LOC: J7A

digital

E125

Fred

RK06 DISC
E125

10 DAYS

OBJECTIVES

Following the course, the successful student will be able to perform preventive maintenance routines, dismantle and reassemble the Disc Drive and align both mechanically and electronically all relevant items in the drive. In addition, the student will be able to diagnose and repair faults on the RK611 controller and the RK06 Drive using the recommended test equipment and associated diagnostic software.

PARTICIPANTS

The course is suitable for engineers who will be maintaining the RK611/RK06 cartridge disc subsystem.

PREREQUISITES

The student will have successfully attended the Engineers Introduction to the PDP11 course and have a working knowledge of the material covered in any PDP11 Processor Maintenance Course.

COURSE TOPICS

RK611

1 Unibus Interface.
2 Data Module.
3 Drive Interface.
4 Register Board.
5 PLO Operation.
6 Error Correction.
7 Flow Diagrams.
8 Maintenance Wraps.
9 Obtaining Status by Program.
10 Interpreting Error Messages.

RK06

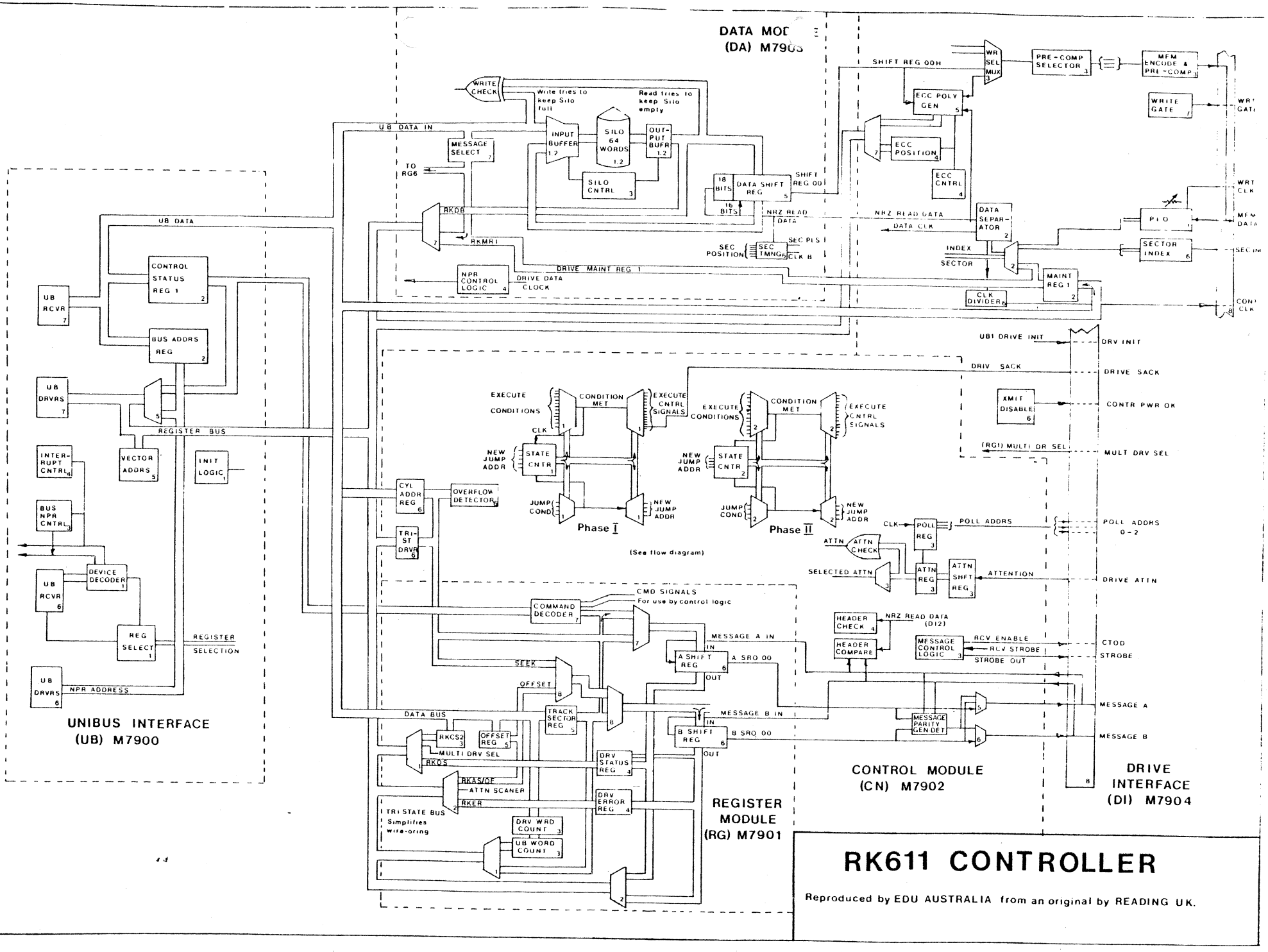
1 Power Up Routine.
2 Servo System/Head Positioning.
3 Servo Data Processing Chain.
4 Sector/Index Production.
5 Message Assembly/Distribution.
6 Read/Write Circuitry.
7 Offset operation.

Practical

1 Subassembly removal and replacement.
2 Mechanical alignments and electronic adjustments.
3 Diagnose simulated faults in a controlled environment.

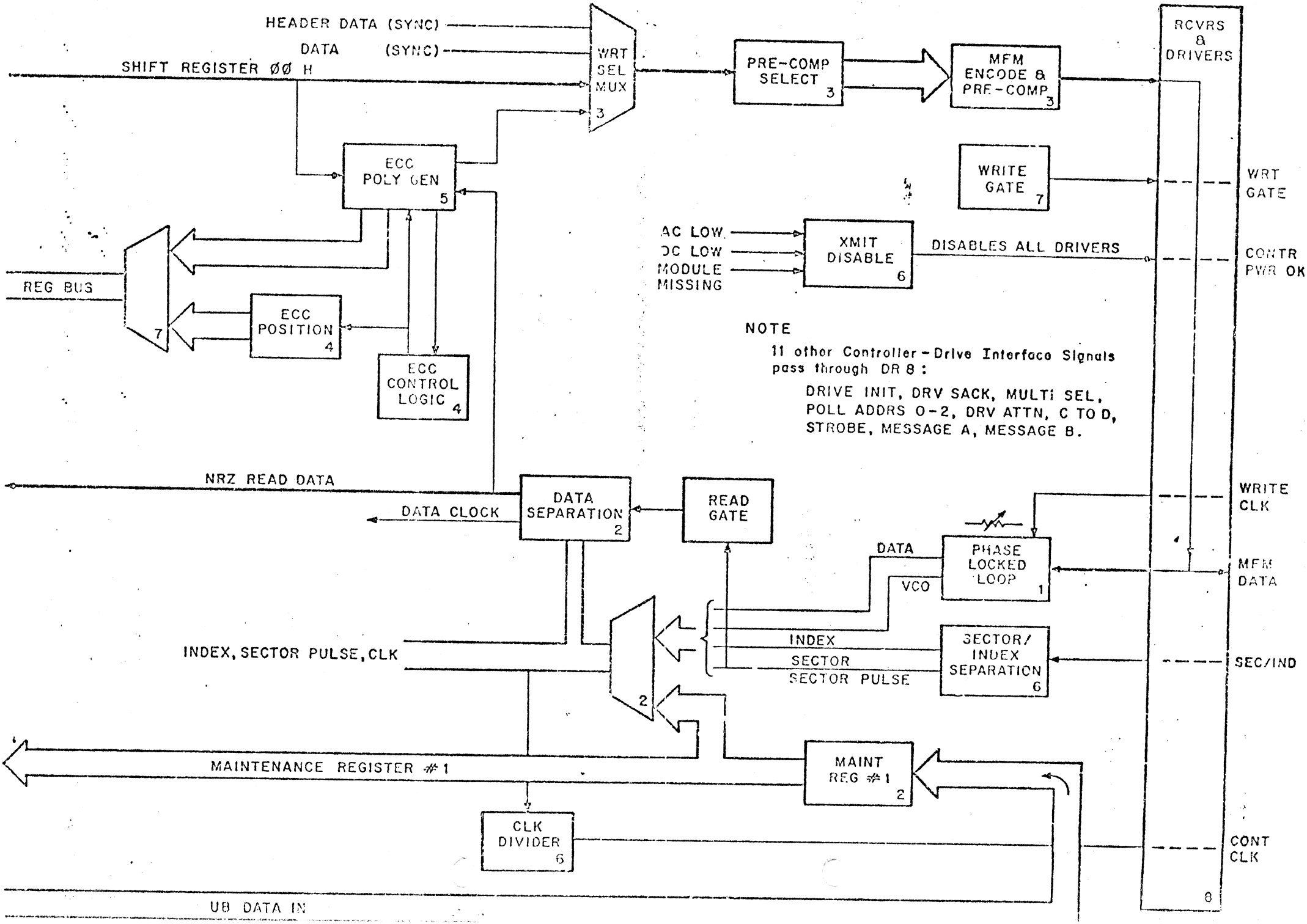
COMPARISON OF PDP-11 DEC-DISK SPECIFICATIONS

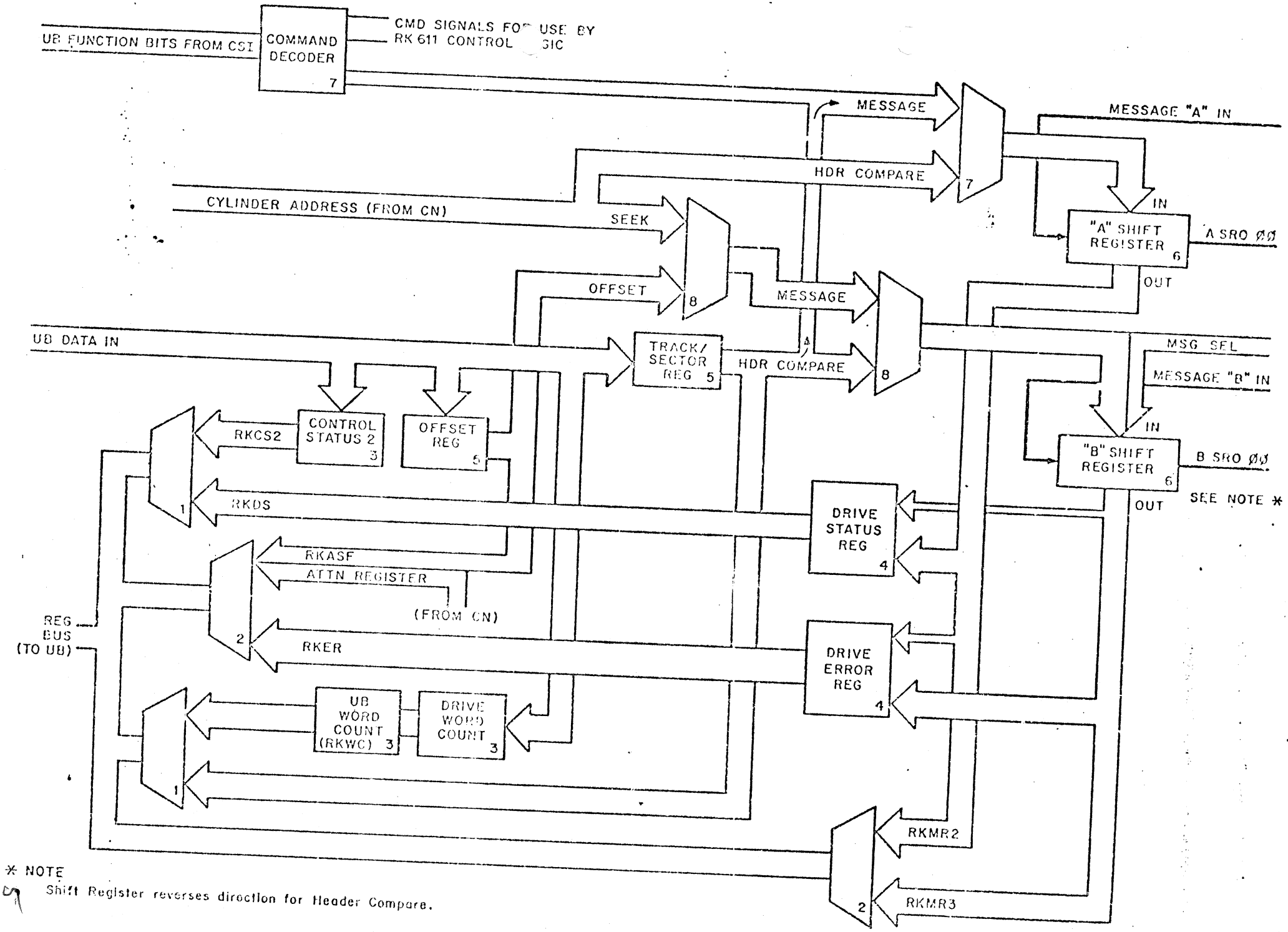
	RS64/ RC11	RS08-M/ RS11/ RF11	RS03/ RH	RS04/ RH	RX01	RK05/ RK11	RK05-F/ RK11	RP02/ RPR02/ RJP11/C/E	RP02S/ RP11	RP03/ RP11-C	RP04/ DCL/ RH	RP05/ DCL/ RH	RP06/ DCL/ RH	RK06/ RK611
MANUFACTURER	DEC	DEC	DEC	DEC	CAL COMP/ CENTURY DATA	DEC	DEC	MEMOREX (660-1)	I.S.S. (714)	I.S.S. (715)	I.S.S. (733)	MEMOREX (677-51)	MEMOREX (677-01)	DEC
TYPE DISK	FIXED HEAD	FIXED HEAD	FIXED HEAD	FIXED HEAD	MOVING HEAD	MOVING HEAD	MOVING HEAD	MOVING HEAD	MOVING HEAD	MOVING HEAD	MOVING HEAD	MOVING HEAD	MOVING HEAD	MOVING HEAD
MEDIUM	10" NI-CO PLATED, NON-REMOVABLE	15" NI-CO PLATED, NON-REMOVABLE		→	IBM "DISKETTE," REMOVABLE	IBM 2315 REMOVABLE CARTRIDGE	IBM 2315 NON-REMOVABLE CART	IBM 2316 DISK PACK, REMOVABLE	IBM 2316 DISK PACK, REMOVABLE	IBM 2316 DISK PACK, REMOVABLE	IBM 3336 DISK PACK, REMOVABLE	IBM 3336 DISK PACK, REMOVABLE	IBM 3336-11 DISK PACK, REMOVABLE	DEC [illegible] REMOVABLE [illegible]
CAPACITY (1 DISK)	65 KW	262 KW	262 KW	524 KW	125 KW	1.2 MW	2.4 MW/ TWO LOGICAL UNITS	10 MW	10 MW	20 MW	44 MW	44 MW	88 MW	6.9 MW
MAX # DISKS PER CONTROLLER	4	8	8	8	1	8	3 PHYSICAL UNITS (6 LOGICAL)	8	8	8	8	8	8	8
# WORDS PER SECTOR	32	1	64	128	64	256	256	256	256	256	256	256	256	256
# SECTORS/ TRACK	64	2048	64	64	26	12	12	10	10	10	22/20	22/20	22/20	22/20
# TRACKS/ SURFACE	32	128	64	64	77	203	406	203	203	406	411	411	815	411
# DATA SURFACES	1	1	1	2	1	2	2	20	20	20	19	19	19	3
BIT CELL TIME	835 NS	720 NS	200 NS	200 NS	4 μS	690 NS	690 NS	400 NS	400 NS	400 NS	155 NS	155 NS	155 NS	232 NS
WORD XFER RATE	14 μS	16 μS	8 μS	2 μS FOR SHORT XFERS 4 μS > 8K	36 μS	11 μS	11 μS	7.4 μS	7.4 μS	7.4 μS	2.5 μS	2.5 μS	2.5 μS	3.7 μS
MAX. ACCESS TIME	33 MS	33 MS	17 MS	17 MS	103 MS	85 MS	85 MS	60 MS	55 MS	55 MS	52 MS	53 MS	53 MS	67 MS
MAXIMUM BIT DENSITY	1800	1900	2200	2200	3200	2200	2200	2200	2200	2200	4040	4040	4040	4040
RECORDING METHOD	NRZI	NRZI	MFM (MILLER ENCODING)	MFM	FM FREQUENCY MODULATION	FM	FM	FM	FM	FM	MFM	MFM	MFM	MFM
TIMING, OR SERVO TRACKS	CLOCK (A) MARK (B) ADDRESS (C)	CLOCK (A) ADDRESS (B) DELIMITER (C)	CLOCK	CLOCK	SOFT SECTOR	NONE	NONE	NONE	NONE	NONE	TRACK FOLLOWING SERVO DATA ON ONE DISK SURFACE	→	→	→
MOTOR	1 PH. 1800 RPM	1 PH. 1800	1 PH. 3500	1 PH. 3500	1 PH 360	1 PH. 1500	1 PH. 1500	1 PH. 2400	1 PH. 2400	1 PH. 2400	3 PH. 3600	1 PH. 3600	1 PH. 3600	1 PH. 2400
COST PER 8K OF STORAGE	≅ $760	≅ $456	≅ $424	≅ $200	≅ $250	≅ $74	≅ $37	≅ $16	≅ $21	≅ $15	≅ $4.90	≅ $4.90	≅ $3.09	≅ $6



