UNIVAC 494 Real-Time System

Operating System

Operator Reference

SPERRY UNIVAC COMPUTER SYSTEMS

UP-7632 Rev. 2

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I. GENERAL

1.1. SCOPE

The purpose of this document is to inform the UNIVAC 494 System operator of the procedures to be followed in initiating and maintaining the activities of the UNIVAC 494 Operating System. The term 'operating system', as used in this document, encompasses all of the software components of the UNIVAC 494 Real-Time System. A summary description of the site hardware environment is presented in Section 2, together with appropriate references to publications containing more detailed information about the hardware components. The remainder of the document supplies detailed information concerning operator controls and indicators, operating system startup and maintenance procedures, and operating system messages.

1.2. OPERATING SYSTEM

The controller and coordinator of the activities of the operating system is the executive routine, which is referred to generally as OMEGA. Under direction of the executive routine, the full capabilities of the hardware and software are realized through a flexible control language used by the programmer, and through efficient response to system demands by the operator.

The executive routine controls the loading, allocation, and execution of programs by largely automatic operation, and eliminates the need for frequent human intervention in the activities of the operating system.

During program execution, user programs may request the service of the executive routine by means of the executive-return (EXRN) instruction. This instruction generates an interrupt to which the executive routine responds automatically.

Automatic operation is aided and overall system efficiency is increased by extensive use of direct access storage devices, which allow swift retrieval of the temporary intermediate files required for operation of a specific program. A record (the master file directory) is kept by the executive routine of the files that transcend jobs. The master file directory (MFD) registers information files and can be used by different jobs. A file can remain in the system after being loaded until the file is no longer useful or until there is no room for the file.

The executive routine is designed to permit the programmer to construct any logical combination of programs by inserting the appropriate control cards containing control language statements into the job deck. The control statements specify the functions that the executive routine will perform, and other program parameters, before the execution of a user program. The user thus directs automatic system operation and specifies needed operator functions in system operation, control, and maintenance.

1.3. OPERATOR'S RESPONSIBILITIES

As the individual in immediate physical charge of the system, the operator must respond promptly and accurately to system messages in order to maintain efficient system operation. The operator must supervise production and quality control in the computer activities, and he must determine when the system needs repair.

To perform his duties properly, the operator must know the location and function of the system controls and indicators which he is called upon to operate or interpret. By referring to the appropriate UNIVAC 494 System document, the operator must acquaint himself with the operation and maintenance of the peripheral subsystems; he must know how to mount, demount, and label tape files; how to change paper on the console typewriter and printer, and to make adjustments; and how to clear card reader/punch errors and paper tape jams.

1.4. RELATED UNIVAC PUBLICATIONS

The following is a list of publications which contain detailed descriptions of system components referenced in this manual. These publications furnish information of assistance to the computer operator in acquiring a fuller understanding of the UNIVAC 494 Real-Time System.

- *UNIVAC 494 Real-Time System, System Description,*
  UP-4032 (current version)

- *UNIVAC 494 Real-Time System Operating System Programmer Reference,*
  UP-7504 (current version)

- *UNIVAC 494 Central Processor Programmer/Operator Reference,*
  UP-4049 (current version)

- *UNIVAC 491/492/494 UNISERVO VI C Magnetic Tape Subsystem Programmer/Operator Reference,*
  UP-4101 (current version)

- *UNIVAC 491/492/494 UNISERVO VIII C Magnetic Tape Subsystem Programmer/Operator Reference,*
  UP-7523 (current version)

- *UNIVAC 491/492/494 Punched Card Subsystem Programmer/Operator Reference,*
  UP-7522 (current version)

- *UNIVAC 491/492/494 High Speed Printer Subsystem Programmer/Operator Reference,*
  UP-7571 (current version)

- *UNIVAC 494 FH-432 Magnetic Drum Subsystem Programmer/Operator Reference,*
  UP-4102 (current version)

- *UNIVAC 491/492/494 FH-880 Magnetic Drum Subsystem Programmer/Operator Reference,*
  UP-7533 (current version)

- *UNIVAC 491/492/494 FASTRAND Mass Storage Subsystem Programmer/Operator Reference,*
  UP-7528 (current version)

- *UNIVAC 494 Online 1004 Program Programmer/Operator Reference,*
  UP-7575 (current version)

- *UNIVAC 418/490/491/492/494/1108 Communication Terminal Modular Control Subsystem,*
  UP-7519 (current version)

- *UNIVAC DCT 2000 Data Communications Terminal Operator Reference,*
  UP-7545 (current version)

- *UNIVAC UNISCOPE 300 Visual Communications Terminal Operator Reference,*
  UP-7615 (current version)

2. SYSTEM HARDWARE

2.1. GENERAL

The UNIVAC 494 System hardware components, which are under supervision of the operator, include the central processor unit (CPU), main storage, and onsite peripheral devices. In this manual, only the salient operating characteristics of the hardware are presented; detailed information concerning hardware maintenance and operation can be found in the document referenced in the discussion of the specific device.

2.2. CENTRAL PROCESSOR UNIT

The central processor unit (CPU), which is the primary component of the UNIVAC 494 System, is a word-addressable, multipurpose, digital computer which operates on fixed-word length data and instructions, and which possesses full capability for operation in a multiprogram environment. The CPU contains a control section, an arithmetic section, an input/output section, and a primary storage interface. There is also a fixed interface with the operator's console via channel 0. The sections of the CPU are shown in Figure 2–1.

For detailed information concerning the CPU, refer to *UNIVAC 494 Real-Time System Central Processor Programmer/Operator Reference, UP-4049* (current version).

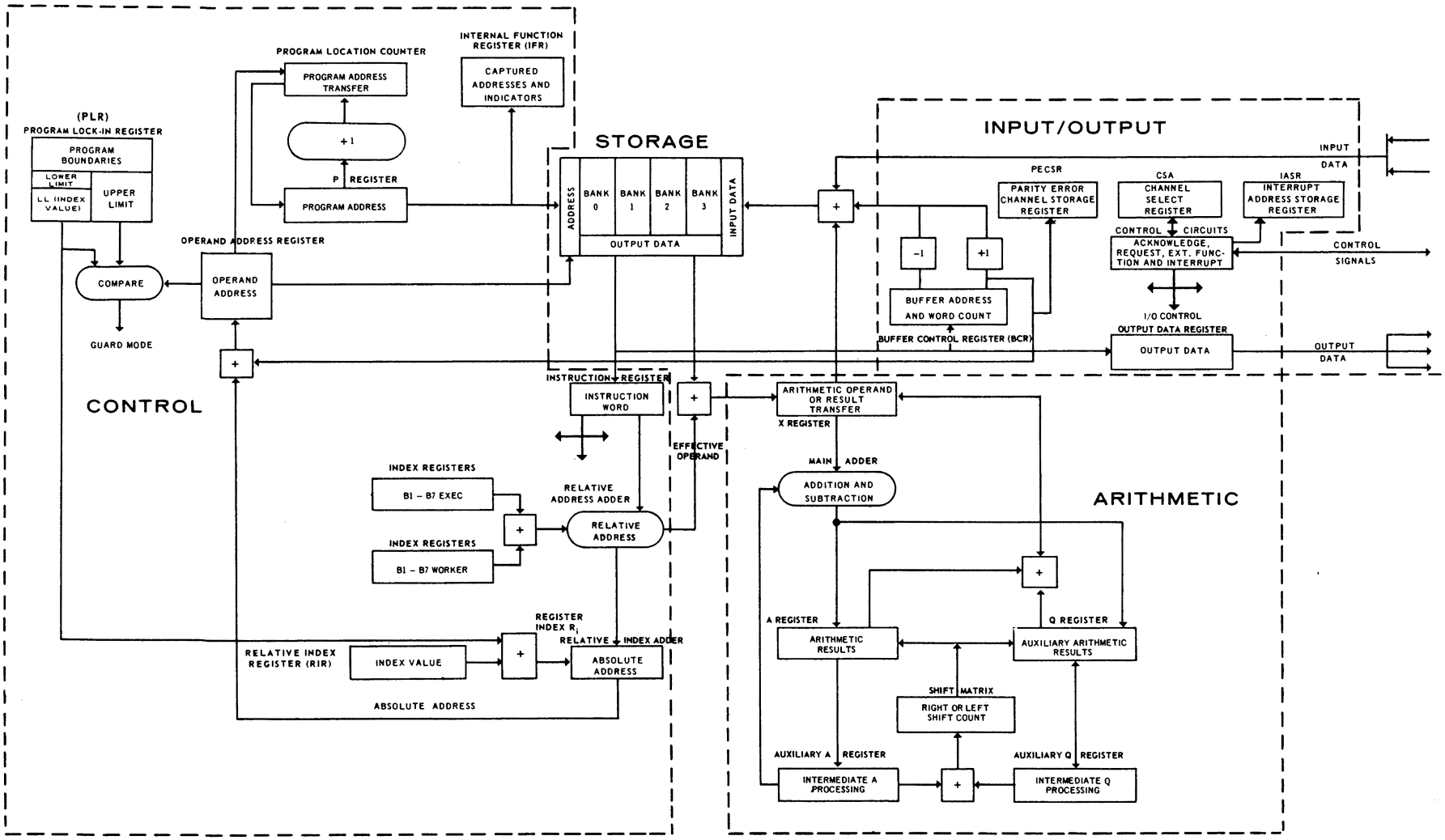


Figure 2–1. Central Processor Operation, Block Diagram

2.3. PRIMARY STORAGE

The primary storage or main storage is direct-access, 32-plane, coincident-current ferrite core storage. The 32 planes permit storage of 30-bit words, with a parity bit for each half of a word. Each access to main storage is an access to the entire 30-bit word, to the lower half, to the upper half, or to selected portions of the word at a specified location. Access time is the time needed to acquire the contents of an address; cycle time is the time required per main storage reference for successive references to the same bank of main storage. The principal characteristics of main storage are:

- Capacity: $65{,}536_{10}$ 30-bit words in two $32{,}768_{10}$ word modules, field-expandable to $262{,}144_{10}$ words in increments of 65,536 words. For operation under the executive routine, a minimum of 65,536 words are required.
- Read access time: 400 nanoseconds
- Read/write cycle time: 750 nanoseconds
- Parity check: Odd parity bit is stored for each half of the word; both parity bits are checked on read.

Primary storage is made up of independently accessible storage modules of 32,768-word capacity. Two modules are contained in one cabinet to form a main storage bank, which provides an address range of 65,536 words. Each main storage module presents a continuous addressing structure to the CPU for increased processing efficiency. In usual system operation to decrease processing time, the main storage uses odd/even addressing which provides address interleaving. In the odd/even organization, all even addresses are referred to one module and all odd addresses are referred to another module (Figure 2–2). In certain applications (such as bypassing main storage fault areas) normal/straight addressing can be selected manually with all addresses, odd and even consecutively in a 32,768-word range, being referred to one or the other module (Figure 2–2). The sequential/straight mode of main storage organization is provided for maintenance and other purposes through which the addresses within each 32,768-word module are arranged in consecutive order and the modules are interleaved.

Available storage configurations permit the use of one main storage bank (cabinet containing two modules), which supplies the minimum system capacity of 65,536 words, or up to four main storage banks (eight modules), which furnish the maximum system capacity of 262,144 words. The size of the minimum main storage capacity can be expanded in units of one main storage bank (65,536 words).

The 15-bit address register contained in each main storage module provides a continuous addressing structure of 32,768 words. The CPU generates an 18-bit address for each storage location reference, thereby specifying one of the 262,144 possible locations. In the odd/even mode of addressing, three of the address bits, 2^0 (representing the module), and 2^{16} and 2^{17} (representing the main storage bank), are used by the main storage select register (MSR) for identification and selection of one of the eight possible modules in the main storage configuration. In the normal/straight mode of addressing, bits 2^{17} and 2^{16} are used for the main storage bank and bit 2^{15} for the module, respectively. In the sequential/straight mode of addressing, bits 2^{15} and 2^{16} (2^{15} being the module select bits) are used for the main storage bank, and bit 2^{17} is used for the module. The remaining 15 bits are sent to the address register of the selected module, providing a set of unique addresses for each module. The addressing modes are selected manually (3.3.5).

MAIN STORAGE CABINET

Module Select Bits	0 U	0 L	1 U	1 L	2 U	2 L	3 U	3 L
	065,534 Even	065,535 Odd	131,070 Even	131,071 Odd	196,606 Even	196,607 Odd	262,142 Even	262,143 Odd
	0	1	065,536	065,537	131,072	131,073	196,608	196,609
2^0	0	1	0	1	0	1	0	1
2^{16}	0	0	1	1	0	0	1	1
2^{17}	0	0	0	0	1	1	1	1

Bits 2^1 through 2^{15} indicate storage location in module.

NORMAL/ODD-EVEN

MAIN STORAGE CABINET

Module Select Bits	0 U	0 L	1 U	1 L	2 U	2 L	3 U	3 L
	032,767	065,535	098,303	131,071	163,839	196,607	229,375	262,143
	000,000	065,536	065,536	098,304	131,072	163,840	196,608	229,376
2^{15}	0	1	0	1	0	1	0	1
2^{16}	0	0	1	1	0	0	1	1
2^{17}	0	0	0	0	1	1	1	1

Bits 2^0 through 2^{14} indicate storage location in module.

NORMAL/STRAIGHT

MAIN STORAGE CABINET

Module Select Bits	0 U	0 L	1 U	1 L	2 U	2 L	3 U	3 L
	032,767	163,839	098,303	229,375	065,535	196,607	131,071	262,143
	000,000	131,072	065,536	196,608	032,768	163,840	098,304	229,376
2^{17}	0	0	0	0	1	1	1	1
2^{16}	0	0	1	1	0	0	1	1
2^{15} MSB	0	1	0	1	0	1	0	1

Bits 2^0 through 2^{14} indicate storage location in module.

SEQUENTIAL/STRAIGHT

Figure 2–2. Distribution of Main Storage Addresses

2.3.1. Common Storage

In a dual processor configuration, contiguous portions of a primary storage associated with each central processor unit are designated as common storage, accessible by each central processor unit within the system. The concept of common storage, within this system, means that all write operations to a location in the common storage address range from either central processor are made to that common storage location associated with both processors.

Common storage is located in the uppermost addresses of each central processor's primary storage. Common storage locations are selected from a single (65k) primary storage unit associated with each central processor (the primary storage units themselves are unmodified), while the remainder of the primary storage units are retained and used as private storage for each processor.

Further details can be obtained from the *UNIVAC 494 Real-Time System Central Processor Unit Programmer/ Operator Reference, UP-4049* (current version).

2.3.2. Dual Storage Controller

The dual storage controller (DSC) is an extension to the UNIVAC 494 Central Processor Unit (CPU) in a dual processor configuration.

The function of the DSC is to enable each UNIVAC 494 CPU in a dual processor configuration to have a separate copy of identical information stored in the common storage area of main storage. Each CPU has its own disc unit in a dual storage configuration.

The DSC controls a common storage area by patchboard selection. The size of common storage can be from 2k to 65k, selected in 2k increments. Further details can be obtained from the *UNIVAC 494 Real-Time System Central Processor Unit Programmer/Operator Reference, UP-4049* (current version).

2.4. ONSITE PERIPHERAL SUBSYSTEMS

Onsite peripheral subsystems comprise one or more peripheral units of the same kind, with the appropriate control unit(s), connected directly to the desired CPU input/output channel(s). The peripheral subsystems perform diverse functions complementary to the CPU according to the design characteristics of the peripheral equipment and the needs of the system. The functions may include input/output, auxiliary storage, data preparation and communications, file handling, and other activities as required.

The following types of peripheral subsystems are available for use onsite with the UNIVAC 494 System:

- Direct access storage subsystems
- Magnetic tape subsystems
- Unit record subsystems
- Communication subsystem

When an operating program requires access to a subsystem, the CPU issues control signals which select the needed subsystem and initiate the desired action. Program execution by the CPU continues automatically until the subsystem has completed the requested activity. The subsystem signals the CPU when the activity is completed, and the CPU deals with the result of the action.

Each subsystem is controlled by a control unit which performs the following functions:

- Interprets the control signals and instructions issued by the CPU.
- Effects the transfer of data to or from the selected unit and the CPU.
- Indicates the status or availability of the peripheral units to the CPU.
- Informs the CPU when errors or faults occur which affect the operation of the subsystem.

2.4.1. Direct Access Storage Subsystems

Direct access storage subsystems provide high speed auxiliary storage facilities for program elements and libraries, subroutines, and data which, for reasons of economy and efficiency, may not be kept in primary storage, but which must be called into the operating programs rapidly and/or often, as in program development and control, and language translation operations.

2.4.1.1. UNIVAC FH-432 Magnetic Drum Subsystem

The UNIVAC FH-432 Magnetic Drum Subsystem is a high speed, medium-capacity, word-addressable, direct access storage medium. The subsystem consists of one UNIVAC 6013 Control Unit and from three to nine UNIVAC F0696 FH-432 drums. Each drum is capable of storing 262,144 computer words of 30 data bits plus parity, or 1,310,720 alphanumeric characters per drum. The average access time for a word in the subsystem is 4.33 milliseconds.

Operating characteristics of the UNIVAC FH-432 Magnetic Drum Subsystem are given in the following table. Detailed information may be found in *UNIVAC 494 Real-Time System FH-432 Magnetic Drum Subsystem Programmer/Operator Reference, UP-4102* (current version).

Characteristics	
Storage capacity (per drum)	262,144 30-bit words 1,310,720 6-bit characters
Access time	
Minimum	120 microseconds
Average	4.33 milliseconds
Maximum	8.55 milliseconds
Drum speed	7,120 revolutions per minute
Number of read/write data heads	486 (one per track)
Word transfer rate	240,000 words per second (maximum)
Character transfer rate	1,200,000 characters per second (maximum)
I/O channels required	1 channel
Number of drums per subsystem	Minimum 3 Maximum 9

2.4.1.2. UNIVAC FH-432/FH-1782 Magnetic Drum Subsystem

The UNIVAC FH-432/FH-1782 Magnetic Drum Subsystem is a high speed, medium-capacity, word-addressable, direct access storage medium consisting of one or two UNIVAC 5012 Control Units and one to eight UNIVAC FH-1782 or UNIVAC 6016 FH-432 Drum Units in any combination. The physical characteristics and functions of the type 6016 FH-432 drum units are the same as those for the type F0696 FH-432 drum units. The hybrid subsystem provides both the fast access time of the FH-432 drum and the large storage capacity of the FH-1782 drum (2,097,152 words).

Operating characteristics of the FH-432 drum and FH-1782 drum are given in the following table. Detailed information may be found in *UNIVAC 494 Real-Time System FH-432/FH-1782 Magnetic Drum Subsystem Programmer/Operator Reference, UP-7630* (current version), and in UP-4102 (for the FH-432 drum) as previously mentioned.

Characteristics		
	FH-432 Drum	**FH-1782 Drum**
Storage capacity (words per drum)	262,144	2,097,152
Drum speed	7,120 rpm	1,770 rpm
Number of read/write heads	486	1890
Recording density (bits per inch)	889	750
Word transfer rate	240,000 words per second (maximum)	240,000 words per second (maximum)
Character transfer rate	1,200,000 characters per second (maximum)	1,200,000 characters per second (maximum)
Access time		
Minimum	120 microseconds	200 microseconds
Average	4.33 milliseconds	17 milliseconds
Maximum	8.55 milliseconds	34 milliseconds
Number of drums (per subsystem)	8 maximum – any combination	8 maximum – any combination
I/O channels required	1 or 2 channels (one for each control unit)	1 or 2 channels (one for each control unit)

2.4.1.3. UNIVAC FH-880 Magnetic Drum Subsystem

The UNIVAC FH-880 Magnetic Drum Subsystem is a medium-capacity, word-addressable, direct access storage medium consisting of one UNIVAC 8103 Control Unit and from one to eight UNIVAC 7304-01 FH-880 Magnetic Drum Cabinets. Each drum can store 786,432 30-bit words plus parity, or the equivalent of 3,932,160 alphanumeric characters maximum. The average access time for any word in the subsystem is 17 milliseconds.

Operating characteristics of the FH-880 drum are given in the following table. Detailed information may be found in *UNIVAC 491/492/494 Real-Time System FH-880 Magnetic Drum Subsystem Programmer/Operator Reference, UP-7533* (current version).

Characteristics	
Storage capacity (per drum) Words Characters	 786,432 3,932,160
Access time Minimum Average Maximum	 160 microseconds 17 milliseconds 34 milliseconds
Drum speed	1,770 rpm
Number of read/write data heads	880 (one per track)
Word transfer rate (maximum)	60,000 words per second
Character transfer rate (maximum)	300,000 characters per second
I/O channels required	1
Number of drums per subsystem	1 to 8

2.4.1.4. FASTRAND II Subsystem

The FASTRAND II Mass Storage Subsystem is a large-capacity, sector-addressable, direct access storage medium which comprises one type 5009 FASTRAND control unit and one to eight type 6010–09 FASTRAND mass mass storage units. Each mass storage unit contains two drums which store a maximum of 25,952,256 words. The average access time for any word in the subsystem is 92 milliseconds. Normal data read/write operations use read/write heads mounted on a movable boom which positions the heads for the operation. As an option, each mass storage unit may also contain Fastband tracks which use fixed-position read/write heads for faster access times. Another option permits two I/O channels to use the subsystem with some degree of concurrency in read and write operations.

Operating characteristics of the FASTRAND II subsystem are summarized in the following table. Detailed information is given in *UNIVAC 491/492/494 FASTRAND Mass Storage Subsystem Programmer/Operator Reference, UP-7528* (current version).

Characteristics	
Storage capacity (per mass storage unit)	25,952,256 words
Fastband storage capacity	50,688 words
Recording mode	Bit-serial, NRZ
Normal access time	
Average	92 milliseconds
Maximum	156 milliseconds
Fastband access time	
Average	35 milliseconds
Maximum	70 milliseconds
Transfer rate	31,000 words per second

NOTE:

A word contains 30 bits (5 characters).

2.4.1.5. FASTRAND III Subsystem

The FASTRAND III Mass Storage Subsystem is a large-capacity, sector-addressable, direct access storage medium consisting of one type 5009 FASTRAND control unit and one to eight type 6010–10 FASTRAND III mass storage units. Each mass storage unit can store a maximum of 38,928,384 words of 30 data bits plus parity characters. The average access time for any word in the subsystem is 92 milliseconds.

The FASTRAND III subsystem has been developed to provide greater online storage capacity than the FASTRAND II subsystem. The FASTRAND III mass storage unit has the same general and physical characteristics, and provides the same functions as the FASTRAND II unit; moreover, these functions have been generally enhanced and the data storage capacity has been increased by 50 percent.

Operating characteristics of the FASTRAND III subsystem are given in the following table.

Characteristics	
Storage capacity (per mass storage unit)	38,928,384 words
Fastband storage capacity	76,032 words
Recording mode	Bit-serial
Normal access time	
Average	92 milliseconds
Maximum	156 milliseconds
Fastband access time	
Average	35 milliseconds
Maximum	70 milliseconds
Transfer rate	45,257 words per second

2.4.2. UNISERVO Magnetic Tape Subsystems

UNISERVO Magnetic Tape Subsystems provide high speed auxiliary storage media for program elements and libraries, subroutines, and data which for various reasons may not be kept in direct access storage and which may be necessarily brought in for input/output, sort/merge, and file maintenance operations.

2.4.2.1. UNISERVO VIII-C Magnetic Tape Subsystem

The UNISERVO VIII-C Magnetic Tape Subsystem which is used as an input/output peripheral subsystem to the UNIVAC 494 System, provides high speed tape handling facilities and compatibility between UNIVAC and non-UNIVAC tape systems. The subsystem comprises 1 to 16 UNISERVO VIII-C magnetic tape units with appropriate control units, and may be replaced or interchanged with the lower speed UNISERVO VI-C Magnetic Tape Subsystem.

Operating characteristics of the UNISERVO VIII-C magnetic tape unit are given in the following table. Detailed information may be found in *UNIVAC 491/492/494 Real-Time System UNISERVO VIII-C Magnetic Tape Subsystem Programmer/Operator Reference, UP-7523* (current version).

Characteristics	
Tape handling speed	120 inches per second
Recording densities	200, 556, or 800 frames per inch
Transfer rate @200 frames per inch @556 frames per inch @800 frames per inch	 24,000 frames per second 66,666 frames per second 96,000 frames per second
Rewind speed	240 inches per second
Rewind time (2400-foot reel)	2.0 minutes

2.4.2.2. UNISERVO VI-C Magnetic Tape Subsystem

The UNISERVO VI-C Magnetic Tape Subsystem, which may be used as an input/output peripheral subsystem to the UNIVAC 494 System, provides high speed tape handling facilities and compatibility between UNIVAC and non-UNIVAC tape systems. The subsystem comprises 1 to 16 UNISERVO VI-C magnetic tape units with appropriate control units, and may be replaced or interchanged with the higher speed UNISERVO VIII-C Magnetic Tape Subsystem.

Operating characteristics of the UNISERVO VI-C magnetic tape unit are given in the following chart. Detailed information may be found in *UNIVAC 491/492/494 Real-Time System UNISERVO VI-C Magnetic Tape Subsystems Programmer/Operator Reference, UP-4101* (current version).

Characteristics	
Tape handling speed	42.7 inches per second
Recording densities	200, 556, or 800 frames per inch
Transfer rate	
@200 frames per inch	8,540 frames per second
@556 frames per inch	23,720 frames per second
@800 frames per inch	34,160 frames per second
Rewind speed	160 inches per second
Rewind time (2400-foot reel)	3.0 minutes

2.4.2.3. UNISERVO 12/16 Magnetic Tape Subsystem

The UNISERVO 12/16 Magnetic Tape Subsystem is a byte-orientated, high speed, magnetic tape subsystem providing compatibility between UNIVAC and non-UNIVAC standard tapes. The UNISERVO 12 subsystem may contain 16 UNISERVO 12 tape units, in multiples of four, together with the appropriate control units. A group of four UNISERVO 12 units is called a quad and consists of one master unit and three slaves. The UNISERVO 16 subsystem may consist of any number of units from 1 to 16 together with the appropriate control units. Because of their byte orientation, the UNISERVO 12/16 units must be used in conjunction with a multi-subsystem adapter (MSA) which handles the data conversion from bytes to words and vice-versa. (See 2.4.6.)

Operating characteristics of the UNISERVO 12/16 tape units are given in Table 2–1. Detailed operating information may be found in *UNIVAC UNISERVO 12/16 Magnetic Tape Subsystem Operator Reference, UP-7882* (current version).

Table 2–1. UNISERVO 12/16 Magnetic Tape Subsystem Capabilities
(Part 1 of 2)

	UNISERVO 12	UNISERVO 16
Tape units per subsystem	1–4 quads	1–16
Tape speed	42.7 inches/second	120 inches/second
Recording mode 9-track 7-track (without data converter) 7-track (with data converter on)	9-track (phase encoding) 7-track (NRZI) ■ 8-bit byte plus parity per 9-bit frame ■ 6-bit character plus parity per 7-bit frame ■ Three 8-bit bytes per four 7-bit frames (6-bit character plus parity)	9-track (phase encoding) 7-track (NRZI) ■ 8-bit byte plus parity per 9-bit frame ■ 6-bit character plus parity per 7-bit frame ■ Three 8-bit bytes per four 7-bit frames (6-bit character plus parity)
Recording density 9-track (phase encoding) 9-track (NRZI) 7-track	 1600 frames/inch 800 frames/inch 200/556/800 frames/inch	 1600 frames/inch 800 frames/inch 200/556/800 frames/inch
Data block length Recommended minimums	43 frames (phase encoding) 18 frames (NRZI)	43 frames (phase encoding) 18 frames (NRZI)
Interblock spacing 9-track 7-track *Start stop time 9-track (phase encoding) 9-track (NRZI) 7-track Nonstop time 9-track (phase encoding) 9-track (NRZI) 7-track	 0.6 inch (nominal) 0.75 inch (nominal) 23.0 milliseconds 21.8 milliseconds 24.1 milliseconds 16.8 milliseconds 15.6 milliseconds 18.0 milliseconds	 0.6 inch (nominal) 0.75 inch (nominal) 8.3 milliseconds 7.9 milliseconds 9.35 milliseconds 5.3 milliseconds 4.9 milliseconds 6.35 milliseconds
Reverse delay	25 milliseconds	10 milliseconds
Rewind speed	3 minutes (2,400 feet)	2 minutes (2,400 feet)

*Time from issuance of start command until tape returns to zero velocity minus time reading or writing tape block.

Table 2–1. UNISERVO 12/16 Magnetic Tape Subsystem Capabilities (Part 2 of 2)

	UNISERVO 12	UNISERVO 16
Data transfer rate		
9-track (phase encoding)	68,320 bytes/second	192,000 bytes/second
9-track (NRZI)	34,160 bytes/second	96,000 bytes/second
7-track (without data converter) density=200/556/800 BPI	8,540/23,740/34,160 characters/second	24,000/66,720/96,000 characters/second
7-track (with data converter on) density=200/556/800 BPI	6,405/17,806/25,620 bytes/second	18,000/50,040/72,000 bytes/second
Channel parity (over interface lines)	Odd vertical parity on command, address, status sense, and data bytes	Odd vertical parity on command, address, status sense, and data bytes
Command checking	Detection of invalid codes (code not applicable to unit)	Detection of invalid codes (code not applicable to unit)
Parity checking	Generated on write operations and checked by automatic readback; checked on read operations	Generated on write operations and checked by automatic readback; checked on read operations
Vertical parity recording		
9-track (phase encoding)	Odd	Odd
7-track (NRZI without data converter)	Even or odd	Even or odd
7-track (NRZI with data converter on)	Odd	Odd
Longitudinal parity recording (NRZI)	Even	Even
Error detection and correction (9-track NRZI tape units only)	CRC (cyclic redundancy character) generated and checked for vertical parity on each write operation; (TIE used) checked on reads in any direction.	CRC (cyclic redundancy character) generated and checked for vertical parity on each write operation; (TIE used) checked on reads in any direction.
9-track (phase encoding)	Correction – On the fly	Correction – On the fly
Mode of operation Normal (burst)	Subsystem controls interface for the entire period of time required to transfer data.	Subsystem controls interface for the entire period of time required to transfer data.

