



**FD-30 MASS MEMORY SYSTEM  
FOR THE HEWLETT-PACKARD 9830A / B COMPUTER**

**INSTRUCTION MANUAL**



**Infotek Systems**

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# INFOTEK FD-30 MASS MEMORY SYSTEM



FD-30 MASS MEMORY SYSTEM

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## INTRODUCTION

The FD-30 Mass Memory provides the HP 9830A/B Desk Top Computer a means of storing 305K bytes of data on a single, inexpensive flexible disk. Because the FD-30 is designed to emulate the cassette system of the 9830, it operates under the control of the cassette syntax. In this regard, the FD-30 obeys all existing 9830 cassette syntax without exception. The only differences lie in the fact that the FD-30 searches for and transfers data much faster.

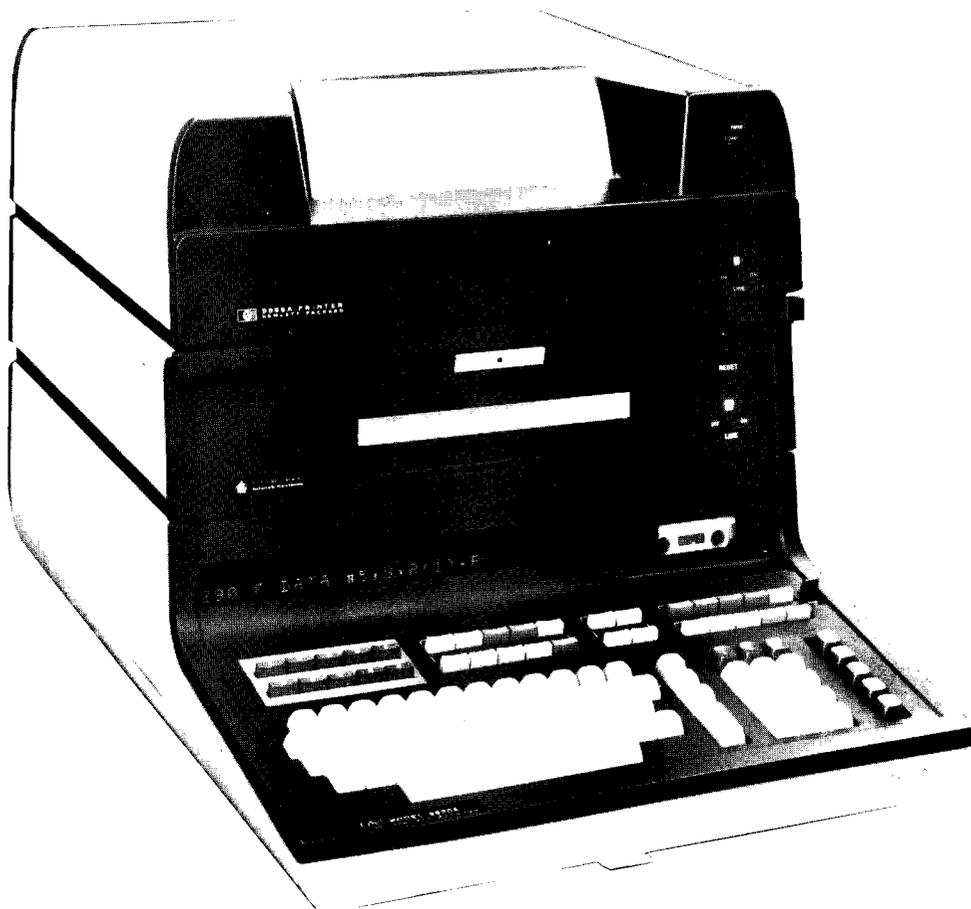


Figure 1. FD-30 Mass Memory System with an HP 9830A/B Computer

# INSPECTION AND UNPACKING



The FD-30 Mass Memory drive has been thoroughly inspected and tested prior to shipment and is ready for operation when received. However, before installation and use, the FD-30 must be inspected for any possible damage incurred during transit.

Carefully remove the FD-30 from the shipping carton and inspect the unit for possible damage. If there is any damage, file a claim with the carrier. Retain the original packing carton for use in the event that it becomes necessary to re-ship the unit.

