EUROPEAN

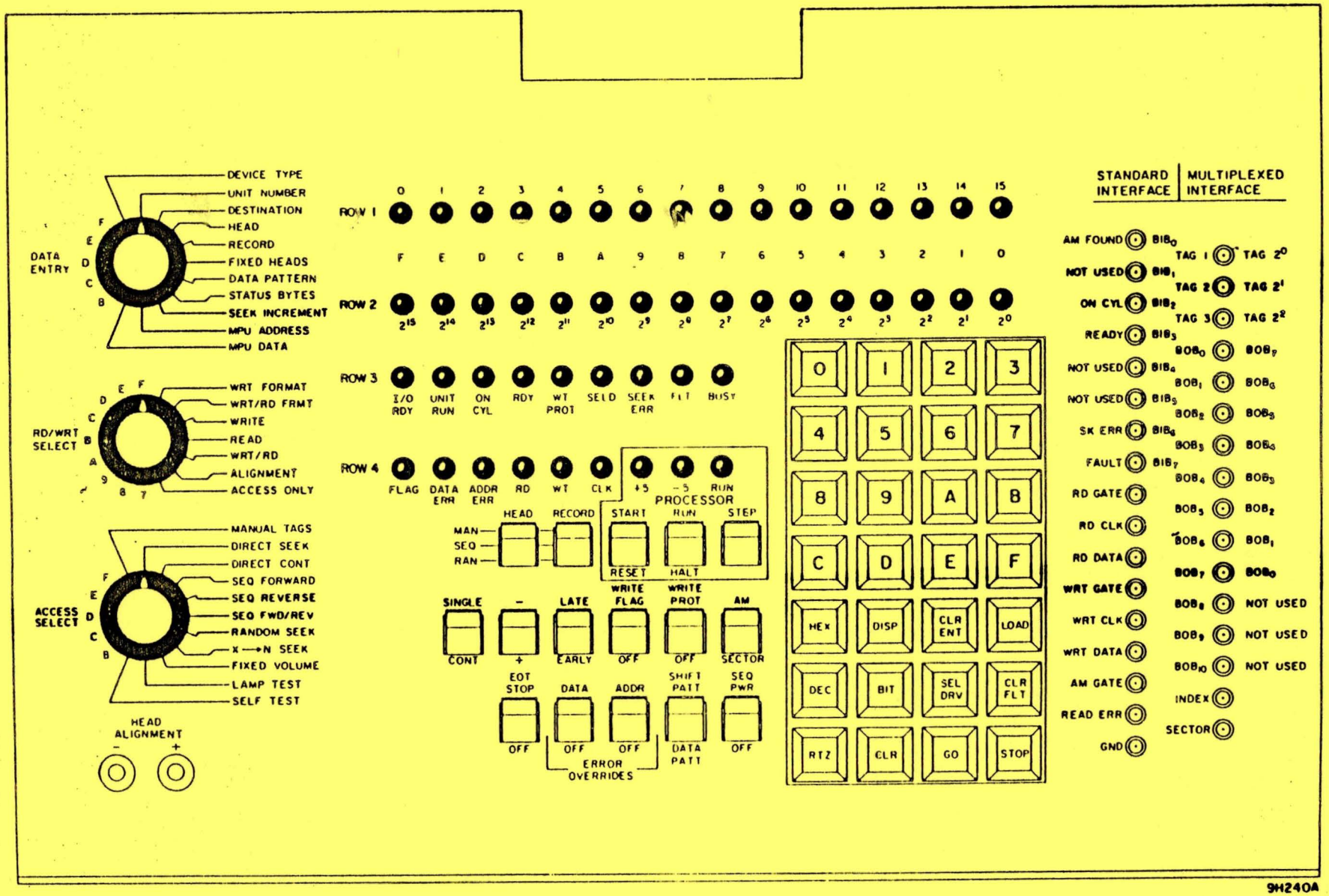
OEM

TRAINING CENTER
HEPPENHEIM

TB216 FTU

TRAINING HANDOUTS

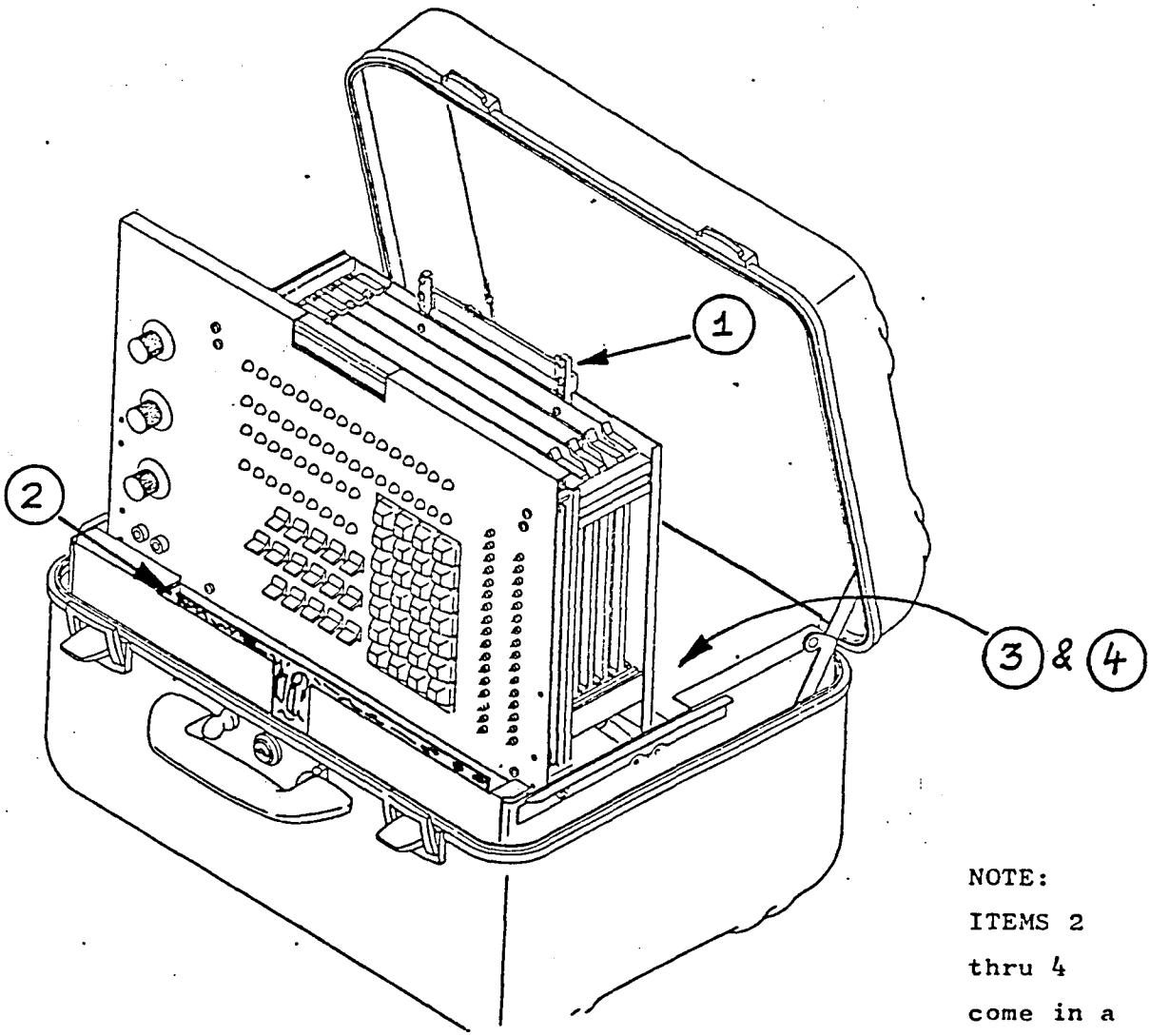
MAGNETIC PERIPHERALS INC.
-GERMANY



FTU Front Panel

INTRODUCTION

The TB 216A is a programmable, microprocessor-controlled off-line testbox for the CDC Module family of Disk Drives.
It'll operate all MMD's, SMD's, CMD's and FMD's, both OEM and multiplexed interfaces. It is designed to be used on the 8" Drive Family as well (Lark).



NOTE:
ITEMS 2 thru 4 come in a seperate box.

The TB 216 is shipped in an aluminium air-case with all cabling seperately bypacked. A complete manual is shipped with each box.
Accessories supplied are as follows:

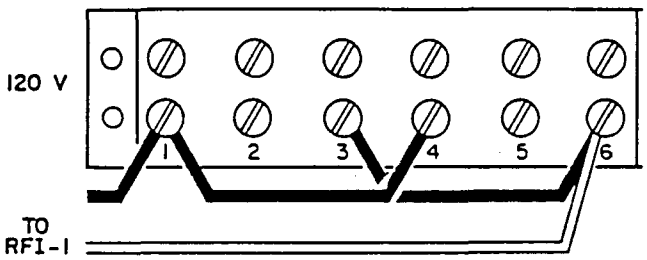
1) Head Alignment extender card for the CMD, included in the Testers Logic Chassis.
2) Analog head alignment card for CMD's + SMD's.
3) Power cord.
4) Various interface cables and adapters as well as head alignment cables for the different products.

Power Supply

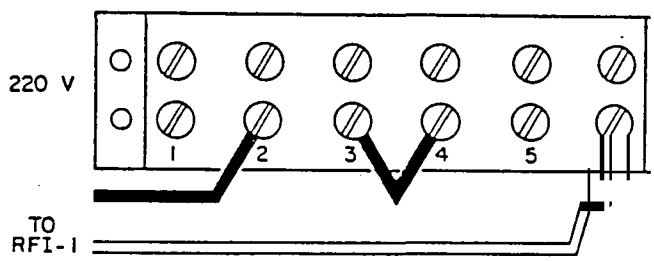
The textbox comes with an American power plug and wired to 120 V/60 Hz.

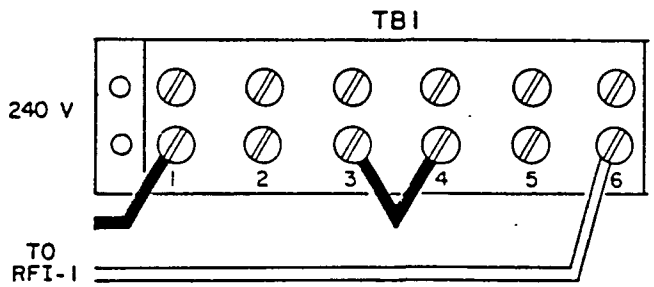
For conversion to 220/240 V/50 Hz open the Power Supply and configurate the jumpers on the Terminal Board according to the Table (no. 2) or tester manual.
Change plug on Power Card accordingly, close power supply, plug in TB 216 and switch DC-breaker to ON.

FROM:



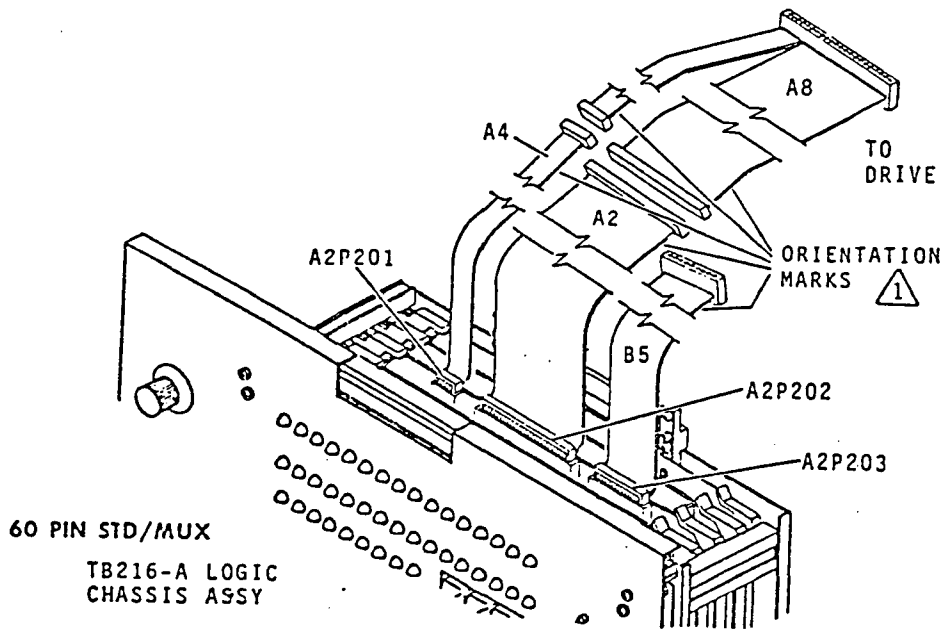
TO:

