           ENDP
0129        C                       MOVE ORNM       DATAST
0130        C             STATS     COMP '*****'                    21
0131        C   N21                 SETON                           99
0132        C   N21                 GOTO END
0133        C                       MOVE 'LKCO'     REFER
0134        C                       MOVE 'ADDVC'    FUNCT
0135        C                       GOTO ADDVAR
            C*************************************************************************
            C*************************************************************************
            C********** THE FOLLOWING SECTION IS A DUMMY SECTION USED **********
            C************ TO DEFINE THE DATA-AREA AS WELL AS TO ******************
            C**************** SPECIFY WHICH DBMOD IS TO BE USED. ******************
            C******************** THIS SECTION SHOULD NEVER  **********************
            C************************** BE EXECUTED. ********************************
0136        C             DUMMY     TAG
```

```
0137        C                       EXIT SUBROK
0138        C                       MOVE ' '        LINENO  2
0139        C                       MOVE ' '        CODENO  2
            C*************************************************************************
            C*************************************************************************
0140        C             END       TAG
0141        CLR                     EXCPT
            C*************************************************************************
            C*************************************************************************
            C******* THE FOLLOWING SECTION IS EXECUTED ONCE TO  ********************
            C************ INITIALIZE DATA FIELDS NECESSARY FOR  ********************
            C************** THE EXECUTION OF THE TOTAL     ***************************
            C***************** COMMANDS IN THE PROGRAM.  ******************************
0142        CSR           INIT      BEGSR
0143        CSR                     MOVE SCHEMA     REALM   22
0144        CSR                     MOVFL'CUSTPRIV'FILE1    12
0145        CSR                     MOVEL'INVTPRIV'FILE2    12
0146        CSR                     MOVFL'DATEPRIV'FILE3    12
0147        CSR                     MOVEL'CORDPRIV'FILE4    12
0148        CSR                     MOVEL'ORNMPRIV'FILE5    12
0149        CSR                     MOVE 'END.'     ENDP     4
0150        CSR                     MOVE 'ORNMLKCO'ORNMLK    8
0151        CSR                     MOVE 'CORD'     CORD     4
0152        CSR                     MOVE 'ORNM'     ORNM     4
0153        CSR                     MOVE 'CORDLINE'ELEM1     8
0154        CSR                     MOVE 'CORDCODE'ELEMB     8
0155        CSR                     MOVE 'END.'     ELEMC    4
0156        CSR                     MOVE 'CORDCODE'ECORCD    8
0157        CSR                     MOVE 'CORDORNM'FCORON    8
0158        CSR                     MOVE 'CORDLINE'FCORLN    8
0159        CSR                     MOVE 'CORDDATA'ECORDA    8
0160        CSR                     MOVE 'END.'     EENDP    4
0161        CSR                     MOVE 'ORNMCTRL'EORNCT    8
0162        CSR                     MOVE 'END.'     OENDP    4
0163        CSR                     ENDSR
0164        CSR           CDPRNT    BEGSR
0165        CSR                     SETON                           90
0166        CSR                     EXCPT
0167        CSR                     SETOF                           90
0168        CSR                     ENDSR
            C*************************************************************************
            C*************************************************************************
0169        OPRFL     E 1       90
0170        O                               ORDREC     79
0171        O                                         100 'INPUT RECORD'
0172        OPRFL     D 1       21
0173        O                               STATS       4
0174        O                                          50 'SUCCESSFUL COMPLETION'
0175        O         D 1       99
0176        O                               STATS       4
0177        O                                          25 'UNRECOVERABLE ERROR,'
0178        O                                          35 'FUNCT WAS '
0179        O                               FUNCT      41
0180        O                                          54 'DATA SET WAS'
0181        O                               DATAST     59
0182        O         D 1       98
0183        O                                          23 'INVALID LINE CHANGE -- '
0184        O                                          42 'ORDER NUMBER IS - '
0185        O                               ORDNUM     50
0186        O                                          65 ' , CODES ARE - '
0187        O                               CODENO     67
```

```
0188         O                                          72 ' AND '
0189         O                                RECCD     74
0190         O          F  1        LR
0191         O                                STATS      4
             C*************************************************************************
             C*************************************************************************
```

A.8 COBOL SAMPLE PROGRAM

A COBOL sample program is provided on the following pages.

```
VARIAN DATA V-75 COBOL

    1  000100 IDENTIFICATION DIVISION.
    2  000200 PROGRAM-ID. ORDRPRG.
    3  000300 REMARKS.
    4  000400      THIS PROGRAM ILLUSTRATES THE USE OF TOTAL THE DATA
    5  000500      BASE MANAGEMENT SYSTEM. TO ADD ORDER TRANSACTIONS
    6  000600      INTO AN ORDER ENTRY SYSTEM. THE ORDER TRANSACTIONS
    7  000700      ARE INPUTTED IN NO SEQUENCE. THIS PROGRAM -
    8  000800
    9  000900            1. INSERTS TRANSACTIONS IN SEQUENCE USING THE
   10  001000               READV, ADDVC, OR ADDVB COMMANDS.
   11  001100
   12  001200            2. UPDATES TRANSACTIONS USING THE
   13  001300               READV AND WRITV COMMANDS.
   14  001400
   15  001500            3. CREATES A NEW ORDER NUMBER MASTER RECORD
   16  001600               USING THE ADD-M COMMAND.
   17  001700*
   18  001800 ENVIRONMENT DIVISION.
   19  001900 CONFIGURATION SECTION.
   20  002000 SOURCE-COMPUTER. V75.
   21  002100 OBJECT-COMPUTER. V75.
   22  002200 INPUT-OUTPUT SECTION.
   23  002300 FILE-CONTROL.
   24  002400      SELECT TRANS-IN ASSIGN TO READER.
   25  002500*
   26  002600 DATA DIVISION.
   27  002700 FILE SECTION.
   28  002800 FD  TRANS-IN
   29  002900      LABEL RECORDS ARE OMITTED
   30  003000      DATA RECORDS ARE ORDER-RECORD,
   31  003010                       ORDER-RECORD-2,
   32  003020                       ORDER-RECORD-3.
   33  003040 01  ORDER-RECORD.
   34  003050          05  COMMON-DATA.
   35  003060              10  RECORD-CODE      PIC X(02).
   36  003070              10  ORDER-NUMBERX    PIC X(12).
   37  003080              10  LINE-NUMBER      PIC 99.
   38  003090          05  REDEFINED-AREA-1.
   39  003100              10  HEADER-RECORD.
   40  003110                  15  CUSTOMER-NUMBER        PIC X(06).
   41  003120                  15  DATE-RECEIVED          PIC 9999.
   42  003130                  15  DATE-SHIP              PIC 9999.
   43  003140                  15  ORDER-VALUE            PIC 999V99.
```

```
VARIAN DATA V-75 COBOL

  44  003150                    15  TOTAL-LINES                PIC 99.
  45  003160                    15  ORDER-TERMS                PIC X(10).
  46  003170                    15  FILLER                     PIC X(33).
  47  003180 01  ORDER-RECORD-2.
  48  003190          05  FILLER                  PIC X(16).
  49  003200          05  REDEFINED-AREA-2.
  50  003210              10  ITEM-RECORD.
  51  003220                    15  ITEM-NUMBER               PIC X(08).
  52  003230                    15  ITEM-QUANTITY             PIC 9(04).
  53  003240                    15  ITEM-PRICE                PIC 999V99.
  54  003250                    15  ITEM-WEIGHT               PIC 999V9.
  55  003260                    15  FILLER                    PIC X(43).
  56  003270 01  ORDER-RECORD-3.
  57  003280          05  FILLER                  PIC X(16).
  58  003290          05  REDEFINED-AREA-3.
  59  003300              10  COMMENT-RECORD.
  60  003310                    15  COMMENT                   PIC X(55).
  61  003320                    15  FILLER                    PIC X(09).
  62  005400**
  63  005500 WORKING-STORAGE SECTION.
  64  005600 01       READV                        PIC X(05)   VALUE 'READV'.
  65  005700 01       ADD-M                        PIC X(05)   VALUE 'ADD-M'.
  66  005800 01       ADDVC                        PIC X(05)   VALUE 'ADDVC'.
  67  005900 01       ADDVB                        PIC X(05)   VALUE 'ADDVB'.
  68  006000 01       WRITV                        PIC X(05)   VALUE 'WRITV'.
  69  006100 01       STAT                         PIC X(04)   VALUE '****'.
  70  006200 01       ENDP                         PIC X(04)   VALUE 'END.'.
  71  006300 01       REFER                        PIC X(04)   VALUE 'LKXX'.
  72  006400 01       ORNMLKCO                     PIC X(08)   VALUE 'ORNMLKCO'.
  73  006500 01       CORD                         PIC X(04)   VALUE 'CORD'.
  74  006600 01       ORNM                         PIC X(04)   VALUE 'ORNM'.
  75  006700 01       SINON                        PIC X(05)   VALUE 'SINON'.
  76  006800 01       SINOF                        PIC X(05)   VALUE 'SINOF'.
  77  006900 01   SCHEMA.
  78  007000       07  TASKNAME                    PIC X(08)   VALUE 'ORDRPGX'.
  79  007100       07  DBMODULE                    PIC X(06)   VALUE 'ORDRDB'.
  80  007200       07  ACCESS                      PIC X(06)   VALUE 'UPDATE'.
  81  007300       07  LOGOPT                      PIC X(02)   VALUE 'NL'.
  82  007400       07  REALM.
  83  007500       09  FILE1                       PIC X(12) VALUE 'CUSTPRIV****'.
  84  007600       09  FILE2                       PIC X(12) VALUE 'INVTPRIV****'.
  85  007700       09  FILE3                       PIC X(12) VALUE 'DATEPRIV****'.
  86  007800       09  FILE4                       PIC X(12) VALUE 'CORDPRIV****'.
```

```
VARIAN DATA V-75 COBOL

 87  007900      09  FILE5                  PIC X(12) VALUE 'ORNMPRIV****'.
 88  008000      09  TERMINATOR             PIC X(04) VALUE 'END.'.
 89  008100 01  DATA-SETS                  PIC X(04).
 90  008200 01  FUNCT                      PIC X(05).
 91  008300 01  LOCATION-SEGS.
 92  008400      05  FILLER                 PIC X(08)   VALUE 'CORDCODE'.
 93  008500      05  FILLER                 PIC X(08)   VALUE 'CORDLINE'.
 94  008600      05  FILLER                 PIC X(04)   VALUE 'END.'.
 95  008700 01  CORD-SEGS.
 96  008800      05  CORDCODE               PIC X(08)   VALUE 'CORDCODE'.
 97  008900      05  CORDORNM               PIC X(08)   VALUE 'CORDORNM'.
 98  009000      05  CORDLINE               PIC X(08)   VALUE 'CORDLINE'.
 99  009100      05  CORDDATA               PIC X(08)   VALUE 'CORDDATA'.
100  009200      05  FILLER                 PIC X(04)   VALUE 'END.'.
101  009300 01  ORNM-SEGS.
102  009400      05  ORNMCTRL               PIC X(08)   VALUE 'ORNMCTRL'.
103  009500      05  FILLER                 PIC X(04)  VALUE 'END.'.
104  009600 01  LINE-CODE.
105  009700      05  CODE-NO                PIC X(02).
106  009800      05  LINE-NO                PIC 99.
107  009900 01  ORDER-NUMBER                PIC X(12).
```

```
VARIAN DATA V-75 COBOL

 108   010000 PROCEDURE DIVISION.
 109   010100
 110   010200
 111   010300 SIGN-ON-FUNCTION.
 112   010400     ENTER ASSEMBLER.
 113   010500     CALL 'DATBAS'   USING SINON STAT SCHEMA ENDP.
 114   010600     IF STAT = '****'
 115   010700         GO TO SIGN-ON-OK.
 116   010800     DISPLAY 'ERROR ON SINON,          STAT = ' STAT.
 117   010900         GO TO THATS-IT.
 118   011000 SIGN-ON-OK.
 119   011100     OPEN INPUT TRANS-IN.
 120   011200 READ-TRAN-IN.
 121   011300     READ TRANS-IN RECORD
 122   011400         AT END GO TO END-OF-JOB.
 123   011500     IF RECORD-CODE = 'HD' OR
 124   011600        RECORD-CODE = 'IT' OR
 125   011700        RECORD-CODE = 'CM'
 126   011800         MOVE 'LKCO' TO REFER
 127   011900     ELSE GO TO INVALID-RECORD.
 128   012000     DISPLAY 'INPUT   RECORD '   ORDER-RECORD.
 129   012100     MOVE ORDER-NUMBERX TO ORDER-NUMBER.
 130   012200 FIND-POSITION.
 131   012300     ENTER ASSEMBLER.
 132   012400     CALL 'DATBAS'   USING READV STAT CORD REFER ORNMLKCO
 133   012500                           ORDER-NUMBER LOCATION-SEGS LINE-CODE ENDP.
 134   012600     MOVE CORD TO DATA-SETS.
 135   012700     MOVE READV TO FUNCT.
 136   012800     IF STAT = 'MRNF'
 137   012900         GO TO ADD-NEW-ORDER-NO.
 138   013000     IF STAT NOT = '****'
 139   013100         GO TO ERROR-ROUTINE.
 140   013200     IF REFER = 'END.'
 141   013300         MOVE 'LKCO' TO REFER
 142   013400         GO TO ADDVC-ROUTINE.
 143   013500     IF LINE-NO IS GREATER THAN LINE-NUMBER
 144   013600         GO TO ADDVB-ROUTINE.
 145   013700     IF LINE-NO = LINE-NUMBER
 146   013800         GO TO CHANGE-THE-LINE.
 147   013900     GO TO FIND-POSITION.
 148   014000 ADDVC-ROUTINE.
 149   014100     ENTER ASSEMBLER.
 150   014200     CALL 'DATBAS'   USING ADDVC STAT CORD REFER ORNMLKCO
```

```
VARIAN DATA V-75 COBOL

 151  014300                              ORDER-NUMBER CORD-SEGS ORDER-RECORD ENDP.
 152  014400      MOVE CORD TO DATA-SETS.
 153  014500      MOVE ADDVC TO FUNCT.
 154  014600      IF STAT NOT = '****'
 155  014700          GO TO ERROR-ROUTINE.
 156  014800      GO TO READ-TRAN-IN.
 157  014900 ADDVB-ROUTINE.
 158  015000      ENTER ASSEMBLER
 159  015100      CALL 'DATBAS'   USING ADDVB STAT CORD REFER ORNMLKCO
 160  015200                          ORDER-NUMBER CORD-SEGS ORDER-RECORD    ENDP.
 161  015300      MOVE CORD TO DATA-SETS.
 162  015400      MOVE ADDVB TO FUNCT.
 163  015500      IF STAT NOT = '****'
 164  015600          GO TO ERROR-ROUTINE.
 165  015700      GO TO READ-TRAN-IN.
 166  015800**
 167  015900 CHANGE-THE-LINE.
 168  016000      IF CODE-NO NOT = RECORD-CODE
 169  016100          GO TO INVALID-LINE-CHANGE.
 170  016200      ENTER ASSEMBLER
 171  016300      CALL 'DATBAS'   USING WRITV STAT CORD REFER ORNMLKCO
 172  016400                          ORDER-NUMBER CORD-SEGS  ORDER-RECORD ENDP.
 173  016500      MOVE CORD TO DATA-SETS.
 174  016600      MOVE WRITV TO FUNCT.
 175  016700      IF STAT NOT = '****'
 176  016800          GO TO ERROR-ROUTINE.
 177  016900      GO TO READ-TRAN-IN.
 178  017000 ADD-NEW-ORDER-NO.
 179  017100      ENTER ASSEMBLER.
 180  017200      CALL 'DATBAS'   USING ADD-M STAT ORNM ORDER-NUMBER
 181  017300                            ORNM-SEGS ORDER-NUMBER ENDP.
 182  017400      MOVE ORNM TO DATA-SETS.
 183  017500      MOVE ADD-M TO FUNCT.
 184  017600      IF STAT NOT = '****'
 185  017700          GO TO ERROR-ROUTINE.
 186  017800      MOVE 'LKCO' TO REFER
 187  017900          GO TO ADDVC-ROUTINE.
 188  018000 ERROR-ROUTINE.
 189  018100      IF STAT = 'MRNF'
 190  018200          GO TO INVALID-RECORD.
 191  018300      DISPLAY 'UNRECOVERABLE ERROR,STAT =-STAT- FUNCT WAS'
 192  018400              FUNCT 'DATA SET WAS' DATA-SETS.
 193  018500      GO TO END-OF-JOB.
```

VARIAN DATA V-75 COBOL

```
194   018600 INVALID-LINE-CHANGE.
195   018700     DISPLAY 'INVALID LINE CHANGE'.
196   018800     DISPLAY 'ORDER NUMBER' ORDER-NUMBER.
197   018900     DISPLAY 'LINE NUMBER' LINE-NUMBER.
198   019000     DISPLAY 'CODES-CODE-NO-' RECORD-CODE.
199   019100     GO TO READ-TRAN-IN.
200   019200 INVALID-RECORD.
201   019300     DISPLAY 'INVALID RECORD ' ORDER-RECORD.
202   019400     GO TO READ-TRAN-IN.
203   019500 END-OF-JOB.
204   019600     CLOSE TRANS-IN.
205   019700 SIGN-OFF-FUNCTIONS.
206   019800     ENTER ASSEMBLER.
207   019900     CALL 'DATBAS'   USING SINOF STAT SCHEMA  ENDP.
208   020000     DISPLAY 'STAT ON SINOF = ' STAT.
209   020100 THATS-IT.
210   020200     STOP RUN.
```

A.9 FORTRAN SAMPLE PROGRAM

A FORTRAN sample program is provided on the following pages.