RK611 CONTROLLER

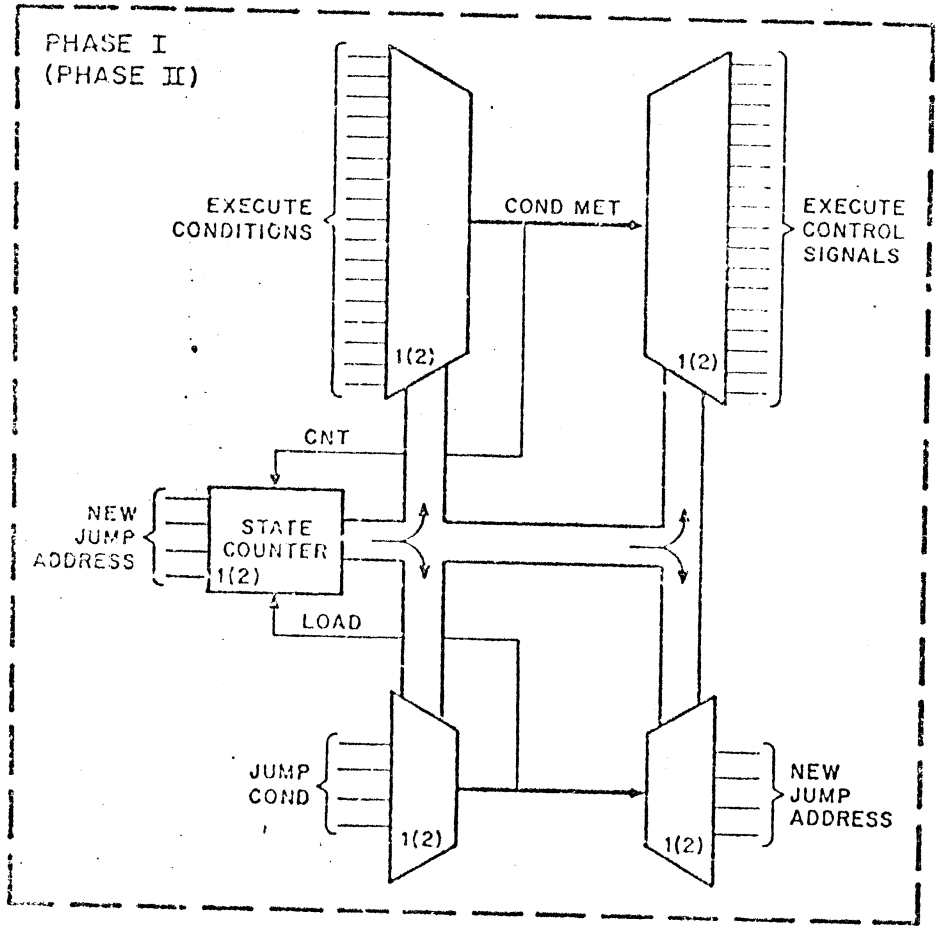
Reproduced by EDU AUSTRALIA from an original by READING UK.

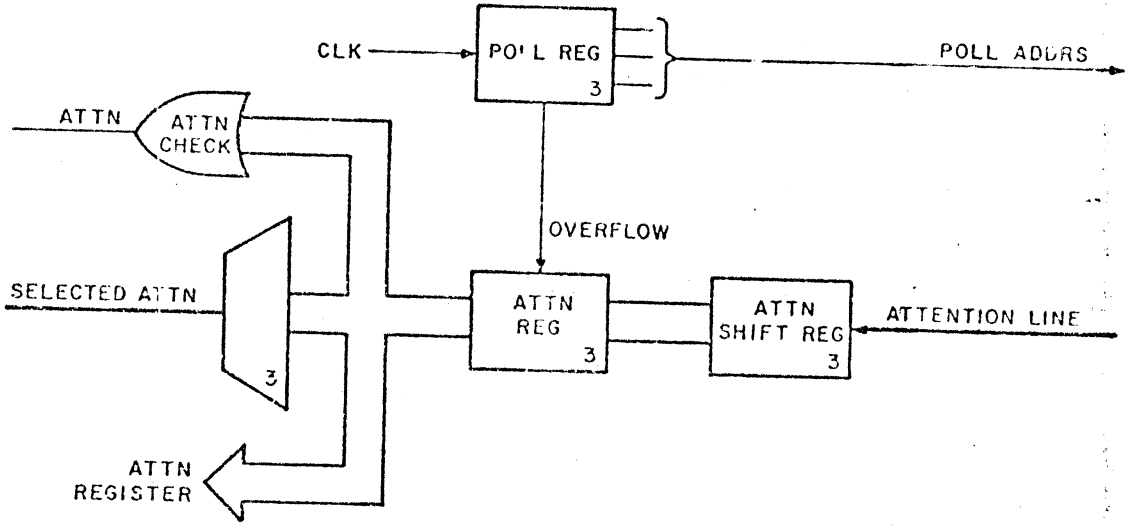

HEADER DATA (SYNC)
DATA (SYNC)
SHIFT REGISTER ØØ H
WRT SEL MUX 3
PRE-COMP SELECT 3
MFM ENCODE & PRE-COMP 3
RCVRS & DRIVERS
ECC POLY GEN 5
WRITE GATE 7
WRT GATE
AC LOW
DC LOW
MODULE MISSING
XMIT DISABLE 6
DISABLES ALL DRIVERS
CONTR PWR OK
REG BUS
7
ECC POSITION 4
ECC CONTROL LOGIC 4
NOTE
11 other Controller-Drive Interface Signals pass through DR 8 :
DRIVE INIT, DRV SACK, MULTI SEL, POLL ADDRS 0-2, DRV ATTN, C TO D, STROBE, MESSAGE A, MESSAGE B.
NRZ READ DATA
DATA CLOCK
DATA SEPARATION 2
READ GATE
WRITE CLK
DATA
VCO
PHASE LOCKED LOOP 1
MFM DATA
INDEX, SECTOR PULSE, CLK
2
INDEX
SECTOR
SECTOR PULSE
SECTOR/ INDEX SEPARATION 6
SEC/IND
MAINTENANCE REGISTER #1
MAINT REG #1 2
CLK DIVIDER 6
CONT CLK
8
UB DATA IN

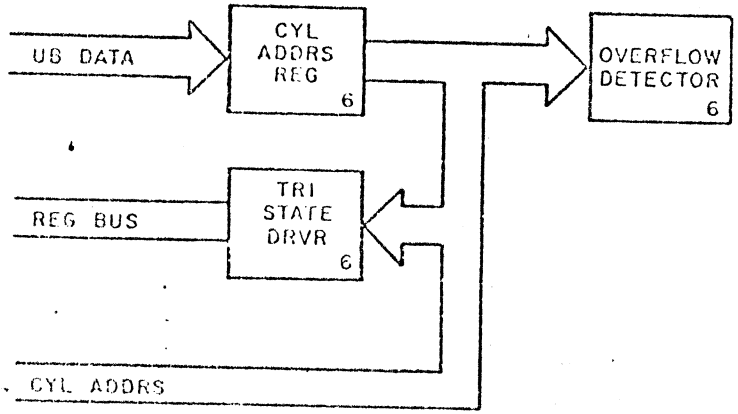


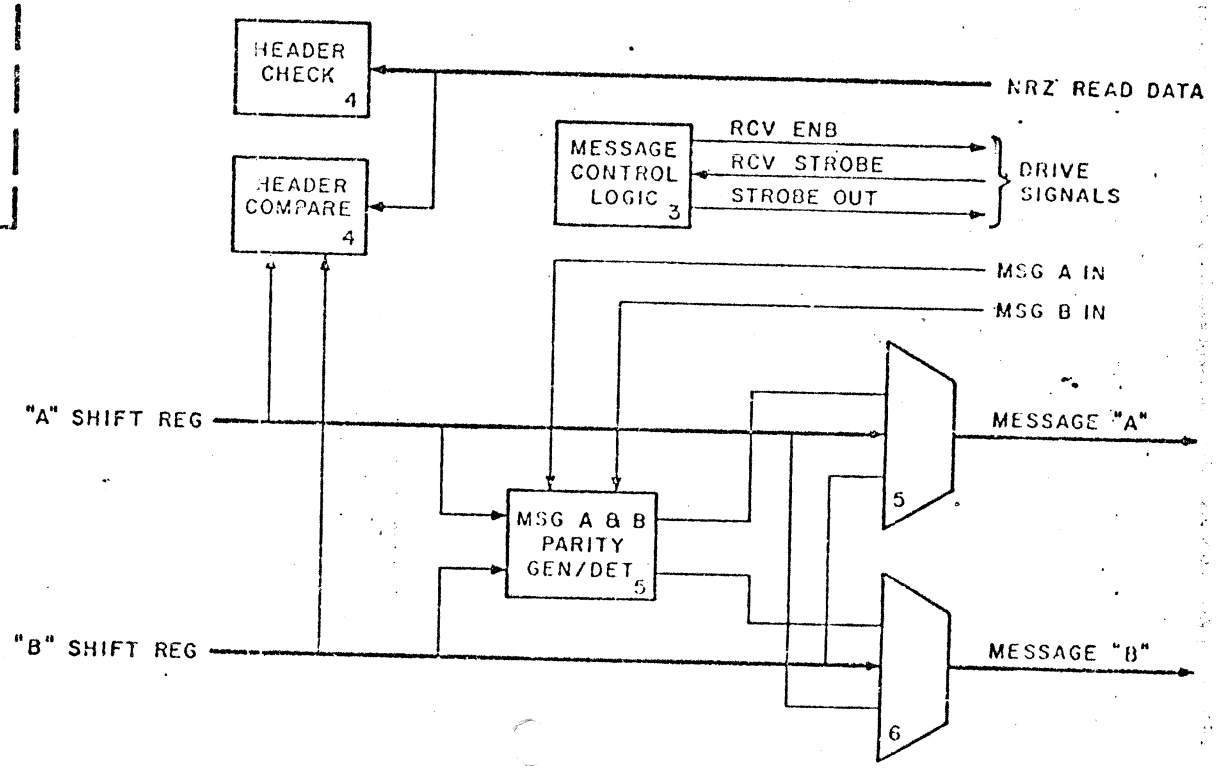
* NOTE

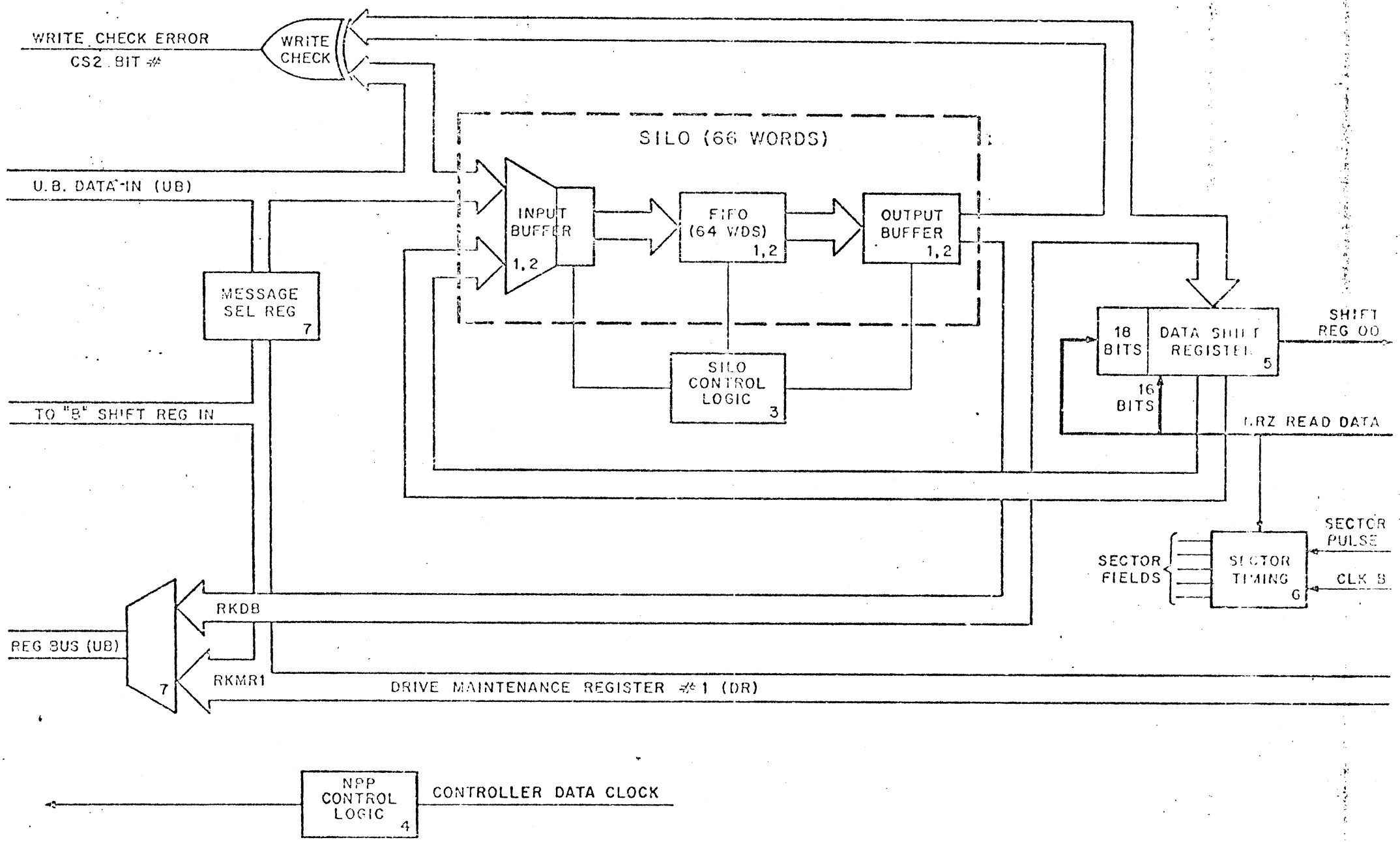
5 Shift Register reverses direction for Header Compare.