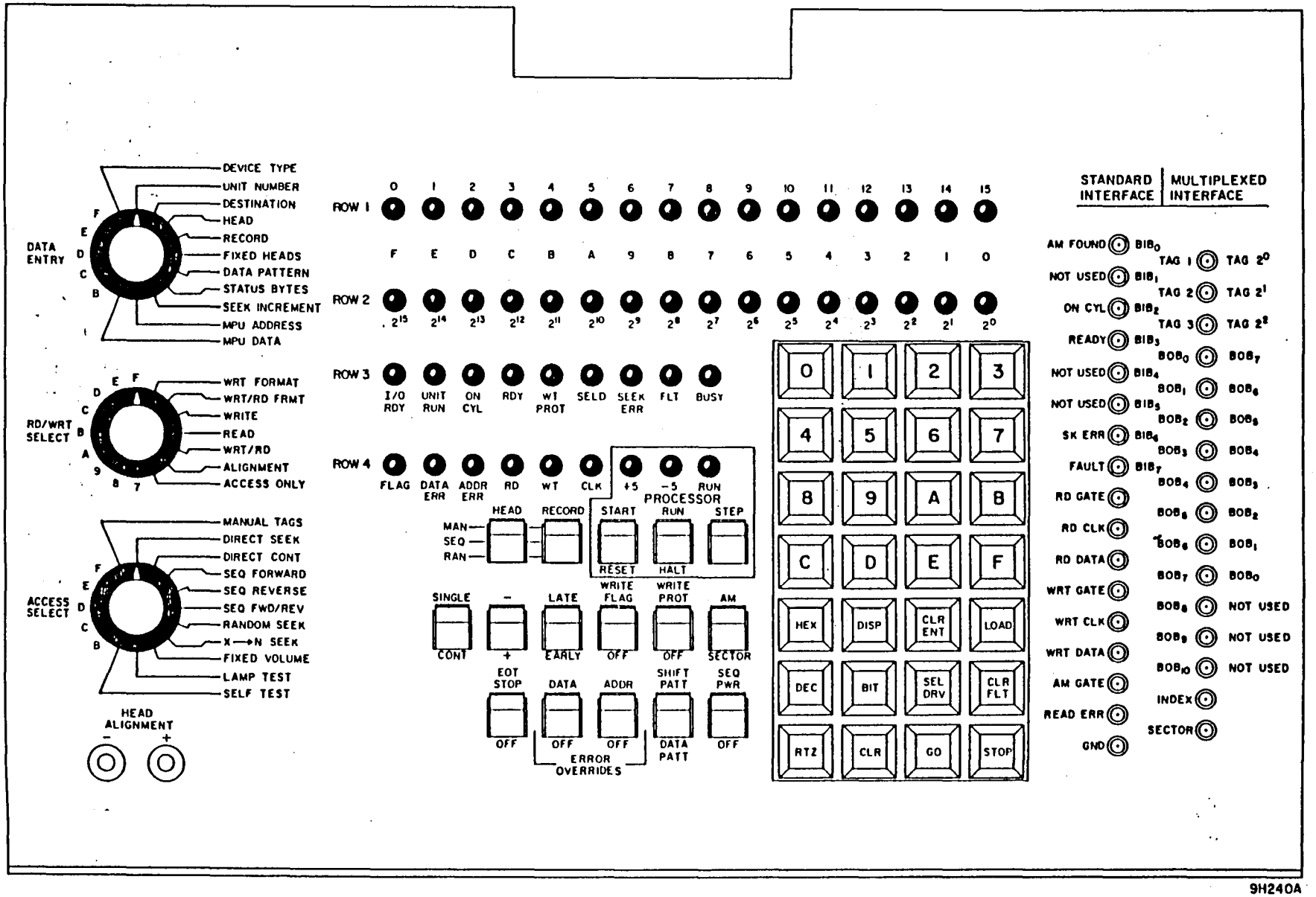




I/O Cable Connections

Remove I/O cables and appropriate adapters from separate box and hook up to the FTU as shown:




DATA ENTRY
DEVICE TYPE
UNIT NUMBER
DESTINATION
HEAD
RECORD
FIXED HEADS
DATA PATTERN
STATUS BYTES
SEEK INCREMENT
MPU ADDRESS
MPU DATA
RD/WRT SELECT
WRT FORMAT
WRT/RD FRMT
WRITE
READ
WRT/RD
ALIGNMENT
ACCESS ONLY
ACCESS SELECT
MANUAL TAGS
DIRECT SEEK
DIRECT CONT
SEQ FORWARD
SEQ REVERSE
SEQ FWD/REV
RANDOM SEEK
X→N SEEK
FIXED VOLUME
LAMP TEST
SELF TEST
HEAD ALIGNMENT
ROW 1
ROW 2
ROW 3
I/O RDY
UNIT RUN
ON CYL
RDY
WT PROT
SELD
SEEK ERR
FLT
BUSY
ROW 4
FLAG
DATA ERR
ADDR ERR
RD
WT
CLK
+5
-5
RUN
PROCESSOR
HEAD
RECORD
START
RUN
STEP
MAN
SEQ
RAN
RESET
HALT
SINGLE
CONT
LATE
EARLY
WRITE FLAG
OFF
WRITE PROT
OFF
AM
SECTOR
EOT STOP
OFF
DATA
OFF
ADDR
OFF
SHIFT PATT
DATA PATT
SEQ PWR
OFF
ERROR OVERRIDES
HEX
DISP
CLR ENT
LOAD
DEC
BIT
SEL DRV
CLR FLT
RTZ
CLR
GO
STOP
STANDARD INTERFACE
MULTIPLEXED INTERFACE
AM FOUND
NOT USED
ON CYL
READY
NOT USED
NOT USED
SK ERR
FAULT
RD GATE
RD CLK
RD DATA
WRT GATE
WRT CLK
WRT DATA
AM GATE
READ ERR
GND
INDEX
SECTOR
NOT USED
NOT USED
NOT USED

9H240A

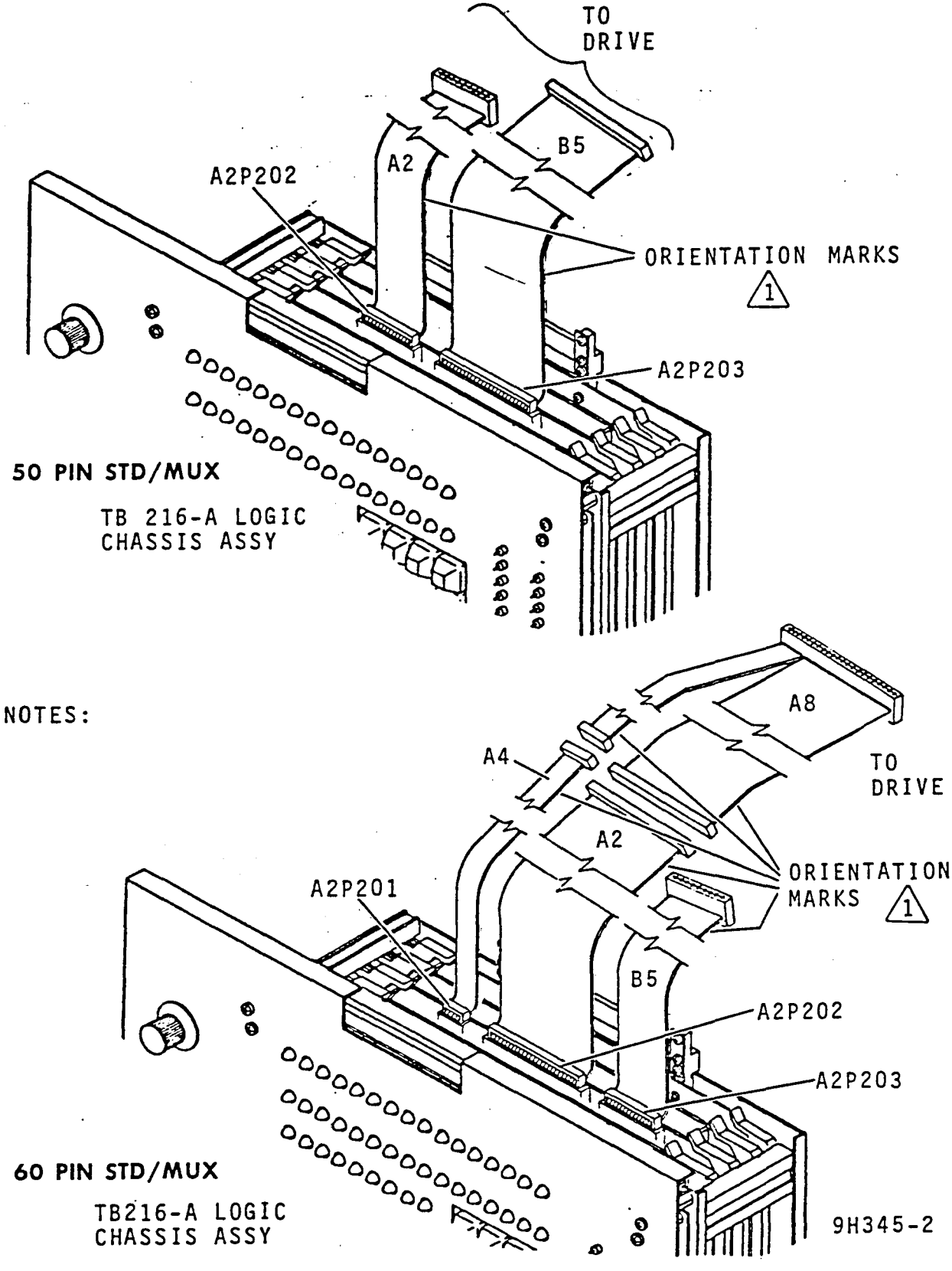


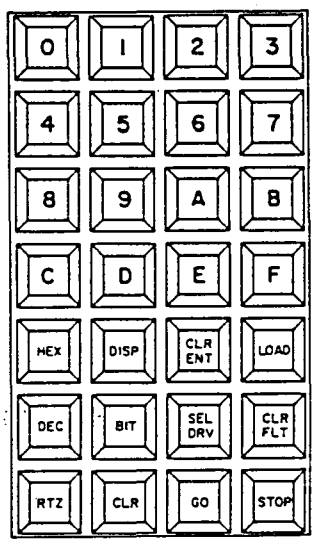
Figure I/O Cable Hook-Up (Sheet 2)

FRONT PANEL

Let's have a look to the Operator Panel first and talk about its switches and indicators.

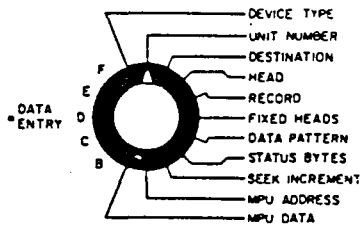
There are 5 major areas on the front panel:

no. 1 is the KEYBOARD, used to enter all data and commands into the testbox.

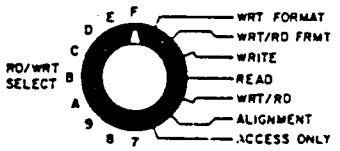


no. 2 is three multifunction rotary switches, each having 16 positions.

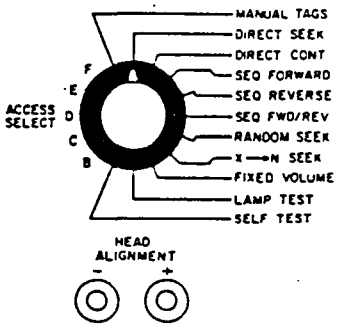
DATA ENTRY SWITCH - decides which data you enter via the keyboard.



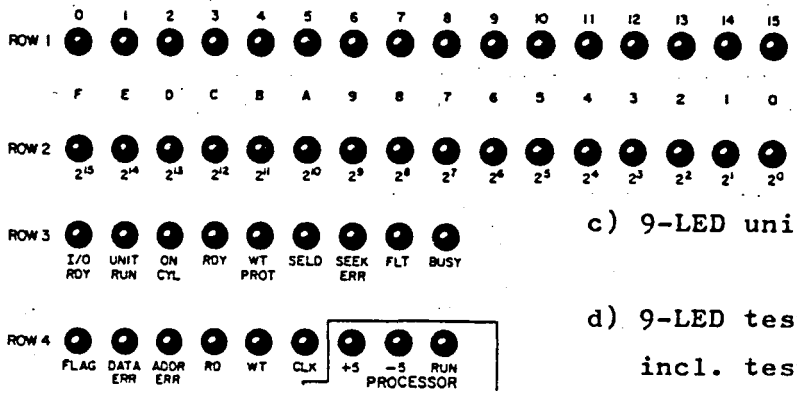
RD/WR SEL SWITCH - decides the mode of operation
- ACCESS ONLY
- HEAD ALIGNMENT or
- ANY OF THE RD/WR FUNCTIONS



ACCESS SEL SWITCH
- offers various manual and automatic access modes plus volume select feature for CMD's as well as tester internal selftest and lamptest.



no. 3 is four (4) rows of indicators:



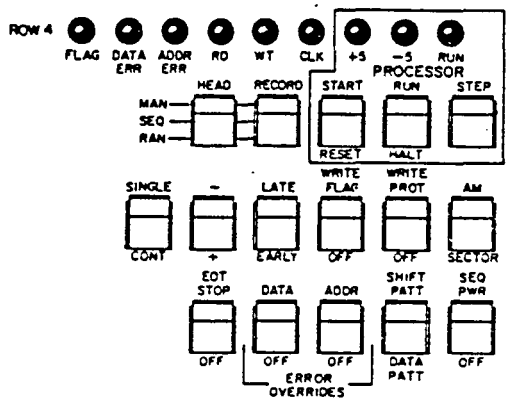
a) 16-LED top row

b) 16-LED bottom row

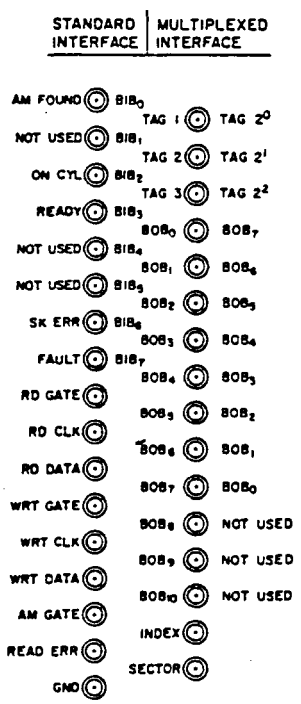
c) 9-LED unit status display

d) 9-LED tester status display
incl. tester power and uP indicator.

no. 4 is various control switches used in conjunction with the basic 3 operation select switches on the left.



no. 5 is a number of testpoints for tester and unit key-signals. There are 2 different meanings for each of them depending on OEM or multiplexed interface operation.