TABLE 1. EQUIPMENT SUPPLIED

Item	Description	Quantity
1	Mass Memory System, Model FD-30A	1 ea
2	Interface Cable for 9830A/B, Factory Preset for Select Code 5 (unless otherwise specified in the purchase order)	1 ea
3	AC Power Cord	1 ea
4	Blank Disk	1 ea
5	Utility Program Disk	1 ea
6	Instruction Manual	1 ea
7	Spare Fuse for 120 V Operation (1 Amp)	1 ea
8	Fuses for 240 V Operation (1/2 Amp)	2 ea

## SPECIFICATIONS



**INPUT POWER:** 60 Hz units; 110 or 220Vac; 70VA  
**OPTION 02:** 50 Hz units; 220Vac; 70VA  
**OPTION 02B:** Variable Frequency Units;  
47 to 67 Hz, 110 or 220Vac; 85VA

**TEMPERATURE:** 45 to 105°F (7 to 40°C) Operating  
0 to 125°F (-18 to 52°C) Storage

**HUMIDITY:** 95% Relative, Non-Condensing

**DIMENSIONS:** WIDTH — 17.5 in. (44.45cm)  
HEIGHT — 4 in. (10.16cm)  
DEPTH — 16 in. (40.64cm)

**WEIGHT:** 31 lbs. (14.1 KG)



## INSTALLATION

The FD-30 was designed to fit between the 9830A/B Computer and the 9866A/B Thermal Printer. The bottom of the FD-30 has the same pattern as the bottom of the printer and the top of the FD-30 has the same pattern as the top of the computer. Therefore, all components continue to interlock. The FD-30 may also be operated in any location relative to the 9830 that is within the reach of the interface cable.

### NOTE

The FD-30, as shipped, is factory set for 120-volt, 60-Hz operation. The system can be reconfigured for 240-volt, 60-Hz operation. To accomplish this, slide the fuse cover over the input power connector. Remove the input voltage programming card and the fuse, which are now exposed.

Re-install the input voltage programming card with the legend '220' facing up as shown in Figure 2. Install the 240-volt fuse.

After insuring that the input power selection corresponds to the available power, proceed with the installation of the FD-30.

### NOTE

The FD-30A, without option 02, will not operate from 50-Hz lines. If 50-Hz operation is intended, make certain that the nameplate on the rear panel indicates 50 Hz.



Figure 2. Installing Voltage Programming Card

STEP 1. Turn off the power to the 9830 and turn off any peripheral device that may be connected to it, such as the printer, outboard cassette, etc.

STEP 2. If you intend to install the FD-30 between the computer and printer, remove the printer and set it along side the computer. If there is not enough space along side the computer, disconnect the cables from the back of the printer before removing it. As shown in Figure 3, place the FD-30 on top of the computer and place the printer on top of the FD-30 as if you were placing it on top of the computer. Reconnect the cables to the printer.

STEP 3. The interface cable (Item 2, Table 1), in the absence of specific arrangements to the contrary, is shipped from the factory as SELECT CODE 5. If SELECT CODE 5 is acceptable, or a special SELECT CODE has been preselected at the time your order was placed, you may proceed to install the interface cable connector box into an available I/O slot at the back of the 9830 as in Figure 4.

If you wish to change the SELECT CODE number for your FD-30, refer to Appendix A.

STEP 4. After installing the I/O box into the back of the 9830, connect the other end of the interface cable to the back of the FD-30 as shown in Figure 5. The connector is rectangular at one end and rounded on the other, and cannot be mated unless the cable points toward the center of the unit.

STEP 5. Install the power cord (Item 3, Table 1) as shown in Figure 6.

STEP 6. Turn on the power to the computer, the printer and the FD-30. The power application or turn off sequence is not critical.

This completes the installation of the FD-30.

### NOTE

The door of the FD-30 is power protected. This means that the door cannot be opened unless power is applied.

