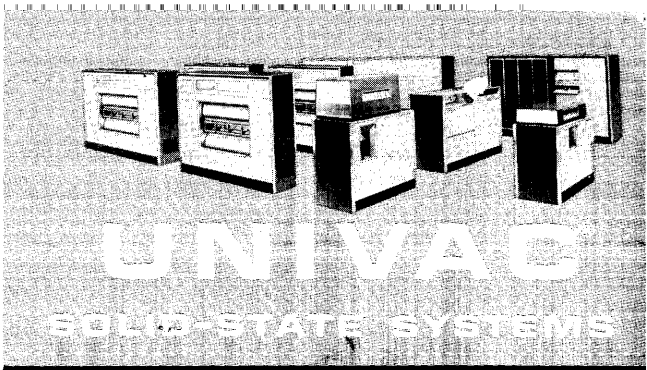


TECHNICAL BULLETIN

RANDEX

Storage System

December, 1961

CONTENTS

1. INTRODUCTION

RANDEX® is a mass storage drum file which can be used on-line with the UNIVAC® Solid-State Systems. A single RANDEX unit, with its two magnetic storage drums, has the capacity to store more than 24,000,000 digits of information. Large files and routines can be placed in RANDEX storage and accessed without limit to the number of calls made to drum storage (Figure 1–1).

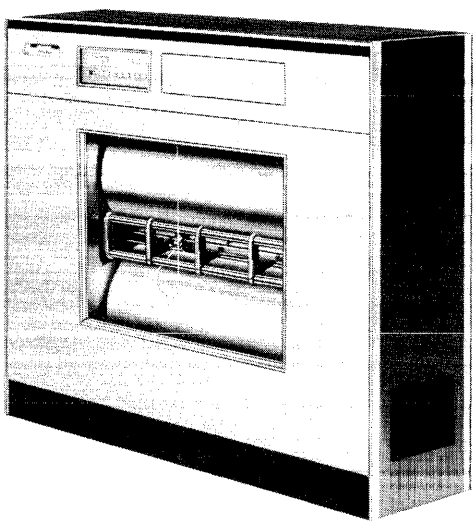


Figure 1–1. RANDEX Unit

A maximum of ten RANDEX units may be incorporated in any system in the UNIVAC Solid-State line. If all ten units are attached to a computing system, nearly a quarter of a billion digits of readily accessible information is added to the existing storage capacity of the system. In addition, the RANDEX units operate under complete program control in the same on-line manner as other units of the UNIVAC Solid-State Computing System.

CHARACTERISTICS

The RANDEX System consists of a synchronizer and one or more RANDEX Drum File units. A drum file unit contains two storage drums on which data is recorded and from which data is read by means of two read-write heads. The read-write heads are attached to a servo mechanism which moves along a bar, or boom, between the two storage drums (Figure 1–2). The boom itself moves to obtain fine positioning of the read-write heads. The movement of the servo mechanism is called a *major* move; the movement of the boom is called a *minor* move. The system has been designed so that the two movements, major and minor, can occur simultaneously and thus insure that no additional time is involved when both movements are necessary.

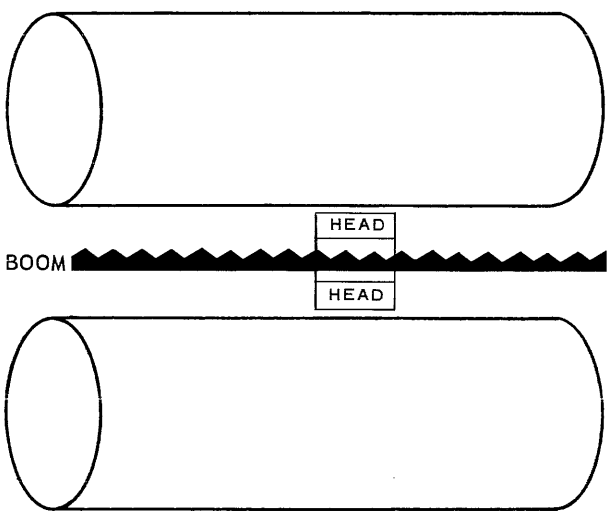


Figure 1-2. RANDEX Unit Schematic

The synchronizer, common to both RANDEX drum units and tape units, coordinates the flow of information between drum or tape units and the Central Processor. All data which passes between the drum or tape units and main storage is stored temporarily in a synchronizing register and on the synchronizer buffer band.

FEATURES

- MASS STORAGE – Each RANDEX unit has a capacity of 24,000,000 digits of readily accessible information.
- ON-LINE OPERATION – RANDEX operates completely on-line under program control.
- BALANCED PROCESSING – Execution of RANDEX instructions from the synchronizer leaves the Central Processor free to perform other operations. Simultaneous operation with the various other units in the UNIVAC Solid-State System is ensured by buffer control.
- PROGRAMMING FLEXIBILITY – Search instructions are provided which give RANDEX users increased programming flexibility.
- ASSURED ACCURACY – Data transfers are automatically checked to ensure accuracy in transmission. In addition, error conditions are handled under program control.
- REDUCED HANDLING – The availability of RANDEX storage greatly reduces the physical handling necessary with cards and tape.
- CENTRALIZED CONTROL – Through the control unit in the synchronizer, data transfers are handled for both the RANDEX units and the tape units.

