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BASIC DISC SUPPORT PROGRAMS FOR MAN-MACHINE  
COMMUNICATIONS STUDIES

- J. K. PULFER -

OTTAWA

NOVEMBER 1968

## **ABSTRACT**

Programs developed for the handling of disc files in a man-machine communication environment on a small computer are described. The programs make use of modified versions of the disc software supplied by the manufacturer of the computer. The software is particularly oriented towards facilitating the storage on disc of files of data generated by graphical display programs.

## PREFACE

This report is one of a series describing programming support for a digital computer used by the Radio and Electrical Engineering Division. The computer, Model 840A, manufactured by Systems Engineering Laboratories Inc., is being employed as a tool for research in computer usage problems. It is not used for computation or for scientific or business data processing. Specific areas of interest include; man-machine communications using graphical CRT displays, time sharing and multiprogramming problems on small computers, analysis and synthesis of sound including speech and music, three-dimensional graphic construction and manipulation, and the production of animated films.

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## BASIC DISC SUPPORT PROGRAMS FOR MAN-MACHINE COMMUNICATIONS STUDIES

— J.K. Pulfer —

### Introduction

This report will describe some of the software used on the 840A digital computer in this Division. The programs are particularly oriented toward facilitating the storage on disc of files of data generated by graphical display programs.

To understand the programs and their descriptions in detail, some familiarity with the 840A computer and its supporting software is required. This can be obtained from programming and hardware reference manuals supplied by the manufacturer, and from NRC report ERB-794 entitled 'Support Programming for a Small Research Computer', by J.K. Pulfer and M. Wein.

By way of introduction, the computer is being used not for computation, or for scientific or business data processing, but rather as a tool to do basic research in computer usage problems. One such area of research is man-machine communications using a graphical display. Other peripheral equipment available to the system includes a magnetic tape unit, two high-speed paper-tape reader punch systems, several typewriters, and assorted analog and digital interface equipment. Figure 1 shows a block diagram of the central processing unit and peripheral equipment.

The disc file used by the SEL 840A (Control Data Model) has the following pertinent specifications:

Total number of 24 bit words stored	1,024,000
Number of cylinders	100
Number of heads per cylinder	10
Number of sectors per track	16
Number of words per sector	64
Maximum transfer rate	52,083 words/sec
Time to move to adjacent cylinder	0.03 sec
Maximum time to access any cylinder	0.165 sec
Maximum time to access any sector on a cylinder	0.025 sec

Transfer of data blocks between disc and core is usually controlled by hardware which steals memory cycles from the central processing unit (CPU). The hardware is called a block transfer control unit (BTC).

Transfers may also be done under program control by executing input/output (I/O) instructions (non-BTC transfer).

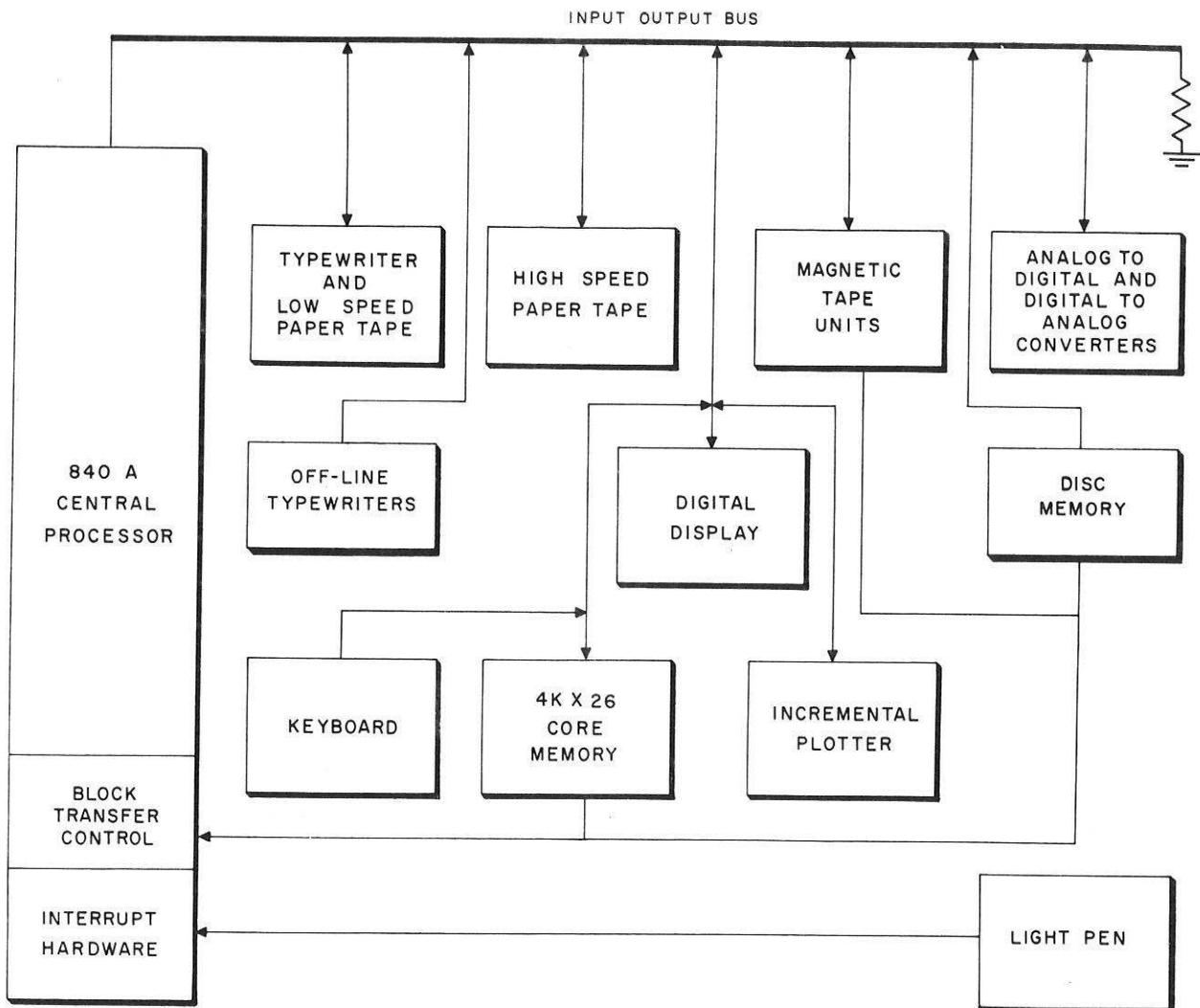


Fig. 1 Simplified block diagram of 840A processor

### SEL Executive Software

The SEL executive system which is being used on the 840A computer at the present time (November 1967 version) has several functions which must be explained before proceeding to a discussion of programs.

An operator seated at the console teletype communicates to the system executive his commands for transfer of records between the central processor and various pieces of peripheral equipment. The peripheral devices are identified in the commands by logical device numbers. In a disc-oriented system for example, logical device numbers might be assigned as follows:

Console TTY paper tape	$2_8$
High-speed paper tape	$3_8$
CRT display	$4_8$
Flexowriter	$5_8$
Disc library 06	$6_8$
Disc library 07	$7_8$
Disc library 10	$10_8$
Disc library 11	$11_8$
Disc library 12	$12_8$
Disc small scratch area (13)	$13_8$
Disc large scratch area (14)	$14_8$
Disc subroutine library (15)	$15_8$
Disc system library (16)	$16_8$

The subscript 8 indicates that the number is in octal notation.

Notice that, in this particular assignment, nine of the fourteen device numbers are used for nine different areas on a single device — the disc storage unit. Figure 2 is a schematic illustration of the I/O program system.

The disc software as supplied by the manufacturer consisted of the following programs:

- (1) A disc diagnostic exerciser SEL No. 463001A which checks the various aspects of disc hardware performance.
- (2) A disc bootstrap program — SEL No. 460008A which allows the user to generate a set of executive programs based on a system of disc libraries for which the directories are also stored on disc.
- (3) A disc directory ‘handler’ program SEL No. 460009A which allows the user to search and modify entries in the disc directory.
- (4) A non-BTC disc ‘handler’ program SEL No. 460003B which allows the user to transfer data between any location in core and any location on disc in blocks. The disc is addressable by track, sector, and head, and the minimum disc area which can be read from or written into is one sector. This handler also provides for positioning of the disc at a given sector and automatic incrementing of track, sector, and head as necessary during data transfers. Data is transferred by programmed I/O instructions rather than by block transfer hardware.
- (5) A BTC disc handler program, SEL No. 460007A which provides all the facilities of (4) above but which is also designed to manipulate files within

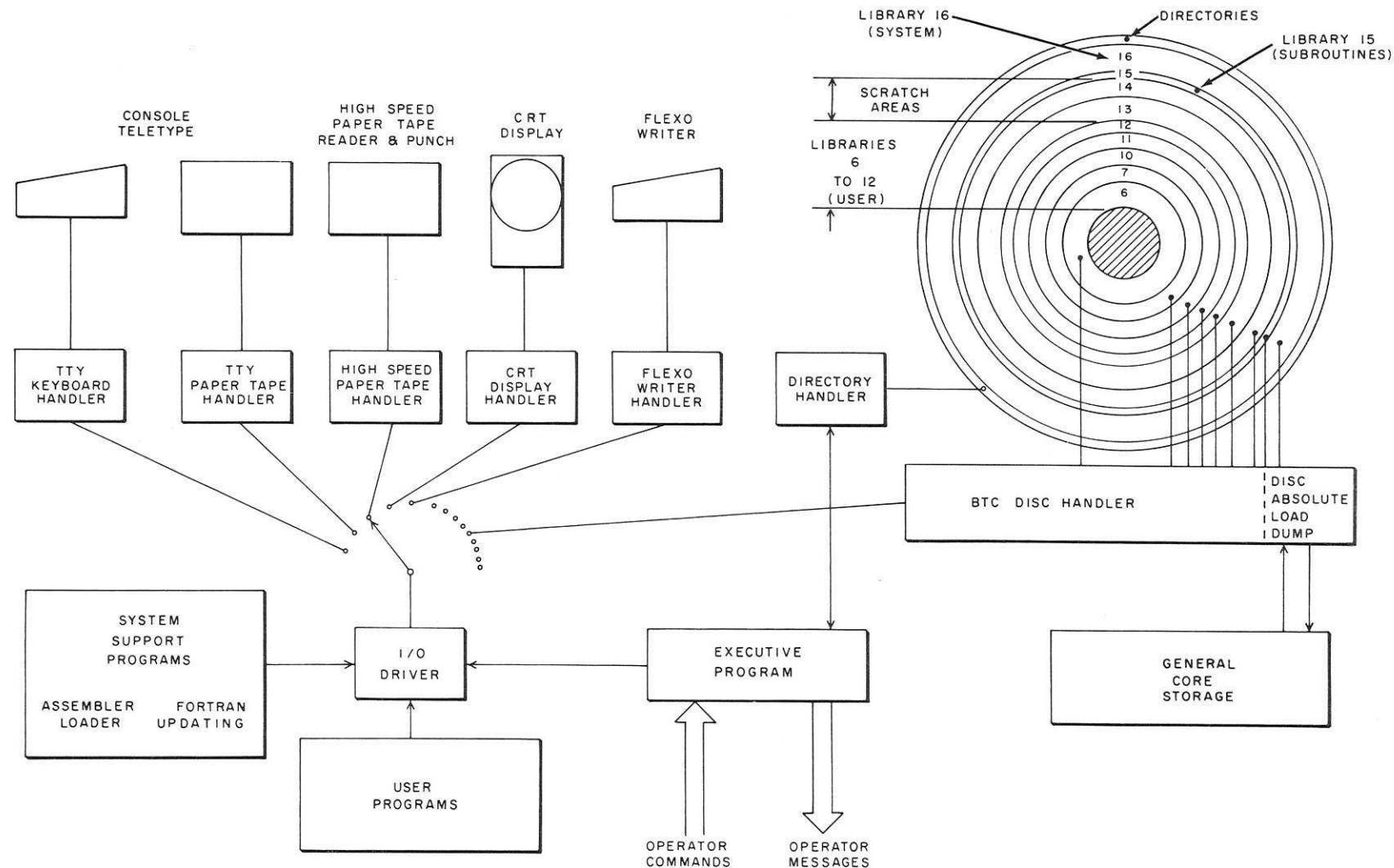


Fig. 2 A schematic illustration of input/output programming

an executive system. Files may be named and dumped in absolute form on disc and may be loaded in the same form. The necessary manipulation of the directory is also taken care of by the BTC disc handler. Data transfers are made under block transfer control in a cycle stealing mode as implied by the name of the program.

The executive system (including the SEL No. 460007A disc handler and SEL No. 460009A directory handler program) is specifically written so that LDN (logical device number)  $16_8$  is the system library and is different from all other devices. Library  $16_8$  is located in the 10 outer cylinders of the disc which also contain directories for all 9 libraries. The disc handler is capable of performing absolute load-dump operations (single-file core-image transfers between disc and core) for logical device  $16_8$  only. These core-image transfers are identified on disc as named files where the name consists of four ASCII characters.

Although the directory handler and directories on disc are capable of keeping track of named files on all nine libraries, the system (because of the way the BTC handler is written) allows such transfers for logical device  $16_8$  only.

In addition to data transfer commands, the system executive has device control or program control commands.

HOME initializes the BTC disc handler and mechanically positions disc heads to cylinder zero.

GOTO transfers control to a program in core memory whose starting address is specified by the octal digits following the GOTO command.

EOF. results in an end of file record being written on the device specified.

There are many other similar commands which it is not necessary to describe for the purposes of this report and are, therefore, not included here.

## Disc Software

There are four important functions of disc software required in man-machine communication studies which are not provided by the SEL programs as described above. These are:

The ability to transfer any given sector of the disc to any given 64-word area in core, and vice versa, with a simple program using control switches and preset registers, as is done in the SEL absolute paper-tape system.

The ability to isolate program development areas and scratch areas on the disc from user files on disc, so that neither can overwrite the other. This is illustrated schematically in Figs. 3 and 4.