# INSTALLATION [Cont.]

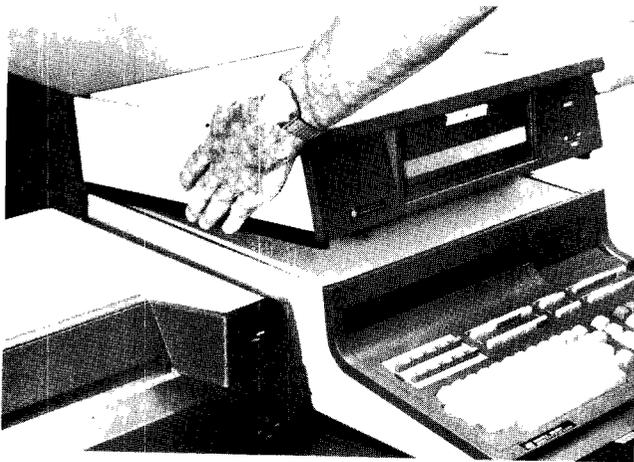


Figure 3. Positioning FD-30 Mass Memory Unit

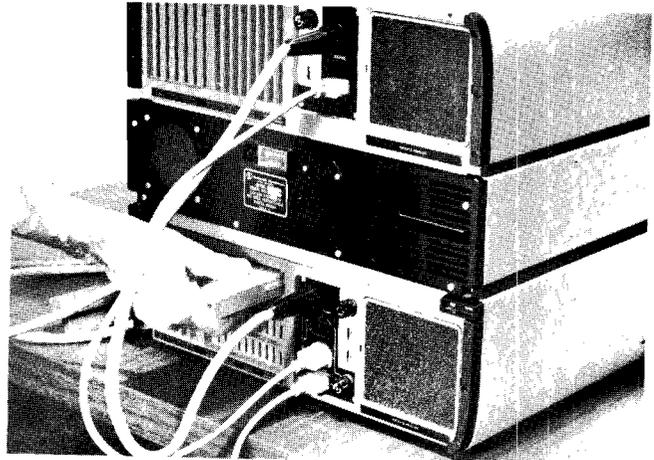


Figure 4. Installing Interface Connector Box

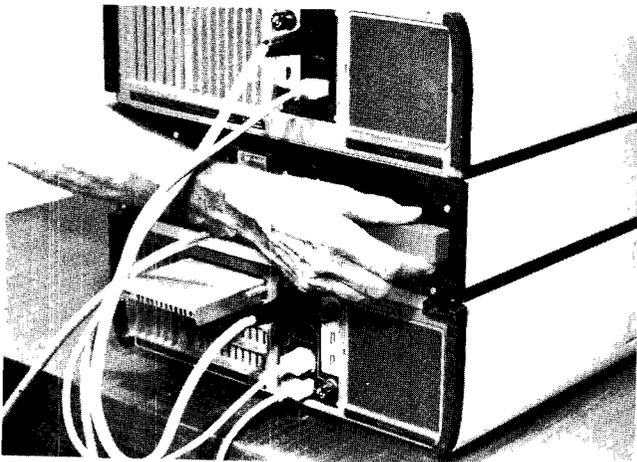


Figure 5. Interface Cable Connector



Figure 6. Connecting Power Cord





## OPERATION

Your FD-30 emulates the Hewlett-Packard cassette system. Accordingly, the FD-30 will function logically exactly like a cassette and, more specifically, like the 9865A outboard cassette. Every peripheral device operating in conjunction with the 9830 must have a SELECT CODE number. This is true even of peripherals contained within the 9830, such as its internal cassette which is SELECT CODE 10.

Cassette control commands which do not specify a SELECT CODE default to SELECT CODE 10, the inboard cassette. In order for cassette commands to be executed by the FD-30, it is necessary to insert its SELECT CODE and a pound sign (#) into every command that is to be executed. For example, STORE #5. Other than the inclusion of the pound sign (#) and SELECT CODE, no other additions to syntax are required. This subject is covered by the 9830 manual.

The power turn-on sequence for the 9830 and the FD-30 is arbitrary. Because the FD-30 disk is hard sectored, it is not possible to accidentally overwrite sector marks and thereby destroy a disk. The hard sectoring is unique to the type of drive used in the FD-30.

In order to obtain consistently good and predictable results, INFOTEK disks should be used. INFOTEK disks are made with a high quality surface to ensure long life of the read-write head.

If proper care is used to protect the disk from contamination by dust and vapors, a head life of 20,000 hours, minimum, can be expected. The FD-30 lifts the head when not actually reading or writing, thus prolonging its life and giving many years of reliable service.

### The Write Protect

A notch in the protective cover of the disk pack allows a photo-emitter light source to activate a write protect circuit. When this notch, shown in Figure 7, is NOT covered, the disk cannot be written and a STORE or MARK command will result in error 58.

To defeat the write protect, install the adhesive-backed, metallic tab provided with the disk, as shown in Figure 7.

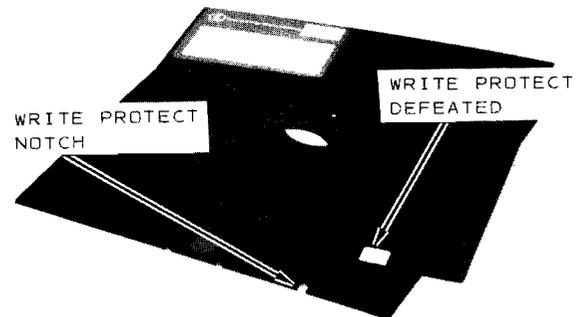


Figure 7. INFOTEK Disks

### Installing a Disk

The drive door cannot be opened unless the disk system is energized. To open the drive door, press the door lock release as shown in Figure 8. The disk should be installed with the label oriented as shown in Figure 9. The right-hand corner of the disk must be locked down in the locking tab, located at the right end of the disk slot, as shown in Figure 10.

Each time that the drive door is closed, the disk system goes through a RESET procedure exactly as it would if the RESET button was depressed. The RESET of the FD-30 is identical in function to the REWIND of a cassette drive. That is, the head will be positioned at the beginning of the first file on the disk.

Begin by installing the blank disk provided with your FD-30. Then execute TLIST, pound sign (#) and the SELECT CODE used for your FD-30 (for example, TLIST #5).

The TLIST will be 10 files long, beginning at file 0 and ending at file 9. While the files are 15,000 words long, the TLIST indicates 1500 words because the 9830 TLIST format is limited to 4-digit numbers. The least significant number, therefore, is dropped off. This anomaly, with respect to TLIST, will not be noted in systems using 8K word or smaller memories. 9830's equipped with the HP B Model memory of 15,072 words, or the Infotek 16,096 work memory, will exhibit this anomaly on files exceeding 9999 words in length.



