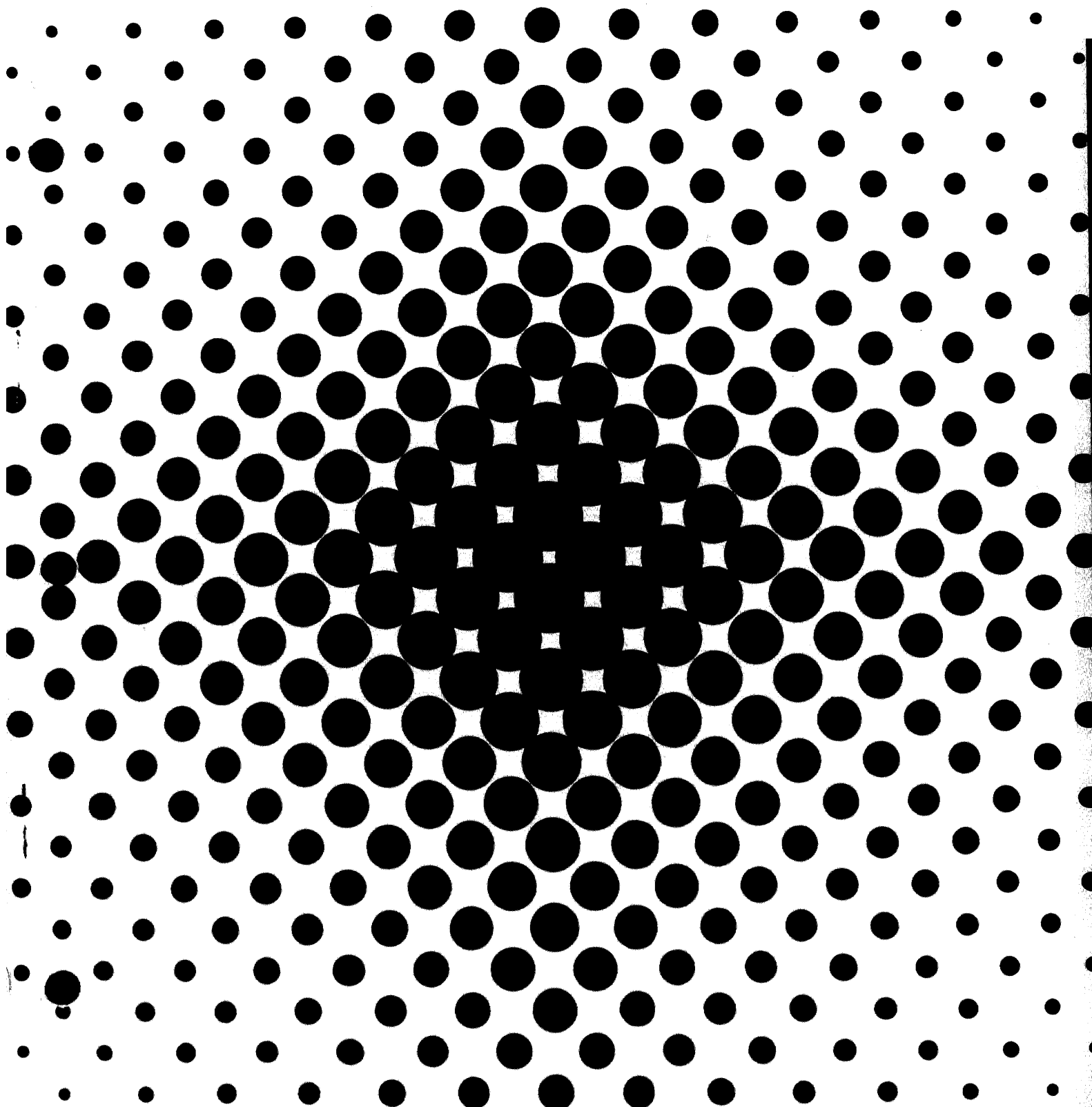


SYSTEM TEN BY SINGER

FRIDEN MODEL 40 DISC DRIVE
MACHINE REFERENCE MANUAL



Only the numeric portions (1-4) of each character are used for specifying this information. Bit 7 may be either 0 or 1; Bit 5 must always be 1. The information is specified as follows.