2.4.3. Unit Record Subsystems

Unit record subsystems provide facilities for preparation, input, output, display, and storage of information according to the design functions of the subsystem. Each subsystem is governed by a control unit which is connected to an I/O channel of the CPU.

2.4.3.1. High Speed Printer Subsystem

The high speed printer subsystem is an output facility which is capable of printing single or multiple copies of data, at 700–1600 lines per minute dependent upon the printer unit used. Each line of output data may contain a maximum of 132 printed characters.

The printer unit is a contact, "on-the-fly" printer, which can print one copy or, with the aid of carbons, more copies simultaneously. Three types of printers are available for a subsystem: UNIVAC 0751, UNIVAC 0755, and UNIVAC 0758. The type 0751 printer and type 0755 printer have similar characteristics, though differing in external appearance. The type 0758 printer is essentially a higher speed version of the type 0755 printer.

Operating characteristics of the high speed printer subsystem are summarized in the following chart. Additional information is contained in the *UNIVAC 491/492/494 Real-Time Systems High Speed Printer Subsystem Programmer/Operator Reference, UP-7571* (current version).

Characteristics	
Printing speed (single-spaced) Type 0751 printer Type 0755 printer Type 0758 printer	(maximums)* 700 – 922 lines per minute 700 – 922 lines per minute 1200 – 1600 lines per minute
Characters/line	132
Number of characters	Up to 63 different characters plus space
Paper forms	Continuous forms, 4" to 22" wide. Carbons may be attached with multicopy forms to a maximum of six parts.
Print format	Full print width of 132 characters anywhere on 16.5" form. On 22" form, only central 13.2" can be used.

**Higher maximums can be attached by limiting number of different characters to less than 63.*

2.4.3.2. Punched Card Subsystem

The UNIVAC 491/492/494 Punched Card Subsystem is an input/output facility consisting of a control unit with a card reader and/or a card punch for processing 80-column cards.

Punched card subsystem operating characteristics are summarized in the following table. Detailed information may be found in *UNIVAC 491/492/494 Real-Time System Punched Card Programmer/Operator Reference, UP-7522* (current version).

Characteristics	
Card Reader	
Card rate	900 cards per minute (maximum)
Input hopper capacity	3000 cards
Output stacker capacity Normal stacker Error stacker	 2100 cards 100 cards
Read Mode	Column-by-column
Card Punch	
Card rate	300 cards per minute (maximum)
Input hopper capacity	1000 cards
Output stacker capacity Normal stacker Select stacker	 850 cards 850 cards
Punch mode	Row-by-row

2.4.3.3. UNIVAC 1004 System

The UNIVAC 1004 System is a complete data processing system, with its own peripheral units, which may be used online with the UNIVAC 494 System as a peripheral subsystem to provide input/output facilities and to perform supplementary processing of the transfer data. The basic subsystem is the card processor, which is a card reader, a printer, and a processor in one unit. A card punch may be added, one or two magnetic tape units, a paper tape reader, paper tape punch, card read/punch unit, auxiliary card reader, and a separate communications capability in the data line terminals.

The UNIVAC 1004 Card Processor reads 80- or 90-column cards photoelectrically at a normal speed of 615 cards per minute (400 cpm for 1004-I). The 80-column cards are read serially, one column at a time. The 90-column cards are read serially, one frame at a time; that is, two opposing columns (column 1 and column 46) are read simultaneously. After a card has been read, the card is transported from the read section and deposited on end on a receiver shelf above the input station. The card receiver holds more than 1,500 cards. Card reading can be carried on simultaneously with printing and card punching operations.

UNIVAC 1004 System operating characteristics are summarized in the following table. Detailed information may be obtained in *UNIVAC 1004 Card Processor, 80 Column Card Processor Reference, UP-2543* (current version) and *UNIVAC 494 Real-Time System Online 1004 Program Programmer/Operator Reference, UP-7575* (current version).

Characteristics	
Required Features	
External interrupt	
Punch stacker select (with card punch)	
30-bit word transfer interface	
Card Operations	
Card reading speed	615 cpm
Card punching speed	200 cpm
Card reading modes	80-column Hollerith and column binary
Card punching modes	80-column Hollerith and column binary
Print Operations	
Printing speed	600 lpm
Maximum number of characters per line	132
Number of printable characters	63 (26 alphabetic, 10 numeric, and 27 special characters) plus space
Lines per inch (vertical)	6 or 8 (manually selected)
Paper Tape Operations	
Reading rate	400 characters per second
Punching rate	110 characters per second
Number of channels	5, 6, 7, or 8
Characters per inch	10
Tape speed	40 inches per second reading 11 inches per second punching
Tape width	11/16, 7/8, or 1 inch

2.4.3.4. UNIVAC 9300 Series Systems

The UNIVAC 9300 computer normally constitutes a complete processing system with its own peripheral subsystems. However, it may be used online to the UNIVAC 494 to provide supplementary processing of transfer data. The UNIVAC 9300 is a byte-orientated machine, operating byte-orientated peripheral subsystems and therefore must be connected to an inter-computer control unit (ICCU) to provide the interface with the word-orientated UNIVAC 494 System. The basic configuration is the card processing subsystem which consists of the processor, plated-wire main storage, card reader, card punch, and printer. This configuration may be extended by the addition of magnetic tape and disc units.

The UNIVAC 9300 can perform reading, printing and punching operations simultaneously. A summary of the system performance is listed in Table 2–2. Detailed information may be found in *UNIVAC 9200, 9200 II, 9300, 9300 II Systems Processor and Storage Operator Reference, UP-7781* (current version).

Table 2–2. Configurations for UNIVAC 9300 System Processors

9300	9300 II
Printer processor	Printer processor
■ Control ■ Printer ■ Form control loop ■ 600 lpm bar printer 120 print positions 63-character print	■ Control ■ Printer ■ Form control loop ■ 600 lpm bar printer 120 print positions 63-character print bar
■ 8K-byte storage Expandable to 32K bytes 0.6 μsec. cycle time	■ 16K-byte storage Expandable to 32K bytes 0.6 μsec. cycle time
■ Arithmetic/control Control for printer, punch, and reader	■ Arithmetic/control Control for printer punch, and reader
* Multiplexer channel Accesses up to 8 subsystems or another processor	■ Multiplexer channel Accesses up to 8 subsystems or another processor
■ Multiply, divide, edit	■ Multiply, divide, edit ■ Selector channel
† Print position expansion	† Print position expansion
† High speed numeric print	† High speed numeric print
† 8LPI print spacing	† 8LPI print spacing

LEGEND:

■ Basic Equipment

* Processor Optional Features

† Printer Optional Features

2.4.4. Communications Terminal Module Controller Subsystem

The UNIVAC 494 Communications Terminal Module Controller (CTMC) Subsystem enables the UNIVAC 494 System to receive and to transmit serial data by way of any common carrier in any of the standard rates of transmission up to 4800 bits per second (baud). The CTMC can receive data from or transmit data to low-speed, medium-speed, and high-speed lines in any combination.

The UNIVAC CTMC consists of three elements: communications terminal modules (CTM), interface modules (IM), and a communications terminal module (CTM) controller. Each CTM connects two input and two output communications lines to the CTM controller, which is connected to either a normal or a compatible channel operating in externally specified index (ESI) mode at the UNIVAC 494 CPU. The IMs make the conversion between electrical operating levels of the CTMs and the communications lines and external equipment. A CTM controller can accommodate a maximum of 16 CTMs. A single subsystem can multiplex up to 32 input and 32 output lines to a single UNIVAC 494 CPU channel. More than one CTMC can be used.

A CTMC is housed in two central site peripheral cabinets. One cabinet contains the power supply for the subsystem as well as space for IMs for all of the currently available communications equipment. The second cabinet contains the CTM controller as well as space for 16 modules, an additional controller, and six output clocks.

Detailed information may be found in *UNIVAC 418,490/491/492, and 494 and 1108 Systems Communication Terminal Module Controller (CTMC) Subsystem Programmer/Operator Reference, UP-7519* (current version).

2.4.5. UNIVAC 8414/8424 Disc Subsystems

The UNIVAC 8414 and 8424 Disc Subsystems are byte-oriented, direct-access exchangeable disc file subsystems providing millisecond sequential or random access to large data files for online use. The minimum configurations consist of two disc drives, a control unit, and, because of the byte orientation, a Multi-Subsystem Adapter (MSA). The MSA is described in 2.4.6. Each exchangeable 8414 pack has a capacity of 4.27 million words when used in a FASTRAND format of 33 words per record. This represents a minimum configuration capacity of 8.54 million words. Each 8424 pack has a FASTRAND format capacity of 8.56 million words, a minimum capacity of 17.12 million words.

Each disc pack consists of eleven discs arranged on a central spindle. The upper surface of the top disc and lower surface of the bottom disc are protective plates leaving twenty surfaces available for data storage. The disc packs are industry compatible.

The UNIVAC 8414/8424 Disc Subsystems are expandable up to eight control units per channel and eight drives per control unit. Operating capabilities are shown in Table 2–3, and full details of operating instructions may be found in *UNIVAC 8411/8414 Direct Access Subsystems Operator Reference, UP-7802* (current version).

2.4.6. Multi-Subsystem Adapter (MSA)

The Multi-Subsystem Adapter is used as an interface between byte-orientated peripheral devices and word-orientated system processors. The MSA handles the conversion, compaction, and expansion of bytes to words and vice versa.

Full details and operator instructions may be found in *UNIVAC Multi-Subsystem Adapter Operator Reference, UP-7891* (current version).

Table 2–3. Capabilities of UNIVAC 8414/24 Disc Subsystems

	UNIVAC 8414 Disc Subsystem	UNIVAC 8424 Disc Subsystem
Disc drives per control unit	2 to 8	2 to 8
Control units per MSA channel	1 to 8	1 to 8
Disc drives per cabinet	1	2
Recording surfaces per pack	20	20
Tracks per disc surface	203	406
Tracks available per pack ④	4050	8110
Data capacity per track ①	1056 words	1056 words
Data capacity per track ②	1320 words	1320 words
Data capacity per track ③	1485 words	1485 words
Data capacity per pack ①	4.27 million words	8.56 million words
Track density	100 per inch	200 per inch
Bit density	2228 per inch	2228 per inch
Nominal data transfer rate	83,000 wps	83,000 wps
Disc speed	2400 rpm	2400 rpm
Disc diameter	14 inches	14 inches
Vertical spacing between discs	0.350 inches	0.350 inches
Parity (over interface line)	Odd byte parity on command, address, status, sense, and data bytes. Longitudinal parity on all record fields.	

NOTES:

① *In FASTRAND format of 33 words per record.*

② *Double FASTRAND format, 66 words per record.*

③ *Triple FASTRAND format, 99 words per record.*

④ *After storage of operating system control data.*

3. OPERATOR'S CONTROLS AND INDICATORS

3.1. OPERATOR'S CRT DISPLAY CONSOLE

The operator's display console (Figure 3–1) furnishes the means for communicating instructions and information between the computer operator and the operating system. The components of the display console are:

- an indicator and control panel;
- a four-bank, 63-character keyboard;
- a cathode-ray tube (CRT) display, which can accommodate up to 16 lines of 64 characters each; and
- a PAGEWRITER printer, which prints up to 80 characters per line at a rate of 25 characters per second.

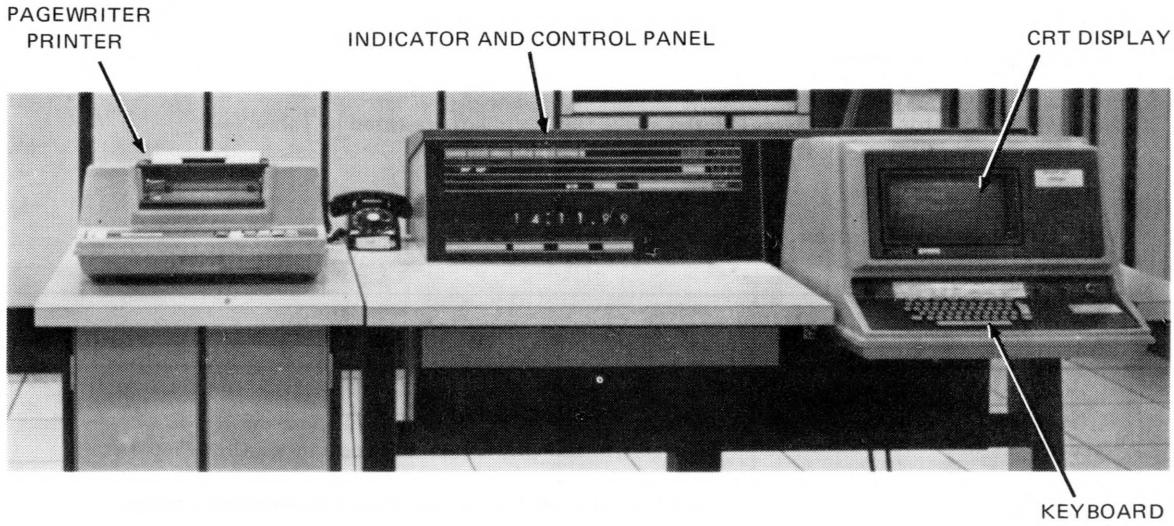


Figure 3–1. Operator's Display Console

3.1.1. Keyboard and CRT Display Unit

The keyboard and CRT display unit (Figure 3–2) consists of a viewing screen and a 4-bank keyboard resembling a typewriter keyboard.

Figure 3–2. Console Keyboard and CRT Display Unit

- Indicator and Control Panel

The switch, indicator, and controls located above the keyboard are listed in Table 3–1.

Table 3–1. Indicator Control Panel Controls and Indicators

Control/Indicator	Function
ON-OFF switch	Used to apply power to the CRT and to place the CRT in an operating state. A key is required to operate the ON-OFF switch.
FOCUS control	Used to adjust the focus of the symbols on the viewing screen.
BRIGHTNESS control	Used to adjust the intentsiy of the symbols being displayed.
HI-TEMP indicator	Lights when the temperature of the display device exceeds the maximum allowable temperature.

■ Character Codes

Table 3–2 shows the relationship between the symbol shown on the face of each keyboard data code sent to the CPU when that key is pressed. The table also shows the symbol displayed on the CRT or printed on a PAGEWRITER printer when each of the 64 possible 6-bit codes is sent to the CRT display console by the CPU. Of the 47 data keys, 45 are used to produce 60 display symbols. This is accomplished by using an uppercase (capital) shift to obtain the additional 15 display symbols.

Table 3–2. CRT Display and PAGEWRITER Printer Code

Fieldata	Symbol
00	∫∫
	①
01	[
02	]
03	NL
	(new line) ②
04	(not used)
05	space bar
	(no display)
06	A
through	through
37	Z
40	)
41	–
42	+
43	<
44	=
45	>
46	—
	(underscore) ③
47	$

Fieldata	Symbol
50	*
51	(
52	"
53	:
54	?
55	!
56	'
	(comma)
57	Ⓢ
60	0
61	1
through	through
71	9
72	'
	(apostrophe)
73	;
74	/
75	.
	(period)
76	▱
77	↑

NOTES:

① Used for input only.

② Combination carriage return and line feed.

③ Two symbols cannot be printed simultaneously in the same location; therefore, the underscore symbol (___) cannot be used to underline a displayed character.

- Keyboard

  The console keyboard is used by the computer operator to enter information into the system. The data entered may be directed to an operational task or to the executive routine, and may be either solicited or unsolicited.

  Keyboard input must be initiated by a carriage return (NL key) and be terminated by the stop character (octal code 57, Ⓢ). The initial carriage return is required to avoid locking out console output when a key other than the carriage return is accidentally pressed by the operator. All characters entered before the initial carriage return are ignored and are not displayed on the CRT viewing screen. Striking the carriage return establishes the input mode on the console; all console output messages are suspended until the operator has completed his input. The initial carriage return signal may be entered at any time; if an output message is being transmitted when the carriage return signal is entered, the input mode is established at the completion of the output message. When input mode has been established, a colon symbol (octal 53, :) is displayed in the first character position of the console entry line on the CRT viewing screen.

- Each character entered after the initial carriage return, except another carriage return or the erase character (octal 77, ↑), is displayed on the console viewing screen for verification. If the character is entered incorrectly, the incorrect character may be deleted by entering the erase character (↑).

  The operator may erase as many characters as have been entered; if the initial colon (:) is erased, the input mode is terminated.

- CRT Display

  All messages are displayed on the CRT viewing screen. The format of the messages displayed is as follows: The upper 15 lines of the screen contain all messages and edited operator typeins that have entered the system; the 16th line (the bottom line) is used to display operator typeins and to edit messages. As each character is entered by an operator typein, the character is displayed on the 16th line. When the stop code is entered, the input message is moved to the first vacant line in the upper 15 lines of the screen. When the screen becomes filled, messages other than those requiring an operator response are rolled off the screen, and the noncurrent messages are deleted first. The remainder of the messages are moved up, providing an area for new messages to be inserted. Unanswered response messages remain on the upper portion of the screen until the messages are timed-out by the operating system or until an operator response is entered.

  The PAGEWRITER printer provides a hard-copy log of all communications displayed on the viewing screen.

- Interrupt key functions

The CRT display console unit contains eight interrupt keys. Each key is assigned to a specific function when using the operating system. Table 3–3 is a summary of the functions performed when the appropriate interrupt keys are pressed:

Table 3–3. Summary of Interrupt Key Functions

Key	Action When Pressed
INTERRUPT 1	The entire console entry line (bottom line) is erased and the input mode is terminated.
INTERRUPT 2	All messages which are currently being displayed on lines 1 through 15 of the viewing screen and which do not require an operator's response are erased. Messages requiring an operator's response remain on the upper portion of the screen.
INTERRUPT 3	The CRT viewing screen is marked as being in an operational state. Used when screen has been previously marked as down by use of INTERRUPT 5.
INTERRUPT 4	The PAGEWRITER printer is marked as being in an operational state. Used when PAGEWRITER printer has been previously marked down by use of INTERRUPT 6 or when OMEGA was unsuccessful in transmitting data to the PAGEWRITER printer.
INTERRUPT 5	The CRT viewing screen is marked as being down.
INTERRUPT 6	The PAGEWRITER printer is marked as being down.
INTERRUPT 7	Unassigned
INTERRUPT 8	A master clear of the CRT input/output console is performed. Current input/output activity is terminated.

- Characteristics

The operating characteristics of the CRT display and keyboard are given in the following table.

Characteristics	
Display	
Viewing area	10 inches wide by 5 inches high
Buffer character capacity	1024
Display format	16 lines, 64 symbols per line
Symbol size	0.113 inch wide by 0.150 inch high
Symbol set	60 output symbols plus space/erase and new line
Symbol generation	Closed stroke, maximum 8 per character
Scan method	Digital
Regeneration rate	60 times per second
Keyboard	Basic alphanumeric typewriter: 47 character keys space bar 2 function keys 63 characters 8 interrupt keys

3.1.2. PAGEWRITER Printer

The PAGEWRITER printer (Figure 3–3) is mounted on a pedestal cabinet which houses the associated circuits, power supply, and paper store. The PAGEWRITER printer uses the Fieldata code/symbol relationship standard, which is applicable to other UNIVAC 494 System components. Maximum line length is 80 characters; the printing rate is 25 characters per second. Horizontal spacing of characters is ten to the inch. Vertical spacing is six lines per inch.

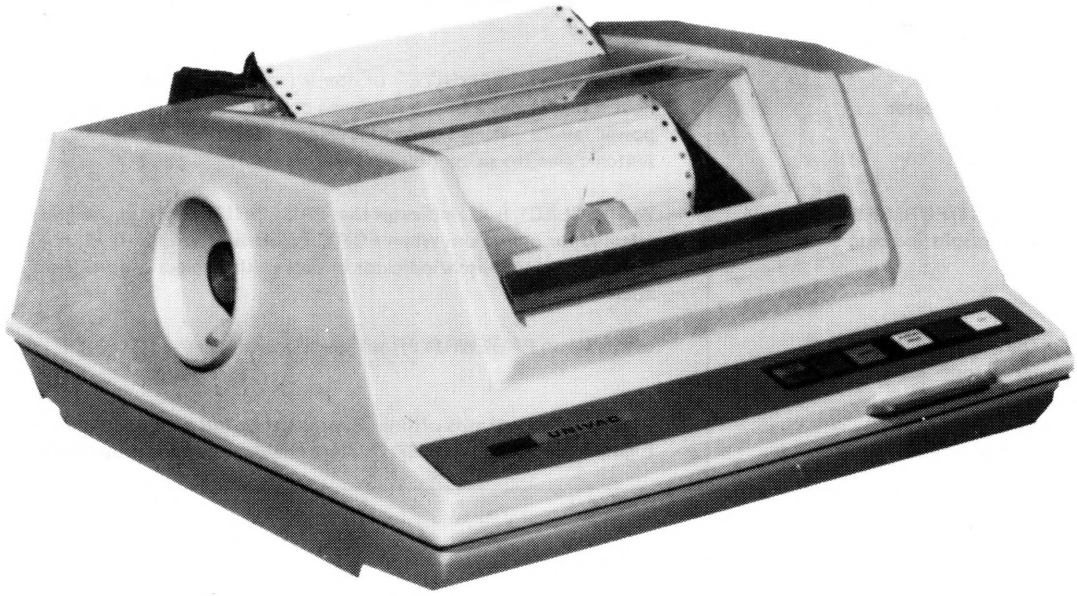


Figure 3–3. PAGEWRITER Printer

The PAGEWRITER printer is used as a logging device to record all CRT transactions between the control program and the operator. Printable symbols are given in Table 3–2.

- PAGEWRITER Printer Control Panel
- The PAGEWRITER printer control panel (Figure 3–4) is used by the operator to control and monitor printer operations. Table 3–4 contains a description of the operation of each component.

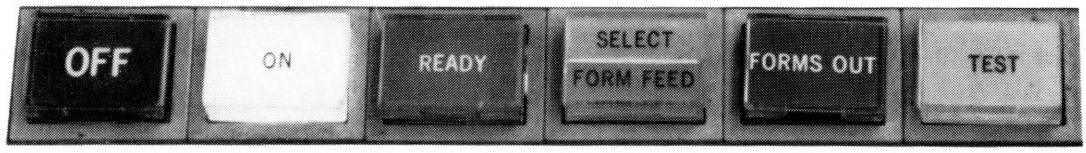


Figure 3–4. PAGEWRITER Control Panel

Table 3–4. PAGEWRITER Printer Control Panel Controls and Indicators

Control/Indicator	Function
OFF switch/indicator	Used to remove dc power from PAGEWRITER printer. Lights when dc operating power is removed.
ON switch/indicator	Used to apply power to PAGEWRITER printer. Lights when power is applied.
READY switch/indicator	Lights when PAGEWRITER printer is ready to operate. Does not light if one or more of the following conditions occurs: out of paper, power failure, interlock open, or print actuator failure. Pressing this switch clears the printer buffer main storage.
SELECT/FORM FEED switch/split/indicator	When SELECT is lit, indicates that PAGEWRITER printer has been selected for operation. When FORM FEED is lit, printer feed is being tested. Pressing switch/indicator initiates either select or form feed alternately.
OUT OF FORMS indicator	Lights when PAGEWRITER printer is out of paper.
TEST switch/indicator	When pressed, permits offline printing for maintenance purposes. Lights when PAGEWRITER printer is being tested for proper phasing.

3.1.2.1. Loading Forms Into the PAGEWRITER Printer

To load forms into the PAGEWRITER printer, proceed as follows (Figure 3–5):

1. Press OFF switch/indicator and remove cover from printer.
2. Expose rubber rollers by lifting paper guide rod and upper paper support.
3. Release tension of paper drag plate by sliding lever to right (lever located under control switches).
4. Remove old paper through the takeup chute. If paper is on roller, remove paper by lifting roller from support slots, releasing collar, and sliding roll from spindle.
5. Slide new paper roll over spindle, and replace collar.
6. Place roll, with paper unrolling from back side, in slots.

   NOTE:

   If forms with edge sprockets are used, remove roller and put box under takeup chute.

7. Pull paper through takeup chute, between paper drag plate and frame, over platen assembly (if paper has holes with teeth of both sprockets), and under rollers of upper paper support.

   a. Center paper so that left side overlaps path of print wheel.

   b. Slide paper drag plate lever to left.

c. Lower paper guide rod and upper paper support.

d. Lift lever located a few inches behind control switches so that OFF switch/indicator lights. Release lever.

e. Press ON switch/indicator. ON and READY indicators should light.

f. Press TEST switch. Print wheel should glide across paper and print a line of Es.

g. From line of Es determine if paper needs further adjustment; if adjustment is needed, press OFF switch/indicator, and repeat steps a through f.

8. Press SELECT/FORM FEED switch to test for proper feed without jamming, slipping, and so forth.

9. Replace cover.

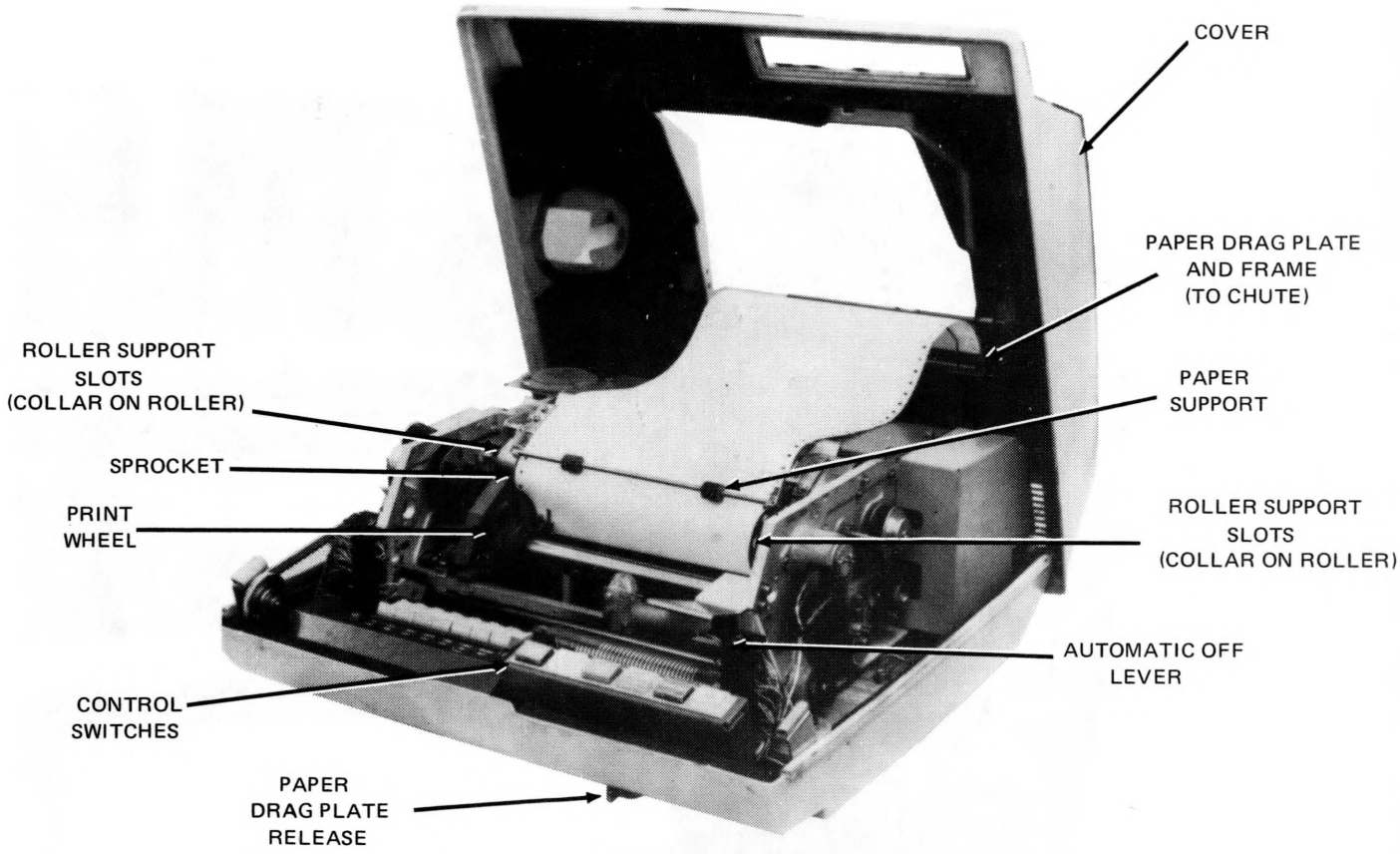


Figure 3–5. Loading Forms into PAGEWRITER Printer

3.1.2.2. Changing PAGEWRITER Printer Ribbon

To change the printer ribbon, proceed as follows (Figure 3–6):

1. Press OFF switch/indicator, and remove cover.
2. Slide covers from ribbon reels.
3. Snap wire guides away from reels.
4. Slip ribbon from guides on print wheel assembly, and remove ribbon from both reel centers.

