

System 45 Data Base Management



The Hewlett-Packard System 45 Data Base Management System (DBMS) package consists of two major parts: IMAGE/45 and QUERY/45. IMAGE/45 is a Read Only Memory (ROM) implemented extension of the System 45 operating system. It is similar to the other ROMs designed for the System 45 (Graphics, I/O, Mass Storage, Advanced Programming, etc.) that add powerful new statements to the System 45's BASIC language.

There are two IMAGE/45 ROMs: one for the Language Processor and one for the Peripheral Processor. In addition to the ROMs, IMAGE/45 includes some BASIC Utility programs that enable you to define, restructure, back-up and recover the data base.

QUERY/45 is a powerful, interactive BASIC program that serves as a primary data base manipulation tool for both programmers and non-programmers. It provides almost all the capabilities of IMAGE/45 in an interactive format. It allows new data types, multiple set searches, sorting and range checking. QUERY/45 is designed for use by both the casual and frequent user by providing both a prompted mode with "help" files and a formal command mode that bypasses all screen prompting and lets the experienced programmer type in his commands directly.

IMAGE/45 Data Base Structure. At the most basic level, IMAGE/45 is structured as a simple network DBMS that is similar to implementations on other HP DBM Systems. It allows up to two distinct levels of files or data sets. It uses a path oriented or chained approach to data retrieval. Pointers are maintained that logically connect records that have com-



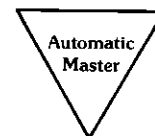
mon attributes. This allows cross-referenced access to collections of data down to the smallest unit (data items) and makes it possible to access related data very quickly by key values.

An IMAGE/45 Data Base consists of one or more data sets which have some logical relationship with each other. A data set consists of one or more fixed length records or data entries. A data entry consists of one or more data items (fields), see Figure 1.

IMAGE/45 supports two types of data sets: Master and Detail, see Figure 3. Master data sets are a collection of key values used for fast access to information that is stored in the Master data set or in a related Detail data set. Access to data entries

within a Detail data set is usually via a key value which is linked from a related Master data set. Detail data entries can also be accessed serially or directly. IMAGE/45 Master data sets (or index files) are usually accessed by "hashing" to determine a relative record address. Hashing is the use of an algorithm to calculate a record location based on a key value.

There are two types of Master data sets: Automatic Master and Manual Masters.



- contains one data item, the key item;
- an update of a related Detail data set causes the system to automatically update the Master;
- contains current key items;
- used when a manual update is unreasonable and data checking is unnecessary;
- must be tied to at least one Detail data set.



- contains at least one data item, the key item, and possibly some related non-key items;
- must be updated manually before updating the Detail data set;
- used to check for erroneous key values and to reduce data repetition by storing detail information with the key item;
- contains all allowable key items;
- can stand alone

System 45 DBMS Logical Components

The System 45 Data Base Management System provides easy-to-use facilities to:

- create a data base,
- query the data base,
- access the base from a user program,
- maintain the data base.

The diagram below shows the System 45 DBMS functions:

