4050 Users Share Data Storage and Retrieval in New Tektronix Hard Disk

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. . . 1 to 10 simultaneous users . . . 768 million bytes of disk storage . . . removable disk cartridge . . . dynamically allocated files . . . variable length records . . . indexed files . . . file security . . . continuous time/date clock . . .

These functions characterize the advanced technology of the TEKTRONIX 4909 Multi-User File Management System. The 4909's smart approach to file management and its cost effective data storage and sharing bring convenient economical mass storage to 4050 Series users.

Flexible configurations allow easy expansion of users or storage. The modular design of the 4909's controller connects up to 11 GPIB or special purpose interfaces through simple plug-in slots.

Each GPIB interface supports one 4050 desktop computer; each disk interface handles two disk drives.

With full plug-in configuration up to 10 4050 Systems may be interfaced to the 4909–10 simultaneous users! It solves the transportability problem for users who share data; it also provides large local storage for applications such as drafting, design, mapping, data acquisition, data analysis, research and development.

When adding more users to a system, no software or operating system change are required. The modular plug in approach to the controller allows you to add or reduce users easily.

As part of the standard 4909 package, a GPIB interface is included which will transfer data in burst mode at 240,000 bytes per second. (Of course, the actual data transfer rate depends on your system and application.) Additional GPIB interfaces are available as users are added.

Maximum storage capacity is 768 megabytes; the standard 4909 configuration includes the controller and one disk drive of 32 megabytes; 16 megabytes of which are

Supports one or two disk drives per interface

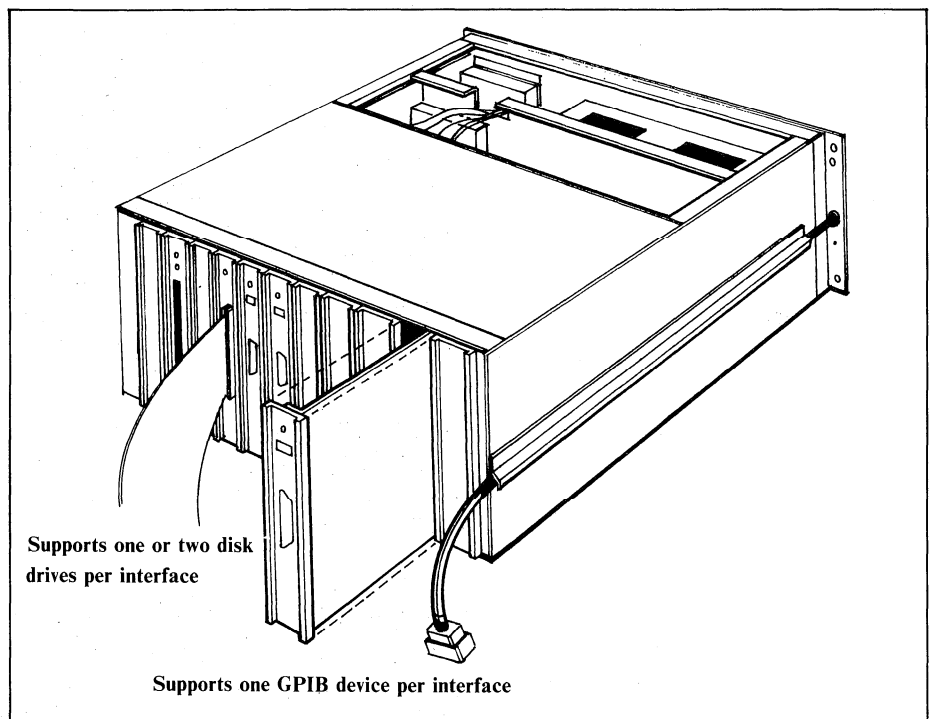Supports one GPIB device per interface

Fig. 1. Easy plug-in interfacing supports up to 11 interfaces.