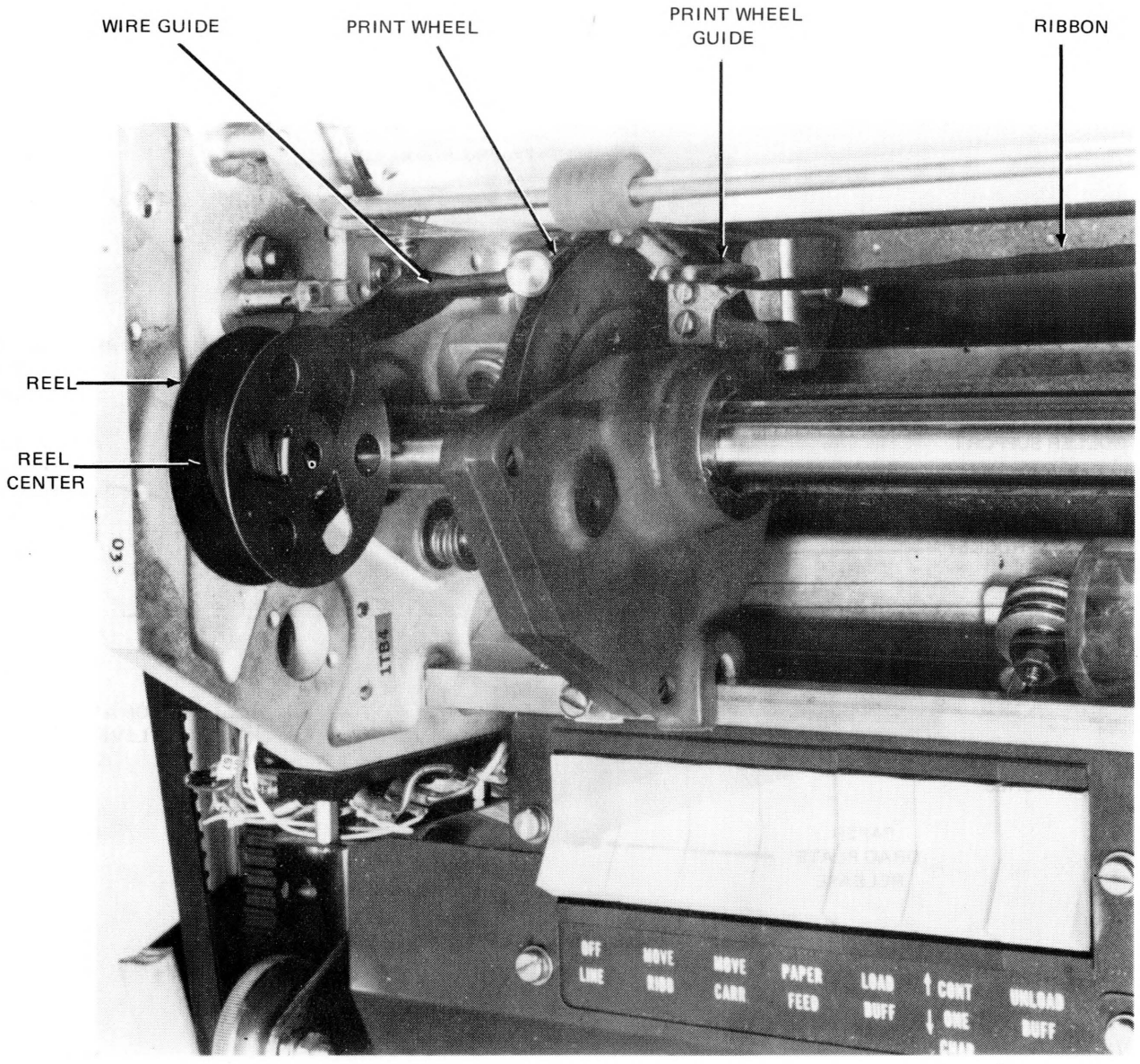


Figure 3–6. Changing PAGEWRITER Printer Ribbon

5. Slip new ribbon onto one reel center, and replace reel cover.

6. Unwind a portion of ribbon, and insert end into groove on other reel center. Replace cover.

7. Position ribbon around each wire guide and into guides on print wheel assembly so that ribbon is in front of two guides closest to print wheel and behind copper-colored strip.

8. Replace cover, and press ON switch/indicator.

9. After READY indicator lights, press TEST switch/indicator to test proper ribbon movement.

3.1.3. Operator's Control and Indicator Panel

A layout of the operator's control and indicator panel is shown in Figure 3–7.

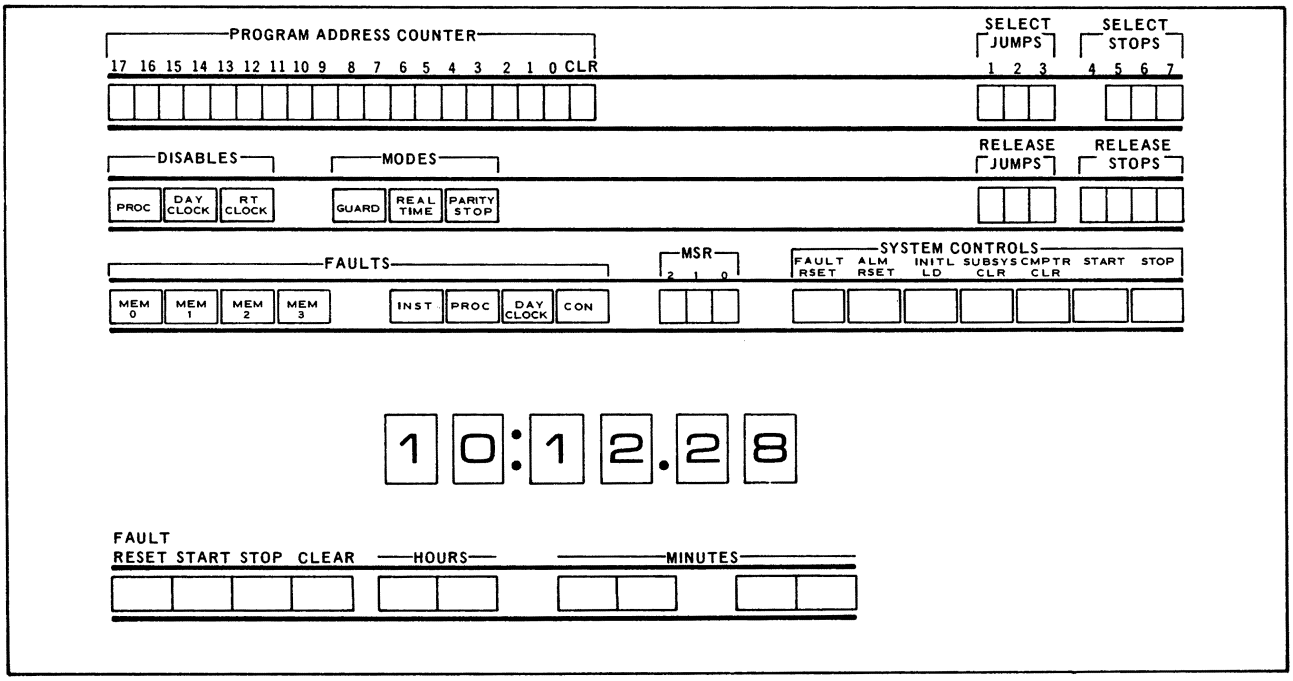


Figure 3–7. Operator's Control and Indicator Panel

- PROGRAM ADDRESS COUNTER Section

  This section contains 18 switch/indicators (labeled 17 through 0) and one switch labeled CLR. The indicators display the contents of the program address counter (P register) in the control section of the CPU. The P register normally contains the address of the next instruction to be performed. Pressing the CLR switch clears the P register to all 0's. Pressing any of the 17 operable switch/indicators sets the corresponding bit position of the P register to a 1 bit. All indicators and switches are disabled while a program is running.

- DISABLES Section

The DISABLES section contains three indicators as follows:

PROC
: When lit, indicates that a disable switch, other than a clock disable, on the CPU maintenance panel or a main storage maintenance panel has been set.

DAY CLOCK
: When lit, indicates that day clock request and interrupt lines have been disabled.

RT CLOCK
: When lit, indicates that decrementation of the real time clock register has been disabled. (The purpose of the real time clock at main storage location 000017_8 is to monitor the running time of a program, routine, or subroutine, and to inform the executive program when the time exceeds a predetermined limit.)

- MODES Section

The MODES section contains three indicators.

GUARD
: When lit, indicates that the storage protection feature of the UNIVAC 494 is active.

REAL TIME
: When lit, indicates that certain controls on the operator's control and indicator panel are disconnected as a result of setting a switch on the CPU maintenance panel. When the REAL TIME indicator is lit, the only controls which have any effect on processor operation are the SELECT JUMPS switches, and the keyboard with its eight associated interrupt switches.

PARITY
STOP
: Lights when the STOP ON PARITY switch on the CPU maintenance panel is set; indicates that the processor will stop on parity errors.

- FAULTS Section

There are eight fault indicators. The indicators are:

MEM 0, MEM 1, MEM 2, MEM 3
: When lit, each of these four main storage fault indicators shows detection of a parity error in one of four main storage module pairs.

INST
: When lit, indicates detection of an illegal f field in an instruction in the control section of the CPU.

PROC
: When lit, indicates a power, air, or temperature failure in either the CPU or a main storage module pair.

DAY CLOCK
: When lit, indicates that a voltage transient may have caused an incorrect time readout.

CON
: When lit, indicates a detection of an air flow fault within the console or an abnormal setting of a switch on the display console maintenance panel.

- SELECT JUMPS AND RELEASE JUMPS Section

  The three SELECT JUMPS switch/indicators and the three RELEASE JUMPS momentary-contact switches are used in conjunction with the manual jump instruction (f=61_8 or 65_8). Pressing a SELECT JUMPS switch lights the indicator and enables a corresponding jump when called for in the program. Pressing a RELEASE JUMPS switch extinguishes the corresponding SELECT JUMPS indicator and disables the jump. The switches can be set and released while the CPU is operating, even while in the real time mode.

- SELECT STOPS AND RELEASE STOPS Section

  Pressing a SELECT STOPS switch lights its corresponding indicator. Pressing a RELEASE STOPS switch (labeled 5 through 7) extinguishes the corresponding SELECT STOPS indicator. If the CPU is operating in neither guard mode nor real time mode, it will stop when the j field of a manual jump instruction (f=61_8 or 65_8) contains the value 4 or a value corresponding to a lit SELECT STOPS indicator. When the CPU stops as a result of a manual jump instruction, the RELEASE STOPS indicator (labeled 4 through 7), which corresponds to the value in the j field of the instruction, lights. Following a stop, pressing the START switch extinguishes the lit RELEASE STOPS indicator and starts the operation of the CPU.

  If the CPU is operating in either guard mode or real time mode (or both), no combination of the j field value in a manual jump instruction and lit SELECT STOPS indicators will cause it to stop.

- MSR (Memory Select Register)

  These three MSR positions are not used.

- SYSTEM CONTROLS Section

  This section contains seven momentary-contact switches as follows:

  FAULT RSET
  When pressed, clears all fault indicators on the panel, except the DAY CLOCK FAULT.

  ALM RSET
  When pressed, turns off the audio alarm which was turned on by a fault condition.

  INITL LD
  When pressed, loads a portion of main storage with a predetermined program from the subsystem selected at the CPU maintenance panel and starts the running of that program.

  SUBSYS CLR
  When pressed, clears the I/O section of the CPU and sends a master clear signal to each subsystem which is connected to any I/O channel of the CPU.

  CMPTR CLR
  When pressed, clears all CPU registers required to start the CPU.

  START
  When pressed, starts execution of the CPU program with the instruction at the location specified by the program address counter.

  STOP
  When pressed, stops execution of instructions, but allows previously specified I/O data transfers to continue.

- Time Display

  This set of six projection-type indicators displays the time of day in hours, minutes, and hundredths of minutes. The display is driven by a 24-hour (day clock) counter which automatically cycles from 23:59.99 to 00:00.00.

- Day Clock Controls

  The following 10 momentary-contact switches control operation of the day clock. They are disabled when the REAL TIME mode switch on the CPU maintenance panel is set for real time operation.

  FAULT RESET
  When pressed, extinguishes the DAY CLOCK FAULT indicator.

  START
  When pressed, starts the day clock running.

  STOP
  When pressed, stops the day clock to permit setting.

  CLEAR
  When pressed, clears the counters for the day clock to all 0 bits.

  HOURS
  and
  MINUTES
  These six switches set the 6-digit positions of the day clock counter to the time of day.

3.2. OPERATOR'S CONSOLE (ALTERNATE)

The operator's console (alternate) consists of the following (Figure 3–8):

- keyboard and printer;
- operator's control and display panel; contains the day clock switches and indicators; and
- paper take-up motor, system EMERGENCY OFF switch, and loudspeaker for program and fault alarms.

3.2.1. Keyboard and Printer

The keyboard enables the operator to insert control characters or data into the CPU. The printer furnishes hard copy of messages sent to the CPU and prints messages from the CPU, thereby enabling the operator to monitor the performance of the executive routine and the CPU. The keyboard is a 4-bank typewriter keyboard which can generate the 64 basic Fieldata characters. The printer operates at 10 characters per second. These characters are the 26 alphabetic characters, 10 numeric characters, and 20 special characters of the Fieldata code. The printer also responds to the remaining 8 control codes (space, carriage return, and others). The relation between the keyboard characters, the printer display, and the corresponding Fieldata code is shown in Table 3–5.

Table 3–5. Keyboard and Printer Fieldata Conversion

Fieldata Code	Keyboard Symbol	Printer Symbol	Fieldata Code	Keyboard Symbol	Printer Symbol
000000	none	⍰ (Master Space)	100000	)	)
000001	UC	⌇ (Upper Case)	100001	–	–
000010	LC	□/□ (Lower Case)	100010	+	+
000011	LF	Line Feed	100011	<	<
000100	RETURN	Car. Return	100100	=	=
000101	none	Space	100101	>	>
000110	A	A	100110	—	—
000111	B	B	100111	$	$
001000	C	C	101000	*	*
001001	D	D	101001	(	(
001010	E	E	101010	"	"
001011	F	F	101011	:	:
001100	G	G	101100	?	?
001101	H	H	101101	!	!
001110	I	I	101110	,	,
001111	J	J	101111	Ⓢ	Ⓢ
010000	K	K	110000	0	0
010001	L	L	110001	1	1
010010	M	M	110010	2	2
010011	N	N	110011	3	3
010100	O	O	110100	4	4
010101	P	P	110101	5	5
010110	Q	Q	110110	6	6
010111	R	R	110111	7	7
011000	S	S	111000	8	8
011001	T	T	111001	9	9
011010	U	U	111010	'	'
011011	V	V	111011	;	;
011100	W	W	111100	/	\
011101	X	X	111101	.	.
011110	Y	Y	111110	SPEC	□
011111	Z	Z	111111	↑	(Idle)

Immediately above the banks of keys are the four switch/indicators described in Table 3–6 which control keyboard and printer operations.

Table 3–6. Keyboard and Printer Controls and Indicators

Control/Indicator	Function
PAPER TAKE-UP DISCONNECT alternate-action switch/indicator	Pressing this switch enables change of paper or review of previous copy.
KEYBOARD DISCONNECT switch/indicator	Press this switch to disconnect the keyboard.
INTERRUPT ENABLE alternate-action switch/indicator	Press this switch so that the indicator is lit; allows the keyboard to interrupt CPU processing for a keyin. (If the indicator is not lit, the CPU can accept a keyin only when character 0 is activated during an I/O priority scan.) If no keyin is to be sent, press the switch so that the indicator is not lit.
PAPER FEED switch	As long as this switch is pressed, paper will be fed continuously.

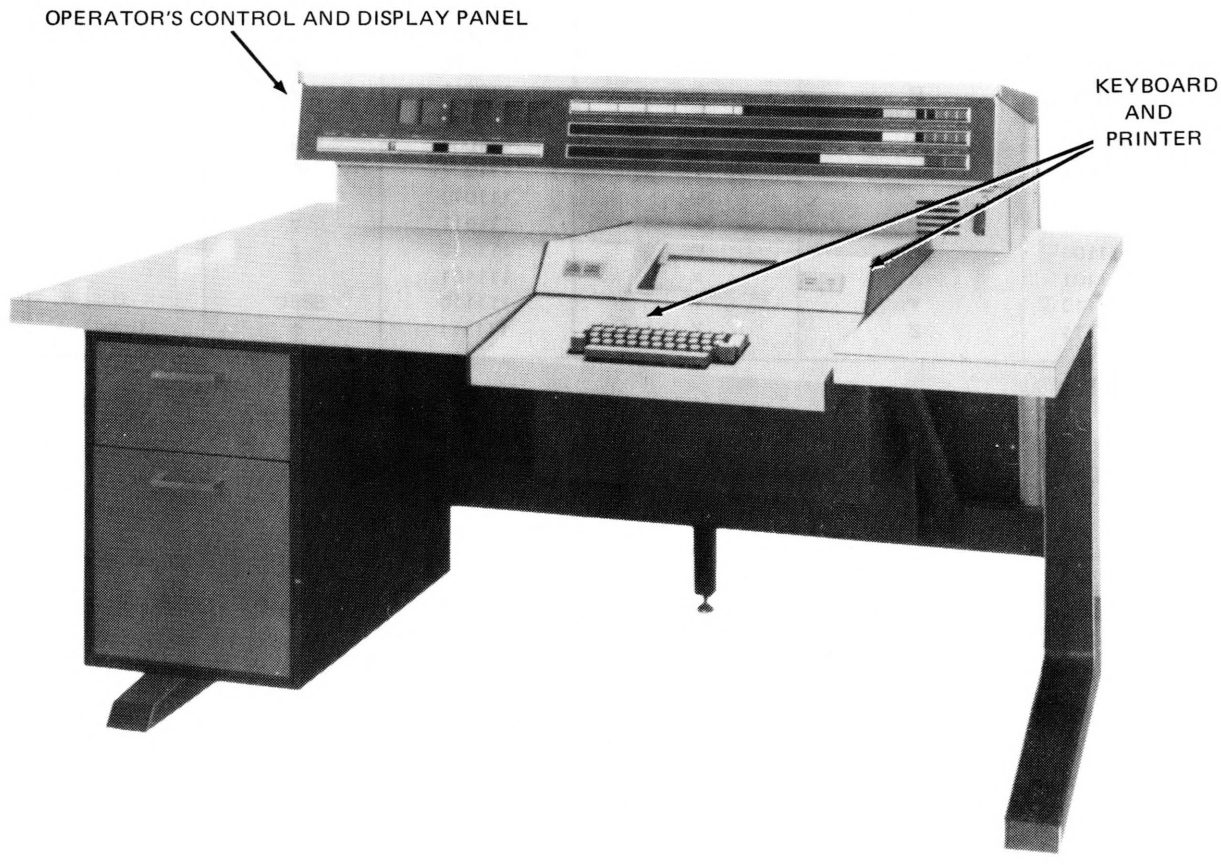


Figure 3–8. UNIVAC 494 Operator's Console (Alternate)

3.3. CPU MAINTENANCE PANEL

The maintenance panel located at the rear of the CPU (Figure 3–9) is used primarily by Sperry Univac field engineering in the operation and maintenance of the system. However, there are procedures which the computer operator performs from the maintenance panel instead of from the operator's console. These procedures include:

- clearing primary storage
- performing a 170 dump
- changing system drum channels

The bootstrap procedure may be performed both from the CPU maintenance panel and from the operator's console. The controls and indicators of significance to the computer operator are discussed in this section. Operating system start-up and maintenance procedures, such as bootstrap, are described in Section 4.

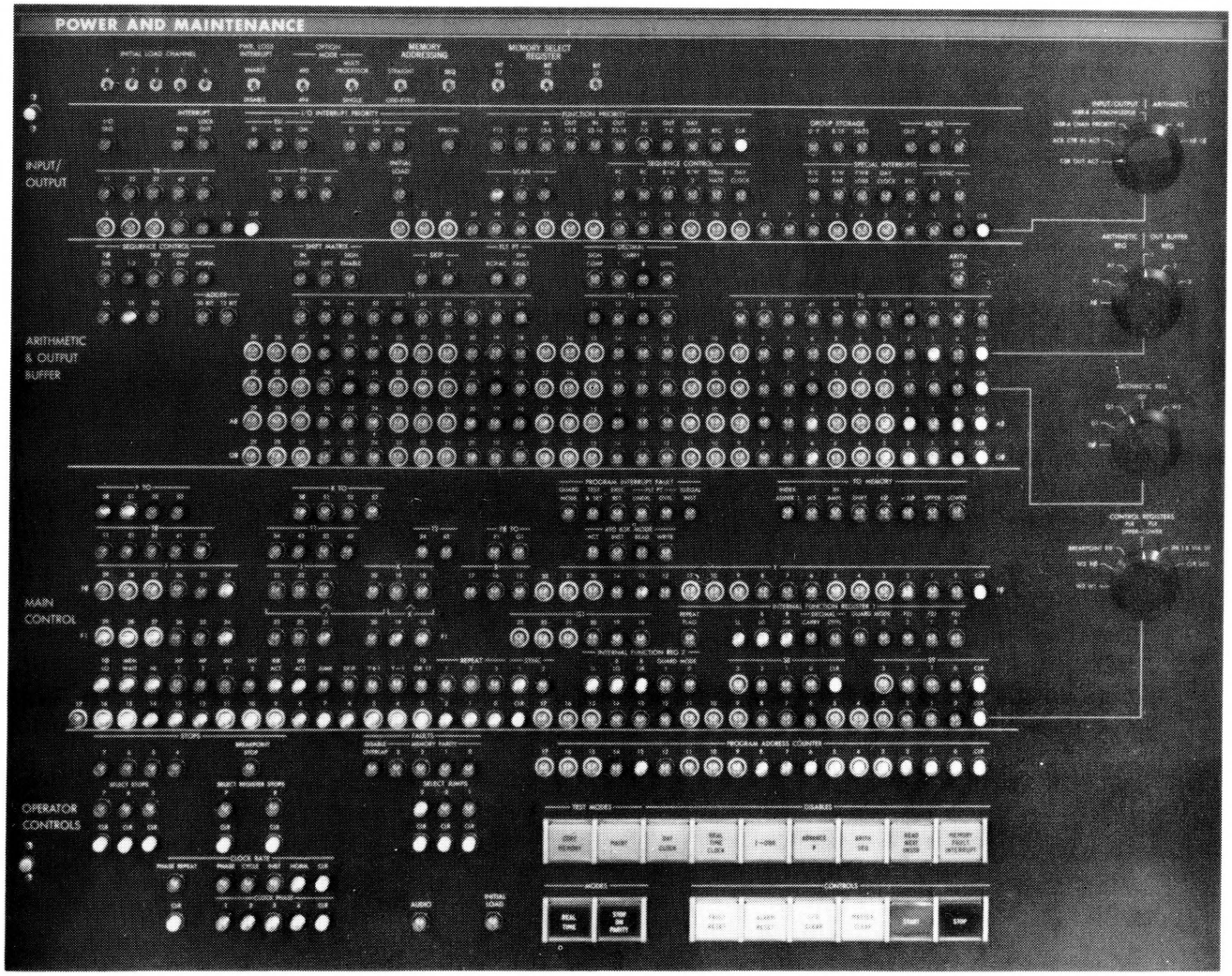
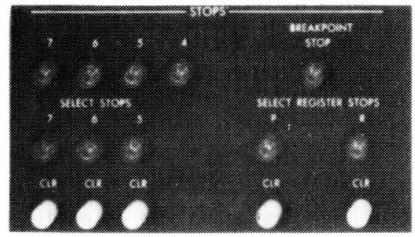


Figure 3–9. CPU Maintenance Panel

3.3.1. OPERATOR CONTROLS Section

The OPERATOR CONTROLS section (Figure 3–9) is located along the bottom of the maintenance panel.

- STOPS Switches and Indicators



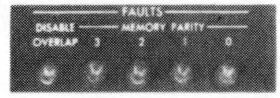
STOPS switches represent three internal switches, 5, 6, and 7, which can be set or cleared manually, and an unconditional stop internal switch, 4, which cannot be manually set. The computer stops when a STOPS switch is set, and the corresponding j field of the jump or return jump instruction is also set. When the j designator is set to 4 in the instruction, an unconditional 4 stop occurs.

The BREAKPOINT STOP indicator lights whenever the BREAKPOINT STOP switch is set and breakpoint stop conditions are satisfied.

Setting of the P switch brings the computer to a stop when the address in the breakpoint register equals the address in the P register.

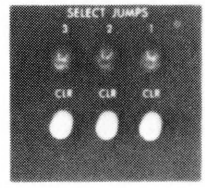
Setting of the R switch brings the computer to a stop when the address in the breakpoint register equals the primary storage read or write operand address y.

- FAULTS Switches and Indicators



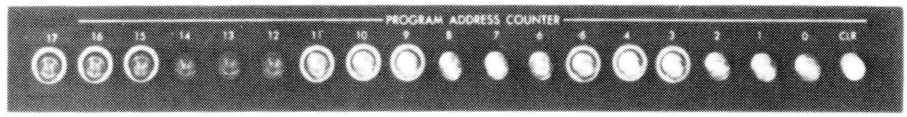
There are five fault switches: MEMORY PARITY 0, 1, 2, and 3, and DISABLE OVERLAP. When the MEMORY PARITY switches are set by primary storage parity errors, the fault alarm is activated. The fault switches are cleared from the maintenance panel or the control console by pressing the MASTER CLEAR switch. The DISABLE OVERLAP switch is set when a primary storage parity error is encountered.

- SELECT JUMP Switches



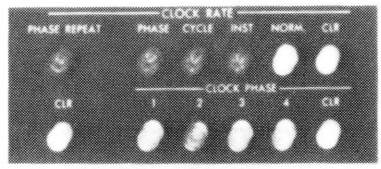
There are three SELECT JUMP switches which are manually set or cleared. The jump is made if the jump switch corresponding to the j portion of the instruction is set.

- PROGRAM ADDRESS COUNTER (P register)



The 18 indicators are used to insert an address manually into the P register. The indicators show the contents of the register. A lighted indicator represents a binary 1, and an unlighted indicator represents a binary 0. Pressing the CLEAR switch on the right of the P register clears the register.

- CLOCK RATE and CLOCK PHASE Switches



The PHASE REPEAT switch disables the phase-step distributor. Pressing the CLEAR switch (directly beneath the PHASE REPEAT switch) clears the internal switch.

The PHASE switch is used to select the clock phase rate of operation.

The CYCLE switch selects the clock cycle rate of operation. The clock phases are generated in the order: 4, 1, 2, 3.

The INST switch is used to select the instruction rate of operation. When the INST switch is set, the operator may step through the I/O T8 timing chain if the computer is in maintenance mode.

The NORM switch is used to select the normal rate of operation. The switch is cleared by pressing the CLEAR switch next to the NORM switch when the computer is stopped. Pressing the MASTER CLEAR switch automatically selects the normal rate of operation.

Press the CLEAR switch to clear any of the four rate switches described. To change rate selection, the CLEAR switch is pressed before setting the new rate.

The four CLOCK PHASE switches are used to select a clock phase and to indicate the next generated clock phase. The indicators represent the four steps of the phase-step distributor.

The CLOCK PHASE CLR switch is used to clear the phase-step distributor.

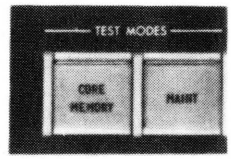
- AUDIO Switch

The AUDIO switch is set to turn on the fault alarm. The alarm sounds when the guard mode switch is set, and is turned off when the guard mode switch is cleared. This switch is cleared by pressing the FAULT RESET switch on the maintenance panel or console.

- INITIAL LOAD Switch

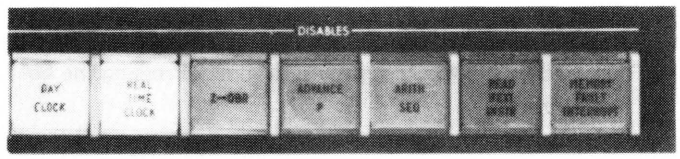
The INITIAL LOAD switch is pressed to set the switch which, in turn, initiates the initial load sequence when the START switch is pressed.

- TEST MODES Indicator and Switch



The CORE MEMORY indicator lights when the TEST/NORMAL switch on the main storage maintenance panel is in the TEST position. The MAINT switch is used to disable the timeout interrupt and to detect 77 instructions as illegal in UNIVAC 490 mode. The MAINT switch, when set, also overrides a STOP DISABLE indicator applied by the REAL TIME mode switch or by the guard mode. When the MAINT switch is set, I/O operation and breakpoint Stop on I/O main storage references may be stopped.

- DISABLES Switch Indicators



The DISABLES DAY CLOCK switch is used to disable the interrupts and to update the time of the day clock. The operator's console DISABLES DAY CLOCK lights when the real time clock is disabled.

The DISABLES Z-OBR switch is used to disable data transmission from primary storage to output registers. The operator's console DISABLES PROCESSOR indicator lights when the disable mode is active.