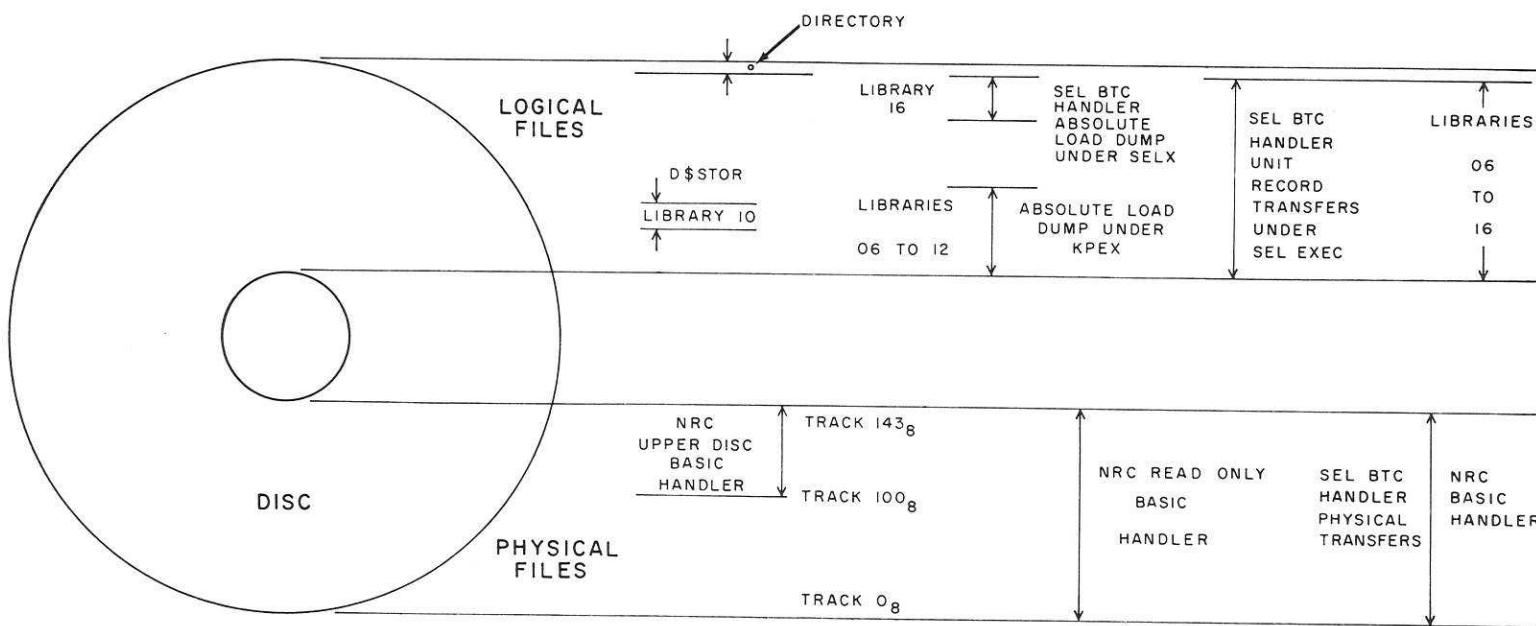


Fig. 3 A comparison of physical and logical storage of system and user information on disc

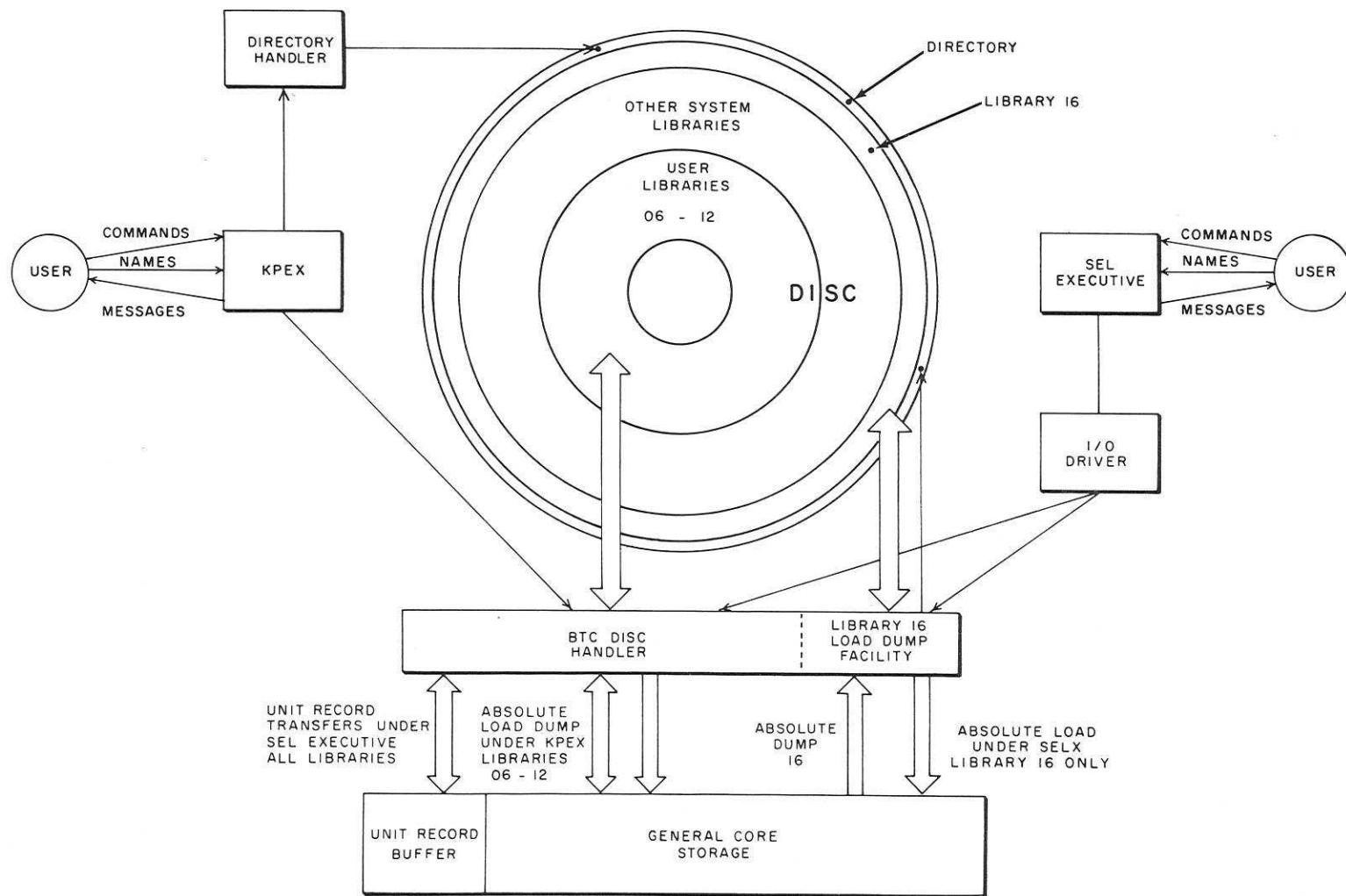


Fig. 4 A comparison of the operation of executive programs KPEX and SELX

The ability to transfer rapidly the contents of disc libraries to magnetic tape for long-term backup storage. For this use, large blocks are necessary for speed and convenience as well as for efficient packing on magnetic tape.

The ability to build up files on disc, and to access, delete, and modify them, for the case where the files are generated by the computer, and the user is not aware of their size or location in core or on disc. This description applies particularly to files generated by the computer in the process of drawing and manipulating graphical images on a cathode-ray tube display.

The programs included in this report were written to meet the above requirements.

### Basic Handler Programs

Three versions of the SEL non-BTC handler are listed under the name of DISC in the program library catalog No. 1058 in Appendix 1.

For each of these versions, the handler was modified so that the track address would be split up into bits 5-7 and bits 16-19 in the seek command word. In addition, the *home* track sector and head stored in the location SCRA + 1 was changed to track 100<sub>8</sub>, sector 0 and head 0. This means that an unintentional device positioning call to the non-BTC handler would cause the heads to be positioned at cylinder 100 rather than at cylinder 0 as in the SEL version. (The directory handler normally stores the directory for all libraries on cylinder zero and so this area must be protected from accidental erasure.)

The second (upper disc) version of the non-BTC handler merges a value of 1000000<sub>8</sub> with all seek command words. To the user, this means that only cylinders from 100<sub>8</sub> to 141<sub>8</sub> can be accessed when using this version of the handler. A user program which manipulates files using the upper disc handler would thus be prevented from overwriting the directory or systems library stored on the outer cylinders of the disc (see Fig. 3).

The third (read-only) version of the handler has been modified so that it can read from any sector on disc but can only write if a key instruction is added to the program in core. It is thus useful for disc-to-magnetic-tape transfers of systems programs and directories since it makes unintentional erasures of the disc more difficult to accomplish.

Two simple programs which call the basic handler are also listed under catalog No. 1058 in Appendix 1.

The first, DALD, is a disc absolute-load-dump program. The three words describing a core-to-disc or disc-to-core transfer are loaded into the control switches and A and B accumulators before starting the program. This program allows detailed manual manipulation and inspection of disc contents from the 840A control console.

The second program, D\$PNT, allows the basic handlers to be called and used by the standard system I/O driver. The problem of positioning the disc for a given transfer is turned over to the console operator by raising the message *LCS for track, sector, head* on the digital display. The operator then can set track, sector, and head for the beginning of the desired area on disc into the console control switches, and release the display to proceed with the file transfer.

BASIC DISC BTC HANDLER is a version of DISC converted for block transfer control operation. The disc area from cylinder 20 to cylinder 84 is available to this handler. The *home* track has been set to cylinder 20. Reinitialization after transfer of each sector is done by an interrupt routine. The interrupt is requested by the BTC hardware when a transfer is completed. The handler is used for real-time storage of data on disc. It can operate together with a handler for an analog-to-digital converter to digitize and store analog data at a rate of 10,000 samples per second using two buffers of  $2000_8$  words each of core storage.

D2TR (catalog No. 1065, Appendix 1) is a program which is used to transfer the contents of disc libraries and directories to magnetic tape for back-up storage. The program uses the read-only basic handler described above as well as the standard magnetic tape handler. Disc files are specified by library number and beginning and ending sector. Each dump consists of two or more records on magnetic tape. The first record contains the directory for the specified library. Each succeeding record contains 16 sectors of the library ( $2000_8$  words) except for the last which is also  $2000_8$  words but is padded as necessary with zeros. Each record contains a header with identification information and checksum.

In addition to disc-to-tape transfers, the program also verifies the tape records by means of checksums and can if desired transfer these records to the same area of disc from which they were dumped. In order to write on disc, the write key must be loaded into core.

### Programs Using the Advanced Handler (SEL BTC Handler)

KPEX (catalog No. 1061, Appendix 2) is a version of the SEL systems executive program modified for disc use only. The program can perform the functions of LIST, DELETE, and COMPRESS the directories for all disc libraries (06, 07, 10, 11, 12, 13, 14, 15, 16). It can also perform the functions HOME and GOTO. As explained previously, the SEL BTC handler is designed to dump and load core-image files only for the system library (16). Since libraries 13, 14, and 15 are also reserved for system use, KPEX was written so that it could dump on disc only in libraries 06, 07, 10, 11, and 12. KPEX can, however, load from any disc library into core (see Fig. 4).

To summarize, the NRC upper disc executive program (KPEX) allows the user to load and dump core-image modules on disc for libraries 06, 07, 10, 11, 12 which are not accessible to the systems executive, and at the same time prevents the user from writing

into libraries 13, 14, 15, and 16 which are reserved for system use. KPEX differs from programs such as DALD and D\$PNT in that KPEX works with logical libraries and logical files on the disc whereas DALD and D\$PNT deal with physical areas and physical files. Figures 3, 4 and 5 illustrate the basic differences between KPEX and other related programs.

The last program to be described – D\$STOR, D\$CORD, D\$WIPE (catalog No. 1063, Appendix 3) is a subroutine which can be called by user programs to manipulate logical files on disc.

Details of usage are given with the program listing and will not be repeated here. It is probably more instructive at this point to describe a typical situation in which D\$STOR would be used.

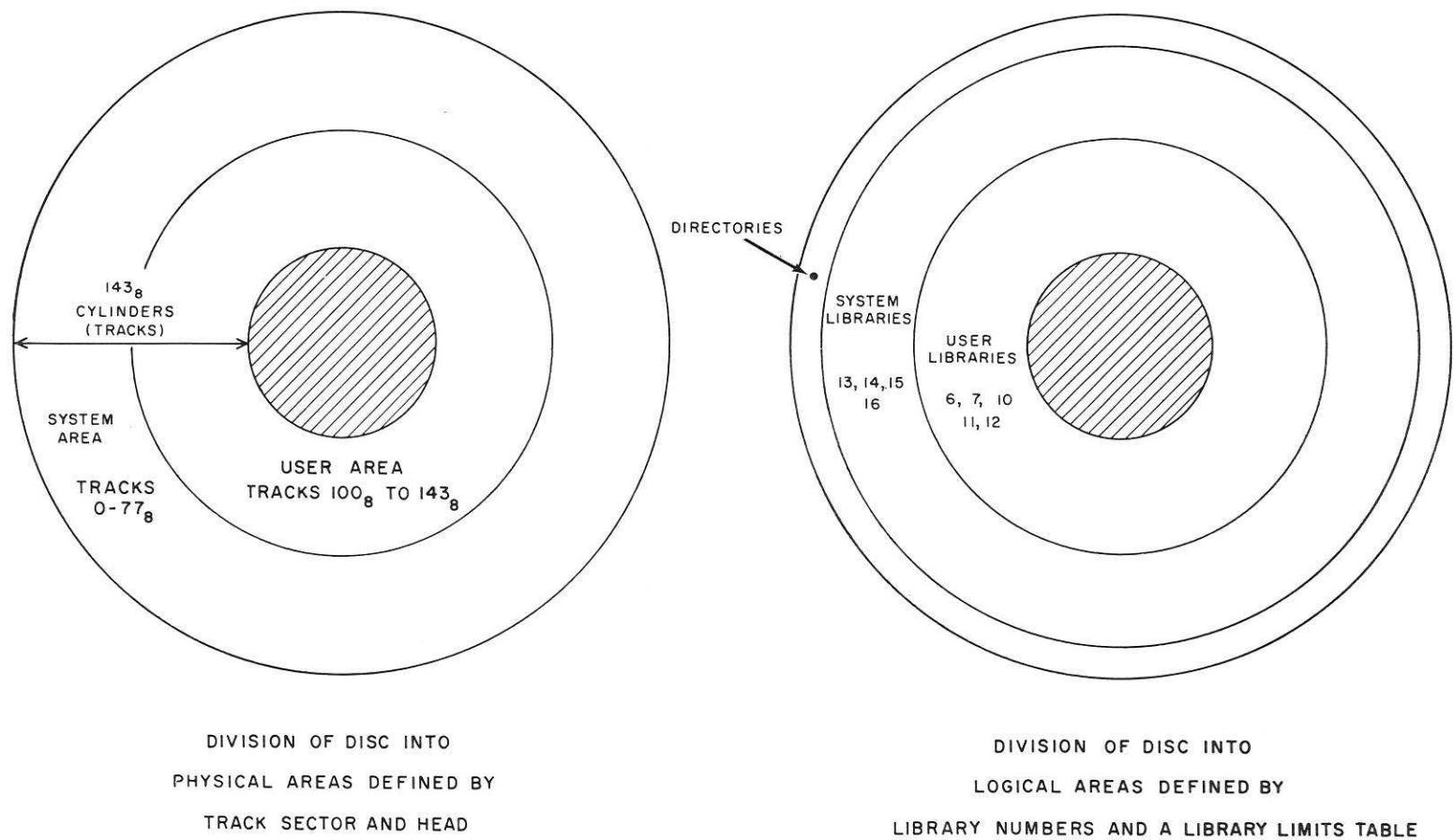
Suppose for example that a user has access to a computer and digital display, and a program exists which allows him to sit at the display and construct images which represent three-dimensional objects. As he constructs and manipulates images, the program builds up tables in core which specify the size, shape, orientation, position, and motion of each object. The size of each table and its location in core is not known to the user. Now suppose that the operator would like to temporarily store one or more images on disc while constructing or manipulating others. Suppose further that he would like to name the objects as they were stored, and at a later time to recall them from disc or delete them from the list in current use. It might also be desirable to load the tables or 'objects' into core at a location different from where they were dumped. Another useful function might also be to wipe clear all objects stored on disc in order to begin a new sequence, or to store on disc the current list of names so that recovery to the current status could be made at a later time.