Character	1	2	3	4	5	6	Bit
D	A	T	T	S	S		4
D	A	T	T	S	S		3
D	A	T	T	S	S		2
D	T	T	T	S	S		1

1
 2
 3
 4
 5
 6

150254
 Einheit 1
 Linie 1
 Spalte 102
 Sektor 10

- 1 DEVICE NUMBER (0-9)
- 4 UNITS DIGIT (0-9) OF A THREE DIGIT TRACK NUMBER
- 2 HUNDREDS DIGIT (0 or 1) OF A THREE DIGIT TRACK NUMBER
- 5 TENS DIGIT (0-9) OF A TWO DIGIT SECTOR NUMBER
- 3 TENS DIGIT (0-9) OF A THREE DIGIT TRACK NUMBER
- 6 UNITS DIGIT (0-9) OF A TWO DIGIT SECTOR NUMBER
- 7 ARM NUMBER (0-4)

0-49 über
 50-99 unter

NOTE:

- The bits in characters 1,3,4,5, and 6 have the following values:
 - Bit 1 has the value 1 when it is ON.
 - Bit 2 has the value 2 when it is ON.
 - Bit 3 has the value 4 when it is ON.
 - Bit 4 has the value 8 when it is ON.
- The bits in character 2 have the following values:
 - Bit 1 has the value 1 when it is ON.
 - Bit 2 has the value 1 when it is ON.
 - Bit 3 has the value 2 when it is ON.
 - Bit 4 has the value 4 when it is ON.

Table H5-1 Condition Code Summary

DISC DRIVE (MODEL 40)

DESCRIPTION

General Characteristics

DISC DRIVE

- * Uses removable disc packs.
- * Automatic "read after write" (when attached to the System Ten).
- * 10 read/write heads.
- * Rotation time: 25 ms.
- * Average access time: 73 ms.
- * Maximum access time (i.e., when the head must be moved from the outermost track to the innermost track): 135 ms.
- * Up to ten may be attached to the File Access Channel of the System Ten (none may be attached to any of the Input/Output Channels).

DISC PACK

- * Maximum data capacity: 10 million 6-bit characters.
- * 10 recording surfaces.
- * 200 tracks per surface.
- * 50 sectors per track.
- * 100 characters (6-bit characters) per sector.

A disc pack consists of six circular aluminum plates coated with magnetic oxide. They are joined to one another by a common vertical axis (there is about 1/2" between plates) and when the pack is mounted on the Friden Model 40 Disc Drive the plates rotate together at approximately 2400 rpm.

The disc drive's access mechanism has five arms, one for each interplate gap. Each arm has two read/write heads, one for the surface above the arm and the other for the surface below the arm (the top surface of the top plate and the bottom surface of the bottom plate are not used for recording data). All five arms move together and can be fully retracted from the interplate gaps to allow the pack to be removed.

DISC DRIVE (MODEL 40)

General Operation

In the System Ten, each Read instruction which addresses a disc implicitly requests that 100 characters be read from a disc sector into memory and, conversely, each Write instruction which addresses a disc implicitly requests that 100 characters be written from memory onto a disc sector. In this manual, such a group of 100 characters is referred to as a record.

Read or Write Instructions

A System Ten Read or Write instruction which addresses a disc contains the following parameters:

<u>Field</u>	<u>Contents</u>
--------------	-----------------

A	Address of a 100 character segment of memory. The A address may be modified by an index register (See READ instruction). For a Read instruction, this is the address where the record will be put in memory when it is read. For a Write instruction, this is the memory address of the record to be written onto the disc.
B	Address of a six character segment of memory (the B address may be modified by an index register). This segment contains a six character "disc address".
LA	Must be 0.
LB	Must be 0.

Six Character 'Disc Address'

The six character segment of memory which is pointed to by the B field of the Read or Write instruction contains the following pieces of information:

- * device number (0-9).
- * arm number (0-4, where 0 specifies the uppermost of the five arms).
- * track number (000-199, where 000 specifies the outermost track).
- * sector number (00-99, where sectors 00-49 are accessed by the upper head and sectors 50-99 by the lower head).