PHASE I
(PHASE II)
EXECUTE CONDITIONS
COND MET
EXECUTE CONTROL SIGNALS
1(2)
1(2)
CNT
NEW JUMP ADDRESS
STATE COUNTER
1(2)
LOAD
JUMP COND
1(2)
1(2)
NEW JUMP ADDRESS

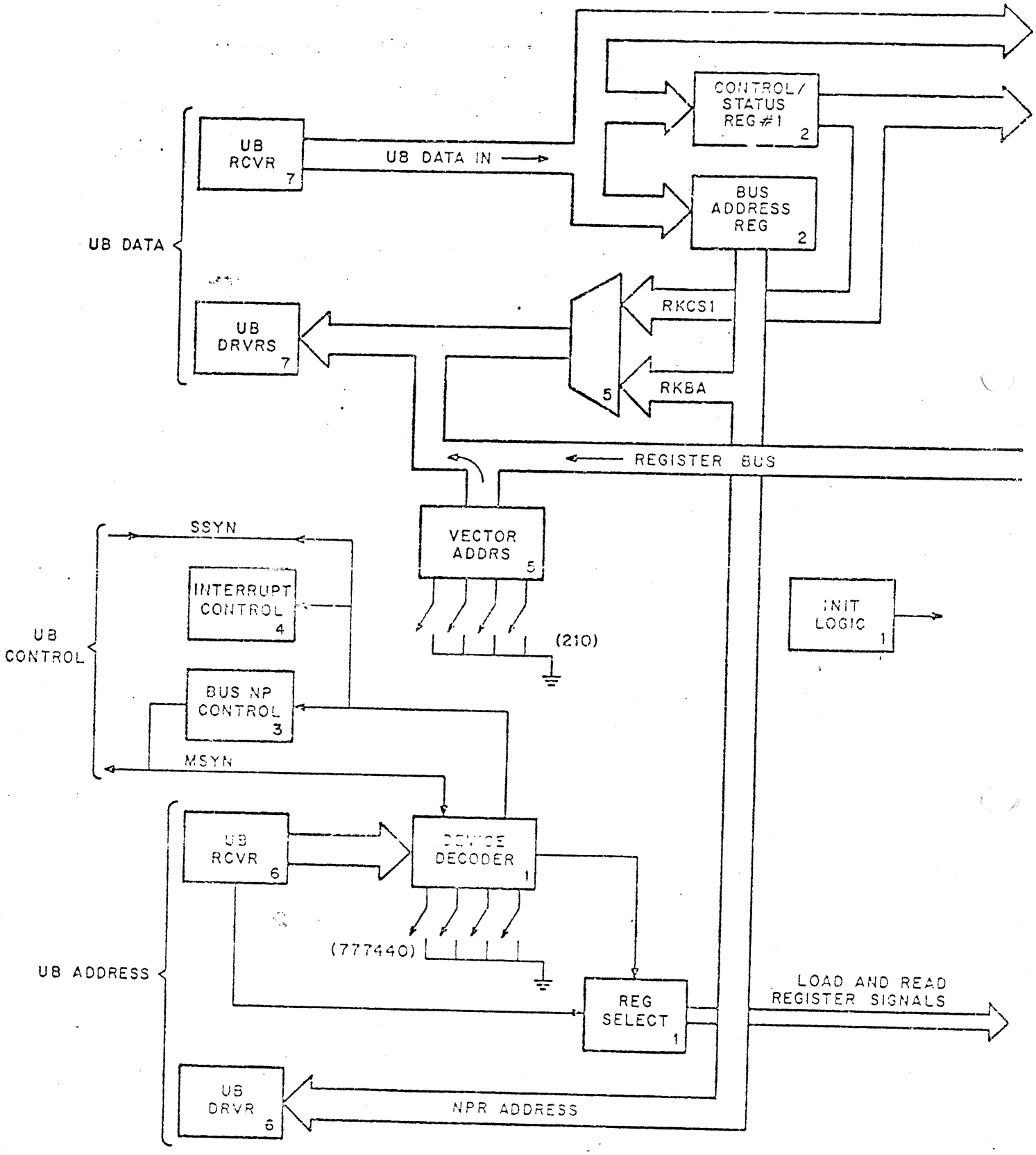

CLK
POLL REG
3
POLL ADDRS
ATTN
ATTN CHECK
OVERFLOW
SELECTED ATTN
3
ATTN REG
3
ATTN SHIFT REG
3
ATTENTION LINE
ATTN REGISTER

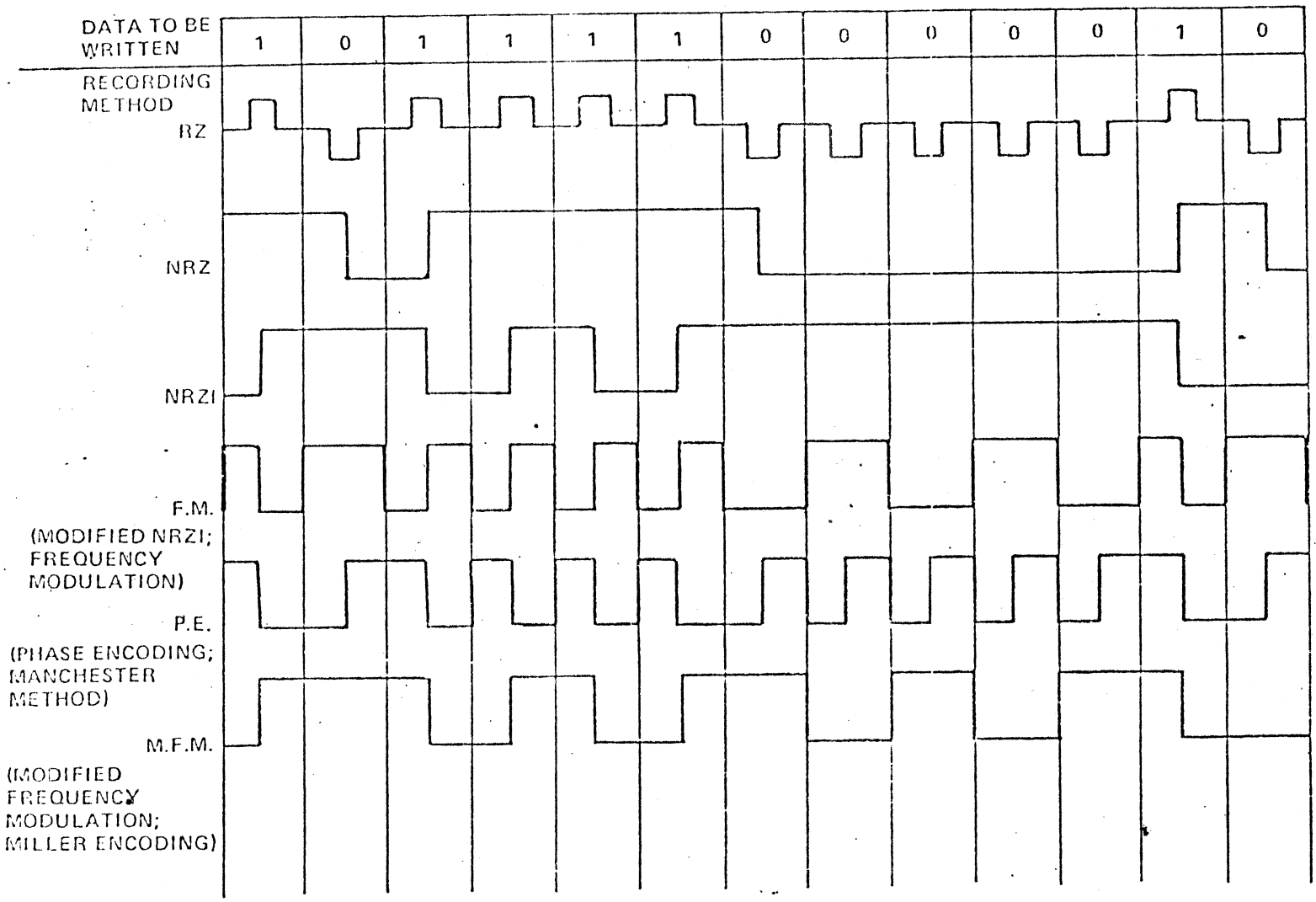

UB DATA
CYL ADDRS REG
6
OVERFLOW DETECTOR
6
REG BUS
TRI STATE DRVR
6
CYL ADDRS


HEADER CHECK
4
NRZ READ DATA
HEADER COMPARE
4
MESSAGE CONTROL LOGIC
3
RCV ENB
RCV STROBE
STROBE OUT
DRIVE SIGNALS
MSG A IN
MSG B IN
"A" SHIFT REG
MESSAGE "A"
MSG A & B PARITY GEN/DET
5
5
"B" SHIFT REG
MESSAGE "B"
6


WRITE CHECK ERROR
CS2 BIT #
WRITE CHECK
SILO (66 WORDS)
U.B. DATA IN (UB)
INPUT BUFFER
1,2
FIFO (64 WDS)
1,2
OUTPUT BUFFER
1,2
MESSAGE SEL REG
7
SILO CONTROL LOGIC
3
18 BITS
DATA SHIFT REGISTER
5
16 BITS
SHIFT REG 00
TO "B" SHIFT REG IN
NRZ READ DATA
SECTOR PULSE
SECTOR FIELDS
SECTOR TIMING
6
CLK B
RKDB
REG BUS (UB)
7
RKMR1
DRIVE MAINTENANCE REGISTER #1 (DR)
NPP CONTROL LOGIC
4
CONTROLLER DATA CLOCK

11-3847


UB RCVR 7
U8 DATA IN
CONTROL/ STATUS REG#1 2
BUS ADDRESS REG 2
UB DATA
UB DRVRS 7
RKCS1
5
RKBA
REGISTER BUS
SSYN
VECTOR ADDRS 5
INTERRUPT CONTROL 4
(210)
INIT LOGIC 1
UB CONTROL
BUS NP CONTROL 3
MSYN
UB RCVR 6
DEVICE DECODER 1
(777440)
UB ADDRESS
REG SELECT 1
LOAD AND READ REGISTER SIGNALS
UB DRVR 6
NPR ADDRESS
11-3846



ONE OF ORIGINAL RECORDING TECHNIQUES, NOW OBSOLETED

1ST MODIFICATION; USED ON MAGNETIC DEVICES BUILT IN 1950's

USED ON MOST TAPE DRIVES (UP TO 800 BPI) INCLUDING DEC'S TU10, PLUS DF-32, RS04, AND RS08 DECDISKS

USED ON MOST MOVING HEAD DISK DRIVES DURING 1960's. (INCLUDING RK05 AND RP03)

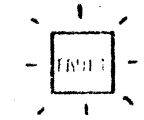
USED WITH NEWER TAPE DRIVES (1600 BPI) AND SOME HI-DENSITY DISK PACKS (PLUS DECTAPE)

NEWER METHOD ALLOWS EXTREMELY HI-DENSITY COUPLED WITH VERY RELIABLE READ-BACK. USED ON VERY HIGH-DENSITY TAPES AND DISKS INCLUDING RS04, RP04/05/06 AND THE RK06 DEC DISKS

COMPARISON OF VARIOUS RECORDING METHODS AND EQUIPMENTS USED ON.

TR-0611

RK06 DRIVE ERROR INDICATIONS



Fault Lite ON
(BO #7)

- Programming
  - Non-executable Fun. (ER #2/BO #8)
    - Do Pack Acknowledge ? (DS #6/AO #6)
  - Write Lock (ER #11/BO #11)
    - Write Protect Switch ? (DS #11/AO #11)
    - Maintenance Switch #2 ?
- Power
  - AC Lo (DS #3/BO #6)
    - Any panel lites on ?
    - Fan Noise (Breaker) ?
  - DC Lo (implied)
    - +15vdc Fuse?
    - Regulated Power ?
    - + & - 5vdc adjust ?
  - Speed Loss (DS #4/BO #12)
    - Spindle Pulley Belt ?
    - Optical Speed Sensor ? (speed sense adjust. ?)
    - Spindle motor thermal switch 2.4us
- Read/Write Unsafe (ER #14/BO #14) (select cmd) B1 #4-11
  - Sector Error B1 #4
    - M7705
    - M7706
  - Data B1 #5-8
    - Check connectors,
    - Swap Read/Write Mod.
  - Multiple Drv Select (ES #9)
    - Duplicate Unit Select Plugs ? M7706
  - Servo Timing B1 #9-11
    - M7708 Servo PreAmp
    - M7705
- Positioning
  - Drive Off-track (DS#5/BO #13)
    - Drive "bumped" during a Write?
  - Seek Incomplete (ER #1/BO #10)
    - No Motion
      - ER #10(BO #5) B1 #12
    - Motion
      - Spindle Stopped (SVO UNS)? (B1 #14)
        - tach pre-amp adjusted?
        - Swap: glass tach sub-assembly, Power Amp, connectors, M7729
      - B1 #13 M7707, M7708, M7729, M7706
- Message Integrity (controller to drive parity) (ER #3)

The purpose of this diagram is to provide an overview of the error detection resources within the RK06 disc drive. It is also intended to point out simple checks, fixes, and swaps that may correct a problem. A more detailed version of this flow is being planned by RK06 product support.