All of the functions described above are made available to the user if his program calls the D\$STOR subroutine. In brief, he is presented with a list of names on the CRT to which he can add and from which he can select items for loading into core or deleting. More detailed descriptions of the calling sequences are given in Appendix 3.

#### Acknowledgment

Many of the programs described in this report are based on standard system support programming supplied by systems Engineering Laboratories Inc., the manufacturer of the 840A computer.

The author would like to acknowledge the help of his colleagues in the Data Systems Section during the preparation of this report.



*Fig. 5 An illustration of the areas of disc memory accessible to various programs*

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APPENDIX 1

DATA SYSTEMS PROGRAM LIBRARY

PROGRAM DESCRIPTION

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Catalog No. 1058

IDENTIFICATION: DISC, INCTSH, DALD, D\$PNT

AUTHOR: SEL + J.K. Pulfer

ACCEPTED: June 1968

- PURPOSE:
1. To correct SEL non-BTC disc handler so that it will operate with our 840A and disc.
  2. To provide flexible software for transfer of user programs and data between core and disc.
  3. To provide a read-only handler for use in transferring the executive system from disc to mag tape.
  4. To provide a user disc handler facility which is incapable of writing over the system area of the disc.

COMPUTER

CONFIGURATION:

SUBROUTINES  
REQUIRED:

None

STORAGE: DISC--206<sub>8</sub> to 211<sub>8</sub> depending on version  
INCTSH--52<sub>8</sub>

DALD--50<sub>8</sub>

D\$PNT--43<sub>8</sub>

TIMING:

DATA SYSTEMS PROGRAM LIBRARY

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Catalog No. 1058

USE:

A number of short programs have been written which allow a user to make core to disc transfers in a number of different ways. The programs all make use of corrected versions of the SEL disc I/O handler named DISC, and the increment track sector and head routine INCTSH.

DISC requires 206<sub>8</sub> locations and contains four entry points

DISC - called entry for transfer of data

SCRA - location storing the Hollerith word "SCRA"

SCRA+1 - location of "home" track sector and head

NATSH - location of next available track sector and head

Calling sequence is:      LAA LDN  
                              CALL DISC  
                              DAC BLOK  
                              DATA WCNT

where: BLOK is the beginning address of the block

WCNT is the number of words in the block

Three versions are available:

- (1) NRC corrected version giving full access to disc.
- (2) NRC Upper disc allowing read-write from cylinder 64 through cylinder 100 only.
- (3) Read only disc handler which allows read-only transfer from entire disc to core. Halts when write is attempted.

INCTSH

INCTSH is called as follows: LAA NATSH  
                              CALL INCTSH

It then increments the track sector or head as necessary and returns with the new value in the A accumulator.

DALD - Disc Absolute Load/Dump

The first load/dump program is called DISC ABSOLUTE LOAD/DUMP. It requires 35<sub>8</sub> locations. It is designed for manual operation from the control switches.

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DATA SYSTEMS PROGRAM LIBRARY

Page 3 of 3

Catalog No. 1058

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Procedure is: Load DALD into core at address X

- (1) set starting core address to be dumped in A register
- (2) set final address to be dumped in B register
- (3) set starting track, sector, and head in control switches
- (4) set program counter to X+1
- (5) push start twice to execute dump. The program will return to system executive at 7777.
- (6)

To transfer disc to core the procedure is:

- (1) set program counter to X
- (2) set control switches to beginning track, sector and head.
- (3) Press start twice.

Program returns to executive after transfer is complete. The program transferred from disc will go back to its previous absolute location in core.

D\$PNT Disc Handler Entry Routine

This small program (33<sub>8</sub> locations) allows the disc handler to be called by the system I/O driver. It is therefore called by:

LAA LDN  
CALL D\$PNT  
DAC BLOK  
DATA WCNT

D\$PNT then puts a message on the CRT asking for track, sector and head in the control switches. It then proceeds to call the disc handler DISC as outlined above. Once the program has been give T, S, H, set sense switch 0 for consecutive data transfers.

DISC I/O HANDLER NON-BTC

*****NRC CORRECTED NON BTC DISC I/O***			
0001			
0003	00000002	NAME	DISC,DISC
0004	00000115	NAME	SCRA,SCRA
0005	00000116	NAME	SCRA&1,SP1
0006	00000117	NAME	NATSH,NTSH
0007	00013	D	EQU '13
0008	00000	FWA1	BSS 2
0009	00002	DISC	ZZZ
0010	00003	STA	LDN
0011	00004	STI	IND1,1
0012	00005	STI	IND2,2
0013	00006	STI	IND3,3
0014	00007	LIX	DISC,2
0015	00010	LAA	0,2
0016	00011	STA	FWA1
0017	00012	LAA	1,2
0018	00013	AMX	=2,2
0019	00014	STI	DISC,2
0020	00015	BAZ	RD
0021	00016	BAP	IRW
0022	00017	LSL	2
0023	00020	STA	BUSY
0024	00021	RSL	2
0025	00022	MAA	=7777777
0026	00023	SMP	BUSY
0027	00024	BRU	IRW
0028	00025	BRU	ID
0029	00026	RD	LAA SP1
0030	00027	MAA	=7777777
0031	00030	00300117*	ID STA NTSH
0032	00031	01310013	CEU D,W
0033	00032	00000010	DATA '10
0034	00033	01200047*	SPB BUSY
0035	00034	02700205*	MAA =170000
0036	00035	00010015	RSL 8
0037	00036	03000204*	MOA =12
0038	00037	00300044*	STA BUSY-3
0039	00040	00100117*	LAA NTSH
0040	00041	02700203*	MAA =1600000
0041	00042	03100044*	AAM BUSY-3
0042	00043	01310013	CEU D,W
0043	00044	00000000	ZZZ
0044	00045	01200047*	SPB BUSY
0045	00046	01100110*	BRU EXIT
0046	00047	00000000	BUSY ZZZ
0047	00050	01320013	TEU D
0048	00051	00000002	DATA 2
0049	00052	01100050*	BRU *-2
0050	00053	41100047*	BRU* BUSY
0051	00054	05600000	IRW NEG
0052	00055	00300124*	STA TNWC
0053	00056	00100202*	LUP LAA =-64
0054	00057	01500124*	CMA TNWC
0055	00060	00100124*	LAA TNWC

DISC I/O HANDLER NON-BTC

0056	00061	00000022	NOP			
0057	00062	05600000	NEG			
0058	00063	00300125*	STA	WPS		
0059	00064	03100124*	AAM	TNWC		
0060		*	MOA	=*40000000	TERMINATE BTC BIT	
0061	00065	00300001*	STA	FWA1&1		
0062	00066	00100117*	LAA	NTSH		
0063	00067	02700201*	MAA	=*00007777		
0064	00070	00200200*	LBA	=0		
0065	00071	00004012	FRA	4		
0066	00072	00006016	LSL	6		
0067	00073	00010013	FLA	8		
0068	00074	03500123*	SMP	LDN		
0069	00075	01100100*	BRU	WRIT		
0070	00076	01200150*	SPB	RADS		
0071	00077	01100101*	BRU	RTN		
0072	00100	01200126*	WRIT	SPB	WADS	
0073	00101	00100125*	RTN	LAA	WPS	
0074	00102	03100000*	AAM	FWA1		
0075	00103	00100117*	LAA	NTSH		
0076			CALL	INCTSH		
0077	00105	00300117*	STA	NTSH		
0078	00106	03500124*	SMP	TNWC		
0079	00107	01100056*	BRU	LUP		
0080	00110	13200120*	EXIT	LIX	IND1,1	
0081	00111	23200121*	LIX	IND2,2		
0082	00112	33200122*	LIX	IND3,3		
0083	00113	00100117*	LAA	NTSH		
0084	00114	41100002*	BRU*	DISC		
0085	00115	23032201	SCRA	DATA	"SCRA"	
0086	00116	41000000	SP1	DATA	"41000000	
0087	00117	00000000	NTSH	ZZZ		
0088	00120	00000000	IND1	ZZZ		
0089	00121	00000000	IND2	ZZZ		
0090	00122	00000000	IND3	ZZZ		
0091	00123	00000000	LDN	ZZZ		
0092	00124	00000000	TNWC	ZZZ		
0093	00125	00000000	WPS	ZZZ		
0094	00126	00000000	WADS	ZZZ		
0095	00127	03000177*	MOA	=*00000002		
0096	00130	00300142*	STA	WAS1		
0097	00131	00100000*	LAA	FWA1		
0098	00132	00500001*	AMA	FWA1&1		
0099	00133	03000175*	MOA	=*10000000		
0100	00134	00300144*	STA	WAS2		
0101	00135	00100001*	LAA	FWA1&1		
0102	00136	05600000	NEG			
0103	00137	10000001	TAI	,1		
0104	00140	01200047*	SPB	BUSY		
0105	00141	01310013	CEU	D,W		
0106	00142	00000000	WAS1	DATA 0		
0107	00143	41750013	MOP*	D,W		
0108	00144	00000000	WAS2	*** **		
0109	00145	13400143*	IIB	WAS2-1,1		

DISC I/O HANDLER NON-BTC

0110	00146	01200047*	SPB	BUSY
0111	00147	41100126*	BRU*	WADS
0112	00150	00000000	RADS	ZZZ
0113	00151	03000176*	MOA	=*00000001
0114	00152	00300164*	STA	RAS1
0115	00153	00100000*	LAA	FWA1
0116	00154	00500001*	AMA	FWA1&1
0117	00155	03000175*	MOA	=*10000000
0118	00156	00300166*	STA	RAS2
0119	00157	00100001*	LAA	FWA1&1
0120	00160	05600000	NEG	
0121	00161	10000001	TAI	,1
0122	00162	01200047*	SPB	BUSY
0123	00163	01310013	CEU	D,W
0124	00164	00000000	RAS1	DATA 0
0125	00165	41770013	MIP*	D,W
0126	00166	00000000	RAS2	*** **
0127	00167	13400165*	IIB	RAS2-1,1
0128	00170	01200047*	SPB	BUSY
0129	00171	01320013	TEU	D
0130	00172	00000010	DATA	*10
0131	00173	00000000	HLT	
0132	00174	41100150*	BRU*	RADS
0133			END	
	00175	10000000		
	00176	00000001		
	00177	00000002		
	00200	00000000		
	00201	00007777		
	00202	77777700		
	00203	01600000		
	00204	00000012		
	00205	00170000		
	00206	07777777		

DISC I/O HANDLER NON-BTC

0001				**UPPER NRC DISC NON BTC IO***
0003	00000002			NAME DISC,DISC
0004	00000117			NAME SCRA,SCRA
0005	00000120			NAME SCRA&1,SP1
0006	00000121			NAME NATSH,NTSH
0007	00013	D	EQU	'13
0008	00000	FWA1	BSS	2
0009	00002	00000000	DISC	ZZZ
0010	00003	00300125*	STA	LDN
0011	00004	13300122*	STI	IND1,1
0012	00005	23300123*	STI	IND2,2
0013	00006	33300124*	STI	IND3,3
0014	00007	23200002*	LIX	DISC,2
0015	00010	20100000	LAA	0,2
0016	00011	00300000*	STA	FWA1
0017	00012	20100001	LAA	1,2
0018	00013	26100201*	AMX	=2,2
0019	00014	23300002*	STI	DISC,2
0020	00015	02200026*	BAZ	RD
0021	00016	02400056*	BAP	IRW
0022	00017	000002016	LSL	2
0023	00020	00300051*	STA	BUSY
0024	00021	000002015	RSL	2
0025	00022	02700211*	MAA	=7777777
0026	00023	03500051*	SMP	BUSY
0027	00024	01100056*	BRU	IRW
0028	00025	01100030*	BRU	ID
0029	00026	00100120*	RD	LAA SP1
0030	00027	02700211*	MAA	=7777777
0031	00030	00300121*	ID	STA NTSH
0032	00031	01310013	CEU	D,W
0033	00032	00000010	DATA	*10
0034	00033	01200051*	SPB	BUSY
0035	00034	03000210*	MOA	=1000000
0036	00035	00300121*	STA	NTSH
0037	00036	02700207*	MAA	=170000
0038	00037	00010015	RSL	8
0039	00040	03000206*	MOA	=12
0040	00041	00300046*	STA	BUSY-3
0041	00042	00100121*	LAA	NTSH
0042	00043	02700205*	MAA	=1600000
0043	00044	03100046*	AAM	BUSY-3
0044	00045	01310013	CEU	D,W
0045	00046	00000000	ZZZ	
0046	00047	01200051*	SPB	BUSY
0047	00050	01100112*	BRU	EXIT
0048	00051	00000000	BUSY	ZZZ
0049	00052	01320013	TEU	D
0050	00053	00000002	DATA	2
0051	00054	01100052*	BRU	*-2
0052	00055	41100051*	BRU*	BUSY
0053	00056	05600000	IRW	NEG
0054	00057	00300126*	STA	TNWC
0055	00060	00100204*	LUP	LAA =-64