## Programming

It should be remembered that the FD-30 simply emulates a 9830 cassette drive. Therefore, the operating procedures in the 9830 manual relative to cassette operations hold true in all respects for FD-30 operations. The FD-30 will obey all of these statements and commands. The only noticeable difference is that the on-line capacity is much greater and the speed with which these commands and statements are executed is also much greater.

## Back-up Disk Recommended for Continuous Use

The disk has a life expectancy of five million passes per cylinder. That is equal to 10 days (around the clock) of head contact on a single track and would require reading and/or writing the contents of the Los Angeles telephone directory 31 times. Programs which require constant reading and writing of a single cylinder should provide for data back-up after the 200th hour of continuous **head contact time**.

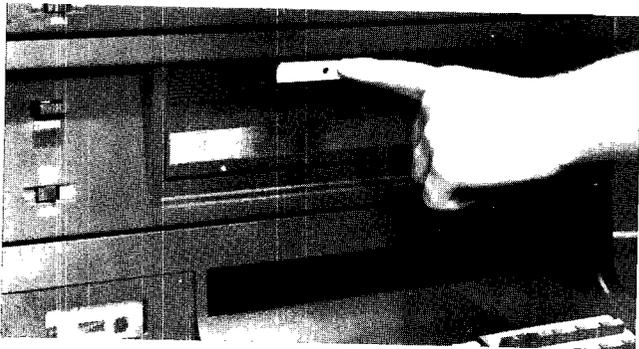


Figure 8. Drive Door Lock Release

## Controls and Indicators (See Figure 11)

The LINE switch controls input power to the unit. The clear window above the line switch will illuminate when the unit is energized.

A RESET button located above the line switch sets the drive to sector 0, cylinder 0, of the disk. This is analogous to a tape cassette on clear leader after REWIND.

The white rectangle in the upper center of the drive system door is the lock RELEASE. Pushing this RELEASE will open the door, only if the unit is energized.

A red BUSY light is located in the center of the lock release. When illuminated, it indicates that the drive has not completed the last command. When the BUSY lamp is illuminated, the lock will not release.



Figure 9. Inserting a Disk

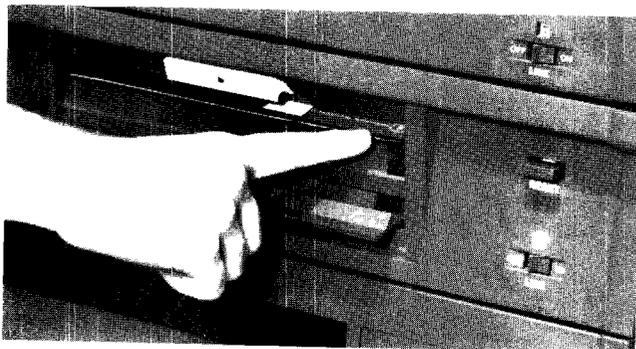


Figure 10. Locking Tab Location

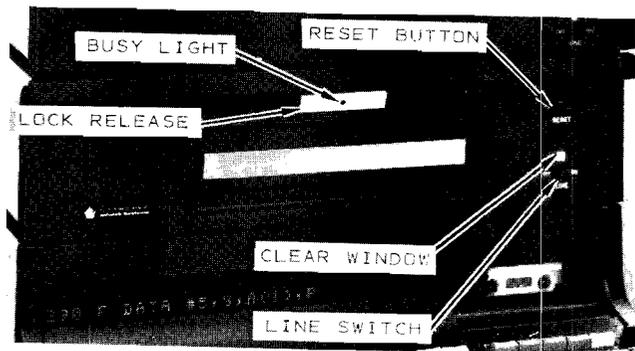


Figure 11. Controls and Indicators



## UNDERSTANDING THE 9830 AND YOUR FD-30

Media capacity efficiency can be optimized if the conventions of the 9830, with respect to files structure, and the format of the FD-30 disk are understood.

### Cassette Tape Transport "Slack"

Because the 9830 cassette transports have a wide speed variation, the MARK statement allocates physical file lengths which are 1.5 times the length specified in the MARK statement. This tape is totally surplus to the needs of the transport which performed the MARK. However, if the tape file is rewritten by a different transport, the "slack" may be required.

The FD-30 media speed is precise and "slack" file space is not used. All comments in this manual relative to "slack" or the "50 percent constant" apply only to cassettes, and NOT the FD-30.

The 9830 writes 114 bytes of information as a file header for any type of file. Moreover, the 9830 allocates a constant 50 percent extra or "slack" tape, relative to the file size specified in the MARK statement. When a MARK statement is executed, the 9830 will mark one file more than the number specified by the MARK statement.

