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THE ILLINOIS STATE LIBRARY "ON-LINE" CIRCULATION CONTROL SYSTEM

"On-Line" circulation control has been a reality at the Illinois State Library since late in 1966. It would be incorrect, of course, to think that this was accomplished overnight or instantaneously. Such was decidedly not the case. Beginning as early as 1959, many hours of discussion and planning were required by the office of Secretary of State and its collaborating Drivers License Division and Illinois State Library staff members.

The enormous size of the Illinois State Library collections to be controlled indicated from the outset that some type of data processing would be needed to handle circulation of books in meeting the growing needs of citizens and libraries throughout the state. It was recognized, too, that this would eventually involve the need for machine-processing of new acquisitions as a continuing update for the system.

Card formats were then agreed upon and the punching of 80-column cards was started by Drivers License keypunch operators for the total shelflist of some 575,000 circulating items in the Illinois State Library. At first this was a "fill-in" job between busy seasons. Therefore, a fixed schedule was not established for completion, and as a result approximately two years were required to finish the project. Also, owing to cataloging and classification difficulties, some items held by the Library, such as Federal and state documents, and periodicals, were not included in the listing at this time.

Because of the anticipated installation costs, conversion to data processing control then remained at a standstill for a period of time. There was also the complicating possibility that a centralized computer facility would be acquired by the Office of Secretary of State to handle large-scale service and bureau-type operations for all its divisions, including the Library. To gather

further information, various systems were studied in the meantime, and many "on-site" trips were made to discuss problems and methods of operation. The planner's foremost desire remained, however, the establishment of an on-line system that would not require several conversions.

Late in 1965, a final survey was made to determine the probable accessibility of local computer facilities for State Library use, and it was concluded that no such equipment was available. The survey also indicated there was no computer facility available to operate on the desired "time-sharing" basis. As a result, an order was placed for an IBM 1800 System with remote processing capabilities.

Time went on, and owing to development of third generation computers, the originally scheduled delivery dates for the 1800 System were pushed into the fourth quarter of 1967. However, IBM representatives then indicated that a 1710 System (i.e., a 1620 computer with four disk drives and equipped for remote processing) could be delivered earlier (in mid-October, 1966), and the decision was made accordingly to substitute our original order with the IBM 1710 System.

IBM 1620 20K CPU	Transmission Control--#1026
IBM 1402 Card Reader	
IBM 1443 Printer	4 Input Readers--#1031
	4 Printers--#1033
1 Disk Drive--IBM 1311-004	
1 Disk Drives--IBM 1311-002	18 Disk Packs

Figure 1. IBM 1710 System* Equipment

*The 1710 System was renamed because of the addition of remote processing facilities. The System includes a 1620 Model 1 20K computer with 4 disk drives, a 1026 controller for handling the remotes, which consists of 1031 readers with 1033 printers. Four sets of remote units are used in various parts of the Illinois State Library.

In view of the type of equipment thus finally scheduled for delivery, a small staff of personnel was brought together to undertake the task of getting all areas ready for the arrival of the computer. Procedures and flow charts were brought up to date as needed. At the same time, tape formats were changed.

The cards punched between 1962-64 had originally been loaded onto tape by the Drivers License Division's UNIVAC III in card image format. Since one of the requirements for the final system was to be a machine-readable book card, it was determined that the UNIVAC tape format would need to be reconfigured in IBM format. Since the local computer division did not have the programs for handling such a job, three basic reels of UNIVAC tape were sent to a service company in Pennsylvania, and shortly thereafter thirteen reels of reconfigured tape were returned.

The next job was that of producing book cards from the reconfigured tapes. An IBM 1401 was used to punch off a book card for each item on the tape and to interpret these cards so that ordinary clerks could work readily with them. Some 440,000 usable cards were punched, and an error list of bad records was printed.

The most massive job, however, was that of matching the cards to books in the stacks. Since a complete inventory had not been taken of the Library for some 100 years, it was decided to inventory the Library while inserting the book cards. This project got underway in August 1966. Completion of the task was hopefully scheduled to coincide with the delivery date of the computer.