DISC I/O HANDLER NON-BTC

0056	00061	01500126*	CMA	TNWC	
0057	00062	00100126*	LAA	TNWC	
0058	00063	00000022	NOP		
0059	00064	05600000	NEG		
0060	00065	00300127*	STA	WPS	
0061	00066	03100126*	AAM	TNWC	
0062		*	MOA	= '40000000	TERMINATE BTC BIT
0063	00067	00300001*	STA	FWA1&1	
0064	00070	00100121*	LAA	NTSH	
0065	00071	02700203*	MAA	= '00007777	
0066	00072	00200202*	LBA	= 0	
0067	00073	00004012	FRA	4	
0068	00074	00006016	LSL	6	
0069	00075	00010013	FLA	8	
0070	00076	03500125*	SMP	LDN	
0071	00077	01100102*	BRU	WRIT	
0072	00100	01200152*	SPB	RADS	
0073	00101	01100103*	BRU	RTN	
0074	00102	01200130*	WRIT	SPB	WADS
0075	00103	00100127*	RTN	LAA	WPS
0076	00104	03100000*	AAM	FWA1	
0077	00105	00100121*	LAA	NTSH	
0078			CALL	INCTSH	
0079	00107	00300121*	STA	NTSH	
0080	00110	03500126*	SMP	TNWC	
0081	00111	01100060*	BRU	LUP	
0082	00112	13200122*	EXIT	LIX	IND1,1
0083	00113	23200123*		LIX	IND2,2
0084	00114	33200124*		LIX	IND3,3
0085	00115	00100121*	LAA	NTSH	
0086	00116	41100002*	BRU*	DISC	
0087	00117	23032201	SCRA	DATA "SCRA"	
0088	00120	41000000	SP1	DATA '41000000	
0089	00121	00000000	NTSH	ZZZ	
0090	00122	00000000	IND1	.ZZZ	
0091	00123	00000000	IND2	.ZZZ	
0092	00124	00000000	IND3	.ZZZ	
0093	00125	00000000	LDN	.ZZZ	
0094	00126	00000000	TNWC	.ZZZ	
0095	00127	00000000	WPS	.ZZZ	
0096	00130	00000000	WADS	.ZZZ	
0097	00131	03000201*	MOA	= '00000002	
0098	00132	00300144*	STA	WAS1	
0099	00133	00100000*	LAA	FWA1	
0100	00134	00500001*	AMA	FWA1&1	
0101	00135	03000177*	MOA	= '10000000	
0102	00136	00300146*	STA	WAS2	
0103	00137	00100001*	LAA	FWA1&1	
0104	00140	05600000	NEG		
0105	00141	10000001	TAI	,1	
0106	00142	01200051*	SPB	BUSY	
0107	00143	01310013	CEU	D,W	
0108	00144	00000000	WAS1	DATA 0	
0109	00145	41750013	MOP*	D,W	

DISC I/O HANDLER NON-BTC

0110	00146	00000000	WAS2	***	**
0111	00147	13400145*	IIB	WAS2-1,1	
0112	00150	01200051*	SPB	BUSY	
0113	00151	41100130*	BRU*	WADS	
0114	00152	00000000	RADS	ZZZ	
0115	00153	03000200*	MOA	='00000001	
0116	00154	00300166*	STA	RAS1	
0117	00155	00100000*	LAA	FWA1	
0118	00156	00500001*	AMA	FWA1&1	
0119	00157	03000177*	MOA	='10000000	
0120	00160	00300170*	STA	RAS2	
0121	00161	00100001*	LAA	FWA1&1	
0122	00162	05600000	NEG		
0123	00163	10000001	TAI	,1	
0124	00164	01200051*	SPB	BUSY	
0125	00165	01310013	CEU	D,W	
0126	00166	00000000	RASI	DATA 0	
0127	00167	41770013	MIP*	D,W	
0128	00170	00000000	RAS2	***	**
0129	00171	13400167*	IIB	RAS2-1,1	
0130	00172	01200051*	SPB	BUSY	
0131	00173	01320013	TEU	D	
0132	00174	00000010	DATA	'10	
0133	00175	00000000	HLT		
0134	00176	41100152*	BRU*	RADS	
0135			END		
	00177	10000000			
	00200	00000001			
	00201	00000002			
	00202	00000000			
	00203	00007777			
	00204	77777700			
	00205	01600000			
	00206	00000012			
	00207	00170000			
	00210	01000000			
	00211	07777777			

DISC I/O HANDLER NON-BTC

0001		***READ ONLY NRC NON BTC DISC I/O***		
0002		***NRC CORRECTED NON BTC DISC I/O***		
0004	00000002	NAME	DISC,DISC	
0005	00000117	NAME	SCRA,SCRA	
0006	00000120	NAME	SCRA&1,SP1	
0007	00000121	NAME	NATSH,NTSH	
0008	00013	D	EQU	'13
0009	00000	FWA1	BSS	?2
0010	00002	00000000	DISC	ZZZ
0011	00003	00300125*	STA	LDN
0012	00004	13300122*	STI	IND1,1
0013	00005	23300123*	STI	IND2,2
0014	00006	33300124*	STI	IND3,3
0015	00007	23200002*	LTX	DISC,2
0016	00010	20100000	LAA	0,2
0017	00011	00300000*	STA	FWA1
0018	00012	20100001	LAA	1,2
0019	00013	26100201*	AMX	=2,2
0020	00014	23300002*	STI	DISC,2
0021	00015	02200026*	BAZ	RD
0022	00016	02400056*	BAP	IRW
0023	00017	00002016	LSL	?2
0024	00020	00300051*	STA	BUSY
0025	00021	00002015	RSL	?2
0026	00022	02700211*	MAA	=17777777
0027	00023	03500051*	SMP	BUSY
0028	00024	01100056*	BRU	IRW
0029	00025	01100030*	BRU	ID
0030	00026	00100120*	RD	LAA SP1
0031	00027	02700211*	MAA	=17777777
0032	00030	00300121*	TD	STA NTSH
0033	00031	01310013	CEU	D,W
0034	00032	00000010	DATA	'10
0035	00033	01200051*	SPB	BUSY
0036	00034	02700210*	MAA	=17770000
0037	00035	02200112*	BAZ	EXIT
0038	00036	02700207*	MAA	=1700000
0039	00037	00010015	RSL	?2
0040	00040	03000206*	MOA	=12
0041	00041	00300046*	STA	BUSY-3
0042	00042	00100121*	LAA	NTSH
0043	00043	02700205*	MAA	=1600000
0044	00044	03100046*	AAH	BUSY-3
0045	00045	01310013	CEU	D,W
0046	00046	00000000	ZZZ	
0047	00047	01200051*	SPB	BUSY
0048	00050	01100112*	BRU	EXIT
0049	00051	00000000	BUSY	ZZZ
0050	00052	01320013	TEU	D
0051	00053	00000002	DATA	?2
0052	00054	01100052*	BRU	=-2
0053	00055	41100051*	BRUX	BUSY
0054	00056	05600000	IRW	NEG
0055	00057	00300126*	STA	TNWC

DISC I/O HANDLER NON-BTC

0056	00060	00100204*	LUP	LAA	=-64
0057	00061	01500126*		CMA	TNWC
0058	00062	00100126*		LAA	TNWC
0059	00063	00000022		NOP	
0060	00064	05600000		NEG	
0061	00065	00300127*		STA	WPS
0062	00066	03100126*		AAM	TNWC
0063		*		MDA	= *40000000 TERMINATE BTC BIT
0064	00067	00300001*		STA	FWA1&1
0065	00070	00100121*		LAA	NTSH
0066	00071	02700203*		MAA	= *00007777
0067	00072	00200202*		LBA	=0
0068	00073	00004012		FRA	4
0069	00074	00006016		LSL	6
0070	00075	00010013		FLA	8
0071	00076	03500125*		SMP	LDN
0072	00077	00000000		HLT	
0073	00100	01200152*		SPB	RADS
0074	00101	01100103*		BRU	RTN
0075	00102	01200130*	WRIT	SPB	WADS
0076	00103	00100127*	RTN	LAA	WPS
0077	00104	03100000*		AAM	FWA1
0078	00105	00100121*		LAA	NTSH
0079				CALL	INCTSH
0080	00107	00300121*		STA	NTSH
0081	00110	03500126*		SMP	TNWC
0082	00111	01100060*		BRU	LUP
0083	00112	13200122*	EXIT	LIX	IND1,1
0084	00113	23200123*		LIX	IND2,2
0085	00114	33200124*		LIX	IND3,3
0086	00115	00100121*		LAA	NTSH
0087	00116	41100002*		BRU*	DISC
0088	00117	23032201	SCRA	DATA	"SCRA"
0089	00120	41000000	SP1	DATA	*41000000
0090	00121	00000000	NTSH	ZZZ	
0091	00122	00000000	IND1	ZZZ	
0092	00123	00000000	IND2	ZZZ	
0093	00124	00000000	IND3	ZZZ	
0094	00125	00000000	LDN	ZZZ	
0095	00126	00000000	TNWC	ZZZ	
0096	00127	00000000	WPS	ZZZ	
0097	00130	00000000	WADS	ZZZ	
0098	00131	03000201*		MDA	= *00000002
0099	00132	00300144*		STA	WAS1
0100	00133	00100000*		LAA	FWA1
0101	00134	00500001*		AMA	FWA1&1
0102	00135	03000177*		MDA	= *10000000
0103	00136	00300146*		STA	WAS2
0104	00137	00100001*		LAA	FWA1&1
0105	00140	05600000		NEG	
0106	00141	10000001		TAI	,1
0107	00142	01200051*		SPB	BUSY
0108	00143	01310013		CEU	D,W
0109	00144	00000000	WAS1	DATA	0

DISC I/O HANDLER NON-BTC

0110	00145	41750013	MOP*	D,W
0111	00146	00000000	WAS2	*** **
0112	00147	13400145*	IIB	WAS2-1,1
0113	00150	01200051*	SPB	BUSY
0114	00151	41100130*	BRU*	WADS
0115	00152	00000000	RADS	ZZZ
0116	00153	03000200*	MOA	= '00000001
0117	00154	00300166*	STA	RAS1
0118	00155	00100000*	LAA	FWA1
0119	00156	00500001*	AMA	FWA1&1
0120	00157	03000177*	MOA	= '10000000
0121	00160	00300170*	STA	RAS2
0122	00161	00100001*	LAA	FWA1&1
0123	00162	05600000	NEG	
0124	00163	10000001	TAI	,1
0125	00164	01200051*	SPB	BUSY
0126	00165	01310013	CEU	D,W
0127	00166	00000000	RAS1	DATA 0
0128	00167	41770013	MIP*	D,W
0129	00170	00000000	RAS2	*** **
0130	00171	13400167*	IIB	RAS2-1,1
0131	00172	01200051*	SPB	BUSY
0132	00173	01320013	TEU	D
0133	00174	00000010	DATA	'10
0134	00175	00000000	HLT	
0135	00176	41100152*	BRU*	RADS
0136			END	
	00177	10000000		
	00200	00000001		
	00201	00000002		
	00202	00000000		
	00203	00007777		
	00204	77777700		
	00205	01600000		
	00206	00000012		
	00207	00170000		
	00210	07770000		
	00211	07777777		

			NAME	INCTSH, ITSH
0001	00000000	D	EQU	'13
0002	00013*	ITSH	ZZZ	
0003	00000		AMA	= '100
0004	00001	00500052*	STA	TSH
0005	00002	00300037*	MAA	= '7700
0006	00003	02700051*	CMA	= '2000
0007	00004	01500050*	BRU	EXIT
0008	00005	01100035*	NOP	
0009	00006	00000022	LAA	= '7770077
0010	00007	00100047*	MAA	TSH
0011	00010	02700037*	=1	
0012	00011	00500046*	AMA	= 1
0013	00012	00300037*	STA	TSH
0014	00013	02700045*	MAA	= '77
0015	00014	01500044*	CMA	= '12
0016	00015	01100035*	BRU	EXIT
0017	00016	00000022	NOP	
0018	00017	00100043*	LAA	= '7777700
0019	00020	02700037*	MAA	TSH
0020	00021	00500042*	AMA	= '10000
0021	00022	00300037*	STA	TSH
0022	00023	02700041*	MAA	= '7770000
0023	00024	01500040*	CMA	= '1440000
0024	00025	01100030*	BRU	SEEK
0025	00026	00000022	NOP	
0026	00027	01100026*	BRU	*-1
0027	00030	01310013	SEEK	CEU D,W
0028	00031	00000032	DATA	'32
0029	00032	01320013	TEU	D
0030	00033	00000002	DATA	2
0031	00034	01100032*	BRU	*-2
0032	00035	00100037*	EXIT	LAA TSH
0033	00036	41100000*	BRU*	ITSH
0034	00037	00000000	TSH	ZZZ
0035			END	
	00040	01440000		
	00041	07770000		
	00042	00010000		
	00043	07777700		
	00044	00000012		
	00045	00000077		
	00046	00000001		
	00047	07770077		
	00050	00002000		
	00051	00007700		
	00052	00000100		

0001			* DISC ABSOLUTE LOAD/DUMP
0002			*
0003			* SET STARTING ADDRESS IN A REG
0004			*
0005			* SET LAST ADDRESS IN B REG
0006			*
0007			* SET TRACK SECTOR AND HEAD IN CONTROL SWITCHES
0008			*****
0009	00000	01100026*	BRU LOAD
0010	00001	00300023*	DUMP STA ADDR
0011	00002	00000004	TBA
0012	00003	00600023*	SMA ADDR
0013	00004	00300024*	STA WCNT
0014	00005	01400024*	IMS WCNT
0015	00006	05700000	LCS
0016	00007	03000050*	MOA = 40000000
0017	00010	00300014*	STA NACH
0018	00011	00100047*	LAA = -13
0019			CALL DISC
0020	00013	00000000	DAC 0
0021	00014	40000000	NACH DAC* 0
0022	00015	00100047*	LAA = -13
0023			CALL DISC
0024	00017	00000023*	DAC ADDR
0025	00020	00000002	DAC 2
0026	00021	00100047*	LAA = -13
0027			CALL DISC
0028	00023	00000000	ADDR DAC 0
0029	00024	00000000	WCNT DAC 0
0030			CALL HOME
0031	00026	05700000	LOAD LCS
0032	00027	03000050*	MOA = 40000000
0033	00030	00300034*	STA NOCH
0034	00031	00100047*	LAA = -13
0035			CALL DISC
0036	00033	00000000	DAC 0
0037	00034	40000000	NOCH DAC* 0
0038	00035	00100046*	LAA = 13
0039			CALL DISC
0040	00037	00000043*	DAC ADDX
0041	00040	00000002	DAC 2
0042	00041	00100046*	LAA = 13
0043			CALL DISC
0044	00043	00000000	ADDX DAC 0
0045	00044	00000000	DAC 0
0046			CALL HOME
0047			END
	00046	00000015	
	00047	77777763	
	00050	40000000	

0001	* DISC HANDLER ENTRY ROUTINE			
0002	* CALLING SEQUENCE IS LAA LDN			
0003	* CALL D\$PNT			
0004	* DAC ADDR			
0005	* DATA WCNT			
0006	* PUT DISC TRACK, SECTOR, HEAD IN CONTROL SWITCHES			
0007	00000000	NAME D\$PNT,DPNT		
0008	00000	00000000	DPNT	ZZZ **
0009	00001	00300042*	STA	LDN
0010	00002	40100000*	LAA*	DPNT
0011	00003	00300027*	STA	ADDR
0012	00004	01400000*	IMS	DPNT
0013	00005	40100000*	LAA*	DPNT
0014	00006	00300030*	STA	WCNT
0015	00007	01400000*	IMS	DPNT
0016	00010	01342200	SNS	0
0017	00011	01100025*	BRU	NACH&1
0018	00012	00100043*	LAA	=-4
0019			CALL	CRT
0020	00014	00000032*	DAC	MESS
0021	00015	77777771	DATA	-7
0022	00016	05700000	LCS	
0023	00017	03000041*	MOA	NEG
0024	00020	00300024*	STA	NACH
0025	00021	00100042*	LAA	LDN
0026			CALL	DISC
0027	00023	00000000	DAC	0
0028	00024	00000000	NACH	DAC 0
0029	00025	00100042*	LAA	LDN
0030			CALL	DISC
0031	00027	00000000	ADDR	DAC 0
0032	00030	00000000	WCNT	DAC 0
0033	00031	41100000*	BRU*	DPNT
0034	00032	14032340	MESS DATA "LCS FOR TRACK SECTOR HEAD"	
00033	06172240			
00034	24220103			
00035	13402305			
00036	03241722			
00037	40100501			
00040	04404040			
0035	00041	40000000	NEG	DATA 40000000
0036	00042	00000000	LDN	DAC 0
0037			END	
	00043	77777774		

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PROGRAM DESCRIPTION

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Catalog No. 1083

**IDENTIFICATION:** DISC (Basic BTC Version)

**AUTHOR:** N. Burtnyk

**ACCEPTED:** August, 1968

**PURPOSE:** To provide a user disc handler facility where the CPU is not dedicated for the duration of the disc/core transfer.