on a removable cartridge. An optional 4909 disk drive contains 96 megabytes of storage (16 megabytes removable).
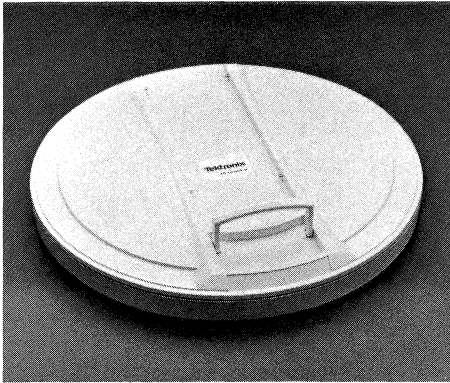

Fig. 2a. 16 Megabyte removable disk pack provides backup and transportability of data.
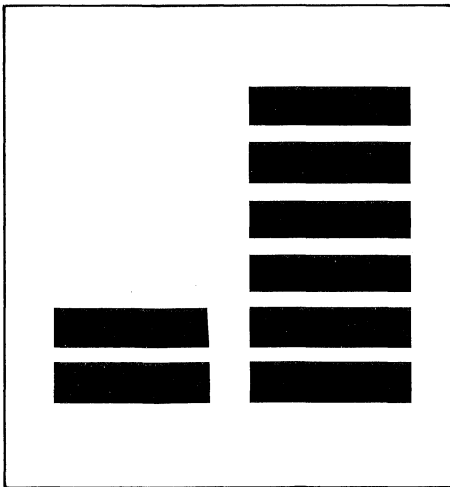

Fig. 2b. Disk capacity is either 32 megabytes or 96 megabytes.

A total of eight drives may be used with one 4909 controller, resulting in maximum storage capacity of 768 megabytes (8 x 96). Additional drives are housed in attractive auxiliary cabinets, each of which supports one or two disk drives.
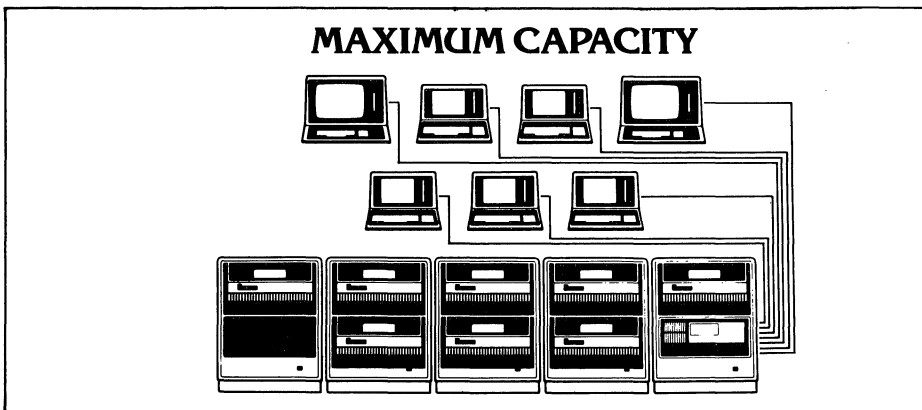
English (ASCII) commands which operate the 4909 may be directly transmitted over the GPIB. Therefore, any computer or instrument controller which supports IEEE-488 1978 may access the 4909. For 4050 Series users, a ROM pack is available which allows easy access to the 4909's file handling in 4050 BASIC, without having to use GPIB print and input statements for file operation.

Through its intelligent controller, advanced file management functions formerly available only on mini or mainframe systems have been implemented in the 4909. Because the file management system resides within the 4909, very little 4050 memory is required and commands are executed from the 4909 not from 4050 software. With more of the file handling chores built into the 4909, it takes fewer commands to get the job done; and default parameters make the commands easy to use.