```
PAGE    1              CMFGSMP   VORTXTI FTN IV

     1          NAME MFGSMP
     2   *
     3   *                  - A SAMPLE PROGRAM TLLUSTRATING THE USE OF
     4   *                    THE  'IOIAL'  DATA BASE MANAGEMENT SYSTEM
     5   *
     6   *                  - IHE PROGRAM PERFORMS VARIOUS MAINTENANCE
     7   *                    AND REIRIEVAL FUNCITONS
     8   *
     9   *                - IHE DATA BASE UTILIZED TS TYPICAL OF A
    10   *                  STMPLE MANUFACIURING ENVIRONMENT
    11   *
    12   *                * PART - PART MASIER DATA SET
    13   *                * BILL - BILL OF MAIERIAL VARIABLE DATA SET
    14   *                * ROUI - ROUTING VARIABLE DATA SEI
    15   *                * WCTR - WORK CENIER MASTER DATA SEI
    16   *
    17   *
    18   *
    19   *                PPPPPPPPPPPP                    BRBRBR
    20   *                P           P   LKBM/ALI     BR       BR
    21   *                P           P---------------R           B
    22   *   PART         P                         R   BILL    B
    23   *                P           P---------------R           B
    24   *                P           P   LKWU/ALI     BR       BR
    25   *                PPPPPPPPPPPP                   BRBRBR
    26   *                     T
    27   *                  I  T  A
    28   *                  K  T  I
    29   *                  P  T  I
    30   *                  T  T
    31   *                     T
    32   *                  RRRRRR                          WWWWWWWWWWW
    33   *               RP        RP                       W         W
    34   *              P             R      LKRT          W         W
    35   *              P   ROUI      R--------------W     WCTR      W
    36   *              P             R     CODE=SR       W         W
    37   *               RP        RP                      W         W
    38   *                  RRRRRR                         WWWWWWWWWWW
    39   *
    40   *
    41   *
    42          EXIERNAL DATBAS
```

```
PAGE    2              CMFGSMP   VORTXTI FTN IV

   43          DIMENSION KSCHEM(37)
   44          DIMENSION CPARTL(7),CBTLLL(7),CWCTRL(5),CROUTL(9)
   45          DIMENSION KPARTA(16),KBTLLA(11),KWCTRA(12),KROUTA(27)
   46          DIMENSION KKEY(5), KFUNC(3), TPATH(2), KCKEY(5), KPKEY(5)
   47          DIMENSION IBREF(10), KIBPRI(5,10), TIBUTY(10)
   48          DIMENSION KXNUM(20), KINUM(20)
   49          DIMENSION KARDX2(40), CARDX4(20)
   50          EQUIVALENCE (KARDX2(1),CARDX4(1))
   51    * * SCHEMA FOR SINUN/SINUF * *
   52          DATA KSCHEM/2HMF,2HGS,2HAM,2HPL,2HMF,2HGD,2HBS,2HUP,2HDA,2HTE,
   53         1                2HNI,2HPA,2HRT,2HPR,2HIV,2HXX,2HXX,
   54         1                     2HWC,2HIR,2HPR,2HIV,2HXX,2HXX,
   55         1                     2HBI,2HLL,2HPR,2HIV,2HXX,2HXX,
   56         1                     2HRU,2HUT,2HPR,2HIV,2HXX,2HXX,
   57         1                     2HFN,2HD./
   58    * * ELEMENT LISTS * *
   59          DATA CPARTL/4HPART,4HCTRL,4HPART,4HDESC,4HPART,4HLLCD,4HEND./
   60          DATA CBTLLL/4HBTLI,4HPARN,4HBTLI,4HCOMP,4HBTLI,4HDTYP,4HEND./
   61          DATA CWCTRL/4HWCTR,4HCTRL,4HWCTR,4HDESC,4HEND./
   62          DATA CROUTL/4HROUT,4HCODE,4HROUT,4HPART,4HROUT,4HSEQN,
   63         1            4HROUT,4HDATA,4HEND./
   64    * * ELEMENT AREAS * *
   65          DATA KPARTA/16*2H  /, KBTLLA/11*2H  /
   66          DATA KWCTRA/12*2H  /, KROUTA/27*2H  /
   67    * * ERROR CODES, CONSTANTS, ETC * *
   68          DATA CENDP/4HEND./,TSTAT/4HXXXX/,TSTAR/4H****/
   69          DATA TFILE/4HFFFF/, IREFR/4HLKXX/, TQUAL/4HREGN/, SREFR/4HLKXX/
   70          DATA CBEGN/4HREGN/, CLKBM/4HLKBM/, CLKWU/4HLKWU/, CLKRT/4HLKRT/
   71          DATA CMRNF/4HMRNF/, CNSMR/4HNSMR/, CDUPM/4HDUPM/, CTMDL/4HIMDI/
   72          DATA CCARD/4HCARD/, CCONS/4HCONS/, CASTR/4H*   /
   73          DATA KAD/2HAD/,KRD/2HRD/,KDL/2HDL/,KWR/2HWR/,KAL/2HAL/
   74          DATA KMD/2HMD/,KSB/2HSB/,KSW/2HSW/,KIR/2HTB/,KIW/2HTW/
   75          DATA KBP/2HBP/,KBW/2HBW/,KSR/2HSR/,KCM/2HCM/
   76          DATA KDV/2HDV/,KC/2HC /,KB/2HB /,KSPAC/2H  /
   77          DATA KKEY/5*2H  /, KFUNC/3*2H  /, IPATH/4HFFFF,4HLKXX/
   78          DATA TBREF/10*4HLKXX/
   79          DATA TIBUTY/10*0/, TQTY/0/, IHLICD/0/
   80          DATA KXNUM/2H01,2H02,2H03,2H04,2H05,2H06,2H07,2H08,2H09,2H10,
   81         1           2H11,2H12,2H13,2H14,2H15,2H16,2H17,2H18,2H19,2H20/
   82          DATA KINUM/1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20/
   83          ITN=4
   84          IOUT=5
```

```
PAGE    3              CMFGSMP    VORTXTI FTN IV

    85          WRITE (TOUT,1)
    86    * * STNON TO TOTAL * *
    87          CALL DATBAS(5HSTNON,TSTAT,KSCHEM,CENDP)
    88          IF (TSTAT.EQ.TSTAR) GO TO 100
    89          WRITE (TOUT,4) TSTAT
    90          WRITE (TOUT,6) KSCHEM
    91    * * STNOF FROM TOTAL * *
    92     90   CONTINUE
    93          CALL DATBAS(5HSTNOF,TSTAT,KSCHEM,CENDP)
    94          IF (TSTAT.EQ.TSTAR) GO TO 91
    95          WRITE (TOUT,5) TSTAT
    96          WRITE (TOUT,6) KSCHEM
    97     91   WRITE (TOUT,2)
    98          STOP
    99    * * INPUT FROM CARDS, OUTPUT TO PRINTER * *
   100     95   ITN=4
   101          IOUT=5
   102          GO TO 100
   103    * * INPUT AND OUTPUT TO CONSOLE * *
   104     96   ITN=3
   105          IOUT=3
   106          GO TO 100
   107    * * ERROR STATUS * *
   108     99   WRITE (TOUT,9) TSTAT
   109    * *
   110    * * READ INPUT TRANSACTION * *
   111    100   READ (ITN,8) KARDX2
   112          WRITE (TOUT,7) KSPAC
   113          WRITE (TOUT,7) KARDX2
   114    * * CHECK FIRST 4 CHARACTERS OF TRANSACTION CODE * *
   115          IF (CARDX4(1).EQ.CPARTL(1)) GO TO 200
   116          IF (CARDX4(1).EQ.CWCIRL(1)) GO TO 400
   117          IF (CARDX4(1).EQ.CBTLIL(1)) GO TO 600
   118          IF (CARDX4(1).EQ.CROUTL(1)) GO TO 800
   119          IF (CARDX4(1).EQ.CENDP)    GO TO 90
   120          IF (CARDX4(1).EQ.CASTR)    GO TO 100
   121          IF (CARDX4(1).EQ.CCARD) GO TO 95
   122          IF (CARDX4(1).EQ.CCONS) GO TO 96
   123    * * INVALID TRANSACTION CODE * *
   124     101  WRITE (TOUT,3)
   125          GO TO 100
   126    * *
```

```
PAGE    4                CMFGSMP   VORTXTI FTN IV

  127   * * *
  128   * * *
  129   * * *
  130   * * *
  131   * * PROCESS 'PART' TRANSACTIONS * *
  132   * * *
  133   * * *
  134   * * *
  135   * * *
  136    200  CONTINUE
  137         DO 201 I=4,8
  138         KKEY(I-3)=KARDX2(I)
  139    201  CONTINUE
  140         IF (KARDX2(3).EQ.KRD) GO TO 210
  141         IF (KARDX2(3).EQ.KAD) GO TO 220
  142         IF (KARDX2(3).EQ.KDL) GO TO 230
  143         IF (KARDX2(3).EQ.KWR) GO TO 240
  144         IF (KARDX2(3).EQ.KAL) GO TO 250
  145         GO TO 101
  146   * * *
  147   * * READ A PART MASTER * *
  148   * * *
  149    210  CONTINUE
  150         CALL DATBAS(5HREADM,ISTAT,CPARTL,KKEY,CPARTI,KPARTA,CFNDP)
  151         IF (ISTAT.EQ.CMRNF) GO TO 1024
  152         IF (ISTAT.NE.TSTAR) GO TO 99
  153         WRITE(IOUT,42) (KPARTA(I),I=1,5),(KPARTA(I),I=6,15),KPARTA(16)
  154         GO TO 100
  155   * * *
  156   * * ADD A PART MASTER * *
  157   * * *
  158    220  CONTINUE
  159         DO 221 I=4,8
  160         KPARTA(I-3)=KARDX2(I)
  161    221  CONTINUE
  162         DO 222 I=9,18
  163         KPARTA(I-3)=KARDX2(I)
  164    222  CONTINUE
  165         KPARTA(16)=1
  166         CALL DATBAS(5HADD-M,ISTAT,CPARTL,KKEY,CPARTI,KPARTA,CFNDP)
  167         IF (ISTAT.EQ.CDUPM) GO TO 1025
  168         IF (ISTAT.NE.TSTAR) GO TO 99
```

```
PAGE    5                CMFGSMP   VORTXTI FTN 4V

  169          GO TO 1021
  170   * * *
  171   * * DELETE A PART MASTER * *
  172   * * *
  173    230   CONTINUE
  174          CALL DATBAS(5HDELM,ISTAT,CPARTL,KKEY,CPARTI,KPARTA,CENDP
  175          IF (ISTAT.EQ.CMRNF) GO TO 1024
  176          IF (ISTAT.EQ.CIMDI) GO TO 1020
  177          IF (ISTAT.NE.TSTAR) GO TO 99
  178          GO TO 1022
  179   * * *
  180   * * UPDATE A PART MASTER * *
  181   * * *
  182    240   CONTINUE
  183          CALL DATBAS(5HKEADM,ISTAT,CPARTL,KKEY,CPARTI,KPARTA,CENDP
  184          IF (ISTAT.EQ.CMRNF) GO TO 1024
  185          IF (ISTAT.NE.TSTAR) GO TO 99
  186          DO 241 I=9,18
  187          KPARTA(I-3)=KARDX2(I)
  188    241   CONTINUE
  189          CALL DATBAS(5HWRITM,ISTAT,CPARTI,KKEY,CPARTI,KPARTA,CENDP
  190          IF (ISTAT.NE.TSTAR) GO TO 99
  191          GO TO 1023
  192   * * *
  193   * * SERIALLY READ ALL PART MASTERS * *
  194   * * *
  195    250   CONTINUE
  196          IQUAL=CBEGN
  197    251   CONTINUE
  198          CALL DATBAS(5HKDNXI,ISTAT,4HPART,IQUAL,CPARTL,KPARTA,CENDP)
  199          IF (ISTAT.NE.TSTAR) GO TO 99
  200          IF (IQUAL.EQ.CENDP) GO TO 100
  201          WRITE(IOUT,42) (KPARTA(I),I=1,5),(KPARTA(I),I=6,15),KPARTA(16)
  202          GO TO 251
  203   * * *
  204   * * *
  205   * * *
  206   * * *
  207   * * *
  208   * * *
  209   * * *
  210   * * *
```

```
PAGE    6                CMFGSMP   VORTXTI FTN IV

   211   * * *
   212   * * *
   213   * * *
   214   * * *
   215   * * PROCESS 'WCTR' TRANSACTIONS * *
   216   * * *
   217   * * *
   218   * * *
   219   * * *
   220    400  CONTINUE
   221         DO 401 I=1,5
   222         KKEY(I-3)=KARDX2(I)
   223    401  CONTINUE
   224         IF (KARDX2(3).EQ.KRD) GO TO 410
   225         IF (KARDX2(3).EQ.KAD) GO TO 420
   226         IF (KARDX2(3).EQ.KDI) GO TO 430
   227         IF (KARDX2(3).EQ.KWR) GO TO 440
   228         IF (KARDX2(3).EQ.KAI) GO TO 450
   229         GO TO 101
   230   * * *
   231   * * READ A WCTR MASTER * *
   232   * * *
   233    410  CONTINUE
   234         CALL DATBAS(5HREADM,ISTAT,CWCTRI,KKEY,CWCTRI,KWCTRA,LFNDP)
   235         IF (ISTAT.EQ.CMRNF) GO TO 1029
   236         IF (ISTAT.NE.TSTAR) GO TO 99
   237         WRITE(IOUT,44) (KWCTRA(I),I=1,2),(KWCTRA(I),I=5,12)
   238         GO TO 100
   239   * * *
   240   * * ADD A WCTR MASTER * *
   241   * * *
   242    420  CONTINUE
   243         DO 421 I=1,5
   244         KWCTRA(I-3)=KARDX2(I)
   245    421  CONTINUE
   246         DO 422 I=6,15
   247         KWCTRA(I-3)=KARDX2(I)
   248    422  CONTINUE
   249         CALL DATBAS(5HADD-M,ISTAT,CWCTRL,KKEY,CWCTRL,KWCTRA,LFNDP)
   250         IF (ISTAT.EQ.CDUPM) GO TO 1030
   251         IF (ISTAT.NE.TSTAR) GO TO 99
   252         GO TO 1026
```