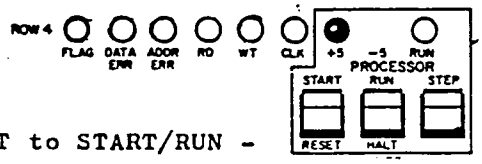


For any more details of all those switches and indicators refer to TB 216 manual.

DC ON / uP RUN

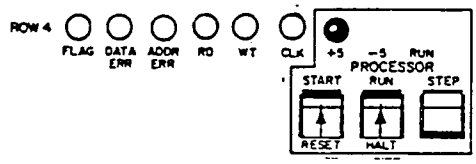
With DC breaker on the following can be observed:

- the blower starts operating
- ± 5 V indicators in the uP field come up

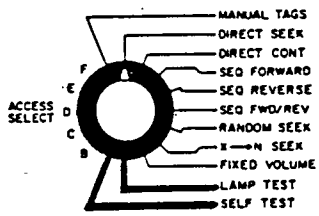


- when switching the uP switches from RESET/HALT to START/RUN - all status LED's come up, except the 2 most left ones.

This configuration now indicates, that the testbox is ready to be programmed by you.



LET'S START WITH THE TESTER'S INTERNAL CHECKS:



LAMP TEST

Place ACCESS SEL SW IN LAMP TEST position and press the GO-key. All LED's should flash, except the 3 in the uP field, however, these 3 will be constantly on.

The lamp test is stopped by pressing the STOP-key, and you're back to the testbox-ready display which you have started with.

SELF TEST

Place ACCESS SEL SW in SELF TEST position and press the GO-key. Observe the RD/WR LED's alternately to flash, with no DATA ERRORLED coming up. Ignore the flashing LED pattern on the top and bottom 16-LED rows.

The SELF TEST stops automatically with the RD-LED on and no DATA ERROR indicated. If you end up with a self test error, immediate trouble-shooting is limited to voltage checks and reseating of the testers logic cards and/or looking for any obvious damage, loose connections, missing cards etc. If no obvious cause can be found, you can either order replacement cards or send the testbox back to CDC for repair.

After a good self test routine, you can check each SWITCH on the front panel, except SEQ PWR and the uP switches.

Each switch and its position must show a change in LED display in a pre-assigned area of the upper and lower 16-LED rows. No LED reaction of a certain switch position indicates a broken switch and/or missing connection into the testers logic.

DEVICE TYPE CODES

DEVICE CODE
R.V.

0919
↓
19 is Amount OF HEADS

09 = B cable with index/actor
01 = A cable with index/actor

[Ampex Capricorn 330 Code 0916]

[Ampex DFR996 code0101]

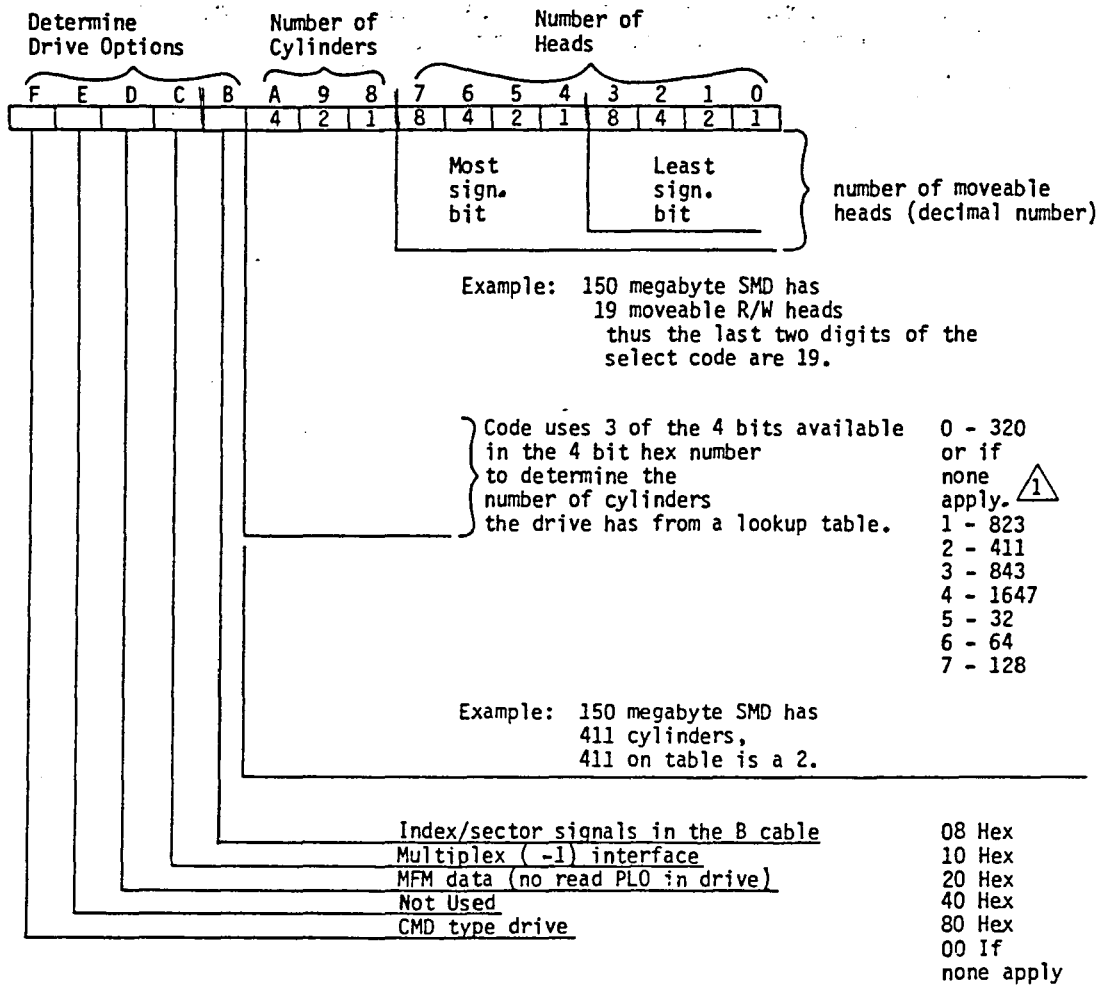
DRIVE FAMILY	DEVICE CAPACITY	INTER-FACE	DEVICE TYPE INDEX-SECTOR/B (NRZ DATA)*B	DEVICE TYPE INDEX-SECTOR/A (NRZ DATA)*A	DEVICE TYPE INDEX-SECTOR/B (MFM DATA)**B	DEVICE TYPE INDEX-SECTOR/A (MFM DATA)**A
SMD	9760-40	Mux 60/75 Std	1A05 0A05	1205 0205	3A05 2A05	3205 2205
SMD	9762-80	Mux 60/75 Std	1905 0905	1105 0105	3905 2905	3105 2105
SMD	9764-150	Mux 60/75 Std	1A19 0A19	1219 0219	3A19 2A19	3219 2219
SMD	9766-300	Mux 60/75 Std	1919 0919	1119 0119	3919 2919	3119 2119
MMD	973X-12	Mux 60/75 Std	1802 0802	1002 0002	3802 2802	3002 2002
MMD	973X-24	Mux 60/75 Std	1804 0804	1004 0004	3804 2804	3004 2004
MMD	973X-80	Mux 60/75 Std	1905 0905	1105 0105	3905 2905	3105 2105
MMD	973X-160	Mux 60/75 Std	1910 0910	1110 0110	3910 2910	3110 2110
HPTMMD	973X-2.5	Mux 60/75 Std	1D04 0D04	1504 0504	2D04 2D04	3504 2504
HPTMMD	973X-5.0	Mux 60/75 Std	1E04 0E04	1604 0604	3E04 2E04	3604 2604
HPTMMD	973X-10	Mux 60/75 Std	1F04 0F04	1704 0704	3F04 2F04	3704 2704
CMD	9448	Mux 60/75 Std	99XX **** 89XX	91XX 81XX	B9XX A9XX	B1XX A1XX
FMD	9775	Mux 60/75 Std	1B40 0B40	1340 0340	3B40 2B40	3340 2140
LMD ***	9455/ 9457	Mux 60/75 Std	1904 0904	1104 0104	3904 2904	3104 2104
FSD	9715-160	Mux 60 Std	1910 0910	9110 0110	---- ----	---- ----
FSD	9715-340 **** 9715-515	60 Std	0924 4924	0124 4124	----	----
RSD	9710-80	60 Std	0905	0105	----	----

* Units with Read PLO for MFM to NRZ conversion
** Units without Read PLO for MFM to NRZ conversion
*** Maximum cylinder number must be modified (DATA ENTRY position F) to 00CD hex (9455) or 026E hex (9457).
**** Maximum cylinder number must be modified (DATA ENTRY position F) to 02C6 hex.
***** Special application only

TABLE DEVICE TYPE CODES

DRIVE FAMILY	DEVICE CAPACITY	INTER-FACE	DEVICE TYPE INDEX-SECTOR/B (NRZ DATA)*B	DEVICE TYPE INDEX-SECTOR/A (NRZ DATA)*A	DEVICE TYPE INDEX-SECTOR/B (MFM DATA)**B	DEVICE TYPE INDEX-SECTOR/A (MFM DATA)**A
SMD	9760-40	Mux 60/75 Std	1A05 0A05	1205 0205	3A05 2A05	3205 2205
	9762-80	Mux 60/75 Std	1905 0905	1105 0105	3905 2905	3105 2105
	9764-150	Mux 60/75 Std	1A19 0A19	1219 0219	3A19 2A19	3219 2219
	9766-300	Mux 60/75 Std	1919 0919	1119 0119	3919 2919	3119 2119
MMD	973X-12	Mux 60/75 Std	1802 0802	1002 0002	3802 2802	3002 2002
	973X-24	Mux 60/75 Std	1804 0804	1004 0004	3804 2804	3004 2004
	973X-80	Mux 60/75 Std	1905 0905	1105 0105	3905 2905	3105 2105
	973X-160	Mux 60/75 Std	1910 0910	1110 0110	3910 2910	3110 2110
	973X-2.5	Mux 60/75 Std	1D04 0D04	1504 0504	2D04 2D04	3504 2504
MMD	973X-5.0	Mux 60/75 Std	1E04 0E04	1604 0604	3E04 2E04	3604 2604
	973X-10	Mux 60/75 Std	1F04 0F04	1704 0704	3F04 2F04	3704 2704
CMD	9448	Mux 60/75 Std	99XX 89XX	91XX 81XX	B9XX A9XX	B1XX A1XX
FMD	9775	Mux 60/75 Std	1B40 0B40	1340 0340	3B40 2B40	3340 2340
LMD ***	9455/ 9457	Mux 60/75 Std	1904 0904	1104 0104	3904 2904	3104 2104
FSD	9715-160	Mux 60 Std	1910 0910	1110 0110	---- ----	---- ----
	9715-340 ****	60 Std	0924	0124	----	----
	9715-515 ****	60 Std	4924	4124	----	----
RSD	9710-80	Mux 60 Std	1905 0905	1105 0105	---- ----	---- ----
XMD	9771-825 *****	60 Std	4816	4016	----	----

* Units with Read PLO for MFM to NRZ conversion
** Units without Read PLO for MFM to NRZ conversion
*** Maximum cylinder number must be modified (DATA ENTRY position F) to 00CD hex (9455) or 026E hex (9457).
**** Maximum cylinder number must be modified (DATA ENTRY position F) to 02C6 hex or 710 decimal.
***** Maximum cylinder number must be modified (DATA ENTRY position F) to 03FF hex or 1023 decimal.



The first 5 bits determines I/O and drive options and are entered with the cylinder code as two Hex numbers.

Example: 150 megabyte SMD with standard 60 pin I/O with no read PLO, and index/sector signals in the B cable is a 28 (Hex) code.

```
  28 Hex  Thus the device type code is 2A19.
+ 2 Hex
  2A Hex
```

Note:

1 If none apply, after selecting drive, rotate DATA ENTRY switch to F position and manually enter, via keyboard, the number of cylinders.

Figure . Device Type Code Determination

UNIT SELECTION

After interface connection to the Drive has been made, we can select the unit via the testbox. We start with the display "Testbox ready", which is uP switches from HALT/RESET back up to START/RUN. Place DATA ENTRY SW to DEVICE TYPE position, have the WR PROT SW up and enter device type number via the keyboard.
The example shown is 0105, which stands for an 80 MB SMD, OEM I/O, entered at the bottom row of 16 LED's. The number is shown as 0105 HEX.