File Space Allocated Dynamically

For instance, the space required for data is calculated by the 4909. It expands or contracts the file size as data is stored or modified. No longer does the user need to worry about estimating the correct file size or what to do when he reaches the end of the file.
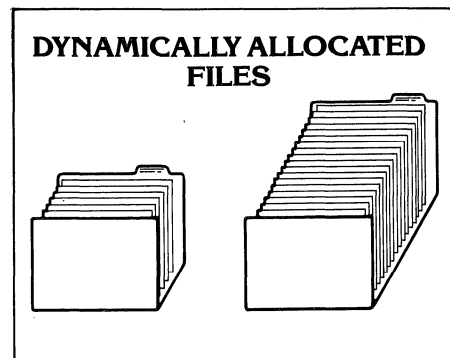

Fig. 4. 4909 handles file management chores.

Records May Be Variable Lengths

Records within a file may be different lengths. For example, within a binary file a record holding x,y,z coordinate position data might contain 28 bytes while in the same file another record holding a text string might contain 100 bytes. And the storage space for each record is calculated and allocated as needed by the 4909.

Concatenated Volumes Link Disk

Concatenation allows two or more disk to be treated as if they were one. Files on one disk may overflow to another, yet appear as one logical unit. Thus, the remaining capacity on a disk is not a limiting factor when storing data. Large data bases may be continued from one disk to another. And, information may be retrieved without specifying which disk it is on.
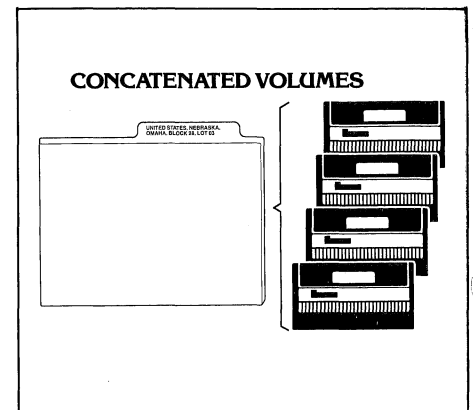

Fig. 5 Files may occupy more than one disk yet be accessed as though on one.

Multiple Level Storage Structure

There is no limit to the number of libraries permitted in the 4909 storage structure and file names may be up to 100 characters long. These features result in meaningful file storage.
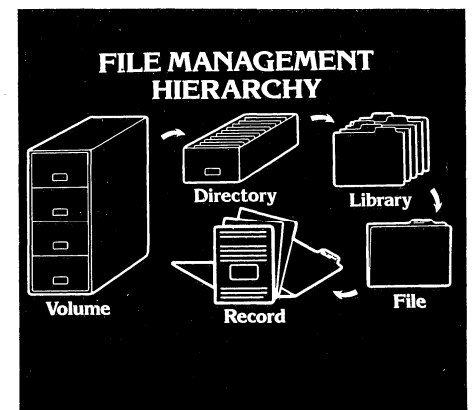

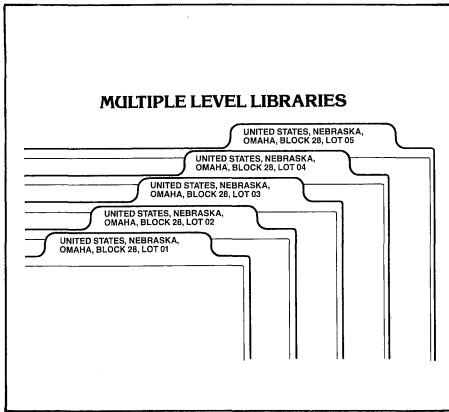*Fig. 6a. An overview of 4909 file management hierarchy.*

Fig. 3. A fully configured system would include 8 disk drives and 7 users.

MULTIPLE LEVEL LIBRARIES

UNITED STATES, NEBRASKA, OMAHA, BLOCK 28, LOT 05
UNITED STATES, NEBRASKA, OMAHA, BLOCK 28, LOT 04
UNITED STATES, NEBRASKA, OMAHA, BLOCK 28, LOT 03
UNITED STATES, NEBRASKA, OMAHA, BLOCK 28, LOT 02
UNITED STATES, NEBRASKA, OMAHA, BLOCK 28, LOT 01

Fig. 6b. Multiple level libraries result in coherent data bases.