```
PAGE    7              CMFGSMP   VORTXTI FTN IV

   253   * * *
   254   * * DFLFTF A WCTR MASTER * *
   255   * * *
   256    430  CONTINUF
   257         CALI DATBAS(5HDFL-M,ISTAT,CWCTRI,KKFY,CWCTRI,KWCTRA,CFNDP)
   258         IF (ISTAT.EQ.CMRNF) GO TO 1029
   259         IF (ISTAT.EQ.CIMDI) GO TO 1020
   260         IF (ISTAT.NF.TSTAR) GO TO 99
   261         GO TO 1027
   262   * * *
   263   * * UPDATF A WCTR MASTER * *
   264   * * *
   265    440  CONTINUF
   266         CALI DATBAS(5HRFADM,ISTAT,CWCTRL,KKFY,CWCTRI,KWCTRA,CFNDP)
   267         IF (ISTAT.EQ.CMRNF) GO TO 1029
   268         IF (ISTAT.NF.TSTAR) GO TO 99
   269         DO 441 I=5,15
   270         KWCTRA(I-3)=KARDX2(I)
   271    441  CONTINUF
   272         CALI DATBAS(5HWRITM,ISTAT,CWCTRL,KKFY,CWCTRI,KWCTRA,CFNDP)
   273         IF (ISTAT.NF.TSTAR) GO TO 99
   274         GO TO 1028
   275   * * *
   276   * * SFRTAILY READ ALL WCTR MASTERS * *
   277   * * *
   278    450  CONTINUF
   279         IOUAL=CBEGN
   280    451  CONTINUF
   281         CALI DATBAS(5HRDNXT,ISTAT,4HWCTR,IOUAL,CWCTRL,KWCTRA,CFNDP)
   282         IF (ISTAT.NF.TSTAR) GO TO 99
   283         IF (IOUAL.EQ.CFNDP) GO TO 100
   284         WRITE(IOUT,44) (KWCTRA(I),I=1,2),(KWCTRA(I),I=3,12)
   285         GO TO 451
   286   * * *
   287   * * *
   288   * * *
   289   * * *
   290   * * *
   291   * * *
   292   * * *
   293   * * *
   294   * * *
```

```
PAGE    8                CMFGSMP    VORTXTI FTN IV

   295   * * *
   296   * * *
   297   * * *
   298   * * *
   299   * * PROCESS 'BILL' TRANSACTIONS * *
   300   * * *
   301   * * *
   302   * * *
   303   * * *
   304    600   CONTINUE
   305          DO 601 I=4,8
   306          KKEY(I-3)=KARDX2(I)
   307    601   CONTINUE
   308          IREFR=CLKRM
   309          IF (KARDX2(3).EQ.KAD) GO TO 620
   310          IF (KARDX2(3).EQ.KDI) GO TO 630
   311          IF (KARDX2(3).EQ.KWR) GO TO 640
   312          IF (KARDX2(3).EQ.KAL) GO TO 650
   313          IF (KARDX2(3).EQ.KMD) GO TO 660
   314          IF (KARDX2(3).EQ.KSR) GO TO 670
   315          IF (KARDX2(3).EQ.KSW) GO TO 680
   316          IF (KARDX2(3).EQ.KIR) GO TO 710
   317          IF (KARDX2(3).EQ.KIW) GO TO 720
   318          GO TO 101
   319   * * *
   320   * * ADD A BILL OF MATERIAL VARIABLE * *
   321   * * *
   322    620   CONTINUE
   323          IREFR=CLKRM
   324    621   CONTINUE
   325          CALL DATBAS(SHREADV,ISTAT,CBILLI,IREFR,RHPART1KRM,KKEY,
   326         1                CBILLI,KBILLA,CENDP)
   327          IF (ISTAT.EQ.CMRNF) GO TO 1024
   328          IF (ISTAT.NE.ISTAR) GO TO 99
   329          IF (IREFR.EQ.CENDP) GO TO 625
   330          DO 622 I=9,15
   331          IF (KBILLA(I-3).NE.KARDX2(1)) GO TO 621
   332    622   CONTINUE
   333          GO TO 1055
   334    623   CONTINUE
   335          DO 624 I=4,8
   336          KBILLA(I-3)=KARDX2(I)
```

```
      KBILLA(I+2)=KARDX2(I+5)
624   CONTINUE
      KBILLA(11)=1
      DO 625 I=1,20
      IF (KARDX2(14).EQ.KYNUM(I)) KBILLA(11)=KINUM(I)
625   CONTINUE
      IREFR=CIKRM
      CALL DATBAS(SHADDVC,ISTAT,CBILLI,IREFR,RHPARTLKRM,KKEY,
     1                 CBILLI,KBTLLA,CENDP)
      IF (ISTAT.EQ.CMRNF) GO TO 1024
      IF (ISTAT.NE.TSTAR) GO TO 99
      GO TO 1031
* * *
* * DELETE A BILL OF MATERIAL VARIABLE * *
* * *
630   CONTINUE
      IREFR=CIKRM
631   CONTINUE
      CALL DATBAS(SHREADV,ISTAT,CBILLI,IREFR,RHPARTLKRM,KKEY,
     1                 CBILLI,KBTLLA,CENDP)
      IF (ISTAT.EQ.CMRNF) GO TO 1024
      IF (ISTAT.NE.TSTAR) GO TO 99
      IF (IREFR.EQ.CENDP) GO TO 1034
      DO 632 I=9,13
      IF (KBILLA(I-3).NE.KARDX2(I)) GO TO 631
632   CONTINUE
      CALL DATBAS(SHDELVD,ISTAT,CBILLI,IREFR,RHPARTLKRM,KKEY,
     1                 CBILLI,KBTLLA,CENDP)
      IF (ISTAT.NE.TSTAR) GO TO 99
      GO TO 1032
* * *
* * UPDATE A BILL OF MATERIAL VARIABLE * *
* * *
640   CONTINUE
      IREFR=CIKRM
641   CONTINUE
      CALL DATBAS(SHREADV,ISTAT,CBILLI,IREFR,RHPARTLKRM,KKEY,
     1                 CBILLI,KBTLLA,CENDP)
      IF (ISTAT.EQ.CMRNF) GO TO 1024
      IF (ISTAT.NE.TSTAR) GO TO 99
      IF (IREFR.EQ.CENDP) GO TO 1034
      DO 642 I=9,13
```

```
PAGE   10              CMFGSMP    VORTXTI FTN IV

 379          IF (KBILLA(I-3).NE.KARDX2(1)) GO TO 641
 380    642   CONTINUE
 381          KBILLA(11)=1
 382          DO 643 I=1,10
 383          IF (KARDX2(14).EQ.KXNUM(I)) KBILLA(11)=KINUM(I)
 384    643   CONTINUE
 385          CALL DATBAS(5HWPITV,ISTAT,CBILLL,TREFR,8HPARTLKBM,KKEY,
 386         1                 CBILLL,KBTLLA,CENDP)
 387          IF (ISTAT.NE.TSTAR) GO TO 99
 388          GO TO 1033
 389    * * *
 390    * * SERIALLY READ ALL BTLI VARIABLES * *
 391    * * *
 392     650  CONTINUE
 393          IOUAL=CBEGN
 394     651  CONTINUE
 395          CALL DATBAS(5HRDNXT,ISTAT,4HBTLI,TWHAT,CBTLLL,KBILLA,CENDP)
 396          IF (ISTAT.NE.TSTAR) GO TO 99
 397          IF (IOUAL.EQ.CENDP) GO TO 100
 398          WRITE(IOUT,46) (KBILLA(I),I=1,5),(KBILLA(I),I=6,10),KBILLA(11)
 399          GO TO 651
 400    * * *
 401    * * DELETE ALL BILL OF MATERIAL VARIABLES FOR A PART * *
 402    * * *
 403     660  CONTINUE
 404          IREFR=CIKBM
 405     661  CONTINUE
 406          CALL DATBAS(5HREADV,ISTAT,CBILLL,TREFR,8HPARTLKBM,KKEY,
 407         1                 CBILLL,KBTLIA,CENDP)
 408          IF (ISTAT.EQ.CMRNF) GO TO 1024
 409          IF (ISTAT.NE.TSTAR) GO TO 99
 410          IF (IREFR.EQ.CENDP) GO TO 1032
 411          CALL DATBAS(5HDELVD,ISTAT,CBILLI,TREFR,8HPARTLKBM,KKEY,
 412         1                 CBILLI,KBTLLA,CENDP)
 413          IF (ISTAT.NE.TSTAR) GO TO 99
 414          GO TO 661
 415    * * *
 416    * * READ A SINGLE LEVEL BTLI OF MATERIAL * *
 417    * * *
 418     670  CONTINUE
 419          IREFR=CIKBM
 420          IPATH(1)=CPARTL(1)
```

```
PAGE   11              CMFGSMP   VORTXII FTN IV

  421          IPATH(2)=CLKBM
  422    675   CONTINUE
  423          CALL DATBAS(SHREADV,ISTAT,CBILLL,TREFR,TPATH,KKEY,
  424         1                CBILLI,KBTLLA,CENDP)
  425          IF (ISTAT.EQ.CMRNF) GO TO 1024
  426          IF (ISTAT.NE.TSTAR) GO TO 99
  427          IF (IREFR.EQ.CENDP) GO TO 100
  428          WRITE(IOUT,46) (KBILLA(I),I=1,5),(KBILLA(I),I=6,10),KBILLA(11)
  429          GO TO 675
  430   * * *
  431   * * READ A SINGLE LEVEL WHERE USED LIST * *
  432   * * *
  433    680   CONTINUE
  434          IREFR=CLKWU
  435          IPATH(1)=CPARTL(1)
  436          IPATH(2)=CLKWU
  437          GO TO 675
  438   * * *
  439   * * READ AN INDENTED BILL OF MATERIAL * *
  440   * * *
  441    710   CONTINUE
  442          SREFR=CLKBM
  443          IPATH(1)=CPARTL(1)
  444          IPATH(2)=CLKBM
  445          J=6
  446          K=10
  447          GO TO 730
  448   * * *
  449   * * READ AN INDENTED WHERE USED * *
  450   * * *
  451    720   CONTINUE
  452          SREFR=CLKWU
  453          IPATH(1)=CPARTL(1)
  454          IPATH(2)=CLKWU
  455          J=1
  456          K=5
  457    730   CONTINUE
  458          LEVL=1
  459          IQTY=1
  460          CALL DATBAS(SHREADM,ISTAT,CPARTL,KKEY,CPARTI,KPARTA,CENDP)
  461          IF (ISTAT.EQ.CMRNF) GO TO 1024
  462          IF (ISTAT.NE.TSTAR) GO TO 99
```

```
PAGE   12              CMPGSMP   VORTXTI FTN IV

   463          WRITE(IOUT,42) (KPARIA(I),I=1,5),(KPARIA(I),I=6,15),KPARIA(16)
   464          IREFR=SREFR
   465    734   CONTINUE
   466          CALL DATBAS(5HRFADV,ISTAT,CRILLL,IREFR,IPATH,KKEY,
   467         1                  CRILLL,KBTLIA,CENDP)
   468          IF (ISTAT.NE.ISTAR) GO TO 99
   469          IF (IREFR.EQ.CENDP) GO TO 750
   470    736   CONTINUE
   471          IBREF(LEVL)=IREFR
   472          ITBQTY(LEVL)=TQTY
   473          DO 738 I=1,5
   474          KTBPRT(I,LEVL)=KKEY(I)
   475    738   CONTINUE
   476          L=0
   477          DO 740 I=1,K
   478          L=L+1
   479          KKEY(L)=KBILLA(I)
   480    740   CONTINUE
   481          CALL DATBAS(5HRFADM,ISTAT,CPARTL,KKEY,CPARTL,KPARTA,CENDP)
   482          IF (ISTAT.NE.ISTAR) GO TO 99
   483          IQTY=KBTLIA(11)*ITBQTY(LEVL)
   484          WRITE (IOUT,55) LEVL,TQTY
   485          WRITE(IOUT,42) (KPARIA(I),I=1,5),(KPARIA(I),I=6,15),KPARIA(16)
   486          IREFR=SREFR
   487          CALL DATBAS(5HRFADV,ISTAT,CRILLL,IREFR,IPATH,KKEY,
   488         1                  CRILLL,KBTLIA,CENDP)
   489          IF (ISTAT.NE.ISTAR) GO TO 99
   490          IF (IREFR.EQ.CENDP) GO TO 754
   491          LEVL=LEVL+1
   492          IF (LEVL.GT.10) GO TO 1056
   493          GO TO 736
   494    750   CONTINUE
   495          IF (LEVL.EQ.1) GO TO 100
   496          LEVL=LEVL-1
   497    754   CONTINUE
   498          IREFR=IBREF(LEVL)
   499          IQTY=ITBQTY(LEVL)
   500          DO 756 I=1,5
   501          KKEY(I)=KTBPRT(I,LEVL)
   502    756   CONTINUE
   503          GO TO 734
   504    * * *
```

```
PAGE   13              CMFGSMP   VORTXTI FTN IV

  505   * * *
  506   * * *
  507   * * *
  508   * * *
  509   * * PROCESS 'ROUT' TRANSACTIONS * *
  510   * * *
  511   * * *
  512   * * *
  513   * * *
  514    800  CONTINUE
  515         DO 801 I=4,8
  516         KKEY(I-3)=KARDX2(I)
  517    801  CONTINUE
  518         TREFR=CLKRT
  519         IF (KARDX2(3).EQ.KAD) GO TO 820
  520         IF (KARDX2(3).EQ.KDL) GO TO 830
  521         IF (KARDX2(3).EQ.KWR) GO TO 840
  522         IF (KARDX2(3).EQ.KAI) GO TO 850
  523         IF (KARDX2(3).EQ.KBP) GO TO 870
  524         IF (KARDX2(3).EQ.KBW) GO TO 880
  525         GO TO 101
  526   * * *
  527   * * ADD A ROUTING VARIABLE * *
  528   * * *
  529    820  CONTINUE
  530         TREFR=CLKRT
  531    821  CONTINUE
  532         CALL DATBAS(5HREADV,ISTAT,CROUTE,TREFR,8HPARTLKRT,KKEY,
  533        1                 CROUTE,KROUTA,CENDP)
  534         IF (ISTAT.EQ.CMRNF) GO TO 1024
  535         IF (ISTAT.NE.TSTAR) GO TO 99
  536         IF (TREFR.EQ.CENDP) GO TO 823
  537         IF (KROUTA(7).LT.KARDX2(9)) GO TO 821
  538         IF (KROUTA(7).GT.KARDX2(9)) GO TO 822
  539         GO TO 1040
  540    822  CONTINUE
  541         KFUNC(3)=KB
  542         GO TO 824
  543    823  CONTINUE
  544         KFUNC(3)=KC
  545         TREFR=CLKRT
  546    824  CONTINUE
```

```
PAGE   14                    CMFGSMP    VORTXTI FTN IV

  547           DO 825 I=4,8
  548           KROUTA(I-2)=KARDX2(I)
  549    825    CONTINUE
  550           KROUTA(7)=KARDX2(9)
  551           IF (KARDX2(10).EQ.KSPAC) GO TO 827
  552           KROUTA(1)=KSR
  553           KROUTA(8)=KARDX2(10)
  554           KROUTA(9)=KARDX2(11)
  555           DO 826 I=12,23
  556           KROUTA(I-2)=KARDX2(I)
  557    826    CONTINUE
  558    829    KFUNC(2)=KDV
  559           KFUNC(1)=KAD
  560           CALL DATBAS( KFUNC,ISTAT,CROUTI,TREFR,BHPARTI KRI,KKEY,
  561          1                 CROUTI,KROUTA,CENDP)
  562           IF (ISTAT.EQ.CMRNF) GO TO 1029
  563           IF (ISTAT.NE.TSTAR) GO TO 99
  564           GO TO 1036
  565    827    CONTINUE
  566           KROUTA(1)=KCM
  567           DO 828 I=12,31
  568           KROUTA(I-4)=KARDX2(I)
  569    828    CONTINUE
  570           GO TO 829
  571   * * *
  572   * * DEFEIF A ROUTING VARIABLE * *
  573   * * *
  574    830    CONTINUE
  575           IREFR=LIKRI
  576    831    CONTINUE
  577           CALL DATBAS(5HREADV,ISTAT,CROUTI,TREFR,BHPARTI KRI,KKEY,
  578          1                 CROUTI,KROUTA,CENDP)
  579           IF (ISTAT.EQ.CMRNF) GO TO 1024
  580           IF (ISTAT.NE.TSTAR) GO TO 99
  581           IF (IREFR.EQ.CENDP) GO TO 1039
  582           IF (KROUTA(7).NE.KARDY2(9)) GO TO 831
  583    832    CONTINUE
  584           CALL DATBAS(5HDELVD,ISTAT,CROUTI,TREFR,BHPARTI KRI,KKEY,
  585          1                 CROUTI,KROUTA,CENDP)
  586           IF (ISTAT.NE.TSTAR) GO TO 99
  587           GO TO 1037
  588   * * *
```