2. GENERAL DESCRIPTION

RANDEX DRUM FILE

The two drums of the RANDEX unit, designated Drum *A* (lower drum) and Drum *B* (upper drum), contain a total of 4,000 tracks (2,000 for each drum) on which file data may be stored. For addressing purposes, each drum is considered to be divided into drum-half segments coded 0 and 1 for Drum *A*, and 2 and 3 for Drum *B* (Figure 2–1).

Sectors and Tracks

The 2,000 tracks of each drum are divided into one-hundred 20–track groupings called *sectors*. Sectors are addressed by code numbers 00 through 99 (Figure 2–2). Each sector is contained on two-drum half segments and, therefore, references to a particular sector must indicate which drum half

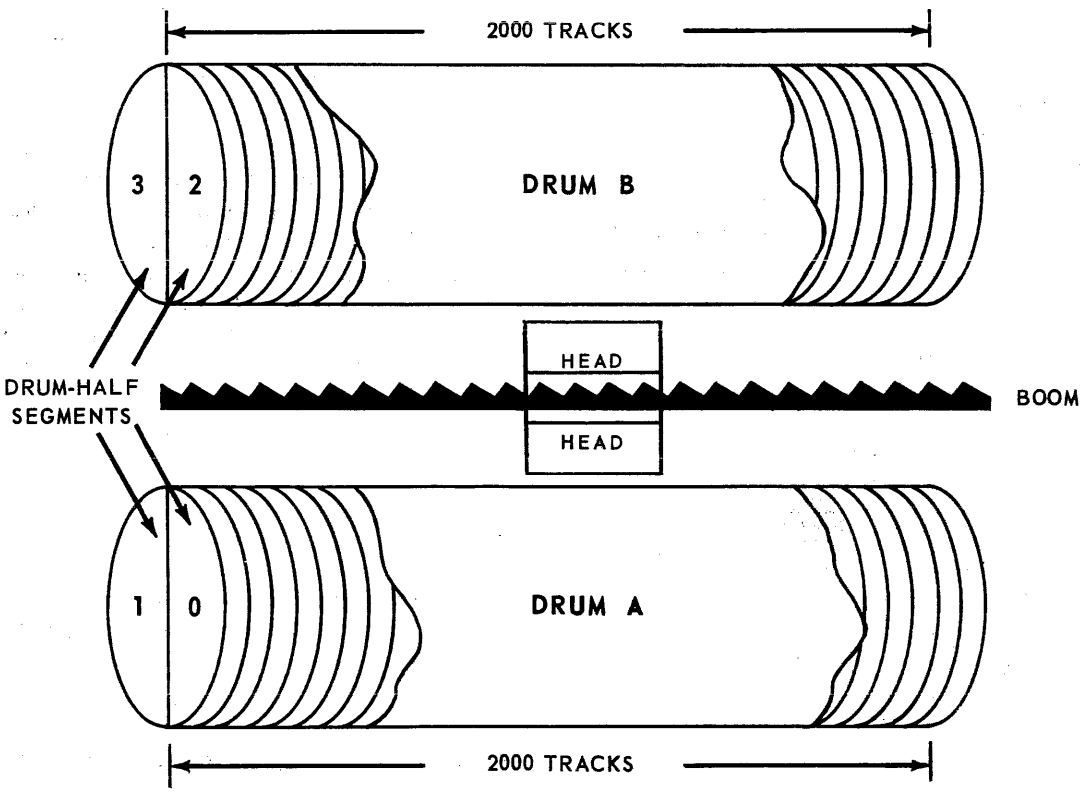


Figure 2–1. The RANDEX Drum File

segment (0,1,2, or 3) is being referenced. The exact method of referencing will be discussed in Chapter 3.

Tracks are addressed as they relate to a particular position within a sector. Since each sector contains twenty tracks, they are addressed 00 through 19 (Figure 2–2).

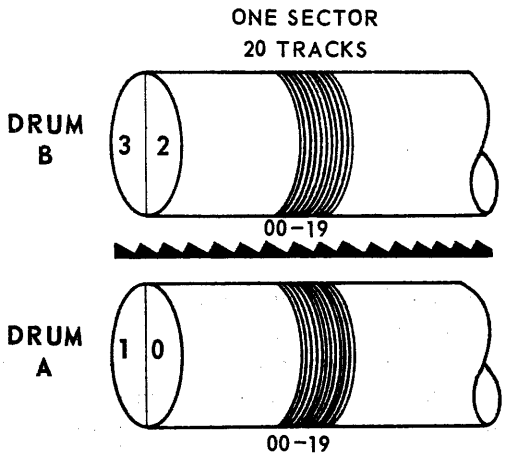


Figure 2–2. Drum Sectors

Blocks

The *block* is the only addressable unit of information on the RANDEX drum. There are twelve blocks of data per track with six located in each drum-half segment. Each block consists of *forty-eight* 11–digit words (10 digits plus sign). Each block on a drum-half segment is identified by a 1–digit block tag of from 0 to 5 (Figure 2–3).