The actual format is shown in Figure H5-1.

DISC DRIVE (MODEL 40)

Programming Hints

A disc drive is free if it is not bound to any partition. It is bound to a given partition as soon as the partition institutes a seek upon it; it remains bound until data transmission is complete. When a disc drive is bound, no other partition may institute a seek upon it.

In a multi-disc environment, all disc drives may be performing seeks simultaneously; however, only one may be transmitting data at a time. The System Ten Disc Controller remembers which disc drives are bound to which partitions.

If several seeks are being performed simultaneously, then the first partition to gain control of the Central Processor after its seek has been completed pre-empts the FAC for data transmission. That partition may read or write records indefinitely so long as it maintains control of the Central Processor and does not attempt to move the read/write heads. If it does, then it loses control of the Central Processor and the disc drive is freed. Thus, before it regains control of the Central Processor, another partition may institute a seek upon the drive.

After the read/write heads have been properly positioned, the maximum amount of time which a read operation can take is 100 milliseconds (minimum time 12.5ms). and the maximum amount of time which a write operation can take is 200 milliseconds (minimum time 37.5 ms).

DISC DRIVE (MODEL 40)

Operator Control Panel

The disc drive's control panel (Figure H5-2) consists of three toggle switches and three condition indicator lights.

The switches are labeled POWER ON/POWER OFF, ENABLE/DISABLE, and START/STOP. The functions of each switch are described in the following paragraphs:

POWER ON/POWER OFF--Turns the disc drive's main power ON or OFF.

ENABLE/DISABLE--When this switch is in the DISABLE position, the disc drive is forced into "Not Ready" status. Thus, the spindle motor can be turned ON and the disc pack brought up to the proper speed well in advance of when the pack is actually needed and no one can accidentally disturb its contents. When the switch is in the ENABLE position, the disc drive is effectively placed on line.

START/STOP--Turns the spindle motor (which rotates the disc pack) ON or OFF. It will not have any effect unless the disc drive's main power is ON, a disc pack is mounted, and the disc drive's cover is closed. Note that it takes about 60 seconds for the disc pack to achieve the required rotating speed (2400 rpm \pm 2%).

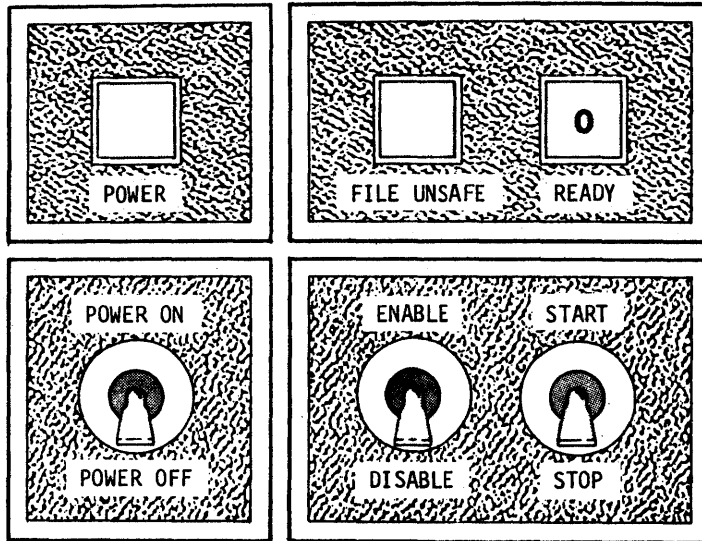
The condition indicator lights are labeled POWER, READY and FILE UNSAFE. The functions of each light are described in the following paragraphs:

POWER-----This light goes ON when the disc drive's main power is turned ON. It goes OFF when the disc drive's main power is turned OFF.

READY-----This light goes ON when the disc pack is rotating at the required speed (2400 rpm \pm 2%). It goes OFF when the rotating speed fluctuates more than 2% from 2400 rpm.

FILE UNSAFE--This light goes ON whenever some condition is sensed which makes it unreliable to continue reading or writing (e.g., the access arm gets positioned so that the heads are trying to read or write between tracks, "out of tolerance" electrical impulses get sensed during reading or writing, etc.).