```
589   * * UPDATE A ROUTING VARIABLE * *
590   * * *
591    840  CONTINUE
592         TREFR=CLKRT
593    841  CONTINUE
594         CALL DATBAS(5HREADV,ISTAT,CROUTL,TREFR,8HPARTLKRT,KKEY,
595        1            CROUTL,KROUTA,CENDP)
596         IF (ISTAT.EQ.CMRNF) GO TO 1024
597         IF (ISTAT.NE.TSTAR) GO TO 99
598         IF (KROUTA(1).EQ.KSR) GO TO 843
599         DO 842 I=12,31
600         KROUTA(I-4)=KARDX2(I)
601   842   CONTINUE
602         CALL DATBAS(5HWRITV,ISTAT,CROUTL,TREFR,8HPARTLKRT,KKEY,
603        1            CROUTL,KROUTA,CENDP)
604         IF (ISTAT.NE.TSTAR) GO TO 99
605         GO TO 1038
606   843   DO 844 I=12,23
607         KROUTA(I-2)=KARDX2(I)
608   844   CONTINUE
609         GO TO 842
610   * * *
611   * * SEQTALLY READ ALL ROUT VARIABLES * *
612   * * *
613    850  CONTINUE
614         IQUAL=CBEGN
615    851  CONTINUE
616         DO 852 I=8,27
617         KROUTA(I)=KSPAC
618   852   CONTINUE
619         CALL DATBAS(5HRDNXT,ISTAT,4HROUT,IQUAL,CROUTL,KROUTA,CENDP)
620         IF (ISTAT.NE.TSTAR) GO TO 99
621         IF (IQUAL.EQ.CENDP) GO TO 100
622         WRITE(IOUT,48) KROUTA(1),(KROUTA(I),I=2,6),KROUTA(7),
623        1               (KROUTA(I),I=8,27)
624         GO TO 851
625   * * *
626   * * READ ALL ROUTINGS FOR A PART * *
627   * * *
628    870  CONTINUE
629         TREFR=CLKRT
630         IPATH(1)=CPARTL(1)
```

```
PAGE   16              CMFGSMP   VORTXTI FTN IV

   631          IPATH(2)=CLKRT
   632   * * *
   633    875   CONTINUE
   634          DO 876 I=8,27
   635          KROUTA(I)=KSPAC
   636    876   CONTINUE
   637          CALL DATBAS(SHREADV,ISTAT,CROUTL,TREFR,TPATH,KKEY,
   638         1                  CROUTI,KROUTA,CENDP)
   639          IF (ISTAT.EQ.CMRNF) GO TO 877
   640          IF (ISTAT.NE.TSTAR) GO TO 99
   641          IF (IREFR.LO.CENDP) GO TO 100
   642          WRITE(IOUT,48) KROUTA(1),(KROUTA(I),I=2,6),KROUTA(7),
   643         1                  (KROUTA(I),I=8,27)
   644          GO TO 875
   645    877   CONTINUE
   646          IF (IPATH(1).EQ.CPARTI(1)) GO TO 1024
   647          GO TO 1029
   648   * * *
   649   * * READ ALL ROUTINGS FOR A WCTR * *
   650   * * *
   651    880   CONTINUE
   652          IREFR=CLKRT
   653          IPATH(1)=CWCTRL(1)
   654          IPATH(2)=CLKRT
   655          GO TO 875
   656   * * *
   657   * * *
   658   * * *
   659   * * *
   660   * * *
   661   * * *
   662   * * *
   663   * * *
   664   * * *
   665   * * *
   666   * * *
   667   * * *
   668   * * *
   669   * * *
   670   * * *
   671   * * *
   672   * * *
```

```
PAGE   17              CMFGSMP   VORTXII FTN IV

  673   * * *
  674   * * *
  675   * * LOW LEVEL CODE UPDATE ROUTINE * *
  676   * * *
  677   * * *
  678   * * *
  679   * * *
  680    1200 DO 1202 I=1,5
  681         KKEY(I)=KBILLA(I)
  682         KPKEY(I)=KBILLA(I)
  683   1202 CONTINUE
  684         CALL DATBAS(SHREADM,ISTAT,CPARIL,KKEY,CPARTL,KPARTA,CENDP)
  685         IF (ISTAT.NE.TSTAR) GO TO 99
  686         IHLLCD=KPARTA(16)
  687         IHLLCD=IHLLCD+1
  688         DO 1204 I=1,5
  689         KKEY(I)=KBILLA(I+5)
  690         KPKEY(I)=KBILLA(I+5)
  691   1204 CONTINUE
  692         CALL DATBAS(SHREADM,ISTAT,CPARIL,KKEY,CPARTL,KPARTA,CENDP)
  693         IF (ISTAT.NE.TSTAR) GO TO 99
  694         IF (KPARTA(16).LT.IHLLCD) GO TO 1206
  695         GO TO 1210
  696   1206 KPARTA(16)=IHLLCD
  697         CALL DATBAS(SHWRITM,ISTAT,CPARIL,KKEY,CPARIL,KPARTA,CENDP)
  698         IF (ISTAT.NE.TSTAR) GO TO 99
  699         LEVL=1
  700         TREFR=CLKBM
  701         IPATH(1)=CPARTL(1)
  702         IPATH(2)=CLKBM
  703   1210 CONTINUE
  704         CALL DATBAS(SHREADV,ISTAT,CBILLL,TREFR,TPATH,KKEY,
  705        1                  CBILLI,KBILLA,CENDP)
  706         IF (ISTAT.NE.TSTAR) GO TO 99
  707         IF (TREFR.EQ.CENDP) GO TO 1240
  708   1220 DO 1222 I=1,5
  709         IF (KPKEY(I).NE.KBILLA(I+5)) GO TO 1224
  710   1222 CONTINUE
  711         GO TO 1260
  712   1224 TREFF(LEVL)=TREFR
  713         ITBOTY(LEVL)=IHLLCD
  714         DO 1226 I=1,5
```

```
PAGE   18              CMFGSMP   VORTXTI FTN IV

  715          KTBPRT(T,LEVL)=KKEY(I)
  716    1226  CONTINUE
  717          DO 1228 I=1,5
  718          KKEY(T)=KBILLA(T+5)
  719    1228  CONTINUE
  720          IHLICD=IHLICD+1
  721          CALL DATBAS(5HREADM,ISTAT,CPARTL,KKEY,CPARTL,KPARTA,CENDP)
  722          IF (ISTAT.NE.TSTAR) GO TO 99
  723          IF (KPARTA(16).LT.IHLICD) GO TO 1230
  724          GO TO 1250
  725    1230  KPARTA(16)=IHLICD
  726          CALL DATBAS(5HWRITM,ISTAT,CPARTL,KKEY,CPARTL,KPARTA,CENDP)
  727          IF (ISTAT.NE.TSTAR) GO TO 99
  728          TREFR=CLKBM
  729          CALL DATBAS(5HREADV,ISTAT,CBILLL,TREFR,TPATH,KKEY,
  730         1                  CBILLL,KBILLA,CENDP)
  731          IF (ISTAT.NE.TSTAR) GO TO 99
  732          IF (TREFR.EQ.CENDP) GO TO 1250
  733          LEVL=LEVL+1
  734          IF (LEVL.GT.10) GO TO 1056
  735          GO TO 1220
  736    1240  IF (LEVL.EQ.1) GO TO 1270
  737          LEVL=LEVL-1
  738    1250  TREFR=TBREF(LEVL)
  739          IHLICD=TIBUTY(LEVL)
  740          DO 1252 I=1,5
  741          KKEY(T)=KTBPRT(T,LEVL)
  742    1252  CONTINUE
  743          GO TO 1210
  744    1260  CONTINUE
  745          CALL DATBAS(5HDELVD,ISTAT,CBILLL,TREFR,TPATH,KKEY,
  746         1                  CBILLL,KBILLA,CENDP)
  747          IF (ISTAT.NE.TSTAR) GO TO 99
  748          WRITE (TOUT,53)
  749          DO 1262 I=1,5
  750          KCKEY(I)=KSPAC
  751    1262  CONTINUE
  752          GO TO 1210
  753    1270  GO TO 2062
  754     * * *
  755     * * *
  756     * * *
```

```
PAGE    19              CMFGSMP    VORTXTI FTN IV

   757   * * *
   758   * * *
   759   * * MISC MESSAGES * *
   760   * * *
   761   * * *
   762   * * *
   763   * * *
   764    1     FORMAT(16H  *START MFGSAMP)
   765    2     FORMAT(16H  *E O J MFGSAMP)
   766    3     FORMAT(20H  ** INVALID REQUEST)
   767    4     FORMAT(18H  ** SINUN ERROR  ,A4)
   768    5     FORMAT(18H  ** SINUF ERROR  ,A4)
   769    6     FORMAT(2H   ,37A2)
   770    7     FORMAT(2H   ,40A2)
   771    8     FORMAT(40A2)
   772    9     FORMAT(18H  ** ERROR STATUS  ,A4)
   773  * * *
   774   20    FORMAT(18H  *INVALID DELETE )
   775   1020  WRITE (IOUT,20)
   776         GO TO 100
   777   21    FORMAT(18H  *PART ADDED     )
   778   1021  WRITE (IOUT,21)
   779         GO TO 100
   780   22    FORMAT(18H  *PART DELETED   )
   781   1022  WRITE (IOUT,22)
   782         GO TO 100
   783   23    FORMAT(18H  *PART UPDATED   )
   784   1023  WRITE (IOUT,23)
   785         GO TO 100
   786   24    FORMAT(18H  *PART NOT FOUND )
   787   1024  WRITE (IOUT,24)
   788         GO TO 100
   789   25    FORMAT(18H  *DUPLICATE PART )
   790   1025  WRITE (IOUT,25)
   791         GO TO 100
   792   26    FORMAT(18H  *WCTR ADDED     )
   793   1026  WRITE (IOUT,26)
   794         GO TO 100
   795   27    FORMAT(18H  *WCTR DELETED   )
   796   1027  WRITE (IOUT,27)
   797         GO TO 100
   798   28    FORMAT(18H  *WCTR UPDATED   )
```

```
PAGE   20                CMFGSMP   VORTXTI FTN IV

   799    1028 WRITE (TUNIT,28)
   800         GO TO 100
   801    28   FORMAT(16H  *WCTR NOT FOUND )
   802    1029 WRITE (TUNIT,29)
   803         GO TO 100
   804    30   FORMAT(18H  *DUPLICATE WCTR )
   805    1030 WRITE (TUNIT,30)
   806         GO TO 100
   807    31   FORMAT(18H  *BILL ADDED     )
   808    1031 WRITE (TUNIT,31)
   809         GO TO 1200
   810    2062 CONTINUE
   811         GO TO 100
   812    32   FORMAT(18H  *BILL DELETED   )
   813    1032 WRITE (TUNIT,32)
   814         GO TO 100
   815    33   FORMAT(18H  *BILL UPDATED   )
   816    1033 WRITE (TUNIT,33)
   817         GO TO 100
   818    34   FORMAT(18H  *BILL NOT FOUND )
   819    1034 WRITE (TUNIT,34)
   820         GO TO 100
   821    35   FORMAT(18H  *DUPLICATE BILL )
   822    1035 WRITE (TUNIT,35)
   823         GO TO 100
   824    36   FORMAT(18H  *RUN1 ADDED     )
   825    1036 WRITE (TUNIT,36)
   826         GO TO 100
   827    37   FORMAT(18H  *RUN1 DELETED   )
   828    1037 WRITE (TUNIT,37)
   829         GO TO 100
   830    38   FORMAT(18H  *RUN1 UPDATED   )
   831    1038 WRITE (TUNIT,38)
   832         GO TO 100
   833    39   FORMAT(18H  *RUN1 NOT FOUND )
   834    1039 WRITE (TUNIT,39)
   835         GO TO 100
   836    40   FORMAT(18H  *DUPLICATE RUN1 )
   837    1040 WRITE (TUNIT,40)
   838         GO TO 100
   839  * * *
   840    42   FORMAT(10H    PART= ,5A2,8H  DESC= ,10A2,8H  ILCD= ,I2)
```

```
PAGE    21              CMFGSMP    VORTXTI FTN IV

   841   * * *
   842    44    FORMAT(10H     WCIR= ,2A2,8H  DESC= ,10A2)
   843   * * *
   844    46    FORMAT(10H     PARN= ,5A2,8H  COMP= ,5A2,8H  QTYP= ,T2)
   845   * * *
   846    48    FORMAT(10H     CODE= ,A2,8H  PART= ,5A2,8H  SEQN= ,
   847         1          A2,8H  DATA= ,20A2)
   848   * * *
   849    56    FORMAT (22H  ** LEVEL TABLE FULL )
   850    1056  WRITE (TOUT,56)
   851          GO TO 100
   852   * * *
   853    55    FORMAT (8H  *LEVL=,T2,6H  QTY=,T4)
   854   * * *
   855    53    FORMAT (38H  ** CONTINUITY ERROR, RECORD DELETED )
   856   * * *
   857          END
ENTRY/COMMON BLOCK NAMES
   013264 R MFGSMP
EXTERNAL NAMES
   011643 E DATRAS
   013114 E     $WR
   000000 E V$REAR
   000000 E V$REAI
   000000 E V$REAN
   013120 E     $ND
   011662 E     $WI
   001025 E     $I3
   010430 E     $I1
   001736 E     $ST
   001035 E     $KD
   011722 E     $DO
SYMBOL TABLE
   013201 R 000001
   013221 R 000002
   013241 R 000004
   011643 E DATRAS
   000002 R KSCHEM
   000011 R LPARTI
   000065 R LBILLI
   000103 R LWLTKI
   013171 R 000005
```

APPENDIX B
DIAGNOSTICS/STATUS CODES

B.1 DATA BASE GENERATION

The DBGEN program, while analyzing DBDL statements, may determine various error conditions which would lead to an erroneous Data Base Descriptor module. If this should occur, appropriate messages will be printed along with the DBDL statement listing and the output of source statements will be suppressed. Certain error conditions will cause immediate termination of the DBGEN program, while other conditions allow further processing of the DBDL input. All output messages are output to LO logical unit.

The message: MISSING STATEMENT:

Followed by a DBDL statement, will cause immediate termination of the DBGEN run. Correct the error and resubmit.

The message: BYPASSING FILE:

Followed by an indicative message, will cause the DBGEN to ignore the remainder of the statements for that file, but will continue processing with the next file definition. Output is suppressed. Correct the error and resubmit.

The message: STATEMENT IGNORED:

Indicates the current DBDL statement has been ignored by DBGEN, usually because of a prior error condition. Correct the prior and resubmit.

The following messages are among those used in combination with BYPASSING FILE: and are indicative of the error condition. Each message is following by a description.

DUPLICATE NAME

The same name has been used for more than one data set, I/O area, data element, or linkage path.

I/O AREA NOT DEFINED

The I/O area named for a data set has not been previously defined in the prologue.

NO I/O AREAS DEFINED

Between SHARE-IO and END-IO, there are no I/O areas.

CODE=2 MUST BE FIRST ENTRY

The VVVVCODE=2 ENTRY when specified must be the first element in the variable file definition following BASE-DATA.

DATA BASE TOO LARGE

Indicates there is not enough storage available for DBGEN's internal tables.

EXCEEDS MAX PARTITION SECTORS

A drive statement entry specified a number of sectors in excess of the maximum partition size.

DRIVE TABLE FULL

The maximum number of drive statements permissable for a file was exceeded.

NO DRIVE STATEMENT

All files must have at least one drive statement.

RECORDS/SECTOR ERROR

The logical record length specified or calculated is not a multiple of VORTEX sector size.

SECTORS/RECORD ERROR

The logical record length specified is not a multiple of VORTEX sectors.

SECTOR NUMBER ERROR

The number of sectors specified on drive statements is less than required to accomodate TOTAL records in the file.

NO DASMR OUTPUT

No output of DASMR source resulted because either "OPTIONS-OUTPUT=N" has been specified, or an error was encountered in processing files.

INVALID STATEMENT

An unrecognized statement or statement has appeared in an illogical order.

NUMERIC FORMAT ERROR

An expected numeric field contains invalid characters or an invalid delimiter.

INVALID ELEMENT NAME

An element name does not begin with the data set name or otherwise contains invalid characters.

ELEMENT LENGTH ERROR

The length of sub-elements is greater than the length of a parent element.

RECORD CODE INVALID

The record-code entry is invalid at this point or the record-code itself is invalid (**).

NO VVVVCODE=2 ENTRY

The record-code entry is invalid unless a prior definition has been made for vvvvcode=2.

MASTER LINK MISSING

The linkage path specified in a variable entry definition was not previously defined in a master file.

LINK FIELD MISSING

The element specified as a variable entry control field was not previously defined.