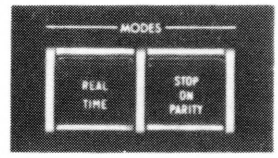
The DISABLES ADVANCE P switch is used to disable initiation of the advance P sequence. The operator's console DISABLES PROCESSOR indicator lights when this switch is set.

The DISABLES ARITH SEQ switch is used to disable initiation of the arithmetic timing chain. The operator's console DISABLES PROCESSOR indicator lights when the arithmetic timing chain is disabled.

The DISABLES READ NEXT INSTR switch is used to disable clearing of the F register and the Z to F data transfer. When the switch is set, the DISABLES PROCESSOR indicator is lit at the operator's console.

The DISABLES MEMORY FAULT INTERRUPT switch is used to disable all primary storage fault interrupts. This switch does not disable the setting of the fault switches. The operator's console DISABLES PROCESSOR indicator lights whenever main storage fault interrupts are disabled.

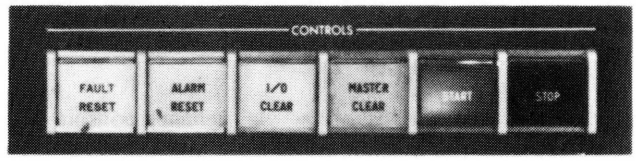
- MODES Switch/Indicators



The REAL TIME switch is used to reflect real time operation and to disable the majority of the controls at the operator's console. The operator's console REAL TIME MODES indicator lights when this mode is selected. Only the following operator's console switches are not disabled: SELECT JUMPS, RELEASE JUMPS, MANUAL STOP RELEASE, FAULT RESET and ALARM RESET.

The STOP ON PARITY switch causes the computer to stop on the occurrence of a primary storage parity error. If the error occurs on a non-I/O reference, any previously initiated input or output is completed. If the error occurs during an I/O reference, the I/O reference is terminated by the CPU internal timing mechanisms.

- CONTROLS Switches/Indicators



The FAULT RESET switch is used to clear the following conditions: MEMORY PARITY 0, 1, 2, 3, DISABLE OVERLAP, ILLEGAL INSTRUCTION, and AUDIO.

The ALARM RESET switch is pressed to turn off the audio alarm after the alarm has been activated by a program.

When the computer is stopped, pressing the I/O CLEAR switch sends a CLEAR signal to each peripheral subsystem by way of the input/output channels.

When the computer is stopped, pressing the MASTER CLEAR switch clears the computer and the primary storage transient registers.

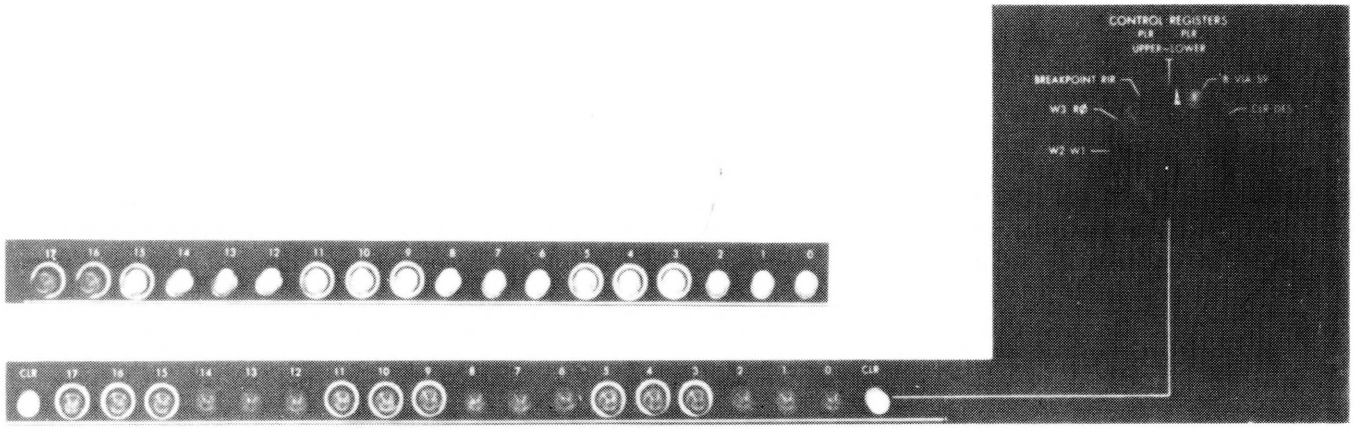
The START switch/indicator is used to initiate computer operation. The indicator remains on during normal operation. The switch must be pressed once each time that an initiation pulse is needed to generate a phase, cycle, or instruction during the phase, cycle, or instruction clock rate of operation.

The STOP switch/indicator is used to halt computer operation during the normal rate of operation. The STOP indicator is on whenever the computer is in the instruction phase or cycle rate of operation.

3.3.2. MAIN CONTROL Section

The MAIN CONTROL section (Figure 3–9) contains the following switches and indicators which are significant to the operator.

- BREAKPOINT RIR Switch and Registers

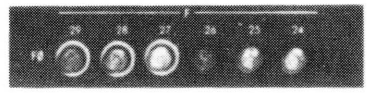


When the bottom rotary switch on the right of the maintenance console is set to BREAKPOINT RIR, the 18-bit register on the left contains the breakpoint address, and the 18-bit register on the right contains the RIR address. The breakpoint refers to the SELECT STOPS as described in 3.2.1.

- T0 LO Switch/Indicator

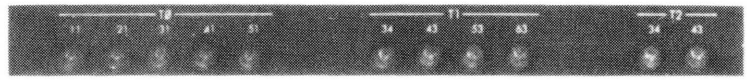
The LO switch/indicator is on during operation of the main timing chain. Press this switch if the computer does not stop after pressing the STOP control.

- F0 Indicator



The F0 indicator lights when an instruction is read from main storage.

- T0, T1, T2 Indicators



T0 represents the main timing chain.

T1 represents the operand timing chain.

T2 represents the instruction timing chain.

- ILLEGAL INSTRUCTION Indicator

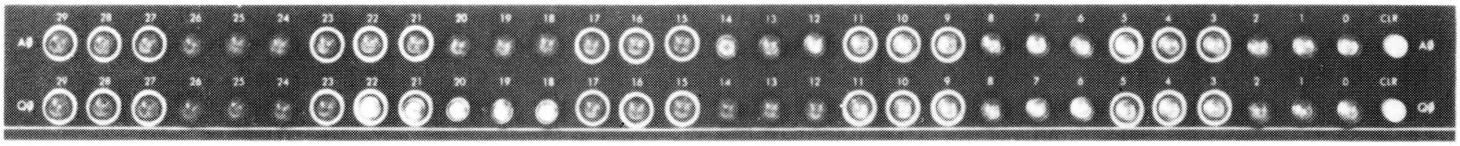
The ILLEGAL INSTRUCTION indicator is located at the right of the PROGRAM INTERRUPT FAULT area at the center top of the MAIN CONTROL section.

The indicator lights when a 00 or privileged 77 instruction is attempted in guard mode or an I/O instruction is attempted in worker program mode. The indicator also lights when any 00 or 77 instruction is attempted while in 490 mode.

3.3.3. ARITHMETIC & OUTPUT BUFFER Section

The ARITHMETIC & OUTPUT BUFFER section, which is located directly above the MAIN CONTROL section (Figure 3–9), contains the following registers which are of significance to the computer operator:

- A Register and Q Register

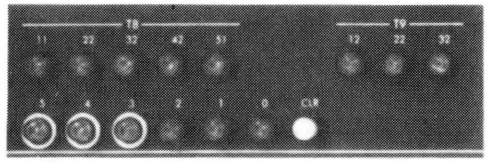


The A register and the Q register are arithmetic registers.

3.3.4. INPUT/OUTPUT Section

The INPUT/OUTPUT section, which is located directly above the ARITHMETIC and OUTPUT BUFFER section (Figure 3–9), includes the following indicators:

- T8 and T9 Indicators



T8 and T9 represent the I/O timing chain.

- INTERRUPT

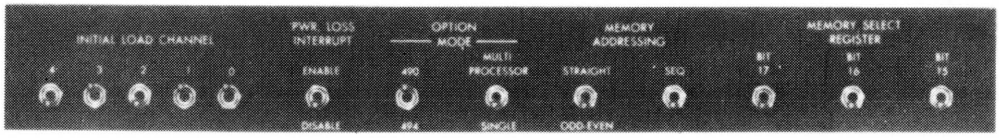
The REG (regular) indicator lights when an interrupt is detected by an I/O operation.

The LOCK OUT indicator lights when interrupts are locked out by the program.

3.3.5. System Parameter Toggle Switches

The system parameter toggle switches are located on the upper left of the operator's panel (Figure 3–9).

- INITIAL LOAD



The five switches numbered 0 through 4 are used to select the I/O channel used for the initial load. A switch in the up position indicates a binary 1, and a switch in the down position indicates a binary 0. The group of five switches can represent any one of the 24 possible channels. As an example: If switches 2 and 1 are up, and 4, 3, and 0 are down, a binary 00110 for selection of channel 6 is indicated.

- PWR. LOSS

When this switch is in the ENABLE position (up) and a failure in service power is detected, an interrupt occurs at address 00002. If the switch is in the DISABLE position (down), the interrupt is prevented.

- OPTION MODE

This switch selects the mode of operation to be used. When the switch is set to 490 (up), the system operates as if it were a UNIVAC 490 System. When set to 494 (down), the normal setting, the system operates in the UNIVAC 494 mode.

- MULTI PROCESSOR

This switch controls the word count for the initial load; the MULTI position sets up a word count of 0. When bootstrapping OMEGA, the switch must be set to the SINGLE position. The SINGLE position sets up a word count of 200.

- MEMORY ADDRESSING

These switches control the mode of main storage addressing. When the left hand switch is in the ODD-EVEN position, successive odd addresses are in one bank, and the even addresses are in another. When this switch is in the STRAIGHT position, successive main storage addresses are located in one main storage bank.

When the right hand switch is in the NORM position, STRAIGHT or ODD-EVEN addressing mode may be selected. When the switch is in the SEQ position, the STRAIGHT mode must be used.

- MEMORY SELECT

  The three MEMORY SELECT REGISTER (MSR) switches are used in conjunction with the MEMORY ADDRESSING switch to permit switching of fixed address locations within the four main storage cabinets or eight storage modules as illustrated in Figure 2–2.

3.4. DUAL STORAGE CONTROLLER (DSC)

The operation of the dual storage controller (DSC) is controlled by the processor, storage, and other DSCs in the system after it has been powered up and master cleared. There is no maintenance panel; however, Figure 3–10 illustrates the DSC power control panel, which contains the operator controls and indicators and the power controls and indicators.

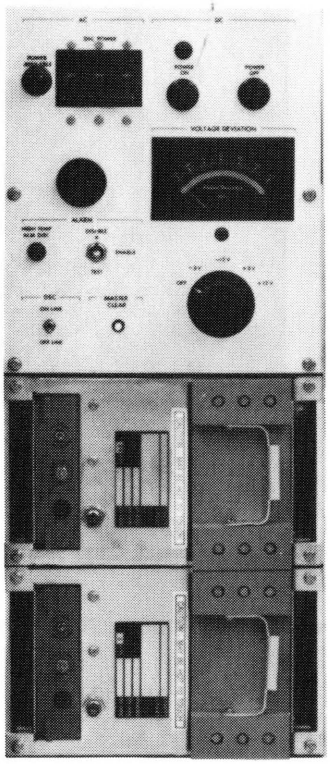


Figure 3–10. DSC Power Control Panel

3.4.1. DSC Cabinet Description

The DSC is contained in a standard UPS–2 cabinet, 24 inches deep and 64 inches high, which is shown in Figure 3–11. The cabinet decor is compatible with the UNIVAC 494 System. The cabinet contains a logic deck, three DC power supplies, a power control panel, and two fan assemblies (one under the power supplies and one under the logic deck). There are three interface connector panels in the cabinet. Two of these panels, A08 and A09, one mounted on each side of the logic deck, provide the connections for the processor-to-DSC cables and DSC-to-storage unit cables. The third, panel A02, mounted below the logic deck, provides the connections for the DSC-to-DSC cables.

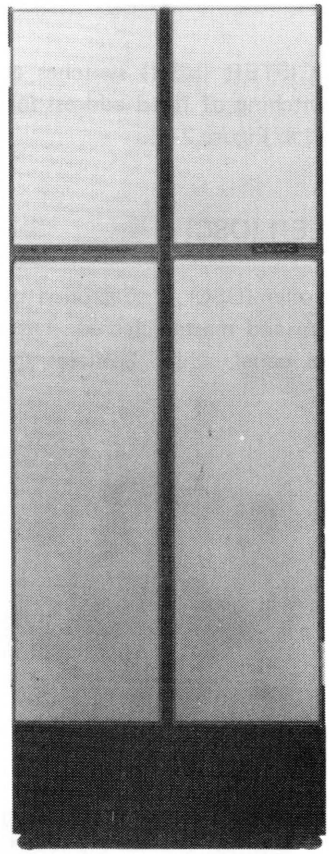


Figure 3–11. DSC Cabinet

A line filter box is provided for AC input line connections. A brief description of each cabinet assembly follows.

3.4.1.1. Logic Deck (A01)

The logic deck contains 148 UNIVAC 1108-type printed circuit cards. Of the 148 cards, 103 are used with the basic deck, 36 are added for extended addressing and 9 are added for DSC expansion. The card side of the logic deck is accessible from the front of the cabinet with the doors open.

3.4.1.2. Power Supplies

The DSC contains three power supplies which are rated as follows:

- −3V dc at 60 amps (A05)
- −12V dc at 25 amps (A06)
- +30V dc at 1800 watts (A07)

The −3V dc and −12V dc output voltage supplies are screwdriver adjustable. A toggle switch on each supply enables checking of the ± 5% voltage margins.

The +30V dc common supply feeds the −3V dc and −12V dc regulators and is capable of operating with either 50 Hz or 60 Hz primary input power.

3.4.1.3. Power Control Panel (A04)

The power control panel is accessible from the rear of the cabinet with the doors open. The main ac power circuit breaker for the DSC cabinet is mounted on this panel. Also mounted on the panel is a selector switch and a percent-deviation meter, which permits monitoring the output voltages of the −3V dc and −12V dc power supplies in the DSC cabinet. Two voltages, +3V dc and +12V dc, required for the DSC logic and supplied by the main storage power cabinet, can also be monitored on the deviation meter. Other controls and indicators mounted on the power control panel include the dc power ON and power OFF push-button switches, dc power ON indicator, ac power available indicator, audio alarm, alarm disable/enable test toggle switch, high temp/alarm disconnect indicator, DSC ON Line/OFF Line toggle switch, and a master clear push button.

3.4.1.4. Fan Assemblies

Three fans (A03) mounted beneath the logic deck draw air through the grill at the bottom of the cabinet and provide cooling for the logic deck. The power supplies and power control panel are cooled by a single fan (A10) mounted beneath the −12V dc power supply. Exhaust air is expelled through vents in the top of the cabinet.

3.4.1.5. Line Filter Box (A11)

The line filter box contains a radio frequency noise filter for the three phases and neutral of the ac input line. A pressure terminal is provided for each input line connection of the customer's power.

3.4.2. DSC Controls and Indicators

3.4.2.1. Power Sequencing and Controls

The ac line voltage required for operation of the +30V dc common power supply and the cooling fans is controlled by the ac circuit breaker labeled DSC POWER. Three relays provide the power sequencing for the negative dc power supplies. The +30V dc is used for the control circuitry for power sequencing. The −3V dc and −12V dc supplies located in the DSC cabinet are activated by depressing the DC POWER ON switch, and their outputs are used by the logic deck. The +3V dc and +12V dc logic voltages are obtained from the core storage power cabinet and are controlled by the relay K02. This relay is activated when the 12V dc voltage is present. There are no +3V dc and +12V dc power supplies in the DSC cabinet. The +3V dc and +12V dc logic voltages are not detected in the DSC during the sequencing of the DSC power supplies. However, if the +3V dc and/or +12V dc voltages are not available to the DSC cabinet, the DC ON indicator does not light.

Since the +3V dc and +12V dc are obtained from the storage cabinet they cannot be adjusted at the DSC cabinet.

3.4.2.2. Fault Sensing

The audio alarm sounds, and the HIGH TEMP/ALM DISC indicator lights when the air temperature at the high-temperature thermostat located over the card deck (A01S01) or over the power supplies (A10S01) reaches 46 degrees centigrade. The audio alarm may be silenced by placing the alarm toggle switch in the DISABLE position, but the indicator remains lit until the high-temperature condition no longer exists, and the alarm toggle switch is placed in the ENABLE position. The audio alarm and the HIGH-TEMP indicator may be tested by placing the alarm toggle switch in the TEST position when no high-temperature or over-temperature condition exists.

When the air temperature at the over-temperature thermostat above the card deck (A01S02) or above the power supplies (A10S02) reaches 55 degrees centigrade, the −3V dc and +12V dc power supplies are shut off. When these supplies turn off, the +3V dc and +12V dc voltages from the storage power cabinet are removed from the card deck.

If an over-current (under-voltage) or an over-voltage condition is detected in the –3V dc or –12V dc power supplies, the supply turns off. This condition causes the loss of all DC logic voltages in the DCS cabinet. The –3V dc power supply has a 15-amp pushbutton circuit breaker, and the –12V dc power supply has a 30-amp pushbutton circuit breaker. These breakers pop out when the supplies are overloaded and may be reset by pushing them in. Each supply has an indicator which is lit when the supply is operating.

3.4.2.3. Master Clear

When DC power is sequenced up, a thermal time delay relay provides the logic deck with a 2-second positive (ground) level signal for an initial master clear. A master clear pushbutton is provided on the power control panel for manually clearing the logic deck.

3.4.2.4. DSC Online/Offline

The online/offline mode is controlled by a 2-position toggle switch on the power control panel. When this toggle switch is in the OFF LINE position, the DSC has no interface connections with its processor or with DSCs in the system. When this switch is in the ON LINE position, normal interface paths are established between the DSC and its processor and other DSCs in the system.

3.4.3. UNIVAC 494 Single/Dual Processor Remote Select Box

The remote selection box provides a means of selecting the single or dual processor mode of operation in the UNIVAC 494 System from a remote location.

The remote selection box contains three selection keys that allow the operator to select single or dual processor operation mode of up to three UNIVAC 494 CPUs. These keys will provide the same physical selection on the mode select switch on the UNIVAC 494 maintenance panel.

The keys are numbered 0, 1, and 2 to indicate the processor and DSC relationship. To enable common storage, the keys of the respective processors are turned to the ON position, and to disable common storage, these keys are turned to the OFF position.

Each dual processing system includes a remote selection box. The single/dual processor selection is made via the remote box. The redundant switch on the UNIVAC 494 maintenance panel is disconnected within the DSC through a patch card. This patch card provides a method to disconnect the remote box and utilize the local switches if so desired.

4. OPERATING SYSTEM START-UP AND MAINTENANCE PROCEDURES

4.1. BOOTSTRAP PROCEDURE

The bootstrap procedure is used to load the executive routine from storage on tape or drum into primary storage. Until the executive is loaded into primary storage, no worker program can operate. The bootstrap procedure can be performed from the operator's console or from the central processor unit (CPU) maintenance panel. The bootstrap procedure is followed when the system is turned on initially; when faulty operation of a main storage bank is indicated, the bootstrap procedure may have to be performed under direction of a Sperry Univac field engineer. Usually, the bootstrap procedure need not be performed after a power failure or turn-off procedure because both primary storage and mass storage are nonvolatile, and a snapshot dump is provided of volatile registers when a power failure occurs. The bootstrap procedure must be performed after a 170 dump (4.3); however, this is normally executed automatically by the system (4.4). The policy of the installation determines whether the execution routine is loaded from tape storage or drum storage.

4.1.1. Tape Bootstrap Procedure at Operator's Console

To load the executive routine from tape storage at the operator's console, proceed as follows:

1. Mount the bootstrap tape on a tape unit. (The manual describing the tape unit in use contains instructions for mounting the tape.) Make sure that the patch card on the control and indicator panel of the subsystem control unit is connected from PROGRAM 0 to the physical number of the tape unit being used.

2. At the maintenance panel, set the INITIAL LOAD CHANNEL toggle switches (3.3.5) to the value of the I/O channel connected to the tape subsystem, and ensure that the OPTION MODE toggle switch is set to 494.

3. At the operator's console, press the STOP button in the SYSTEM CONTROLS section (3.1.3). If the CPU does not stop, press the T0 LO switch/indicator at the maintenance panel MAIN CONTROL section (3.3.2), and set the CONTROLS REGISTER selector to BREAKPOINT RIR.

4. Press the STOP switch at the operator's console. Press in sequence the SUBSYSTEM CLR, CMPTR CLR, and INITL LD switches.

5. Select JUMP keys can now be set. Key 1 causes a software check on the presence of all mass storage devices. Key 3 causes the MFD on all mass storage devices to be destroyed and reinitialized.

6. Press the START switch.

If the executive routine is not loaded into primary storage, check for an unrecoverable tape error. If a tape error has occurred, try the bootstrap procedure from a different tape unit or from a subsystem on a different channel. To check for a tape error, set the selector at the top right-hand side of the maintenance panel to ACK CTR IN ACT. If the tape channel indicator (in the INPUT/OUTPUT section of the maintenance panel) remains lit (does not turn off and on) after an attempt to bootstrap the executive routine, there is a tape error.

If, after completion of the bootstrap procedure, no error message appears at the console and the CPU does not run, there may be an error in the first block of tape. This error causes a 4 stop, and a new tape must be used. If the computer does not run after completion of the bootstrap routine, and there is no indication of an error, follow the procedure for clearing primary storage at the maintenance panel (4.2), and perform the bootstrap procedure again.

When the executive system is loaded and is ready to initialize itself, and when key 3 has been set at boot time, the confirmation message:

*1 : THIS TAPE BOOT WILL DESTROY PREVIOUS MFD

appears on the console.

If 1□N Ⓢ is typed in reply, key 3 is ignored, and the MFD is recovered, not initialized. If 1 Ⓢ is typed in reply, systems initialization destroys the previous MFD and initializes a new one.

When the executive routine is initialized, and the system is ready for operation, the following message requesting the date appears at the console: *1:YYDDD. At this point, the system will accept error corrections. If Ⓢ is typed in reply, the corrections are submitted through the system standard card reading unit. By typing in the P-name of a peripheral device, the user specifies a different device for input of corrections. After the corrections are made, the date request message *1:YYDDD appears again at the console. The user now types in the date message 1Δyyddd, where yy represents the year and ddd represents the Julian day of the year.

Care must be exercised to ensure that the correct date is typed in because it is stored and used in the creation and updating of records and in future bootstraps from drum. At midnight, the new date is automatically written to the drum.

If an ERRATA deck is to be submitted to the system at bootstrap time, the operator should have the cards ready in the primary input card reader and reply 1ΔCIN8 to the date request. The cards will be read, the system changes will be effected, and the date message will reappear and can be replied to normally.

After the date is typed in, the executive routine responds with the message *n,nΔREADY*, and the computer is ready to run. n,n is the release and update level of the executive routine bootstrapped; for example, OMEGA-release 6 having update C would be displayed as *6.0CΔREADY*. Type in UR Ⓢ to start the first input stream from the card reader.

4.1.2. Tape Bootstrap at Maintenance Panel

To load the executive routine at the maintenance panel from tape to primary storage and drum storage, proceed as follows:

1. Press the STOP control (OPERATOR CONTROLS section) to halt computer operations. If the computer does not stop, press the T0 LO control (MAIN CONTROL section), set the CONTROLS REGISTER selector to BREAKPOINT RIR, and press the STOP control again.

2. Mount the executive routine tape on tape unit 0 of the appropriate magnetic tape subsystem.

3. Set the INITIAL LOAD CHANNEL toggle switches to the octal number of the channel being used to load the executive routine from the tape.

4. Set the OPTION MODE toggle switch to 494.

5. Press the MASTER CLEAR control (in the OPERATOR CONTROLS section).

6. Press the I/O CLEAR control (OPERATOR CONTROLS section, CONTROLS set).

7. Set SELECT JUMPS 1 or 2 (OPERATOR CONTROLS section, SELECT JUMPS set) if loading of an executive routine errata deck is required. Load the errata deck at the primary input in accordance with procedures described for the appropriate peripheral device.

8. Press the INITIAL LOAD CONTROL (OPERATOR CONTROLS section, CONTROL set).

9. Press the START control (OPERATOR CONTROLS section, CONTROLS set).

The system should now have accepted the executive routine, and the message *1:YYDDD will be printed at the console to indicate successful loading.

10. Key in the message □yyddd Ⓢ, where yyddd represents year and day of year.

The system then causes *READY* to be printed at the console, indicating that the system is ready for worker programs.

11. Key in UR Ⓢ to start the first input stream from the card reader.

4.1.3. Channel Removal at Tape Bootstrap Time

Mass storage channels may be removed at tape bootstrap time by setting the channel numbers in master bit form in the A0 register (ARITHMETIC & OUTPUT BUFFER section). Thus, if channels 5 and 12 are to be removed, bits 5 and 12 should be set.

The following message appears prior to the 1*YYDDD message detailing the channels which have been removed:

CH nn MARKED REMOVED.

4.1.4. Drum Bootstrap Procedure

The drum-stored bootstrap routine allows fast reestablishment of the executive routine and conserves the system library, the master file directory, and other drum-stored system elements. Unlike the tape bootstrap procedures, no date request message *1:yyddd appears at the console; the current value of the data typed in at tape bootstrap time is the value used for the date. Any errata read in at tape bootstrap time will be in effect after a drum bootstrap.

To perform the drum bootstrap routine, proceed as follows:

1. At the upper left corner of the maintenance panel, set the INITIAL LOAD CHANNEL toggle switches to the octal number of the channel being used to load the executive routine from drum storage.

   NOTE:

   The controls indicated in steps 2, 3, 4, and 5 are all located in the OPERATOR CONTROLS section of the maintenance panel and on the operator console.

2. Press the MASTER CLEAR control.

3. Press the I/O CLEAR control.

4. Press the INITIAL LOAD control.

5. Press the START control.

The system now causes the *READY* message to appear at the console.

6. At the console, key in UR Ⓢ to start the first input stream.

4.1.5. Changing Drum Bootstrap Channels

In the event of a drum fault, it may be necessary to load the executive routine into a different drum at bootstrap time, requiring use of a different channel. To change channels, proceed as follows at the maintenance panel:

1. Press the STOP control.

2. Press the MASTER CLEAR control.

3. Set the octal value of the drum channel required in bits 0→5 of the Q0 register in the ARITHMETIC & OUTPUT BUFFER section.

4. Set bits 3 through 7 to the value designating the new channel.

The tape bootstrap procedure can now be performed (4.1.2).

4.2. BOOTSTRAP PROCEDURE ON DUAL-PROCESSOR

The dual processor system consists of two UNIVAC 494 central processors linked to one another by synchronous interrupt lines, with their respective main storage areas accessed and linked through two dual storage controllers (DSCs). They are both linked to common peripherals by the use of shared peripheral interfaces (SPIs) and may or may not have private peripherals available to only one machine. In some systems, a third backup processor may be present, linked into the main system by the interrupt lines and a DSC. The third processor is normally run in an offline unit processor mode. The procedure for bootstrapping this full system from tape is:

1. Stop all machines.

2. Set the DSCs for both machines in the online system to dual mode. This is done at the DSC remote control box if one is provided. If it is not provided, the MULTI PROCESSOR option mode switches on each of the maintenance panels must be used.

3. Set the INITIAL LOAD CHANNEL on the processor which is to perform the tape bootstrap to the value of the I/O channel connected to the tape subsystem. (This processor is normally, but not necessarily, the processor designated as DP1.)

4. Set the INITIAL LOAD CHANNEL switches for the other processors to the value of the I/O channel connected to the system drum.

5. SELECT JUMP keys 1 and 3 are available for setting on each of the processors. Key 3 is set if the master (tape booting) processor causes all existing mass storage files to be discarded and reinitialized. Key 3 is set if either of the slave (drum booting) processors only reinitializes the files on the private subsystems available to that processor.

6. If any channels are to be removed from the system, the Q register of the processor to be tape booted should be set as described in paragraph 4.1.3.

7. Press the START control of the processor being tape booted.

If the executive routine is not loaded into primary storage, check for an unrecoverable tape error. If a tape error has occurred, try the bootstrap procedure from a different tape unit or from a subsystem on a different channel, or try booting to the other processor of the online system. To check for a tape error, set the selector at the top right side of the maintenance panel to ACK CTR IN ACT. If the tape channel indicator (in the INPUT/OUTPUT section of the maintenance panel) remains lit (does not turn off and on) after an attempt to bootstrap the executive routine, there is a tape error.

If, after completion of the bootstrap procedure, no error message appears at the console, and the CPU does not run, there may be an error in the first block of tape. This error causes a 4 stop, and a new tape must be used. If the computer does not run after completion of the bootstrap routine, and if there is no indication of an error, follow the procedure for clearing primary storage at the maintenance panel (paragraph 4.3) and perform the bootstrap procedure again.

When the system is loaded and ready to initialize itself, the following message appears on the console:

*1 : THIS BOOT IS ON PROCESSOR DP1

If this is correct, the replies 1 Ⓢ , 1□Y Ⓢ, or 1□DP1 Ⓢ should be made.