When a FIND statement is executed from within a running program, control is passed from the cassette system back to the program immediately after reading the first file header and following execution of the FIND statement. Therefore, a tape positioned more than one file away in front of, or anywhere following, the file number specified in a FIND statement, **and**, if the next program statement is a MARK operation, then an existing file other than the one specified in the FIND statement will be **overwritten**.

An anomaly associated with the Advanced Programming I ROM is that it causes a SCRATCHALL to be executed when a FIND statement or command is executed while the machine is in LOWCASE mode.

The AP I ROM also contains a DUP statement which allows a tape loaded in the internal cassette (SELECT CODE 10) to be duplicated on a tape loaded into a peripheral cassette (9865A). The DUP command does not allow a tape loaded in the peripheral cassette to be duplicated on the internal

cassette. Moreover, the DUP command does not provide for duplicating more than one source tape to a single destination tape because the command will not execute unless both tapes begin on clear leader. To use DUP with your FD-30, the disk must be RESET prior to execution.

All of the foregoing characteristics of the 9830 cassette system are established by the firmware (Basic ROM and optional ROM's) of the 9830. The FD-30 operates under the control of this firmware to the same extent as does the cassette system. Therefore, no difference in operation of the FD-30 should be expected.

Because the FD-30 only **emulates** a cassette, it is not a random-access system. That is, all files are read sequentially from the start of the disk to the end of the disk. A file physically located in the center of the disk must be found by searching through files exactly as though searching for a file located in the center of a tape. If the disk head is positioned beyond a file, the head will step outward (reverse motion) just as the tape would rewind toward the desired file. The only difference here lies in the fact that the disk steps cylinders toward the desired file at an equivalent speed of 800 inches of tape per second, which is equal to approximately an entire cassette every 4 seconds. Programs and data files which are related, should be located with the same considerations as if tape were being used. Just as it would not be efficient to locate related files at opposite ends of a tape, it would also be inefficient to locate such related files at opposite ends of a disk.

### FD-30 Format

Although the FD-30 disk may appear to the user as a continuous length of tape, it is actually organized into 77 cylinders, with 31 sectors per cylinder, and 128 bytes per sector. Sector zero of cylinder zero is analogous to clear leader on a cassette. While there is a 32nd sector in each cylinder, this sector is utilized for system overhead and is not available to the user. Because the 9830 firmware discards approximately 512 bytes of media following a start on clear leader (which is analogous to cylinder 0, sector 0), the first 5 sectors of the first cylinder are unavailable.

# UNDERSTANDING THE 9830 AND YOUR FD-30 [Cont.]



One sector, or 128 bytes, is the smallest file or increment of available space that can be written. The system will use space in the amount of the nearest whole number of sectors required to accommodate the specified file size.

At 128 bytes per sector, and 31 sectors per cylinder, a cylinder can accommodate 3,968 bytes. Therefore, the 77 cylinders (less the first five sectors) contain 304,896 bytes. At 31 sectors per cylinder, and 77 cylinders (again less five sectors), there are 2,382 possible files available. As the 9830 consumes 114 bytes in order to identify the file, only 14 bytes remain available for data **within** the sector in which the header resides. On this basis, it is clear that maintaining data in a large number of small files is inefficient, because 2,382 files would hold, in the aggregate, only 16,389 words of data. On the other hand, approximately ten times as much data could be contained if the entire disk were written with 8,000 word files. It is evident, then, that storage efficiency rapidly drops off as the specified file size decreases below several hundred words.

## Data File Identification

Just as with the 9830 cassette system, it is necessary that file numbers be maintained in sequential and contiguous order. This is because file control exercised by 9830 firmware **assumes** files to be in sequential and contiguous order. On such an assumption, and given instructions to proceed to a specific file number, the 9830 will read the first file forward of the current position. It will then advance or rewind a number of records that is the computed difference between the current location and the desired location. That is, the 9830 does not read file numbers when searching, it merely counts off the computed number of files.

Files will become numerically noncontiguous if an existing file, which is not the last file, is overwritten by a MARK statement. If the MARK statement specifies a file sufficiently small so that one or more new headers are written prior to the pre-existing following header, or sufficiently large

so that pre-existing following headers are overwritten by the single new file, then the file number sequence is no longer numerically sequential and contiguous. When a tape or disk head is positioned in an erroneous file sequence area, it will no longer be possible to find specified files in the customary manner.

### NOTE

Because of the foregoing, the **re**-marking of an existing file which is not the last file should be avoided. When it cannot be avoided, it must be understood that the balance of all files may very well have to be rewritten in order to maintain contiguous file sequence.

When it becomes necessary to re-mark an existing file which is not the last file, it is most important to remember that the 9830 marks one file in addition to the specified number. Given this fact, together with the 50 percent slack tape constant, it follows that when a specific file (other than the last file) is overwritten by a new MARK statement, even though that statement may specify a file size significantly smaller than the original file, the file following will likely be overwritten. In order to prevent loss of information, specific precautions must be taken with respect to duplicating all of the files which will be affected by the new MARK statement. The number of files that will be affected can be computed, and appropriate precautions taken, to **avoid loss of data**.