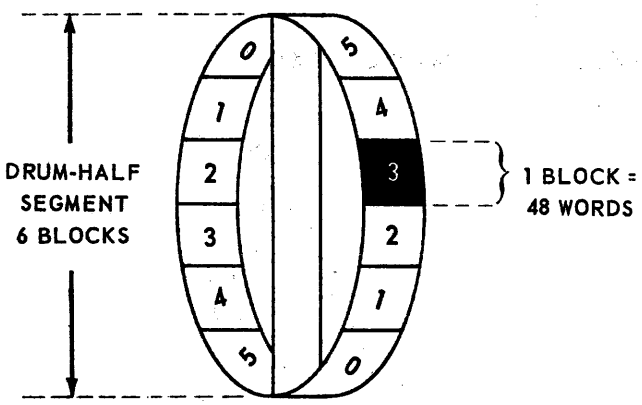


Figure 2–3. FUNCTIONAL Description of Block Layout

RANDEX Word

The RANDEX word is a 10–digit-plus-sign configuration. Each digit of the RANDEX word is represented by four data bits and one parity bit. Both digits and bits are recorded serially on the drum (Figure 2–4).

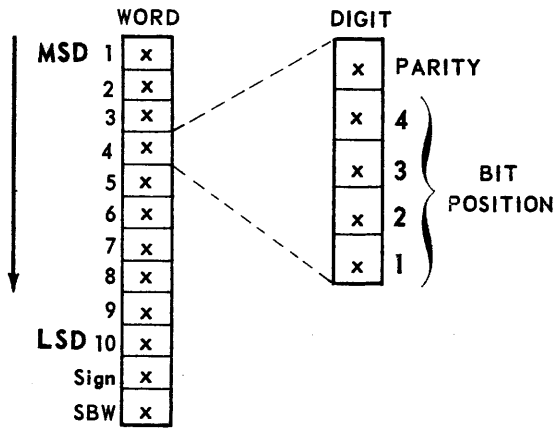


Figure 2–4. RANDEX Word And Digit

SYNCHRONIZER

The differences in both speed and data formats between the Central Processor and the RANDEX unit require that data flow between the two units be controlled by the synchronizer. The same synchronizer is utilized by the tape units.

The synchronizer contains four synchronizing registers and the Synchronizer Instruction Register *(SIR)* discussed in section 3. It also contains the logic circuitry which controls and checks the transfer of information. The synchronizing registers store briefly all data which pass between the RANDEX units and main storage of the Central Processor. The capacity of each of the four registers is one 12–digit word and information is transferred digit-serial and bit-parallel. The twelfth digit position is used as the space between words *(SBW)* and is included as part of the word.

The synchronizer also checks the parity of words written on or read from the RANDEX file. The movement of data through the four synchronizing registers is not under program control.

RANDEX BUFFER AND INTERLACE

The RANDEX buffer is an intermediate storage area used by both drum-file and tape units. The

MEMORY LEVEL	WORD	MEMORY LEVEL	WORD	MEMORY LEVEL	WORD	MEMORY LEVEL	WORD
000	93′	050	18′	100	43′	150	68′
▶001 ①	0 R	▶051	25 R	101	50	151	75
002	62′	052	87′	102	12′	152	37′
003	69	053	94	▶103	19R	▶153	44R
004	31′	054	56′	104	81′	154	6′
▶005	38R	055	63	105	88	▶155	13R
006	0′	056	25′	106	50′	156	75′
▶007	7R	▶057	32R	107	57	157	82
008	69′	058	94′	108	19′	158	44′
009	76	▶059	1R	▶109	26R	159	51
010	38′	060	63′	110	88′	160	13′
▶011	45R	061	70	111	95	▶161	20R
012	7′	062	32′	112	57′	162	82′
▶013	14R	▶063	39R	113	64	163	89
014	76′	064	1′	114	26′	164	51′
015	83	▶065	8R	▶115	33R	165	58
016	45′	066	70′	116	95′	166	20′
017	52	067	77	▶117	2R	▶167	27R
018	14′	068	39′	118	64′	168	89′
▶019	21R	▶069	46R	119	71	169	96
020	83′	070	8′	120	33′	170	58′
021	90	▶071	15R	▶121	40R	171	65
022	52′	072	77′	122	2′	172	27′
023	59	073	84	▶123	9R	▶173	34R
024	21′	074	46′	② 124	71′	174	96′
▶025	28R	075	53	125	78	▶175	3R
026	90′	076	15′	126	40′	176	65′
027	97	▶077	22R	▶127 ④	47R	177	72
028	59′	078	84′	128	9′	178	34′
029	66	079	91	▶129	16R	▶179	41R
030	28′	080	53′	130	78′	180	3′
▶031	35R	081	60	131	85	▶181	10R
032	97′	082	22′	132	47′	182	72′
▶033	4R	▶083	29R	133	54	183	79
034	66′	084	91′	134	16′	184	41′
035	73	085	98	▶135	23R	185	48
036	35′	086	60′	136	85′	186	10′
▶037	42R	087	67	137	92	▶187	17R
038	4′	088	29′	138	54′	188	79′
▶039	11R	▶089	36R	139	61	189	86
040	73′	090	98′	140	23′	190	48′
041	80	▶091	5R	▶141	30R	191	55
042	42′	092	67′	142	92′	192	17′
043	49	093	74	143	99	▶193	24R
044	11′	094	36′	144	61′	194	86′
▶045	18R	▶095	43R	145	68	195	93
046	80′	096	5′	146	30′	196	55′
047	87	▶097	12R	▶147	37R	197	62
048	49′	098	74′	③ 148	99′	198	24′
049	56	099	81	▶149	6R	▶199	31R

① START ② UNIVAC END ③ USS END ④ RANDEX END R RANDEX

TABLE 1. – *RANDEX Interlace*

buffer band enables arithmetic and other functions to proceed in the Central Processor simultaneously with the transfer of input or output to and from the band.