CONTROL PANEL
LIGHTS



CONTROL PANEL
SWITCHES

Figure H5-2 Disc Control Panel

DISC DRIVE (MODEL 40)

ABNORMAL EVENTS

Disc Drive Not Ready

If reading or writing is requested of a disc drive which is not ready (i.e., the disc pack is not rotating at the proper speed, or the disc drive's main power is OFF, or some other kind of electrical or mechanical failure exists), then the Fault Condition Indicator (Condition Code 4) in the Central Processor is turned ON and the Read or Write instruction is terminated.

Write Errors

When attached to the System Ten, the Friden Model 40 disc drive does an automatic "read after write" to check for write errors. That is, immediately after a record has been written it is automatically read and compared with the 100 positions of memory from which it was written. If the disc record exactly matches the 100 positions of memory, then the write operation is considered successful. If it does not, then the write operation is considered unsuccessful.

If, on the first attempt, a record is not successfully written, then writing (and check reading) is repeated up to three more times. If, after a total of four attempts, the record still has not been successfully written, then the sector is marked "bad", the Flag Condition Indicator (Condition Code 3) in the Central Processor is turned ON, and the Write instruction is terminated.

DISC DRIVE (MODEL 40)

Read Errors

If a record cannot be successfully read, then reading is retried up to three more times. If, after a total of four attempts, the record still cannot be successfully read, then the Error Condition Indicator (Condition Code 1) in the Central Processor is turned ON and the Read instruction is terminated.

If an attempt is made to read a record from a sector which has been marked "bad", then the Flag Condition Indicator (Condition Code 3) in the Central Processor is turned ON and the Read instruction is terminated.

ABNORMAL EVENT	CONDITION CODE
Disc drive not ready	4
Write error	3
Read error	1
Trying to read a "bad" sector	3

Table H5-1 Condition Code Summary

GLOSSARY

INTRODUCTORY NOTE

The purpose of the Glossary is to define all new terms introduced in the text and to define any special use made of standard terms. Standard terms which are used in a standard sense are not included. For elucidation on these, the reader is referred to Computer Dictionary and Handbook by Charles J. Sippl (Howard W. Sams & Co., Inc., Indianapolis, 1966).

Following is a list of the items defined in the Glossary:

Alphabetic Field	Hexadecimal Number System
Arithmetic and Control Unit (ACU)	Host Partition
Auxiliary Storage	Index Register
Bootstrapping	IOC
Branch	Link
Buffer	Local Mode
Burst Mode Transmission	Main Memory
Byte	Memory Module
Byte Mode Transmission	Mixed Field
Central Processing Unit (CPU)	Multiprogramming
Channel	Numeric Field
Characters	On-Line Mode
Common Area of Memory	Operation Code
Control Character	Overdraft
Control Field	Overflow
Cycle-Stealing	Parity Bit
Disc, Bound	Partition
Disc, Free	Partition Switching
Double Frame	Privileged Area of Memory
Effective Address	Protected Area of Memory
Filler Characters	Return Address
Flowcharting Symbols	Sector
	USASCII

GLOSSARY

A

Alphabetic Field

A field consisting strictly of the alphabetic characters A thru Z.

Arithmetic and Control Unit (ACU)

In System Ten, that part of the Central Processing Unit (CPU) which controls and performs the execution of machine instructions.

Auxiliary Storage

Storage in addition to the main storage of a computer. Auxiliary storage usually holds much more information than the main storage, and the information is accessible less rapidly. In System Ten, the disc is considered to be auxiliary storage.

B

Bootstrapping

A technique for loading the first few instructions of a program into storage, then using these instructions to bring the rest of the program into storage. This sometimes involves either the manual entering of a few instructions or the use of a key on a console. In System Ten, the bootstrap sequence is initiated by the depression of a LOAD button on an input device or by the occurrence of certain errors during program execution.

Branch

In System Ten, a departure from the normal sequential processing of instructions as caused by the execution of the Branch instruction. Another type of departure from sequential processing is the switch which passes control to a neighboring partition.