Now press the LOAD key.

The display is transferred to the upper row of LED's and conditions the processor to operate that specific type of device.
The status display is marginal at this point in time and will be corrected after you

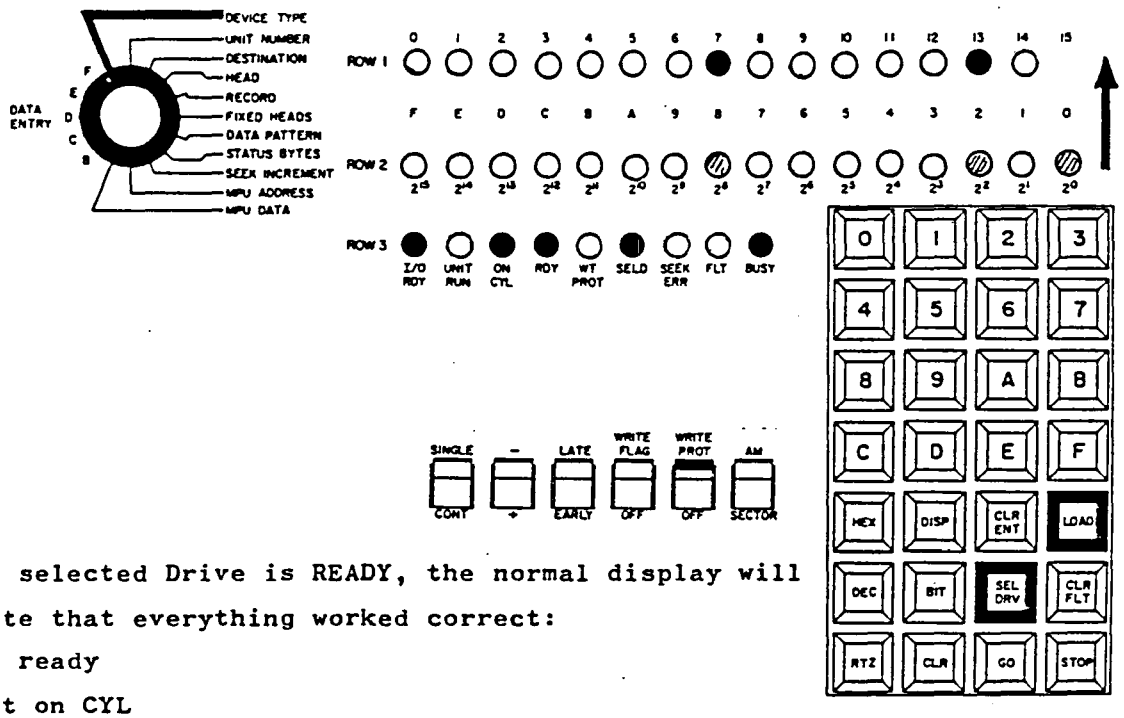
..... have pressed the SEL DRV key.

The following can be observed on the status LED's:

1) I/O RDY comes up

   "Selected" LED comes up, but busy LED starts flashing.

   This indicates that the Drive under Test is sufficiently selected, but not yet READY. Wait for the Drive to come READY.



2) If the selected Drive is READY, the normal display will indicate that everything worked correct:

   I/O ready

   Unit on CYL

   Unit ready

   Unit SEL

   BUSY ON, but not flashing.

   Try a RTZ command to see if unit reacts.

Two more displays are possible when pressing the SEL DRV-key:

1) The WR PROT LED starts flashing. This indicates that the WR PROT SW has not been up during Drive selection. Switch tester in WR PROT and the unit will be selected.

2) Display turns into any undefined, marginal condition or no display is given at all.
This indicates that the unit is not properly connected, terminated, or unit DC is off. Try to correct and repeat selection.
After the unit is selected, you can ask for the logic number, under which the FTU found the Drive under test. This number should correspond with the unit logic plug or switch settings (anything between ($\emptyset$ - 15_{10}). To do so, you can stop the busy lamp from flashing or wait for unit ready, then go to DATA ENTRY SW pos: UNIT NUMBER. The LSB on the right of the top row LED's will display the unit logic number.

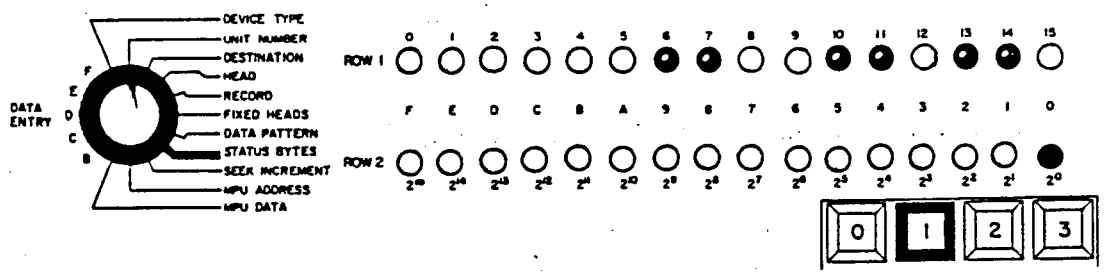
STATUS BYTE FEATURE

To recall multiple information during operation of TB 216, such as Cyl.-Address or Head Address we have the Status Byte Display feature. Place DATA ENTRY SW to STATUS BYTE position and press the appropriate key. The number pressed is indicated at the bottom row of 16 LED's, while the information itself is displayed on the top row.

Here are some of the major displays:

STATUS BYTE 1 - CYL ADDR DISPLAY

During operation the LED's indicate the CYL Address placed on the I/O cable and sent to the unit, in this case 822_{10}.(which is 336 HEX).



Tag-Bus I/O (0)

This status byte displays tag and bus signals as they are sent from the FTU to the drive.

Cylinder (1)

This status byte displays the cylinder on which the drive is operating. The binary value assigned to each LED is given in table 2-10.

Head (2)

This status byte displays the head with which the drive is reading or writing in hexadecimal. For example, for head 17, LEDs 4 and 0 are lighted.

Record (3)

This status byte displays the record on which the drive is performing a read/write operation. The display pattern is identical to the Head display. This is readily visible only in manual or random record (see description of RECORD toggle switch in table 2-2).

Sector (4)

When the drive has been selected, this status byte indicates the total number of sectors being used by the drive. During read/write operations, the sector on which the drive is reading or writing is indicated. This is readily visible only in manual or random record.

Pattern (5)

This status byte displays the 16-bit data pattern that has been entered in FTU memory and is repeated in the data field written by the drive.

Address Error Counter (6)

This status byte displays a count of the number of address errors occurring during an extended read operation. Unless the ADDR ERROR OVERRIDE toggle switch is in the up position, the drive will stop reading when an address error occurs.

Data Error Counter (7)

This status byte displays a count of the number of records that contain data errors. Unless the DATA ERROR OVERRIDE toggle switch is in the up position, the drive will stop reading when a data error occurs.

Flag/Pass Counters (8)

Display bits 0 through 7 indicate how many passes the drive has made through the disk pack in an extended seek operation. Display bits 8 through F indicate the number of flagged tracks detected in a read operation.

Seek Counter (9)

This status byte displays a count of number of seeks performed in a multiple seek operation.

Average Access Time (A)

This status byte displays the average access time for a series of seeks. The display is binary-coded decimal where each group of four LEDs represents a decimal digit. The least significant digit is in tenths of milliseconds.

Access Time Counter (B and C)

These two displays indicate the total access time required for a series of seeks. This is a binary representation where the lower order 16 bits compose the C status byte, and the higher order 16 bits compose the B status byte. The readout is in tenths of milliseconds.

Cylinder Destination 1 (D)

When the drive is performing a continuous seek between two cylinders, this status byte indicates the address of the first cylinder.

Cylinder Destination 2 (E)

When the drive is performing a continuous seek between two cylinders, this status byte indicates the address of the second cylinder.

MUX Status (F)

This display indicates the fault status signals sent back from a drive that has a multiplexed interface. The status condition indicated by each LED is given in table 2-10. LEDs 2 and 6 are not used.

Status Byte Number/Name					
		0 Tag-Bus I/O	1 Cylinder	2 Head	3 Record
	F	R/W First Enabled	Fixed Volume Access	Enabled (CMD)	Not Used
D	E	T 4	16384	Not Used	
I	D	A 2	8192		
S	C	G 1	4096		
P	B	Hold Tag	2048		
L	A	1024	1024		
A	9	512	512		
Y	8	256	256	Not Used	Not Used
	7	B 128	128	128	128
	6	U 64	64	64	64
B	5	S 32	32	32	32
I	4	16	16	16	16
T	3	I 8	8	8	8
S	2	/ O 4	4	4	4
	1	2	2	2	2
	0	1	1	1	1

Status Byte Number/Name					
		4 Sector	5 Pattern	6 Addr Error Ctr	7 Data Error Ctr
D	F	Not Used	32768	Not Used	32768
I	E		16384		16384
S	D		8192		8192
P	C		4096		4096
L	B		2048		2048
A	A		1024		1024
Y	9		512		512
	8	Not Used	256	Not Used	256
	7	128	128	128	128
B	6	64	64	64	64
I	5	32	32	32	32
T	4	16	16	16	16
S	3	8	8	8	8
	2	4	4	4	4
	1	2	2	2	2
	0	1	1	1	1

Status Byte Number/Name					
		8 Flag/Pass Counters	9 Seek Counter	A Average Access Time	B Access Time Cts (0.1MS)
DISPLAY BITS	F	FLAG CTR 128	32768	800 MS	2 147 483 648
	E	64	16384	400 MS	1 073 741 824
	D	32	8192	200 MS	536 870 912
	C	16	4096	100 MS	268 435 456
	B	8	2048	80 MS	134 217 728
	A	4	1024	40 MS	67 108 864
	9	2	512	20 MS	33 554 432
	8	1	256	10 MS	16 777 216
	7	PASS CTR 128	128	8 MS	8 388 608
	6	64	64	4 MS	4 194 304
	5	32	32	2 MS	2 097 152
	4	16	16	1 MS	1 048 576
	3	8	8	0.8 MS	524 288
	2	4	4	0.4 MS	262 144
	1	2	2	0.2 MS	131 072
	0	1	1	0.1 MS	65 536

STATUS BYTE NUMBER/NAME					
		C Access Time Ctr (0.1MS)	D Cylinder Destination	E Cylinder Destination	F Mux Status
DISPLAY BITS	F	32768	32768	32768	No Head Sel
	E	16384	16384	16384	Wrt Fault
	D	8192	8192	8192	W+R Off Cyl
	C	4096	4096	4096	W/R Fault
	B	2048	2048	2048	Voltage Fault
	A	1024	1024	1024	HD SEL Fault
	9	512	512	512	Seek Error
	8	256	256	256	WRT Protect
	7	128	128	128	
	6	64	64	64	
	5	32	32	32	On Cyl
	4	16	16	16	Unit Rdy
	3	8	8	8	
	2	4	4	4	
	1	2	2	2	Offset Active
	0	1	1	1	Chk Diag.

DATA ENTRY GENERAL

The following are 3 methods of entering data after rotating data entry switch to the desired position:

- Normal entry - Each time any (0-F) key is pressed, its hexadecimal value is entered into lower 4 LEDs (0-4) of row 2. Data presently in LEDs 0-4 shifts 4 LEDs to the left. Any data shifted left beyond F is lost (drops off).