Table 6-1

RK611/RK06 Diagnostics

Test Program No.	Name of Diagnostic Program	MAINDEC No.	Function
1	RK611 Diskless Controller Diagnostic (Part 1)	11-DZR6A	Check controller for hard faults.
2	RK611 Diskless Controller Diagnostic (Part 2)	11-DZR6B	
3	RK611 Diskless Controller Diagnostic (Part 3)	11-DZR6C	
4	RK611 Diskless Controller Diagnostic (Part 4)	11-DZR6D	
5	RK611 Diskless Controller Diagnostic (Part 5)	11-DZR6E	
6	Unibus RK06 Drive Diagnostic (Part 1)	11-DZR6H	Check mechanical and electrical characteristics of drive, assuming good controller.
7	Unibus RK06 Drive Diagnostic (Part 2)	11-DZR6I	
8	Unibus RK06 Drive Diagnostic (Part 3)	11-DZR6J	Manual intervention for checking drive switches, lamps, etc, assuming good controller.
9	RK611 Functional Controller Diagnostic*	11-DZR6K	Checks controller, assuming good drive.
10	RK06K Cartridge Formatter	11-DZR6L	Utility program, primarily for placing headers on disks.
11	RK611/RK06 Subsystem Verification (Part 1)	11-DZR6M	Assume RK611 and RK06 are functioning properly. Perform worst-case testing (marginal testing) and simulate user operations.
12	RK611/RK06 Subsystem Verification (Part 2)	11-DZR6N	
13	RK611/RK06 Performance Exerciser	11-DZR6P	
14	RK06 Drive Compatibility	11-DZR6Q	Verifies that all drives can communicate with each other without error.
15	RK611/RK06 User Defined Test	11-DZR6R	Provides capability of entering, editing, saving, recalling, and executing test programs designed by the user.
16	Dual-Port Logic Test		Checks dual-port operation.

*Contains controller clock adjustment

DZR6L Cartridge Formatter Problems.

Problem. The Formatter Maindec will not Re-Format any packs that have had the headers or data od Cyl.410 Trk 2 damaged.

Reason. This cylinder contains the following information:-

a. Pack Serial Number.

b.Alignment / Data Pack Identifier code.

c. (1) Locations of any Bad Spots on the pack.

(2) A code to show that no further Bad Spots exist beyond those recorded in the file.

Because the Formatter Program incorporates the previous recordings in any new format operation that is to be performed, a pack that has a damaged CYL 410 will cause the program to hang.

Solution. Utilise the User Defined Tests of DZR6R to place new Header, Serial Number , Identifier Code and synthetic Bad File information on CYL 410 before a Format operation is performed.

Note. (1). CYL 410 information is allways recorded in 22 Sector mode of operation.

(2). See attached sheet for Bad Sector File layout and a specimem program of DZR6R operational commands.

This User Defined Test program may be employed to replace a non existent or unreadable Bad Sector File located at CYL 410 TRK 2 odd and even sectors of an RK06 cartridge mounted on unit number 0.

Run Maindec DZR6R (User Defined Tests) and enter the following parameters.

```
SF,CS,0, (CR)
SF,PA,0, (CR)
SF,WH,0,632,2,0,(CR)
SF,WD,0,632,2,0,377,X,(CR)
SF,WD,0,632,2,I,377,X,(CR)
SF,WD,0,632,2,I2,377,X,(CR)
SF,WD,0,632,2,I3,377,X,(CR)
DP,X,
     001234 (CR)
     000000 (CR)
     000000 (CR)
     000000 (CR)
     177777 (CR)
     177777 (CR) (CR)
CO.(CR)
RU.(CR)
```

Halt the program with Cntrl.C
Halt the CPU with the HLT.KEY.

The program will have executed the above commands and issued the pack with the following information:-

Serial No; 001234. Data Pack Identifier.No bad sectors.

Following this operation the Pack must be Formatted with Two passes of the ZR6L maindec, first pass in 20 sector Format to plot the bad spots in the surface, and finally in 22 Sector Format to plot the bad spots in this format.

On the first pass of the Formatter default all paremeters except SECTOR/TRK (enter 24). In reply to the questions about the bad sector files, enter (N) to both Questions.

On the second pass, again default all parameters except SECTOR/TRK (enter 26). In reply to the questions about the bad sector files, enter (N) to both questions.

The pack is now ready for use.

RK06/7 BOOTSTRAPS

1. M9301-YF WILL BOOT RK06.

2. M9312 WITH 23-752-A9 ROM WILL BOOT RK06 AND RK07.

3. IF NO HARDWARE BOOTSTRAP AVAILABLE, USE TOGGLE-IN BOOT AS BELOW.

RK06

```
L/A 1ØØØ     DEP
          Ø12737
              3
          17744Ø
          1Ø5737
          17744Ø
          1ØØ375
          Ø12737
             21
          17744Ø
              1
```

RK07

```
L/A 1ØØØ     DEP
          Ø12737
             2ØØ3
          17744Ø
          1Ø5737
          17744Ø
          1ØØ375
          Ø12737
             2Ø21
          17744Ø
              1
```

```
L/A 1ØØØ
START
HALT
L/A Ø
START
```

Preventive Maintenance

The P.M.'s necessary to maintain the integrity of Disk Subsystem will vary depending on the environmental conditions and use of the subsystem. The preventive maintenance will be set up as defined by the operating time of the subsystem, and not to be more frequent than quarterly for the average operating system. An outline for the P.M. tasks is shown in the following.

Quarterly .

Inspect:

- R/W Heads
- Spindle Ground
- Brushes
- Filter, Absolute
- For ECO Requirements
- Cabling and Wiring Harnesses
- Lamps
- For dust or other foreign matter in the cartridge chamber.
- Error Log, if supported by system software.

Clean:

- R/W Heads (as needed)
- Spindle Cone
- Carriage Rail
- Cartridge Chamber
- Exterior

Replace:

- Filter, Absolute (as needed)
- Pre-Filter
- Brushes (as needed)
- Lamps (as needed)
- Spindle Ground (as needed)

Perform:

- Head Alignment Check (see note)
- Diagnostic Performance Tests
- System Exerciser, RK611 module

NOTE:

Other adjustments should only be checked if the error log or performance tests indicate a problem.

Annually

In addition to the quarterly tasks the following will be done.

Perform:

- Voltage Checks
- Complete Alignment and Adjustment Checks
- Drive Selection Checks

Five Year, or 30,000 hours

The drive is designed and constructed to provide a useful life of 5 years or 30,000 power-on hours, whichever occurs first before overhaul or replacement is required. The method and tasks necessary to perform the overhaul is to be determined (before FCS).

Installation

The detailed installation procedures and site preperation will be provided in the System Installation Manual. An outline of the tasks follows:

- Check Power Source(s)
- Unpack and inventory RK611/RK06
- Install Drive Interface Cable in the RK611 and the first RK06
- Daisy-chain Interface Cable to other Drive (s)
- Insert terminator in last RK06
- Visually inspect RK611 (module rev, modules and cable seated, address jumpers, etc) and RK06
- Power-up and perform voltage checks
- Run diagnostics, in order
- Do head alignment check
- Run Performance Tests (acceptance)
- Run System Exerciser (acceptance)

Field conversion of the RK06 for various power sources will be accomplished with the following guidelines.

The drive will operate from the following power sources:

60 $\pm$ 0.5 Hz	90 to 132 VAC or 180 to 264 VAC
50 $\pm$ 0.5 Hz	90 to 132 VAC or 180 to 264 VAC

- Changing between voltage ranges at the same line frequency is a simple jumper rearrangement and line cord change.
- Field converting from one frequency to the other requires substitution of the line filter, power supply, spindle motor, and pulley.

The drive is designed to be powered from the switched outlet of a DEC 861 Power Control. The 861A or 861C are used to power the low voltage drives, the 861B for high voltage drives.

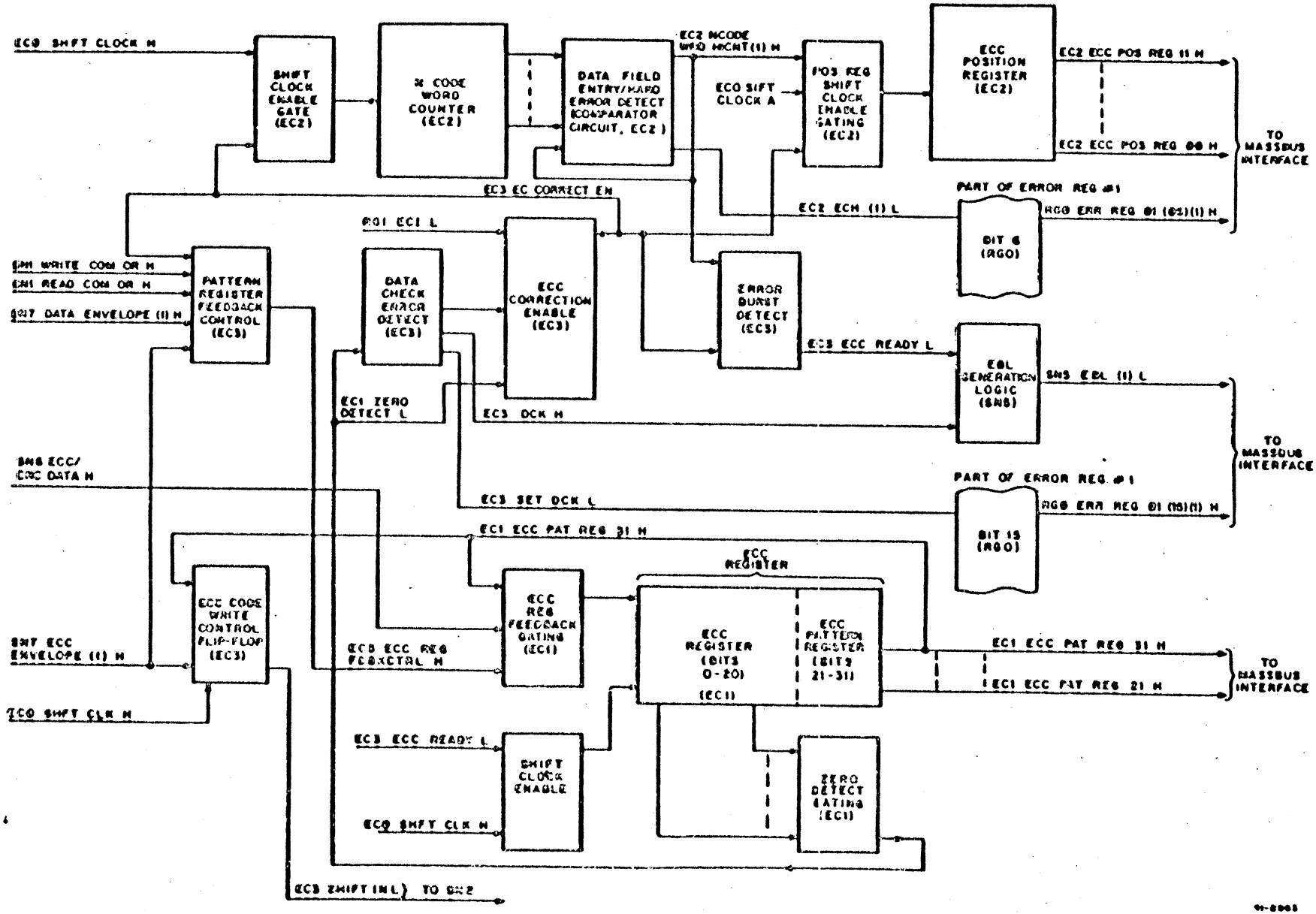


Figure 2-3 Error Correction Logic Block Diagram

RP04

RK06 TESTER OPERATION

I. INTRODUCTION

The RK06 Field Tester (RK06-TA, TB) is a self contained, system independent, suitcase tester capable of complete RK06 operation directly through the drive's interface hardware and is necessary to perform RK06 head alignment. The section of the tester used in head alignment is functionally independent from the section of the tester that communicates with an Ø6 through the interface (Interface Section). Therefore, head alignment may be performed with the Ø6 interface under either diagnostic control or under control of the Interface Section of the Tester.

To fully utilize the capabilities of the Interface Section of the Tester a knowledge of the RK06 interface is mandatory. The tester panel is designed to be a visual reminder of the interface to anyone who has read the interface specification and should become self-explanatory after a short period of use.

II. INTERFACE SECTION OPERATION

Operation of the Interface Section of the Tester will be described as follows: A basic loop operation is defined by putting all applicable front panel switches in their underlined position. Operation in this mode puts an RK06 through the most complex exercises the tester is capable of generating. This "basic loop" operation will then be discussed thoroughly.

Since much of the usefulness of the tester lies in the flexibility with which the "basic loop" may be modified the "basic loop" description will be followed by a front panel switch description defining each switch's function and detailing how each switch modifies the "basic loop" operation.

The operation of the Interface Section of the Tester centers around a repetitive loop in which the tester sends the RK06 a message, receives Messages AØ and BØ from the RK06, checks for a Drive to Controller parity error or a Drive Fault and then a Drive Ready. These steps happen repetitively until a message from the drive indicates the command has been executed (Drive Ready asserted). This assertion of Drive Ready is delayed (an operator variable amount of time) by the tester and then the write process starts.

As sector Ø comes under the selected head, the tester starts writing at high frequency (232.5 ns/flux reversal) on all even numbered sectors and low frequency (465 ns/flux reversal) on all odd numbered sectors (in either format). Data is always written from the end of one sector pulse to the middle of the next sector pulse. This high frequency is the same frequency as an all Ø or an all 1 data pattern. The low frequency is the same frequency as the frequency of a data pattern of 1Ø1Ø1Ø....[1]

Reading starts next on sector Ø and continues for a whole revolution (in either format). Any data error is stored and halts operation after the whole revolution is completed.[1] If no errors are found the tester increments its address (head first, then cylinder) and sends out its new address starting the whole cycle over again.

In "basic loop" operating mode, cylinders are addressed in an alternating [ALT] mode. This means that the cylinder address sent out by the tester alternates between the address in the Switch Register [SWR] and the address in an incrementing register in the tester. For example, if the [SWR] contents is 5, the order of cylinders addressed would be 5, 0, 5, 1, 5, 2, 5, 3, -- 5, 410, 5, 0, 5, 1, --- etc.

NOTE: [1] Writing and Reading are automatically inhibited on Cylinder #410 to avoid destruction of important bad track information prerecorded on each pack.

The following switch descriptions detail the function of each front panel control and describe how the "basic loop" operation may be varied by the operator. Where applicable, potential uses for these deviations from "basic loop" operation will be mentioned.

[EXERCISE-STATUS]

In [STATUS] mode, the tester formulates a message requesting back the message set in the [MESSAGE SELECT] switch, transmits the message once, receives back the requested message, displays it in the [MESSAGE A] and [MESSAGE B] LED's and halts.