In addition to the new personnel assigned to the Library by the Drivers License Division (a data processing manager, two keypunch operators, and several computer operators) IBM supplied a system engineer and other support help to assist in making ready for the arrival of the computer. As previously noted, many of the procedures had already been flow-charted for operations on a computer, so that much of the system analyst's work was largely completed. Accordingly, work was also carried forward at this time on the actual programs to be used with the 1620 Computer. The primary task of the computer, at the start, was to be the control of circulation of books from the State Library. The program for this purpose was named CIRCON.

This program was designed to handle each transaction concerning a book, developing the necessary records as appropriate to accomplish each preassigned task. It charges out and records the return of each book; it can also renew the item and set up a new due date for the book.

To take a closer look at how CIRCON operates, we can trace its charging-out procedure (Figures 2 and 3). In this procedure, a patron card is inserted in the badge section of the remote 1031 terminal together with the book card. The program then calls in the master patron file* and checks to see if the patron's number refers to a valid borrower or user of the Library. If the patron is identified as a valid user, the patron number as well as the book card information is transmitted to the computer for final editing. When editing is complete, the information is placed on the transaction packs for the day. Charge-outs and returns are listed in the order in which they occur, for further processing after hours.

If a title is returned for which a reserve has been placed, it is checked against the list which is at the beginning of the day's transaction pack (Figure 4). A book being discharged from circulation has the call number and the Cutter number taken from the book card and checked against the reserve list. If a reserve exists on the file, it then transmits the information to the printer located next to the discharging terminal. The 1033 printer indicates the call number, Cutter number, patron number, and the date the reserve was placed. The book is then turned over to the reserve clerk for handling.

The essential feature of CIRCON is that it is run in a "time-sharing" mode. An interrupt feature allows the computer to set in the program until the 1026 controller signals that information is being received from a terminal for handling. This feature allows the central processing unit to run only when handling information is fed to it. Needless to say, this cuts down a great deal on the amount of logged time on the computer.

*This file is generated from the registration data for patrons of the Library. It includes names, addresses, and Library card numbers and is available at all times to CIRCON.

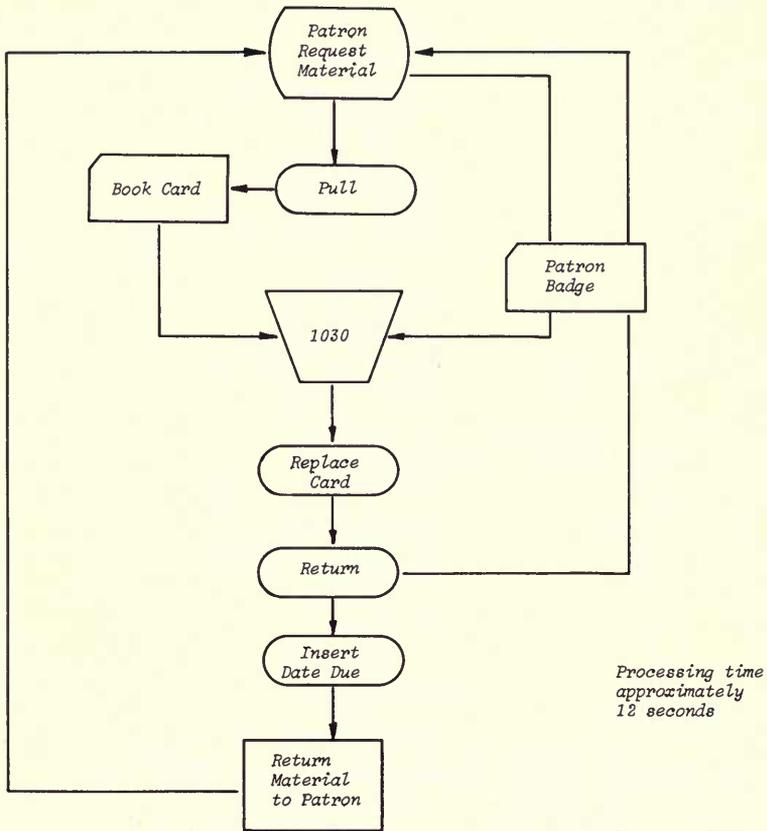
Each evening, the computer room lists and punches a card for each transaction which has occurred during the day as it appears on the circulation transaction disk. The lists and cards are filed as a back-up for the computer in case of a major disaster. Daily transactions are also sorted into Dewey, Cutter, and serial number order, and a program for circulation updating (CIRCUP) is next called into the computer to handle the merging of the sorted transactions with the master circulation record. CIRCUP takes an item from the transaction pack and locates its place in the master file. If the transaction is a discharge, it removes it from the master pack, and if it is a charge, the information is added to the file. Occasionally a book is charged out, which for some unknown reason has not previously been discharged from the master file. In this case, a section of the program places the new charge on the pack, removes the one on the pack, and punches out a card as well as listing the item on the printer. CIRCUP maintains the new master file in Dewey order, building a new file each time it is updated, and at the same time printing out the day's statistical information of activity by Dewey classification.