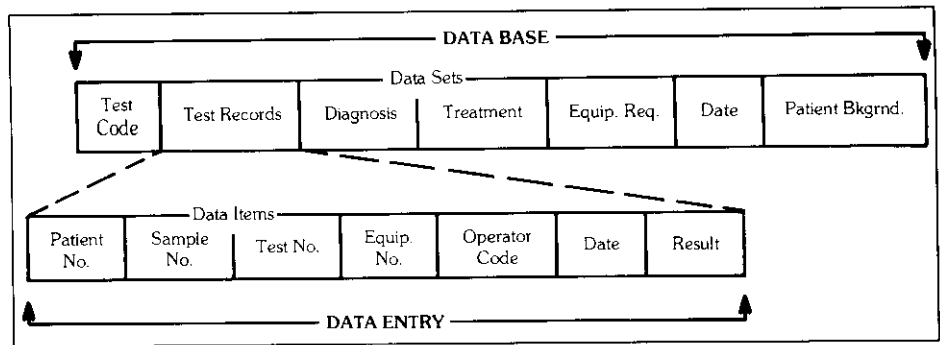


Figure 1

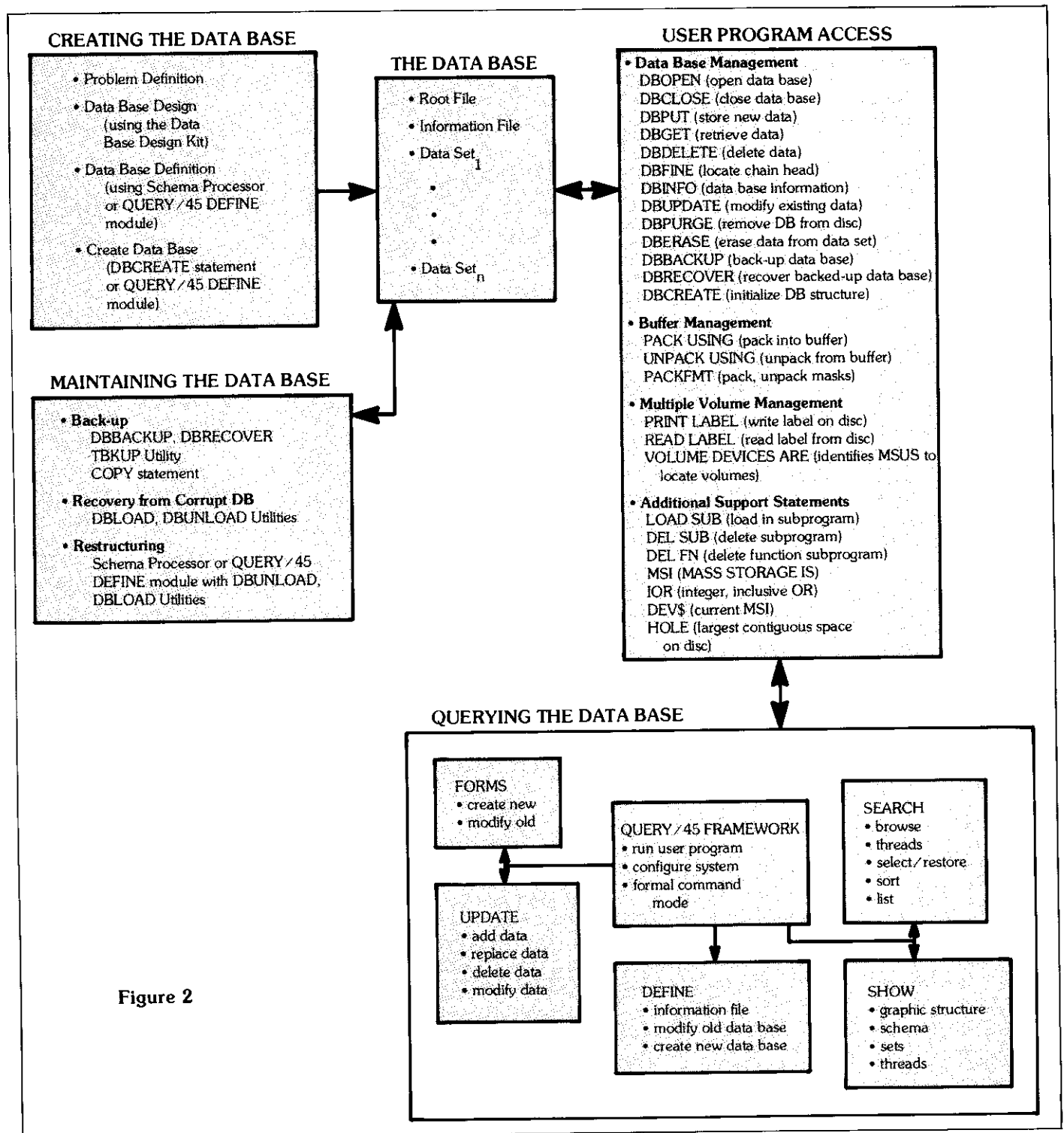


Figure 2

Maintaining the data base. There are three major functions associated with maintaining data bases: Back-up, Recovering from corrupt data bases and Restructuring. DBBACK-UP and DBRECOVER statements in IMAGE/45 can be programmed so that a "snapshot" of the data base can be taken at appropriate intervals. For multiple volume data bases and for those who would prefer to run a separate back-up program, the TBKUP utility is available on the IMAGE/45 Utility program. This utility allows backing-up to standard