If the tape bootstrap is performed on the processor designated as DP2, the reply 1□DP2 Ⓢ must be made.

If key 3 has been set, the confirmation following message appears:

*1 : THIS TAPE BOOT WILL DESTROY PREVIOUS MFD

The procedure outlined in section 4.1.1 should be followed from this point, with the exception that before the READY message appears, the following message is transmitted:

*1 : NO IPI RESPONSE. OK???

Reply 1 Ⓢ (or 1□Y Ⓢ) must be made.

The READY message then appears:

X.XX READY ON DP1

The master processor is now ready to accept the first job. The second online machine can now be drum booted.

Press the START control.

If key 3 has been set, the following message appears:

*1 : THIS DRUM BOOT WILL DESTROY PREVIOUS MFD.

This should be answered as for the master processor.

The system now transmits the message:

X.XX READY ON DP2

The whole online system is now ready for use.

If the third processor is to be used in unit processor mode from the same system drum, the same procedure should be followed as for the second online processor.

The system displays the following message when it is ready for use:

X.XX READY ON UP

4.2.1. Console Messages at Tape Bootstrap

If the DSC switches have been set correctly the initial messages of a DP bootstrap are as detailed in the previous section.

If, however, the switches have not been set correctly, the initial messages are outlined as follows.

There are two cases to consider:

1. The DSC is turned OFF when a dual processor is being booted.

2. The DSC is turned ON when a unit processor is being booted.

In case 1, the following message appears:

*1 : THIS BOOT IS ON PROCESSOR UP

1□DP1Ⓢ (1□DP2Ⓢ)

ENABLE DUAL STORAGE CONTROLLER

The DSC should now be set, and the following message is typed in:

1□YⓈ

(A reply of 1□NⓈ causes the bootstrap to abort and the processor is 4 stopped.)

The following message appears:

1 : THIS BOOT IS ON PROCESSOR DP1

Continue on to paragraph 4.3.

In case 2, the following message appears:

*1 : THIS BOOT IS ON PROCESSOR DP1

1□UPⓈ

*1: DISABLE DUAL STORAGE CONTROLLER

The DSC should be turned off, and the 1□YⓈ reply should be made.

The following message appears:

1: THIS BOOT IS ON PROCESSOR UP

4.3. CLEARING PRIMARY STORAGE

This procedure is used if the bootstrap procedure described in 4.1.1 and 4.1.2 has not been performed successfully, and none of the error conditions described in 4.1.1 has occurred. After this procedure, the bootstrap procedure is followed again.

To clear main storage at the maintenance panel:

1. Press the STOP control (OPERATOR CONTROLS, CONTROLS set). (It may be necessary to press the T0 LO control of the MAIN CONTROL section as described in step 1 of the bootstrap procedure; see 4.1.3.)

2. Press in sequence the MASTER CLEAR and I/O CLEAR controls.

3. Set 14_8 (Store Q) in the function code portion of the F register (MAIN CONTROL section, F set, buttons 27 and 26 of the F0 row).

4. Set the k portion of the instruction to 3 (buttons 19 and 18) and the b portion to 4 or higher (button 17 and (optionally) buttons 16 and/or 15) for the 18-bit B register mode.

5. Press the F2J 0 control (MAIN CONTROL section, INTERNAL FUNCTION 1 set); the control lights to indicate that the switch is set.

6. Set the repeat 2 switch. (Press the 2 indicator/control, in the REPEAT set of the MAIN CONTROL section; the indicator/control lights to indicate that the switch has been set.)

7. Set the clock rate to normal. (Press the NORM. control/indicator, in the CLOCK RATE set of the OPERATOR CONTROLS section; the indicator/control lights to indicate a normal clock rate.)

8. Disable the READ NEXT INSTR. switch.

9. Press the START control.

10. Press the STOP control.

11. Enable the READ NEXT INSTR. switch by pressing the READ NEXT INSTR. control so that the light is extinguished.

After step 11, main storage has been cleared, and the bootstrap procedure can be started again.

4.4. 170 DUMP PROCEDURE

The 170 dump procedure may dump the entire contents of primary storage or the contents of a specified range in primary storage to a high speed printer (or to a UNIVAC 1004 printer if the high speed printer is not available). The same facilities are available for a primary storage dump to magnetic tape. The procedure to be followed is determined by the policy of the computer center. After each dump, OMEGA must be bootstrapped into the system.

4.4.1. Unlimited/Limited Primary Storage to Magnetic Tape Dump

To perform a primary storage to magnetic tape dump:

1. Press the STOP control.

2. Press the MASTER CLEAR control.

   NOTE:

   For partial dumps: Set the starting absolute primary storage address in the rightmost portion of the A register and the dump-ending address in the rightmost portion of the Q register. (These control/indicators are located in the A0 and Q0 set of the MAIN CONTROLS section. A lighted indicator signifies a 1 bit; an unlighted indicator, a 0 bit.)

3. Set the P register to 170_8.

4. Set SELECT JUMP 2.

5. Press the START control.

The main storage contents are dumped automatically on logical unit 13 (octal 15). A 4-Stop condition indicates interlock status for the tape unit.

4.4.2. 170 Dump to High Speed Printers

To obtain a 170 dump on the UNIVAC Type 0751, 0755, or 0758 High Speed Printer, the following procedure is used at the UNIVAC 494 maintenance panel:

1. Press the STOP control.

2. Press the MASTER CLEAR control.

   NOTE:

   For partial (limited) dump, set the A and Q registers as described in NOTE of 4.4.1.

3. Set the P register to 170_8 (in the PROGRAM ADDRESS COUNTER set of the OPERATOR CONTROLS section).

4. Press the START control.

The CPU will now dump the main storage contents to the printer.

4.4.3. 170 Dump to UNIVAC 1004 Printer

This procedure is to be followed only if no high speed printer is available. For a 170 dump, proceed as follows:

1. Press the STOP control. (It may also be necessary to use the T0 LO control as described in step 3 of 4.1.1).

2. Press the MASTER CLEAR control.

   NOTE:

   For a partial dump: set the dump-start address in the A register and the dump-ending address in the Q register, as described in the NOTE of 4.4.1.

3. Set the P register to 170_8.

4. Press the SELECT JUMPS 1 indicator/control so that the indicator is lit (in the SELECT JUMPS set in the OPERATOR CONTROLS section).

5. Press the START control.

The dump is now performed. However, in some cases, it may be necessary to change channels for this dump. In such cases, perform the following procedure after step 4 of the preceding procedure:

6. Press the SELECT STOPS 7 indicator/control so that it is lit. (In the SELECT STOPS set of the OPERATOR CONTROLS section.)

7. Press the START control.

8. When the STOPS 7 indicator is lit, clear the CSR (press the CLR control in the lowest center set of 25 indicator/controls of the INPUT/OUTPUT section).

9. Set the required channel control/indicator of the CSR.

10. Clear the SELECT STOPS 7 control/indicator (press the CLR control immediately under the SELECT STOPS 7 control).

11. Press the START control.

4.5. PROGRAMMED SYSTEM RESTART (PSR)

The PSR mechanism provides for dumping the contents of main storage to tape or FASTRAND mass storage and then automatically restarting the system. The dump is then printed by a program running as a normal job under the recovered system, thus enabling normal operation to be resumed as quickly as possible.

The PSR mechanism may, at the user's discretion, replace the 170 panic dump mechanism.

4.5.1. Sequence of Events

A PSR can occur automatically or can be initiated by the operator. After a PSR has occurred, operator action is the same for both contingencies.

In the event of a dump, console hardcopy should always be returned.

4.5.1.1. Manual 170 DUMP

Step	Action
1.	STOP MACHINE.
2.	TAKE NOTE OF REGISTERS.
3.	MASTER CLEAR.
4.	SUBSYSTEM CLEAR
5.	SET P = 170
6.	START.

The following message will then be displayed:

PSR hh:mm:ss OPER INITIATED

where:

hh:mm:ss
Is the edited day clock time captured upon entrance to PSR.

OPER INITIATED
Indicates that entrance to PSR was initiated manually by the operator.

4.5.1.2. Automatic PSR

PSR hh:mm:ss jjj T/A fffff ppppp

where:

hh:mm:ss
Is the edited day clock time captured upon entrance to PSR.

jjj
Is the number of the job in control.

T/A
Where T indicates the task in control has an RIR equal to the base of the task and A indicates the RIR was not equal to the task base.

fffff
Is the last EXRN function.

ppppp
Is relative P.

4.5.1.3. Tape Dump

If no FASTRAND files are available to take the dumped main storage image or if KEY2 is set, the system will request a tape unit via the following console message:

TAPE DUMP? cc/uu

to which the operator must respond with the channel/unit number of a tape unit containing the tape to which he wants the core image dumped. This tape can be subsequently printed via the UR PT routine.

If the request is not satisfied it will be repeated and subsequently will be timed-out resulting in an automatic system restart as in the following example:

PSR hh:mm:ss 000 T 00000 03423

TAPE DUMP? cc/uu

TAPE DUMP? cc/uu

SYSTEM RESTARTED hh:mm:ss FROM CNN
CORE IMAGE NOT DUMPED

6.0K READY

4.5.2. Automatic Restart

After the dump has been executed, whether to FASTRAND mass storage or tape, the system will restart itself, displaying the following information:

SYSTEM RESTARTED hh:mm:ss FROM C nn

CORE IMAGE ON USER 00001 FILE 00010

6.0K READY

nn equals the channel number from which the system re-booted itself.

USER 00001 FILE 00010 represents the MFD file on FASTRAND mass storage containing the dump. Files 1/10 and 1/11 are used by the unit processor and by DP1 in a dual processor system. DP2 uses files 1/22 and 1/23.

If the dump has been taken to tape, the second line of this message would be replaced by the following:

CORE IMAGE ON cc/uu 5/3

5/3 represents the tape unit containing the dump tape.

If for some reason (e.g., the drum image of the EXEC has been corrupted) the system cannot automatically be re-booted, the following message will appear:

BOOT FROM TAPE!

Under these circumstances, the operator must execute a tape boot before continuing.

4.5.3. Printing a Dump

After the system has been restarted, the dump must be printed. This activity can be time-shared with any other work currently executing.

If the dump was taken to tape, the tape can be printed via the UR PT routine as described in section 5.2. (A tape dump cannot be analyzed via program ANDMP.)

If the dump was taken to FASTRAND mass storage, a canned job stream, resident on the system library, must be activated to print and analyze the dump. To effect this, the operator must type in:

ST PD Ⓢ

This activates the following job stream:

#JOB F PRINT/FAST,00000,c,c,c/c

#ASG PRINT,A

#GO ANDMP,SYS

#END

#DUMP LOCE,77777,0,2

#GO PRPDA,SYS

#END

#DUMP LOCE,77777,0,2

#FIN

This job stream executes two programs from the system library:

ANDMP – Analyze dump

PRPDA – Print dump

Both produce console messages.

4.5.3.1. Console Messages From Job PD

02:PRINT/FAST 09:34:51

02:A 2/2

02: ENTER NUMBER OF FILE TO BE PRINTED

*1 : 02 : ANS : N, 1/10, 1/11, OR
STOPCODE (FOR BOTH).

This is asking if the dumps on files 10 and/or 11 are required to be printed.

[DP2 will use 1/22 and 1/23]

Answer N for neither, 10 or 11 (22 or 23) if one file is required; any other response is assumed to be a request for both.

10, 11 (22, 23) are the dump file numbers and match up with the file number on PSR output as in:

PSR 06:09:25 OPER INITIATED

SYSTEM RESTARTED 06:09:19 FROM C14

CORE IMAGE ON USER 00001 FILE 00010

Typical replies:

1 N ⓢ

1 10 ⓢ

1 11 ⓢ

1 BOTH ⓢ

If the response is N, the program and job will close out, making the file(s) available for use once more.

Other replies will result in the dump(s) being printed or the message:

NO DUMP. PRINT FILE? ANS Y OR N

This message has been displayed because there is no dump on the FASTRAND file, or the dump that is there has been printed before.

An answer of Y will cause any information that is present to be printed. An answer of N will cause PRPDA to close out.

While the dump is being printed, the routine will accept an unsolicited typein which gives the operator the ability to print selected areas of main storage. The format of the typein is as follows:

JxΔSKIPΔyyyyyy Ⓢ

x is the job number of the print task.

yyyyyy is the main storage address at which it is desired that printing be resumed. Upon receipt of this typein, PRPDA will suspend printing of the dump and resume at the address stated.

If it is desired to abort the printing of the remainder of a dump file, the operator can type in:

JxΔSTOP Ⓢ

This causes the printing to stop.

02: SHALL I ANALYZE THE DUMP (S)?

*1 : 02: ANS: N,10,11, OR BOTH

[on DP2 – *1: 02: ANS: N,22,23, OR BOTH]

This is asking if a dump analysis is required. (Because a dump analysis is so useful, it should be taken wherever possible).

1 N Ⓢ

1 1/10 Ⓢ

1 1/22 Ⓢ

1 1/11 Ⓢ

1 1/23 Ⓢ

1 Ⓢ

Program ANDMP is now initialized. When it has finished the message

02: STOP

is displayed on the console.

4.5.3.2. Exit

Upon the termination of ANDMP, the FASTRAND files in question are made available for further dumps and marked as empty. The job then closes in the normal fashion.

4.6. LOGGING AND ACCOUNTING

Logging is a means of directing informative statements, about an operating environment to a central record. Under OMEGA, the log file may be maintained on any mass storage device, or magnetic tape, although FASTRAND mass storage is recommended. All statements are entered into a common output file, while those of interest to the operator are also directed to the EXEC primary output stream and/or the console. The file created from the logging over a period of time is then processed by the accounting routine which summarizes the information into various reports for use in determining maintenance requirements, scheduling conflicts, and billing charges.

The information logged by OMEGA consists of error reporting and job accounting. Most aspects of the logging mechanism are optional and may be selected or inhibited automatically at bootstrap time, or through a console typein.

4.6.1. Operator Control of Logging and Accounting

- Console Typeins

  All console typeins related to logging and accounting must conform to the following format:

  LG □ command 1 □ command 2 □ ... □ command n Ⓢ

  The command may be listed in any order and as many as ten commands may be included in one typein. The following list gives a brief description of each of the possible commands.

  PS

  Processes the logging statements that have accumulated in the EXEC secondary output chain. Each full cooperative module will be processed and written onto file L. This call will be activated by OMEGA without operator command under certain conditions.

  PP

  Processes the logging statements that have accumulated in the EXEC primary output chain. The EXEC primary output chain (except for the final partial module) is added to the end of logtask's primary output chain, and is listed as part of its primary output.

  SE

  Performs PS and then indicates, by a console typeout, on which channels unrecoverable I/O errors have occurred.

  RE

  Resets the indicators used to produce the typeout for SE. (The SE command is automatically processed before the RE command).

  E

  Performs PS and then lists, on the printer, a summary of the I/O errors that have been detected.

  L

  Assigns but does not initialize the logging files J, K, L, and Q.

T

Initializes the logging files J, K, L, and Q.

TT

Performs PS, writes two end-of-file blocks of file L, and sets a flag to cause the cooperative to cease saving logging data.

TL

Releases logging files J, K, L, and Q and sets a flag to cause the cooperative to cease saving logging data.

J

Causes job accounting to occur on all jobs.

TJ

Inhibits automatic job accounting. In this case, only jobs which have requested accounting will be accounted.

A

Performs PS then runs the accounting routine.

R

Performs PS, writes two end-of-file blocks on file L, assigns a new file L, and releases old file L.

The following two commands should only be input if user statistics routines are in the system.

S

Activates system statistics.

TS

Terminates system statistics.

Initially the system will be in the following state:

1. The logging files J, K, L, and Q will be assigned and initialized.

2. Automatic accounting will be in effect.

- Illegal Typeins

If any of the following pairs of commands are entered at the same time the message LOGGING COMMAND CONFLICT will be output to the console:

T and TT

J and TJ

L and TL

Any combination of commands which cause the conflict message to be printed will be ignored.

Any command which is not in the following list causes the message ILLEGAL COMMAND to be output to the console: PS, PP, SE, RE, E, L, T, TT, TL, J, TJ, A, R, S, TS. The illegal command is ignored.

- Normal Mode of Operation

  The command LG□A Ⓢ should be entered, at least, every 300_8 jobs.

4.7. PREPPING OF DISC PACKS

Before information can be stored on discs, the surface has to be prepared or prepped. This involves writing a home address, a track descriptor record, and the appropriate number of dummy records on each track. Each dummy record consists of a count area and a blank data area. Then, when data is stored, only the data need be written to the data area of the record.

If each area of the disc was prepped every time it was assigned, it would often involve prepping the area to the same format; for example, the system files are continually expanded and contracted, which involves a large amount of redundant prepping. To avoid this overhead, the pack can be prepped before use. Then, at assign time, no preparation of the surface is required.

4.7.1. Operator Control of Prepping

The facility update typein, enter and prep (E/P) (5.2), is used to prepare a virgin pack or to reformat an existing pack.

The enter and initialize (E/I) typein parallels its function for drum subsystems. That is, it clears the pack of unwanted information and sets it available for reassignment. It leaves the pack in the same prepped format. Hence, as for the enter and recover (E/R) typein, it can only be performed on OMEGA format pack; that is, packs that have previously been prepped by the enter and prep typein.

The pack ID message displayed on the console when a pack reaches operational speed also contains the record size to which the pack has been prepped.

4.7.2. Operational Notes

Indiscriminate use of the E/P typein should be avoided. It involves a large amount of I/O to the disc; for example, 7 1/2 minutes for an 8414, and 15 minutes for an 8424.

It is recommended that packs be labeled and prepped once by the E/P typein and then kept in that condition. The E/I typein can then be used each time the pack must be cleared. This procedure leaves the pack in the same prepped format, hence eliminating the I/O time necessary for reprepping that pack.

5. CONSOLE MESSAGES

5.1. GENERAL

This section describes the messages appearing at the operator's console and the operator's actions in response to the messages specified, if any. Console messages may be divided into two broad classifications: unsolicited input messages, which are sent by the operator to the operating system, and system output messages, which are sent to the computer operator by the operating system. The system output messages may require a typein response from the operator, in which case the output message is preceded by an asterisk (*). The significance of other symbols and characters used in defining message formats is as follows:

Symbol	Meaning
z	Represents the response number assigned to the message.
f	Represents the function.
x	Represents numeric characters indicating the job number, unless otherwise specified.
c	Represents a decimal channel number.
u	Represents a decimal unit number.
Δ	Represents a blank space.
□	Is a separator.
:	Is a separator.
Ⓢ	Is the stop character.

The use of the console keyboard is described in 3.1.

5.2. UNSOLICITED INPUT MESSAGES TO THE OPERATING SYSTEM

Unsolicited keyboard input may be directed to the operating system by the computer operator. For recognition by the system, the input messages have a fixed format and a fixed content. The general form of this class of message is:

nnΔtext Ⓢ

where:

nn is a 2-character alphabetic code defining the primary function to be performed by the operating system.

The text portion of the message, when required, further defines the operation to be performed when more than one option exists under the specified primary function. If the function nn cannot be recognized by the system, or if the format and/or content of the text is incorrect, the word ERROR is displayed on the console and the input message is rejected.

The unsolicited messages recognized by the operating system are detailed here with a description of the action taken by the system in response to the input message.

- Load Unit Record Routine

  This message instructs the operating system to load and start the unit routine defined by name/version.

  Message format:

  URΔname/version Ⓢ

  The indicated routine must be contained in the systems library. Name/version may be omitted when the standard unit record routine, which is determined at systems generation time, is desired. In this case, the input message may be abbreviated to UR Ⓢ.

- Print Tape Routine

  The print tape routine is used to print tapes which have been written in XS–3 format by either the URTAPEOUT routine or the 170 dump routine. The print tape routine is initiated by the following unsolicited keyin:

  Message format:

  URΔPT Ⓢ

  The operating system responds with the mount tape message:

  *z:ΔΔΔ□x:MTΔLIST Ⓢ

  After the tape is mounted, the operator answers with either

  z Ⓢ or

  MTΔc/uΔLIST Ⓢ

  (The mount tape (MT) message is described in 5.4.2) and then

  z Ⓢ or

  zΔc/u Ⓢ

  The operating system responds:

  *z:ΔΔΔ□x:ENTERΔI.D.

The operator answers with one of the following keyins:

Message Format	Meaning
JXΔPASS Ⓢ	Skip to next EOF.
JΔABCDE Ⓢ	Any 5-character identifier can be input. This will be output as a heading on subsequent printout.
ZΔN Ⓢ	This will terminate the routine.
Z Ⓢ	Start printing, without a heading.
JXΔSTOP Ⓢ	This can be input at any point during the tape print, and will terminate the routine, leaving the tape at the end of the last tape block that was printed. (This routine cannot be terminated with the TR typeins).

Before printing is initiated, the following message is output:

*Z:ΔΔΔX:REWIND?

The responses to this message are:

Z Ⓢ — Rewind tape to load point and start printing

ZΔY Ⓢ — (as above)

ZΔN Ⓢ — Start printing the tape from its current position.

At the end of each tape file the following message is output:

*Z:ΔΔΔX:MORE?

Possible responses to this message are:

Z Ⓢ — Print next file.

ZΔY Ⓢ — (as above)

ZΔN Ⓢ — Terminate the routine.

Below is an example of the series of messages employed to print the first and second files encountered, skip the third and fourth files, print the fifth file, and exit.

URΔPT Ⓢ

*zΔΔΔ□x:MTΔLIST

zΔc/u Ⓢ

*z:ΔΔΔ□x:ENTERΔI.D.

zΔDUMP4 Ⓢ

*z:ΔΔΔ□x:REWIND?

z Ⓢ

*z:ΔΔΔ□x:MORE?

z Ⓢ

*z:ΔΔΔ□x:MORE?

JxΔPASS Ⓢ

*z:ΔΔΔ□x:MORE?

JxΔPASS Ⓢ

*z:ΔΔΔ□x:MORE?

z Ⓢ

*z:ΔΔΔ□x:MORE?

zΔN Ⓢ

- Unit Record Routine for Magnetic Tape in Fieldata Format

  The Fieldata magnetic tape unit record routine is used to read information in Fieldata format from magnetic tape to be used as primary input. The operator initiates the routine by the following keyin:

  Message format:

  URΔTA PEFD Ⓢ

- Unit Record Routine for Magnetic Tape in XS–3 Format

  The XS–3 magnetic tape unit record routine is used to read information in XS–3 format from magnetic tape to be used as primary input. The operator initiates the routine by the following keyin:

  Message format:

  URΔTAPE Ⓢ

- Unit Record Routine for Paper Tape

  The paper tape unit record routine is used to read data from paper tape to be used as primary input. The operator initiates the routine by the following keyin:

  Message format:

  URΔPTIN Ⓢ

- Enter Systems Log (not currently available)

  The enter systems log message instructs the operating system to enter the text portion of the message into the systems log.

  Message format:

  SLΔtext Ⓢ

- Facility Update

  The facility update message is used by the operator to cause the operating system to change the status of registered peripheral devices. The status of an entire subsystem, a unit of a subsystem, half of a dual-channel subsystem (such as FASTRAND/Fastband), or a channel path can be altered.

  Message format for altering status of an entire subsystem:

  FUΔccΔf Ⓢ

  where:

  cc
  Represents the decimal channel number of the system.

  f
  Represents the value of the function, which may be as follows:.

  U
  Mark the subsystem up and available for assignment.

  D
  Mark the subsystem down and unavailable for assignment.

  R
  Remove the subsystem from the pool of available facilities.

  E
  Enter the subsystem into the pool of available facilities.

  I
  Inspect the subsystem; submit reply prefaced by channel and unit number (c/u), indicating subsystem as UP, DOWN, or REMOVED.

  E/I
  Enter the mass storage subsystem into the pool of available facilities and initialize the master file directory for that subsystem (not applicable to discs).

  E/R
  Enter the mass storage subsystem into the pool of available facilities, and recover the master file directory for that subsystem (not applicable to discs).

Message format for altering status of unit on subsystem:

FUΔcc/uuΔf Ⓢ

where:

cc
Represents the decimal channel number.

uu
Represents the decimal unit number.

f
Represents the function, which may be as follows:

U
Mark the unit on the subsystem up and available for assignment.

D
Mark the unit on the subsystem down and unavailable for assignment.

R
Remove the unit on the subsystem from the pool of available facilities.

E
Enter the unit on the subsystem into the pool of available facilities.

I
Inspect the unit on the subsystem for these conditions and submit the appropriate message prefaced by the channel and unit number. Indicate the unit as UP, DOWN, REMOVED, MTD, ASSIGNED, or AVAILABLE.

E/I
Enter the mass storage unit on the subsystem into the pool of available facilities and initialize the master file directory tables for that unit (disc units only).

E/R
Enter the mass storage unit on the subsystem into the pool of available resources, and recover the master file directory tables contained on that unit (disc units only).

Message format for altering status of half of a dual-channel subsystem:

FUΔca/uΔf Ⓢ or

FUΔcb/uΔf Ⓢ

where:

ca
Represents the channel number of the first logical subsystem to be assigned (FASTRAND).

cb
Represents the channel number of the second logical subsystem to be assigned (Fastband).

f

Represents the function, which may be one of the following:

U

Mark the subsystem up and available for assignment.

D

Mark the subsystem down and unavailable for assignment.

R

Remove the subsystem from the pool of available facilities.

E

Enter the subsystem into the pool of available facilities.

I

Inspect the subsystem; submit reply prefaced by channel and unit number (c/u), indicating subsystem as UP, DOWN, or REMOVED.

Message format for altering status of a channel path:

FUΔCccΔf Ⓢ

where:

c

Represents the channel number.

f

Represents the function, which may be one of the following:

U

Mark the channel path up and available for use.

D

Mark the channel path down and unavailable for use.

I

Inspect the availability of the channel; submit reply prefaced by channel number, indicating status of channel as UP or DOWN.

- Suspension or Resumption of Printer Unit Record Routine

The following messages direct the operating system to suspend or resume the printer unit record routine.

The message format is:

FRΔxΔfⓈ

where:

f

May be:

PS

Suspend the printer unit record routine indicated by the job number x.

PR

Resume the printer unit record routine that has been previously suspended.

After the printer unit record routine is suspended, the following message is displayed at the console, and the printer is released:

ΔΔX:POΔSPDΔATΔhh:mm:ss

When the printer unit record routine is resumed, the following message is displayed at the console:

ΔΔ0:POΔRSMΔATΔhh:mm:ss

If a suspension or resumption message is ignored by the system, a message is displayed at the console explaining why the directive was ignored. The error messages and the meaning of each follow:

ΔΔ0:JOBΔNUMΔERR

Invalid job number.

ΔΔ0:O/PΔINΔTERM

The printer unit record routine specified is in the process of termination.

ΔΔ0:SPECIALΔOP

The printer unit record routine specified is not a standard one.

ΔΔ0:FUNCTIONΔERR

Function specified is other than PS or PR.

ΔΔ0:O/P NOT ACTIVE

The printer unit record routine has not been activated.

ΔΔ0:O/P NOT SPD

The printer unit record routine has not been suspended; therefore, the resume typein is invalid.

- *Magnetic Tape Availability*

The magnetic tape availability message indicates to the operating system that the magnetic tape with the file identifier xx...x has been mounted on the specified c/u.

Message format:

MTΔc/uΔxx...x Ⓢ

With this message, the operator informs the system that a certain file has been mounted. When the file is required, the specified unit is assigned. The file identifier entered by the operator may be the word BLANK or SCRATCH. In this case, the type indicated is registered with the system and is assigned when the need arises.

If the unit specified in the message is not available, one of the following typeouts occur:

UNIT X UNAVAILABLE

UNIT NUM ERROR

- Magnetic Tape Release

The magnetic tape release (demount) input message is the complement of the magnetic tape availability message. In response to the magnetic tape release message from the operator, the operating system releases units on the subsystem which were previously dedicated to specific files. The message may specify either a particular unit on a subsystem or all dedicated units on a subsystem.

Message format to release a unit on a channel:

DTΔxx/yy Ⓢ

where:

xx
Represents the channel number of the subsystem.

yy
Represents the logical unit designation.

Message format to release all dedicated units on a channel:

DTΔxx Ⓢ

- Terminate

This message instructs the operating system to terminate an operational task.

Message format for task or job termination:

TRΔxΔf Ⓢ

The task identified by the job number x is terminated in accordance with the function f, which may be specified as follows:

T
Terminates task. The present task is to be terminated and the next task of the job is to be initiated.

J
Terminates job. The present task is to be terminated; succeeding tasks of the job are not to be scheduled.

P

Terminates primary output. All remaining primary output associated with the job is to be purged from the system.

S

Terminates secondary output. All remaining secondary output associated with the job is to be purged from the system.

If a termination message is ignored by the system, a message is printed at the console explaining why the directive was ignored. The error messages, and the meaning, of each are:

Δ□0: TRΔERROR

There is an error in the termination message sent from the console.

Δ□x: INΔCKPT

The job specified is in the process of checkpoint and cannot be terminated at this time.

Δ□x: INΔTERM

The job specified is already in the process of termination.

Δ□0: NOTΔINΔSYS

The job specified is not in the system.

Δ□x: SPECΔJOB

The job specified cannot be terminated from the console; a system processor is being used (#OUT, #IN, etc.).

where:

x represents the job number.

- Graceful Degradation

This message instructs one processor of a dual processor system to remove itself from the dual processor system.