Overdue notices are another product of the system. At assigned intervals overdues are selected from the master transaction file. These are first transferred to a disk pack from which they are sorted by patron number. Paper is loaded into the printer and the overdues program (DUENOT) is called in to print overdue notices for books which are listed for each borrower. The master patron file is accessed to obtain a mailing address for each notice.

Monthly statistics are a further product which records the use of the Library by Dewey classification as well as departments. Statistical analysis of reserves, both by borrower and type of book, is also easily obtained from the appropriate punched cards. All such statistics are of great use to the collection development staff.

In summary, the system as outlined above first became operational on December 1, 1966, handling by computer at that time only the adult charges from the Library. The inventory, which had taken a great deal more time than anticipated, was finally completed so that by September 1, 1967, all charges were being handled by the computer.

What does such a system cost in round dollar figures? Our basic rental has been \$6,500 per month. This includes our keypunches and some allied equipment. A breakdown of average costs during the past year indicates that the cost per transaction has been 32 cents. When we compare this to manual charge costs, we find it broadly comparable except in the case where a large, cheap labor supply is available. We may note, too, that as a result of the system the number of the employees in the circulation records unit of the Library has been reduced from twenty-two at the peak of the season to a staff of nine who handle the shipment of most of the books from the Library.



Patron checks made by computer:

*Patron number valid
Patron authorized A. V. material
Patron blocked*

Record updated by computer:

*Patron record
Circulation record
Department statistics
Book use list*

Figure 2. Charge-Out Procedure

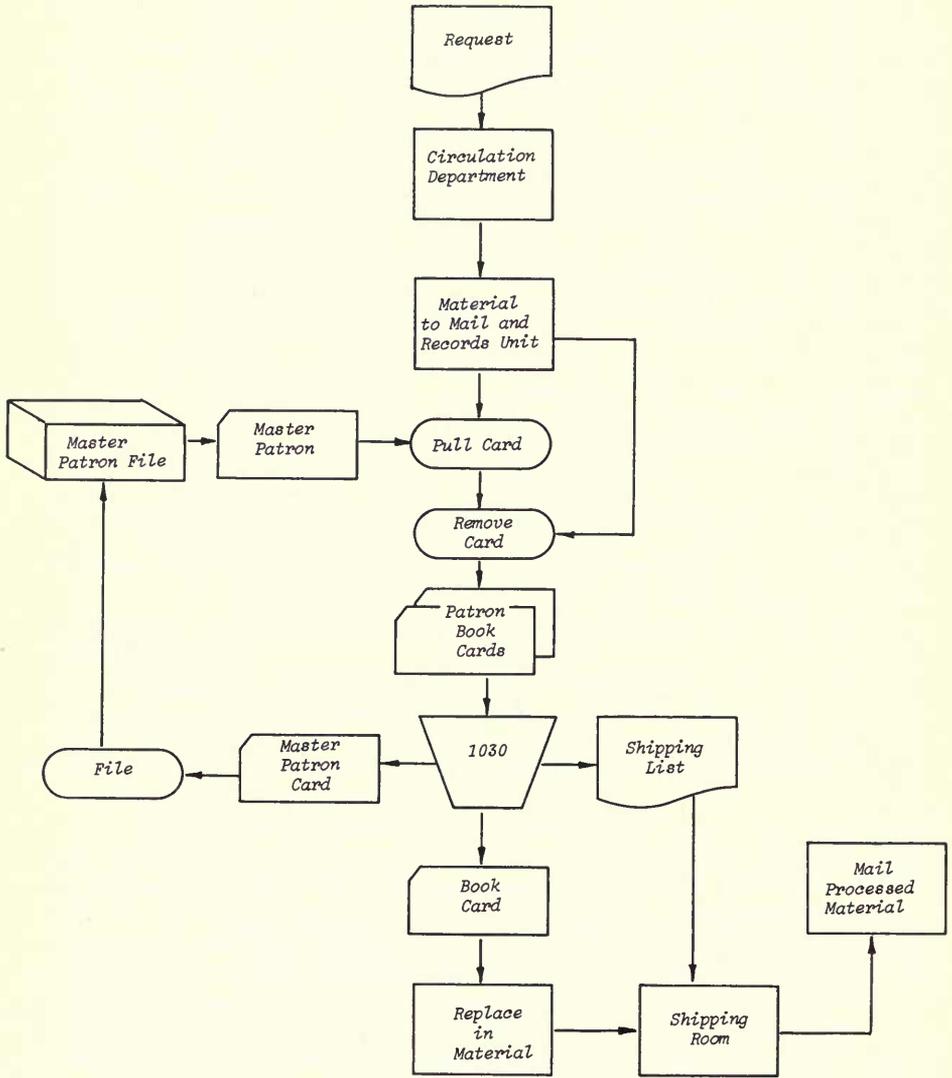


Figure 3. Processing Material for Shipment

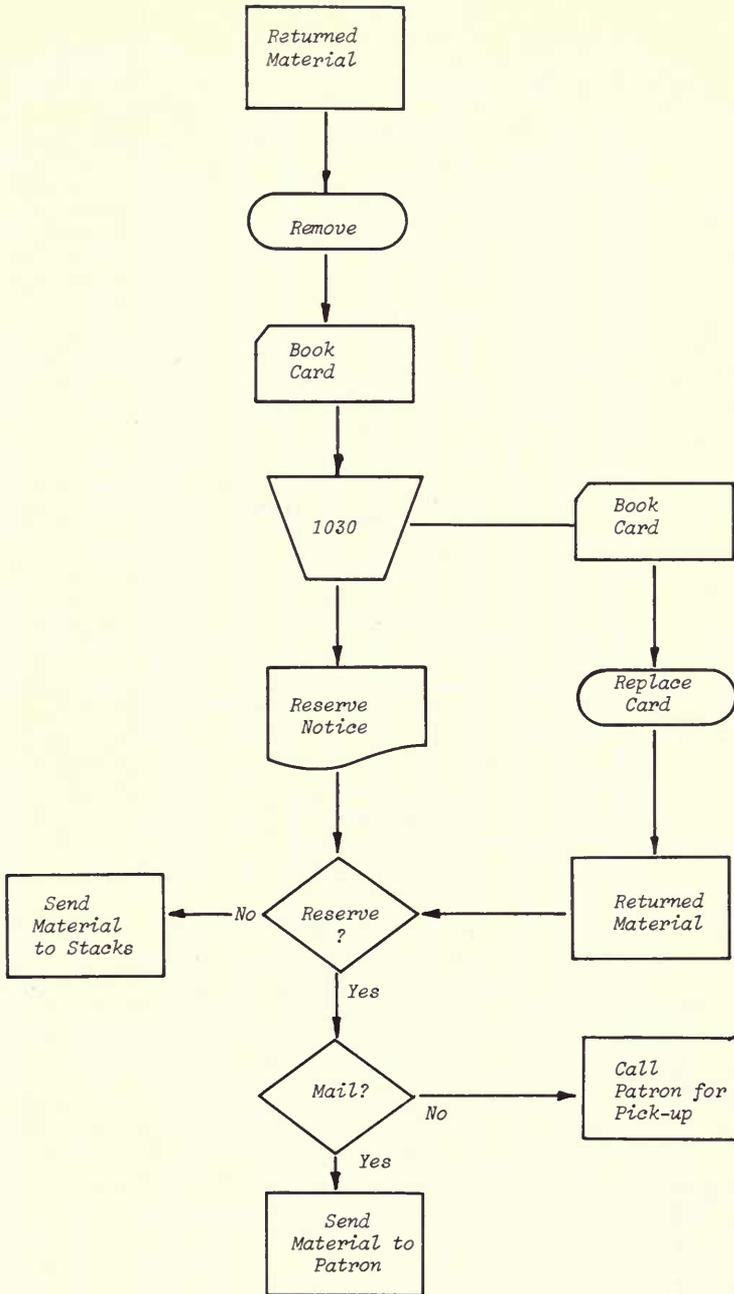


Figure 4. Discharging Procedure

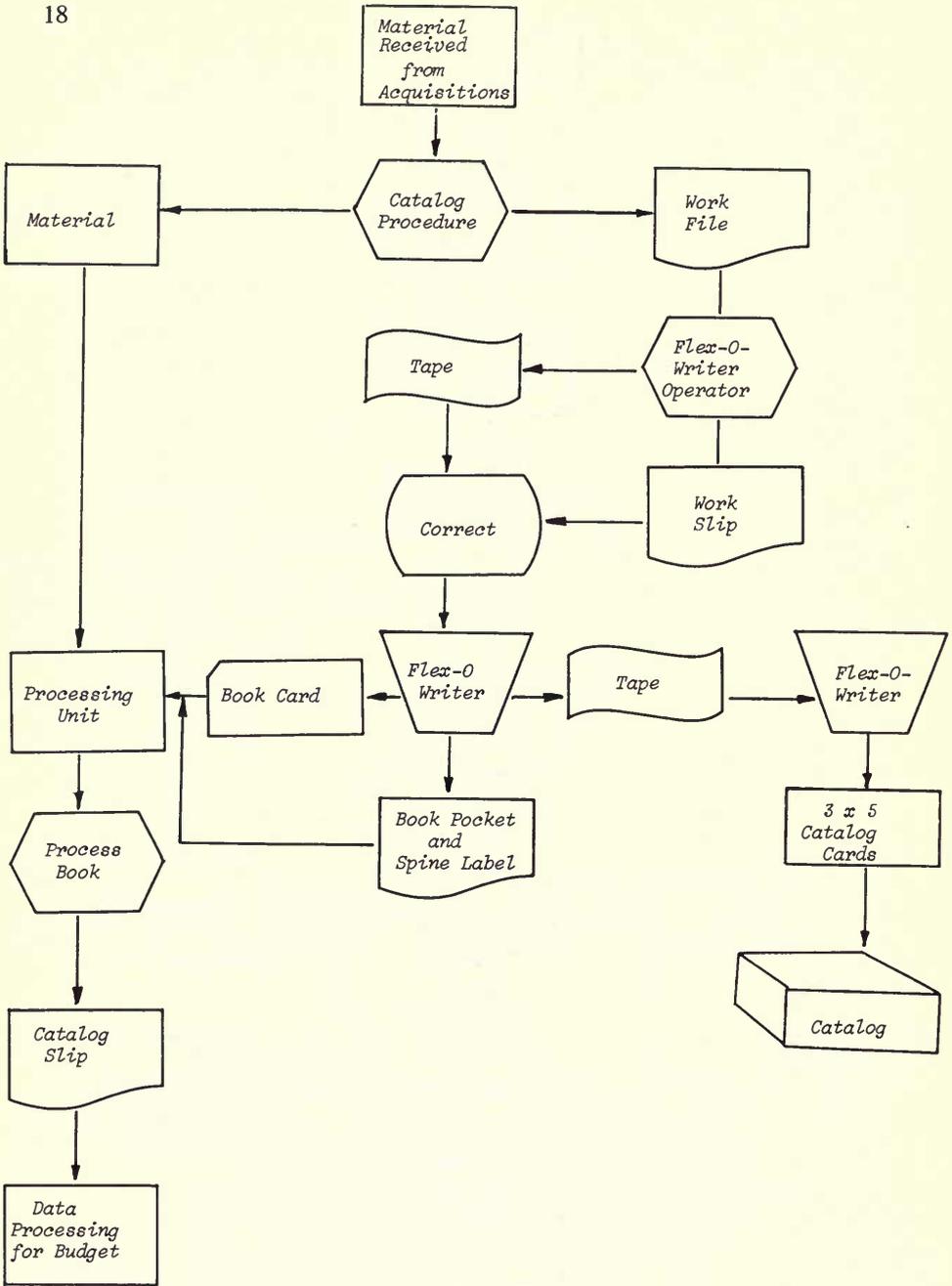


Figure 5. Catalog Procedure

KEY 27 zeros	NEXT SECTOR (5)	LIMIT SECTOR (9599) (5)	0 (5)	1 (5)	2 (5)	3 (5)	4 (5)	5 (5)	6 (5)	7 (5)	8 (5)	9 (5)	10 (5)	11 (5)
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DEPARTMENTS 0 - 11

Figure 7. Transaction Control Field: Department Statistics

PREFIX (2)	DEWEY (18) 9 characters	SERIAL NUMBER (7) num	T I O PATRON I I NUMBER (5) num	TITLE (60) 30 characters	DATE (5) num
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TI - TRANSACTION INDICATOR 0 - Discharge 01 - OVERDUE INDICATOR 0 - OK
 1 - Desk Charge 1 - Overdue Once, etc.
 2 - Mail Charge PREFIX - F, Y, J, P, etc. DEWEY PREFIX
 4 - Recharge (renewal)

Figure 8. Transaction Record