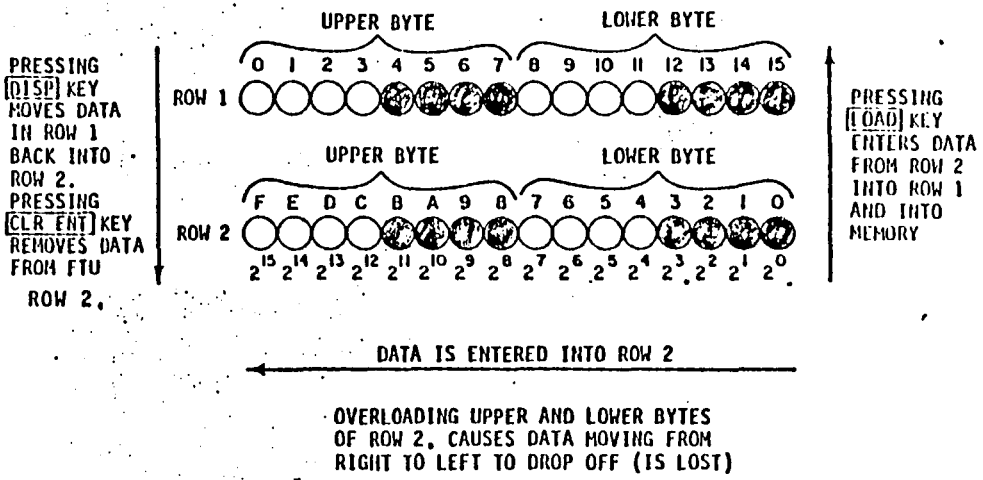
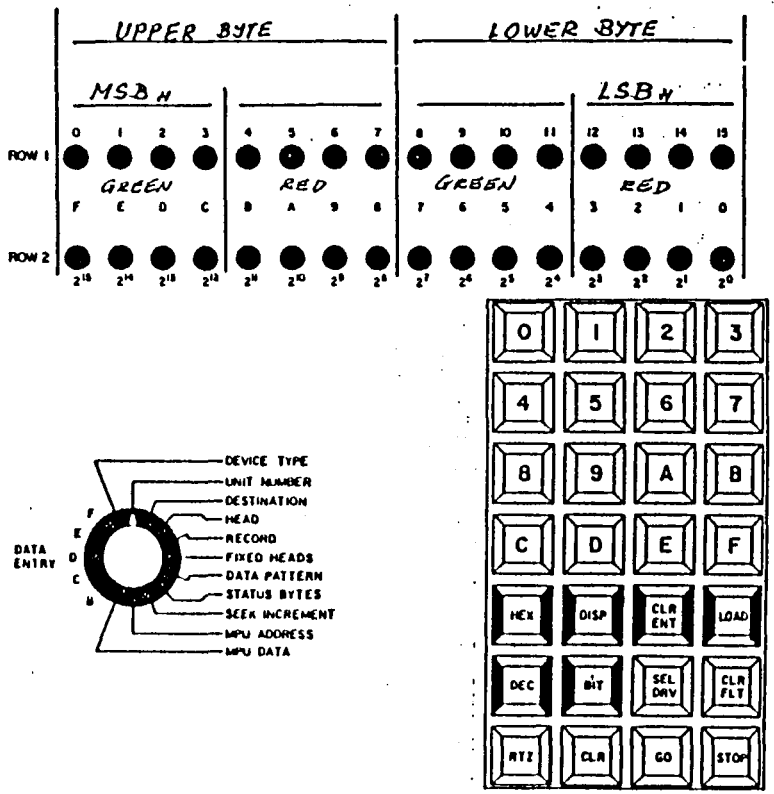


Figure 2-7. Loading Data into FTU

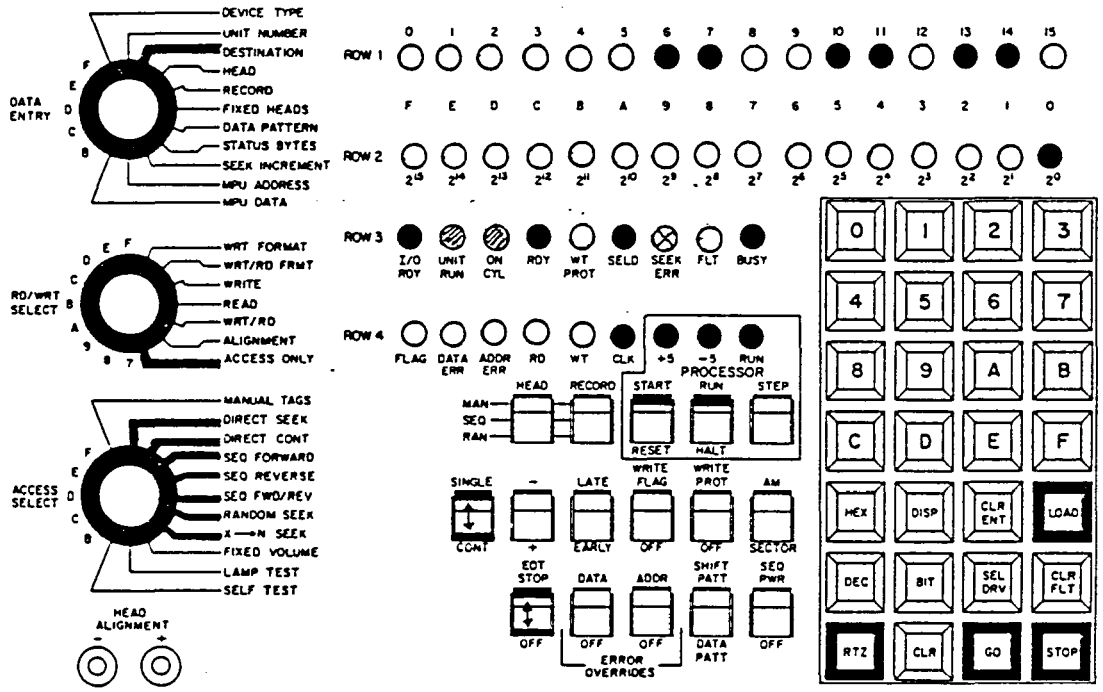
- Bit entry - Pressing BIT key, prior to entering data, causes the corresponding LEDs to toggle. Pressing LOAD key clears bit mode.
- Display - Data can be exchanged between row 1 and row 2 by pressing DISP key (action will not effect memory).

Pressing DEC key converts row 2 hexadecimal data to (BCD) data. Pressing HEX key converts row 2 decimal data (to hexadecimal data. Pressing CLR ENT key clears row 2 LEDs.



ACCESS MODES

To check various access modes, place the R/W SEL switch to ACCESS ONLY and select proper access mode on ACCESS SEL SW. The first 2 modes are direct and direct cont. In both cases you have to give the tester a destination address by placing the DATA ENTRY SW to DESTINATION, entering the desired address via keyboard and press load. Entered address will be shown on bottom row of 16 LED's in HEX; after pressing LOAD key it transfers to top row and converts into Binary. PRESS GO to initiate seek operation.



DIRECT SEEK

Unit will seek to 822_{10} in this case, indicated by a short drop of ON CYL LED and RUN LED coming up. If you do not press STOP key afterwards the TB 216 will continuously issue 822 and seek tag to the interface and drive (RUN LED on!) thus,keeping the drive busy with Ø-track seeks. Press STOP key to terminate that operation, or have SINGLE/CONT SW in SINGLE.

DIRECT CONT

Unit will seek between ØØØ and entered address 822 continuously, provided, the SINGLE/CONT SWITCH is in CONT.

If in SINGLE, alternate seeks can be done by pressing the GO-key for each new seek, in this case, ØØØ ..... and 822.

Continuous operation of course, can be stopped by pressing the STOP key.

If the entered address is illegal and GO key is pressed, the drive will react with SK ERROR, indicated on the STATUS LED's. The drive will not accept any further seek command until SK ERROR is cleared. This can be accomplished by issuing an RZT command from the tester.

NOTE: STOP, CLEAR,OR RTZ do not remove the contents from the destination register. If you want to clear or change destination register contents, load new address or zero in it.

All other ACCESS MODES are automatic modes and do not require the destination register. A short description is given here:

SEQ FWD: one-track seeks sequentially forward from Ø to max Cyl address.

SEQ REV: one-track seeks sequentially backwards from max Cyl address to zero.

SEQ FWD/REV: this is the combination of the previous two.

RANDOM: access to random Cyl. addresses generated by the tester.

X-N: alternate seeks between Ø and incremented by 1 after each seek. It ends up with Ø to 822 in our case and would start all over with the RETURN ADDR. 1 instead of Ø and so on. This test will do all possible seeks in the tested device.

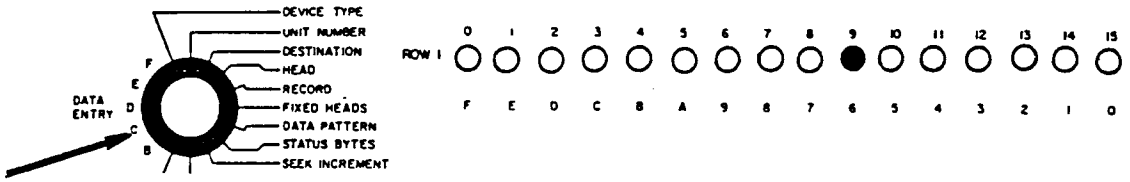
NOTE: All of the automatic modes will work in SINGLE (GO-key is required for each seek) and CONT (automatically).
The automatic operation can be stopped with the STOP key.
If the EOT (End of Test) switch is active, the tester will do a limited operation, such as: one complete pass of SEQ FWD or REV only or
10.000 RANDOM seeks only.

For more details and better understanding, refer to tester manual or ... do it yourself.

SECTOR NUMBERS

Before setting up the FTU for writing, verify that the number of sectors the unit is set for corresponds with the number the TB 216 displays.

When unit is rdy & selected, place DATA ENTRY SWITCH to pos. C and read the number of sectors from the top row LED's.
For example: unit is set to 64 sectors, LED 2^6 is lit.



Due to the fact that the FTU simply counts the transmitted sector pulses to determine the number of sectors; however, some drive sector numbers end up with a short, non-usable sector before index, your tester might display a wrong sector number (+ 1) and set up internally to access them all. This will result in a RD/WR hang up of the TB 216. The same will happen if there is no display at all. This might be caused by the wrong device type code for sector & IDX in A or B cable.

The following table will give you all sector numbers between 4 and 128 with their appropriate sector SW setting in the disc drive (SMD's and MMD's only).
The sector numbers:

NOT MARKED - will be displayed correct and FTU will work.

MARKED: * - will be displayed as X + 1, the FTU will not work unless you reload the correct sector number.
Example: 65 sectors is displayed as 66 and has to be altered to 65 to make the TB216 work properly.

MARKED: Y - will be displayed as X + 1 but the FTU will work. You might leave it or change it.

If you have/want to enter a sector number different from the display, proceed as follows:
With DATA ENTRY SW in pos. C type in sector number, which appears on bottom row LED's, press [HEX] and [LOAD] key, the top row LED's will display the sect.numb.in binary and the TB 216 program will set up accordingly.

Number of Sectors	Switch Number											
	0	1	2	3	4	5	6	7	8	9	10	11
4	C	C	C	C	C	O	O	O	C	O	C	C
5	C	C	C	C	C	C	C	O	O	C	O	C
6	C	C	C	C	C	C	O	C	O	O	O	C
7	C	C	C	C	C	C	C	O	C	C	C	O
8	C	C	C	C	O	O	O	C	O	C	C	O
9	O	O	C	O	C	O	C	C	C	O	C	O
10	C	C	C	C	C	C	O	O	C	O	C	O
11	O	O	C	O	O	O	C	C	O	O	C	O
12	C	C	C	C	C	O	C	O	O	O	C	O
13	O	O	O	C	O	O	O	O	O	O	C	O
14	C	C	C	C	C	C	O	C	C	C	O	O
15	C	C	C	C	C	C	C	O	C	C	O	O
16	O	C	C	O	O	O	C	O	C	C	O	O
* 17	C	O	C	O	C	O	O	O	C	C	O	O
* 18	C	O	O	C	O	C	C	C	O	C	O	O
19	O	C	O	O	O	O	C	C	O	C	O	O
20	C	C	C	C	C	O	O	C	O	C	O	O
21	C	C	C	C	C	C	C	O	O	C	O	O
* 22	C	O	O	O	O	C	C	O	O	C	O	O
* 23	C	C	C	O	O	O	C	O	O	C	O	O
24	C	C	C	C	O	C	O	O	O	C	O	O
* 25	O	O	O	C	C	O	O	O	O	C	O	O
* 26	C	C	O	O	O	O	O	O	O	C	O	O
* 27	O	O	O	O	C	C	C	C	C	O	O	O
28	C	C	C	C	C	O	C	C	C	O	O	O
* 29	O	C	C	C	O	O	C	C	C	O	O	O
30	C	C	C	C	C	C	O	C	C	O	O	O
* 31	O	O	O	O	C	C	O	C	C	O	O	O
32	C	C	O	O	O	C	O	C	C	O	O	O
* 33	O	C	C	O	C	O	O	C	C	O	O	O
* 34	O	C	O	C	O	O	O	C	C	O	O	O
35	C	C	C	C	C	C	C	O	C	O	O	O

Number of Sectors	Switch Number											
	0	1	2	3	4	5	6	7	8	9	10	11
* 36	O	O	C	O	C	C	C	O	C	O	O	O
* 37	O	C	O	C	O	C	C	O	C	O	O	O
* 38	O	O	O	O	O	C	O	O	C	O	O	O
* 39	C	C	C	O	C	O	O	O	C	O	O	O
40	C	C	C	C	O	O	C	O	C	O	O	O
Y 41	O	C	C	O	O	O	C	O	C	O	O	O
42	C	C	C	C	C	C	O	O	C	O	O	O
* 43	C	C	C	O	C	C	O	O	C	O	O	O
* 44	O	O	O	O	C	C	O	O	C	O	O	O
Y 45	C	O	O	C	O	C	O	O	C	O	O	O
46	C	C	O	O	O	C	O	O	C	O	O	O
* 47	O	O	C	C	C	O	O	O	C	O	O	O
48	C	C	C	O	C	O	O	O	C	O	O	O
* 49	C	O	O	O	C	O	O	O	C	O	O	O
* 50	C	C	O	C	O	O	O	O	C	O	O	O
* 51	O	C	C	O	O	O	O	O	C	O	O	O
* 52	C	O	O	O	O	C	O	O	C	O	O	O
Y 53	O	O	C	C	C	C	C	C	O	O	O	O
* 54	C	C	C	O	C	C	C	C	O	O	O	O
* 55	C	C	O	O	C	C	C	C	C	O	O	O
56	C	C	C	C	O	C	C	C	O	O	O	O
* 57	O	C	O	C	O	C	C	C	O	O	O	O
* 58	O	C	C	O	O	C	C	C	O	O	O	O
* 59	O	C	O	O	O	C	C	C	O	O	O	O
60	C	C	C	C	C	O	C	C	O	O	O	O
* 61	C	C	O	C	C	O	C	C	O	O	O	O
* 62	C	C	C	O	C	O	C	C	O	O	O	O
* 63	O	O	C	O	C	O	C	C	O	O	O	O
64	C	O	O	O	C	O	C	C	O	O	O	O
* 65	C	O	C	C	O	O	C	C	O	O	O	O
* 66	O	C	O	C	O	O	C	C	O	O	O	O
* 67	C	C	C	O	O	O	C	C	O	O	O	O

Note: C = Closed or On position; O = Open or Off position.