INDEXED FILES

FLOOR PLAN

UNITED STATES, NEBRASKA, OMAHA, BLOCK 28, LOT 03

UNITED STATES, NEBRASKA, OMAHA, BLOCK 28, LOT 03, FLOOR PLAN

Fig. 7a. ASCII indexed files are a natural method for storing and retrieving data.

FILE NAMES

UNITED STATES, NEBRASKA, OMAHA, BLOCK 28, LOT 03

Fig. 6c. File names may be up to 100 characters long.

KEY

Index: "FLOORPLAN"

or

Approximate:"FLOOR"

or

Prefix: "FL"

Fig. 7b. Users have three options for retrieving data from ASCII indexed files.

Fig. 7. Schematic of an ASCII indexed file. The combination of file types offers a blend of efficient data storage and flexibility.

Three File Types Provide Flexible Data Manipulation

The 4909 offers six types of data files: binary or ASCII direct, binary or ASCII numeric indexed, or ASCII indexed binary or ASCII.

A **direct** file contains a stream of bytes usually accessed in a serial fashion. However, an individual byte may be addressed by specifying the byte number relative to the beginning of the file.

Indexed files are similar to direct files but are divided into records. Each record may be accessed by a unique key. If the file is a **numeric indexed** file, the keys are integers and a record is retrieved by number, like most random access files.

If the file is an **ASCII indexed** file, the keys are alphanumeric, i.e., employee names, payroll codes. Because names are easier for most of us to remember, ASCII indexed files provide a natural method for storing aand retrieving data. And the 4909 can be directed to locate a record in an ASCII indexed file without stipulating the record's exact key. By specifying an approximate key, the 4909 will locate that 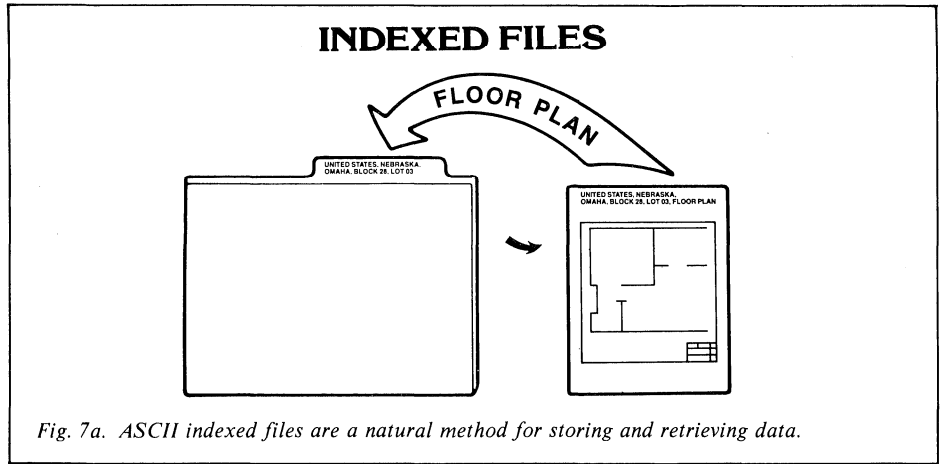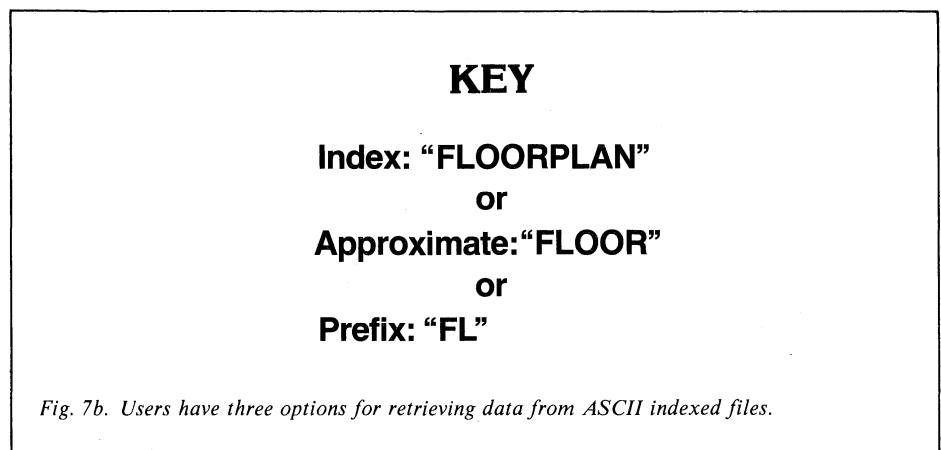index and then step through other records having a key equal to or greater than the specified key. A prefix search will locate an index that starts with the specified prefix. This is many times faster than searching numeric indexed records from beginning to end, or faster even than a binary search of numeric indexed records.