Potential uses are, if the tester halts on a [DRIVE FAULT] error, [STATUS] mode may be selected, and [START] pushed to display any one of four messages in the Message LED's to find the specific error condition generating [DRIVE FAULT].

[DRIVE SELECT]

The [DRIVE SELECT] Switch is used to select the drive number to which messages will be sent. The switch also determines what drive number will be sent on the 2^0, 2^1, and 2^2 Polled Address interface lines.

The [POLLED ATTENTION] LED indicates the condition of the [POLLED ATTENTION] interface line. If the drive whose address is in the [DRIVE SELECT] switch has attention set, the LED should be on.

NOTE: The LED will appear to be on all of the time. In reality, however, the 2^0 Polled Address Line sent out to the RK06 is automatically inverted for a very short amount of time to properly toggle the RK06 logic and facilitate scoping in the RK06, i.e., although the [POLLED ATTENTION] LED in the tester appears fully on, it is actually being run at a very high duty cycle.

The [SACK] LED displays the condition of the Select Acknowledge line transmitted by the RK06. It should be on after the drive number set in the [DRIVE SELECT] switch is sent out to the RK06 if, and only if, the RK06 Select button matches the number in the [DRIVE SELECT] switch and if the [DESELECT/RELEASE] bit is negated.

The [MULTIPLE DRIVE SELECT] LED displays the state of the Multiple Drive Select line transmitted by the RK06. The light should light when the [MULTIPLE DRIVE SELECT] button is pushed. Pushing the button causes the tester to assert the Index-Sector line. The drive under test should detect Multiple Drive Select and assert the Multiple Drive Select line after sensing Index and Sector assertions other than its own.

All switches in the [COMMAND TO RK06] block (top middle of panel) set the message bits which the tester sends to the drive in Message A, T3 [DESELECT/RELEASE] thru T11 [SET VOLUME VALID]. These bits are exactly as described in the RK06 Interface Specification.

All switches in the [LOOP CONTROL] Block (upper right of panel) allow modification of the "basic loop" mode of system operation.

If the top switch is removed from the [CONTINUOUS] mode and put into the [SINGLE CYCLE] mode, a command is formulated, messages are continuously transmitted and received until Drive Ready is asserted, Writing and Reading are done, errors are checked and a new command is formulated in the tester but is not sent. In this [SINGLE CYCLE] mode, the new message is sent only when the start button is activated. That is, repetitive operations must be manually initiated by repetitive activation of the [START] switch.

Typical uses for the [SINGLE CYCLE] modification of "basic loop" operation are:

1. To write only one track of the disk and have the writing stop in an orderly manner at a track boundary. Pushing [STOP] would stop writing instantly potentially making an error in the current sector.

2. If positioning problems were present causing the drive to shut itself down, it would be useful to manually initiate seeks at a very low rate while scoping the problem.

The [DELAY] knob is a continuously adjustable time delay control that delays tester recognition of Drive Ready from approximately 100 μs to approximately .7 seconds. This offers a continuously adjustable time delay between completion of a seek and initiation of a [WRITE/READ].

Typical uses for the adjustable time delay could be:

1. If settling of the servo was taking longer than is proper, waiting before writing could make data errors cease, thereby giving a clue to the problem source.
2. If a problem exists which causes the drive to cease operation for its own safety, a long time between seeks would give more time for scoping before the drive stopped itself.
3. Any unwanted resonances could be excited by varying (tuning) the time between seeks.

The [FUNCTION] switch is self-explanatory. "Basic loop" operation involves positioning, writing and then reading. The modifications to the "basic loop" offered by this switch

involve [SEEK ONLY] or [SEEK & WRITE] or [SEEK & READ]. The positions are useful when working on positioning problems not involving reading or writing, or when working on data problems to separate write problems from read problems.

[SYNC] - In "basic loop" operating mode, the "system" clock source is interface Write Clock always generated by the RK06 from its disk pack. Write Clock is so imperative to proper Read/Write operation of an RK06 with either a controller or tester that difficult to detect problems with Write Clock can cause very random data errors. To help isolate this type of problem, the [SYNC] switch can be put into its [INT] position. This causes the tester to use an internal oscillator as "system" clock and ignore interface Write Clock. In summary, if random data errors are occurring, and switching to [SYNC][INT]ernal stops the errors, Write Clock should be suspected.

[CLOCK] - Main Clock on the interface clocks status and command information between the tester and RK06. In [FAST] mode, Control Clock happens at standard subsystem speed ($\approx$465 ns/cycle) and in [SLOW] mode Control Clock happens at (465 x 64) $\approx$29.8 us/cycle. Slow speed makes scoping much easier and is useful in detecting speed problems.

The [HALT ON ERROR] switch is self-explanatory. The [DRIVE FAULT] LED is lit (in [EXERCISE] mode only) whenever the Interface Drive Fault bit is asserted by the drive. Simply put, this LED indicates error detected by the RK06. The other LED indicates any error detected by the tester. These may be of two types:

1. [DATA] error. (If [FUNCTION] includes a [READ] or
2. An RK06 to tester - [D]rive→[C]ontroller - parity error.

NOTE: To aid in debugging intermittent problems, the error LED's will light when errors exist independent of the setting of the [HALT ON ERROR] switch.

The [ADDRESSING] block provides many addressing variations from the "basic loop" operation addressing scheme already described.

Successive [CYLINDER] addresses may be:

1. [SEQUENTIAL] - 0, 1, 2,--- 410, 0, 1,---
2. or [OSC]illating - [SWR], 0, [SWR] 1,--- [SWR], 410,--- [SWR], 0,---
3. or just [SWR].

NOTE: In just [SWR] mode, successive messages call for the same cylinder (contained in the Switch Register) and allow repetitive Writing and Reading with no physical seeking.

Successive [HEAD] (track) addresses may be:

1. [ALL] - 0, 1, 2, 0, 1, 2...

   or

2. [SWR] - Only the head address set in the Switch Register.

[SECTOR]

Sectors to be written and read may be [ALL] sectors (20 in 20 sector mode or 22 in 22 sector mode) or sector [ZERO ONLY] LED's under the Cylinder and Head switch registers always display the last Cylinder and Head addresses sent to the RK06.

The [MESSAGE A] and [MESSAGE B] [PARITY] switches (bottom right of panel) cause the tester to transmit wrong [EVEN] parity to the RK06 independently on A and B to insure the drive can detect these errors independently.

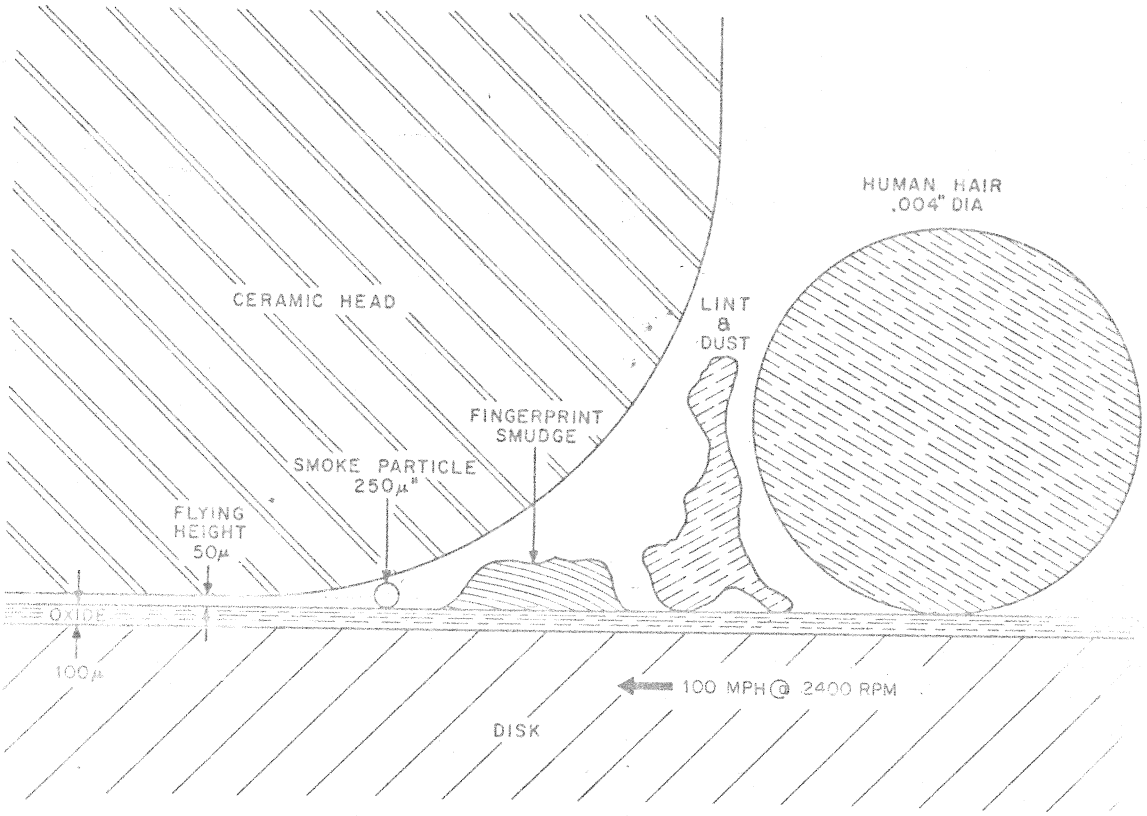
The [CONTROLLER POWER OFF] button tells the drive through the interface line of similar name that the controller (or tester) has lost power. It is used to verify that the RK06 will properly sense this line in case a real power loss

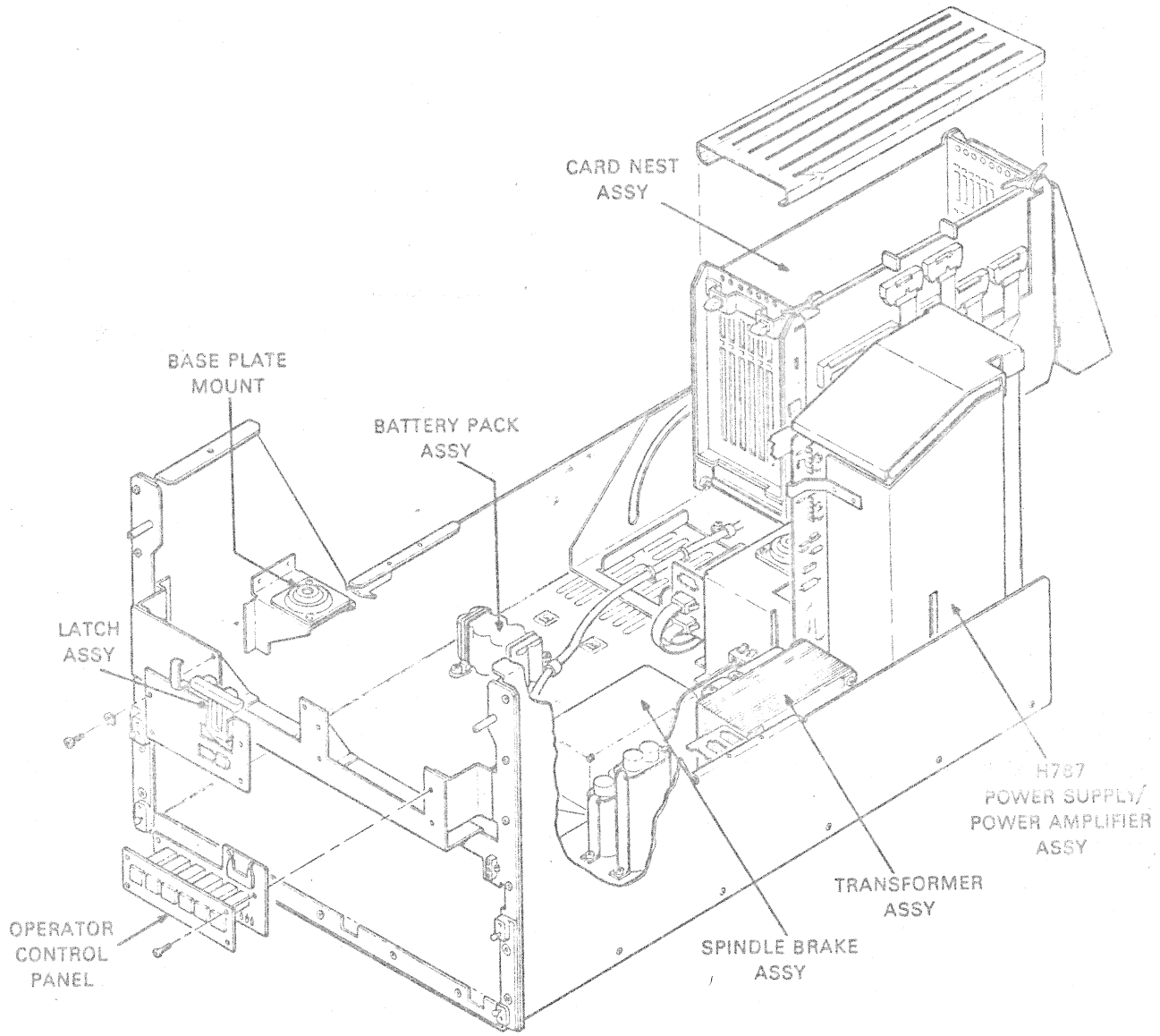
occurs on the computer system. This interface line is also connected to +5 in the tester so the 06 will behave properly if any true lack of tester power disables the interface.

The [INIT] button generates an assertion on the Initialize interface line.