The other processor continues running in "degraded DP" mode.

The message format is:

TRΔSYS Ⓢ

The system replies with the following message:

*1:□X: DEGRADE DP 1/2 AT hh:mm:ss

where:

hh:mm:ss is the current time.

A reply of 1 ⓢ causes the system to degrade. A reply of 1 N ⓢ causes the routine to abort.

The operation of graceful degradation is such that it can only be attempted in an idle system. (It is necessary to perform a slave shutdown on TCS if it was running on the online system.)

Graceful degradation clears all trace of the processor from the common main storage tables and informs the other processor (via interprocessor interrupt) that it is about to stop. The degrading processor is then 4-stopped.

A number of error messages may be generated by graceful degradation. They all result in the routine being aborted. The messages are as follows:

Δ□0: NOT DP SYS

This is not a full dual processor system. You may not degrade a unit processor nor an already degraded dual processor.

Δ□0: JOBSTK ERR

An error was encountered while reading the job stack. If on a subsequent attempt this message recurs, a 170 dump of both systems should be taken.

Δ□0: IPI FAILED

No response has been received from the other processor. If the other processor appears to be running normally, try again. If not, take a 170 dump.

Δ□0: REAL-TIME PROGRAM +

TCS or other online system is still running. Perform slave TCS shutdown and try again. (This message only appears in company with the next.)

Δ□0: THESE JOBS STILL ACTIVE n,n,n,n,n,n,n,etc. UNABLE TO DEGRADE SYSTEM

There are jobs still outstanding in the system. The jobs listed should be allowed to run to completion or until terminated before attempting to degrade the system. (The second line of the message shows the job numbers of the jobs still outstanding. If more than eight are in the system, the abbreviation ETC is displayed.)

- Suspend

This message directs the operating system to suspend the function specified by f.

Message format:

SPΔxΔf ⓢ

J

Suspends the task indicated by the job number x. The task is allowed to come to a steady state (that is, no I/O or service requests are outstanding), and then is transferred to mass storage. The facilities remain assigned to the task, but the primary storage is made available for other use.

After the job is suspended, the following message is displayed at the console:

Δ□0:x:ΔSPDΔhh:mm:ss

- Resume

  The resume message directs the operating system to resume a function that has been previously suspended.

  Message format:

  RSΔxΔf Ⓢ

  Suspended operations are resumed in accordance with the f function, which is specified as follows:

  J
  The task indicated by the job number x may now be rolled in.

  After the job is resumed, the following message is displayed at the console:

  Δ□0:xΔ:RSMΔhh:mm:ss

- Run

  The run message provides the computer operator with a means for altering the dynamic scheduling of jobs.

  Message format:

  RNΔx Ⓢ

  The job identified by the job number x, which must be a nonscheduled job contained in the system backlog, is scheduled as soon as the necessary facilities become available. As each operating task terminates, an attempt is made to schedule the first task of job x. If the task cannot be scheduled at this time, only the successor of the terminating task may be scheduled.

- Update Communication Facility

  This message is used by the operator to update communication facilities.

  Message format:

  RFΔxxx/yyΔf Ⓢ

  The identification of the CTM is represented by xxx; yy represents the unit number. The function represented by f may be one of the following:

  U
  Marks the facility up.

  D
  Marks the facility down.

  M
  Marks the facility for maintenance.

- System Display Messages

  The system display messages provide the operator with the means for listing information concerning the current job mix, and to change, within system conventions, the service or selection priority of a job. In each of the five messages, the letters hh:mm:ss represent the time of day in hours, minutes, and seconds.

– List Job

The list job message causes a printout of a list of all active jobs and of all dormant jobs. Dormant jobs are jobs which are currently in the process of selection or preselection.

Message format:

LJ ⓢ

For each job, the job number, priority, and elapsed time (if the job is active) are displayed on the console.

Console output format:

LJΔΔΔhh:mm:ss

JOB PRI TIME:

x p e

x p e

where:

x
Represents the job number.

p
Represents the service priority or selection priority of the job.

e
Represents the elapsed CPU time if the job is active. If the job is not active, DORMANT is displayed in place of the elapsed time value.

– System Display

The system display typein causes a dump of the job stack to be displayed.

Message Format:

SDΔD ⓢ

Console output format is as in the following example:

0:*****JOB STACK SUMMARY*****

0: JOB 13 S/P 17 EXECUTING CORE 167400/003000

0: JOB 14 S/P 37 ROLD OUT

0: JOB 15 S/P 24 ON QUEUE CORE /044300

0: JOB 16 S/P 20 NO TASK

0: JOB 17 S/P 30 IN SEL NO CORE

0: JOB 18 S/P 31 IN TERM NO CORE

0: **AVAILABLE CORE**

0: 076000/044300

0: *****END SUMMARY*****

— System Facilities

Keying in the system facilities message causes a list to be displayed of the facilities available for assignment.

Message format:

SF Ⓢ

Console output format:

SFΔhh:mm:ss

$v_0/n,v_{0-j}/n,...v_1/u,v_{1-j}/u,...CORE/n$

where:

v_0
Represents the peripheral code for direct access storage.

n
Represents the decimal number of words available.

v_1
Represents the peripheral code of the unit record device.

u
Represents the number of units available.

CORE
Represents the number of words of primary storage available.

Example:

SF 10:15:20

F432/2450, F880/1000000, UN8C/3, CIN/1, CORE/32450.

In the example, the facilities available at 15 minutes and 20 seconds after 10:00 A.M., are: 2,450 words of storage on an FH-432 magnetic drum unit; 1,000,000 words of storage on an FH-880 magnetic drum unit; UNISERVO VIII-C magnetic tape unit number 3; punched card unit number 1; and a primary storage module of 32,450 words. (All numbers are decimal.)

– Job Facilities

The job facilities message causes a list to be printed showing the facility usage of a specified job. The amount of program primary storage allocated for the job is also listed.

Message Format:

FLΔx ⏎

Console output format:

FLΔΔΔhh:mm:ssΔΔΔJOB:Δx

v_0/n v_1/u CORE/n

where:

x
Represents the job number.

v_0
Represents the peripheral code for direct access storage.

n
Represents the decimal number of words used by the specified job.

v
Represents the peripheral code of the unit record device.

u
Represents the number of units used.

CORE
Represents the amount of primary storage used by the specified job.

Example:

hh:mm:ss JOB:30

F432/2450ΔF880/1000000ΔUN6C/4ΔPRINT/1ΔCORE/32450

■ Inspect Priority

The inspect priority message causes the service priority or selection priority of the specified job to be printed.

Message format:

IPΔx

Console output format:

IP hh:mm:ss JOB:x PRI:p{ACTIVE / IN TERM / DORMANT}

where:

x
: Represents the job number.

p
: Represents the service priority or selection priority of the job specified. The value of p ranges from 17 to 37.

- Change Priority

The change priority message changes the service or selection priority of an active job or of a job which is in process of selection or preselection.

Message format:

CPΔxΔp1 Ⓢ

where:

x
: Represents the job number.

p1
: Represents the value to which the priority is to be changed; p1 may range from 17 to 37.

If the job is active, the difference between the new and the old service priority is calculated, and the priority of activities is modified by the value of the difference. If the job is in the process of preselection or selection, the system display routine modifies the selection priority to reflect the requested priority.

Console output format:

CP hh:mm:ss JOB:x PRI:p2 {ACTIVE IN / TERM. / DORMANT}

where:

x
: Represents the job number.

p2
: Represents the value to which the job priority has been changed. The value of p2 will be the same as the value of p1 if there is no conflict with system conventions for activity registration.

- Execute Canned Job Streams

The following message can be used to execute a job stream from a specified library:

STΔPROGNAME/VERSΔLIB Ⓢ

Where PROGNAME/VERS represents the NAME/VERSION of the element to be executed and LIB represents the library type containing the element. On receipt of this typein, the specified job stream will be executed as an independent job.

The VERS field may be omitted, in which case the file version encountered in the library is used.

The LIB field may be omitted, in which case the SYSTEM library is assumed.

PRINTER SWAP FACILITY. L6L00132.

A console entry is provided whereby the operator can switch a primary output stream from one printer to another, thus preventing jobs with long run times and little printer output from occupying the printer for their run duration.

This facility may be used in the following manner.

A typein of the following format suspends or resumes the printer output unit record routine of a job:

FRΔxxxΔff ⓢ

where:

ff
May be:

PS
Suspends or resumes the printer output unit record routine.

PR
Resumes the printer unit record routine.

xxx
Is the job number.

Upon suspension of the printer unit record routine (PURR) the following message is displayed on the console:

Δ □ : P0 SPD AT hh:mm:ss

The printer is then free.

Upon resumption of the PURR, the following message is displayed on the console.

Δ □ : P0 RSM AT hh:mm:ss

If a message is ignored by the system, an explanatory message appears on the console:

Δ □ 0 : JOB NUM ERR 0/P IN TERM

An invalid job number. The PURR is in termination.

SPECIAL 0P

The PURR specified is not the standard one.

0/P NOT ACTIVE

The PURR specified is not active.

0/P NOT SPD

The PURR specified has not been suspended.

5.3. UNSOLICITED TASK INPUT MESSAGES

This input message may be sent to the operating system only when the task referenced is currently operational and provision has been made in the program for receipt of unsolicited task input messages. This type of message is generally used in real time communications activities, although such messages may be used in batch processing.

The format used by the computer operator for unsolicited task input is as follows:

JxΔtext Ⓢ

where:

x
Is the job number of the desired task (3-digit maximum).

Δ
Is a space.

text
Is the input message to be presented to the task.

All characters within the text, except carriage return, line feed, master space, and erase, become part of the input message. The end of input is signaled by the stop character, which becomes part of the message. The text is limited to a maximum of 40 characters, including the stop character.

5.4. CONSOLE OUTPUT MESSAGES FROM THE OPERATING SYSTEM

Output messages appearing at the operator's console may or may not require a keyin response from the operator; if a keyin response is required, the message is preceded by *z. The letter z represents the response number assigned to the message by the system.

5.4.1. System Output Messages

System output messages give information to the operator concerning the status of the operating system.

- System Generation

  If errors are encountered during execution of the system generation routine, the following message is displayed:

  Message format:

  *z:x: SHALL WE CONTINUE? ANS YES OR NO

  Operator action: determine whether system generation is to be continued. Key in the appropriate response.

Keyin Format	Meaning
zΔY ⓢ	Continue execution even though errors are present.
zΔN ⓢ	Abort the job.

- System Directive

The system directive informs the operator to follow the instructions in the text and to key in a response of no more than five Fieldata characters.

Message Format:

*z: □ x: text

where:

z
Represents the response number.

x
Represents the job number.

Keyin format:

z□text ⓢ

The system message may also take the following format:

□x:Δtext

Follow the instructions in the text. No keyin response is required.

- Scheduler Display

Scheduler display messages are transmitted without operator request as each new job is scheduled to be processed. The message contains the job number, the job identity, and the time of day that the job entered the system.

Message format:

□x: identity/individual hh:mm:ss

where:

x
Represents the job number assigned (3-digit maximum).

identity/individual
Is the job identification as contained in the job card submitted by the programmer.

hh:mm:ss
Represents the time of day in hours, minutes, and seconds.

The remainder of this message is described in 5.4.9 and is not significant unless the interlock condition cannot be cleared by normal operating procedures. In this case, the message data should be examined by appropriate maintenance personnel for evidence of a possible hardware malfunction.

Keyin Format	Meaning
zΔY Ⓢ	Yes, interlock corrected.
zΔN Ⓢ	No, interlock not corrected. If the system is attempting to make an assignment, assignment will be re-attempted on another unit.
zΔA Ⓢ	Abort, interlock not corrected. If the system is attempting to make an assignment, abort the job or task per X or Y option specified on the following task activation control statement.
zΔB Ⓢ	Bootstrap the UNIVAC 9300 subsystem.

- Output Overflow

The output overflow message indicates that a job has exceeded the job output estimate.

Message format:

*z: □x: O/P OFLO

where:

z
Is the response number assigned to the message (2-digit maximum).

x
Is the job number (3-digit maximum) of the job which has exceeded its estimated output.

Operator action: decide whether to continue the task, to abort the job, or to terminate the task in error. Report the decision to the operating system by a keyin message.

Keyin Format	Meaning
zΔC Ⓢ or z Ⓢ	Continue the task and double job card estimate.
zΔA Ⓢ	Abort the job.
zΔE Ⓢ	Discontinue the task through an error routine.

- Central Processor Overflow

The central processor overflow message indicates that a job exceeds the job's estimated CPU run time.

Message format:

*z: □x: C/P OFLO

Operator action: decide whether to continue or to abort the task. Report the decision to the operating system by a keyin message.

- Interlock

The interlock message indicates to the operator that a specified required peripheral device is in a nonoperable condition; the device requires manual attention before it may be used by the system.

Magnetic tape and unit record message format:

*z: □x: INTLK c/u

where:

z
Is the response number assigned to the message (two digit maximum).

x
Is the job number.

c/u
Is the channel number and unit number of the interlocked device.

Operator action: try to repair the defective peripheral device. Report success or failure of attempt by keyin response. In the case of an onsite, online UNIVAC 9300, the subsystem may need locating (5.4.11).

Drum message format:

Jnnn INTRLK cc/uu Innnnnnnnnn Fnnnnnnnnnn

where:

Jnnn
Is the job number interlocked, in octal.

cc/uu
Is the channel and unit number of the interlocked drum device, in decimal.

The remainder of this message is described in 5.4.9 and is not significant unless the interlock condition cannot be cleared by normal operating procedures. In this case, the message data should be examined by appropriate maintenance personnel for evidence of a possible hardware malfunction.

Disc message format:

Jnnn { DISC INT / FILEPROT / CU O/LN / I/O O/LD } CC/p/u +++/hh Imss Aaaaaaa Sbb bb Fxy

where:

Jnnn
Is the job number interlocked.

DISC INT
Indicates a general interlock condition.

FILEPROT
Indicates that the file protect feature of the specified disc drive is engaged, and that the specified job is attempting to write data on the drive.

CU O/LN
Indicates that the specified control unit is offline.

I/O O/LD
Indicates that the system has entered an I/O overload condition and is unable to present data to the specified disc subsystem at a high enough rate for its correct operation. When the condition is persistent, operator intervention should reduce the I/O load in the system by terminating or suspending jobs.

cc/p/u
Is the channel, control unit, and drive number interlocked in decimal.

Keyin Format	Meaning
zΔY(S) or z(S)	Abort the activity; continue the job with a double-time estimate.
zΔC(S)	Continue the task.
zΔA(S)	Abort the job.
zΔE(S)	Discontinue the current task through an error routine.

Overflow messages may be suppressed by an option exercised at systems generation time, thereby relieving the computer operator of responsibility in this area. If sending of overflow messages is suppressed, an overflow condition causes an automatic continuation or abortion of the task, as previously determined at systems generation time.

- Exit Message

Upon normal termination of a job, the following message is displayed:

□x: EXIT hh:mm:ss

where:

x
Represents the job number.

hh:mm:ss
Represents the time of day in hours, minutes, and seconds.

Operator action: no keyin response is required.

- *Primary Input*

As primary input occurs for a job, the following message is displayed:

Δ□ x: ZA c/u

where:

x
: Represents the job number.

c/u
: Represents the channel number/unit number.

- Primary Output

  As primary output occurs for a job, the following message is displayed:

  Δ□ x: ZB c/u

  where:

  x
  : Represents the job number.

  c/u
  : Represents the channel number/unit number.

  Operator action: no keyin response is required.

5.4.2. Magnetic Tape Messages

Output messages concerning magnetic tape units are displayed at the console to inform or instruct the operator about procedures to be carried out on magnetic tape units.

- Mount Tape Message

  The mount tape message instructs the operator to mount a tape specified by file identification. The message is generated from information on the #ASG card.

  Message format:

  *z: #□ x: MTΔfi

  where:

  x
  : Represents the job number.

  fi
  : Represents the file identification.

  Operator action: respond in one of the following ways:

  1. Determine on which channel and unit the tape specified is to be mounted. After mounting the tape, key in the following message:
     z Ⓢ

In this case, the system will select the first available unit, starting at unit one, and request that the tape be mounted on that unit.

MTΔc/uΔfi Ⓢ

The operating system responds:

□ 0: c/u MT'D

The operator answers:

Z Ⓢ
or
ZΔc/u Ⓢ

The operating system then acknowledges assignment of the file code by displaying:

□x: FCΔc/uΔfi

FC is the file code of the assigned tape.

If the channel/unit number of the MT response is not typed correctly, one of the following error messages is displayed:

□ 0: CHANNEL ERROR

□ 0: UNIT NUM ERROR

If the unit selected in the MT response is already assigned, the following message is displayed.

□ 0: UNIT x UNAVAILABLE

2. Allow the operating system to assign the tape file identifier to the first channel and unit available by keying in the following message:

z Ⓢ

The operating system informs the operator of the channel and unit assigned to the tape by displaying the following message:

□ xxx: FC c/u fi

If the appropriate option was selected by the programmer, the operating system then instructs the operator to acknowledge that the tape is mounted by displaying the following message.

*z: RDY IPT c/u

or

*z: OUTPUT c/u

Signal that the tape is mounted by keying in:

z Ⓢ

- MOUNT$ Tape Message

The ready tape message is displayed in response to a MOUNT$ input/output service request within the program.

Message format:

*z: MOUNT xx...x ON c/u

where:

xx...x
Represents the file identifier.

c/u
Represents the channel number/unit number.

The file identifier is an alphanumeric identification of the file which is to be mounted. The maximum length of this field is 15 characters. The identifier may specify a class of tapes such as BLANK or SCRATCH.

Operator action: mount the specified file on the specified unit and key in response indicating completion.

Keyin Format	Meaning
z(S)	Operator action is completed.

- DEMOUNT$ Tape Message

The demount tape message is displayed in response to a DEMOUNT$ input/output service request within the program. The operator is directed to demount and label a specified file.

Message format:

*z: c/u DEMOUNT AND LABEL xx...x

where:

z
Represents the response number (2-digit maximum).

c/u
Represents the channel and unit.

xx...x
Represents the name to be placed on the file label.

Operator action: demount and label the specified tape file, and type in response indicating completion.

Keyin Format	Meaning
z(S)	Operator action is completed.

- Change Tape

The change tape message instructs the operator that a particular file is to be demounted, labeled, and another file mounted in its place.

Message format:

*z: c/u LABEL xx...x AND MOUNT yy...y

where:

z
Represents the response number assigned (2-digit maximum).

c/u
Represents the channel and unit.

xx...x
Represents the name to be placed on the label of the demounted file.

yy...y
Represents the label of the new file to be mounted.

Operator action: demount and label the specified file. Mount the specified file. Type in response indicating completion.

Keyin Format	Meaning
z(S)	Operator action is completed.

- Tape Error

The tape error message advises the operator that an error has occurred in the magnetic tape unit specified.

Message format:

*z: TAPE ERROR wxy c/u

where:

wxy
Represents octal notation of bits 17 through 9 of a status word from a UNISERVO VI-C or UNISERVO VIII-C magnetic tape unit. The significance of the bit positions is shown as follows:

	Bit Position	Condition
w	17	Abnormal frame count
	16	(Possible) end of file
	15	End-of-tape warning/load point
x	14	Interlock
	13	Busy
	12	Parity error
y	11	Late acknowledge error
	10	Tape hash
	9	Invalid function

Operator action: clean transport and attempt to correct error. If the message is preceded by an asterisk, report by typein response the success or failure of the attempt to correct the tape error.

Keyin Format	Meaning
zΔY⏎	Yes, error corrected.
zΔN⏎	No, error not corrected.
zΔA⏎	No, abort job.

- Labeling Error

The labeling error message is produced after a check has been executed on the tape label and has resulted in a mismatch.

Message format:

□xxx: FILE FC WRONG LABEL

□xxx: WANTED www

□xxx: FOUND fff

*Z□xxx: TYPE F FOR FORCE/R – REJECT/A – ABORT

where:

fc
Represents the tape's file code.

www
Represents the file name specified by the user on the control cards.

fff
Represents the actual file name on the tape.

A reply of F will cause the job to continue, ignoring the label discrepancy. A reply of A will cause the task or complete job to terminate, depending on the user's control card options. A reply of R will rewind the tape with interlock and the message:

*Z□xxx: REMOUNT FILE fc

will be displayed. This allows the operator to mount a correct tape on the same logical unit and continue. A reply of:

Z⏎

causes the complete label checking procedure to be re-enacted. If the labels still do not match, the messages will be repeated. If the labels do match, the job will continue.

- BFH Tape Error

The BFH tape error message indicates to the operator that the basic file handler is encountering tape problems, such as, no block numbering present when block numbering is specified, or a bad checksum.

Message format:

*z: □ TPERR FC xx

Operator action: clean tape heads and perform other standard maintenance. Decide whether to attempt tape operation, and type in reply.

Keyin Format	Meaning
*z: Δ:Y(S)	Resume operation.
*z: Δ:N(S)	Exit to worker subroutine.
*zΔA(S)	Abort job.

- Wrong Label (Basic File Handler)

The wrong label message advises the operator that the label specified for a particular file code is incorrect.

Message format:

□ x: FILEfc WRONG LABEL

□ x: WANTED yy...y REEL nn DATE ddddd

□ x: FOUND yy...y REEL nn DATE ddddd

*z: x:TYPE F FOR FORCE/R FOR REJECT

where:

fc
Represents the file code.

yy...y
Represents a label of up to 15 characters.

nn
Represents the reel number.

ddddd
Represents the date when OMEGA was loaded.

Operation action:

Keyin Format	Meaning
*z: □:F(S)	It is assumed that a correct tape is mounted. Continue processing.
*z: □:R(S)	Rewind the tape with interlock and issue a new mount message.

5.4.3. Messages During Bootstrap Procedure

The following messages may occur during the bootstrap procedure.

- Mass Storage Subsystem Error

  The mass storage reference error message indicates to the operator that the system is unable to reference a mass storage subsystem listed in the facility table.

  Message format:

  *z: UNABLE TO REFERENCE CHxx

  Operator action: processing is not resumed until the message is answered. Key in a reply removing the subsystem from the facility table.

Keyin Format	Meaning
z ⓢ or zΔY ⓢ	Remove the subsystem from the facility table.

  If the subsystem removed from the facility pool is referenced during a subsequent bootstrap procedure, the operator is advised of the status of the subsystem by the following message: CHxx MARKED REMOVED. The bootstrap routine then resumes operation.

- Subsystem Access Error

  The subsystem access error message is sent to the operator when the system attempts to access the incorrect subsystem.

  Message format:

  UNIT DEVICE FOR LIB–REBOOT

- Drum (Primary Storage) Error

  This message indicates to the operator that a request for free primary storage is unsatisfied, or that an attempted drum assignment cannot be made. An unrecoverable error has occurred and processing is discontinued.

  Message format:

  NOT ENOUGH DRUM (CORE) TO BOOT

- Drum Area Error

  This message indicates to the operator that sufficient drum area is not available.

  Message format:

  COOP LIB AREA NOT AVAILABLE

- Drum Error

  The drum error message indicates that an unrecoverable drum error has occurred. The digits represented by xx in the message indicate the status code of the error for the information of the programmer.

  Message format:

  UNRECOVERABLE DRUM ERROR xx

- Tape Load Error

  The tape load error message is caused by system links on tape or drum errors during the bootstrap procedure.

  Message format:

  SYSTEM NOT ABLE TO LOAD TAPE

- MFD Capacity Error

  After the bootstrap procedure, the system restores all tables and records required for master file directory functions. The MFD capacity error message indicates that the user number or the file number exceeds the maximum number allowed.

  Message format:

  NO MFD – USER xxxxx FIL yyyyy

  where:

  xxxxx and yyyyy
  Represent the digits of the user and file number respectively.

  After the message is printed, system operation proceeds, restoring as many as possible of the mass storage file records.

- MFD Recovery Error

  The MFD recovery error message indicates that the system is unable to locate all records for a valid user number and file number.

  Message format:

  UNRECOVERABLE MFD – USER xxxxx FILE yyyyy

  After the message is printed, system operation proceeds, restoring as many as possible of the mass storage file records.

- Bootstrap Without MFD Recovery

  The drum subsystems may be initialized without recovering the MFD files by leaving jump key 3 in the ON position during the tape bootstrap procedure. Any packs mounted on disc subsystems have MFD files recovered on completion of the drum subsystems initialization. These packs may be initialized by leaving jump key 1 in addition to jump key 3 in the ON position during the tape bootstrap procedure. With or without jump key 3, the setting ON of jump key 1 also causes any drum subsystems which have been switched offline to be marked REMOVED. The operator is advised by the following message that the MFD files will be lost.

Message format:

*z: THIS TAPE BOOT WILL DESTROY PREVIOUS MFD

To acknowledge that the impending loss of MFD files is recognized, the operator should key in the following message:

Keyin Format	Meaning
Z ⓢ or ZΔY ⓢ	Proceed with initialization of drums and/or disc packs.
Any other character	Proceed with recovery of drums and disc packs.

5.4.4. Messages During CHECKPOINT/RESTART

The CHECKPOINT segment of the CHECKPOINT/RESTART routine enables the user to record on magnetic tape the operational environment existing at a specified point during program execution. The RESTART segment of CHECKPOINT/RESTART enables the user to reinitiate execution at any previously recorded checkpoint.

The request for checkpoint is made within the program. For each request, one of the following messages is displayed at the console (xxxxx represents the identity assigned to the checkpoint):

CHECKPOINT xxxxx COMPLETED

CHECKPOINT ABORTED DUE TO BAD REQUEST PACKET

CHECKPOINT xxxxx ABORTED DUE TO RANDOM STORAGE I/O ERROR

CHECKPOINT xxxxx ABORTED DUE TO SUBSYSTEM ERROR ON CHECKPOINT TAPE

CHECKPOINT xxxxx ABORTED DUE TO END OF TAPE ERROR ON CHECKPOINT TAPE

The RESTART segment is initiated by an unsolicited keyin by the operator.

Message format:

RRΔxxxxxΔpnΔf

where:

xxxxx
: Represents the checkpoint identity.

pn
: Represents the peripheral name that is to be used to assign a tape unit for the CHECKPOINT file.

f (optional)
: Represents the function U or N. U indicates unnumbered block format on the tape. N indicates numbered block format on the tape. If no specification is given, numbered block format is assumed. H, M, or L specifies high, medium, or low density recording. X, Y, or Z specifies A, B, or C format to be used with UNISERVO 12/16 tape units. E specifies that errata cards are to be read in at restart.

One of the following messages is displayed on the console in response to the restart keyin:

RESTART FROM CHECKPOINT xxxxx COMPLETED

RR TYPE-IN IS INCORRECT

TAPE NOT AVAILABLE FOR RESTART

RESTART TAPE FORMAT ERROR

RESTART TAPE UNREADABLE

RESTART FROM CHECKPOINT xxxxx ABORTED DUE TO RANDOM STORAGE I/O ERROR

RESTART FROM CHECKPOINT xxxxx ABORTED DUE TO JOB LIBRARY OVERFLOW

RESTART FROM CHECKPOINT xxxxx ABORTED DUE TO TAPE FORMAT ERROR ON CHECKPOINT TAPE

RESTART FROM CHECKPOINT xxxxx ABORTED DUE TO SUBSYSTEM ERROR ON CHECKPOINT TAPE

RESTART FROM CHECKPOINT xxxxx ABORTED DUE TO END OF FILE ERROR ON CHECKPOINT TAPE

RESTART FROM CHECKPOINT xxxxx ABORTED DUE TO SUBSYSTEM ERROR ON TAPE FILE POSITIONING

RESTART FROM CHECKPOINT xxxxx ABORTED DUE TO SEND/RECEIVE ERROR

RESTART FROM CHECKPOINT xxxxx ABORTED DUE TO ERROR IN RESTORING CORE

The rerun option in COBOL utilizes the CHECKPOINT/RESTART routines. If the checkpoint routine fails, the following message appears:

FAULT IN CKPT. TYPE x

where:

x

Represents the error code, which may be as follows:

Code	Meaning
A	Abort the entire job.
C	Continue the production run; ignore the fault. If a restart operation is required, the last valid checkpoint will be used.
R	Restart the production run from the last valid checkpoint.
T	Retry the checkpoint in the same place. This assumes that the error cause has been corrected, such as bad tape or bad tape unit.

If, in the course of recording a checkpoint, the end of tape is reached, then the checkpoint is aborted, the tape is rewound, and the following message is displayed on the console:

LBL FC C/U CHECKPOINT TAPE + MNT NEW TAPE

When the operator has replaced the tape, the checkpoint will be recorded on the new tape.

5.4.5. Peripheral Device Status Messages

Messages informing the operator concerning the status of peripheral devices include the following:

- ASSIGN Message

  The ASSIGN message informs the operator that a specified peripheral device has been assigned to a job.

  Message format:

  □x: fc c/u

  where:

  x
  Represents the job number.

  fc
  Represents the file code.

  c/u
  Represents the channel number and the unit number.

  Operator action: no keyin response is required.

- FREE Message

  The FREE message informs the operator that a peripheral device has been released from a job.

  Message format:

  Δ□x: c/uΔFREE

  where:

  x
  Represents the job number.

  c/u
  Represents the channel and unit.

  fc
  Represents the file code.

  Operator action: no keyin response is required.

5.4.6. Remote Device Status Messages

Remote device status messages include the following:

- Transmission Error

  The transmission error message informs the operator that excessive transmission errors have occurred.