The RANDEX interlace (see Table 1) employs the same band levels as the tape interlace utilizing the first 48 unprimed words of the tape interlace. All data to be written on the RANDEX drum is first stored in main storage in the desired block image sequence. The data is then transferred to the buffer band by a program instruction. The remaining unprimed and primed portions of the tape interlace are not affected.

When data is to be transferred from the RANDEX drum to main storage, the synchronizer will read the addressed block and transfer it through the synchronizing registers to the buffer band. The 48 RANDEX words are then entered in the first 48 unprimed word locations of the RANDEX interlace pattern on the buffer band. The 48 primed locations of the interlace are filled with zeros developed in the synchronizer as the RANDEX block is transferred through the synchronizing registers.

If, however, alphabetical information is to be stored, both numeric and zone portions are recorded in the unprimed locations of the interlace. That is, two unprimed locations are used to store an alphabetic word.

CODES

Data is stored on the RANDEX drum in a 4–bit plus-parity configuration. If numerical data is to be stored on the drum file, the data, in either computer code or XS-3 code, is entered into the first 48 unprimed locations of the tape interlace. The zone bits, which are used to form alphabetic characters, are ignored.

3. THEORY OF OPERATION

Two types of instructions control the RANDEX Drum File System; instructions controlled by the Processor, and instructions staticized and controlled by the synchronizer.

The first group of instructions employ normal instruction word format while the second group is modified to accommodate references to the RANDEX drum.

RANDEX INSTRUCTION FORMAT

To access a block of information on one of the RANDEX units, a special instruction format is employed. The seven low-order digits of the instruction word are used for the RANDEX address while the two high-order digits, contain the operation code. The remaining digit (position 3) is disregarded by the Processor and may, for convenience, be specified as zero. The following indicates the construction of the RANDEX instruction.

1	2	3	4	5	6	7	8	9	10
O	P	*0*	U	D	S	S	T	T	B

Here: **OP** is *operation code*.

U is number of RANDEX *unit* (0 – 9).

D is number of *drum-half segment* (0 – 3).

SS is number of *sector* (00 – 99).

TT is number of *track* (00–19).

B is number of *block* (0 – 5).

SYNCHRONIZER INSTRUCTION REGISTER (SIR)

The synchronizer contains a special instruction register, the Synchronizer Instruction Register *(SIR)*, which staticizes the special format of the RANDEX instruction word and also decodes and executes the instructions which control RANDEX operations.

The SIR consists of eight subregisters, one for each of the address digits plus one for the first digit of the operation code. The second digit of the operation code is a nonvariable parity-correct number 8.

A RANDEX instruction is first transferred from storage in the Central Processor to the Synchronizer Instruction Register. Execution of the instruction begins immediately upon receipt of the instruction by the SIR . If the synchronizer is not free when the instruction is given, the Processor will be interlocked. Interlocking can be avoided if the methods set forth in Chapter 5 are adhered to.

INSTRUCTION REPETOIRE

The instruction repertoire of the RANDEX system is divided into instructions which are staticized by the Processor and instructions which are staticized in the Synchronizer Instruction Register. The Processor-controlled instructions are of two types: instructions common both to the RANDEX unit and the Tape System and those applicable only to the RANDEX unit.

PROCESSOR-CONTROLLED INSTRUCTIONS - RANDEX UNIT AND TAPE

In the most significant digit of an operation code, *C* and *F* represent the non-numeric bit combinations 0111 and 1101.

		WORD TIMES
SYNCHRONIZER TEST		
C2 m c	Test the synchronizer to determine if it is available. If the synchronizer is available, transfer the contents of register *C* to register *A* and go to *m* for the next instruction. If the synchronizer is busy, direct control to c for the next instruction.	4 if m 3 if c
TEST BUFFER		
C7 m c	Test the buffer to determine whether it is loaded, available, or in use. If it is loaded or available, transfer the contents of the error flip-flops into register *L* and transfer the contents of register *C* into register *A*. The next instruction will be at *m*. If the buffer is in use, control is transferred to c for the next instruction.	5 if m 3 if c
LOAD BUFFER		
C6 $\overline{bb00}$ c	Transfer the contents of the storage band specified by *bb* to the buffer. Data should be placed in the interlace positions before giving the C6 instruction. For optimization, this instruction should be placed at level 048 and the next instruction at level 053. When index register modification is used, the C6 order should be placed at level 047.	205
UNLOAD BUFFER		
F6 $\overline{bb00}$ c	Transfer the contents of the buffer to the storage band indicated by *bb*. The words are placed on the storage band in the appropriate interlace positions. For minimum latency the order should be placed at level 198 with the next instruction at level 003. If index register modification is used, the *F*6 instruction should be placed at level 197.	205