PACK NUMBER (5)	MORE? (5)	NEXT SECTOR (5)	UNUSED (85)
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PACK NUMBER - 00001, 00002, etc.
 MORE? - 99999 - YES
 00000 - NO

Figure 9. Circulation Control Field

CYLINDER 0 HIGH DEWEY-CUTTER (38)		SECTOR (5) 00	CYL BLANK (5)	CYLINDER 1 HIGH DEWEY-CUTTER (38)		SECTOR (5) 01	CYL BLANK (5)
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CYLINDER 2 HIGH DEWEY-CUTTER (38)		SECTOR (5) 02	CYL BLANK (5)	CYLINDER 3 HIGH DEWEY-CUTTER (38)		SECTOR (5) 03	CYL BLANK (5)
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Figure 10. Reserve Index

DP	P	DEWEY NUMBER (18) 9 characters	CUTTER NUMBER (18) 9 characters	PATRON Number (5) num	DATE (5) num
R					
C					
E					
O					
F					
D					
I					
E					
J					
X					

* DP CODE - DISPOSITION CODE - 0 - MAIL, 1 - DESK. 1 position num
 DP CODES FLAGGED FOR DELETED OR FILLED RESERVE
 PREFIX - DEWEY PREFIX (ALPHA) - BLANK or J, P, Y, F, etc. 2 positions num

Figure 11. Reserve Record

P	T	PATRON NAME (44) 22 characters	ADDRESS (28) 14 characters	CITY(20) 10 characters	ZIP(5) 5
I	Y				0
P	E				U
					N
					T

* NOTE! - FIRST POSITION OF RECORD (PATRON INDICATOR) IS FLAGGED FOR "SECTOR IN USE". TYPE - PATRON TYPE: 0 - 9
 PI - PATRON INDICATOR: 0 - AUTHORIZED, 1 - BLOCKED, & 2 - BOOKS ONLY COUNT - COUNT OF PATRON USAGE

Figure 12. Patron Disk Record

STATUS		LINE CONDITION
Transmit EOB	0 0 0	Good transmission to terminal or console.
Control EOB Check	1 0 0	1. Answerback not received by 1026 in response to test. 2. Loss of communication line de- tected during transmission.
Transmit Control EOB	1 0 1	Ⓝ received in response to addressing.
Transmit Control EOB Check	1 1 0	1. Addressing answerback time-out (no response received from terminal). 2. Loss of communication line detect- ed during addressing.
Transmit EOB Check	1 1 1	1. Transmission (to terminal or con- sole) has VRC check which was de- tected by 1026. 2. Text answerback from terminal is other than Ⓞ.