  Message format:

  *z: □0 X-ERRORsssss

  where:

  sssss
  Represents the remote site identification.

  Operator action: decide whether to continue, to temporarily halt, or to terminate remote transmission. Report the decision to the operating system by a typein response.

Keyin Format	Meaning
z□C Ⓢ	Continue.
z□H Ⓢ	Halt.
z□T Ⓢ	Terminate.

- Inactive Remote Line

  The inactive remote line message informs the operator that a remote line has become active.

  Message format:

  *z: □0 L-INACT sssss

  where:

  sssss
  Represents the remote site identification.

  Operator action: decide whether to continue, to temporarily halt, or to terminate remote operation. Report the decision to the operating system by a typein response.

Keyin Format	Meaning
z□C Ⓢ	Continue.
z□H Ⓢ	Halt.
z□T Ⓢ	Terminate

- Halt

  The halt message informs the operator that a remote device is temporarily in a halt condition.

  Message format:

  □0: HALTsssss

  where:

  sssss
  Represents the remote site identification.

  Operator action: no typein response is required.

- Halt/Voice

  This message informs the operator that a remote device is temporarily in a halt condition.

  Message format:

  □0: HALT-VOCsssss

  where:

  sssss
  Represents the remote site identification.

  Operator action: place the data line in the TALK mode for voice communication with the operator at the remote site.

- Termination Message

  The termination message indicates that operations with the specified remote site have been terminated due to excessive errors.

  Message format:

  □0: CTM-TERM sssss

  where:

  sssss
  Represents the remote site identification.

  Operator action: no keyin response is required.

5.4.7. Card Reader Messages

Card reader messages include the following:

- Interlock

  This message advises the operator that the card reader is interlocked and inoperable.

  Message format:

  *z: □x: INTLK c/u

  where:

  c
  Represents the channel number assigned to the card reader.

  u
  Represents the unit number assigned to the card reader.

  x
  Represents the job number.

  Operator action: if possible, determine and correct the malfunction (such as card feed error, input hopper gate open) causing the interlock. Report by a keyin response the success or failure of the attempt at repair. If response is affirmative, refer to further instructions given in 5.4.8.

Keyin Format	Meaning
zΔY ⓢ	Yes, interlock corrected
zΔN ⓢ	No, unable to repair interlock.

- Sequence Error Message

  This message advises the operator that a hardware sequence error has occurred.

  Message format:

  *z: CARD ERROR 20

  UN.xx CH.xx Y/N

  where:

  xx
  Represents the number of the unit and channel.

  Operator action: determine whether the card in error is to be reread, or if the image of the card in error is to be given to the requester and the requester is notified of the error condition. Report the decision to the operating system by typein response. If the response is affirmative, refer to further instructions in 5.4.8.

Keyin Format	Meaning
zΔY Ⓢ	Reread card in error.
zΔN Ⓢ	Give image of card in error to requester.

- Light/Dark Check Error (Status Code 54)

This message advises the operator that a light/dark check error has occurred.

Message format:

*z CARD ERROR 54

UN.xx CH.xx Y/N

where:

xx
Represents the number of the unit and channel.

Operator action: decide whether the card in error is to be reread or if the card image is to be given to the requester.

If the card is to be reread, remove the cards from the reject hopper and reproduce the cards if physical damage has occurred. Place the cards behind the deck in the output hopper before typing in the response. If the message is answered with an N response, the requester is notified of the error condition.

Keyin Format	Meaning
zΔY Ⓢ	Reread card in error.
zΔN Ⓢ	Give image of card in error to requester.

- Inappropriate Function Code (Status Code 60)

This message indicates to the operator that the card reader hardware has detected an improper sequence of logical instructions.

Message format:

*z CARD ERROR 60

UN.xx CH.xx Y/N

where:

xx
Represents the number of the unit and channel.

Operator action: decide whether the card in error is to be reread, or if the card image is to be given to the requester. If the response is affirmative, refer to further instructions in 5.4.8.

- Illegal Character (Status Code 70)

  This message indicates to the operator that an illegal Hollerith character has been read; xx represents the number of the unit and channel.

  Message format:

  *z CARD ERROR 70

  UN.xx CH.xx Y/N

  where:

  xx
  Represents the number of the unit and channel.

  Operator action: determine whether the card in error is to be reread or if the card image is to be given to the requester. Report decision to the operating system by a typein response. If response is affirmative, refer to further instructions in 5.4.8.

Keyin Format	Meaning
zΔY Ⓢ	Reread card in error.
zΔN Ⓢ	Give image of card in error to requester.

5.4.8. Preparation of Card Reader for Reread

Upon receipt of an affirmative message from the operator indicating that a reread operation is to be attempted, the operating system completes the required internal procedures and prints a copy of the original error message. The operator responds by repositioning the error card (or cards) for a reread operation. To reposition the cards, proceed as follows:

1. Remove or lift the deck in the input hopper.
2. Place the card reader in offline mode, and feed the card into the wait station.
3. Remove the last five cards from the output hopper, and place them in the input hopper. The first card to go into the input hopper is the card that caused the error. Examine the card and, if damaged, reproduce the card.
4. Replace the input deck which was removed in step 1.
5. Place the reader in online mode; push the READY and START buttons.
6. Type in zΔY at the console.

The recovery procedure is now completed, and the requesting program is not aware that an error has occurred. However, if steps 1 through 5 cannot be completed, type in zΔN so that the recovery program can notify the requester of an unrecoverable error condition.

5.4.9. Hardware Diagnostic Messages

Hardware diagnostic messages inform the operator of the detection of a parity error by the hardware. The time of error occurrence is specified in each message in hours (h), minutes (m), and hundreths of a second (c) in the format hh:mm:cc.

- Parity Error in Instruction or Operand

  The message indicating parity error in an instruction or operand informs the operator that a transient (TRAN) or permanent (PERM) parity error has been detected in an operand (OPER) or instruction (INST). If the error is an instruction, the location (xxxxxx) of the instruction in error is indicated.

PARITY	ERR	OPER	TRANS
		or	or
xxxxxx		INST	PERM

  Operator action: no keyin response is required.

- Power Loss

  The power loss message indicates to the operator that a power loss interrupt has been generated by the hardware.

  Message format:

  POWER LOSS

  Operator action: if power actually drops, the system can be recovered by setting the P register to 0 and pushing the START button. No keyin response is required.

- Buffer Control Register Parity Error

  The BCR parity error message indicates that a parity error has been detected on a buffer control register on the channel specified by xx.

  Message format:

  BCR PARITY CHAN xx

  where:

  xx
  Represents the number of the unit and channel.

  Operator action: no keyin response is required.

- Data Transfer Parity Error

  The data transfer parity error message indicates that a parity error has been detected in a data transfer on the channel specified by xx.

  Message format:

  DATA PARITY CHAN xx yyyyyy

where:

xx
Represents the number of the unit and channel.

yyyyyy
Represents the absolute value of the bad address.

Operator action: no keyin response is required.

- Primary Storage Parity Error

This message indicates that a memory parity error has been detected in a worker program. The job is suspended by the contingency routine:

□X SUSPENDED

Operator action: the RS keyin can be used to restart the job when the fault has been cleared.

- Drum Storage Errors

This message indicates that an unrecoverable error has occurred on an FH drum or FASTRAND subsystem.

Message format:

Jnnn DRUM ERR cc/uu Innnnnnnnn Fnnnnnnnnn

where:

Jnnn
Represents the job number that has encountered error, in octal.

cc/uu
Represents the channel and unit number, in decimal, of the drum device on which the error occurred.

Innnnnnnnn
Represents the external interrupt status word indicating the subsystem error condition, in octal.

Fnnnnnnnnn
Is the subsystem function word, in octal, that resulted in the subsystem error condition.

Operator action: no keyin response is required.

- Disc Storage Errors

This message indicates that an unrecoverable error has occurred on an 8400 series disc subsystem.

Message format:

Jnnn DISC ERR cc/p/u +++/hh Imss Aaaaaaa Sbb bb Fxy

where:

Jnnn
: Represents the job number that has encountered the error, in octal.

cc/p/u
: Represent the channel, control unit, and disc drive numbers, in decimal, on which the error occurred.

+++/hh
: Represents the cylinder and head address, in decimal, of the I/O attempt that resulted in error.

m
: Represents the MSA bits, 2^{17} and 2^{16}, from the external interrupt status word. This is octal, left aligned, so that m=4 means abnormal byte count, and m=2 means MSA error.

ss
: Represents the status byte in hexadecimal.

aaaaaa
: Represents the MSA auxiliary status word in octal.

bb
: Represents sense bytes zero and one respectively, in hexadecimal.

xy
: Represents the command chain type and monitor interrupt status of the I/O.

x may be one of the following:

A – Disc prep seek
- Set file mask (A format)
- Seek cylinder/head (A format)

B – Disc prép write RO, RN
- Set file mask (A format)
- Seek head (C format)
- Write home address (C format)
- Write track descriptor (C format)
- Write count, key, data (C format)
- TIC to write CKD

C – Disc prep read RO, RN
- Set file mask (A format)
- Seek head (C format)
- Read home address (C format)
- Read track descriptor (C format)
- Read count, key, data (C format)
- TIC to read CKD

D – Disc prep read/write data
- As per disc handler, codes F and G.

E – Disc handler seek
Set file mask (A format)
Seek cylinder/Head (A format)

F – Disc handler read data
Set file mask (C format+queueing hold)
Seek head (C format)
Search id equal (C format)
Read data (C format)
Search id equal (truncated)
TIC to read data

G – Disc handler write data
Set file mask (C format+queueing hold)
Seek head (C format)
Search id equal (C format)
Write data (C format)
Search id equal (truncated)
TIC to write data

H – Disc handler recalibrate
recalibrate

I – Disc prep recalibrate
recalibrate

y=m indicates BCR activation with monitor; absence of y indicates without monitor.

NOTES:

1. *When the subsystem is an interprocessor shared peripheral, the seek head commands in chains B, C, D, F, and G will be seek cylinder/head.*

2. *The MSA bit is set in the file masks of command chains B, D (output), and G.*

5.4.10. Miscellaneous Messages Indicating Error

These messages are displayed to inform the operator of illegal operation.

- No Job Card

The no job card message occurs when the input deck contains no job card or when the job card is misread.

Message format:

x:NO JOB CARD

where:

x
Represents the job number.

Operator action: check to see if the card deck contains a job card; if so, attempt to read the deck again. If there is no job card or if the second attempt to read the deck fails, return the deck for correction.

- Input Keyin Error

  When an error is made in a console keyin, a diagnostic message is displayed.

  Message format:

  INPUT ERROR xx...x

  where:

  xx...x
  Represents the line containing the error.

  Operator action: key in message in correct format.

- Error in Primary Output Unit Record Routine

  When an error occurs in the primary output unit record routine (printer), a diagnostic message is displayed.

  Message format:

  □xxx: POUR ERROR STATUS yy

  where:

  xxx
  Represents the job number.

  yy
  Represents the status code of the error.

- Error in Secondary Output Unit Record Routine

  When an error occurs in the secondary output unit record routine (card punch), a diagnostic message is displayed.

  Message format:

  □ xxx: SOUR ERROR STATUS yy

  where:

  xxx
  Represents the job number.

  yy
  Represents the status code of the error.

- SORT/MERGE Error

  During execution of the SORT/MERGE program, error messages with status codes are displayed on the console. The status code of the error is of concern only to the cognizant programmer.

Message format:

SM xxx
or
SM xxx FCyy

where:

xxx
Represents the status code of the error.

yy
Represents the file code of the peripheral device upon which the error occurred.

- Message Length Error

Console input messages are limited in length to 46 characters. When the length of an input message exceeds the maximum allowed, the word ERROR is printed immediately after the end of the entry, and the entry is discarded.

- Delay Number Error

If a delay number which has not been assigned is entered, the word ERROR is printed immediately after the input message and the message is discarded.

- Input Timeout Error

After the carriage return is struck to signal the start of an input message, the console is locked out to all output messages. An input timeout prevents the console from being locked out for extended periods of time.

An input message must be completed within approximately 36 seconds from the time that the message is initiated. If the maximum time allotted is exceeded, the word T'OUT is printed immediately after the incomplete message, the console is opened to output messages, and the partial input message is discarded.

- Response Timeout Error

After an activity causes an output message requiring operator response to be displayed at the console, the activity is suspended until the response is made. A response delay timeout prevents the activity from being suspended immediately. After no answer has been made to an outstanding response number for approximately five minutes, the following message is printed:

T'OUT *z

where:

z
Represents the response number which has not been answered within five minutes.

The response number is then released, and the activity is placed in the queue.

5.4.11. UNIVAC 9300 Series Subsystems

In order to establish the interface between the UNIVAC 9300 Series subsystem and the UNIVAC 494, the UNIVAC 9300 Series system has a resident cycling program capable of handling the data transfer. This program, called SITE, is initially resident on the OMEGA system library and has to be transferred to the UNIVAC 9300 Series system, via a bootstrap routine, at the time of an interlock.

- Interlock Message

  If an abnormal condition exists when attempting to access the UNIVAC 9300 Series subsystem the following message will be displayed:

  *z: □x: INTLK c/u

  Where c represents the UNIVAC 9300 Series subsystem channel and u represents the unit number of the relevant device on that channel. The operator should first ascertain whether or not the unit in question is in an abnormal condition and, if it is, the fault should be corrected and a reply of Y or N should be given in the following format:

  zΔY Ⓢ

  zΔN Ⓢ

  If no abnormal condition exists, the UNIVAC 9300 Series system will need to be bootstrapped.

- Booting the UNIVAC 9300 Series Subsystem

  The interlock message should be answered with:

  zΔB Ⓢ

  and the following steps taken at the UNIVAC 9300 control panel.

  1. Set DATA ENTRY switches to 0000 1010.
  2. Press CHANNEL CLEAR, PROC ABN CLEAR.
  3. Switch LOAD switch to ON position.
  4. Press START.
  5. Switch LOAD switch to OFF position.
  6. Press START.

  The system will then be booted and the job will continue.

APPENDIX A. NUMBER SYSTEMS AND CONVERSION TECHNIQUES

A.1. POSITIONAL NOTATION

In a positional notation system, the value of each digit in a number is determined by its position. Each digit represents the product of the digit (d) plus a power of the radix (r). The value of the entire number is the sum of these digit values. The powers of r range in positive increments from 0 to ∞ for integers, and from −1 to −∞ in negative increments for fractions. The division between the integer and fractional parts of a mixed number is indicated by a point (decimal point, octal point, or binary point) depending upon the number system in use.

$$dr^{\infty} \ldots dr^{2}\, dr^{1}\, dr^{0}.\, dr^{0-1} dr^{-2} \ldots dr^{-\infty}$$

In any numerical system, the values of the powers of r are written in the notation of that system, as shown in the "general rule" line of the following chart. That is, r^3 is always written as 1000 regardless of the value of the radix. The decimal equivalents of r^n in octal and binary notation are shown in the succeeding lines.

Radix	$\ldots r^3$	r^2	$r^1\, r^0$	r^{-1}	r^{-2}
General rule	1000	100	10 1	.0	.01
Decimal	1000	100	10 1	1/10	1/100
Octal	512	64	8 1	1/8	1/64
Binary	8	4	2 1	1/2	1/4

The following specific examples illustrate the principle of positional notation.

A.1.1. Decimal

The decimal number 1964 can be broken down as follows:

$$\begin{array}{lr} 1964 \rightarrow 4 \times 10^0 = & 4 \\ \quad\; \rightarrow 6 \times 10^1 = & 60 \\ \quad\; \rightarrow 9 \times 10^2 = & 900 \\ \quad\; \rightarrow 1 \times 10^3 = & 1000 \\ & \overline{1964} \end{array}$$

A.1.2. Octal

The octal number 3654 can be broken down as follows. Both octal notation indicated by an 8 subscript and decimal equivalents with a 10 subscript are shown.

3654 →			
→	$4 \times 10_8^0 =$	$4_8 =$	4_{10}
→	$5 \times 10_8^1 =$	$50_8 =$	40_{10}
→	$6 \times 10_8^2 =$	$600_8 =$	384_{10}
→	$3 \times 10_8^3 =$	$3000_8 =$	1536_{10}
		3654_8	1964_{10}

A.1.3. Binary

The binary number 11110101100 can be broken down as follows:

11110101100 →			
→	$0 \times 10_2^0 =$	$0_2 =$	0_{10}
→	$0 \times 10_2^1 =$	$00_2 =$	0_{10}
→	$1 \times 10_2^2 =$	$100_2 =$	4_{10}
→	$1 \times 10_2^3 =$	$1000_2 =$	8_{10}
→	$0 \times 10_2^4 =$	$00000_2 =$	0_{10}
→	$1 \times 10_2^5 =$	$100000_2 =$	32_{10}
→	$0 \times 10_2^6 =$	$0000000_2 =$	0_{10}
→	$1 \times 10_2^7 =$	$10000000_2 =$	128_{10}
→	$1 \times 10_2^8 =$	$100000000_2 =$	256_{10}
→	$1 \times 10_2^9 =$	$1000000000_2 =$	512_{10}
→	$1 \times 10_2^{10} =$	$10000000000_2 =$	1024_{10}
		11110101100_2	1964_{10}

A.2. ARITHMETIC

Any decimal number can be expressed by a corresponding binary or octal (or any other radix) number, and similar arithmetic processes can be performed.

A.2.1. Binary Arithmetic

The binary system uses the digits 0 and 1. Binary addition and multiplication are performed according to the following tabulated rules. From these rules, subtraction and division can be inferred.

Addition	Multiplication
0 + 0 = 0	0 x 0 = 0
0 + 1 = 1	0 x 1 = 0
1 + 0 = 1	1 x 0 = 0
1 + 1 = 10	1 x 1 = 1

A.2.2. Octal Arithmetic

The octal system uses the digits 0, 1, 2, 3, 4, 5, 6, and 7. The following tables give the rules for octal addition and multiplication. From these rules, subtraction and division can be inferred.

Addition

	1	2	3	4	5	6	7
0	1	2	3	4	5	6	7
1	2	3	4	5	6	7	10
2	3	4	5	6	7	10	11
3	4	5	6	7	10	11	12
4	5	6	7	10	11	12	13
5	6	7	10	11	12	13	14
6	7	10	11	12	13	14	15
7	10	11	12	13	14	15	16

Multiplication

	1	2	3	4	5	6	7
1	1	2	3	4	5	6	7
2	2	4	6	10	12	14	16
3	3	6	11	14	17	22	25
4	4	10	14	20	24	30	34
5	5	12	17	24	31	36	43
6	6	14	22	30	36	44	52
7	7	16	25	34	43	52	61

A.3. NUMBER CONVERSIONS

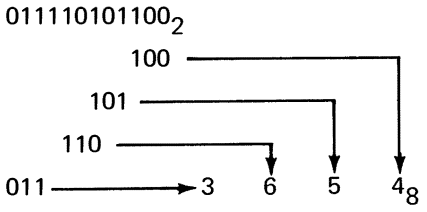
A number in one system can consist of an integer portion, a radix point, and a fractional portion. Two separate procedures are involved in the conversion from one radix system to another; one for the integer portion and one for the fractional portion. In positional notation, conversion of the integer portion from one system to another is always exact (being limited only by the number of digits available); conversion of the fractional portion cannot always be exact (in the sense that 1/3 cannot be represented exactly in decimal notation) but can be performed to any digit of precision. The two procedures (integer and fractional conversion) are described separately in A.3.1 through A.3.11. Conversion from octal to binary and vice versa is always exact because 8 is a multiple of 2.

A.3.1. Integer Binary to Octal

The solution to this problem lies in the octal system. The eight digits of the octal system bear a simple relationship to the binary system.

Binary	Octal	Decimal
000	0	0
010	2	2
011	3	3
100	4	4
101	5	5
110	6	6
111	7	7

Note that the octal digits 0 to 7 can be represented by three binary digits or bits. A large binary number can be separated into 3-bit triads, starting from the binary point at the right; an octal digit can be substituted for each triad. For the fractional part of a number, the division into triads begins at the binary point and proceeds from left to right. For example, the binary number previously used can be converted to octal (note the addition of a leading 0 to complete the leftmost triad in the following example).



With practice, the conversion from binary to octal or from octal to binary can be made at sight. The programmer and machine operator memorize only the binary equivalents of the eight octal digits. The octal system is used as a condensed or shorthand representation of a binary number. The ackward and error-inducing string of 0's, and 1's is presented in a more compact and accurate form with the octal number system.

A.3.2. Integer Octal to Binary

This method is the reverse of the binary to octal conversion process.

A.3.3. Integer Octal to Decimal

To complete the translation from the binary system to the decimal system, the octal number must be converted to its decimal equivalent. The arithmetic in the procedure described below is decimal.

1. Multiply the most significant digit by 8.
2. Add the next most significant digit to the product of step 1.
3. Using the sum derived from step 2 as a new multiplicand, repeat steps 1 and 2 until the least significant digit is added. The sum at this point is the decimal value.

Example:

Convert 3654_8 to the decimal equivalent.

```
  3654
 x8
 ----
 24
 +6
 ----
 30
 x8
 ----
 240
 +5
 ----
 245
 x8
 ----
 1960
 +4
 ----
```

$1964_{10} = 3654_8$

A.3.4. Integer Decimal to Octal

To convert a decimal integer to an octal integer:

1. Divide the decimal number by 8, using decimal arithmetic. The remainder becomes the least significant digit of the final octal result.

2. Repeat step 1, using the previous quotient as the new dividend. Each remainder becomes a digit of the final answer, in order of increasing significance.

3. The process is completed when a quotient of 0 is reached.

Example:

Convert 1964_{10} to the octal equivalent.

		REMAINDER
8 | 1 9 6 4		
8 | 2 4 5	4 ← LEAST SIGNIFICANT DIGIT	
8 | 3 0	5	
8 | 3	6	
0	3	

Result: 3654_8

A.3.5. Integer Binary to Decimal

The conversion may be performed by using the multiplication algorithm as described perviously for the octal to decimal conversion, with 2 as the multiplier. However, it is simpler to convert the binary number to octal and then to decimal.

A.3.6. Integer Decimal to Binary

The conversion may be performed by using the division algorithm as described for the decimal to octal conversion, with 2 as the divisor. However, it is simpler to convert the decimal number to octal and then to binary.

A.3.7. Fraction Binary to Octal

The conversion is the same as for integers. The division into triads begins at the binary point and proceeds from left to right.

A.3.8. Fraction Octal to Binary

The conversion is the same as for integers.

A.3.9. Fraction Octal to Decimal

The digits are the numerators of a series of fractions when denominators are successive powers of 8. The sum of the fractions can then be reduced to a decimal fraction. Decimal arithmetic is used.

Example:

Convert $.14_8$ to the decimal equivalent.

$$.14_8 = \frac{1}{8} + \frac{4}{64}$$

$$= \frac{8}{64} + \frac{4}{64}$$

$$= \frac{3}{16}$$

$$= .1875_{10}$$

A.3.10 Fraction Decimal to Octal

Multiply the decimal number by 8. The successive overflows beyond the extent of the original number form the octal fraction.

Example:

Convert $.1875_{10}$ to the octal equivalent.

	.1875
	x8
1	.5000
	x8
4	.0000

$.14_8 = .1875_{10}$

A.3.11. Binary to Decimal – Decimal to Binary

These conversions are most efficiently performed through an intermediate conversion to octal.

The octal-decimal equivalents in Table A–1 provide a rapid means of converting from octal to decimal and vice versa. The range of the table is $0000 - 4095_{10}$ or $0000 - 7777_8$.

To convert a decimal number greater than 4095 to its octal equivalent, reduce the number to 4095, or less, by subtracting sufficient multiples of 4095. Convert this residue to octal by means of the table, and add 10000_8 for each multiple of 4095 which has been subtracted.

To convert an octal number greater than 7777 to the decimal equivalent, reduce the number to 7777 or less by subtracting sufficient multiples of 10000. Convert this residue to octal by means of the table, and add 4096_{10} for each multiple of 10000 which has been subtracted.

OCTAL 0000 to 0777	DECIMAL 0000 to 0511							
	0	1	2	3	4	5	6	7
0000	0000	0001	0002	0003	0004	0005	0006	0007
0010	0008	0009	0010	0011	0012	0013	0014	0015
0020	0016	0017	0018	0019	0020	0021	0022	0023
0030	0024	0025	0026	0027	0028	0029	0030	0031
0040	0032	0033	0034	0035	0036	0037	0038	0039
0050	0040	0041	0042	0043	0044	0045	0046	0047
0060	0048	0049	0050	0051	0052	0053	0054	0055
0070	0056	0057	0058	0059	0060	0061	0062	0063
0100	0064	0065	0066	0067	0068	0069	0070	0071
0110	0072	0073	0074	0075	0076	0077	0078	0079
0120	0080	0081	0082	0083	0084	0085	0086	0087
0130	0088	0089	0090	0091	0092	0093	0094	0095
0140	0096	0097	0098	0099	0100	0101	0102	0103
0150	0104	0105	0106	0107	0108	0109	0110	0111
0160	0112	0113	0114	0115	0116	0117	0118	0119
0170	0120	0121	0122	0123	0124	0125	0126	0127
0200	0128	0129	0130	0131	0132	0133	0134	0135
0210	0136	0137	0138	0139	0140	0141	0142	0143
0220	0144	0145	0146	0147	0148	0149	0150	0151
0230	0152	0153	0154	0155	0156	0157	0158	0159
0240	0160	0161	0162	0163	0164	0165	0166	0167
0250	0168	0169	0170	0171	0172	0173	0174	0175
0260	0176	0177	0178	0179	0180	0181	0182	0183
0270	0184	0185	0186	0187	0188	0189	0190	0191
0300	0192	0193	0194	0195	0196	0197	0198	0199
0310	0200	0201	0202	0203	0204	0205	0206	0207
0320	0208	0209	0210	0211	0212	0213	0214	0215
0330	0216	0217	0218	0219	0220	0221	0222	0223
0340	0224	0225	0226	0227	0228	0229	0230	0231
0350	0232	0233	0234	0235	0236	0237	0238	0239
0360	0240	0241	0242	0243	0244	0245	0246	0247
0370	0248	0249	0250	0251	0252	0253	0254	0255
0400	0256	0257	0258	0259	0260	0261	0262	0263
0410	0264	0265	0266	0267	0268	0269	0270	0271
0420	0272	0273	0274	0275	0276	0277	0278	0279
0430	0280	0281	0282	0283	0284	0285	0286	0287
0440	0288	0289	0290	0291	0292	0293	0294	0295
0450	0296	0297	0298	0299	0300	0301	0302	0303
0460	0304	0305	0306	0307	0308	0309	0310	0311
0470	0312	0313	0314	0315	0316	0317	0318	0319
0500	0320	0321	0322	0323	0324	0325	0326	0327
0510	0328	0329	0330	0331	0332	0333	0334	0335
0520	0336	0337	0338	0339	0340	0341	0342	0343
0530	0344	0345	0346	0347	0348	0349	0350	0351
0540	0352	0353	0354	0355	0356	0357	0358	0359
0550	0360	0361	0362	0363	0364	0365	0366	0367
0560	0368	0369	0370	0371	0372	0373	0374	0375
0570	0376	0377	0378	0379	0380	0381	0382	0383
0600	0384	0385	0386	0387	0388	0389	0390	0391
0610	0392	0393	0394	0395	0396	0397	0398	0399
0620	0400	0401	0402	0403	0404	0405	0406	0407
0630	0408	0409	0410	0411	0412	0413	0414	0415
0640	0416	0417	0418	0419	0420	0421	0422	0423
0650	0424	0425	0426	0427	0428	0429	0430	0431
0660	0432	0433	0434	0435	0436	0437	0438	0439
0670	0440	0441	0442	0443	0444	0445	0446	0447
0700	0448	0449	0450	0451	0452	0453	0454	0455
0710	0456	0457	0458	0459	0460	0461	0462	0463
0720	0464	0465	0466	0467	0468	0469	0470	0471
0730	0472	0473	0474	0475	0476	0477	0478	0479
0740	0480	0481	0482	0483	0484	0485	0486	0487
0750	0488	0489	0490	0491	0492	0493	0494	0495
0760	0496	0497	0498	0499	0500	0501	0502	0503
0770	0504	0505	0506	0507	0508	0509	0510	0511