**COMPUTER  
CONFIGURATION:**

**SUBROUTINES  
REQUIRED:** INCTSH

**STORAGE:** Octal 203

**TIMING:**

**DESCRIPTION:** This handler is capable of transferring data to and from disc on cylinders 20 to 84 inclusive. When a transfer is requested, the handler initiates BTC for the first sector and returns to the calling program. Successive sector transfers are reinitialized by the BTC interrupt until the call is satisfied. Location \$DBUSY remains negative until the block transfer is complete.

There are five entry points in the program:

\$DISC - called entry for head positioning or transfer of data

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DESCRIPTION (Contd) :

\$SCRA - location storing the Hollerith word "SCRA"

\$SCRA+1 - location containing the "base" track, sector and head

\$NATSH - location containing next available track, sector and head

\$DBUSY - busy flag.

USE: A call to transfer data must be preceded by a positioning call as follows:

CALL DISC  
ZZZ  
BTSH DATA xxxxxxxx

BTSH consists of Bit 0 - must be set  
Bits 5-11 - beginning track  
Bits 12-17 - beginning head  
Bits 18-23 - beginning sector

If BTSH exceeds cylinder 84, the handler halts.

If BTSH is less than cylinder 20, 20 cylinders are added to the value specified.

Calling sequence for data transfer is:

LAA LDN  
CALL DISC  
DAC BLOK  
WCNT DATA xxxxxxxx

Before a subsequent call is made, \$DBUSY must be tested to ensure the previous block has been completed.

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USE: (Contd)

EXAMPLE OF USE FOR THIS HANDLER:

Conversion of an analogue signal to digital form with storage on disc. A to D conversion is controlled by an external clock and alternately fills two blocks in core. Upon completion of each block, a call is made to transfer it to disc. Since sampling interval must be constant, A/D conversion is assigned high priority. BTC interrupt, on lower priority, must reinitialize block transfers and complete block before other block is refilled.

0001		*****BASIC DISC BTC HANDLER*****		
0002		*		
0003		* RETURNS TO CALLING PROGRAM AFTER		
0004		* INITIATING TRANSFER OF FIRST SECTOR		
0005		*		
0006		* SUCCESSIVE SECT TRANS ARE REINITIALIZED		
0007		* BY BTC INTPT UNTIL BLOCK IS COMPLETE		
0008		*		
0009		* \$DBUSY REMAINS NEG UNTIL BLOCK COMPLETE		
0010		*		
0011		* CYLINDERS 20 TO 84 (LIB. 14-10)		
0012		*		
0013	00000000	NAME DISC,DISC		
0014	00000160	NAME SCRA,SCRA		
0015	00000161	NAME SCRA&1,SP1		
0016	00000162	NAME NATSH,NTSH		
0017	00000163	NAME DBUSY,DB		
0018	00013	D	EQU	'13
0019	00060	FWA1	EQU	'60
0020	00000	00000000	DISC	ZZZ
0021	00001	00300164*	STA	LDN
0022	00002	40100000*	LAA*	DISC
0023	00003	00500174*	AMA	=-64
0024	00004	00300060	STA	FWA1
0025	00005	01400000*	IMS	DISC
0026	00006	40100000*	LAA*	DISC
0027	00007	01400000*	IMS	DISC
0028	00010	02200021*	BAZ	RD
0029	00011	02400057*	BAP	IRW
0030	00012	00002016	LSL	2
0031	00013	00300052*	STA	BUSY
0032	00014	00002015	RSL	2
0033	00015	02700202*	MAA	='7777777
0034	00016	03500052*	SMP	BUSY
0035	00017	01100057*	BRU	IRW
0036	00020	01100023*	BRU	ID
0037	00021	00100161*	RD	LAA SP1
0038	00022	02700202*	MAA	='7777777
0039	00023	00300162*	ID	STA NTSH
0040	00024	01310013	CEU	D,W
0041	00025	00000010	DATA	'10
0042	00026	01200052*	SPB	BUSY
0043	00027	01500201*	CMA	='1240000
0044	00030	01100033*	BRU	OK
0045	00031	01100033*	BRU	OK
0046	00032	00000000	ZERO	HLT
0047	00033	01500200*	OK	CMA ='240000
0048	00034	00500200*	AMA	='240000
0049	00035	00000022	NOP	
0050	00036	00300162*	STA	NTSH
0051	00037	02700177*	MAA	='170000
0052	00040	00010015	RSL	8
0053	00041	03000176*	MOA	='12
0054	00042	00300047*	STA	BUSY-3

0055	00043	00100162*	LAA	NTSH	
0056	00044	02700175*	MAA	=*1600000	
0057	00045	03100047*	AAM	BUSY-3	
0058	00046	01310013	CEU	D,W	
0059	00047	00000000	ZZZ		
0060	00050	01200052*	SPB	BUSY	
0061	00051	01100067*	BRU	EXIT	
0062	00052	00000000	BUSY	ZZZ	
0063	00053	01320013	TEU	D	
0064	00054	00000002	DATA	2	
0065	00055	01100053*	BRU	*-2	
0066	00056	41100052*	BRU*	BUSY	
0067	00057	05600000	IRW	NEG	
0068	00060	00300165*	STA	TNWC	
0069	00061	01200071*	SPB	LOOP	TO SET UP BTC CWRD
0070	00062	04304000	PID	'4000,0	TO CANCEL REQST
0071	00063	00100121*	LAA	BTCI	
0072	00064	00300114	STA	'114	SET UP BTC INTPT
0073	00065	14304000	PIE	'4000,0	
0074	00066	01200142*	SPB	CEU	STRT BTC
0075	00067	00100162*	EXIT	LAA	NTSH
0076	00070	41100000*	BRU*	DISC	
0077	00071	00000000	LOOP	ZZZ	
0078	00072	00100174*	LUP	LAA	=-64
0079	00073	01500165*	CMA	TNWC	
0080	00074	00100165*	LAA	TNWC	
0081	00075	00000022	NOP		
0082	00076	05600000	NEG		
0083	00077	00300166*	STA	WPS	
0084	00100	03100165*	AAM	TNWC	
0085	00101	03100060	AAM	FWA1	
0086	00102	00000020	ASC		BTC TERMINATE BIT
0087	00103	00300061	STA	FWA1&1	
0088	00104	03300167*	STI	CODE,0	CLEAR EXIT FLAG
0089	00105	00100162*	LAA	NTSH	
0090	00106	02700173*	MAA	=*000007777	
0091	00107	00200032*	LBA	ZERO	
0092	00110	00004012	FRA	4	
0093	00111	00006016	LSL	6	
0094	00112	00010013	FLA	8	
0095	00113	00500172*	AMA	K1	BIT 23 FOR READ
0096	00114	03500164*	SMP	LDN	
0097	00115	00500172*	AMA	K1	BIT 22 FOR WRITE
0098	00116	00000020	ASC		BIT 0 TO STRT BTC
0099	00117	00300145*	STA	CWRD	
0100	00120	41100071*	BRU*	LOOP	
0101	00121	01200122*	BTCI	SPB	DONE
0102	00122	00000000	DONE	ZZZ	
0103	00123	00300170*	STA	SAVA	
0104	00124	00400171*	STB	SAVB	
0105	00125	00000003	CLA		
0106	00126	00300163*	STA	DB	CLEAR DBUSY FL
0107	00127	03500167*	SMP	CODE	TEST EXIT FLAG
0108	00130	01100133*	BRU	*&3	YES-DISABLE

			SPB	CEU	NO, NEXT BTC
0109	00131	01200142*			
0110	00132	01100137*	BRU	*&5	
0111	00133	00100162*	LAA	NTSH	
0112			CALL	INCTSH	
0113	00135	00300162*	STA	NTSH	
0114	00136	04304000	PID	'4000,0	BLK COMPLETE, DISABLE
0115	00137	00100170*	LAA	SAVA	
0116	00140	00200171*	LBA	SAVB	
0117	00141	03600122*	PIR	DONE	
0118	00142	00000000	CEU	ZZZ	
0119	00143	01200052*	SPB	BUSY	
0120	00144	01310013	CEU	D,W	
0121	00145	00000000	CWRD	ZZZ	
0122	00146	00100161*	LAA	SP1	
0123	00147	00300163*	STA	DB	SETS DBUSY FLAG
0124	00150	00300167*	STA	CODE	SETS EXIT FLAG
0125	00151	00100165*	LAA	TNWC	
0126	00152	42400142*	BAP*	CEU	EXIT IF BLK COMPLETE
0127	00153	00100162*	LAA	NTSH	
0128			CALL	INCTSH	
0129	00155	00300162*	STA	NTSH	
0130	00156	01200071*	SPB	LOOP	SET UP NEXT BTC
0131	00157	41100142*	BRU*	CEU	
0132	00160	23032201	SCRA	DATA "SCRA"	
0133	00161	40240000	SP1	DATA '40240000	CYL. 20
0134	00162	00000000	NTSH	ZZZ	
0135	00163	00000000	DB	ZZZ	
0136	00164	00000000	LDN	ZZZ	
0137	00165	00000000	TNWC	ZZZ	
0138	00166	00000000	WPS	ZZZ	
0139	00167	00000000	CODE	ZZZ	
0140	00170	00000000	SAVA	ZZZ	
0141	00171	00000000	SAVB	ZZZ	
0142	00172	00000001	K1	DAC 1	
0143			END		
	00173	00007777			
	00174	77777700			
	00175	01600000			
	00176	00000012			
	00177	00170000			
	00200	00240000			
	00201	01240000			
	00202	07777777			

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DATA SYSTEMS PROGRAM LIBRARY

PROGRAM DESCRIPTION

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IDENTIFICATION: D2TR Disc to Tape Transfer

AUTHOR: M. Wein

ACCEPTED: July 1968

PURPOSE:

- (a) To create a copy on magnetic tape, of the directories and libraries stored on disc and thus provide back up in case of accidental erasure of the disc.
- (b) To rewrite the libraries back on disc if an accident occurs.
- (c) To provide a scheme for a quick interchange of alternate program systems.

COMPUTER  
CONFIGURATION:

SEL 840A, a disc, Magnetic Tape Transport

SUBROUTINES  
REQUIRED:

TRASH - Conversion of octal sector number to track-sector-head.

DISC - Non BTC handler - read only version, with a write key.

H\$WR Driver, paper tape and magnetic tape handlers

STORAGE: 613<sub>8</sub> locations - main

DATA SYSTEMS PROGRAM LIBRARY

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USE: To dump a library on tape the command on the console typewriter is DUMPDATEXX..LO,HI  
DATE is an identifying label e.g., JL21, XX is the logical number of the library, LO is the sector number of the lower library limit, and HI is the next available sector number (octal). The library on disc is copied on magnetic tape as a file, consisting of two or more records. The directory of the library is the first record of the file. The library itself is copied in as many records as required. An end-of-file mark is automatically written to close the file.

FORMAT ON TAPE

The first record contains the six sectors of the appropriate directory. Each succeeding record contains sixteen disc sectors ( $2000_8$  words). The last record of a file is expanded with zeroes to the full length of  $2000_8$  words.

Each record begins with six identifying words.

DATE	Identifier, as given in the dump command
XX..	Library number
CKSM	Program checksum over all following words in the record
LOW	Starting sector number for this record
SC	Number of sectors in this record
TNOS	Total remaining sectors in the file.

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After dumping a number of libraries (in our case 6, 10, 16) the tape is repositioned to the beginning of the first file by typing the command.

BSF.YY where

YY is the number of files.

The command VRFY causes the program to read the file and verify the program checksum. For each file the program causes the identifier, DATEXX.. to be typed on the console typewriter.

In normal practice new files are added daily to one reel of tape until the tape is full. Thus there is a record of the disc libraries for about two weeks. In order to reload the disc, the write-key instruction must be changed in the disc handler (Non-BTC).

The command LOAD initiates loading.

The program reads the tape, verifies the checksum and types the identifier. The operator then types Y (or Yes) CR/LF to load the file on disc. If the operator types any other character, to indicate that this is not the desired file, the tape is advanced to the next file, ready for the next load command.

The following tape positioning commands are recognized:

ADVF YY Advance YY files

BSF.YY Backspace YY files. The tape is positioned to the beginning of the file.

PLDN Position to the beginning of the current file

REW. Rewind tape

All tape positioning commands operate on logical device No. 7. The command QUIT positions the heads to cylinder 0 and the control is transferred to the main executive.

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SENSE SWITCH ZERO

Sense switch zero is used during loading.

Switch set: the loading proceeds continuously

Switch not set: the program halts before writing each record on disc. The starting sector number for this record is shown in A accumulator, the last sector in this record is shown in the B accumulator, and the number of remaining sectors in the file is shown in the index register 3. Press start switch to load each record on disc.

NOTE ON PROGRAM GENERATION

This program, should be loaded with its own driver H\$WR and the necessary handlers and subroutines to form a stand-alone package.