```
MMMMLKXX=8
MMMMROOT=8
MMMMCTRL=
VVVVCODE=2
```

The statement contains an improper character, delimiter, or length.

B.2 DATA BASE FORMAT STATUS CODES

The DBFMT program provides printed output describing the results of processing each file. A list of possible messages follows:

bFORMAT dbname FILE1, FILE2,...,FILEn

The above line displays the parameter card requesting the format function. 'b' in the first column represents a blank space.

MMMM FILE FORMATTED AND CLOSED

NNN TOTAL SECTORS WRITTEN

The above lines indicate formatting of the requested data set has been successfully completed. MMMM is the name of a TOTAL file.

MMMM NOT FOUND IN FILE TABLE

The above line indicates the requested data set cannot be found in the DBMOD. MMMM is the name of a TOTAL file.

INVALID FORMAT STATEMENT

The above message indicates the requested parameter card is in error.

INVALID DESCRIPTOR

---- NOT FORMATTED

The above lines indicate the requested DBMOD is not valid.

```
'FFFFTB LN CREATE IO ERROR'
'FFFFTB LN OPEN IO ERROR'
'FFFFTB LN WRITE TO ERROR'
'FFFFTB LN RETRY TIME OUT'
'FFFFTB LN DIRECTORY STRUCTURE ERROR'
'FFFFTB LN INSUFFICIENT SPACE'
```

where FFFF is the TOTAL file name

TB is the FCB tie breaker number assigned when DBMOD was built

LN is the logical unit number of the VORTEX TOTAL file

The preceding messages indicate I/O errors, clock errors, directory structure errors, and file creation errors.

```
END DATA BASE FORMAT
```

The above line is the normal end of job message.

B.3 DML COMMAND DIAGNOSTIC STATUS CODES

All DML messages are listed in table B-1.

B.3.1 Status Code Testing

After execution of any DML Command, a status code will be moved to the user's status field to indicate the result of the operation, such as:

a. Successful completion of the operation.

b. Command failure because of:

1. An incorrect command parameter.

2. A violation of conditions (e.g., an attempt to update a locked data-set).

3. A redundant command (e.g., Sign-On of an active task).

It is up to the user program to test the status field after each DML command and to take appropriate action. If the command failed, the program should be terminated and the problem corrected. If the status code indicates some special condition other than failure, the problem program should include logic to handle and rectify the situation.

Table B-1. DML Diagnostic Messages

Status Code \ DML Command	ADD-M	ADDVA	ADDVB	ADDVC	DEL-M	DELVD	RDNXT	READD	READM	READR	READV	RQLOC	SINOF	SINON	WRITM	WRITV	MARKL	WRITD	QUIET	STATUS CODE DEFINITION
1. BCTL	X	X	X	X	X				X	X	X	X			X					Blank (or zero) control field
2. DUPM	X																			Duplicate Master Record
3. DUPO														X						Duplicate Open
4. ENTF	X	X	X	X			X	X	X	X	X				X	X				Element (data field) not found
5. EXSO														X						Extra SINON
6. FATL		X	X	X						X	X									Internal Core damage - fatal condition
7. FNOP	X	X	X	X	X	X	X	X	X	X	X				X	X				File not open
8. FNTF	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				File not found
9. FTYP	X	X	X	X	X	X			X	X	X	X			X	X				Invalid file type
10. FULL	X	X	X	X																File is full
11. FUNC	◄——— SNAPDUMP/EXIT ———►																X	X	X	Function error
12. IDBM	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X				Invalid Data Base Module
13. IMDL					X															Invalid Master Delete
14. IOER	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X				I/O Error
15. IPAR	◄——— SNAPDUMP/EXIT ———►																			Invalid Parameter
16. IRLC	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X				Invalid Record Location
17. IVEL		X	X	X			X	X		X	X					X				Invalid Element
18. IVRC		X	X	X				X		X	X					X				Invalid Record Code
19. IVRP		X	X	X		X	X	X		X	X					X				Invalid Reference Parameter
20. IVTF														X						Invalid Total File
21. LOAD													X	X						File above load point
22. LOCK														X						File is locked by another task
23. MLNF		X	X	X						X	X									Master Linkage Path not found
24. MRNF		X	X	X	X	X			X	X	X				X					Master Record not found
25. NOSO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				No previous SINON
26. UACM														X						Undefined ACCESS MODE
27. UCTL	X																			Unequal control field
28. ULGO														X						Undefined Logging Option
29. UPDE	X	X	X	X	X	X									X	X				Update error

NOTES:

1. An X means the corresponding command will respond to the corresponding status code.
2. MARKL, WRITD, and QUIET are not implemented.

The status code field is defined by the user and named in the command parameter list. Normally, it is a 4-byte alphanumeric field.

It should be noted that for certain commands, several status codes may result from multiple violations or conditions. However, only the status codes of highest severity (or the first of equal status codes) encountered will be retained and passed to the user. A secondary error may occur during backout of a failing function; only the first error is reported to the user.

B.3.2 Explanation of Terms

A few terms used in the following listing of status codes are defined here for clarification:

Serial	Refers to physical order as opposed to logical order, e.g., a Serial Read retrieves records in physical order.
Primary	Refers to the current controlling linkage path as specified in the Link Path parameter.
Secondary	Refers to any linkage path other than the Primary.
Base	Refers to the Base Data portion of a coded variable record, i.e., that portion which is common to all records in the data set and does not depend on a record code for its identification.
Coded	Refers to the redefined portion of a variable record, i.e., elements which are defined under a specific record code.

B.3.3 Status Code Listing

The status codes fall into three categories:

a. Successful completion ('****')

b. Informative; some user action may be required.

c. Fatal; the requested function has not been completed. Any modifications to the data base performed before the error was detected were "backed out" to the condition immediately prior to the request. The data base is closed down automatically. User program will then receive control.

d. Any status codes that are FATAL are marked with an F after the heading.

BCTL — Blank or Zero Control Field. An attempt was made to add, read or write a master record with a blank control field:

a. In a master data set command parameter.

b. In a variable data set command parameter or I/O area.

DUPM — Duplicate Master Record. A master record with the same key already exists on the data set.

DUPO — Duplicate Open of a Data Set (F). TOTAL sensed at SINON command time, a request for a data set that this program has already OPENED.

ENTF — Element Not Found. An element name in the command parameter list is incorrect or the requested element does not exist in the data base descriptor currently in use.

EXSO — Extra SINON. More than one sign-on.

FATL — Fatal Error. Internal memory backout attempt failed. Memory or data base is destroyed.

FNOP — File Not Open (F). The requested data set in the command parameter list has not been opened. This same data set was not specified in the SINON command.

FNTF — File Not Found (F). The data set name in the command parameter list is misspelled or the data set does not exist in the data base descriptor module now in use.

FTYP — Invalid File Type. An attempt was made to process a master data set with a variable function or vice-versa.

FULL — File Loaded to Capacity. The number of records loaded equals the number of TOTAL-LOGICAL-RECORDS specified in the data base descriptor less any control records. This status code is returned when the excess record addition is attempted.

FUNC — Invalid Function Code (F). The function code in the command parameter list is misspelled. A SNAPSHOT dump is given.

IDBM — Invalid Data Base Module (F). When the name or the definition of DB is not correct.

IMDL — Invalid Master Delete. One or more variable entry records are still linked to this master record. These variable

entry records must be deleted before the master record can be deleted.

IOER — I/O error. Selected by VORTEX driver. FATAL condition. If an I/O error occurs, there are two possible causes:
(a) The error was detected while in the process of writing.
(b) The error was detected before any attempt to write.
In (a) TOTAL already executed an internal SINOF which left the appropriate files locked. The only recovery left is reloading the file(s) from the backup storage and re-starting the update process.

In (b) it is up to the user application program to decide on the proper action (e.g. SINOF and backup, ignore, etc.).

IPAR — Invalid Parameter (F). Parameters are missing or incorrect in the command list.

IRLC — Invalid Record Location (F). The content of the Reference Field, a linkage path or the generated master address is invalid.

a. The address generated is outside of the file limits.

b. FATAL condition.

INVEL — Invalid Element Name.

IVRC — Invalid Record Code. The record code being processed is invalid.

a. Upon encountering an ADDVC, ADDVA, or ADDVB and with record-codes defined, the user I/O area contains an invalid record code.

b. Using a READV, READR, or READD and with record-codes defined, the user I/O area has an invalid record code.

IVRP — Invalid Reference Parameter. TOTAL has encountered an invalid reference parameter in a variable entry function prior to execution. If this function was allowed to continue, an 'IRLC' condition would have been returned with FATAL shutdown.

IVTF — Invalid TOTAL file. File name during Sign On does not match DBGEN. Format may not be the same as run time. (Print last record on MASTER or first record on VARIABLE to look for name.)

LOAD Variable Entry File Loaded Beyond Load Limit.

a. The reference variable entry file has been loaded to the load limit as specified in the data base description.

b. Subsequent addition may still be done until the physical load limit is reached, which will result in a FULL status code.

LOCK Data Set Locked (F).

a. A program using the data base is in UPDATE mode previously aborted and left the data set(s) locked. It is necessary to restore the data base from backup and reprocess everything since that backup. Failure to restore the data base will cause unpredictable results.

b. Another copy of TOTAL has already locked this specific data set. If the LOCK status is ignored, further processing will return the NOSO status code.

c. This status is returned in the GENERAL command status as well as the file area of the REALM section.

MLNF Master Link Not Found. A master linkage name is invalid:

a. READV, READR, or READD cannot find requested linkage path name as stated.

b. ADDVC, ADDVA, or ADDVB cannot find associated linkage path names in defined masters.

MRNF Master Record Not Found. The master record corresponding to a given control field cannot be found.

In a variable entry function, this will correspond to a primary control field.

NOIO No Assigned I/O Area (F). TOTAL sensed, while trying to open a file from the SINON command, that no I/O area exists in the data base descriptor being used.

Severe problem with DBGEN output.

NOSO No SINON. A function without a former SINON has been issued.

UACM Undefined Access Mode (F). The access Mode parameter in the SINON command parameter is invalid.

UCTL — Unequal Control Field. The control field referenced in the command parameter list does not match that in the user I/O area.

UPDE — Update Mode Error. An add, delete or write function was requested against a file(s) whose access mode was stated as RDONLY or whose file mode was SHRE in the SINON command.

APPENDIX C
'TEXT' BLOCK

The 'TEXT' portion of the TOTAL core dump is used to interpret the dump. It contains the following sections:

Address in DATBAS for TOTAL to return to
Parameter list pulled from user call
Parameter count for a particular function
Save area lists
I/O macros
Statistics
DBMOD prefix
Task general information
Status
Sequential function dependent text
Work (Variable) fields
File table definition
IOTABLE(IOPOOL) entry description
Buffer prefix definition
General file descriptor
Master file unique description
Variable file unique description
Variable file linkpath table
Element table
Relative labels for file/cylinder control records
I/O macro control block expansion
File partition control blocks

The 'TEXT' block listing is provided on the following pages.

```
                                VORTXII DASMR   DATBAS    2039 HOURS

                    89          EJEC
        000000 R    90 TEXT     EQU     *
000000  000000 R    91          DATA    (*)

                    93 ************************************************************************************
000001  152305 A    94          DATA    'TEXT'                                                          *
000002  154324 A
                    95 *        ADDRESS (IN DATBAS) FOR TOTAL TO RETURN TO                              *
        000003 R    96 FRETRN   EQU     *
        000003 A    97 ARETRN   EQU     3                           * RX *
000003  000000 A    98          DATA    0                                                               *
000004  150301 A    99 PARM     DATA    'PARM'                                                          *
000005  151315 A
                   100 *        PARAMETER LIST PULLED FROM USER CALL                                    *
                   101 ************************************************************************************
                   102 *                                   VARIABLE  MASTER    RDNXT     SINON/OFF
        000006 A   103 PA       EQU     6                           * RX *
000006  000000 A   104          DATA    0
        000007 A   105 PB       EQU     PA+1            STATUS
000007  000000 A   106          DATA    0
        000010 A   107 PC       EQU     PB+1            FILE
000010  000000 A   108          DATA    0
        000011 R   109 EPD      EQU     *
        000011 A   110 PD       EQU     PC+1            REFER     KEY       REFER     END
000011  000000 A   111          DATA    0
        000012 A   112 PE       EQU     PD+1            LINKPATH  ELEMENT LIST
000012  000000 A   113          DATA    0
        000013 A   114 PF       EQU     PE+1            KEY       I/O AREA
000013  000000 A   115          DATA    0
        000014 A   116 PG       EQU     PF+1            ELEMENT   END
000014  000000 A   117          DATA    0
        000015 A   118 PH       EQU     PG+1            I/O AREA
000015  000000 A   119          DATA    0
        000016 A   120 PI       EQU     PH+1            END
000016  000000 A   121          DATA    0
                   122 *        PARAMETER COUNT FOR THIS PARTICULAR FUNCTION                            *
                   123 *                                  ----------                                       *
                   124 *        USED BY DATBAS TO CALCULATE RETURN ADDRESS IN USER PROGRAM              *
        000017 A   125 PARMCT   EQU     PI+1                        * RX *
000017  000000 A   126          DATA    0

                   128 ************************************************************************************
```

```
                                VURTXII DASMR   DATBAS    2039 HOURS

                    129 *       SALTS (SAVE AREA LISTS)                                          *
                    130 *       THESE SAVE WORDS ARE USED TO SAVE REGISTERS                      *
                    131 *       THE NAMES (LABELS) ARE DEFINED AS FOLLOWS--SALTNX                *
                    132 *       WHERE 'N' IS THE LEVEL NUMBER (LOWEST LEVEL IS 1,INDICATING NO   *
                    133 *                OTHER SUBROUTINES-LOWER LEVELS-ARE USED-PERFORMED)      *
                    134 *       AND X IS THE REGISTER INDICATOR--A--A REGISTER                   *
                    135 *                                        B--B REGISTER                   *
                    136 *                                        C--X REGISTER                   *
                    137 ************************************************************************
       000020 A     138 SALT    EQU     PARMCT+1
000020 151701 A     139         DATA    'SALT'
000021 146324 A
       000022 R     140 ESALT1  EQU     *
       000022 A     141 SALT1A  EQU     SALT+2                          * RX *
000022 000000 A     142         DATA    0
       000023 R     143 RETRN1  EQU     *
       000023 A     144 SALT1B  EQU     SALT1A+1                        * RX *
000023 000000 A     145         DATA    0
       000024 A     146 SALT1C  EQU     SALT1B+1                        * RX *
       000024 R     147 EALT1C  EQU     *
       000024 A     148 SALT1X  EQU     SALT1B+1                        * RX *
000024 000000 A     149         DATA    0
       000025 R     150 EALT2A  EQU     *
       000025 A     151 SALT2A  EQU     SALT1C+1                        * RX *
000025 000000 A     152         DATA    0
       000026 R     153 RETRN2  EQU     *
       000026 A     154 SALT2B  EQU     SALT2A+1                        * RX *
000026 000000 A     155         DATA    0
       000027 R     156 EALT2C  EQU     *
       000027 A     157 SALT2C  EQU     SALT2B+1                        * RX *
000027 000000 A     158         DATA    0
       000030 A     159 SALT3A  EQU     SALT2C+1                        * RX *
000030 000000 A     160         DATA    0
       000031 R     161 RETRN3  EQU     *
       000031 A     162 SALT3B  EQU     SALT3A+1                        * RX *
000031 000000 A     163         DATA    0
       000032 A     164 SALT4A  EQU     SALT3B+1                        * RX *
000032 000000 A     165         DATA    0
       000033 R     166 RETRN4  EQU     *
       000033 A     167 SALT4B  EQU     SALT4A+1                        * RX *
000033 000000 A     168         DATA    0
       000034 A     169 SALT5A  EQU     SALT4B+1                        * RX *
```