One last precaution regarding the marking of files relates to passing of system control during a FIND command. If a FIND command is executed, and tape motion stop is **not confirmed** prior to executing a MARK command, a file other than that specified in the FIND command **may** be overwritten and data contained in that file will be lost.

Use the BUSY lamp of the FD-30 to avoid this potential problem. When the lamp extinguishes, it is equivalent to confirming that tape motion is terminated.



# NEW FILE MANAGEMENT CAPABILITY

The various limitations and anomalies associated with the 9830 cassette control logic previously discussed have been addressed by the Infotek FAST BASIC Series of ROM's.

## TLIST Supplanted by FILEID and BKSPACE Statements

The TLIST anomaly is offset by the FILEID statement in the FAST BASIC I ROM. Additionally, FAST BASIC I provides a BKSPACE statement

which allows the tape to be backspaced to the beginning of the preceding file header. FILEID brings all file header information into program. Therefore, all parameters associated with the file header are available for use in arguments. Moreover, as all parameters are in memory, it is simple to write a utility which will produce a TLIST in any format possible. A sample of the TLIST produced by the utility routine supplied on the utility programs disk (item 5, Table 1) is shown in Figure 12.

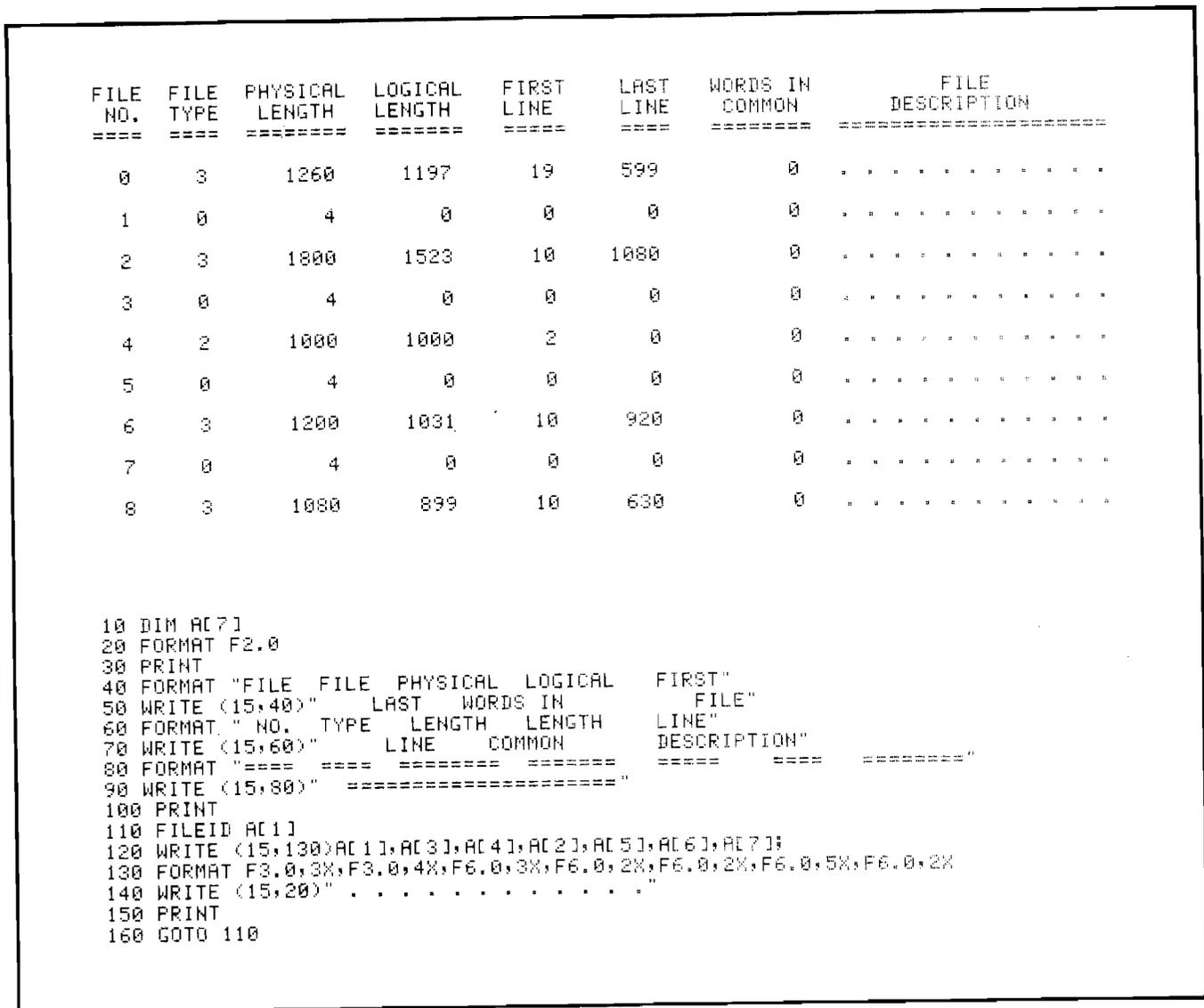


Figure 12. Sample TLIST Utility Program

## NEW FILE MANAGEMENT CAPABILITY [Cont.]



### Universal File Management

The anomaly which causes a SCRATCHALL to be executed when executing a FIND statement in LOWCASE, is corrected by the FAST BASIC II ROM. In addition to a number of new capabilities, FAST BASIC II provides two statements which allow data and/or program files to be loaded into arrays or stored from arrays. When stored from an array, the file will reappear on the tape or disk as the same file TYPE that had been loaded. This permits the programmer virtually universal control over the management of files **from within a program**. The limitations associated with the DUP command in the AP I ROM are totally circumvented.

### File "Packing" Capability

With the FAST BASIC II ROM, it is possible not only to duplicate files, but to do so from any specified source SELECT CODE to any specified

destination SELECT CODE. It is also possible to redefine file headers so that tapes or disks can be "packed" to delete unnecessary file space allocated, and possibly further packed to delete the 50 percent excess file size constant of the tapes.