disc media and it will prompt the user through the operation.

Alternatively, you can COPY files but it is very easy to forget to copy a file and you could end up with an incomplete back-up.

You may need to restructure or re-define your data base for a variety of reasons. You might want to change the data base name or security passwords. Or you may want to change the capacity or volume label for a data set. Adding or deleting non-key items, adding or deleting Master or Detail data sets, or moving items

around within data sets also require restructuring. To re-define a data base, System 45 DBMS provides two tools: The Schema Processor which can be used if the old Schema text file is available; and the DEFINE module of QUERY/45, which can be used whether or not the old Schema file is available. To do this, the data base is DBUNLOADED and the old data sets are purged. The new data base is then created and the data DBLOADED into it.

System Configuration

The following systems have been tested and will support a System 45 Data Base Management System. They have been tested with up to

four on-line volumes encompassing up to 24-volume data bases. You can add other peripherals such as printers, plotters, more memory and other ROMs to these systems.



		Peripherals
Minimum System	System 45 Desktop Computer (9845T) with: 187K bytes r/w memory Mass Storage ROM Built-in Thermal Printer IMAGE/45 ROMs	HP 9885 M&S Flexible Disc Drives (Master and Slave required)
Recommended System	System 45 Desktop Computer (9845T) with: 187K bytes r/w memory Mass Storage ROM Built-in Thermal Printer IMAGE/45 ROMs *Advanced Programming ROM	HP 7906 M (& S) Disc Drive(s)
Expanded System	System 45 Desktop Computer (9845T) with: 187K bytes r/w memory Mass Storage ROM Built-in Thermal Printer *Advanced Programming ROM IMAGE/45 ROMs	HP 7920 or HP 7925 Disc Drives

*required to run QUERY/45. Used in SHOW STRUCTURE, for lexical order and to reduce QUERY/45 program size through MAT SORT and MAT SEARCH.

Ordering Information

	Part No.	Components
System 45 Data Base Management System	98430A	1. Product Binder 2. QUERY/45 Software (three tapes) 3. QUERY/45 User's Guide 4. IMAGE/45 ROMs (two) 5. IMAGE/45 Utility Software 6. IMAGE/45 Programming Manual 7. Data Base Design Kit 8. Quick Reference Guide 9. Sample Data Base (Library) 10. Error Message Stickers
IMAGE/45 ROMs and Components Only	98429A	1, 4, 5, 6, 7, 8, 9, 10
QUERY/45 Software and Components Only	98428A	1, 2, 3, 7, 9, 10
QUERY/45 Right-to-Copy	98428R	--

These buffer management statements can also give you variable-format records:

PACK USING — Packs the data from program variables into the buffer.

UNPACK USING — Unpacks the data from the buffer into program variables.

PACKFMT — Describes the buffer in terms of the variables in the program and allows for skipped fields.

The System 45 allows data bases to be created and used that are larger than the available on-line storage capacity of the mainframe. To manage such a data base, it is necessary to identify each storage medium (diskette, cartridge, etc.) by

name. It is also necessary that the system know which volumes are on which mass storage devices since the System 45 can support up to four on-line volumes at one time. Data sets can be associated with specific disc labels at data base definition time.

PRINT LABEL — Writes an alphanumeric label of up to eight characters onto the disc.

READ LABEL — Reads the above label.

VOLUME DEVICES ARE — Sets up a new device/label table to identify which volumes are in which mass storage devices.