PROCESSOR-CONTROLLED INSTRUCTIONS - RANDEX UNIT

HEAD POSITION SAMPLE		
43 $\overline{0n00}$ c	Test the RANDEX unit, specified by *n*, and set the head position flip-flop if the head is in position.	3
HEAD POSITION TEST		
92 m c	Test the head position flip-flop. If it has been set, transfer the contents of register *C* to register *A* and go to *m* for the next instruction. If the head position flip-flop is not set, go to c for the next instruction.	4 if m 3 if c

LOAD SIR

40 m c	Transfer the contents of memory location specified by *m* to the SIR and go to c for the next instruction. The location specified by *m* should contain an instruction in the RANDEX instruction format. The instruction is executed immediately upon receipt by the SIR.	4

SIR-CONTROLLED RANDEX INSTRUCTIONS

POSITION RANDEX HEAD

18 $\overline{m}$ $\overline{c}$ *OUDS STTB*	Move read-write heads to the track and sector of the drum unit specified. If the positioning of the read-write heads requires only a minor movement (move to another track in the same sector), 125 milliseconds will be required. If a major move is needed (move to a track in another sector), up to 550 milliseconds will be required. During the execution of the instruction, the synchronizer will be interlocked for a period of 15 milliseconds. Since the tape units use the same synchronizer, no tape order can be executed during that time. The buffer is not interlocked, however, and the Central Processor is free to perform other operations.	125 ms. (min) 550 ms. (max)

WRITE INSTRUCTION

28 $\overline{m}$ $\overline{c}$ *OUDS STTB*	Transfer one block of data from the buffer to the indicated block address on the RANDEX drum. If the block is not located after passing of one drum revolution, set error flip-flop, release buffer and synchronizer interlock flip-flops.	35 ms. (min) 105 ms. (max)

READ INSTRUCTION

38 $\overline{m}$ $\overline{c}$ *OUDS STTB*	Transfer one block of data from the RANDEX drum to the buffer band. If the block is not located after passing of one drum revolution, set error flip-flop, release buffer and synchronizer interlock flip-flops.	35 ms. plus latency

WRITE-CHECK INSTRUCTION

48 $\overline{m}$ $\overline{c}$ *OUDS STTB*	Transfer one block of data from the buffer band to the indicated block address on the RANDEX drum. Reread the block immediately and check for bit count and parity. If the block is not located after passing of one drum revolution, set error flip-flop, release buffer and synchronizer interlock flip-flops.	105 ms. plus latency

SEARCH-WRITE INSTRUCTION

58	$\overline{OUDS}^{m}$ $\overline{STTB}^{c}$	Transfer one block of data from the buffer to the RANDEX block identified by the search. If the block is not located after passing of one drum revolution, set error flip-flop, release buffer and synchronizer interlock flip-flops.	35 ms. plus latency

SEARCH-READ INSTRUCTION

68	$\overline{OUDS}^{m}$ $\overline{STTB}^{c}$	Transfer one block of information identified by the search from the RANDEX unit to the buffer. If the block is not located after passing of one drum revolution, set error flip-flop, release buffer and synchronizer interlock flip-flops.	35 ms. plus latency

SEARCH IDENTIFICATION

A one-word identifier is loaded into unprimed word position 0 (location X001) in the buffer band interlace. In the execution of either the search-read or search-write order, this one-word identifier is compared with each of the first four words in the first block of the drum-half segment, sector, and track specified by the instruction. Agreement between the identifier and any one of the first four words in the block will signal a find. If the identifier agrees with none of the four words, the comparison proceeds through the first four words of each successive block until a match is found or until the last block on the last drum-half segment has been examined. If a find occurs, the remainder of the block is read or written in the same revolution of the RANDEX drum. If no match occurs, a "no find" indication will be present in the error flip-flops.

After a find has been made on a search-read instruction, the remainder of the block (beginning with word 4) is read into the buffer. Word 0 of the interlace will contain the identifier originally delivered to the synchronizer register at the beginning of the instruction – regardless of which of the first four words in the block it matched. Words 1, 2, and 3 will contain nothing of value. In the case of the search-write instruction, the writing will begin with word 4 of the block. Words 0 through 3 will be unaltered.

Thus, it is possible to pack several items having one word identifiers into one block. For example, four 12–word items could be packed in a block using the first four words for the identifying data However, it should be noted that, since the original identifier on a search-read is entered into the buffer as word 0 regardless of whether or not it matched words 0, 1, 2, or 3 on the drum, it will be necessary to duplicate the four words of identification elsewhere in the block in order to make a programmed determination of which item was matched.

For example, there are four items of data identified in words 0 to 3 as items *A*, *B*, *C*, and *D*. Item *A* data will be found in words 4 to 14, item *B* data in words 15 to 25, item *C* in words 26 to 36, and item *D* in words 37 to 47. A search is instituted for item *C* by loading its identifier into unprimed word location 0 and performing a search-read (assuming head-positioning and other necessary preliminaries). When the matching block is found on the drum, the identifier for item *C* will be located in word 0 on the interlace despite the fact that the drum holds item *C* identification in word 2. Whether the search had been for item *A*, *B*, or *D*, the identifier originally entered would be located in word 0 of the interlace. Therefore, it becomes necessary to store each item's identifying number elsewhere in order to determine with which of the four records we are concerned.