```
                                        VURTXII DASMR    DATBAS     2039 HOURS

000034 000000 A   170           DATA     0
       000035 R   171 RETRN5 EQU      *
       000035 A   172 SALT5B EQU      SALT5A+1                    * RX *
000035 000000 A   173           DATA     0
       000036 A   174 SALT6A EQU      SALT5B+1                    * RX *
000036 000000 A   175           DATA     0
       000037 R   176 RETRN6 EQU      *
       000037 A   177 SALT6B EQU      SALT6A+1                    * RX *
000037 000000 A   178           DATA     0
       000040 A   179 SALT7A EQU      SALT6B+1                    * RX *
000040 000000 A   180           DATA     0
       000041 R   181 RETRN7 EQU      *
       000041 A   182 SALT7B EQU      SALT7A+1                    * RX *
000041 000000 A   183           DATA     0
       000042 R   184 RETRN8 EQU      *
       000042 A   185 SALT8B EQU      SALT7B+1                    * RX *
000042 000000 A   186           DATA     0

                  188 ********************************************************************************
                  189 *       I / O    M A C R O S
                  190 ********************************************************************************
       000043 R   191 IOOPEN EQU      *
       000043 A   192 TKOPEN EQU      SALT8B+1                    * RX *
                  193           OPEN     FCB,LUN,WAIT,REW
000043 006505 A
000044 000404 A
000045 100000 A
000046 003000 A
000047 000000 A
000050 000000 A
000051 000000 A
000052 006037 A   194           LDXE     TEXT
000053 000000 R
000054 006706 A   195           IJMP     ZERO,REGB
000055 000000 A
                  196 *
       000056 A   197 TKREAD EQU      TKOPEN+11
                  198           READ     FCB,LUN,WAIT,BINARY
000056 006505 A
000057 000404 A
000060 100000 A
000061 000000 A
```

```
                                    VORTXII DASMR    DATBAS    2039 HOURS

000062 000000 A
000063 000000 A
000064 000000 A
000065 006037 A   199           LDXE     TEXT
000066 000000 R
000067 006706 A   200           IJMP     ZERO,REGB
000070 000000 A
                  201 *
        000071 A  202 TKWRIT    EQU      TKREAD+11
                  203           WRITE    FCB,LUN,WAIT,BINARY
000071 006505 A
000072 000404 A
000073 100000 A
000074 000400 A
000075 000000 A
000076 000000 A
000077 000000 A
000100 006037 A   204           LDXE     TEXT
000101 000000 R
000102 006706 A   205           IJMP     ZERO,REGB
000103 000000 A
                  206 *
                  207 *
        000104 A  208 LGWRIT    EQU      TKWRIT+11
                  209 *LOG      WRITE    FCB,LUN,WAIT,BINARY
                  210 *LOG      IJMP     ZERO,REGB
                  211 *

                  213 ************************************************************************
                  214 *       S T A T I S T I C S
                  215 ************************************************************************
                  216 *       COUNT OF LOGICAL READS,I.E. CALL'S TO SBREAD                  *
        000104 A  217 LREADS    EQU      LGWRIT                      * RX *
000104 000000 A   218           DATA     0
                  219 *       COUNT OF LOGICAL WRITES,I.E. CALL'S TO SBWRIT                 *
        000105 A  220 LWRITS    EQU      LREADS+1                    * RX *
000105 000000 A   221           DATA     0
                  222 *       COUNT OF PHYSICAL READS,I.E. ACTUAL READ I/O'S                *
        000106 A  223 PREADS    EQU      LWRITS+1                    * RX *
000106 000000 A   224           DATA     0
                  225 *       COUNT OF PHYSICAL WRITES,I.E. ACTUAL WRITE I/O'S              *
        000107 A  226 PWRITS    EQU      PREADS+1                    * RX *
```

```
                                VORTXII DASMR   DATBAS    2039 HOURS

000107 000000 A   227           DATA    0
                  228 *         COUNT OF TOTAL FUNCTIONS ISSUED BY USER
       000110 A   229 FUNCNT    EQU     PWRITS+1                    * RX *
000110 000000 A   230           DATA    0

                  232 *         COUNT OF LOGICAL RECORDS WRITTEN TO LOG FILE
       000111 A   233 LOGCNT    EQU     FUNCNT+1                    * RX *
                  234 *LOG      DATA    0

                  236 ********************************************************************************
                  237 *         D B M O D   P R E F I X
                  238 ********************************************************************************
                  239 *         SIX CHARACTER DBMOD NAME
       000111 A   240 DBMODN    EQU     LOGCNT                      * RX *
000111 000000 A   241           DATA    0,0,0
000112 000000 A
000113 000000 A
                  242 *         ADDRESS OF DBMOD
       000114 A   243 ADBMOD    EQU     DBMODN+3                    * RX *
000114 010666 R   244           DATA    (ENDATB)
                  245 *         DATE DBMOD WAS GENERATED BY DBGEN
       000115 A   246 DBMDAT    EQU     ADBMOD+1                    * RX *
000115 000000 A   247           DATA    0,0
000116 000000 A
000117 000000 A   248           DATA    0,0
000120 000000 A
                  249 *         TIME DBMOD WAS GENERATED BY DBGEN
       000121 A   250 DBMTIM    EQU     DBMDAT+4                    * RX *
000121 000000 A   251           DATA    0,0
000122 000000 A
                  252 *         ADDRESS OF FILE TABLE
       000123 A   253 AFLTAB    EQU     DBMTIM+2                    * RX *
000123 000000 A   254           DATA    0
                  255 *         ADDRESS OF SAVE AREA
       000124 R   256 ESAVEA    EQU     *
       000124 A   257 ASAVEA    EQU     AFLTAB+1                    * RX *
000124 000000 A   258           DATA    0
                  259 *         ADDRESS OF LOG BUFFER AREA
       000125 A   260 ALOGRA    EQU     ASAVEA+1                    * RX *
000125 000000 A   261           DATA    0
                  262 *         ADDRESS OF LOG FILE FCB
       000126 A   263 ATLOG     EQU     ALOGRA+1                    * RX *
```

```
                                VORTXII DASMR   DATBAS    2039 HOURS

000126 000000 A   264           DATA    0
       000017 A   265 AATLOG EQU     15            ADDRESS EQU FOR A(ATLOG) IN DBMOD PREFIX

                  267 ************************************************************************
                  268 *       T A S K  G E N E R A L  I N F O R M A T I O N
                  269 ************************************************************************
                  270 *       INTERNAL TASK I.D. (VORTEX II T.I.D.B.)                        *
       000127 A   271 WTASKN EQU     ATLOG+1                    * RX *
000127 000000 A   272           DATA    0
                  273 *       THE FUNCTION TABLE ENTRY FOR THIS FUNCTION                     *
       000130 R   274 WFUNCE EQU     *
       000130 A   275 WFUNCT EQU     WTASKN+1                   * RX *
000130 000000 A   276           DATA    0,0
000131 000000 A
000132 000000 A   277           DATA    0,0
000133 000000 A
000134 000000 A   278           DATA    0,0
000135 000000 A
000136 000000 A   279           DATA    0
                  280 *       ADDRESS OF THE FILE DESCRIPTOR FOR FILE NAMED IN PARM 3        *
       000137 A   281 WFFLOC EQU     WFUNCT+7                   * RX *
000137 000000 A   282           DATA    0               PARAMETER 3
                  283 *       ADDRESS OF FILE DESCRIPTOR CURRENTLY BEING ACCESSED            *
       000140 A   284 WFFADR EQU     WFFLOC+1                   * RX *
000140 000000 A   285           DATA    0
                  286 *       ACCESS MODE SPECIFIED IN USER SINON                            *
       000141 A   287 WACMOD EQU     WFFADR+1                   * RX *
000141 000000 A   288           DATA    0             SINON(RD,UP,RE)
                  289 *       LOG OPTIONS SPECIFIED IN USER SINON                            *
       000142 A   290 WLGOPT EQU     WACMOD+1                   * RX *
000142 000000 A   291           DATA    0
                  292 *                                 (L=LOG,N=NOLOG)
                  293 *       ADDRESS OF USER PROGRAM'S REALM (IN SCHEMA)
       000143 A   294 WASCHE EQU     WLGOPT+1                   * RX *
000143 000000 A   295           DATA    0
                  296 *       DISPLACEMETT VALUE OF COMMON CONTROL RECORD
                  297 *       USED BY SINON/SINOF
       000144 A   298 WCCRAD EQU     WASCHE+1                   * RX *
000144 000000 A   299           DATA    0

                  301 ************************************************************************
                  302 *       S T A T U S                    * RX *                          *
```

```
                                VORTXII DASMR    DATBAS    2039 HOURS

                    303 ************************************************************************
                    304 *       4 CHARACTER STATUS CODE (IF ANY)                                *
        000145 R    305 ESTATS  EQU     *
        000145 A    306 WSTATS  EQU     WCCRAD+1                    * RX *
000145  000000 A    307         DATA    0,0
000146  000000 A
                    308 *       DOCUMENTATION NUMBER ,ADDRESS WITHIN TOTAL WHICH PRODUCED THE   *
                    309 *       STATUS CODE FOUND IN WSTATS                                     *
        000147 A    310 DOCNUM  EQU     WSTATS+2                    * RX *
000147  000000 A    311         DATA    0
                    312 *       RECOVERY SWITCH                                                 *
        000150 A    313 RECOVS  EQU     DOCNUM+1                    * RX *
000150  000000 A    314         DATA    0
                    315 *       IF 'FU' FUNCTION HAS BEGUN TO PROCESS AND ERRORS MUST BE
                    316 *               BACKED OUT
                    317 *       IF 'RE' RECOVERY HAS ALREADY BEEN REQUESTED AND ANYFURTHER
                    318 *               ERROR IS A 'FATAL'
        000151 A    319 KBUG    EQU     RECOVS+1                    * RX *
000151  141325 A    320         DATA    'BUG#'                      * RX *
000152  143643 A
        000153 R    321 BUGLOC  EQU     *
        000153 A    322 DOWNSW  EQU     KBUG+2
000153  000000 A    323         DATA    0                           * RX *


        000154 A    326 FUNC    EQU     KBUG+3
000154  143325 A    327         DATA    'FUNC'                      * RX *
000155  147303 A
                    328 *       GENERAL FUNCTION TEXT--COMMON TO MOST FUNCTIONS
                    329 *       RELATIVE RECORD NUMBER OF SPACE FOUND FOR AN ADD
        000156 A    330 WSPACE  EQU     FUNC+2                      * RX *
000156  000000 A    331         DATA    0
000157  000000 A    332         DATA    0
                    333 *       MASTER FUNCTION        DEPENDENT TEXT
                    334 *       WORK (VARIABLE) FIELDS USED BY:RRNCAL                           *
                    335 *       RELATIVE RECORD NUMBER CALCULATED BY RRNCAL                     *
        000160 A    336 WHASH   EQU     WSPACE+2                    * RX *
                    337 *       ADDRESS OF KEY TO BE HASHED                                     *
        000160 A    338 RNAKEY  EQU     WHASH                       * RX *
000160  000000 A    339         DATA    0
                    340 *       LENGTH OF KEY TO BE HASHED                                      *
        000161 A    341 RNLKEY  EQU     WHASH+1                     * RX *
```

```
                                   VORTXII DASMR   DATBAS    2039 HOURS

000161 000000 A   342             DATA    0
                  343 *           'EVEN OR ODD' SWITCH TO TELL RRNCAL IF ON OR OFF A WORD          *
                  344 *           BOUNDARY.                                                        *
       000162 A   345 SWEORD EQU      RNLKEY+1                      * RX *
000162 000000 A   346             DATA    0
                  347 *           MASTER SYNONYM SWITCH                                            *
                  348 *           IF 'B' THE SLOT IS BLANK                                         *
                  349 *           IF 'N' THE SLOT IS OCCUPIED BY A SYNONYM OF ANOTHER 'HOME'       *
                  350 *           IF 'S' THERE IS A VALID 'HOME' AND IT HAS SYNONYM'S              *
                  351 *           IF 'H' THERE IS A VALID HOME,BUT NO SYNONYMS
       000163 A   352 WMSYSW EQU      SWEORD+1                      * RX *
000163 000000 A   353             DATA    0
                  354 *           SYNONYM CHAIN 'END'                                              *
                  355 *           THE RELATIVE RECORD NUMBER OF THE LAST RECORD IN THE CHAIN        *
       000164 A   356 WSYNEN EQU      WMSYSW+1                      * RX *
000164 000000 A   357             DATA    0,0
000165 000000 A
                  358 *           WORKAREA TO HOLD RRN OF 'LOW-SIDE'' IN MASTER SPACE SEARCH
       000166 A   359 MFSLOW EQU      WSYNEN+2                      * RX *
000166 000000 A   360             DATA    0,0
000167 000000 A
                  361 *           ONE DEFINED FOR 32 BIT ARITHMETIC
       000170 A   362 MFSL01 EQU      MFSLOW+2                      * RX *
000170 000000 A   363             DATA    0,1
000171 000001 A
                  364 *           ONE DEFINED FOR 32 BIT ARITHMETIC
       000172 A   365 MFSHI1 EQU      MFSL01+2                      * RX *
000172 000000 A   366             DATA    0,1
000173 000001 A
                  367 *           WORKAREA TO HOLD RRN OF 'HIGH-SIDE' IN MASTER SPACE SEARCH
       000174 A   368 MFSHIH EQU      MFSHI1+2                      * RX *
000174 000000 A   369             DATA    0,0
000175 000000 A
                  370 *           VARIABLE FUNCTION     DEPENDENT TEXT
                  371 *           THE RELATIVE RECORD NUMBER OF THE CCR 'THIS RRN' IS 'IN'         *
       000176 A   372 WVCCR  EQU      MFSHIH+2                      * RX *
000176 000000 A   373             DATA    0,0
000177 000000 A
                  374 *SWITCH TO TELL IF  THIS FILE HAS BASE,CODED,OR BOTH RECORD TYPES
       000200 A   375 WVCODS EQU      WVCCR+2                       * RX *
000200 000000 A   376             DATA    0
                  377 * REFER PULLED FROM USER PARAMETER LIST
```

```
                                VORTXII DASMR    DATBAS     2039 HOURS

        000201 A   378 WVREFR EQU      WVCODS+1                    * RX *
000201  000000 A   379         DATA     0
000202  000000 A   380         DATA     0
                   381 *       ADDRESS OF LINKPATH TABLE
        000203 A   382 WVALNK EQU      WVREFR+2                    * RX *
000203  000000 A   383         DATA     0
                   384 *       ADDRESS OF LAST BASE LINKPATH ENTRY IN TABLE (IF ANY)
        000204 A   385 WVFBAS EQU      WVALNK+1                    * RX *
000204  000000 A   386         DATA     0
                   387 *       ADDRESS OF 1ST CODED LINKPATH ENTRY IN TABLE (IF ANY)
        000205 A   388 WVACOD EQU      WVEBAS+1                    * RX *
000205  000000 A   389         DATA     0
                   390 *       ADDRESS OF LAST CODED LINKPATH ENTRY IN TABLE (IF ANY)
        000206 A   391 WVECOD EQU      WVACOD+1                    * RX *
000206  000000 A   392         DATA     0
                   393 *       ADDRESS OF 1ST LINKPATH IN RECORD (CODED OR BASE)
                   394 *       ADDRESS OF 'CONTROLLING' LINKPATH (I.E. THE ONE REFERENCED IN PE
        000207 A   395 WVCTLK EQU      WVECOD+1                    * RX *
000207  000000 A   396         DATA     0
                   397 *       WORK AREA FOR LOOKUP OF CODED ETC. LINKPATH NAMES
        000210 A   398 WVWORK EQU      WVCTLK+1                    * RX *
000210             399         BSS      5
                   400 *       SWITCH USED BY LINK AND DLINK TO SHOW HISTORY OF PROCESSING
        000215 A   401 WLNKSW EQU      WVWORK+5                    * RX *
000215  000000 A   402         DATA     0
                   403 *       ADDRESS OF LINKPATH NOW BEING PROCESSED IN SAVE AREA RECORD
        000216 A   404 WSAVLK EQU      WLNKSW+1                    * RX *
000216  000000 A   405         DATA     0
                   406 *       ADDRESS OF LINKPATH NOW BEING PROCESSED IN BUFFER RECORD
        000217 A   407 WBUFLK EQU      WSAVLK+1                    * RX *
000217  000000 A   408         DATA     0
                   409 *       ADDRESS OF LINKPATH ENTRY IN TABLE,CORRESPONDING TO WSAVLK
        000220 A   410 WSLKEN EQU      WBUFLK+1                    * RX *
000220  000000 A   411         DATA     0
                   412 *       ADDRESS OF LINKPATH ENTRY IN TABLE,CORRESPONDING TO WBUFLK
        000221 A   413 WBLKEN EQU      WSLKEN+1                    * RX *
000221  000000 A   414         DATA     0
                   415 *       SEQUENTIAL FUNCTION   DEPENDENT TEXT
                   416 ********************************************************************
        000222 A   417 IOTAB  EQU      WBLKEN+1                    * RX *
000222  144717 A   418         DATA     'IOTABL'                    * RX *
000223  152301 A
```