In order to provide QUERY/45 in an easy-to-use form, it was necessary to invent some additional statements:

LOAD SUB — Loads machine-formatted BASIC subprograms three to seven times faster than it would take to LINK the same subprogram or function.

DEL SUB — Deletes one or more subprogram from memory.

DEL FN — Deletes one or more function subprogram from memory.

MSI — A short form of Mass Storage Is.

IOP — Performs the inclusive-OR operation, bit-by-bit, on two integer expressions.

DEV\$ — Returns the current mass storage unit (specified by MSI).

HOLE — Returns the largest available contiguous space on a volume in physical records (256 bytes).

Functional Specifications

Data Base

Max. # of data sets per base

32

Max. size of base

268 M/bytes (32 767 records × 256 bytes/record × 32 sets)

Max. # of volumes

24 (up to 4 on-line at a time)

Name Size

1 to 4 characters (upper & lower case)

Data Set

Max. # of entries per set

32 767 (depends on entry length)

of Detail sets per Master set

up to 16

Name Size

1 to 15 characters

Search items per Detail set

up to 16

Note: a data set cannot span multiple volumes.

Data entry

Max. bytes per entry

1 022 (depends on number of paths)

Data items per entry

up to 127

Data Item

Item types

Integers (2 bytes)

Short real numbers (4 bytes)

Long real numbers (8 bytes)

ASCII character strings (up to 1 022 bytes)

*Names

*Dates

*Codes (35 values/code)

*supported by QUERY/45

Name Size

1 to 15 characters

Item names per data base

up to 255 (names may be repeated in the descriptions of more than one data set)

Compound data items

(vectors of any single data type)

max. 1 022 bytes

Passwords

Password Size

1 to 8 ASCII characters

of passwords (at set level)

31

Access Speed

Actual access speeds vary with the fullness of the data base and the number of paths involved. IMAGE/45 transfers data at 5 physical records per DMA (Direct Memory Access). If very fast data acquisition is required (in excess of 40 DBPUTS per second) the data should be acquired into a separate file and then transferred into the data base.

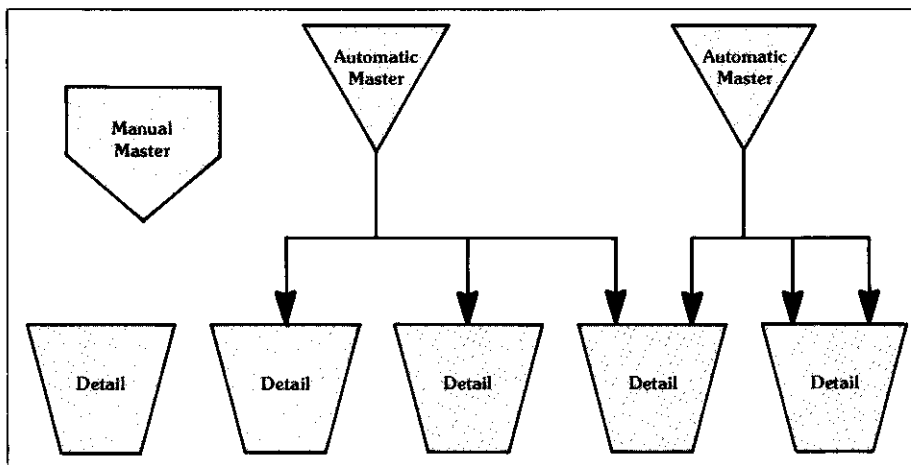


Figure 3

Creating the data base. The formal definition of a System 45 Data Base (or how the data base is described to the desktop computer) is a sort of "data dictionary." It can be accomplished in one of two ways: you can write a **Schema** (a formal description of the data base) or you can use the DEFINE module from QUERY/45. A Schema is written as a commented BASIC program which is entered through the System 45 keyboard. It is then processed by the Schema Processor Program from the Utility software package that accompanies IMAGE/45. The DEFINE module will prompt you through the formal definition. The DEFINE module will also allow some additional data types, range checking and synonyms for data items that the Schema Processor does not recognize.