Files Carry Time and Date

Battery backup on the 4909's clock means it's set at the time of installation only. It doesn't have to be reset at each power up. The current time and date will automatically be stamped on files as operations on them occur.

Disk Security

Each disk drive consists of a fixed and a removable portion, each of which is considered a separate physical volume. However, the term "volume" may be extended to include several physical volumes.

When a disk is initially formatted, volume configuration is stipulated and names are assigned to each logical volume. At the same time the user may provide a master password for each logical volume. If included, other users must supply this password when attempting to reformat the disk(s) or when performing restricted operations.

Volume security also comes in the form of the removable cartridge disk which allows files to be backed up and removed from the system for archiving.

Public and Private Space

Depending upon the number of hard disks interfaced to it, the 4909 can support from one to 10 users at one time. To accommodate the users, public and private file workspaces may be declared.

Private file workspaces are declared in advance for individuals and each is assigned their own password. No one may access a private space without the correct password. Public workspace provides users common access to the same storage space. Thus casual users of the 4909 are not required to remember passwords or special commands. Files need not be copied to a users space in order to access them.

For each file, an access list may be assigned which specifies which users have access to the file and what type of access is allowed. The five levels of access are: full access, write access, append access, read access and no access. Several users may access the same file simultaneously.

Another type of file access works much like an airline reservation system. A user can obtain exclusive use of a file for updating. Operations on the file by others are not permitted until the file is released. Requests to read, write, etc., are queued until the file is free, then are handled on a first come, first served basis. (Users have the option of not remaining in the queue should a file be reserved when they wish to access it.)

4909 Functionally Compatible with 4907

Although the 4909 offers more features than the TEKTRONIX 4907 File Manager and has differing commands, it is functionally compatible. For 4907 users wishing to convert their programs and data files to the 4909, a utility is available through the 4050 Series Applications Library. The utility programs aid in the conversion and identify the changes required in the 4907 program to complete the conversion. The 4907-to-4909 conversion utility will be described in more detail in a future issue of TEKniques.

4909 Not Just Another Hard Disk

The 4909 allows users to store their own individual programs and data, but also allows them access to common programs and data. The latest program version will easily be available to users; the latest data will be at their fingertips. And sharing achieves more value per byte of storage.

4909 storage capacity permits users to download and store a very large amount of data, thus alleviating the interaction problems with a host and increasing user accessibility and control.

While easily slipping into any 4050 Series environment, the 4909 also provides mass storage for data acquired from TEKTRONIX Test and Measurement instruments, or any instrument controller supporting GPIB. The 4909 Supports Tektronix Codes and Formats for GPIB instruments.*

Advanced file management and easy expandability ensure the 4909 a place as a

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*Tektronix Codes and Formats information is available in Tektronix publication part number 99AX-4607. The standard was also discussed in Electronics, March 24, 1981: " In-house standards fill gaps in instrument-computer interface," by Maris Graube, Tektronix, Inc.

long term companion to the 4050 Systems and other GPIB compatible system.

For those interested in details, the following table lists some of the features of the 4909.
    14" hard disk
    600 bits per inch
    384 tracks per inch
    30 millisec seek time
    8.33 millisec latency

Your TEKTRONIX Sales Engineer will be happy to supply you with more details on the 4909 Multi-User File Management System.