The extent to which the 50 percent excess file size constant can be deleted depends on certain variables. The first variable is whether or not the file will be written by a machine other than the one marking the file. If so, it will be necessary to determine experimentally the extent to which the transport speeds differ, so that the file length can be made sufficiently large to accommodate the faster of the two tape transports plus some safety margin. It may well be that this will result in a number approaching 50 percent. On the other hand, if the file is not to be written by a machine other than the one which marked it, experiments often indicate that all of the 50 percent excess space can be deleted.

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## MAINTENANCE

The only preventative maintenance required by the FD-30 is periodic cleaning. The frequency of such maintenance depends entirely on the environment in which it operates.

### Air Filter Cleaning

In an extremely dusty environment, it may be necessary to clean the air intake filter several times per month. In a clean environment, maintenance may be unnecessary for a year. The air intake filter should be examined frequently during the first weeks of use and, based on these observations, a schedule for cleaning should be established.

To remove the filter for cleaning, pinch the filter and simply pull it out. After cleaning, push the filter back into place. The system should not be operated while the filter is removed.

Once a year (or more frequently, if the environment is particularly dusty), the cover of the FD-30 should be removed and the unit examined for an excess of dust accumulation. The dust should be removed by using a clean soft paint brush, in conjunction with a vacuum cleaner, to pick up the dust as it is swept off the surfaces by the brush. Do not use a compressed air blast.

### Lead Screw Cleaning (See Figure 13)

Particular attention should be given to the lead screw on the stepper motor which positions the head. It is important that this lead screw be perfectly clean, as dirt causes wear on the head tracking mechanism. If this occurs, it must then be corrected by readjustment to an alignment disk. Such adjustment must be done either by Infotek or the nearest Pertec Service Center, whichever is more convenient to your location. Given proper care, such adjustment should not be necessary for the life of the unit.

### Use of the HP System Test Cassette

If a malfunction of the FD-30 is suspected, the Hewlett-Packard system diagnostic tape can be used to test the FD-30. Proceed by installing the system test cassette in the 9830, execute SCRATCHALL, LOAD BIN 0, then type in PTEST and execute. This will cause the tape to advance and, after stopping, the display will ask for a model