The processing of the data base definition by either the Schema Processor or the DEFINE module causes a **Root File** to be created. This directory file controls access to the data base. It must remain on-line at all times when the data base is being accessed. QUERY/45 also creates a special information file which serves as an auxiliary to the Root File.

QUERY/45 can be used to create the data sets of a data base which the DEFINE module originally defined or it can be used to restructure and create the information file and data sets for a Schema Processor-defined data base. Optionally, a data base can be created using the DBCREATE statement from IMAGE/45.

Querying the data base. QUERY/45 is written in HP Enhanced BASIC using the IMAGE/45 statements to gain access to the data base. It consists of six main modules:

FRAMEWORK — the path connecting the rest of the modules. It provides for sharing QUERY/45's common areas through the Run User Program facility and features a Formal Command mode for users who don't need prompting screens.

SEARCH — selects and retrieves the required data. Enables a sophisticated multicriteria selection plus a more primitive selection that allows you to "browse" through a data set.

SHOW — provides details about the data base structure and characteristics. You can get a printed graphic representation of a schema listing.

UPDATE — enables addition, deletion and other changes to the data. Lets you add data with or without a pre-defined input form.

DEFINE — lets you set up a data base entirely from QUERY/45. Also lets you modify an existing data base.

FORMS — create new forms and modify old forms used with the UPDATE module. You can define one form per data set.

QUERY/45 software is written using the IMAGE/45 statements. It consists of approximately 500K bytes of BASIC code and is loaded in as subprogram modules as needed.

Accessing the data base from user programs. IMAGE/45 programming statements provide powerful tools to access and manipulate a data base. These statements fall into four categories: Data Base Access and Management, Buffer Management, Multiple Volume Management and Additional Support statements.

Eight IMAGE/45 statements provide flexibility in accessing the data in a data base:

DBOPEN/DBCLOSE — Necessary for a data base operations. DBOPEN opens the data base according to security levels associated with the opening password. All data access operations are handled through a user-defined, mainframe-resident buffer (a string). It is extremely important that DBCLOSE be used to close the data base after access in order to insure that the Root File and data sets are properly updated.

DBPUT — Adds an entry to the specified Manual Master or Detail data set.

DBGET — Retrieves an entry from the specified Master or Detail data set.

DBDELETE — Deletes the "current" entry from the specified data set.

DBFIND — Sets the "current" record pointer to the first entry containing the desired key item in a Detail data set (the chain head).

DBINFO — Gets information about data items, sets, paths and volumes (individually labeled magnetic media such as disc cartridges or diskettes).

DBUPDATE — Updates the "current" entry in the specified Manual Master or Detail data set.

There are five additional IMAGE/45 statements that manage the data base structure and integrity:

DBPURGE — Removes the data base files from the disc directory.

DBERASE — Creates a backed-up data file containing all (or some) of the data base files.

DBRECOVER — Re-establishes a data base from backed-up files.

DBCREATE — Initializes the data base structure.

IMAGE/45 provides three buffer management statements that transport data between variables in programs and items in sets. These statements control data types and the interpretation of the buffer; they are similar to the FORTRAN "EQUIVALENCE" statement. Use of these statements is not restricted to data bases; ordinary mass storage-created files can be more densely packed using them because they strip off the identifying characteristics that are usually stored with each data value.

For assistance call the HP regional office nearest you: Eastern 301/258-2000, Midwest 312/255-9800, Southern 404/955-1500, Western 213/877-1282, Canadian 416/678-9430. Or write to Hewlett-Packard, 3404 East Harmony Road, Fort Collins, Colorado 80525; in Europe, Hewlett-Packard GmbH, Desktop Computer Division, Herrenberger Strasse 110, D-703 Boeblingen, Postfach 1430, West Germany; elsewhere in the world, Hewlett-Packard Intercontinental, 3495 Deer Creek Road, Palo Alto, California 94304.