Figure 13. Address Mode

STATUS		LINE CONDITION
Idle	0 0 0	1. End of polling list. 2. Text answerback has been sent to terminal without multiblock feature. 3. Line has been idled. 4. Disconnect operation has been completed. 5. Connection not established when dialing on an automatic calling line.
Buffer Check	0 0 1	Input message from terminal or con- sole exceeds capacity of buffer or console.
Control EOB Check	1 0 0	1. Test time-out (22. 6-23 seconds). 2. Successful bid for line due to poll- ing time-out (522-533 milliseconds). 3. Loss of communications line during polling or receiving.
Control EOB	1 0 1	1. Ⓞ received by 1026 in response to text answerback (Ⓞ or Ⓝ). 2. Successful bid for line when re- sponse to polling is Ⓝ. 3. Connection established by dialing on automatic calling line.
Receive EOB	1 1 0	Good message received from terminal or console.
Receive Check EOB	1 1 1	Message has VRC or LRC check (from terminal or console).

Figure 14. Polling Mode

1st	Polling Point
2nd	Transaction Code
3rd	Dewey Number
4th	Cutter Number
5th	Author
6th	Title
7th	Serial Number
8th	Patron Number
9th	Due Date
10th	Department Number

Figure 15. Order of Items: Transmission
Over Processing Lines

I. PATRON FILE (ON-LINE)

File on drives 3 & 5, cylinders 0-98 of drive 3 and cylinders 48-98 of drive 5. Patron numbers 0-19,799 are on drive 3 in the corresponding sectors, numbers 19,800-29,999 on drive 5 sectors 9,600-19,799. If patron number exceeds 19,799 we subtract 10,200 from the number to develop the sector number on drive 5. Maximum number of patrons: 30,000. Last patron number: 29,999.

(Updated daily)

II. RESERVE FILE (ON-LINE)

File on drive 5; cylinders 0-3, sectors 0-799. Two records per sector. Reserve index in sectors 0 & 1. Maximum number of reserve records in file is 1,596.

(Updated daily)

III. TRANSACTION FILE (ON-LINE)

File on drive 5; cylinders 4-47, sectors 800-9,599. Maximum number of transactions: 8,799. Transaction control field in sector 800.

(Sorted and merged with circulation file daily)

IV. CIRCULATION FILE (OFF-LINE)

File stored off-line and updated daily with transactions. "Old" (yesterday's) circulation file is placed on drive 5, a "scratch" pack on drive 3 will be the "new" (today's) circulation file after updating with transactions on drive 7. Unlimited storage capacity. Circulation control fields and pack numbers in sector zero of each pack.

(Updated daily)

NOTE: DRIVE NUMBERS ARE PROGRAM NUMBERS--1, 3, 5, 7.

Figure 16. System File Descriptions

0 DISCHARGE----- (NOTE--IT IS A 9 IN THE CARTRIDGE)
 1 MAIL CHARGE
 2 DESK CHARGE
 3 MASTER PATRON CARD
 4 RENEWAL

 1031 SETUPS

	CARD	BADGE	CARTRIDGE
DISCHARGE	X		X
DESK CHARGE	X	X	X
MAIL CHARGE	X		X
MASTER PATRON	X		
RECHARGE (RENEWAL)	X		X

Figure 17. Transaction Codes of CIRCON 1.

MESSAGE	CAUSE	ACTION
"XX/XX/XX Recharged"	Book has been recharged.	Put slip in book.
"Incorrect Year"	Patron attempting to use last year's patron card.	See if patron is still registered and has current card. Charge fails.
"Patron Blocked"	Blocked patron attempting to charge out material.	Disallows him to charge material. Charge fails.
"Patron not authorized for A-V"	Patron attempting to charge audio-visual material and not authorized.	Disallow him to charge material. Charge fails.
"On Reserve"	Patron attempting to recharge material that is reserved.	Disallow him to renew material. Recharge fails.
"XX/XX/XX New Patron"	Patron charging material with no disk patron record.	Charge succeeds--just verify that he is indeed a new patron.
"Invalid Patron Indicator"	Patron indicator is not 0, 1, or 2.	Charge fails. Check disk patron record.
"Patron No. Exceeds 29,999"	Patron number larger than allowed	See data processing

Figure 18. Circulation Control: 1033 Messages