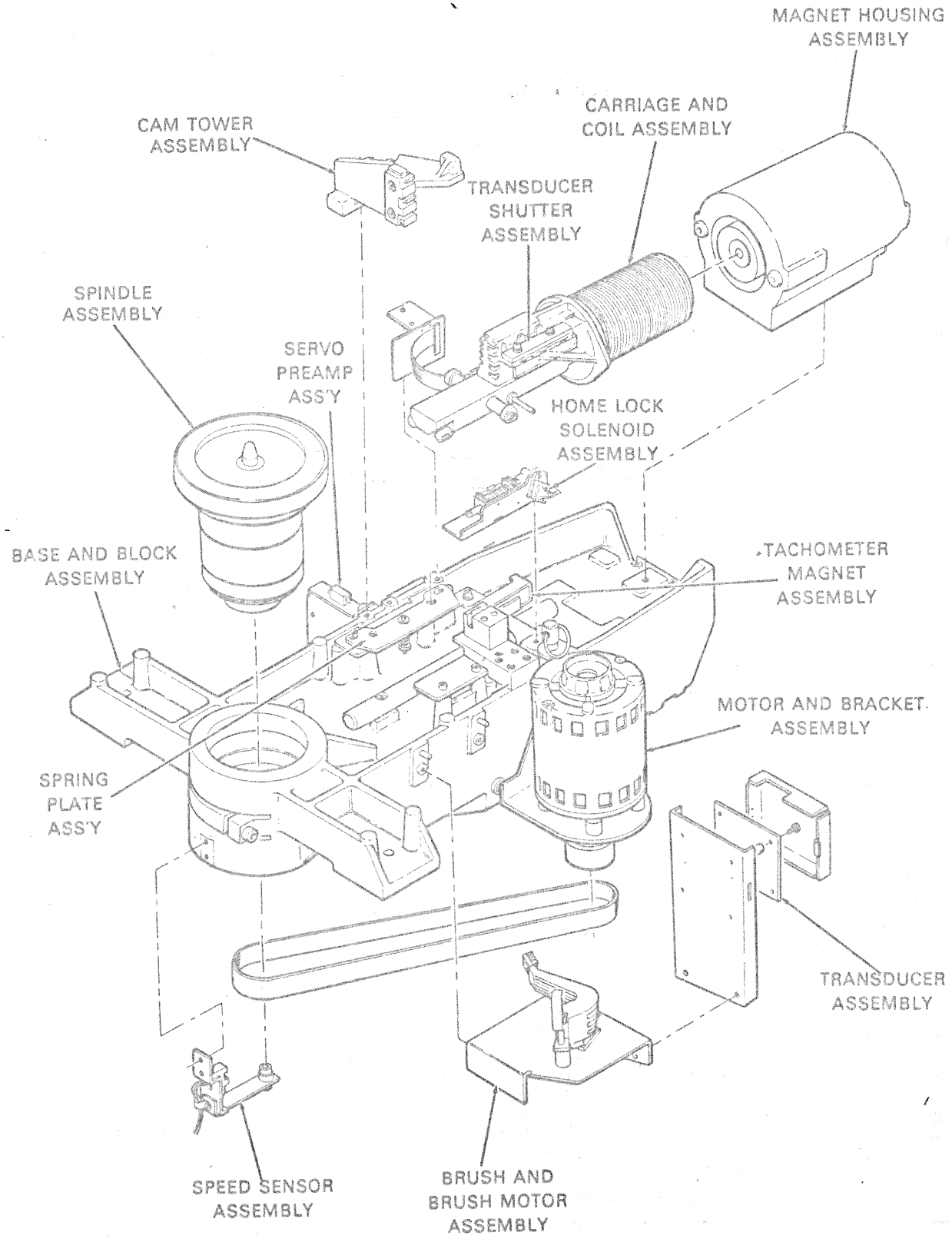
The [START] and [STOP] switches start and stop the tester. Operation is not guaranteed if switches are changed without stopping the tester first. [STOP] clears the whole tester and all addressing, etc., will start at an initialized state when [START] is released after being pushed. Should the tester halt on error, Status may be checked by selecting [STATUS] and repeatedly pushing [START] without pushing [STOP] and the tester formulated message will not change. In [SINGLE CYCLE] mode repetitive [START]s act like continues and will increment the tester while a [STOP] will initialize the tester.

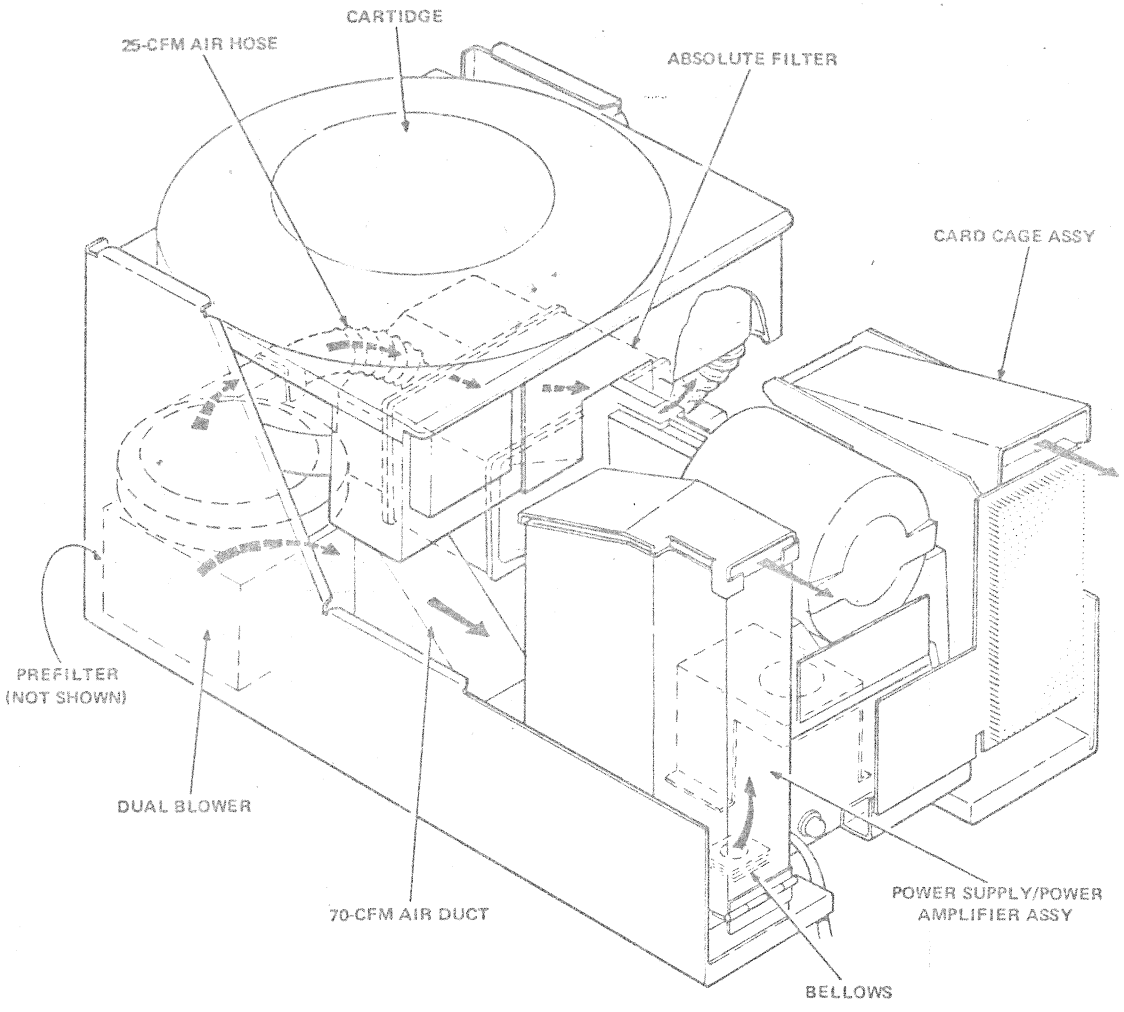
Relationship of Disk Head, Disk, and Contaminants



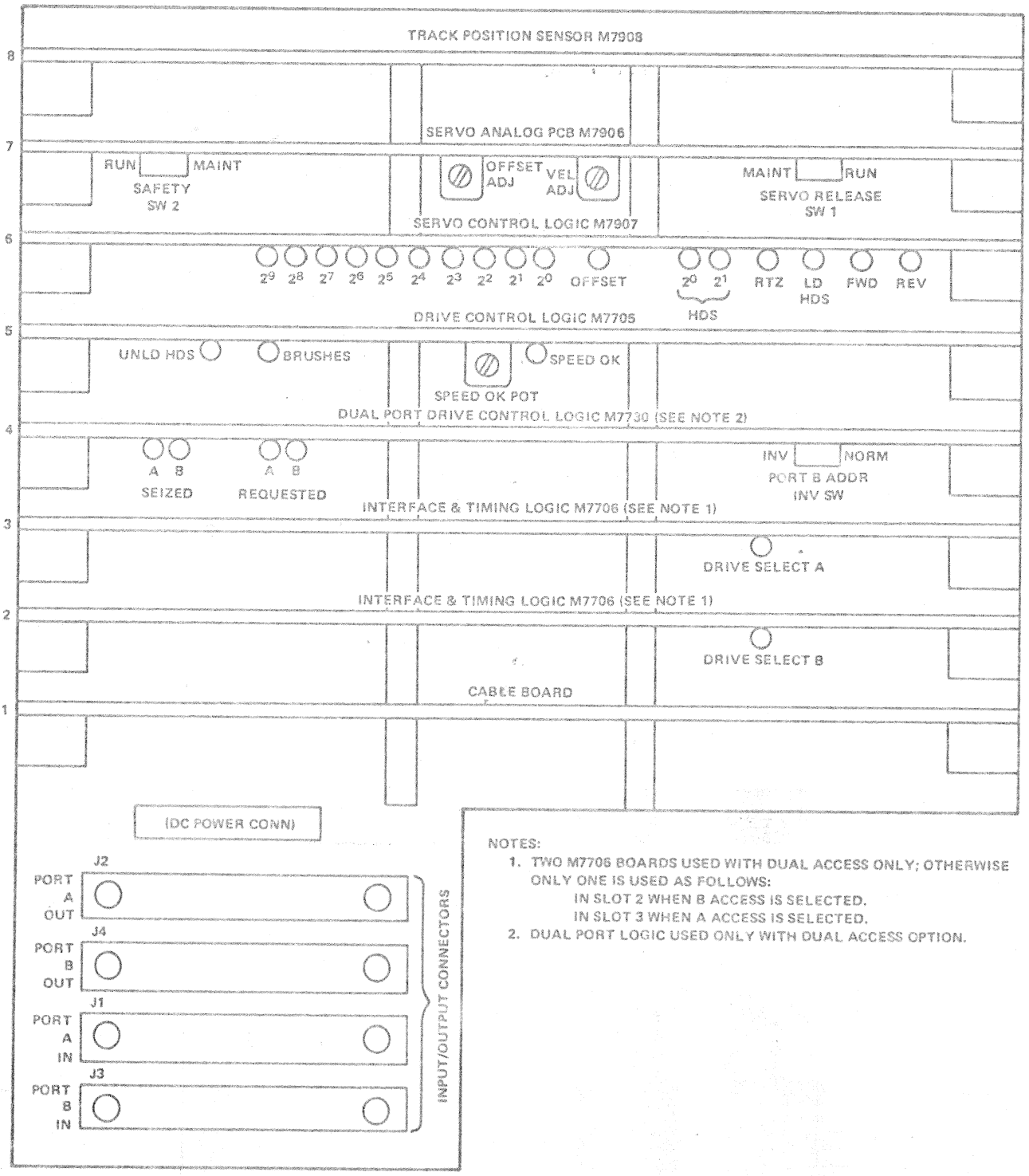

CARD NEST ASSY
BASE PLATE MOUNT
BATTERY PACK ASSY
LATCH ASSY
OPERATOR CONTROL PANEL
H787 POWER SUPPLY/ POWER AMPLIFIER ASSY
TRANSFORMER ASSY
SPINDLE BRAKE ASSY

Base Plate Assembly




CARTIDGE
25-CFM AIR HOSE
ABSOLUTE FILTER
CARD CAGE ASSY
PREFILTER
(NOT SHOWN)
DUAL BLOWER
70-CFM AIR DUCT
POWER SUPPLY/POWER
AMPLIFIER ASSY
BELLOWS

RK07 Disk Drive Logic Module Locations



NOTES:

1. TWO M7706 BOARDS USED WITH DUAL ACCESS ONLY; OTHERWISE ONLY ONE IS USED AS FOLLOWS:
   IN SLOT 2 WHEN B ACCESS IS SELECTED.
   IN SLOT 3 WHEN A ACCESS IS SELECTED.
2. DUAL PORT LOGIC USED ONLY WITH DUAL ACCESS OPTION.

1=parity error
0-22 sector
0 RK06
1 RK07

CONTROL AND STATUS REGISTER 1

RKCS1 — READ/WRITE — UNIBUS ADDRESS 777440 (vector 210)

15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
CERR OCLR	DI	DCT PAR	CFMT	CTO	CDT	BA17	BA16	RDY	IE	Ø	F4	F3	F2	F1	GO

drive int. (bit 14) — Go bit (bit 00)

WORD COUNT REGISTER

RKWC — R/W — 777442

15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
WC 15	WC 14	WC 13	WC 12	WC 11	WC 10	WC 09	WC 08	WC 07	WC 06	WC 05	WC 04	WC 03	WC 02	WC 01	WC 00

BUS ADDRESS REGISTER

RKBA — R/W — 777444

15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
BA 15	BA 14	BA 13	BA 12	BA 11	BA 10	BA 09	BA 08	BA 07	BA 06	BA 05	BA 04	BA 03	BA 02	BA 01	BA 00

DISK ADDRESS (TRACK & SECTOR) REG.

RKDA — R/W — 777446

15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Ø	Ø	Ø	Ø	Ø	TA 2	TA 1	TA Ø	Ø	Ø	Ø	SA 4	SA 3	SA 2	SA 1	SA Ø

Sector NR, + laes kop.

CONTROL AND STATUS REGISTER 2

RKCS2 — R/W — 777450

15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
DLT	WCE	UPE	NED	NEM	PGE	MDS	UFE	OR	IR	SCLR	BAI	RLS	DS 2	DS 1	DS Ø

input Ready (IR) — Bus adres increment (BAI) — output ready (OR) — subsystem clear (SCLR) — dual port bit (RLS) — drive select (DS)

DRIVE STATUS REGISTER

RKDS — READ ONLY — 777452

15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
SVAL	SDA	PIP	Ø	WRL	Ø	Ø	DDT	DRDY	VV	DROT	SPLS	ACLO	OFST	Ø	DRA

ERROR REGISTER

RKER — RO — 777454

15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
DCK	UNS	OPI	DTE	WLE	IDAE	COE	HVRC	BSE	ECH	DTYE	FMTE	DRPAR	NXF	SKI	ILF

ATTENTION SUMMARY AND OFFSET

RKAS/OF — R/W — 777456

15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
ATN 7	ATN 6	ATN 5	ATN 4	ATN 3	ATN 2	ATN 1	ATN Ø	OF 7	OF 6	OF 5	OF 4	OF 3	OF 2	OF 1	OF Ø

ATTension a/s er iets veranderd. komt van drive.
Drive status change

offset code.