{*}=Data/Address errors. {Y}=Works but TB216 "C"= +1 of this count.

Number of Sectors	Switch Number											
	0	1	2	3	4	5	6	7	8	9	10	11
* 68	O	O	C	O	O	O	C	C	O	O	O	O
* 69	C	O	O	O	O	O	C	C	O	O	O	O
70	C	C	C	C	C	C	O	C	O	O	O	O
* 71	O	O	C	C	C	C	O	C	O	O	O	O
* 72	C	O	O	C	C	C	O	C	O	O	O	O
* 73	C	C	C	O	C	C	O	C	O	O	O	O
* 74	O	O	C	O	C	C	O	C	O	O	O	O
* 75	O	C	O	O	C	C	O	C	O	O	O	O
* 76	C	C	C	C	O	C	O	C	O	O	O	O
* 77	C	O	C	C	O	C	O	C	O	O	O	O
* 78	C	C	O	C	O	C	O	C	O	O	O	O
79	C	O	O	C	O	C	O	C	O	O	O	O
80	C	C	C	O	O	C	O	C	O	O	O	O
* 81	O	O	C	O	O	C	O	C	O	O	O	O
* 82	O	C	O	O	O	C	O	C	O	O	O	O
* 83	O	O	O	O	O	C	O	C	O	O	O	O
84	C	C	C	C	C	O	O	C	O	O	O	O
* 85	C	O	C	C	C	O	O	C	O	O	O	O
* 86	C	C	O	C	C	O	O	C	O	O	O	O
* 87	C	O	O	C	C	O	O	C	O	O	O	O
* 88	C	C	C	O	C	O	O	C	O	O	O	O
89	O	C	C	O	C	O	O	C	O	O	O	O
Y 90	O	O	C	O	C	O	O	C	O	O	O	O
* 91	O	C	O	O	C	O	O	C	O	O	O	O
* 92	C	O	O	O	C	O	O	C	O	O	O	O
* 93	C	C	C	C	O	O	O	C	O	O	O	O
* 94	C	O	C	C	O	O	O	C	O	O	O	O
* 95	O	O	C	C	O	O	O	C	O	O	O	O
96	C	C	O	C	O	O	O	C	O	O	O	O
* 97	C	O	O	C	O	O	O	C	O	O	O	O
* 98	O	O	O	C	O	O	O	C	C	O	O	O

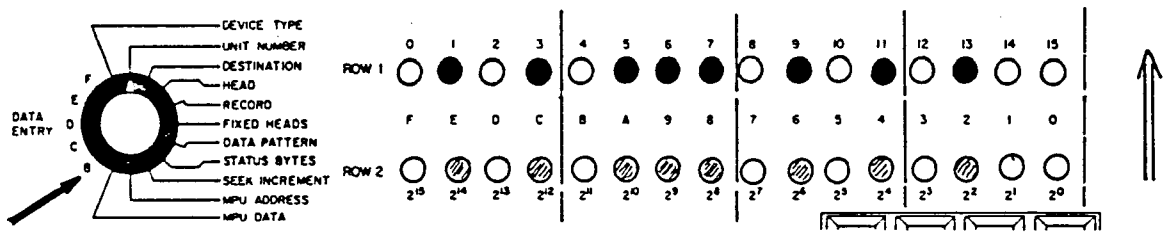
Number of Sectors	Switch Number											
	0	1	2	3	4	5	6	7	8	9	10	11
* 99	O	C	C	O	O	O	O	C	O	O	O	O
* 100	C	O	C	O	O	O	O	C	O	O	O	O
101	O	O	C	O	O	O	O	C	O	O	O	O
* 102	O	C	O	O	O	O	O	C	O	O	O	O
* 103	C	O	O	O	O	O	O	C	O	O	O	O
* 104	O	O	O	O	O	O	O	C	O	O	O	O
105	C	C	C	C	C	C	C	C	O	O	O	O
* 106	C	O	C	C	C	C	C	O	O	O	O	O
* 107	O	O	C	C	C	C	C	O	O	O	O	O
* 108	C	C	O	C	C	C	C	O	O	O	O	O
Y 109	O	C	O	C	C	C	C	O	O	O	O	O
* 110	C	O	O	C	C	C	C	O	O	O	O	O
111	O	O	O	C	C	C	C	O	O	O	O	O
112	C	C	C	O	C	C	C	O	O	O	O	O
Y 113	C	O	C	O	C	C	C	O	O	O	O	O
Y 114	O	O	C	O	C	C	C	O	O	O	O	O
Y 115	C	C	O	O	C	C	C	O	O	O	O	O
Y 116	O	C	O	O	C	C	C	O	O	O	O	O
Y 117	C	O	O	O	C	C	C	O	O	O	O	O
Y 118	O	O	O	O	C	C	C	O	O	O	O	O
Y 119	C	C	C	C	O	C	C	O	O	O	O	O
120	C	C	C	C	O	C	C	O	O	O	O	O
* 121	O	C	C	C	O	C	C	O	O	O	O	O
* 122	C	O	C	C	O	C	C	O	O	O	O	O
Y 123	O	O	C	C	O	C	C	O	O	O	O	O
* 124	C	C	O	C	O	C	C	O	O	O	O	O
* 125	O	C	O	C	O	C	C	O	O	O	O	O
Y 126	C	O	O	C	O	C	C	O	O	O	O	O
Y 127	O	O	O	C	O	C	C	O	O	O	O	O
128	O	O	O	C	O	C	C	O	O	C	O	O

Note: C = Closed or On position; O = Open or Off position.

{*}= Data/Address errors. {Y}= Works but TB216 "C" = +1 of this count

READ/WRITE/FORMAT OPERATIONS

To prepare the Drive for Read/Write operation, you will have to FORMAT the media first, unless it has been formatted with the TB 216. The TRACK FORMAT is configured in the TB 216 by the number of sectors the Disk Drive is set to and a pre-given fixed FORMAT PATTERN. Your influence to the WR FORMAT process is limited to the way you want to do it. WR FORMAT and WR/RD FORMAT do the same except in WR/RD FORMAT all information written is verified before the tester goes on.
In both cases, data is written in the data field following the address field. If you do not specify a certain data pattern at this point, the FTU writes all ZEROS into the DATA FIELD. To prepare the testbox for writing, perform the following operations:



I) OLD FIRMWARE (FTU S/C 23 OR BELOW)

With the WR PROT SW UP, and DATA ENTRY SW in position B, you enter the WRITE ENABLE Code 5754 via the keyboard. Press the LOAD key now and toggle the WR PROT SW down.
The FTU is now able to perform any desired WR/RD function.

II) NEW FIRMWARE

FTU must be S/C 26 or have FCO PE 54 327 installed. The applicable firmware is

EPROMS 5025 7854/-7855 or
ROMS 5025 7904/-7905 (BOARD LOC. 0431 resp. 2731)

(Ref. is TB 216 field manual 8332 3370, Rev. E).

After unit is READY and selected by FTU, rotate DATA ENTRY SW to POS. B and load WRITE ENABLE CODE 5754 (WR PROT SW up).

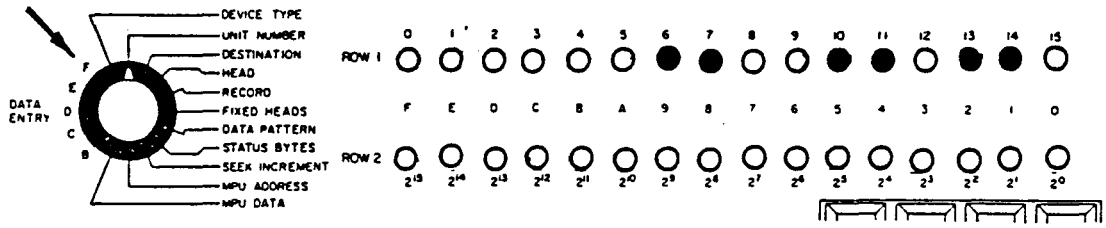
This is the same procedure as it was required with the old Firmware.

However, additionally the new Firmware offers two more programming steps:

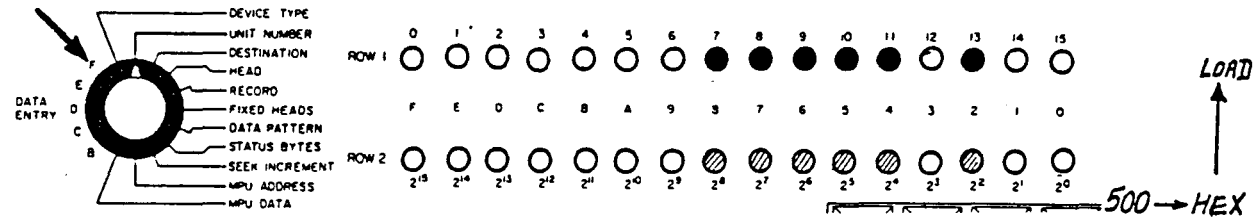
DATA ENTRY

POSITION F :

The MAX CYL ADDRESS (according to the unit code you have previously entered) is displayed in binary, in this case 822_{10} (based on code 0105 for an 80MB SMD).



If you want to alter this max address, for instance to 500_{10} , enter 500 via the keyboard , press HEX ⟶ LOAD. The Display will change accordingly and show the 500 in Binary.



This is not required for writing in particular, however, the new Firmware has this feature built in.

DATA ENTRY

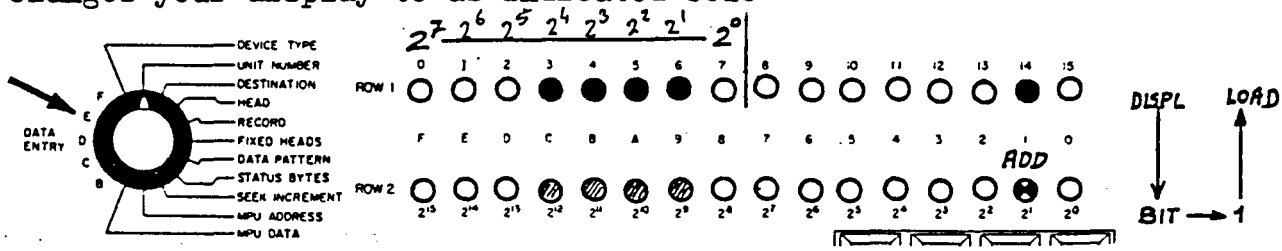
POSITION E : (This step is required for normal WR/RD Operation !)

The left 8 Bits of the upper row of LEDs display automatically the number of DATA RECORDS to be accessed by the FTU, in the case of 32 sectors that would be 30.

Regardless of the number displayed you have to add a NON ZERO value into the 4 low order Bits on the very right.

For instance :

The display is 30_{10} on the left Byte, press DISPLAY, and the 30_{10} moves to the bottom row.Pressing BIT ⟶ 1 ⟶ LOAD changes your display to as indicated below:



Now the TB216 is able to do any desired WR/RD operation.However, refer to the next sheet to see the difference of SECTOR & RECORD.

SECTOR ⟷ RECORD DIFFERENCE

The number of DATA RECORDS written by the FTU is always less than the number of SECTORS available from the Unit.
The Tester does not write a certain time after INDEX to protect special customer formats. This is called HOME ADDRESS PROTECTION GAP.
Depending of the number of sectors , more or less are skipped after Index before the TB216 writes the first DATA RECORD.
Ref. to the SEC/REC. difference table and figure below :

SECTOR AND DATA RECORD RELATIONSHIP

Number of Sectors	Number Protected	Sector Location of 1st Data Record
1-16	1 (0)	1
17-32	2 (0,1)	2
33-48	3 (0-2)	3
49-64	4 (0-3)	4
65-80	5 (0-4)	5
71-96	6 (0-5)	6
87-112	7 (0-6)	7
103-128	8 (0-7)	8

EXAMPLE:

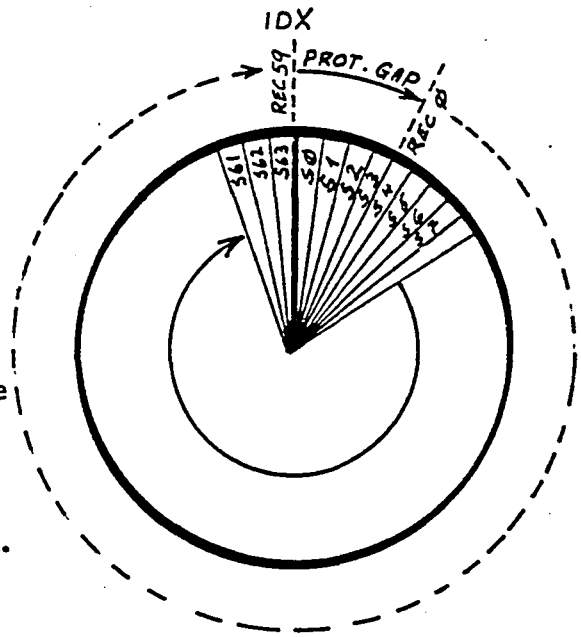
64 sector drive (sector 0-63).