Buffer

Temporary storage used to compensate for the difference in operating speeds of input/output devices and the Central Processing Unit (CPU). In System Ten, the card reader has two card buffers, the card punch has three card buffers, the line printer has two line buffers, etc. Each IOC has one character buffer.

GLOSSARY

Burst Mode Transmission

A mode of communication between the Central Processing Unit (CPU) and external input/output devices. The information is transmitted without interruption as a solid procession of binary bits. In System Ten, the burst mode is employed in transmitting between Main Memory and the Friden Model 40 Disc Drive.

Byte

In System Ten, a group of 6 adjacent binary bits. The bits are referred to as bit-7, bit-5, bit-4, bit-3, bit-2, and bit-1. Bit-6 of the USASCII Standard Code is not used.

Byte Mode Transmission

A mode of communication between the Central Processing Unit (CPU) and external input/output devices. Transmission proceeds one character at a time on a cycle-stealing basis. In System Ten, all transmission through the Input/Output Channel (IOC) is accomplished in this mode, as is also transmission through the File Access Channel (FAC) when the Friden Model 45 Magnetic Tape Drive is the input/output device.

C

Central Processing Unit (CPU)

In System Ten, the Central Processing Unit (CPU) comprises the Arithmetic and Control Unit (ACU), the File Access Channel (FAC), one to twenty Input/Output Channels (IOC), and Main Memory.

Channel

A path along which information, particularly a series of bits or characters, may flow. In System Ten, each partition has a private Input/Output Channel (IOC) which transmits in the byte mode. Common to all partitions is a single File Access Channel (FAC) which transmits in the burst mode when the disc is used.

Characters

A set of coded symbols that includes the decimal digits 0 thru 9, letters A thru Z, punctuation marks, operation symbols, and other symbols. In System Ten, each character is represented by 6 binary bits.

GLOSSARY

Common Area of Memory

In System Ten, that portion of memory which is not partitioned. The Common Area comprises Protected Storage (locations 0-299), a Non-Privileged area, and an optional Privileged area accessible only to privileged partitions.

Control Character

A character whose occurrence in a particular context initiates, modifies, or stops a control operation.

Control Field

In System Ten, the second operand used by the Edit instruction. The control field governs the format of the edited result.

Cycle-Stealing

Data channels give the Arithmetic Control Unit (ACU) the ability to delay the execution of a program for communication of an input/output device with memory. If an input unit requires a memory cycle to store data that it has collected, the data channel makes it possible to delay the program prior to the execution of an instruction, and to store the data without changing the logical condition of the ACU. After the data is stored, the program continues as though nothing has occurred. In System Ten, cycle-stealing occurs between instructions, and during the transmission of data between magnetic tape and memory.

D

Disc, Bound

In System Ten, a disc is bound to a given partition as soon as the partition institutes a seek upon it. The disc remains bound until data transmission is complete. While a disc is bound to a given partition, it cannot be accessed by another partition.

Disc, Free

In System Ten, a disc is free when it is not bound to another partition.

GLOSSARY

Double Frame

In System Ten, a special method of reading or writing 9-track magnetic tape in which the eight bits of data in each tape row are constructed from (or read into) the numeric portions of two consecutive locations in main memory. The same method can also be used on eight-channel paper tape readers and paper tape punches.

E

Effective Address

The address that is actually used in a particular execution of an instruction. In System Ten the effective address for a given instruction address field is the sum of the address field added to the contents of whatever index register is associated with that field.

F

Filler Characters

All characters used in the edit machine instruction EXCEPT the 'at' sign (@), slash (/), dash (-), comma (,), and decimal point (..).

GLOSSARY

Flowcharting Symbols

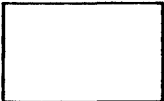
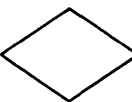
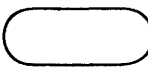

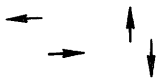
SYMBOL	REPRESENTS
	PROCESSING A GROUP OF PROGRAM INSTRUCTIONS WHICH PERFORM A PROCESSING FUNCTION OF THE PROGRAM.
	DECISION THE DECISION USED TO DOCUMENT POINTS IN THE PROGRAM WHERE A BRANCH TO ALTERNATE PATHS IS POSSIBLE BASED UPON VARIABLE CONDITIONS.
	TERMINAL THE BEGINNING, END, OR POINT OF INTERRUPTION IN A PROGRAM.
	CONNECTOR AN ENTRY FROM, OR AN EXIT TO, ANOTHER PART OF THE PROGRAM FLOWCHART.
	FLOW DIRECTION THE DIRECTION OF PROCESSING OR DATA FLOW.