The specifications mentioned above do not, of course, preclude the use of an identifier of more than ten digits. In those cases where a larger identifier is used, it is necessary to perform the search on a partial identifier. After a search-find has occurred a program comparison is performed on the remaining portion of the identifier. Obviously, the ten digits chosen as the search identifier should be those which are most likely to cause a uniquely correct find. Where a find on the partial search on ten digits is followed by a failure to match on the programmed comparison, the search must be reinstituted.

4. TIMING AND PROGRAMMING CONSIDERATIONS

DATA ACCESS TIME

Average access time can be estimated only when the size of a file is known. The arrangement of the file and the density and frequency of sequential and random references has to be taken into consideration. Distance and time traveled by the read-write heads have to be established.

Head-Positioning Time

The timing involved in positioning the read-write heads as well as that involved in the search will vary according to whether the move occurs within one sector (minor move) or whether it exceeds the boundaries of the sector in which the head was positioned prior to the move (major move). When the head is already positioned over the track that is to be read, there will be no time interval for positioning.

A minor move requires 125 milliseconds regardless of the number of tracks crossed within a sector. A major move requires a varying amount of time depending upon the number of sectors to be moved. The move may involve a minimum of 200 milliseconds if the head is moved to an adjacent sector (which may only be one track away) or a maximum of 550 milliseconds where the head has to travel over 99 sectors. Whenever a major and minor move occur simultaneously, no additional time is added for the minor move inasmuch as the movement of the boom which carries the head occurs concurrently with the movement of the head. Table 2 shows a sampling of the times required for major moves. In each case, the maximum possible time is given.

TABLE 2 – *ACCESS TIME-RANDEX*

DISTANCE OF MOVEMENT (Sectors)	TIME FOR MOVEMENT (Milliseconds)
1	200
2	210
3	220
4	230
5	237
6	245
7	250
8	254
9	259
10	263
15	278
20	285
25	312
30	330
50	392
75	468
99	550

Drum Latency

The RANDEX drum revolves at a rate of 870 rpm and therefore, the period of rotation for one drum-half segment on which the track to be read is

located is 34.48 milliseconds. The delay attributable to latency in accessing one block of data may vary from 0 to 69 milliseconds for the read, write, and write-check orders. In the case of the search instructions, the delay, because of latency, within one track could amount to as much as 140 milliseconds. Six block identifiers can be checked in 2.61 milliseconds.

INTERLOCKS

Two interlock conditions affect the execution of RANDEX instructions:

- *RANDEX Buffer Interlock*
- *RANDEX Synchronizer Interlock*

The instruction affected by either of these interlocks remains in register C and does not initiate an operation until the interlock condition is removed.

RANDEX Buffer Interlock

This interlock is present while the RANDEX write, write-check, read, search-write, and search-read instructions are being executed. The same type of interlock occurs if two consecutive storage -to-buffer transfer instructions are given. In the second case, only the *first transfer* instruction is executed.

The RANDEX buffer test instruction is provided to enable the programmer to avoid a delay, and the danger of a loss of data, which could be caused by an interlocked or stalled Processor. The buffer test instruction should precede any RANDEX instruction which affects the RANDEX buffer.

RANDEX Synchronizer Interlock

The RANDEX synchronizer is interlocked during the execution of all instructions handled by the synchronizer. The duration of the interlock is equivalent to the time it takes to execute the particular instruction. The only exception is the head-positioning order (18) which interlocks the synchronizer for only 15 milliseconds.

PROGRAMMING CONSIDERATIONS

The general sequence in which instructions are issued to reference information in the RANDEX storage system is shown in the following illustration. The purpose of this sequence of instructions is to read a block of data from the RANDEX unit and deliver the information to main storage in the Central Processor.

1. *TEST SYNCHRONIZER (C2)* – The synchronizer must be free to receive an instruction to load the SIR.

2. *LOAD SIR (40)* – A head positioning instruction must be given if the block to be read is not located on the track currently under the read-write head.

3. *POSITION HEAD (18)* – The execution of the instruction begins upon receipt by the SIR. The buffer and Central Processor are free following the 4 word times required for the 40 instruction. The synchronizer is engaged fro 15 milliseconds.

4. *HEAD POSITION SAMPLE (43)* – This instruction examines the RANDEX read-write head and sets the head-position flip-flop if the head movement has been completed.

5. *HEAD POSITION TEST (92)* – The head-position flip-flop now indicates whether the head is ready to read or write data. If set, the next instruction is obtained from *m*. If the head-position flip-flop is not set, the next instruction is obtained from *c*.

6. *BUFFER TEST (C7)* – The buffer test is given prior to the transfer of the read instruction to determine if the buffer is available for loading.

7. *LOAD SIR (40)* – The read instruction (38) is transferred to the SIR. After 4 word times the Central Processor will be free. The buffer and synchronizer will not be available.

8. *RANDEX READ INSTRUCTION (38)* – The read instruction is executed in 35 milliseconds plus latency.

9. *BUFFER TEST (C7)* – The buffer test is given following a read instruction to determine whether the buffer is loaded and to check for possible errors in data transmission.