Sector 0,1,2, and 3 are protected.

Sectors 4 through 63 are available

Record 0 corresponds to sector 4.

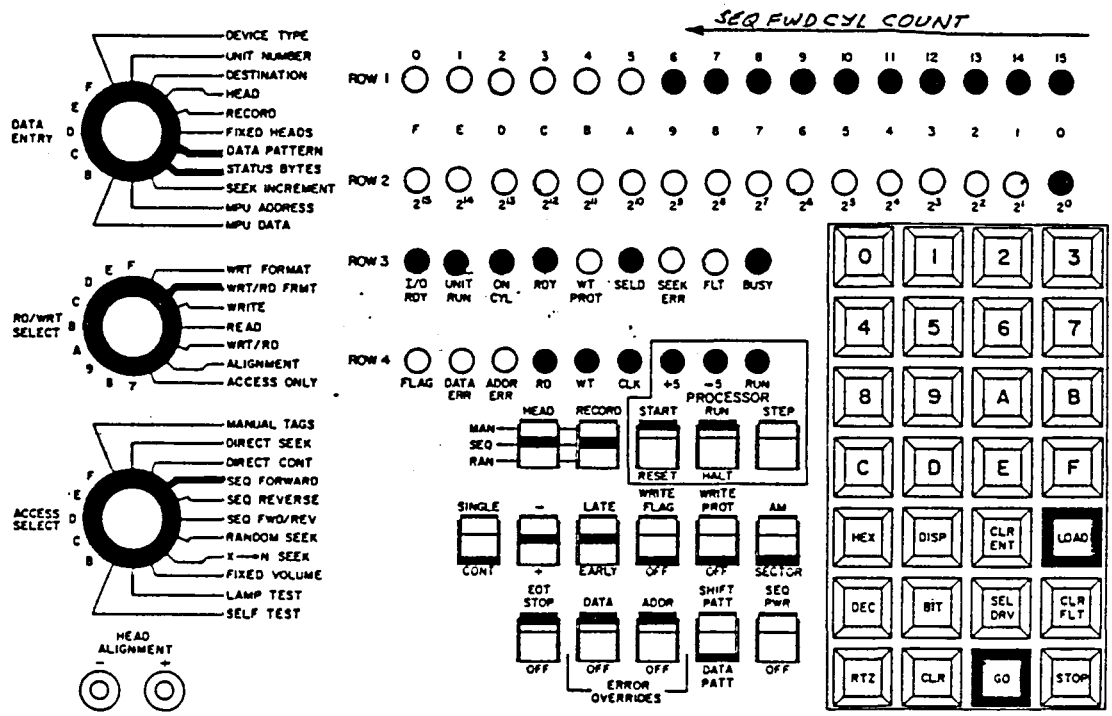
Record 59 corresponds to sector 63.



NOTE : With the new Firmware and the WR ENABLE CODE 5754 only, the FTU will access normally and write on the last CYL only. With the additional programming on DA ENTRY POS E, it will write all CYL, except 256_{10} , which is normal.

The following now describes a typical write format:

With the DATA ENTRY SW in position DATA PATTERN enter desired Pattern via keyboard, for instance B 6 B 6 HEX. Press LOAD. This pattern will be written time after time as a sequence of 1's and Ø's as indicated on top LED's. (Contents of data pattern register).



Now set up TB 216 for appropriate seek mode, head and record select and display mode as follows:

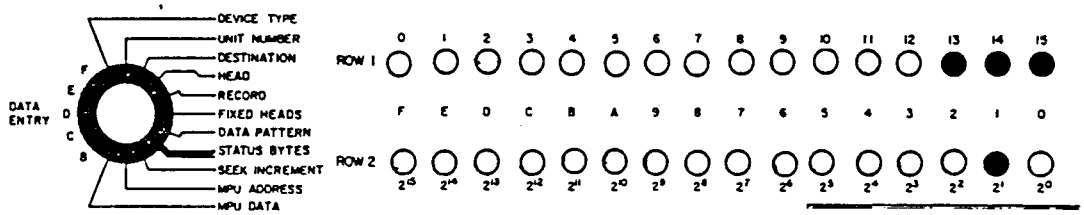
RD/WR SEL	to	WR/RD FORMAT
ACCESS SEL	to	SEQ FWD (ALL CYL)
HEADS	to	SEQUENTIAL (ALL)
RECORDS	to	SEQUENTIAL (ALL)
STATUS BYTE 1	-	CYL ADDR. DISPLAY

Press GO-key. The write and read LED's will alternately come up and the top row of LED's will show the Cyl addresses as you sequentially move in.

NOTE: You may have EOT-switch up to complete one pass and then stop. You should not have the SHIFT PATT switch up during format as this could lead you into confusion later on by not knowing which data you wrote on which track.

Switching into STATUS BYTE 2, the sequential head addresses will be displayed on the top.

If you don't want to stop the operation at the occurance of an address or data error, have the error overide switches up and look if any error has been counted under status byte 6 and 7 later on.



After a good format operation has been completed you can randomly write and read any information in any way you want.

The setup selected here is as follows:

ACCESS SEL: RANDOM

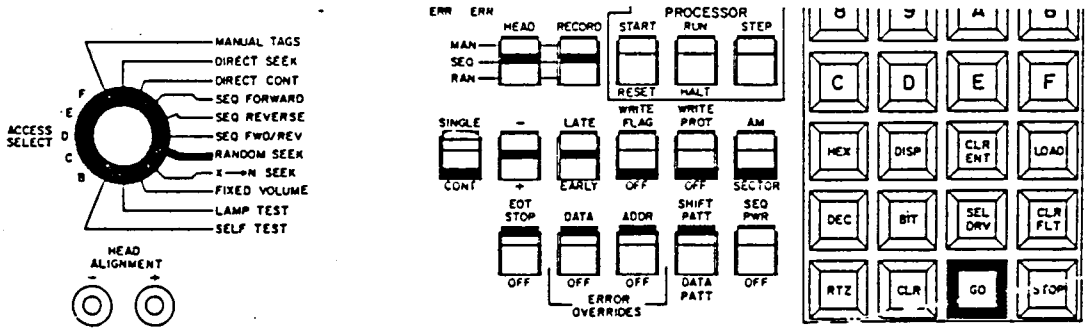
RD/WR SEL: WR/RD

SHIFT DATA PATT SW - UP

ERROR OVERIDE SW - UP

EOT SW - UP

SEQUENTIAL HEADS AND RECORDS



The TB 216 will now do 10.000 Random Seeks. At a stop on CYL it will select all available Data Heads in logical sequence and with each of them at a time perform an Address Read and verification, write the Data Pattern and at the next revolution read back both, Address and Data and verify. This will be done with all records (sectors). After all heads being used, the unit seeks to next random Cyl address.

To speed up this operation you might switch into RANDOM HEADS/RECORDS accordingly.

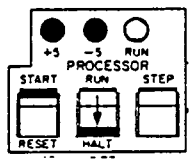
During this test, WRITE DATA PATTERN, entered by you will be shifted by one Bit-position to the left with each write process. This can be seen under STATUS BYTE 5 - data pattern.

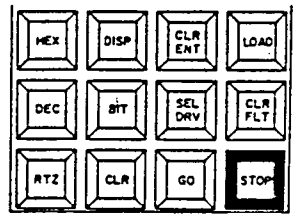
TB 216 would stop with an address or data error if the error override switches are not activated. Otherwise, the tester will continue, and both, addr.- and data errors will be counted. The count can be displayed under status byte 6 and 7.

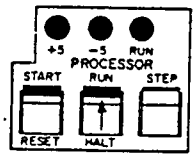
TESTER HANG UP

In an attempt to read illegal, invalid information, very seldomly the TB 216 processor might hang up during a RD/WR operation. The tester will stop, the read lamp might still be on, but the testbox does not react to any switch or PUSH BUTTON anymore.

To bring the tester back to normal without DC OFF/ON, which would require reselection of the drive under test and reloading of all data into various registers, proceed as follows:







uP - RUN-SWITCH to HALT

Press the STOP-key

uP - switch back to RUN
You may issue a RTZ command now to see drive's reaction.
Finally press GO to continue with selected operation.

CLEAR FAULT

If during any operation a disk unit fault occurs, the tester operation stops and the FAULT STATUS LED starts flashing.

Press the CLEAR FLT key to stop the LED from flashing and to issue a FLT CLEAR command via the interface to the unit under test. If the fault condition is not steady and fault status is cleared, normal operation can be resumed.

Another important feature of the TB 216 is the STATUS BYPASS.

This allows you to make the FTU continue operations, even if the required I/O Status is incorrect, such as FLT OR SK ERROR Active or ON CYL or Unit SEL missing.

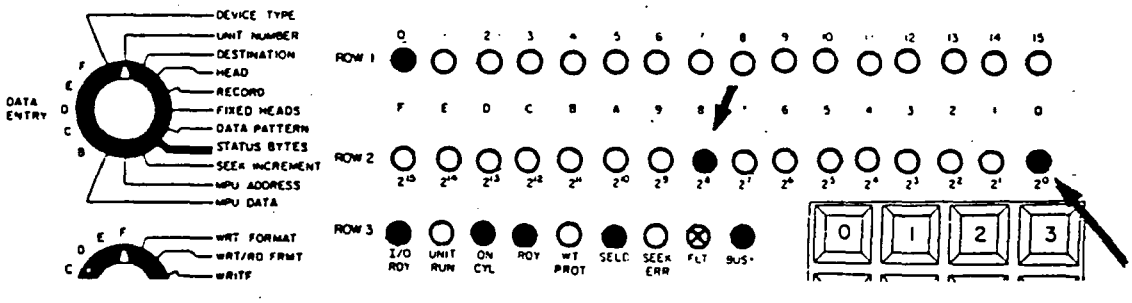
STATUS BYPASS

The FTU will normally not send commands to drive if error conditions are present. For special test purposes; it is possible to override this condition and continue exercising the drive by positioning FTU front panel switches as follows:

1. Rotate DATA ENTRY switch to STATUS BYTES position.
2. Press F key.
3. Press CLR ENT key.
4. Press BIT key.
5. Enter appropriate bypass bit(s) from table 2-9. Row 2 LED's will display the bypass bit(s) of error condition in row 3 directly below it.
6. Press LOAD key.
7. Press F key.
8. After this select any STATUS BYTE you want, the entered bypass BIT will always be displayed on row 1 LEDs.

TABLE 2 - 8. STATUS BYPASS BIT TABLE

Bit Display	Bypass Bit	Bypass Status
2^{13}	D	On Cylinder
2^{12}	C	Tag Gate In (RDY)
2^{10}	A	Selected
2^{9}	9	Seek Error
2^{8}	8	Fault
2^{15}	F	Time Out
2^{14}	E	Continuous Updated MUX Status



This example shows STATUS BYTE 1 selected with the FAULT bypass BIT 8 previously entered.The FTU will now ignore the FAULT STATUS and continue it's operation.

C M D VOLUME SELECTION

The CMD as a DEVICE is selected as any other unit, i.e., in DATA ENTRY POS 'DEVICE TYPE' you enter the appropriate DEVICE CODE, press LOAD (with WR PROT SW up) and SEL DRV. However, in your DEVICE TYPE CODE , the number of DATA HEADS on the FIXED VOLUME has to be correct.

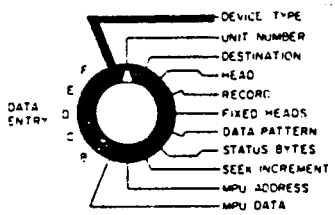
CMD - 96MB - 05 (for 5 DATA HEADS on the fixed volume)

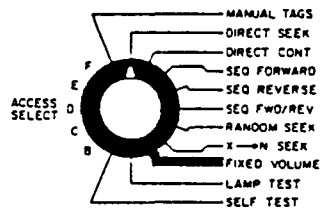
CMD - 64MB - 03

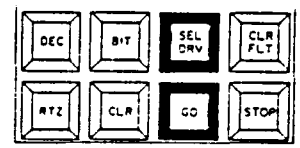
CMD - 32MB - 01

The following procedure describes VOLUME SELECTION of a CMD which works at STANDARD VOLUME,i.e., the Cartridge Srvo is selected after LOAD Operation or RTZ. Let's assume you have already selected the unit with the right CODE. The FTU can be programmed to :

1. access cartridge only ,
2. access fixed volume only ,
3. access both alternately , during any WR/RD operation.







Nr. 1. DATA ENTRY SW to POS 'DEVICE TYPE'
WR PROT SW up (after selection back down)
Press SEL DRV (Access Sel.Sw must not be in FXD VOLUME !)
This is actually what you did after loading the device code for general unit selection.
The FTU will now operate the cartridge volume only.

Nr. 2. ACCESS SEL SW to POS ' FIXED VOLUME '
WR PROT SW up (after selection back down)
Press SEL DRV (Data Entry Sw. must not be in Device Type !)
The FTU will now operate the fixed volume only.