Max 1200 u inch RK06

DESIRED CYLINDER REGISTER

RKDC — R/W — UNIBUS ADDRESS

15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	UNIBUS ADDRESS
0	0	0	0	0	0	DC	DC	DC	DC	DC	DC	DC	DC	DC	DC	777460

UNUSED

																777462

DATA BUFFER

R/W

15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	
DB 15	DB 14	DB 13	DB 12	DB 11	DB 10	DB 09	DB 08	DB 07	DB 06	DB 05	DB 04	DB 03	DB 02	DB 01	DB 00	777464

15 — 8 | 7 — 0

MAINTENANCE REGISTER 1

RKMR1 — R/W

15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	
RD GATE	WRT GATE	ECCW	PCD	PCA	MEWD	MERD	MCLK	MIND	MSP	DMD	PAT	MS 3	MS 2	MS 1	MS 0	777466

15 — 8 | 7 — 0

ECC POSITION REGISTER

RKECPS — RO

15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	
0	0	0	EPS 12	EPS 11	EPS 10	EPS 09	EPS 08	EPS 07	EPS 06	EPS 05	EPS 04	EPS 03	EPS 02	EPS 01	EPS 00	777470

15 — 8 | 7 — 0

ECC PATTERN REGISTER

RKECPT — RO

15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	
0	0	0	0	0	EPT 10	EPT 09	EPT 08	EPT 07	EPT 06	EPT 05	EPT 04	EPT 03	EPT 02	EPT 01	EPT 00	777472

MAINTENANCE REGISTER 2 A

RKMR2 — RO

15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	
																777474

MAINTENANCE REGISTER 3 B.

RKMR3 — RO

15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	
																777476

NOTE

R/W = read/write (selected bits) in relation to Unibus. R = read only in relation to Unibus.

Function Code (F1–F4) – Bits 1–4 – The configuration of the Function Code bits (F1–F4), with the setting of the GO bit, allows the selected drive to respond to the following command control configuration.

Command	F4	F3	F2	F1	GO	Octal
Select Drive	0	0	0	0	1	01
Pack Acknowledge	0	0	0	1	1	03
Drive Clear	0	0	1	0	1	05
Unload	0	0	1	1	1	07
Start Spindle	0	1	0	0	1	11
Recalibrate	0	1	0	1	1	13
Offset	0	1	1	0	1	15
Seek	0	1	1	1	1	17
Read Data	1	0	0	0	1	21
Write Data	1	0	0	1	1	23
Read Header	1	0	1	0	1	25
Write Header	1	0	1	1	1	27
Write Check	1	1	0	0	1	31

must be set for working.

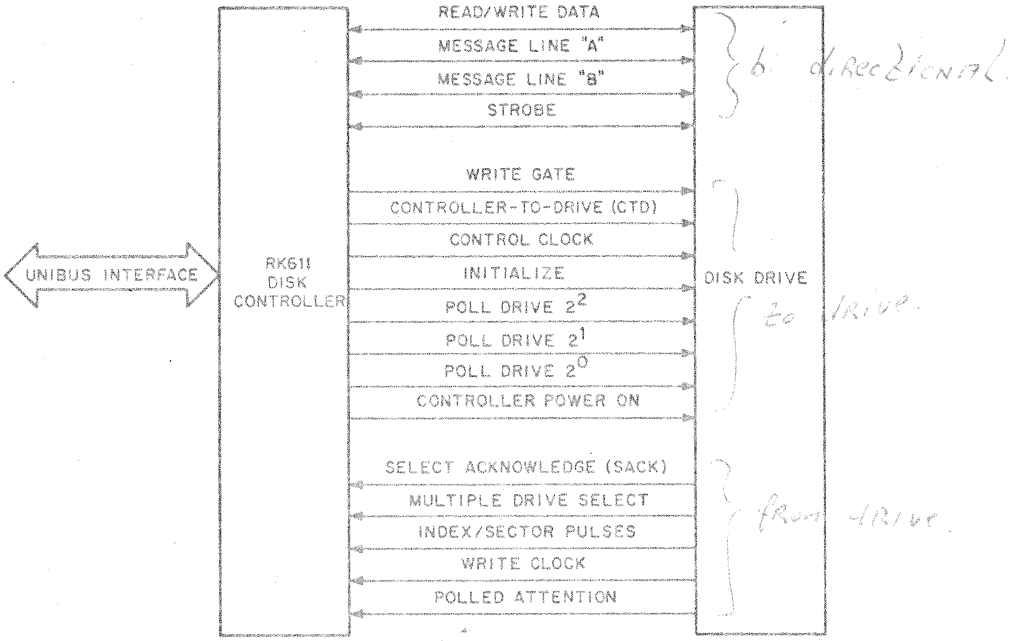
Spare Bit – Spare bit 5 can be written and read back.

Offset (OF0–OF7) – Bits 0–7 – The Offset field (OF0–OF7) defines both the magnitude (OF0–OF5) and direction (OF7) of head movement in relation to the centerline of a track. As shown below, each binary increment of the offset value (excluding OF6) produces a move of 25 microinches (for an RK06) or 12.5 microinches (for an RK07) in a positive (+) or negative (–) direction. A positive offset (OF7 = 0) provides head motion toward the spindle, while a negative offset (OF7 = 1) provides head motion away from the spindle. Therefore, an offset value of all zero would leave the heads positioned on the centerline of a desired cylinder.

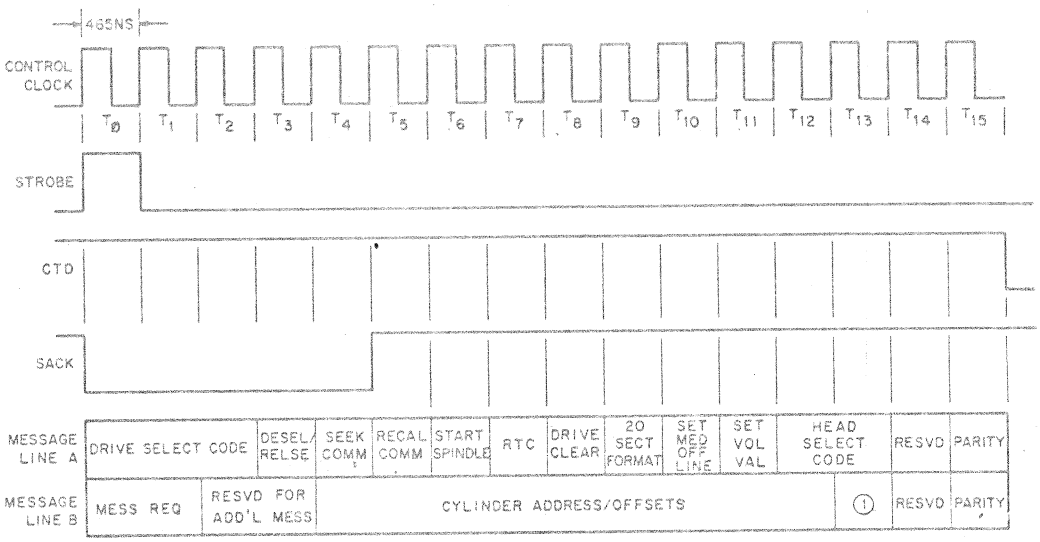
NOTE

X = Don't care.

Sign	Magnitude							RK06 Offset	RK07 Offset
OF7	OF6	OF5	OF4	OF3	OF2	OF1	OF0	(μin)	(μin)
0	X	0	0	0	0	0	0	0	0
1	X	0	0	0	0	0	0	0	0
0	X	0	0	0	0	0	1	+25	+12.5
1	X	0	0	0	0	0	1	–25	–12.5
0	X	0	0	1	0	0	0	+200	+100
1	X	0	0	1	0	0	0	–200	–100
0	X	0	1	0	0	0	0	+400	+200
1	X	0	1	0	0	0	0	–400	–200
0	X	1	0	0	0	0	0	+800	+400
1	X	1	0	0	0	0	0	–800	–400
0	X	1	1	0	0	0	0	+1200	+600
1	X	1	1	0	0	0	0	–1200	–600



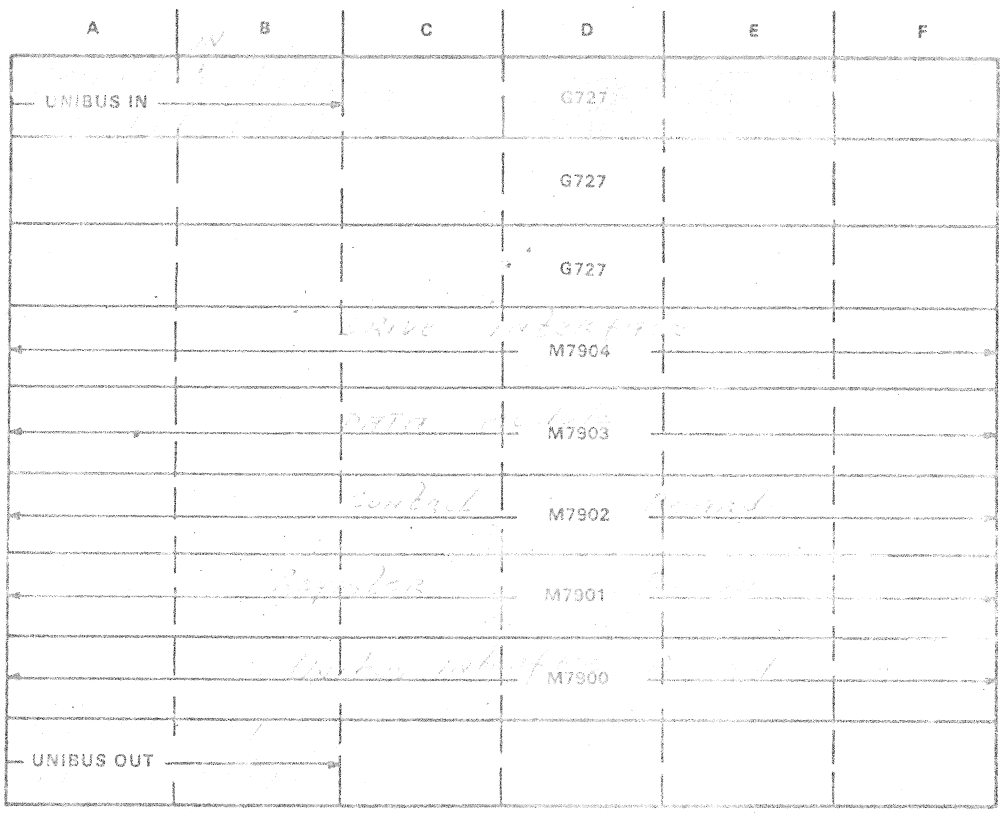
CONTROLLER/DRIVE INTERFACE LINES



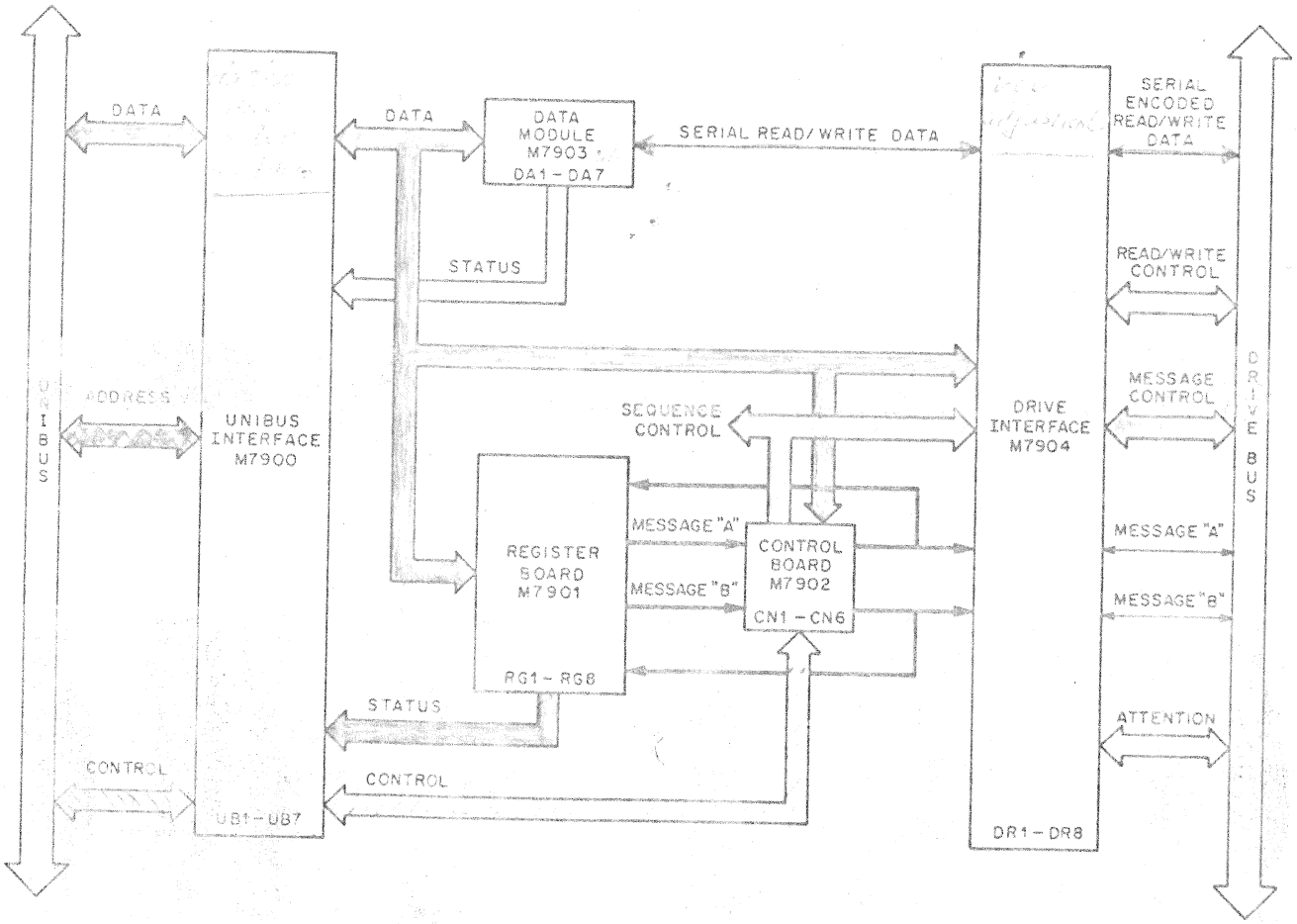
NOTE①: These bits are used only on the RK07.

a. Controller-to-Drive Transmissions

RK611 Controller Backplane (from Module Side)