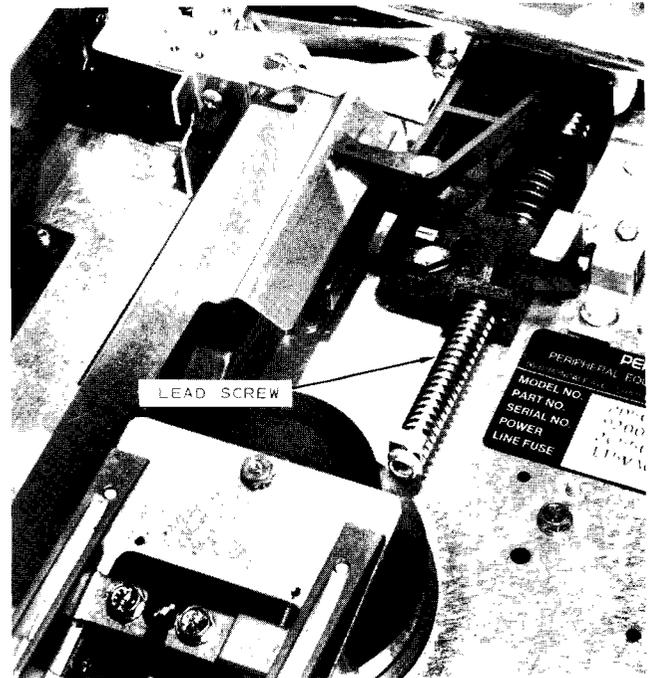


Figure 13. Lead Screw Location

number. Respond by typing in 9865 and execute. The display will then ask for a SELECT code. Respond by typing in the SELECT code assigned to your FD-30. The display will then ask for the number of times to run the test. A test takes approximately half a minute so, if you suspect an intermittent fault, you should ask for a large number of tests. If you suspect a hard failure, ask for one test. After the number of times the test is to be performed is typed in and executed, the display will ask that an unprotected cassette be installed in the transport and rewind, further indicating that when these steps are taken, CONTINUE execute should be pressed. In response to these instructions, install a SCRATCH disk with the WRITE PROTECT slot covered or, if a disk not containing information of value is already in place and unprotected, simply press the RESET button. After these steps are taken, press CONTINUE and execute. The diagnostic can be considered conclusive.

### Precautions

The FD-30 is a precision, complex, electro-mechanical system. Although it is more than



adequately constructed for its intended application, it should be realized that severe mechanical shock and/or vibration can be expected to render certain mechanisms inoperative. Nothing less than the shipping container in which your FD-30 was shipped from the factory is considered to be adequate for commercial transport of your FD-30.

### **Protect FD-30 Disks**

Particular care should be taken with respect to protecting the disks. When not actually installed in the drive, each disk should be kept in its protective envelope in accordance with the instructions imprinted on the back of the envelope. When not required to be immediately available, the disks (in their protective envelopes), should be placed in a closed box and stored in a cool, dry place.

### **Effect of Stray Magnetic Fields on Disks**

Special precautions should be taken to prevent the disks from being subjected to stray magnetic fields. For example, the power transformer in the 9866 printer can bulk erase a large portion of a disk if the disk is on top of the 9866 when power is applied to the printer. It should be assumed that other electrical or electronic equipment produce similar

fields, particularly during turn-on transients; therefore, the disks should never be placed on top of or along side of any such equipment.

### **Keeping the Disk Free of Contamination**

Another important precaution in maintaining the integrity of your disks is to protect them from dirt, particularly oily dirt. Skin oil normally present on the hands and fingers will severely contaminate a disk. The oils will cause dust to adhere to the disk. At that point, it can be anticipated that checksum errors will occur. Removal of such contamination would probably result in scratching the oxide surface, and would, therefore, destroy the disk.

### **CAUTION**

Care should be taken not to bend the disk or emboss the surface of the envelope which could easily also emboss the disk within. A felt tip pen should be used to write on the label of the disk. If a pencil or a ball point pen must be used, then use an absolute minimum of pressure to legibly mark the label.

# NOTES

## APPENDIX A

# CHANGING THE SELECT CODE NUMBER FOR YOUR FD-30



The 9830 computer addresses all peripheral devices simultaneously. Therefore, no two devices may have the same SELECT CODE, as more than one peripheral device would attempt to acknowledge the address.

The I/O structure permits peripheral devices to utilize SELECT CODE numbers between 1 and 9 inclusive. Your FD-30 may be assigned any number in this group.

### Changing SELECT CODE Numbers

To change the SELECT CODE number, proceed by removing the screws from both sides of the I/O connector box and remove the I/O card from its connector.

Figure 14 shows the location where two small wire links, which set the SELECT CODE number, may be found. The number adjacent to each set of holes, in which links may be soldered, defines the SELECT CODE number that will result. Generally, rather than unsoldering an existing set of links, it is more convenient merely to cut existing links, thus opening the circuits, and then soldering new links where required.

It is assumed that the reader is familiar with soldering techniques, particularly as they apply to doubled-sided circuit boards with plated-through holes. Lack of experience in this area could result in a damaged circuit board.

After the links have been soldered in the appropriate locations, examine the work thoroughly to assure that adjacent pads or traces have not been bridged. After inspection, plug the circuit board back into the cable connector so that the component side of the board faces up. Then reassemble the connector box and cover. The SELECT CODE modification is completed.

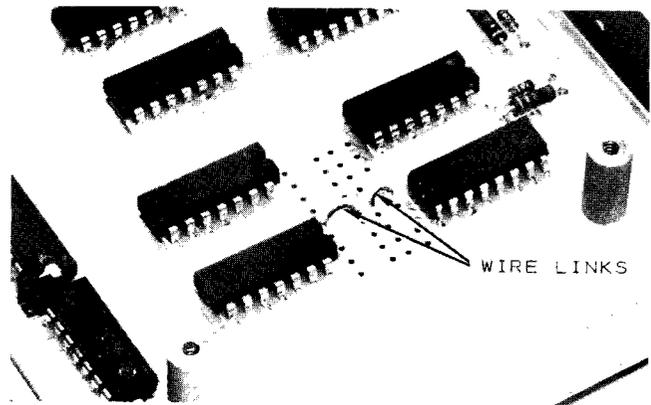


Figure 14. Select Code Wire Links





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