OCTAL 1000 to 1777	DECIMAL 0512 to 1023							
	0	1	2	3	4	5	6	7
1000	0512	0513	0514	0515	0516	0517	0518	0519
1010	0520	0521	0522	0523	0524	0525	0526	0527
1020	0528	0529	0530	0531	0532	0533	0534	0535
1030	0536	0537	0538	0539	0540	0541	0542	0543
1040	0544	0545	0546	0547	0548	0549	0550	0551
1050	0552	0553	0554	0555	0556	0557	0558	0559
1060	0560	0561	0562	0563	0564	0565	0566	0567
1070	0568	0569	0570	0571	0572	0573	0574	0575
1100	0576	0577	0578	0579	0580	0581	0582	0583
1110	0584	0585	0586	0587	0588	0589	0590	0591
1120	0592	0593	0594	0595	0596	0597	0598	0599
1130	0600	0601	0602	0603	0604	0605	0606	0607
1140	0608	0609	0610	0611	0612	0613	0614	0615
1150	0616	0617	0618	0619	0620	0621	0622	0623
1160	0624	0625	0626	0627	0628	0629	0630	0631
1170	0632	0633	0634	0635	0636	0637	0638	0639
1200	0640	0641	0642	0643	0644	0645	0646	0647
1210	0648	0649	0650	0651	0652	0653	0654	0655
1220	0656	0657	0658	0659	0660	0661	0662	0663
1230	0664	0665	0666	0667	0668	0669	0670	0671
1240	0672	0673	0674	0675	0676	0677	0678	0679
1250	0680	0681	0682	0683	0684	0685	0686	0687
1260	0688	0689	0690	0691	0692	0693	0694	0695
1270	0696	0697	0698	0699	0700	0701	0702	0703
1300	0704	0705	0706	0707	0708	0709	0710	0711
1310	0712	0713	0714	0715	0716	0717	0718	0719
1320	0720	0721	0722	0723	0724	0725	0726	0727
1330	0728	0729	0730	0731	0732	0733	0734	0735
1340	0736	0737	0738	0739	0740	0741	0742	0743
1350	0744	0745	0746	0747	0748	0749	0750	0751
1360	0752	0753	0754	0755	0756	0757	0758	0759
1370	0760	0761	0762	0763	0764	0765	0766	0767
1400	0768	0769	0770	0771	0772	0773	0774	0775
1410	0776	0777	0778	0779	0780	0781	0782	0783
1420	0784	0785	0786	0787	0788	0789	0790	0791
1430	0792	0793	0794	0795	0796	0797	0798	0799
1440	0800	0801	0802	0803	0804	0805	0806	0807
1450	0808	0809	0810	0811	0812	0813	0814	0815
1460	0816	0817	0818	0819	0820	0821	0822	0823
1470	0824	0825	0826	0827	0828	0829	0830	0831
1500	0832	0833	0834	0835	0836	0837	0838	0839
1510	0840	0841	0842	0843	0844	0845	0846	0847
1520	0848	0849	0850	0851	0852	0853	0854	0855
1530	0856	0857	0858	0859	0860	0861	0862	0863
1540	0864	0865	0866	0867	0868	0869	0870	0871
1550	0872	0873	0874	0875	0876	0877	0878	0879
1560	0880	0881	0882	0883	0884	0885	0886	0887
1570	0888	0889	0890	0891	0892	0893	0894	0895
1600	0896	0897	0898	0899	0900	0901	0902	0903
1610	0904	0905	0906	0907	0908	0909	0910	0911
1620	0912	0913	0914	0915	0916	0917	0918	0919
1630	0920	0921	0922	0923	0924	0925	0926	0927
1640	0928	0929	0930	0931	0932	0933	0934	0935
1650	0936	0937	0938	0939	0940	0941	0942	0943
1660	0944	0945	0946	0947	0948	0949	0950	0951
1670	0952	0953	0954	0955	0956	0957	0958	0959
1700	0960	0961	0962	0963	0964	0965	0966	0967
1710	0968	0969	0970	0971	0972	0973	0974	0975
1720	0976	0977	0978	0979	0980	0981	0982	0983
1730	0984	0985	0986	0987	0988	0989	0990	0991
1740	0992	0993	0994	0995	0996	0997	0998	0999
1750	1000	1001	1002	1003	1004	1005	1006	1007
1760	1008	1009	1010	1011	1012	1013	1014	1015
1770	1016	1017	1018	1019	1020	1021	1022	1023

Table A–1. Octal-Decimal Integer Conversion Table (Part 1 of 4)

OCTAL 2000 to 2777	DECIMAL 1024 to 1535

	0	1	2	3	4	5	6	7
2000	1024	1025	1026	1027	1028	1029	1030	1031
2010	1032	1033	1034	1035	1036	1037	1038	1039
2020	1040	1041	1042	1043	1044	1045	1046	1047
2030	1048	1049	1050	1051	1052	1053	1054	1055
2040	1056	1057	1058	1059	1060	1061	1062	1063
2050	1064	1065	1066	1067	1068	1069	1070	1071
2060	1072	1073	1074	1075	1076	1077	1078	1079
2070	1080	1081	1082	1083	1084	1085	1086	1087
2100	1088	1089	1090	1091	1092	1093	1094	1095
2110	1096	1097	1098	1099	1100	1101	1102	1103
2120	1104	1105	1106	1107	1108	1109	1110	1111
2130	1112	1113	1114	1115	1116	1117	1118	1119
2140	1120	1121	1122	1123	1124	1125	1126	1127
2150	1128	1129	1130	1131	1132	1133	1134	1135
2160	1136	1137	1138	1139	1140	1141	1142	1143
2170	1144	1145	1146	1147	1148	1149	1150	1151
2200	1152	1153	1154	1155	1156	1157	1158	1159
2210	1160	1161	1162	1163	1164	1165	1166	1167
2220	1168	1169	1170	1171	1172	1173	1174	1175
2230	1176	1177	1178	1179	1180	1181	1182	1183
2240	1184	1185	1186	1187	1188	1189	1190	1191
2250	1192	1193	1194	1195	1196	1197	1198	1199
2260	1200	1201	1202	1203	1204	1205	1206	1207
2270	1208	1209	1210	1211	1212	1213	1214	1215
2300	1216	1217	1218	1219	1220	1221	1222	1223
2310	1224	1225	1226	1227	1228	1229	1230	1231
2320	1232	1233	1234	1235	1236	1237	1238	1239
2330	1240	1241	1242	1243	1244	1245	1246	1247
2340	1248	1249	1250	1251	1252	1253	1254	1255
2350	1256	1257	1258	1259	1260	1261	1262	1263
2360	1264	1265	1266	1267	1268	1269	1270	1271
2370	1272	1273	1274	1275	1276	1277	1278	1279
2400	1280	1281	1282	1283	1284	1285	1286	1287
2410	1288	1289	1290	1291	1292	1293	1294	1295
2420	1296	1297	1298	1299	1300	1301	1302	1303
2430	1304	1305	1306	1307	1308	1309	1310	1311
2440	1312	1313	1314	1315	1316	1317	1318	1319
2450	1320	1321	1322	1323	1324	1325	1326	1327
2460	1328	1329	1330	1331	1332	1333	1334	1335
2470	1336	1337	1338	1339	1340	1341	1342	1343
2500	1344	1345	1346	1347	1348	1349	1350	1351
2510	1352	1353	1354	1355	1356	1357	1358	1359
2520	1360	1361	1362	1363	1364	1365	1366	1367
2530	1368	1369	1370	1371	1372	1373	1374	1375
2540	1376	1377	1378	1379	1380	1381	1382	1383
2550	1384	1385	1386	1387	1388	1389	1390	1391
2560	1392	1393	1394	1395	1396	1397	1398	1399
2570	1400	1401	1402	1403	1404	1405	1406	1407
2600	1408	1409	1410	1411	1412	1413	1414	1415
2610	1416	1417	1418	1419	1420	1421	1422	1423
2620	1424	1425	1426	1427	1428	1429	1430	1431
2630	1432	1433	1434	1435	1436	1437	1438	1439
2640	1440	1441	1442	1443	1444	1445	1446	1447
2650	1448	1449	1450	1451	1452	1453	1454	1455
2660	1456	1457	1458	1459	1460	1461	1462	1463
2670	1464	1465	1466	1467	1468	1469	1470	1471
2700	1472	1473	1474	1475	1476	1477	1478	1479
2710	1480	1481	1482	1483	1484	1485	1486	1487
2720	1488	1489	1490	1491	1492	1493	1494	1495
2730	1496	1497	1498	1499	1500	1501	1502	1503
2740	1504	1505	1506	1507	1508	1509	1510	1511
2750	1512	1513	1514	1515	1516	1517	1518	1519
2760	1520	1521	1522	1523	1524	1525	1526	1527
2770	1528	1529	1530	1531	1532	1533	1534	1535

OCTAL 3000 to 3777	DECIMAL 1536 to 2047

	0	1	2	3	4	5	6	7
3000	1536	1537	1538	1539	1540	1541	1542	1543
3010	1544	1545	1546	1547	1548	1549	1550	1551
3020	1552	1553	1554	1555	1556	1557	1558	1559
3030	1560	1561	1562	1563	1564	1565	1566	1567
3040	1568	1569	1570	1571	1572	1573	1574	1575
3050	1576	1577	1578	1579	1580	1581	1582	1583
3060	1584	1585	1586	1587	1588	1589	1590	1591
3070	1592	1593	1594	1595	1596	1597	1598	1599
3100	1600	1601	1602	1603	1604	1605	1606	1607
3110	1608	1609	1610	1611	1612	1613	1614	1615
3120	1616	1617	1618	1619	1620	1621	1622	1623
3130	1624	1625	1626	1627	1628	1629	1630	1631
3140	1632	1633	1634	1635	1636	1637	1638	1639
3150	1640	1641	1642	1643	1644	1645	1646	1647
3160	1648	1649	1650	1651	1652	1653	1654	1655
3170	1656	1657	1658	1659	1660	1661	1662	1663
3200	1664	1665	1666	1667	1668	1669	1670	1671
3210	1672	1673	1674	1675	1676	1677	1678	1679
3220	1680	1681	1682	1683	1684	1685	1686	1687
3230	1688	1689	1690	1691	1692	1693	1694	1695
3240	1696	1697	1698	1699	1700	1701	1702	1703
3250	1704	1705	1706	1707	1708	1709	1710	1711
3260	1712	1713	1714	1715	1716	1717	1718	1719
3270	1720	1721	1722	1723	1724	1725	1726	1727
3300	1728	1729	1730	1731	1732	1733	1734	1735
3310	1736	1737	1738	1739	1740	1741	1742	1743
3320	1744	1745	1746	1747	1748	1749	1750	1751
3330	1752	1753	1754	1755	1756	1757	1758	1759
3340	1760	1761	1762	1763	1764	1765	1766	1767
3350	1768	1769	1770	1771	1772	1773	1774	1775
3360	1776	1777	1778	1779	1780	1781	1782	1783
3370	1784	1785	1786	1787	1788	1789	1790	1791
3400	1792	1793	1794	1795	1796	1797	1798	1799
3410	1800	1801	1802	1803	1804	1805	1806	1807
3420	1808	1809	1810	1811	1812	1813	1814	1815
3430	1816	1817	1818	1819	1820	1821	1822	1823
3440	1824	1825	1826	1827	1828	1829	1830	1831
3450	1832	1833	1834	1835	1836	1837	1838	1839
3460	1840	1841	1842	1843	1844	1845	1846	1847
3470	1848	1849	1850	1851	1852	1853	1854	1855
3500	1856	1857	1858	1859	1860	1861	1862	1863
3510	1864	1865	1866	1867	1868	1869	1870	1871
3520	1872	1873	1874	1875	1876	1877	1878	1879
3530	1880	1881	1882	1883	1884	1885	1886	1887
3540	1888	1889	1890	1891	1892	1893	1894	1895
3550	1896	1897	1898	1899	1900	1901	1902	1903
3560	1904	1905	1906	1907	1908	1909	1910	1911
3570	1912	1913	1914	1915	1916	1917	1918	1919
3600	1920	1921	1922	1923	1924	1925	1926	1927
3610	1928	1929	1930	1931	1932	1933	1934	1935
3620	1936	1937	1938	1939	1940	1941	1942	1943
3630	1944	1945	1946	1947	1948	1949	1950	1951
3640	1952	1953	1954	1955	1956	1957	1958	1959
3650	1960	1961	1962	1963	1964	1965	1966	1967
3660	1968	1969	1970	1971	1972	1973	1974	1975
3670	1976	1977	1978	1979	1980	1981	1982	1983
3700	1984	1985	1986	1987	1988	1989	1990	1991
3710	1992	1993	1994	1995	1996	1997	1998	1999
3720	2000	2001	2002	2003	2004	2005	2006	2007
3730	2008	2009	2010	2011	2012	2013	2014	2015
3740	2016	2017	2018	2019	2020	2021	2022	2023
3750	2024	2025	2026	2027	2028	2029	2030	2031
3760	2032	2033	2034	2035	2036	2037	2038	2039
3770	2040	2041	2042	2043	2044	2045	2046	2047

Table A–1. Octal-Decimal Integer Conversion Table (Part 2 of 4)

OCTAL 4000 to 4777	DECIMAL 2048 to 2559							
	0	1	2	3	4	5	6	7
4000	2048	2049	2050	2051	2052	2053	2054	2055
4010	2056	2057	2058	2059	2060	2061	2062	2063
4020	2064	2065	2066	2067	2068	2069	2070	2071
4030	2072	2073	2074	2075	2076	2077	2078	2079
4040	2080	2081	2082	2083	2084	2085	2086	2087
4050	2088	2089	2090	2091	2092	2093	2094	2095
4060	2096	2097	2098	2099	2100	2101	2102	2103
4070	2104	2105	2106	2107	2108	2109	2110	2111
4100	2112	2113	2114	2115	2116	2117	2118	2119
4110	2120	2121	2122	2123	2124	2125	2126	2127
4120	2128	2129	2130	2131	2132	2133	2134	2135
4130	2136	2137	2138	2139	2140	2141	2142	2143
4140	2144	2145	2146	2147	2148	2149	2150	2151
4150	2152	2153	2154	2155	2156	2157	2158	2159
4160	2160	2161	2162	2163	2164	2165	2166	2167
4170	2168	2169	2170	2171	2172	2173	2174	2175
4200	2176	2177	2178	2179	2180	2181	2182	2183
4210	2184	2185	2186	2187	2188	2189	2190	2191
4220	2192	2193	2194	2195	2196	2197	2198	2199
4230	2200	2201	2202	2203	2204	2205	2206	2207
4240	2208	2209	2210	2211	2212	2213	2214	2215
4250	2216	2217	2218	2219	2220	2221	2222	2223
4260	2224	2225	2226	2227	2228	2229	2230	2231
4270	2232	2233	2234	2235	2236	2237	2238	2239
4300	2240	2241	2242	2243	2244	2245	2246	2247
4310	2248	2249	2250	2251	2252	2253	2254	2255
4320	2256	2257	2258	2259	2260	2261	2262	2263
4330	2264	2265	2266	2267	2268	2269	2270	2271
4340	2272	2273	2274	2275	2276	2277	2278	2279
4350	2280	2281	2282	2283	2284	2285	2286	2287
4360	2288	2289	2290	2291	2292	2293	2294	2295
4370	2296	2297	2298	2299	2300	2301	2302	2303
4400	2304	2305	2306	2307	2308	2309	2310	2311
4410	2312	2313	2314	2315	2316	2317	2318	2319
4420	2320	2321	2322	2323	2324	2325	2326	2327
4430	2328	2329	2330	2331	2332	2333	2334	2335
4440	2336	2337	2338	2339	2340	2341	2342	2343
4450	2344	2345	2346	2347	2348	2349	2350	2351
4460	2352	2353	2354	2355	2356	2357	2358	2359
4470	2360	2361	2362	2363	2364	2365	2366	2367
4500	2368	2369	2370	2371	2372	2373	2374	2375
4510	2376	2377	2378	2379	2380	2381	2382	2383
4520	2384	2385	2386	2387	2388	2389	2390	2391
4530	2392	2393	2394	2395	2396	2397	2398	2399
4540	2400	2401	2402	2403	2404	2405	2406	2407
4550	2408	2409	2410	2411	2412	2413	2414	2415
4560	2416	2417	2418	2419	2420	2421	2422	2423
4570	2424	2425	2426	2427	2428	2429	2430	2431
4600	2432	2433	2434	2435	2436	2437	2438	2439
4610	2440	2441	2442	2443	2444	2445	2446	2447
4620	2448	2449	2450	2451	2452	2453	2454	2455
4630	2456	2457	2458	2459	2460	2461	2462	2463
4640	2464	2465	2466	2467	2468	2469	2470	2471
4650	2472	2473	2474	2475	2476	2477	2478	2479
4660	2480	2481	2482	2483	2484	2485	2486	2487
4670	2488	2489	2490	2491	2492	2493	2494	2495
4700	2496	2497	2498	2499	2500	2501	2502	2503
4710	2504	2505	2506	2507	2508	2509	2510	2511
4720	2512	2513	2514	2515	2516	2517	2518	2519
4730	2520	2521	2522	2523	2524	2525	2526	2527
4740	2528	2529	2530	2531	2532	2533	2534	2535
4750	2536	2537	2538	2539	2540	2541	2542	2543
4760	2544	2545	2546	2547	2548	2549	2550	2551
4770	2552	2553	2554	2555	2556	2557	2558	2559

OCTAL 5000 to 5777	DECIMAL 2560 to 3071							
	0	1	2	3	4	5	6	7
5000	2560	2561	2562	2563	2564	2565	2566	2567
5010	2568	2569	2570	2571	2572	2573	2574	2575
5020	2576	2577	2578	2579	2580	2581	2582	2583
5030	2584	2585	2586	2587	2588	2589	2590	2591
5040	2592	2593	2594	2595	2596	2597	2598	2599
5050	2600	2601	2602	2603	2604	2605	2606	2607
5060	2608	2609	2610	2611	2612	2613	2614	2615
5070	2616	2617	2618	2619	2620	2621	2622	2623
5100	2624	2625	2626	2627	2628	2629	2630	2631
5110	2632	2633	2634	2635	2636	2637	2638	2639
5120	2640	2641	2642	2643	2644	2645	2646	2647
5130	2648	2649	2650	2651	2652	2653	2654	2655
5140	2656	2657	2658	2659	2660	2661	2662	2663
5150	2664	2665	2666	2667	2668	2669	2670	2671
5160	2672	2673	2674	2675	2676	2677	2678	2679
5170	2680	2681	2682	2683	2684	2685	2686	2687
5200	2688	2689	2690	2691	2692	2693	2694	2695
5210	2696	2697	2698	2699	2700	2701	2702	2703
5220	2704	2705	2706	2707	2708	2709	2710	2711
5230	2712	2713	2714	2715	2716	2717	2718	2719
5240	2720	2721	2722	2723	2724	2725	2726	2727
5250	2728	2729	2730	2731	2732	2733	2734	2735
5260	2736	2737	2738	2739	2740	2741	2742	2743
5270	2744	2745	2746	2747	2748	2749	2750	2751
5300	2752	2753	2754	2755	2756	2757	2758	2759
5310	2760	2761	2762	2763	2764	2765	2766	2767
5320	2768	2769	2770	2771	2772	2773	2774	2775
5330	2776	2777	2778	2779	2780	2781	2782	2783
5340	2784	2785	2786	2787	2788	2789	2790	2791
5350	2792	2793	2794	2795	2796	2797	2798	2799
5360	2800	2801	2802	2803	2804	2805	2806	2807
5370	2808	2809	2810	2811	2812	2813	2814	2815
5400	2816	2817	2818	2819	2820	2821	2822	2823
5410	2824	2825	2826	2827	2828	2829	2830	2831
5420	2832	2833	2834	2835	2836	2837	2838	2839
5430	2840	2841	2842	2843	2844	2845	2846	2847
5440	2848	2849	2850	2851	2852	2853	2854	2855
5450	2856	2857	2858	2859	2860	2861	2862	2863
5460	2864	2865	2866	2867	2868	2869	2870	2871
5470	2872	2873	2874	2875	2876	2877	2878	2879
5500	2880	2881	2882	2883	2884	2885	2886	2887
5510	2888	2889	2890	2891	2892	2893	2894	2895
5520	2896	2897	2898	2899	2900	2901	2902	2903
5530	2904	2905	2906	2907	2908	2909	2910	2911
5540	2912	2913	2914	2915	2916	2917	2918	2919
5550	2920	2921	2922	2923	2924	2925	2926	2927
5560	2928	2929	2930	2931	2932	2933	2934	2935
5570	2936	2937	2938	2939	2940	2941	2942	2943
5600	2944	2945	2946	2947	2948	2949	2950	2951
5610	2952	2953	2954	2955	2956	2957	2958	2959
5620	2960	2961	2962	2963	2964	2965	2966	2967
5630	2968	2969	2970	2971	2972	2973	2974	2975
5640	2976	2977	2978	2979	2980	2981	2982	2983
5650	2984	2985	2986	2987	2988	2989	2990	2991
5660	2992	2993	2994	2995	2996	2997	2998	2999
5670	3000	3001	3002	3003	3004	3005	3006	3007
5700	3008	3009	3010	3011	3012	3013	3014	3015
5710	3016	3017	3018	3019	3020	3021	3022	3023
5720	3024	3025	3026	3027	3028	3029	3030	3031
5730	3032	3033	3034	3035	3036	3037	3038	3039
5740	3040	3041	3042	3043	3044	3045	3046	3047
5750	3048	3049	3050	3051	3052	3053	3054	3055
5760	3056	3057	3058	3059	3060	3061	3062	3063
5770	3064	3065	3066	3067	3068	3069	3070	3071

Table A–1. Octal-Decimal Integer Conversion Table (Part 3 of 4)

OCTAL 6000 to 6777	DECIMAL 3072 to 3583							
	0	1	2	3	4	5	6	7
6000	3072	3073	3074	3075	3076	3077	3078	3079
6010	3080	3081	3082	3083	3084	3085	3086	3087
6020	3088	3089	3090	3091	3092	3093	3094	3095
6030	3096	3097	3098	3099	3100	3101	3102	3103
6040	3104	3105	3106	3107	3108	3109	3110	3111
6050	3112	3113	3114	3115	3116	3117	3118	3119
6060	3120	3121	3122	3123	3124	3125	3126	3127
6070	3128	3129	3130	3131	3132	3133	3134	3135
6100	3136	3137	3138	3139	3140	3141	3142	3143
6110	3144	3145	3146	3147	3148	3149	3150	3151
6120	3152	3153	3154	3155	3156	3157	3158	3159
6130	3160	3161	3162	3163	3164	3165	3166	3167
6140	3168	3169	3170	3171	3172	3173	3174	3175
6150	3176	3177	3178	3179	3180	3181	3182	3183
6160	3184	3185	3186	3187	3188	3189	3190	3191
6170	3192	3193	3194	3195	3196	3197	3198	3199
6200	3200	3201	3202	3203	3204	3205	3206	3207
6210	3208	3209	3210	3211	3212	3213	3214	3215
6220	3216	3217	3218	3219	3220	3221	3222	3223
6230	3224	3225	3226	3227	3228	3229	3230	3231
6240	3232	3233	3234	3235	3236	3237	3238	3239
6250	3240	3241	3242	3243	3244	3245	3246	3247
6260	3248	3249	3250	3251	3252	3253	3254	3255
6270	3256	3257	3258	3259	3260	3261	3262	3263
6300	3264	3265	3266	3267	3268	3269	3270	3271
6310	3272	3273	3274	3275	3276	3277	3278	3279
6320	3280	3281	3282	3283	3284	3285	3286	3287
6330	3288	3289	3290	3291	3292	3293	3294	3295
6340	3296	3297	3298	3299	3300	3301	3302	3303
6350	3304	3305	3306	3307	3308	3309	3310	3311
6360	3312	3313	3314	3315	3316	3317	3318	3319
6370	3320	3321	3322	3323	3324	3325	3326	3327
6400	3328	3329	3330	3331	3332	3333	3334	3335
6410	3336	3337	3338	3339	3340	3341	3342	3343
6420	3344	3345	3346	3347	3348	3349	3350	3351
6430	3352	3353	3354	3355	3356	3357	3358	3359
6440	3360	3361	3362	3363	3364	3365	3366	3367
6450	3368	3369	3370	3371	3372	3373	3374	3375
6460	3376	3377	3378	3379	3380	3381	3382	3383
6470	3384	3385	3386	3387	3388	3389	3390	3391
6500	3392	3393	3394	3395	3396	3397	3398	3399
6510	3400	3401	3402	3403	3404	3405	3406	3407
6520	3408	3409	3410	3411	3412	3413	3414	3415
6530	3416	3417	3418	3419	3420	3421	3422	3423
6540	3424	3425	3426	3427	3428	3429	3430	3431
6550	3432	3433	3434	3435	3436	3437	3438	3439
6560	3440	3441	3442	3443	3444	3445	3446	3447
6570	3448	3449	3450	3451	3452	3453	3454	3455
6600	3456	3457	3458	3459	3460	3461	3462	3463
6610	3464	3465	3466	3467	3468	3469	3470	3471
6620	3472	3473	3474	3475	3476	3477	3478	3479
6630	3480	3481	3482	3483	3484	3485	3486	3487
6640	3488	3489	3490	3491	3492	3493	3494	3495
6650	3496	3497	3498	3499	3500	3501	3502	3503
6660	3504	3505	3506	3507	3508	3509	3510	3511
6670	3512	3513	3514	3515	3516	3517	3518	3519
6700	3520	3521	3522	3523	3524	3525	3526	3527
6710	3528	3529	3530	3531	3532	3533	3534	3535
6720	3536	3537	3538	3539	3540	3541	3542	3543
6730	3544	3545	3546	3547	3548	3549	3550	3551
6740	3552	3553	3554	3555	3556	3557	3558	3559
6750	3560	3561	3562	3563	3564	3565	3566	3567
6760	3568	3569	3570	3571	3572	3573	3574	3575
6770	3576	3577	3578	3579	3580	3581	3582	3583

OCTAL 7000 to 7777	DECIMAL 3584 to 4095							
	0	1	2	3	4	5	6	7
7000	3584	3585	3586	3587	3588	3589	3590	3591
7010	3592	3593	3594	3595	3596	3597	3598	3599
7020	3600	3601	3602	3603	3604	3605	3606	3607
7030	3608	3609	3610	3611	3612	3613	3614	3615
7040	3616	3617	3618	3619	3620	3621	3622	3623
7050	3624	3625	3626	3627	3628	3629	3630	3631
7060	3632	3633	3634	3635	3636	3637	3638	3639
7070	3640	3641	3642	3643	3644	3645	3646	3647
7100	3648	3649	3650	3651	3652	3653	3654	3655
7110	3656	3657	3658	3659	3660	3661	3662	3663
7120	3664	3665	3666	3667	3668	3669	3670	3671
7130	3672	3673	3674	3675	3676	3677	3678	3679
7140	3680	3681	3682	3683	3684	3685	3686	3687
7150	3688	3689	3690	3691	3692	3693	3694	3695
7160	3696	3697	3698	3699	3700	3701	3702	3703
7170	3704	3705	3706	3707	3708	3709	3710	3711
7200	3712	3713	3714	3715	3716	3717	3718	3719
7210	3720	3721	3722	3723	3724	3725	3726	3727
7220	3728	3729	3730	3731	3732	3733	3734	3735
7230	3736	3737	3738	3739	3740	3741	3742	3743
7240	3744	3745	3746	3747	3748	3749	3750	3751
7250	3752	3753	3754	3755	3756	3757	3758	3759
7260	3760	3761	3762	3763	3764	3765	3766	3767
7270	3768	3769	3770	3771	3772	3773	3774	3775
7300	3776	3777	3778	3779	3780	3781	3782	3783
7310	3784	3785	3786	3787	3788	3789	3790	3791
7320	3792	3793	3794	3795	3796	3797	3798	3799
7330	3800	3801	3802	3803	3804	3805	3806	3807
7340	3808	3809	3810	3811	3812	3813	3814	3815
7350	3816	3817	3818	3819	3820	3821	3822	3823
7360	3824	3825	3826	3827	3828	3829	3830	3831
7370	3832	3833	3834	3835	3836	3837	3838	3839
7400	3840	3841	3842	3843	3844	3845	3846	3847
7410	3848	3849	3850	3851	3852	3853	3854	3855
7420	3856	3857	3858	3859	3860	3861	3862	3863
7430	3864	3865	3866	3867	3868	3869	3870	3871
7440	3872	3873	3874	3875	3876	3877	3878	3879
7450	3880	3881	3882	3883	3884	3885	3886	3887
7460	3888	3889	3890	3891	3892	3893	3894	3895
7470	3896	3897	3898	3899	3900	3901	3902	3903
7500	3904	3905	3906	3907	3908	3909	3910	3911
7510	3912	3913	3914	3915	3916	3917	3918	3919
7520	3920	3921	3922	3923	3924	3925	3926	3927
7530	3928	3929	3930	3931	3932	3933	3934	3935
7540	3936	3937	3938	3939	3940	3941	3942	3943
7550	3944	3945	3946	3947	3948	3949	3950	3951
7560	3952	3953	3954	3955	3956	3957	3958	3959
7570	3960	3961	3962	3963	3964	3965	3966	3967
7600	3968	3969	3970	3971	3972	3973	3974	3975
7610	3976	3977	3978	3979	3980	3981	3982	3983
7620	3984	3985	3986	3987	3988	3989	3990	3991
7630	3992	3993	3994	3995	3996	3997	3998	3999
7640	4000	4001	4002	4003	4004	4005	4006	4007
7650	4008	4009	4010	4011	4012	4013	4014	4015
7660	4016	4017	4018	4019	4020	4021	4022	4023
7670	4024	4025	4026	4027	4028	4029	4030	4031
7700	4032	4033	4034	4035	4036	4037	4038	4039
7710	4040	4041	4042	4043	4044	4045	4046	4047
7720	4048	4049	4050	4051	4052	4053	4054	4055
7730	4056	4057	4058	4059	4060	4061	4062	4063
7740	4064	4065	4066	4067	4068	4069	4070	4071
7750	4072	4073	4074	4075	4076	4077	4078	4079
7760	4080	4081	4082	4083	4084	4085	4086	4087
7770	4088	4089	4090	4091	4092	4093	4094	4095

Table A–1. Octal-Decimal Integer Conversion Table (Part 4 of 4)

CUT

Comments concerning this manual may be made in the space provided below. Please fill in the requested information.

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