0001	* DISC TO TAPE TRANSFER				
0002	* PRODUCES TAPE BACKUP FOR THE DISC SYSTEM				
0003	* CONSOLE TTY IS THE INPUT DEVICE				
0004	* DISC LIBRARIES ARE DUMPED AS FILES ON TAPE				
0005	* COMMAND FORMAT IS DUMPNAMEXX..LO,HI				
0006	* WHERE NAME IS AN IDENTIFIER EG JL26				
0007	* XX IS THE LIBRARY NUMBER, LO IS THE LOWER				
0008	* LIBRARY LIMIT AND HI IS THE SECTOR NR				
0009	* OF ''SCRA'' IN THE LIBRARY				
0010	* THE PROGRAM DUMPS THE SIX SECTORS OF THE				
0011	* DIRECTORY AS THE FIRST RECORD IN				
0012	* FILE.				
0013	* SUCCESSIVE RECORDS CONTAIN 16 DISC SECTORS EACH.				
0014	* AN END-OF-FILE MARK IS WRITTEN AFTER THE LAST RECORD				
0015	* THE FIRST SIX WORDS IN A RECORD ARE IDENTIFIERS				
0016	* FIRST WORD NAME				
0017	* LIBRARY NUMBER				
0018	* CHECKSUM				
0019	* FIRST SECTOR NR				
0020	* LAST SECTOR NR				
0021	* SECTORS REMAINING				
0022	* DATA				
0023	00000	00100575*	MOR	LAA	=1
0024				CALL	H\$WR
0025	00002	00000201*	DAC	CCRD	
0026	00003	00000024	DATA	20	
0027	00004	00100201*	LAA	CCRD	
0028	00005	01500065*	CMA	DUMP	
0029	00006	01100010*	BRU	*&2	
0030	00007	01100066*	BRU	DUMP&1	
0031	00010	01500311*	CMA	LOAD	
0032	00011	01100013*	BRU	*&2	
0033	00012	01100312*	BRU	LOAD&1	
0034	00013	01500173*	CMA	EOF	
0035	00014	01100016*	BRU	*&2	
0036	00015	01100174*	BRU	EOF&1	
0037	00016	01500055*	CMA	QUIT	
0038	00017	01100021*	BRU	*&2	
0039	00020	01100056*	BRU	QUIT&1	
0040	00021	01500236*	CMA	ADVF	
0041	00022	01100024*	BRU	*&2	
0042	00023	01100237*	BRU	ADV&1	
0043	00024	01500252*	CMA	BSF	
0044	00025	01100027*	BRU	*&2	
0045	00026	01100253*	BRU	BSF&1	
0046	00027	01500047*	CMA	REW	
0047	00030	01100032*	BRU	*&2	
0048	00031	01100050*	BRU	REW&1	
0049	00032	01500301*	CMA	PLDN	
0050	00033	01100035*	BRU	*&2	
0051	00034	01100302*	BRU	PLDN&1	
0052	00035	01500305*	CMA	VRFY	
0053	00036	01100040*	BRU	*&2	
0054	00037	01100306*	BRU	VRFY&1	

0055	00040	00100573*	NDG	LAA	=-1	ILLEGAL COMMAND
0056				CALL	H\$WR	
0057	00042	00000045*		DAC	ICEM	
0058	00043	00000002		DATA	2	
0059	00044	01100000*		BRU	MOR	
0060	00045	11141405	ICEM	DATA	"'ILLEGAL'"	
	00046	07011440				
0061	00047	22052756	REW	DATA	"'REW.'"	
0062	00050	00100564*		LAA	=7	
0063				CALL	H\$WR	
0064	00052	40000001		DAC*	1	
0065	00053	00000022		NOP		
0066	00054	01100000*		BRU	MOR	
0067	00055	21251124	QUIT	DATA	"'QUIT'"	
0068	00056	01300013		CEU	'13	
0069	00057	00000010		DATA	'10	
0070	00060	01100056*		BRU	**-2,	
0071	00061	01320013		TEU	'13	BUSY WAIT
0072	00062	00000002		DATA	2	
0073	00063	01100061*		BRU	**-2	
0074				CALL	EXIT	
0075	00065	04251520	DUMP	DATA	"'DUMP'"	
0076	00066	00100203*		LAA	CCRD&2	
0077	00067	00300000		STA	\$LIBNO	
0078	00070	01200553*		SPB	RXX	GET LDN
0079	00071	01500612*		CMA	='17	
0080	00072	01500611*		CMA	=5	CHECK LIMITS
0081	00073	01100040*		BRU	NDG	
0082	00074	01100040*		BRU	NDG	
0083	00075	00600610*		SMA	=6	NORMALIZE
0084	00076	10000001		TAI	,1	
0085	00077	10100225*		LAA	DIRT,1	GET DIRECTORY LIMIT
0086	00100	00300000		STA	\$LOW	
0087	00101	00100610*		LAA	=6	
0088	00102	00300000		STA	\$SC	DIRECTORY SECTOR COUNT
0089	00103	03300000		STI	\$TNOS,0	
0090	00104	01200477*		SPB	POSN	
0091	00105	00100571*		LAA	='13	
0092				CALL	DISC	READ DISC DIRECTORY
0093	00107	00000000		DAC	\$BUF	
0094	00110	00000600		DATA	'600	
0095	00111	13200602*		LIX	=-'603,1	
0096	00112	01200460*		SPB	CHEK	
0097	00113	00300000		STA	\$BLOK	
0098	00114	00100202*		LAA	CCRD&1	
0099	00115	00300000		STA	\$NAM	FILE NAME
0100	00116	00100604*		LAA	=-7	
0101				CALL	B\$WR	WRITE DIRECTORY ON TAPE
0102	00120	00000000		DAC	\$NAM	
0103	00121	00000606		DATA	'606	
0104	00122	23200607*		LIX	=3,2	
0105	00123	01200510*		SPB	GLH	GET LIMITS OF FILE
0106	00124	00300000		STA	\$LOW	
0107	00125	00000004		TBA		

0108	00126	00600000	SMA	\$LOW
0109	00127	00500575*	AMA	=1
0110	00130	00300000	STA	\$TNOS
0111	00131	01200477*	SPB	POSN POSITION TO FILE
0112	00132	00100606*	LUP1	LAA =*20
0113	00133	01500000	CMA	\$TNOS
0114	00134	00000022	NOP	
0115	00135	01100137*	BRU	*&2
0116	00136	00100000	LAA	\$TNOS
0117	00137	00300000	STA	\$SC
0118	00140	00006016	LSL	6
0119	00141	00300156*	STA	WC
0120	00142	00100000	LAA	\$SC
0121	00143	05600000	NEG	
0122	00144	03100000	AAM	\$TNOS
0123	00145	13200605*	LIX	=-*2000,1 CLEAR BUFFER
0124	00146	00000003	CLA	
0125	00147	20000001*	TAI	,2
0126	00150	20300000	STA	\$BUF,2
0127	00151	23400152*	IIB	*&1,2
0128	00152	13400150*	IIB	*-2,1
0129	00153	00100571*	LAA	=*13
0130			CALL	DISC READ IN ONE TRACK
0131	00155	00000000	DAC	\$BUF
0132	00156	00000000	WC	ZZZ
0133	00157	13200576*	LIX	=-*2003,1
0134	00160	01200460*	SPB	CHEK GET CHECK SUM
0135	00161	00300000	STA	\$BLOK
0136	00162	00100604*	LAA	=-7
0137			CALL	B\$WR WRITE ONE BLOCK
0138	00164	00000000	DAC	\$NAM
0139	00165	00002006	DATA	*2006
0140	00166	00100000	LAA	\$TNOS
0141	00167	02200174*	BAZ	EOF&1 NO MORE
0142	00170	00100000	LAA	\$SC
0143	00171	03100000	AAM	\$LOW
0144	00172	01100132*	BRU	LUP1
0145	00173	05170656	EOF	DATA "EOF."
0146	00174	00100604*	LAA	=-7
0147			CALL	H\$WR
0148	00176	40000004	DAC*	4
0149	00177	00000022	NOP	
0150	00200	01100000*	BRU	MOR
0151	00201		CCRD	BSS 20
0152	00225	00000061	DIRT	DATA *61
0153	00226	00000053	DATA	*53
0154	00227	00000045	DATA	*45
0155	00230	00000037	DATA	*37
0156	00231	00000031	DATA	*31
0157	00232	00000023	DATA	*23
0158	00233	00000015	DATA	*15
0159	00234	00000007	DATA	*7
0160	00235	00000001	DATA	1
0161	00236	01042606	ADVF	DATA "ADVF" ADVANCE FILES

0162	00237	00100202*	LAA	CCRD&1
0163	00240	01200553*	SPB	RXX NO OF FILES
0164	00241	05600000	NEG	
0165	00242	02400000*	BAP	MOR
0166	00243	10000001	TAI	,1
0167	00244	00100564*	A01	LAA =7
0168			CALL	H\$WR
0169	00246	40000003	DAC*	3
0170	00247	00000000	DATA	0
0171	00250	13400244*	IIB	AD1,1
0172	00251	01100000*	BRU	MOR
0173	00252	02230656	BSF	DATA "BSF."
0174	00253	00100202*	LAA	CCRD&1
0175	00254	01200553*	SPB	RXX
0176	00255	00500575*	AMA	=1
0177	00256	05600000	NEG	
0178	00257	10000001	TAI	,1
0179	00260	00100564*	LAA	=7
0180			CALL	H\$WR
0181	00262	40000002	DAC*	2
0182	00263	00000022	NOP	
0183	00264	01320006	TEU	6
0184	00265	40000000	DATA	"40000000
0185	00266	01100264*	BRU	*-2
0186	00267	01320006	TEU	6
0187	00270	20000000	DATA	"20000000
0188	00271	01100273*	BRU	*&2
0189	00272	01100000*	BRU	MOR
0190	00273	13400260*	IIB	*-11,1
0191	00274	00100564*	LAA	=7
0192			CALL	H\$WR
0193	00276	40000003	DAC*	3
0194	00277	00000022	NOP	
0195	00300	01100000*	BRU	MOR
0196	00301	20140416	PLDN	DATA "PLDN"
0197	00302	00100564*	LAA	=7
0198			CALL	H\$WL
0199	00304	01100000*	BRU	MOR
0200	00305	26220631	VRFY	DATA "VRFY"
0201	00306	00100573*	LAA	=-1
0202	00307	00300424*	STA	TEST
0203	00310	01100313*	BRU	LOAD&2
0204	00311	14170104	LOAD	DATA "LOAD"
0205	00312	03300424*	STI	TEST,0
0206	00313	03300425*	STI	JB,0
0207	00314	00100603*	LAA	=1606
0208	00315	01200426*	SPB	READ READ DIRECTORY
0209	00316	13200602*	LIX	=-1603,1
0210	00317	01200460*	SPB	CHEK
0211	00320	01200467*	SPB	CK2 CHECK SUM TEST
0212	00321	00100573*	LAA	=-1
0213			CALL	H\$WR LIST LIBRARY
0214	00323	00000000	DAC	\$NAM
0215	00324	00000002	DATA	2

0216	00325	03500424*	SMP	TEST
0217	00326	01100346*	BRU	PSA
0218	00327	00100575*	LAA	=1
0219			CALL	H\$WR GET REPLY
0220	00331	00000201*	DAC	CCRD
0221	00332	00000024	DATA	20
0222	00333	00100201*	LAA	CCRD
0223	00334	02700601*	MAA	=*77000000
0224	00335	02600600*	MEA	=*31000000
0225	00336	02200341*	BAZ	*&3
0226	00337	13200573*	LIX	=-1,1
0227	00340	01100244*	BRU	AD1
0228	00341	01200477*	SPB	POSN POSITION DIRECTORY
0229	00342	00100574*	LAA	=-*13
0230			CALL	DISC WRITE DIRECTORY
0231	00344	00000000	DAC	\$BUF
0232	00345	00000600	DATA	*600
0233	00346	00100577*	PSA	LAA =*2006
0234	00347	01200426*	SPB	READ READ LIBRARY
0235	00350	13200576*	LIX	=-*2003,1
0236	00351	01200460*	SPB	CHEK
0237	00352	01200467*	SPB	CK2
0238	00353	03500424*	SMP	TEST
0239	00354	01100400*	BRU	WC2&1 DON'T WRITE
0240	00355	03500425*	SMP	JB
0241	00356	01100360*	BRU	*&2 DON'T INITIALIZE
0242	00357	01200477*	SPB	POSN POSITION TO LIBRARY
0243	00360	00100000	LAA	\$SC
0244	00361	00500000	AMA	\$LOW
0245	00362	00600575*	SMA	=1
0246	00363	00000005	TAB	
0247	00364	00100000	LAA	\$LOW
0248	00365	33200000	LIX	\$TNOS,3
0249	00366	01342200	SNS	0
0250	00367	01100371*	BRU	*&2
0251	00370	00000000	HLT	DISPLAY LO,H*
0252	00371	00100000	LAA	\$SC
0253	00372	00006016	LSL	6
0254	00373	00300377*	STA	WC2 WORD COUNT
0255	00374	00100574*	LAA	=-*13
0256			CALL	DISC WRITE
0257	00376	00000000	DAC	\$BUF
0258	00377	00000000	WC2	ZZZ
0259	00400	00100573*	LAA	=-1
0260	00401	00300425*	STA	JB RESET TOGGLE
0261	00402	00100000	LAA	\$TNOS
0262	00403	02200405*	BAZ	NOMO
0263	00404	01100346*	BRU	PSA
0264	00405	00100564*	NOMO	LAA =7 READ PAST EOF
0265			CALL	H\$WR
0266	00407	00000201*	DAC	CCRD
0267	00410	00000004	DATA	4
0268	00411	00001016	LSL	1 TEST EOF STATUS
0269	00412	02300000*	BAN	MOR OK. FOUND

0270	00413	00100573*	LAA	=-1
0271			CALL	H\$WR
0272	00415	00000420*	DAC	M2
0273	00416	00000004	DATA	4
0274	00417	01100000*	BRU	MOR
0275	00420	05170640	M2	DATA "EOF NOT FOUND"
	00421	16172440		
	00422	06172516		
	00423	04404040		
0276	00424	00000000	TEST	ZZZ
0277	00425	00000000	JB	ZZZ
0278	00426	00000000	READ	ZZZ **
0279	00427	00300433*	STA	*&4
0280	00430	00100564*	LAA	=7
0281			CALL	B\$WR
0282	00432	00000000	DAC	\$NAM
0283	00433	00000000		ZZZ
0284	00434	02300440*	BAN	MES3
0285	00435	00001016	LSL	1
0286	00436	02300445*	BAN	MES4
0287	00437	41100426*	BRU*	READ
0288	00440	00100573*	MES3	LAA =-1
0289			CALL	H\$WR
0290	00442	00000452*	DAC	M3
0291	00443	00000001	DATA	1
0292	00444	01100000*	BRU	MOR
0293	00445	00100573*	MES4	LAA =-1
0294			CALL	H\$WR
0295	00447	00000453*	DAC	M4
0296	00450	00000005	DATA	5
0297	00451	01100000*	BRU	MOR
0298	00452	22052222	M3	DATA "RERR"
0299	00453	05170640	M4	DATA "EOF FOUND TOO SOON"
	00454	06172516		
	00455	04402417		
	00456	17402317		
	00457	17164040		
0300	00460	00000000	CHEK	ZZZ ** CHECKSUM CALCULATE
0301	00461	00000003	CLA	
0302	00462	20000001	TAI	,2
0303	00463	20500000	AMA	\$LOW,2
0304	00464	23400465*	IIB	*&1,2
0305	00465	13400463*	IIB	*-2,1
0306	00466	41100460*	BRU*	CHEK
0307	00467	00000000	CK2	ZZZ ** CHECKSUM TEST
0308	00470	02600000	MEA	\$BLOK
0309	00471	42200467*	BAZ*	CK2
0310	00472	00100573*	LAA	=-1
0311			CALL	H\$WR
0312	00474	00000572*	DAC	"CKSM"
0313	00475	00000001	DATA	1
0314	00476	01100000*	BRU	MOR
0315	00477	00000000	POSN	ZZZ ** POSITION DISC
0316	00500	00100000	LAA	\$LOW