10. *UNLOAD BUFFER (F6)* – The contents of the buffer are transferred to main storage.

TABLE 3–*EFFECT OF INTERLOCKS ON RANDEX OPERATIONS*

INSTRUCTION	NO INTERLOCKS	SYNCHRONIZER INTERLOCK ONLY	SYNCHRONIZER INTERLOCK AND R/T BUFFER INTERLOCK
C2 Synchronizer Test	Yes (rC) ⟶ rA m address	No ⟶ c address	No ⟶ c address
C7 Buffer Test	Yes (rC) ⟶ rA m address	Yes (rC) ⟶ rA m address	No ⟶ c address
43 Head Position Sample	If Head Positioned Set HP Flip-Flop ⟶ c address	⟶ c address	⟶ c address
92 Head Position Test	⟶ m address	⟶ c address	⟶ c address
C6 6MMS Buffer	Normal execution	Normal execution	Stall
F6 6 Buffer MS	Normal execution	Normal execution	Stall
18 Position R/W Head	Normal execution	Stall	Stall
40 RANDEX Instr ⟶ SIR	Normal execution	Stall	Stall
28 RANDEX Write	Normal execution	Stall	Stall
48 RANDEX Write Check	Normal execution	Stall	Stall
38 RANDEX Read	Normal execution	Stall	Stall
58 RANDEX Search/Write	Normal execution	Stall	Stall
68 RANDEX Search/Read	Normal execution	Stall	Stall

5. ERROR CONDITIONS

Error conditions arising in the RANDEX units are handled completely under program control. The RANDEX error conditions will not cause an abrupt stop of the Central Processor except in those areas where safeguards have been built in to protect the equipment. When an error occurs, an error control routine may be used which will correct most off-normal conditions. If the error routine cannot correct the condition, an orderly halt will be initiated to ensure that information committed to the system will not be lost.

Error conditions existing in the RANDEX storage system are made available to program detection by executing a buffer test (C7 instruction). When the test passes, the contents of the error flip-flops are sent to register *L* and the buffer interlock control is reset.

ERROR INDICATIONS IN REGISTER L

RANDEX error indications in register *L* (Table 4) are basically similar to those used with the UNIVAC Solid-State 80 and 90 Tape Systems. A master error indication (0111) will appear in digit position 1 if an error has occurred in either RANDEX or the tape system. Errors occurring in the RANDEX system are differentiated from tape errors by the presence of a 4 bit in digit position 3. A complete listing of RANDEX error indications is given in the Table 3.

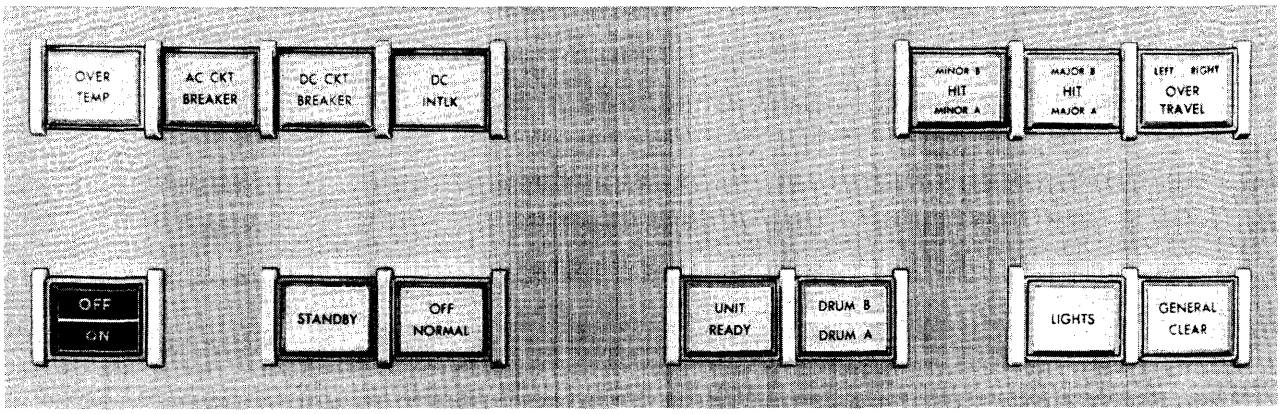
RANDEX CONTROL FEATURES

As in the other input and output units of the UNIVAC Solid-State System, an off-normal condition existing in a RANDEX unit will be shown both on the RANDEX control panel and on the control panel of the Central Processor. The control panel of the RANDEX unit requires relatively little attention by the operator since most operations requiring manual control are keyed in on the panel of the Central Processor. Consequently, the control panel of each RANDEX unit serves principally as a monitor reflecting the performance characteristics of the unit. The arrangement of the operator's controls and indicators on the RANDEX control panel is shown in Figure 5–1.