Table J-1 Flow Chart Symbols

H

Hexadecimal Number System

A number system using the equivalent of the decimal number sixteen as a base. In System Ten, the digits greater than 9 are written as 10, 11, 12, 13, 14, 15.

Host Partition

The partition in control when the given instruction is executed.

GLOSSARY

I

Index Register

A register whose primary purpose is to modify addresses in computer instructions. In System Ten there are three index registers in each partition. They are referred to by number and occupy partition storage locations 11-14 (index register 1), 21-24 (index register 2), and 31-34 (index register 3).

IOC

An abbreviation for Input/Output Channel on the System Ten.

L

Link

In System Ten, a variant of the Branch instruction ordinarily used in calling subroutines. Link first establishes a return path from a subroutine and then passes control to the beginning of the subroutine.

Local Mode

The mode in which data may NOT be transmitted between a device and an Input/Output Channel (IOC).

M

Main Memory

In System Ten, the entire core storage. This includes the storage occupied by all partitions as well as the entire common region which includes the protected area, the non-privileged area, and the privileged area.

Memory Module

In System Ten, the minimum unit of core storage. A Memory Module contains 10,000 character positions. In System Ten, core storage may contain 1-11 Memory Modules.

GLOSSARY

Mixed Field

A field which may include any combination of characters including, for example, alphabetic, numeric, and punctuation characters. In System Ten, a field prepared for printing by the Edit instruction is usually a mixed field.

Multiprogramming

A technique for handling numerous routines or programs simultaneously by overlapping or interleaving their execution. In System Ten, the programs being executed simultaneously each reside in a separate memory partition. Multiprogramming is achieved by passing control from one partition to another in round-robin sequence.

N

Numeric Field

A field containing numeric information and sign indication.

O

On-Line Mode

The mode which permits the transmission of data between a device and an Input/Output Channel (IOC) or File Access Channel (FAC).

Operation Code

The part of a System Ten machine instruction which specifies the operation to be performed.

Overdraft

In System Ten, an intermediate condition which sometimes occurs in the subtraction process. Not to be confused with Overflow, which yields a wrong answer.

Overflow

In System Ten, an erroneous result caused by an attempt to develop an answer too large for the field assigned to it.

GLOSSARY

P

Parity Bit

A binary digit (i.e., either 0 or 1) appended to a string of bits to make the sum of all the bits which are ON either always odd or always even.

Partition

In System Ten, a portion of core storage. A system may contain 1-20 partitions. Each partition has 3 index registers and an Input/Output Channel (IOC). Partitions may communicate with each other only through common storage or devices on the File Access Channel (FAC).

Partition Switching

In System Ten, an automatic process by which control passes from one partition to its neighbor. Partition Switching consists essentially of saving status information necessary to resume the program which is relinquishing control, selecting the partition which is to gain control, restoring its Condition Code, and passing control to the appropriate instruction within it.

Privileged Area of Memory

In System Ten, an optional hardware setting that reserves an upper portion of common storage for use by privileged partitions which are designated when the option is set.

Protected Area of Memory

In System Ten, locations 0-299 of the common storage area. Programs cannot store information in this area which is used by the ACU to keep information pertinent to partition switching and input/output operations. A program may examine information in the protected area even though it cannot (directly) alter it.

R

Return Address

In System Ten, the address of the instruction to which control returns after a particular execution of a subroutine.

GLOSSARY

S

Sector

A sector is one-fiftieth (1/50th) of a track on the Friden Model 40 Disc Drive. Each sector holds 100 characters (each consisting of 6 bits). Reading and writing on the disc is always done in groups of 100 characters.

U

USASCII

A contraction for "United States of America Standard Code for Information Interchange". This standard defines the graphics and codes for a 128 character set. Commonly referred to as ASCII.

SINGER
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