```
                                VORTXII DASMR   DATBAS    2039 HOURS

000224 141314 A
                    419 ********************************************************************************
       000225 A     420 WPRTY   EQU     IOTAB+3                          * RX *
       000225 A     421 WIOSEC  EQU     WPRTY                            * RX *
000225 000000 A     422         DATA    0
       000226 A     423 WIOTAB  EQU     WIOSEC+1                         * RX *
000226 000000 A     424         DATA    0
       000227 A     425 WIOLEN  EQU     WIOTAB+1                         * RX *
000227 000000 A     426         DATA    0
       000230 A     427 WIOBAD  EQU     WIOLEN+1                         * RX *
000230 000000 A     428         DATA    0
       000231 A     429 WIOMOD  EQU     WIOBAD+1                         * RX *
000231 000000 A     430         DATA    0
       000232 A     431 WIOVR   EQU     WIOMOD+1                         * RX *
000232 000000 A     432         DATA    0
       000233 A     433 WIORBM  EQU     WIOVR+1                          * RX *
000233 000000 A     434         DATA    0
       000234 R     435 EIOLOC  EQU     *
       000234 A     436 WIOLOC  EQU     WIORBM+1                         * RX *
000234 000000 A     437         DATA    0
       000235 A     438 WRDRCD  EQU     WIOLOC+1                         * RX *
000235 000000 A     439         DATA    0,0
000236 000000 A

                    441 ********************************************************************************
       000237 A     442 MISC    EQU     WRDRCD+2                         * RX *
000237 153717 A     443         DATA    'WORK'                           * RX *
000240 151313 A
                    444 ********************************************************************************
                    445 *       WORK (VARIABLE) FIELDS USED BY: SCOMPN                                 *
                    446 *                                       SCOMPE                                 *
                    447 *                                       TABLUK                                 *
       000241 R     448 ECOMPA  EQU     *
       000241 A     449 WCOMPA  EQU     MISC+2                           * RX *
000241 000000 A     450         DATA    0
       000242 R     451 ECOMPB  EQU     *
       000242 A     452 WCOMPB  EQU     WCOMPA+1                         * RX *
       000242 A     453 FOUND   EQU     WCOMPB                           * RX *
000242 000000 A     454         DATA    0
                    455 *       WORK (VARIABLE) FIELDS USED BY:MOVE4                                   *
                    456 *                                      SCLEAR WITH                             *
                    457 *                                      SZERO                                   *
```

```
                                VORTXII DASMR    DATBAS     2039 HOURS

                458 *                                          SBLKRD                  *
                459 *                                          SBLKSA                  *
                460 *                                          SMOVEW                  *
                461 *                                          CMPBYT                  *
                462 *                                          MOVBYT                  *
                463 *                                          CHKBYT                  *
000243 R        464 EVBOAT EQU     *
000243 A        465 MVBOAT EQU     FOUND+1                      * RX *
000243 R        466 EMBOAT EQU     *
000243 A        467 CMBOAT EQU     MVBOAT                       * RX *
000243 000000 A 468                DATA    0
000244 R        469 EATO   EQU     *
000244 A        470 ATO    EQU     MVBOAT+1                     * RX *
000244 000000 A 471                DATA    0
000245 R        472 EAFROM EQU     *
000245 A        473 AFROM  EQU     ATO+1                        * RX *
000245 000000 A 474                DATA    0
                475 *       WORK (VARIABLE) FIELDS USED BY:ANY LOGIC INVOLVING DOUBLE  *
                476 *                                      PRECISION ARITHMETIC       *
                477 *       ONE DEFINED FOR 32 BIT ARITHMETIC
000246 A        478 WRKONE EQU     AFROM+1                      * RX *
000246 000000 A 479                DATA    0,1
000247 000001 A
000250 A        480 WORK   EQU     WRKONE+2                     * RX *
000250 000000 A 481                DATA    0,0
000251 000000 A
000252 R        482 EWORK1 EQU     *
000252 A        483 WORK1  EQU     WORK+2                       * RX *
000252 000000 A 484                DATA    0,0
000253 000000 A
000254 A        485 WORK2  EQU     WORK1+2                      * RX *
000254 000000 A 486                DATA    0,0
000255 000000 A
000256 A        487 WTOTAL EQU     WORK2+2                      * RX *
000256 000000 A 488                DATA    0,0
000257 000000 A
000260 A        489 WORK3  EQU     WTOTAL+2                     * RX *
000260 000000 A 490                DATA    0,0
000261 000000 A
                491 *       WORK (VARIABLE) FIELDS USED BY: TABLUK FUNCTION LOOKUP
000262 A        492 TLUKFN EQU     WORK3+2                      * RX *
000263 A        493 TAFUNT EQU     TLUKFN+1                     * RX *
```

```
                                    VORTXII DASMR    DATBAS     2039 HOURS

000262 001012 R   494           DATA    (FUNTAB+1)                    * RX *
000263 000007 A   495 TLFUNT    DATA    7
000264 000002 A   496 TFNARG    DATA    2
                  497 *         WORK (VARIABLE) FIELDS USED BY:SFFILE FOR TABLUK                *
       000265 A   498 TLUKFL    EQU     TLUKFN+3                      * RX *
       000265 A   499 TAFILE    EQU     TLUKFL                        * RX *
000265 000000 A   500           DATA    0                             * RX *
000266 000003 A   501 TLFILE    DATA    3
000267 000002 A   502           DATA    2                  LENGTH OF ARGUMENT
                  503 *         WORK (VARIABLE) FIELDS USED BY:SELECT FOR TABLUK                *
       000270 A   504 TLUKEL    EQU     TLUKFL+3                      * RX *
       000270 A   505 TAELEM    EQU     TLUKEL                        * RX *
000270 000000 A   506           DATA    0                             * RX *
000271 000006 A   507 TLELEM    DATA    6
000272 000002 A   508           DATA    2                  LENGTH OF ARGUMENT
                  509 *         WORK (VARIABLE) FIELDS USED BY:LINKPATH LOOKUP FOR TABLUK       *
       000273 A   510 TLUKLK    EQU     TLUKEL+3                      * RX *
       000273 A   511 TALINK    EQU     TLUKLK                        * RX *
000273 000000 A   512           DATA    0                             * RX *
000274 000010 A   513 TLLINK    DATA    8
000275 000004 A   514           DATA    4                  LENGTH OF ARGUMENT
                  515 *         WORK (VARIABLE) FIELDS USED BY: SFLKBF FOR TABLE LOOKUP
       000276 A   516 TLUKLC    EQU     TLUKLK+3                      * RX *
       000276 A   517 TALKCD    EQU     TLUKLC                        * RX *
000276 000000 A   518           DATA    0                             * RX *
000277 000010 A   519 TLLKCD    DATA    8
000300 000005 A   520 TLCLEN    DATA    5
                  521 *         WORK (VARIABLE) FILEDS USED BY: TABLE LOOKUP RECORD CODES
       000301 A   522 TLUKCD    EQU     TLUKLC+3                      * RX *
       000301 A   523 TACODE    EQU     TLUKCD                        * RX *
000301 000000 A   524           DATA    0
       000302 R   525 TLENCD    EQU     *
000302 000010 A   526           DATA    8
       000303 R   527 TLCODE    EQU     *
000303 000001 A   528           DATA    1
       000304 A   529 TLUKEC    EQU     TLUKCD+3                      * RX *
       000304 A   530 TAELCD    EQU     TLUKEC                        * RX *
000304 000000 A   531           DATA    0                             * RX *
000305 000006 A   532 TLELCD    DATA    6
000306 000003 A   533 TLEARG    DATA    3

                  535 *         WORK (VARIABLE) FIELDS USED BY: SELECT                          *
```

```
                        VORTXII DASMR    DATBAS     2201 HOURS

          6468          EJEC
          6469 ***************************************************************************
          6470 *                                                                         *
          6471 *       FILE TABLE DEFINITION                                             *
          6472 *                                                                         *
          6473 ***************************************************************************
000000 A  6474 TFTNME EQU      0                2 WORD NAME OF THE FILE
          6475 *
000002 A  6476 TFTADD EQU      2                1 WORD ADDRESS OF THE GENERAL FILE DESCRIP
          6477 *                                        TION FOR THIS FILE
          6478 *
          6479 * CTFTIC DATA  3    THIS IS THE LENGTH OF ONE FILE TABLE ENTRY WORDS
```



```
          6480          EJEC
          6481 ***************************************************************************
          6482 *                                                                         *
          6483 *       IOTABLE (IOPOOL) ENTRY DESCRIPTION                                *
          6484 *                                                                         *
          6485 *       AT SIGON THE POOL ENTRY HAS SOME VALUES ESTABLISHED               *
          6486 *       BY THE DBGEN,USING THESE VALUES,THE MBEGIN LOGIC MUST             *
          6487 *       INITIALIZE THE BUFFER PREFIXES                                    *
          6488 ***************************************************************************
          6489 *
000000 A  6490 PLIST  EQU      0                ADDRESS OF THE FIRST BUFFER PREFIX
          6491 *
000001 A  6492 PLAST  EQU      1                BEFORE SGON - THE COUNT OF BUFFERS IN POOL
          6493 *                                AFTER SGON - THE ADDRESS OF THE LAST
          6494 *                                        BUFFER PREFIX
000002 A  6495 PLPRTY EQU      2                BEFORE SGON - THE LENGTH OF 1 BUFFER
          6496 *                                INCLUDING THE LENGTH OF THE PREFIX
          6497 *                                AFTER SGON - THE FIRST BYTE IS THE HIGHEST
          6498 *                                PRIORITY BUFFER IN THE POOL AS
          6499 *                                FOUND BY THE BUFFER SEARCH LOGIC
          6500 *                                IN SBREAD.
000002 A  6501 PLOCK  EQU      PLPRTY           AFTER SGON - THE SECOND BYTE IS A LOCK
          6502 *                                     SWITCH
          6503 *                                -L- LOCKED
          6504 *                                -N- NOT LOCKED
000003 A  6505 PLBUFF EQU      3                THE ADDRESS OF THE BUFFER CORRESPONDING TO
          6506 *                                THE 'PLPRTY' SET ABOVE
```

```
                    VORTXII DASMR    DATBAS    2201 HOURS

          6507          EJEC
          6508 ************************************************************************
          6509 *                                                                      *
          6510 *       BUFFER PREFIX DEFINITION                                       *
          6511 *       THE ACTUAL BUFFER BEGINS IMMEDIATELY AFTER THE PREFIX          *
          6512 *                                                                      *
          6513 ************************************************************************
000000 A  6514 TIOLEN EQU     0               LENGTH OF THE BUFFER CURRENTLY IN USE
          6515 *                               -NOT- INCLUDING THE PREFIX
000001 A  6516 TIONXT EQU     1               ADDRESS OF NEXT BUFFER PREFIX OR
          6517 *                                       POOL CONTROL BLOCK
000002 A  6518 TIOBAD EQU     2               ADDRESS OF THIS BUFFER PREFIX
          6519 *                                       ----
000003 A  6520 TIOAFD EQU     3               ADDRESS OF FILE DESCRIPTOR CURRENTLY
          6521 *                               USING THIS BUFFER
000004 A  6522 TIOMOD EQU     4               ADDRESS OF MODULE (FCB) THIS BUFFER WAS
          6523 *                               READ FROM
          6524 *       NOTE- A BUFFER COULD BE READ FROM MULTIPLE FCB'S IF THEY CROSS
          6525 *             A BOUNDARY WITH MULTIPLE SECTORS -THEY MUST- BE ADJACENT
          6526 *                                                 ---- ----
          6527 *             SO WE NEED ONLY KNOW IF WE NEED 2 FCB'S AND THEN WHICH
          6528 *             FCB GETS WHICH SECTOR'S
000005 A  6529 TIOOVR EQU     5               THE NUMBER OF SECTORS TO WRITE TO
          6530 *                               THE FCB SPECIFIED IN TIOMOD-THE REST ARE
          6531 *                               TO BE WRITTEN TO THE NEXT FCB IN THE TABLE
          6532 *             IF THIS IS -NOT- AN OVERLAPPED BUFFER THE WORD IS ZERO
000006 A  6533 TIORBM EQU     6               RELATIVE SECTOR # WITHIN THE MODULE (FCB)
          6534 *                               SPECIFIED
000007 A  6535 TIOLOC EQU     7               ADDRESS OF CURRENT LOGICAL RECORD WITHIN
          6536 *                               THIS BUFFER -THIS IS 'BYTE FORMAT'
000010 A  6537 TIORCO EQU     8               RELATIVE RECORD NUMBER OF THE RECORD
          6538 *                               CURRENTLY REQUESTED IN THE BUFFER
          6539 *
000012 A  6540 TIOUPD EQU     10              1ST BYTE IS AN UPDATE STATUS SWITCH
          6541 *                               -U- DESIGNATES THIS BUFFER WAS UPDATED
          6542 *                               -N- DESIGNATES THIS BUFFER WAS NOT UPDATED
000012 A  6543 TIOLOK EQU     TIOUPD          2ND BYTE IS A LOCK BYTE FOR THIS BUFFER
          6544 *                               -L- LOCKED
          6545 *                               -N- NOT LOCKED
          6546 *
          6547 *
          6548 *       THE BUFFER PREFIX IS 11 WORDS LONG
```

```
                        VORTXII DASMR   DATBAS    2201 HOURS

          6549          EJEC
          6550 ***************************************************************************
          6551 *                                                                         *
          6552 *       GENERAL FILE DESCRIPTOR TABLE                                     *
          6553 *                                                                         *
          6554 ***************************************************************************
000000 A  6555 TGFNAM EQU     0               2 WORDS NAME OF DATA BASE FILE
          6556 *
000002 A  6557 TGFDAD EQU     2               ADDRESS OF OPERATING SYSTEM FILE DESCRIPTOR
          6558 *                                THIS IS ACTUALLY THE ADDRESS OF THE MODULE
          6559 *                               TABLE,SINCE THE FCB(FILE CONTROL BLOCK)
          6560 *                               IS REQUIRED FOR SECTIONING THE LOGICAL FILE
          6561 *
000003 A  6562 TGFAIO EQU     3               ADDRESS OF I/O TABLE ENTRY FOR BUFFER
          6563 *                               ASSIGNED TO THIS FILE (POOL ENTRY)
000004 A  6564 TGFTRO EQU     4               2 WORDS CONTAINING THE TOTAL # OF LOGICAL
          6565 *                               RECORDS IN THE FILE
000006 A  6566 TGFRCY EQU     6               1 WORD COUNT OF THE # OF LOGICAL RECORDS
          6567 *                               PER CYL
000007 A  6568 TGFRBK EQU     7               1 WORD COUNT OF THE # OF LOGICAL RECORDS
          6569 *                                WITHIN A SECTOR,IF THE LOGICAL RECORD
          6570 *                                IS LARGER THAN THE SECTOR SIZE THIS IS THE
          6571 *                                NUMBER OF SECTORS WITHIN THE RECORD
000010 A  6572 TGFLRZ EQU     8               1 WORD COUNT OF THE # OF BYTES IN A LOGICA
          6573 *                               RECORD
000011 A  6574 TGFLBZ EQU     9               1 WORD COUNT OF THE # OF BYTES IN A SECTOR
          6575 *
000012 A  6576 TGFTYP EQU     10              FIRST BYTE OF THIS WORD IS THE ONE
          6577 *                               CHARACTER FILE TYPE  'M' IS A MASTER
          6578 *                               CHARACTER FILE TYPE  'V' IS A VARIABLE
000012 A  6579 TGFOCS EQU     10              SECOND BYTE OF THIS WORD IS A ONE
          6580 *                               CHARACTER OPEN/CLOSE SWITCH 'O' IS OPEN
          6581 *                                                           'C' IS CLOSED
000013 A  6582 TGFSPA EQU     11              2 WORD FILE SPACE STATUS
          6583 *                               IF SPACE AVAILABLE  ****
          6584 *                               IF FILE ABOVE LOAD  LOAD
          6585 *                               IF FILE FULL        FULL
000015 A  6586 TGFUMD EQU     13              1 WORD USAGE MODE
          6587 *                               'U' THE FILE IS UPDATE
          6588 *                               'R' THE FILE IS READONLY
000016 A  6589 TGFELT EQU     14              ADDRESS OF ELEMENT TABLE
          6590 ***************************************************************************
```