TABLE 4 – *RANDEX ERROR INDICATIONS*

DIGIT* POSIT.	BIT	ERROR	COMMENT
1	0111	MASTER	INDICATES PRESENCE OF AN ERROR IN EITHER RANDEX OR THE TAPE SYSTEM.
2	5	> ONE BLOCK+20	INDICATES A BLOCK COUNT OF GREATER THAN 528 DIGITS, BY AT LEAST 20 DIGITS.
	4	BUFFER PARITY	INDICATES PARITY ERROR IN BUFFER-TO-MEMORY OR BUFFER-TO-SYNCHRONIZER TRANSFER. NOTE: ON A MEMORY-TO-BUFFER TRANSFER ERROR, THE COMPUTER WILL STOP. ON A BUFFER-TO-MEMORY TRANSFER, THE COMPUTER WILL BE DIRECTED TO c+1 FOR THE NEXT INSTRUCTION.
3	5	>ONE BLOCK	INDICATES A BLOCK COUNT OF GREATER THAN 528 DIGITS.
	4	RANDEX	INDICATES ERROR OCCURRED AS A RESULT OF A RANDEX OPERATION.
4	5	<ONE BLOCK	INDICATES A BLOCK COUNT OF LESS THAN 528 DIGITS.
5	5	1/0 PARITY	INDICATES PARITY ERROR DURING DATA TRANSFER BETWEEN RANDEX AND SYNCHRONIZER OR TAPE AND SYNCHRONIZER.
	4	BAD SPOT	INDICATES BAD SPOT ON TRACK. (USED ONLY IN DRUM PREPARATION.)
6	5	BAD TRACK	INDICATES AN ERASED TRACK.
7	5	NO FIND	DURING SEARCH READ OR SEARCH WRITE, THE SEARCH IDENTIFIER DID NOT AGREE WITH ANY ONE OF THE FIRST FOUR WORDS OF ANY BLOCK ON THE TRACK SEARCHED.
8	5	ADDRESS	1. UNUSED ADDRESS (NUMERICAL VALUE EXCEEDING GIVEN RANGE). 2. ILLEGAL DIGIT CODE (ONLY CODES 0–9 CAN BE USED). 3. INDICATES ADDRESS ON DRUM DOES NOT AGREE WITH ADDRESS OF THE INSTRUCTION ALTHOUGH THE ADDRESS IS LEGITIMATE. (MAY RESULT FROM MISPOSITION OF READ-WRITE HEAD, MISREAD, ETC.) 4. DURING DRUM PREPARATION, AN ADDRESSED BAD SPOT WILL CAUSE A MISREAD WHICH WILL BE INDICATED AS AN ADDRESS ERROR.
9			NOT USED FOR RANDEX.
10	5	RIC	INDICATES THAT A RANDEX INTERLOCK CONTROL RESPONSE WAS NOT RETURNED TO THE SYNCHRONIZER WHEN A RANDEX INSTRUCTION WAS INITIATED, WHEREUPON THE RIC ERROR IS GENERATED WHEN CONDITIONS WARRANT.

* *Digit positions are numbered from the MSD (1) to the LSD (10).*



The function of each of the buttons and button-lights on the RANDEX control panel is given in the following descriptions.

OVERTEMP

Normally green, indicating normal temperature conditions. Amber light indicates early warning of over-temperature conditions.

Red light indicates that the unit has shut down except for cooling blowers because of over-temperature condition somewhere in the system.

AC CKT BREAKER

Normally green, indicating that all a.c. circuit breakers are closed.

Red light indicates that a circuit breaker has blown and that all transistor and servo power has been turned off.

DC CKT BREAKER

Normally green, indicating that all d.c. circuit breakers are closed.

Red light indicates that a circuit breaker has blown and that all transistor and servo power has been turned off.

DC INT'LK

Normally green, indicating that all chassis on the electronic deck and all cards in the transistor library are plugged in.

Red light indicates that a chassis or a card has been removed and the d.c. power has been turned off.

MAJOR HIT B – MAJOR HIT A

Normally green, indicating that no hits have occurred since the last clear operation. (A hit refers to a contact made by the read-write head other than a normal positioning operation.)

Red light indicates that a major hit has occurred, that the read-write heads have been retracted, and that an alarm signal has been sent to the control unit.

(The two halves of this indicator operate independently, one half referring to drum B and the other to drum A.)

OVERTRAVEL

Normally green, indicating proper carriage position.

Red light on left side indicates overtravel to the left.

Red light on the right side indicates overtravel to the right. Overtravel in either direction removes power from the servo motor and causes retraction of the read-write heads.

ON-OFF

Normally green, indicating that the drum file is turned on.

Red light indicates that the drum file is turned off. Each actuation of the button reverses the condition of the drum file. After power has been cut off from the drum unit by one of the off-normal conditions, the button will not light and its depression will not have effect until the GENERAL CLEAR button is depressed.

STANDBY

Normally unlighted.

Blue light indicates that the drum unit is in a stand-by condition. This is a condition in which the drums are turning but the servo and transistor power is off.

OFF NORMAL

Normally unlighted.

Amber light indicates that an abnormal condition exists somewhere in the unit.

UNIT READY

Lighted white when the unit is ready to perform a read or write operation or to receive a new track address.

Unlighted when in the process of positioning the read-write head for a new track address.

DRUM B – DRUM A

Upper half lights white when drum B is selected for a read or write operation.

Lower half lights white when drum A is selected for a read or write operation.

LIGHTS

White light indicates that the panel and drum illumination is turned on.

Unlighted when panel and drum illumination is turned off.

GENERAL CLEAR

Normally unlighted.

Depression of this button-light clears and resets all controls and indicators. Lights white during actuation.

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