0317			CALL	TRASH
0318	00502	00300506*	STA	TSH
0319	00503	00100571*	LAA	=13
0320			CALL	DISC
0321	00505	00000022	NOP	
0322	00506	00000000	TSH	ZZZ
0323	00507	41100477*	BRU*	POSN
0324	00510	00000000	GLH	ZZZ
0325	00511	33200563*	LIX	=0,3
0326	00512	00000003	CLA	
0327	00513	20200201*	GLH1	LBA CCRD,2
0328	00514	13200570*	LIX	=-4,1
0329	00515	01200531*	GLH2	SPB ANOD
0330	00516	31100521*	BRU	GLH3,3
0331	00517	13400515*	GLH4	IIB GLH2,1
0332	00520	23400513*	IIB	GLH1,2
0333	00521	00300530*	GLH3	STA GLHL
0334	00522	36100567*	AMX	=4,3
0335	00523	00000003	CLA	
0336	00524	01100517*	BRU	GLH4
0337	00525	00000005	GLH5	TAB
0338	00526	00100530*	LAA	GLHL
0339	00527	41100510*	BRU*	GLH
0340	00530	00000000	GLHL	ZZZ
0341	00531	00000000	ANOD	ZZZ
0342	00532	00300552*	ANO2	STA ANO1
0343	00533	00000003	CLA	
0344	00534	00006017	FLL	6
0345	00535	01500566*	CMA	=154
0346	00536	01100540*	BRU	*62
0347	00537	01100550*	BRU	ANO3
0348	00540	01500565*	CMA	=140
0349	00541	01100543*	BRU	*62
0350	00542	01100550*	BRU	ANO3
0351	00543	02700564*	MAA	=7
0352	00544	04400552*	IAM	ANO1
0353	00545	00003016	LSL	3
0354	00546	03100552*	AAM	ANO1
0355	00547	01400531*	IMS	ANOD
0356	00550	00100552*	ANO3	LAA ANO1
0357	00551	41100531*	BRU*	ANOD
0358	00552	00000000	ANO1	ZZZ
0359	00553	00000000	RXX	ZZZ
0360	00554	00003016	LSL	3
0361	00555	00200563*	LBA	=0
0362	00556	00003014	FRL	3
0363	00557	00003016	LSL	3
0364	00560	00003014	FRL	3
0365	00561	00000004	TBA	
0366	00562	41100553*	BRU*	RXX
0367			END	
	00563	00000000		
	00564	00000007		
	00565	00000040		

00566	00000054
00567	00000004
00570	77777774
00571	00000013
00572	03132315
00573	77777777
00574	77777765
00575	00000001
00576	77775775
00577	00002006
00600	31000000
00601	77000000
00602	77777175
00603	00000606
00604	77777771
00605	77776000
00606	00000020
00607	00000003
00610	00000006
00611	00000005
00612	00000017

APPENDIX 2

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DATA SYSTEMS PROGRAM LIBRARY

PROGRAM DESCRIPTION

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Catalog No. 1061

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IDENTIFICATION: NRC UPPER DISC EXECUTIVE (KPEX)

AUTHOR: SEL Modified by J.K. Pulfer

ACCEPTED: 26 June 1968

PURPOSE: To allow absolute load and dump between  
core and disc libraries 6, 7, 10, 11 and  
12 under control of standard executive  
commands.

COMPUTER

CONFIGURATION: 840A with TTY and DISC

SUBROUTINES REQUIRED: I/O Driver, ASRKB, BTC Disc Handler  
and Disc Directory Handler

STORAGE: 360<sub>8</sub>

TIMING: N/A

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USE:

The standard SEL control processing executive performs absolute load-dump operations between disc and core using the absolute load-dump routine in the BTC disc handler. The BTC handler is written so that it can perform absolute transfer only to disc library 16. This program performs the same operations for logical devices 6, 7, 10, 11 and 12. Libraries 13, 14, and 15 are reserved for relocatable programs and scratch areas.

Commands available to KPEX are

DUMP	- core to disc
LOAD	- disc to core (no execute)
GOTO	- branch to
LIST	- list directory entries
DELE	- delete entry in directory
CMPR	- compress directory
HOME	- initialize BTC disc handler and position heads
WHO	- which executive is this?
EXQT	- execute

Of these only WHO and EXQT are new.

WHO is answered by the word KPEX and allows the user to identify this executive from the standard SEL version.

EXQT causes a branch to the first address of the file most recently loaded.

All magnetic tape and update commands have been removed from this executive.

0001 \*NRC UPPER DISC EXEC MK1\*\*  
0002 \* LOAD KPEX \*\*\*\*\*  
0003 \* JKP JUNE 12 1968 \*\*\*\*\*  
0004 \*\*\*\*\* COMMAND PROCESSOR \*\*\*\*\*  
0005 \*

0006 00000 00100353\* CP LAA =1  
0007 CFCG CALL H\$WR I/O DRIVER  
0008 00002 00000313\* DAC CCRD  
0009 00003 00000024 DATA 20 20 WORDS  
0010 00004 00100313\* LAA CCRD WORD ONE OF CONTROL CARD IS COMMAND(4 CHARACTERS)  
0011 00005 01500124\* CMA DUMP "DUMPNAMEXX..LOW,HI"  
0012 00006 01100010\* BRU \*&2  
0013 00007 01100125\* BRU DUMP&1 DUMP MEMORY IN ABSOLUTE FORMAT ONTO DEVICE XX  
FROM LOW TO AND INCLUDING HI.  
0014 \*  
0015 00010 01500204\* CMA LOAD "LOADNAMEXX"  
0016 00011 01100013\* BRU \*&2  
0017 00012 01100205\* BRU LOAD&1 LOAD ABSOLUTE PROGRAM "NAME" FROM DEVICE XX  
0018 00013 01500117\* CMA GOTO "GOTOA"  
0019 00014 01100016\* BRU \*&2  
0020 00015 01100120\* BRU GOTO&1 BRANCH TO MEMORY ADDRESS A  
0021 \*-----DISC COMMANDS FOLLOW  
0022 00016 01500077\* CMA LIST "LISTXX"  
0023 00017 01100021\* BRU \*&2  
0024 00020 01100100\* BRU LIST&1 LIST ENTRIES IN DIRECTORY XX  
0025 00021 01500104\* CMA DEL "DELENAMEXX"  
0026 00022 01100024\* BRU \*&2  
0027 00023 01100105\* BRU DEL&1 REPLACE NAMED ID WITH ID "DELETE" IN DIRECTORY  
0028 00024 01500112\* CMA CMPR "CMPRXX"  
0029 00025 01100027\* BRU \*&2  
0030 00026 01100113\* BRU CMPR&1 COMPRESS DIRECTORY XX  
0031 \* XX.  
0032 00027 01500071\* CMA HOM \*\*HOME\*\*  
0033 00030 01100032\* BRU \*&2 NO  
0034 00031 01100072\* BRU HOM&1 YES, REPOSITION DISC TO HOME ADDRESS  
0035 00032 01500360\* CMA =\*\*QUIT\*\*  
0036 00033 01100035\* BRU \*&2  
0037 CALL EXIT  
0038 00035 01500060\* CMA WHO  
0039 00036 01100040\* BRU \*&2  
0040 00037 01100061\* BRU WHO&1  
0041 00040 01500067\* CMA EXQT  
0042 00041 01100043\* BRU \*&2  
0043 00042 01100070\* BRU EXQT&1  
0044 00043 01100051\* BRU \*&6  
0045 00044 BSS 5  
0046 \*----- END OF COMMAND LIST -----\*  
0047 00051 00100357\* LAA =-1  
0048 CALL H\$WR OUTPUT ERROR MESSAGE  
0049 00053 00000056\* DAC ICEM  
0050 00054 00000002 DATA 2  
0051 00055 01100000\* BRU CP TRY AGAIN  
0052 00056 11141405 ICEM DATA "ILLEGAL"  
00057 07011440  
0053 \*\*\*\*\*

0054 \* BEGIN PROCESSING \*  
0055 \*\*\*\*\*  
0056 \*  
0057 \* IDENTIFY YOURSELF  
0058 00060 27101740 WHO DATA "WHO"  
0059 00061 00100357\* LAA =-1  
0060 CALL H\$WR  
0061 00063 00000066\* DAC KPEX  
0062 00064 00000001 DATA 1  
0063 00065 01100000\* BRU CP  
0064 00066 13200530 KPEX DATA "KPEX"  
0065 \* EXECUTE THE PROGRAM JUST LOADED  
0066 00067 05302124 EXQT DATA "EXQT"  
0067 00070 41100232\* BRU\* BAL  
0068 \*----- DISC -----\*  
0069 \*  
0070 00071 10171505 HOM DATA "HOME" SEEK HOME TRACK AND INITIALIZE PRESENT TRACK NO  
0071 00072 00100356\* LAA =16 DISC SYSTEM DEVICE NUMBER  
0072 CALL H\$WR  
0073 00074 40000011 DAC\* 9 SEEK HOME CODE  
0074 00075 00000000 ZZZ  
0075 00076 01100000\* BRU CP  
0076 \*  
0077 00077 14112324 LIST DATA "LIST"  
0078 00100 00100314\* LAA CCRD&1  
0079 00101 01200300\* SPB RXX  
0080 CALL D\$LIST  
0081 00103 01100000\* BRU CP  
0082 \*  
0083 00104 04051405 DEL DATA "DELETE" DELETE ENTRY ID  
0084 00105 00100315\* LAA CCRD&2 XX  
0085 00106 01200300\* SPB RXX RETURN OCTAL DEV NO.  
0086 00107 00200314\* LBA CCRD&1 NAME TO BE DELETED  
0087 CALL D\$DELETE DIRECTORY DELETE ROUTINE  
0088 00111 01100000\* BRU CP  
0089 \*  
0090 00112 03152022 CMPR DATA "CMPR"  
0091 00113 00100314\* LAA CCRD&1  
0092 00114 01200300\* SPB RXX  
0093 CALL D\$CMPR COMPRESS  
0094 00116 01100000\* BRU CP  
0095 \*  
0096 \*  
0097 \*----- END OF DISC PROCESSING -----\*  
0098 00117 07172417 GOTO DATA "GOTO"  
0099 00120 23200353\* LIX =1,2 WORD 2 CONTAINS OCTAL ADDRESS.  
0100 00121 01200235\* SPB GLH RETURNS ADDRESS IN A  
0101 00122 20000001 TAI ,2  
0102 00123 21100000 BRU 0,2 BRANCH TO OCTAL ADDRESS.  
0103 00124 04251520 DUMP DATA "DUMP" ABSOLUTE DUMP  
0104 00125 00100315\* LAA CCRD&2  
0105 00126 01200300\* SPB RXX  
0106 00127 01500355\* CMA ='13  
0107 00130 01100133\* BRU \*E3

0108	00131	00300022	NOP			
0109	00132	01100051*	BRU	ICEM-5		
0110	00133	02200051*	BAZ	ICEM-5		
0111	00134	00300312*	STA	LDN	LOGICAL DEVICE NO.	
0112	00135	23200354*	LIX	=3,2		
0113	00136	01200235*	SPB	GLH	GET LOW/HI	
0114		*			RTN LOW IN "A" HI IN "B"	
0115	00137	00300315*	STA	CCRD&2	LOW	
0116	00140	00000004	TBA		HI TO "A"	
0117	00141	00600315*	SMA	CCRD&2	LOW	
0118	00142	00500353*	AMA	=1		
0119	00143	00300316*	STA	CCRD&3	WC	
0120	00144	00100314*	LAA	CCRD&1		
0121	00145	00300337*	STA	DPAR		
0122	00146	00100315*	LAA	CCRD&2		
0123	00147	00300341*	STA	DPAR&2		
0124	00150	00300201*	STA	BAD		
0125	00151	00100316*	LAA	CCRD&3		
0126	00152	00300342*	STA	DPAR&3		
0127	00153	00300202*	STA	WCD		
0128	00154	00100312*	LAA	LDN		
0129	00155	00200352*	LBA	= "SCRA"		
0130			CALL	D\$SEEK		
0131	00157	02300051*	BAN	ICEM-5		
0132	00160	20200001	LBA	1,2		
0133	00161	00400340*	STB	DPAR&1		
0134	00162	00100312*	LAA	LDN		
0135			CALL	D\$FILE		
0136	00164	00000337*	DAC	DPAR		
0137	00165	00100340*	LAA	DPAR&1		
0138	00166	00300174*	STA	NASD		
0139	00167	00100312*	LAA	LDN		
0140	00170	05600000	NEG			
0141	00171	00200351*	LBA	= 6013		
0142			CALL	DISC		
0143	00173	40000012	DAC*	10		
0144	00174	00000000	NASD	ZZZ		
0145	00175	00100312*	LAA	LDN		
0146	00176	05600000	NEG			
0147	00177	00200351*	LBA	= 6013		
0148			CALL	DISC		
0149	00201	00000000	BAD	ZZZ		
0150	00202	00000000	WCD	ZZZ		
0151	00203	01100000*	BRU	CP		
0152	00204	14170104	LOAD	DATA "LOAD"	ABSOLUTE LOAD	
0153	00205	00100315*	LAA	CCRD&2		
0154	00206	01200300*	SPB	RXX		
0155	00207	02200051*	BAZ	ICEM-5		
0156	00210	00300312*	STA	LDN		
0157	00211	00200314*	LBA	CCRD&1		
0158			CALL	D\$SEEK		
0159	00213	02300051*	BAN	ICEM-5		
0160	00214	20200001	LBA	1,2		
0161	00215	00400226*	STB	NASA		