```
                        VORTXII DASMR   DATBAS    2201 HOURS

          6591 *       COMMON FILE CONTROL RECORD                                    *
          6592 *       THE FOLLOWING AREA CONTAINS THE PORTION OF THE FILE CONTROL    *
          6593 *       RECORD THAT IS THE SAME FOR BOTH MASTER AND VARIABLE FILE TYPES*
          6594 ************************************************************************
000017 A  6595 TGFFIL EQU     15              NAME OF FILE AS STORED IN CONTROL RECORD
000021 A  6596 TGFLOK EQU     17              LOCK WORD
000022 A  6597 TGFTID EQU     18              TASK I.D. OF TASK WITH LOCK ON FILE
000023 A  6598 TGFCNT EQU     19              LOGICAL RECORD COUNT FOR THIS FILE 2 WORDS
          6599 ************************************************************************
          6600 *                                                                      *
          6601 * MASTER FILE UNIQUE DESCRIPTION                                       *
          6602 *                                                                      *
          6603 ************************************************************************
000025 A  6604 TMFPRM EQU     21              2 WORD BINARY # CONTAINING THE CLOSEST
          6605 *                               PRIME # TO THE TOTAL # OF RECORDS IN THE
          6606 *                               FILE
000027 A  6607 TMFKLN EQU     23              1 WORD LENGTH (IN BYTES) OF THE KEY
          6608 *
          6609 *
          6610 ************************************************************************
          6611 *                                                                      *
          6612 * VARIABLE FILE UNIQUE DESCRIPTION                                     *
          6613 *                                                                      *
          6614 ************************************************************************
)00025 A  6615 TVFLNK EQU     21              ADDRESS OF VARIABLE LINKAGE TABLE
          6616 *
)00026 A  6617 TVFCCN EQU     22              2 WORD RELATIVE RECORD # OF THE CURRENT
          6618 *                               CYLINDER CONTROL RECORD IF NO CCR IN USE
          6619 *                              THIS CONTAINS 'NONE'
)00030 A  6620 TVFNXT EQU     24              2 WORD RELATIVE RECORD # OF NEXT AVAILABLE
          6621 *                              RECORD IN THIS CYLINDER
)00032 A  6622 TVFUSE EQU     26              1 WORD COUNT OF THE NUMBER OF RECORDS USED
          6623 *                              IN THIS CYLINDER
^00033 A  6624 TVFLMT EQU     27              1 WORD'LOAD' LIMIT THE # OF RRNS ABOVE
          6625 *                                WHICH NEW CHAINS SHOULD NOT BE ADDED'
 00034 A  6626 TVFLCY EQU     28              2 WORD RRN OF THE CCR IN THE FIRST CYL NOT
          6627 *                              'AT OR ABOVE' LOAD LIMIT IF ALL CYL'S ARE
          6628 *                              ABOVE LOAD THE HIGH ORDER BYTE IS 'L' AND
          6629 *                              THIS IS THE FIRST CYL. 'NOT FULL',IF ALL
          6630 *                              CYL.'S ARE FULL THIS CONTAINS 'FULL'
)0036 A   6631 TVFCUP EQU     30              FIRST BYTE IS AN UPDATE INDICATOR FOR THIS
          6632 *                              CCR 'N' MEANS IT HAS NOT BEEN UPDATED
```

```
                    VORTEXII DASMR    DATBAS    2201 HOURS

                6633 *                                  'D' MEANS IT HAS BEEN UPDATED
                6634 ***************************************************************************
                6635 *                                                                         *
                6636 *       VARIABLE FILE  LINKPATH TABLE                                     *
                6637 *                                                                         *
                6638 ***************************************************************************
00000 A         6639 TVLPNM EQU     0               4 WORDS (8 CHARACTERS) OF LINKPATH NAME
                6640 *                              THE FIRST 2 WORDS (4 BYTES) ARE THE MASTER
                6641 *                              FILE NAME THIS LINK IS CONNECTED TO,THE
                6642 *                              NEXT 2 WORDS(4 BYTES) IS THE LINKPATH NAME
00004 A         6643 TVLCOD EQU     4               1 WORD RECORD CODE UNIQUE TO THIS LINKPATH
                6644 *                                IF THE LINKPATH IS COMMON TO ALL RECORD
                6645 *                              TYPES THIS IS '**'
00005 A         6646 TVLVLD EQU     5               1 WORD COUNT IN BYTES REPRESENTING THE
                6647 *                                DISPLACEMENT TO THIS LINK FROM THE BEGIN-
                6648 *                                NING OF THE LOGICAL RECORD
00006 A         6649 TVLVKD EQU     6               AS TVLVLD FOR THE KEY IN THE VARIABLE REC-
                6650 *                                ORD
00007 A         6651 TVLMLD EQU     7               AS'TVLVLD' BUT DISPLACEMENT FOR LINKPATH
                6652 *                                IN MASTER RECORD
                6653 ***************************************************************************
                6654 *                                                                         *
                6655 *       ELEMENT TABLE                                                     *
                6656 *                                                                         *
                6657 ***************************************************************************
01000 A         6658 TELNAM EQU     0               2 WORDS(4 BYTES) WHICH IS THE LAST 4 BYTES
                6659 *                               OF THE ELEMENT NAME - THE FIRST 4 ARE
                6660 *                               ASSUMED - THEY MUST (BY DBGEN) BE THE NAM
                6661 *                               OF THE FILE
01002 A         6662 TELCOD EQU     2               1 WORD RECORD CODE UNIQUE FOR THIS ELEMENT
                6663 *                                IF THIS ELEMENT IS COMMON TO ALL RECORDS
                6664 *                              IT IS '**'
01003 A         6665 TELFTY EQU     3               FIRST BYTE IS THE 'FIELD TYPE' I.E.
                6666 *                              'K' IS A KEY
                6667 *                              'L' IS A LINKPATH
                6668 *                              'R' IS A ROOT IN MASTER RECORDS
                6669 *                              ' ' (BLANK) IS A NORMAL ELEMENT
                6670 *       PRETTY USELESS EXCEPT  IN MASTER FILE RECORDS
01003 A         6671 TELLEV EQU     3               SECOND BYTE IS A ONE CHARACTER LEVEL #
                6672 *
01004 A         6673 TELDSP EQU     4               1 WORD DISPLACEMENT(IN BYTES) FROM BEGIN-
                6674 *                                NING OF THIS RECORD TO THIS ELEMENT
```

```
                    VORTXIT DASMR    DATBAS     2201 HOURS

)005 A 6675 TELLEN EQU     5              1 WORD LENGTH (IN BYTES) OF THIS ELEMENT
       6676 ***************************************************************************
       6677 *       RELATIVE LABELS FOR FILE/CYLINDER CONTROL RECORDS                 *
       6678 ***************************************************************************
       6679 *
)000 A 6680 VCRNXT EQU     0
)002 A 6681 VCRUSE EQU     2
)003 A 6682 VCRLMT EQU     3
)004 A 6683 VCR1ST EQU     4
)014 A 6684 VCREND EQU     12
       6685 *
)000 A 6686 CCRNAM EQU     0              FILE NAME 2 WORDS
)002 A 6687 CCRLOK EQU     2              LOCK WORD 1 WORD
)003 A 6688 CCRTID EQU     3              TASK I.D. OWNING LOCK 1 WORD
)004 A 6689 CCRCNT EQU     4              COUNT OF RECORDS USED IN THIS FILE
       6690 *                             2 WORDS
)006 A 6691 MCREND EQU     6
```

```
 10/26/75            VORTXIT DASMR    DATBAS     2201 HOURS

       6692         EJEC
       6693 ***************************************************************************
       6694 *                                                                         *
       6695 *       I/O MACRO CONTROL BLOCK EXPANSION                                 *
       6696 *                                                                         *
       6697 ***************************************************************************
       6698 *
)000 A 6699 IOBJSR EQU     0              2 WORD JSR X TO I/O SUPERVISOR
       6700 *
)002 A 6701 IOBSTS EQU     2              1 WORD STATUS OF I/O REQUEST -SIGN BIT ON
       6702 *                               INDICATES COMPLETION,LOW ORDER (RIGHT-
       6703 *                               MOST) BIT ON INDICATES UNRECOVERABLE I/O
       6704 *                               ERROR
       6705 *
)003 A 6706 IOBLUN EQU     3              LOW ORDER 8 BITS ARE LOGICAL UNIT #
       6707 *
)004 A 6708 IOBFCB EQU     4              ADDRESS OF FCB
       6709 *
)005 A 6710 IOBITD EQU     5              ADDRESS OF TIDB
       6711 *
)006 A 6712 IOBIOC EQU     6              I/O CONTROL THREAD ADDRESS
```

```
6713          EJEC
6714 ********************************************************************************
6715 *                                                                              *
6716 *       FILE PARTITION CONTROL BLOCKS - (MODULE TABLE)                         *
6717 *                                                                              *
6718 *  A LOGICAL FILE (TOTAL FILE) MAY CONSIST OF MULTIPLE NON-CONTIGUOUS          *
6719 *        DISK AREAS CALLED PARTITIONS - NO PARTITION MAY EXCEED 32,768         *
6720 *        SECTORS - ALL SECTORS ARE 120 WORDS (240 BYTES) LONG                  *
6721 *    THEREFORE ALL BUFFERS ALLOCATED ARE 120 WORDS LONG                        *
6722 *    IN ORDER TO PROVIDE SOME ERROR CHECKING EACH PARTITION WILL HAVE          *
6723 *       AN OPERATING SYSTEM FILE GENERATED FOR IT. THESE FILES REQUIRE         *
6724 *       A CONTROL BLOCK  (FILE CONTROL BLOCK) THESE FILES WILL BE              *
6725 *                              -    -       -                                 *
6726 *       GENERATED WITH SIX BYTE NAMES, WHERE THE FIRST FOUR BYTES ARE          *
6727 *  THE TOTAL FILE NAME AND THE LAST TWO ARE NUMERIC PARTITION SEQUENCE         *
6728 *       NUMBERS FROM 00 TO 99.                                                 *
6729 *       ALTHOUGH RECORDS-PER-BLOCK WILL REMAIN A VALID INPUT CONTROL           *
6730 *       IT WILL BE IGNORED - NO STORAGE WILL BE GENERATED AND IT CAN           *
6731 *       HAVE NO EFFECT                                                         *
6732 *       IF THE LOGICAL RECORD SIZE IS LESS THAN 240 BYTES ONLY ONE             *
6733 *       BUFFER  WILL BE GENERATED (OF 120 WORDS - SECTOR SIZE)                 *
6734 *       IF THE LOGICAL RECORD SIZE IS GREATER THAN 240 BYTES DBGEN WILL        *
6735 *              GENERATE AS MANY BUFFERS OF 120 WORDS AS ARE NECESSARY          *
6736 *              TO EQUAL OR EXCEED THAT RECORD LENGTH                           *
6737 *                                                                              *
000000 A 6738 TMDFCB EQU     0              THIS IS THE FILE CONTROL BLOCK GENERATED *
6739 *                                       FOR THIS PARTITION                     *
6740 ********************************************************************************
000000 A 6741 FCBRLN EQU     0              LOGICAL RECORD LENGTH
6742 *
000001 A 6743 FCBADO EQU     1              DATA ADDRESS
6744 *
000002 A 6745 FCBACS EQU     2              ACCESS MODE (FIRST BYTE)
6746 *
000002 A 6747 FCBKEY EQU     2              PROTECT KEY (SECOND BYTE)
6748 *
000003 A 6749 FCBCSN EQU     3              CURRENT SECTOR NUMBER
6750 *
000004 A 6751 FCBCEN EQU     4              CURRENT END OF FILE SECTOR NUMBER
6752 *
000005 A 6753 FCB1ST EQU     5              FIRST SECTOR #
6754 *
```

```
                                VORTXII DASMR   DATBAS    2201 HOURS

000006 A 6755 FCHLST EQU     6              LAST SECTOR #, NUMBER OF SECTORS IN THIS
         6756 *                             PARTITION
000007 A 6757 FCBNAM EQU     7              FILE NAME-3 WORDS, THE FORMAT
         6758 *                               IS DESCRIBED IN COMMENTS PREFIXING THIS
         6759 *                               DEFINITION
000012 A 6760 TMDLOW EQU     10             2 WORDS LOWEST RRN IN THIS PARTITION
         6761 *
000014 A 6762 TMDHIH EQU     12             2 WORDS HIGHEST RRN IN THIS PARTITION
         6763 *
000016 A 6764 TMDNUM EQU     14             2 WORDS NUMBER OF LOGICAL RECORDS IN THIS
         6765 *                               PARTITION
000020 A 6766 TMDLUN EQU     16             LOGICAL UNIT NUMBERDVE
         6767 *
```

```
   10/26/75             VORTXII DASMR   DATBAS    2201 HOURS

         6768         EJEC
         6769 ********************************************************************************
         6770 *                                                                              *
         6771 *       LOG RECORD PREFIX DESCRIPTION                                          *
         6772 *                                                                              *
         6773 ********************************************************************************
000000 A 6774 TLGLEN EQU     0              LENGTH OF LOG RECORD IN BYTES / WORD
         6775 *
000001 A 6776 TLGSER EQU     1              2 WORD SERIAL # OF LOG RECORD
         6777 *
000003 A 6778 TLGPNM EQU     3              4 WORD PROGRAM NAME
         6779 *
000007 A 6780 TLGDTB EQU     7              3 WORD DBMOD NAME
         6781 *
000012 A 6782 TLGFNM EQU     10             2 WORD FILE NAME IF APPROPO,ELSE '****'
         6783 *
000014 A 6784 TLGRRN EQU     12             2 WORD RELATIVE REC # OR SNON/SNOF/QUIE/
         6785 *                               MARK
000016 A 6786 TLGREC EQU     14             ACTUAL RECORD IMAGE OR DATE FOR SINON OR
         6787 *                               USER MESSAGE FOR QUIET / MARK
```

```
                    VORTXII DASMR   DATBAS    2201 HOURS

          6788          EJEC
          6789 ********************************************************************************
          6790 *        USER BEGIN PARAMETER TABLE                                            *
          6791 *        THIS IS THE FORMAT DEFINITION OF THE USER PROGRAM'S                   *
          6792 *        'SINON SCHEMA'                                                        *
          6793 *                                                                              *
          6794 ********************************************************************************
000000 A  6795 TUBPGM EQU     0               4 WORD (8 BYTE) LOGICAL NAME OF USER PROGR
          6796 *
000004 A  6797 TUBDTB EQU     4               3 WORD (6 BYTE) NAME OF DATA BASE MODULE
          6798 *
000007 A  6799 TUBACS EQU     7               3 WORD (6 BYTE   ACCESS MODE) AS FOLLOWS:
          6800 *                               'ROONLY'  DENOTES USER PROGRAM WILL NOT
          6801 *                                         UPDATE THE DATA BASE
          6802 *                               'UPDATE'  DENOTES THE USER PROGRAM WILL
          6803 *                                         UPDATE THE DATA BASE
000012 A  6804 TUBOPT EQU     10              1 WORD (2 BYTE) LOG OPTION FIELD AS FOLLOW
          6805 *                               'LG' DENOTES LOGGING REQUESTED
          6806 *                               'NL' NO LOGGING REQUESTED
          6807 *       THE FOLLOWING 3 ENTRIES REPRESENT A SET,REPEATED FOR EACH FILE
          6808 *              ACCESSED BY THE USER
          6809 *
000000 A  6810 TUBFIL EQU     0               2 WORD NAME OF FILE
          6811 *
000002 A  6812 TUBMOD EQU     2               2 WORD ACCESS MODE FOR THE SPECIFIED FILE
          6813 *                               'SHRE'    DENOTES THE USER WILL NOT UPDATE
          6814 *                                         THE FILE
          6815 *                               'PRIV'    DENOTES THE USER WILL UPDATE THE
          6816 *                                         FILE
          6817 *
000004 A  6818 TUBSTA EQU     4               2 WORD FIELD TO RECIEVE THE STATUS CODE ON
          6819 *                              RETURN FROM SINON
          6820 ********************************************************************************
010670 R  6821 ENDATB EQU     *
          6822          END
0 ERRORS ASSEMBLY COMPLETE
```