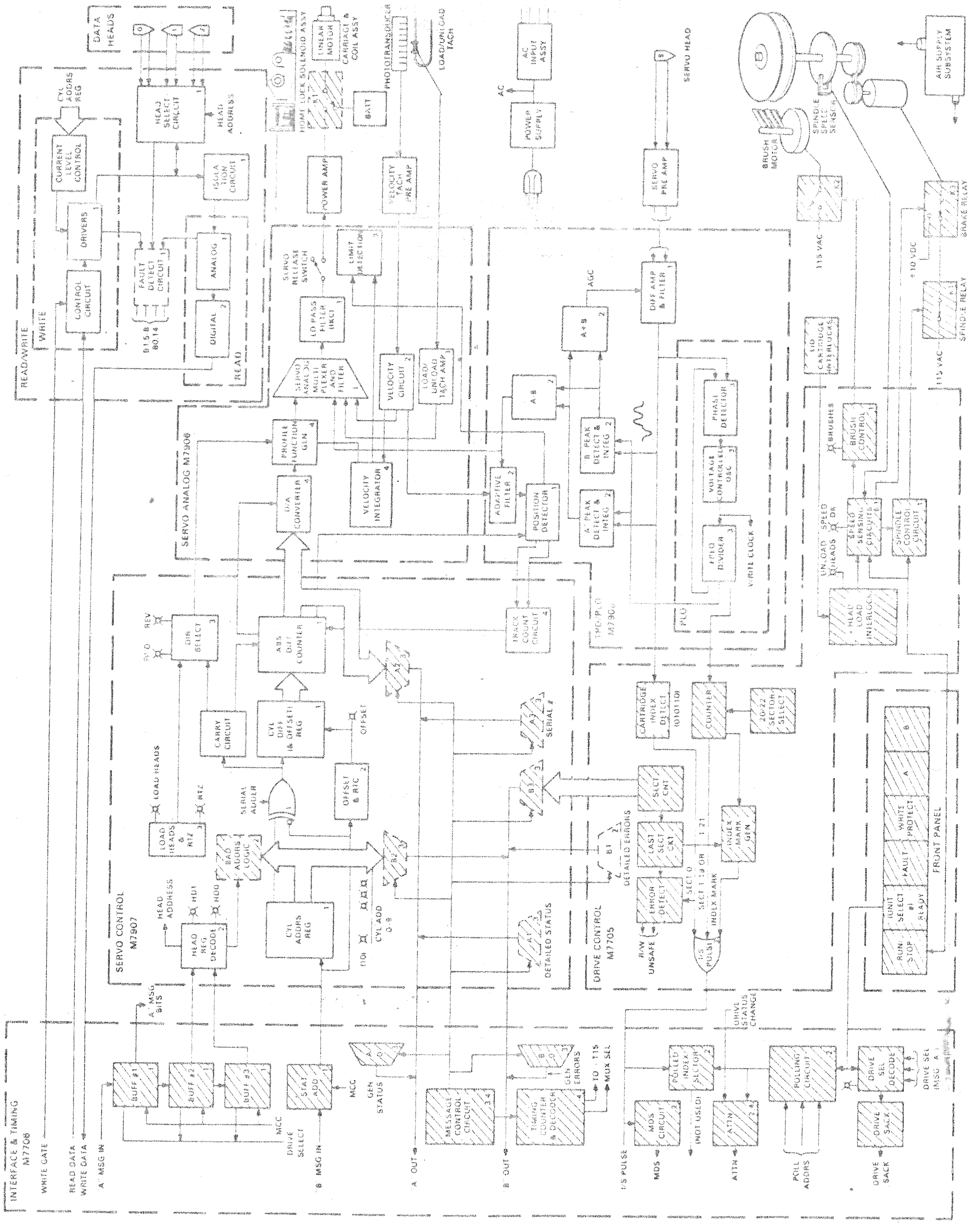
Module No.	Module Name	Addressable Registers
M7900	Unibus Interface	RKBA RKCS1
M7901	Register Board	RKAS/OF RKCS2 RKDA RKDS RKER RKMR2 RKMR3 RKWC
M7902	Control Board	RKDC
M7903	Data Module	RKDB RKMR1
M7904	Drive Interface	RKECPS RKECPT RKMR1



RK07 Disk Drive
Functional Block Diagram
with Drive Control Subsystem Shaded

digital
DIGITAL EQUIPMENT GMBH
MÜNCHEN

Technical Training
Hardware



E125

COURSE: RK07

AUTHOR: JOHN MORGAN

STUDENT:

INSTRUCTOR:

TASK 1 (UP/DOWN)

OBJECTIVE: To consolidate the students' knowledge of the operation of the RK07 cycle Up/Down sequences.

METHOD: Using a. Head Load/Unload Flow Chart (Eng. Dwgs.)

b. Cycle Up/Down Waveforms (Eng. Dwgs.)

c. Tech Manual write up as required

d. Logic prints as required

Analyse the operation of the logic involved in the sequence and answer the following questions:-

Q1 What interlock signals are checked before the Spindle relay is energised

Q2 What errors will cause the Heads not to load (M7705)

Q3 a. What is the purpose of the signals (I & T4 T10) and (I & T4 T6). (M7705)

b. Where do they originate and how would you create them to test the machine's operation.

Q1 Lid Locked.
Cart. Res.
DC low L. = H.

Q2 Brushes not Home.
Servo unsafe.
Limit detected on seek.
Speed not ok.
R/W unsafe.

Please complete your answers on the rear of this sheet and return to your instructor for evaluation and recording.

Q3 a Medium offline FF set on T10
Start Spindle comm on T6.

b message A commands.

TASK 2 (LOAD/UNLOAD)

OBJECTIVE: To consolidate the students' knowledge of the Head Load/Unload sequence

METHOD: Using a. Head Load/Unload Flow Charts (Eng. Dwgs.)

b. Cycle Up/Down Waveforms

c. Logic prints as required M7705/M7707/M7708

d. Tech Manual write up Chapter 4

Analyse the operation of the logic involved in the Head Load/Unload sequence and answer the following questions:-

Q1 What causes the carriage to drive in a Reverse direction after the initial Forward motion

Q2 Which signal causes Reverse Motion to Stop

Q3 Which signal cancels the second forward movement, and from where does it ultimately originate

Q1 Detecting inner limit.

Q2 Detecting outer limit

Q3 Track count.
From course track and move

TASK 3 (SERVO)

OBJECTIVE: To consolidate the students' knowledge of the operation of the Servo System in Velocity mode.

METHOD: Using a. Your Timing Waveforms (Eng. Dwgs.)

b. Your Flow Charts (Eng. Dwgs.)

c. Tech Manual description Chapter 4

d. Logic Prints M7707/M7729

Analyse the operation of the Servo System and answer the following questions:-

Q1 (M7707) The difference register receives the result of the (Old-New) calculation as it is shifted in

a. Between what time periods does this shift occur.

b. What is the Volume Valid Bit and what is it's purpose on sheet SC1.

Q2 (M7707 SC2) What is the purpose of the OR Gates in area D6, and under what conditions would they all operate

Q3 (M7729 SA4) What effect do the FETS E21 (S5 and S6) have upon the operation of the Profile generator E16

Q4a (M7729 SA2) Where is the signal SA2 - Velocity derived from and what is it's purpose

b How would the machine react if due to component failure this signal became inoperative

Q 1 a T4 - T12

B Volume Valid; no changes of pack or Write lock been made. It enables the address shift.

Q 2 To let through cyl dif 0 - 5 if 6 - 8 are '0'

Q 3 Feedback for a seek or and offset.

Q 4 a from sin and cos. It's used to derive the current in the voice coil from.

b. It would generate servo unsafe.

TASK 4 (SERVO)

OBJECTIVE: To consolidate the student's knowledge of the operation of the Servo System in Position Control Mode.

METHOD: Using a. Your Tech Manual description (Chapter 4)

b. Your Logic Prints M7708

Analyse the operaton of the Servo System and answer the following questions:-

Q1.a (M7708 TPD1) Where does the input to this card at quadrant D8 originate

b What processing does it undergo before it reaches this card's input pins

Q2 (M7708 TPDI) What is the purpose of the signal TBDI SVO PLS and from what portion of the Tri Bit stream is it derived

Q3 (M7708 TPD2) Why are the signals TPD3 B PKDET and TPD3 A PKDET necessary and what is their purpose

Q4 (M7708 TPD2) For what purpose and in which mode of operation will the signal TPD2 TRK ERROR be used

Q5.a (M7708 TPD3) The error signal TPD3 SET SVO ERR is suppressed during Head Load operations. Why?

b What conditions after Head Load will generate this signal

Q 1 a servo preamplifier.
b filtering and amplifying.
Q 2 it's used to make servo clock and peak detect signals. It's derived from the sync pulse.
Q 3 They determine the moment the A or B peak are monitored.
Q 4 For settling ?

TASK 5

MECHANICAL STRIP DOWN

OBJECTIVE: To familiarise the student with the mechanical components of the drive, their location, and method of removal.

At each item. Refer to all references listed before doing the practical, and read the warnings (In Heavy Print)

ITEM	DESCRIPTION	SERVICE MAN PAGE REF.	TICK BOX WHEN DONE
1	Covers	2/15	
2	Absolute Filter	2/15	
3	Shroud	2/75	
4	Motor and Bracket Assembly & Belt	2/72	
5	All Heads	2/41 → 45	
6	Cam Tower	2/86	
7	Spring Way	2/86	
8	Fixed Way	2/80	
9	Velocity Transducer Assembly	2/58 → 60	
10	Carriage and Coil Assembly		

TASK 6

MECHANICAL REBUILD AND SETTING UP

OBJECTIVE: As in Task 5, read all service manual references before attempting to replace each item.

ITEM	DESCRIPTION	SERVICE MAN PAGE REF.	TICK BOX WHEN DONE
1	Carriage and Coil Assembly Para 1→4	2/92	
2	Spring Way Para 1→2	2/87	
3	Cam Tower Para 1→3	2/86	
4	Fixed Way Para 1	2/80	
5	Set Up Carriage Roll Para 9→16 Also see Page 2-99	2/93 2/96	
6	Set Up Glass Shutter Para 17 e→q	2/96	
7	Set Up Transducer Housing Para 18→19	2/97	
8	Absolute Filter Para 1→4	2/16	
9	Spindle Motor and Belt	2/73	
10	Shroud Para 1→5	2/95	
11	Servo Head Para 23→27	2/97	
12	RD/WT Heads Para 28 a→d	2/98	

TASK 7

OBJECTIVE: To prove via the "static" checks that all mechanical tolerances on the drive are satisfactory for safe operation.

Using the Service Manual for reference performance the following operations.

PAGE		TICK BOX WHEN DONE
3/25	Cartridge Present Switch	
3/16	Head Load Tacho	
3/15	Home Lock Solenoid	
3/3	Speed Transducer Position	
3/4	Spindle Belt Tension	
3/1	Front Latch Adjustment	

Note: Read next item and task 8 before replacing covers

TASK 8

POWER SUPPLY/PREAMP

OBJECTIVE:

1. To verify that the Power Supply voltages are within tolerance for safe operation and adjust as necessary.
2. To verify that the Sin/COS signals from the Glass Shutter Preamp are of the correct level for safe servo operation and adjust as necessary.
3. To adjust carriage velocity

Using your service manual for reference perform the following items:-

Page		
3/31		Power supplies
3/22	24	Transducer Preamp
3/24		Velocity Adjustment.

Note: Insure head securing bolts are set to final torque 5" Lbs.

TASK 9

HEAD ALIGNMENT

OBJECTIVE: To align the Read/Write Heads to within ± 50 µin of the track centre using an alignment cartridge as a standard.

Using your service manual for reference perform the following operations:

Page — Read, digest and take warning of the dangers present

3/8 or Para 3, 4, 2 — Perform the Head Alignment Using the method assigned by your Instructor

Head 0	
Head 1	
Head 2	

TASK 10

V.C.O.

OBJECTIVE:

To ensure that the preset frequency of the V.C.O. in the controller lies close to the frequency of the RK07 data rate, and adjust if necessary.

TASK 11 (MAINDECS)

OBJECTIVE: That the student familiarise himself with the Diagnostic Software available audit's uses for the RK06/07-611 System.

METHOD: Using the appropriate media and listings, load and run all available Maindecs on your machine in the following order:

DZR6A	Diskless Controller Test	PT1
DZR6B	" " "	PT2
DZR6C	" " "	PT3
DZR6D	" " "	PT4
DZR6E	" " "	PT5
DZR6H	Disk Drive Test	PT1
DZR6I	" " "	PT2
DZR6J	" " "	PT3
DZR6K	Functional Controller Test	
*DZR6L	Cartridge Formatter	
DZR6M	Subsystem Verification	PT1
DZR6N	" "	PT2
DZR6P	Performance Exerciser	
DZR6R	User defined Test	

* NOTE

1. See Handout sheets for problems with this Maindec.
2. DZR6H checks operation of fault lamp

TASK 12 RD/WT

OBJECTIVE: To consolidate the students' knowledge of the operation of the Read/Write logic used in the RK07.

METHOD: Using
a. Logic prints of card 5411060 RD/WT
b. Tech. Manual description (Chapter 2)
c. Course Handout

Analyse the operation of the RD/WT circuitry and answer the following questions:-

Q1 Describe the level transition points for MFM data with respect to the Bit Cells.

Q2 Does the drive receive MFM or NRZ data from the controller.

Q3 What is the purpose of the inputs to the 5411060 card of the signals CYL ADDRS 6/7/8.

Q4 Why are no connections to the Servo Head made on this card

Q5 What conditions are necessary for the Signal SEE CURR FAULT to be produced

Q1 Mid cell change for a '1' No change for a '0' except when the next one is a zero too, then it changes at the end of the bitcell

Q2 MFM data.

Q3 To reduce the write currents when it's getting nearer to the spindle where the heads fly lower.

Q4 It has a seperate servo preamplifier.

Q5 currents supplyed and no write gate.

TASK 13 (Interface & Timing)

OBJECTIVE: To consolidate the students' knowledge of the operation of the Interface and Timing logic card M7706.

METHOD: Using
a. Logic Prints M7706
b. Flow Charts (Eng. Dwgs.)
c. Message Timing Waveforms (Eng. Dwgs.)
d. Tech. Manual Chapter 3.

Analyse the operation of the logic and answer the following questions:-

Q1 (I & T1) What is the purpose of the STROBE signal during message reception from the controller.

Q2 (I & T4) What happens when the Time Slot Counter reaches a count of T15 during message reception and the C T D signal changes state.

Q3 (I & T3) As the programmer has a choice of which Status/Error messages he may receive, how is the selection made within the RK06 as to which bits will be put into the outgoing messages.

Q1 To have all drives receive the first 3 bits which are drive select.

Q2 In en FF is cleared and outen FF is set.

Q3

Write new bad sektor file. ZR6R ??
(user define test).

* NT (CR)

~~* CC~~

* SF, CC (CR) ; controller clear.

* SF, DC, ∅ (CR) ; data compare

* SF, PA, ∅ ; Pack acknoledge.

~~* SF, WH, ∅, 1456, ... ; Write header track 8₁₄~~

* SF, WH, ∅, 1456₈, 2, ∅, 102₈ (CR) ; write header track 8₁₄, head 2 sektor ∅, 66 worden. (3 x 22)

* DP; X, 123456 (CR) ; Special data pattern (Pack serial number) in Buffer X
000000 (CR)
000000 (CR)
000000 (CR) → by ≠ ∅ → aligment pack.
177777 (CR)
177777 (CR)(CR) → (uit functie)

* SF, WD, ∅, 1456₈, 2, ∅, 12,000, X (CR)

* CO (CR) ; compiler.

* Run.

* EXIT.

R ZR6L ??. (formatter).