0162	00216	20200002	LBA	2,2
0163	00217	00400232*	STB	BAL
0164	00220	20200003	LBA	3,2
0165	00221	00400233*	STB	WCL
0166	00222	00100312*	LAA	LDN
0167	00223	00200351*	LBA	=*6013
0168			CALL	DISC
0169	00225	40000012	DAC*	10
0170	00226	00000000	NASA	ZZZ
0171	00227	00100312*	LAA	LDN
0172	00230	00200351*	LBA	=*6013
0173			CALL	DISC
0174	00232	00000000	BAL	ZZZ
0175	00233	00000000	WCL	ZZZ
0176	00234	01100000*	BRU	CP
0177		*****		
0178	00235	00000000	GLH	ZZZ
0179	00236	33200343*	LIX	=0,3
0180		****	LIX	=N,2
			BEFORE CALLING. N = WORD -1 OF FIRST OCTAL DIGIT.	
0181	00237	00000003	CLA	
0182	00240	20200313*	GLH1	LBA CCRD,2
0183	00241	13200350*	LIX	=-4,1
0184	00242	01200256*	GLH2	SPB ANOD
0185	00243	31100246*	BRU	GLH3,3
0186	00244	13400242*	GLH4	IIB GLH2,1
0187	00245	23400240*		IIB GLH1,2
0188	00246	00300255*	GLH3	STA GLHL FOUND A COMMA
0189	00247	36100347*	AMX	=4,3
0190	00250	00000003	CLA	
0191	00251	01100244*	BRU	GLH4 FOR HI
0192	00252	00000005	GLH5	TAB HI FOUND A SPACE
0193	00253	00100255*	LAA	GLHL LOW
0194	00254	41100235*	BRU*	GLH
0195	00255	00000000	GLHL	ZZZ
0196		*****	*****	*****
0197	00256	00000000	ANOD	ZZZ
0198	00257	00300277*	ANO2	STA ANO1
0199	00260	00000003	CLA	
0200	00261	00006017	FLL	6
0201	00262	01500346*	CMA	=*54
0202	00263	01100265*	BRU	*82
0203	00264	01100275*	BRU	AN03
0204	00265	01500345*	CMA	=*40
0205	00266	01100270*	BRU	*82
0206	00267	01100275*	BRU	AN03
0207	00270	02700344*	MAA	=7
0208	00271	04400277*	IAM	AN01
0209	00272	00003016	LSL	3
0210	00273	03100277*	AAM	AN01
0211	00274	01400256*	IMS	ANOD CHAR. IS NOT A , OR A SPACE
0212	00275	00100277*	ANO3	LAA AN01
0213	00276	41100256*	BRU*	ANOD
0214	00277	00000000	ANO1	ZZZ
0215		***		

0216	00300	00000000	RXX	ZZZ	
0217	00301	00003016	LSL	3	
0218	00302	00200343*	LBA	=0	
0219	00303	00003014	FRL	3	
0220	00304	00003016	LSL	3	
0221	00305	00003014	FRL	3	
0222	00306	00000004	TBA		
0223	00307	41100300*	BRU*	RXX	A CONTAINS OCTAL LOGICAL DEVICE N
0224			**		
0225	00310	00000000	NAME	ZZZ	
0226	00311	00000000	TNO	ZZZ	
0227	00312	00000000	LDN	ZZZ	
0228	00313		CCRD	BSS	20
0229			****		
0230	00337		DPAR	BSS	4
0231			END		
	00343	00000000			
	00344	00000007			
	00345	00000040			
	00346	00000054			
	00347	00000004			
	00350	77777774			
	00351	00006013			
	00352	23032201			
	00353	00000001			
	00354	00000003			
	00355	00000013			
	00356	00000016			
	00357	77777777			
	00360	21251124			

APPENDIX 3

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DATA SYSTEMS PROGRAM LIBRARY

PROGRAM DESCRIPTION

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Catalog No. 1063

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IDENTIFICATION: D\$STOR, D\$WIPE, D\$CORD

AUTHOR: J.K. Pulfer

ACCEPTED: 26 June 1968

PURPOSE: To transfer files between core and disc  
directory '10 without direct user control  
over core addresses or disc addresses.

COMPUTER

CONFIGURATION: 840A with display

SUBROUTINES

REQUIRED: BTC Disc I/O handler, Disc Directory Handler,  
I/O driver, ASRKB, SLECTR

STORAGE: 266<sub>8</sub>

TIMING: N/A

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---

USE: 1) D\$STOR

Calling sequence - dump core to disc

```
LAA  KP  
LBA  BA  
CALL D$STOR
```

where KP is a positive constant different from zero

BA is the first address of the file to be  
dumped and which contains the positive  
word count.

Upon calling D\$STOR for a core to disc transfer the user will be presented with a list of names on the CRT display beginning with RETURN, NAME, and others.

- i) if RETURN is selected the control is returned to the calling program with no change.
- ii) if other names are selected the list will remain and no change will occur
- iii) if NAME is chosen, the console typewriter is enabled. When a name of length 8 characters or less is typed on the TTY followed by a CR/LF, the file is dumped on disc and the first four characters of the name is entered in the disc directory. The display list is expanded to include the 8 character name. Control is returned to the calling program.

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2) D\$STOR

Calling sequence - disc to core transfer

CLA  
LBA BA  
CALL D\$STOR

where BA is the desired first core address for  
the file to be transferred.

If BA=0, the file will be loaded into the core  
area from which it was dumped.

Upon calling D\$STOR for a core to disc transfer,  
the user will be presented with the display list  
of names on the CRT.

- i) If RETURN is chosen, control is returned  
to the calling program with no change
- ii) If NAME is chosen, the list will remain and  
no change will occur
- iii) If any other name is chosen, the disc  
directory will be searched for the first  
four characters of the name, and if found,  
the corresponding file will be transferred  
to core, and control returned to the  
calling program.

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3) D\$STOR

Calling sequence for delete a file

LAA KN  
CALL D\$STOR

where KN is a negative number.

As with the other calls, the user will be presented with the list of names on the CRT display.

- i) If RETURN is chosen, control will be returned to the calling program with no change
- ii) If NAME is chosen the list will remain and no change will occur
- iii) If any other name is chosen, the disc directory will be searched for the first four characters of the name. If the name is found, it will be deleted from the directory. The name will also be deleted from the display list and the list compressed. After 8 deletes from the disc directory the directory and library on disc will also be compressed.

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4) D\$WIPE

A call to D\$WIPE deletes each entry in the directory handler which corresponds to a name on the display list, compresses the directory and library, and removes all names except RETURN and NAME from the display list. Control is then returned to the calling program.

5) D\$CORD

The external address D\$CORD contains the word count of the name table and operating parameters describing the display list of names. To save the current list of names in SLECTR, proceed as follows

```
LAA  KP
LBA  D$CORD
CALL D$STOR
```

where KP is a positive constant.

Then select NAME on the CRT name list, and supply an 8 character name via the console TTY. To restart the program it is necessary to load the file from disc (which was named in the D\$CORD dump operation) using KPEX, the NRC typewriter controlled

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---

executive. The file will be on library 10 as will all other files used by this program.

0001 \*\*\*\*  
0002 \*  
0003 \* SUBROUTINE FOR MANAGING DISC  
0004 \* STORAGE OF DISPLAY FILES  
0005 \* ---USES DISC LIBE '10 -----  
0006 \*\*\*\*  
0007 \*  
0008 00000030 NAME D\$CORD,CORE  
0009 00000014 NAME D\$STOR,STOR  
0010 00000000 NAME D\$WIPE,WIPE  
0011 \*-----WIPE CORE DISC DIRECTORIES  
0012 00000000 WIPE ZZZ \*\*  
0013 00001 00100000\* LAA WIPE  
0014 00002 00300014\* STA STOR  
0015 00003 00100026\* LAA NC  
0016 00004 00600261\* SMA =1  
0017 00005 00600150\* SMA NOOW  
0018 00006 05600000 NEG  
0019 00007 00300071\* STA DLFL  
0020 00010 30000001 TAI ,3  
0021 00011 00100035\* LAA NAMT&4  
0022 00012 00300073\* STA PAR  
0023 00013 01100203\* BRU DLET&1  
0024 \*-----ENTRY FOR LOAD, STORE, DELETE  
0025 \*.  
0026 00014 00000000 STOR ZZZ \*\*  
0027 00015 00300071\* STA DLFL  
0028 00016 00400175\* STB BAD A POS - DUMP  
0029 00017 00400133\* STB BAL  
0030 00020 00400075\* STB PAR&2 BEGINNING ADDR  
0031 00021 40100175\* LAA\* BAD  
0032 00022 00300176\* STA WCD WORD COUNT  
0033 00023 00300076\* STA PAR&3  
0034 LOAD CALL SLECTR  
0035 00025 00000033\* PNTR DAC NAMT&2  
0036 00026 00000002 NC DATA 2 NUMBER OF NAMES  
0037 00027 01100077\* BRU GO  
0038 00030 00000117 CORE DAC ENTB-CORE  
0039 00031 22052425 NAMT DATA "RETURN NAME00 ..  
00032 22164040  
00033 16011505  
00034 40404040  
0040 00035 BSS 28  
0041 00071 00000000 DLFL DAC 0  
0042 00072 77777770 CMPR DATA -\*10  
0043 00073 PAR BSS 4  
0044 00077 00300073\* GO STA PAR  
0045 00100 00600266\* SMA = "NAME"  
0046 00101 02200136\* BAZ DUMP GET A NAME FOR DUM  
0047 00102 00600265\* SMA = "DDGP" RETURN00  
0048 00103 42200014\* BAZ\* STOR  
0049 00104 03500071\* SMP DLFL DELETE00  
0050 00105 01100202\* BRU DLET YES  
0051 00106 00200073\* LBA PAR NO MUST BE LOAD

0052	00107	00100257*	LAA	=*10	
0053			CALL	D\$SEEK	
0054	00111	02300200*	BAN	ERR	
0055	00112	20200001	LBA	1,2	
0056	00113	00400127*	STB	NASA	FIRST SECT OF FILE
0057	00114	00100133*	LAA	BAL	
0058	00115	02200117*	BAZ	*&2	USE ADDR OFF DISC
0059	00116	01100121*	BRU	*&3	USE ADDR FROM CALL
0060	00117	20200002	LBA	2,2	
0061	00120	00400133*	STB	BAL	B.A. FROM DISC
0062	00121	20200003	LBA	3,2	
0063	00122	00400134*	STB	WCL	WORD COUNT
0064	00123	00100257*	LAA	=*10	
0065	00124	00200263*	LBA	=*6013	
0066			CALL	DISC	
0067	00126	40000012	DAC*	10	
0068	00127	00000000	NASA	ZZZ	
0069	00130	00100257*	LAA	=*10	
0070	00131	00200263*	LBA	=*6013	
0071			CALL	DISC	
0072	00133	00000000	BAL	ZZZ	
0073	00134	00000000	WCL	ZZZ	
0074	00135	41100014*	BRU*	STOR	EXIT
0075			*****		
0076			*		
0077	00136	00100071*	DUMP	LAA	DLFL
0078	00137	02300024*	BAN	LOAD	
0079	00140	02200024*	BAZ	LOAD	
0080	00141	01400026*	IMS	NC	
0081	00142	01400025*	IMS	PNTR	
0082	00143	00100150*	LAA	NOOW	
0083	00144	03100147*	AAM	ENTB	
0084	00145	00100261*	LAA	=1	
0085			CALL	H\$WR	
0086	00147	00000033*	ENTB	DAC	NAMT&2
0087	00150	00000002	NOOW	DATA	2
0088	00151	40100147*	LAA*	ENTB	
0089	00152	00300073*	STA	PAR	NAME
0090	00153	00100257*	LAA	=*10	
0091	00154	00200264*	LBA	=''SCRA''	
0092			CALL	D\$SEEK	
0093	00156	02300200*	BAN	ERR	
0094	00157	20200001	LBA	1,2	NEXT FREE SECTOR
0095	00160	00400074*	STB	PAR&1	
0096	00161	00400171*	STB	NSD	
0097	00162	00100257*	LAA	=*10	
0098			CALL	D\$FILE	
0099	00164	00000073*	DAC	PAR	
0100	00165	00100262*	LAA	=-*10	
0101	00166	00200263*	LBA	=*6013	
0102			CALL	DISC	SET NAOS
0103	00170	40000012	DAC*	10	
0104	00171	00000000	NSD	ZZZ	
0105	00172	00100262*	LAA	=-*10	

0106	00173	00200263*	LBA	= "6013	
0107			CALL	DISC	
0108	00175	00000000	BAD	ZZZ	DUMP FILE ON DISC
0109	00176	00000000	WCD	ZZZ	
0110	00177	41100014*	BRU*	STOR	
0111	00200	00000000	ERR	HLT	
0112	00201	41100014*	BRU*	STOR	
0113			*****-----		
0114			*		
0115	00202	03300071*	DL ET	STI	DLFL,0
0116	00203	00100257*	LAA	= "10	CLEAR DELETE FLAG
0117	00204	00200073*	LBA	PAR	
0118			CALL	D\$DELE	DELETE NAME ON DISC
0119	00206	01400072*	IMS	CMPR	
0120	00207	01100214*	BRU	SRNK	
0121	00210	00100262*	LAA	= "10	
0122	00211	00300072*	STA	CMPR	
0123	00212	00100257*	COMP	LAA	= "10
0124			CALL	D\$CMPR	COMPRESS DISC AFTER 8 DELETES
0125	00214	00100026*	SRNK	LAA	NC SHRINK CORE DIRECTORY
0126	00215	00001016	LSL	1	
0127	00216	05600000	NEG		
0128	00217	10000001	TAI	,1	
0129	00220	00000003	CLA		
0130	00221	20000001	TAI	,2	
0131	00222	00100073*	LAA	PAR	
0132	00223	21500031*	CMA	NAMT,2	NAME TO BE DELETEDO
0133	00224	01100226*	BRU	*82	
0134	00225	01100232*	BRU	*85	FOUND IT
0135	00226	26100150*	AMX	NOOW,2	2
0136	00227	16100261*	AMX	=1,1	
0137	00230	13400223*	IIB	*5,1	ADV 2 AND TRY AGAIN
0138	00231	41100014*	BRU*	STOR	NOT IN TABLE
0139	00232	20100033*	LAA	NAMT&2,2	
0140	00233	20300031*	STA	NAMT,2	
0141	00234	23400235*	IIB	*81,2	
0142	00235	13400232*	IIB	*-3,1	LOOP TO MOVE NAMES UP
0143	00236	00100261*	LAA	=1	
0144	00237	05600000	NEG		
0145	00240	03100025*	AAM	PNTR	
0146	00241	03100026*	AAM	NC	
0147	00242	03100147*	AAM	ENTB	
0148	00243	03100147*	AAM	ENTB	
0149	00244	03500071*	SMP	DLFL	LISTER NOW SHRUNK
0150	00245	01100247*	BRU	ZOT	WE ARE WIPING
0151	00246	41100014*	BRU*	STOR	
0152	00247	33400007*	ZOT	IIB	WIPE&7,3
0153	00250	00100150*	LAA	NOOW	
0154	00251	00300026*	STA	NC	
0155	00252	00100260*	LAA	=NAMT&2	
0156	00253	00300025*	STA	PNTR	
0157	00254	00100257*	LAA	= "10	
0158			CALL	D\$CMPR	
0159	00256	41100014*	BRU*	STOR	

0160	END
00257	00000010
00260	00000033*
00261	00000001
00262	77777770
00263	00006013
00264	23032201
00265	04040720
00266	16011505