Nr. 3. Same set-up as Nr.2.
Press GO
The FTU will now alternately access cartridge and fixed volume.

NOTE I: If you want to leave either mode and go to another, just repeat the appropriate steps .

NOTE II.
If your CMD operates at the VOLUME INVERT OPTION , the steps one and two are exactly the same, however, you will always be on the opposite volume within the CMD.

LARK SELECTION / OPERATION

For operation with the CDC 9455 LARK MODULE DRIVE the TB 216 must have:
1. The new firmware ROMs
2. A modified AJHX to BJHX I/O Card
   Ref. SPO 68816-1, P/N 9202 5500
3. A new BJHX I/O card

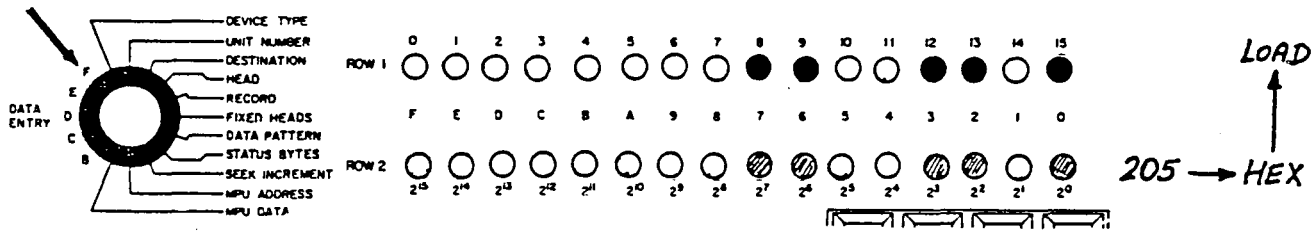
The Tester Cables are connected and terminated at the P/O-Adapter PWA like any other unit. (NOT on the LARK BASE PWA)

SELECT

The 9455 LARK selects with DEVICE TYPE CODE 0104 (4 HEADS)
Note: The LARK DRIVE needs about 2 min. to get READY.

OPERATION

After LARK IS READY and SELECTED, rotate DATA ENTRY SW to POS F:
The TB 216 displays 822_{10} according to the CODE 0104.
As the LARK has only 206^{10} cylinders (Ø - 205), the number 822_{10} has to be changed to 205_{10}.



Enter 205 via Key Board, press HEX LOAD or enter CD_H (which is 205_{10}), press LOAD and the display will change to 205 in binary.

DATA ENTRY SW POS. E

The number of Records displayed on the upper, left Byte of LEDs can either be 30_{10} or 60_{10}, as the LARK operates 32 or 64 Sectors only.
For WRITE ENABLE, you press DISPLAY - BIT - 1 - LOAD!

DATA ENTRY SW POS. B

For WRITE ENABLE you enter 5754 and press LOAD.

Now the FTU will access and WR/RD as desired in all automatic and manual modes as any other unit.

ACCESS TIME CHECK

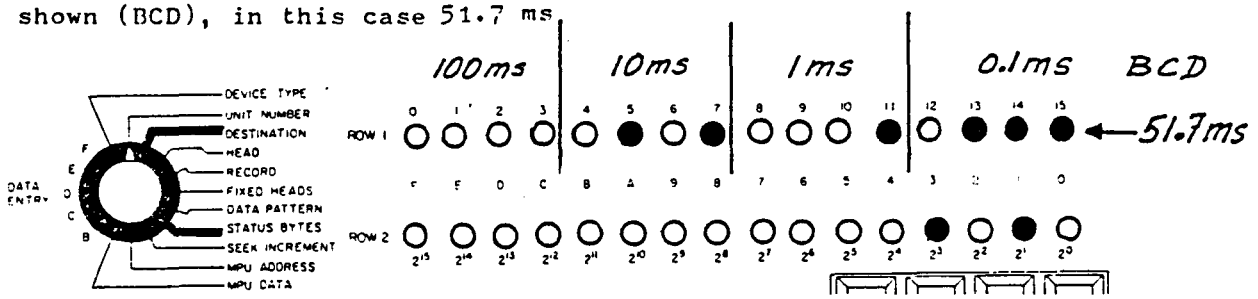
The different Tester modes to verify the unit's seek time are as follows:

1. Manual seek time check for one seek of any length.
2. Average seek time for number of repetitive inclusive RANDOM seek average access time:

No. 1 Example for one 822 Track seek:

SINGLE/CONT SW	to	SINGLE
DATA ENTRY SW	to	DESTINATION
Enter via Keyboard 822	→	press LOAD
DATA ENTRY SW	to	STATUS BYTE → PRESS-A
ACCESS SEL SW	to	DIRECT SK → press GO
Unit performs a	seek to	Track 822
ACCESS SEL SW	to	C → press GO

The upper row of LED's displays the seek time for this seek in milliseconds as shown (BCD), in this case 51.7 ms.



No. 2 Average seek time of a number of continuous seeks (in this case between ∅ - 522)

SINGLE/CONT SW	to	CONTINUOUS
DATA ENTRY SW	to	DESTINATION
ENTER 522	⟶	Press LOAD
DATA ENTRY SW	to	STATUS BYTE → PRESS-A
ACCESS SEL SW	to	DIRECT CONT → Press GO

The unit does now continuous seeks between ∅ - 522.

Press → STOP after any number of seeks.

ACCESS SEL SW to C → Press GO

The FTU displays the average seek time of all 522 track seeks performed.

To find the average access time of a Drive, go to ACCESS SEL - RANDOM and let the unit perform any number of RANDOM seeks, then stop the operation by pressing STOP, or have the EOT SW up (max. 10.000 seeks).

The number of seeks performed can be displayed under STATUS BYTE 9 (seek counter).

HEAD ALIGNMENT

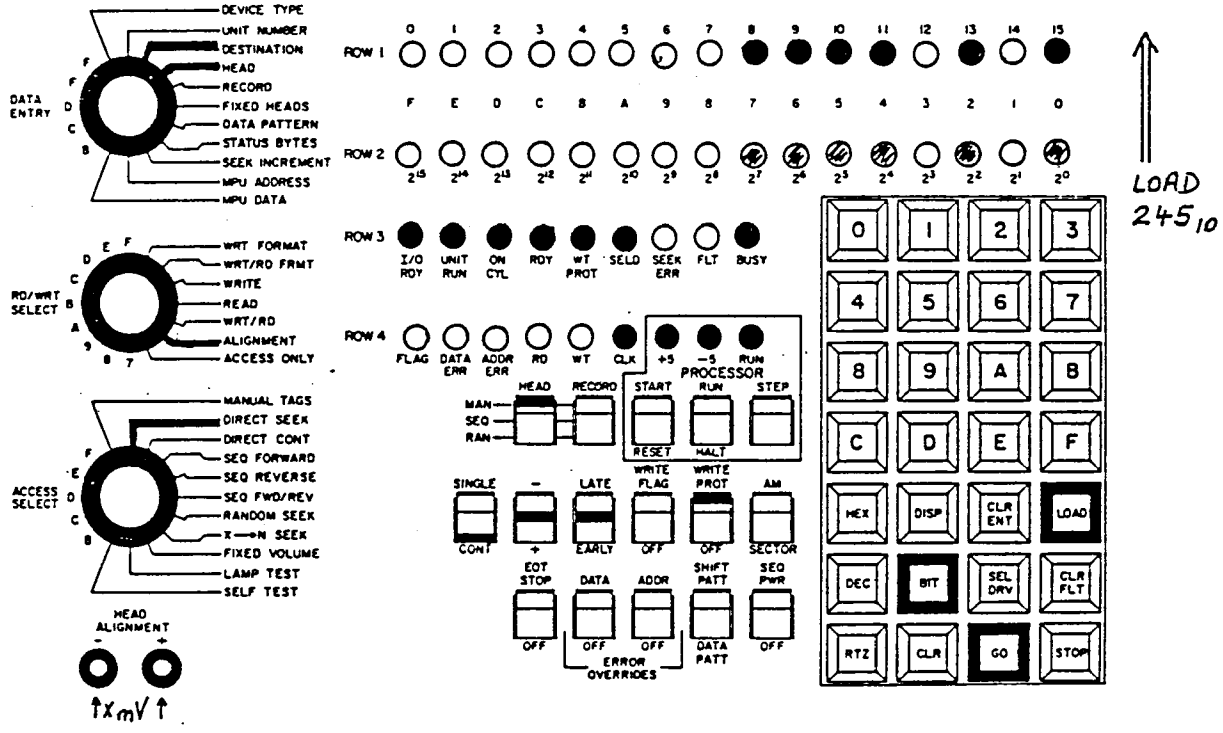
This part of the presentation describes the basic handling of the TB 216 for head alignment.

Set up your disk drive for head alignment and connect head alignment cable into tester front panel (mV offset voltage into internal A/D converter).

Set up testbox by placing

DATA ENTRY SW	to	DESTINATION
RD/WR SEL SW	to	HD ALIGNMENT
ACCESS SEL SW	to	DIR SEEK
HD SEL SW	to	MANUAL, then type

in the alignment Cyl address and load into destination register.



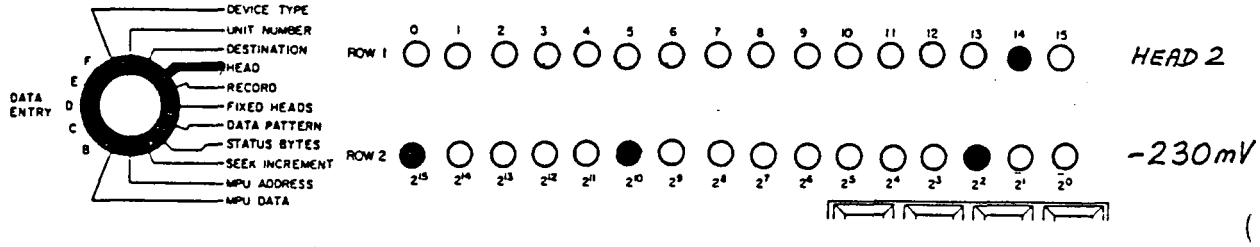
Place and leave DATA ENTRY SW to HEAD position and load head number you want to look for.

There are 3 different display modes for the mV coming from the unit's head alignment card. Refer to Tester Manual for more details.
The one selected here is the so called BIT MODE.

To initiate the direct seek to the alignment TRACK, selection of the head and the alignment display, press BIT-GO.

The 16 LED bottom row display is interpreted as follows:
Going from right to left, each LED is a 10 mV step, up to 100 mV at the tenth LED from the right. Then, the next ones are 200, 300, 400 mV and so on. The extreme left is the polarity sign. Off is positive, on is negative.

The reading of this picture is -230 mV.



To select another head, press STOP and CLEAR, load new head number and press BIT-GO again.

This HANDOUT has been made to assist you in getting started with the basic operations of this tester.
There are many more features built in to support you in troubleshooting and checkout of our Disk products, such as I/O Line Test, bad track flagging and so on.
For more details, extended knowledge and professional handling, refer to Tester Manual, or call MPI-Heppenheim CS/FS to answer specific questions you have and ..... practice with your tester.

GOOD LUCK

MAGNETIC PERIPHERALS INC.-GERMANY
EUROPEAN TRAINING CENTER
HEPPENHEIM OCT/81 L. Mork

TB 2.6 MET Ampex Capricorn 33.

DRIVE SELECT 08.16 [Index Beable, 16 heads]

DATA ENTRY E=32 [+1]

C DEPOSIT 5754
F=1023 [max aantal tracks

VOOR R/W EERST FORMAT MET R/W FLAG OFF

CONTROLS AND INDICATORS

Table 2-2 contains functional descriptions of the controls and indicators located on the front panel of the FTU. The purpose of each switch is given in general terms. Following that is a list of switch positions in the left-hand column; the drive and/or FTU operation corresponding to this switch setting is described in the right-hand column. Keyboard keys are listed on the left with a result of pressing them given to the right. Finally, the LED indicators are listed along with a description of the condition lighting them.

The only control not located on the front panel is the circuit breaker; this is mounted on the power supply module and is used to turn the FTU on and off.

TABLE 2-2. CONTROLS AND INDICATORS

Control/Indicator	Function
DATA ENTRY switch	This is a rotary switch that is set to different positions to allow specific kinds of information to be entered into the FTU memory through the keyboard. This information can be entered in either hexadecimal, decimal, or binary code unless only one of these codes is specified. Also, each switch position allows display (on the top row of 16 LEDs) of data previously entered in that segment of the FTU memory. A description of each switch position follows.
DEVICE TYPE	A four-character code is loaded into the FTU memory. This code programs the FTU to exercise a specific type of drive.

TABLE 2-2. CONTROLS AND INDICATORS (Contd)

Control/Indicator	Function
UNIT NUMBER	The logical address of the drive being tested, determined automatically by the FTU, is displayed on row 1 LEDs. May be reset, to any unit number.
DESTINATION	The track destination for a direct seek is loaded into the FTU memory in the direct seek and direct continuous modes. The entry is made in decimal form.
HEAD	With the HEAD toggle switch in the MAN position, a specific moveable head address is selected. The entry is made in decimal form. High order byte displays bus-in for manual multiplex tag.
RECORD	A specific record address is loaded, provided that the RECORD toggle switch is in the MAN position. The entry is made in decimal form.
FIXED HEADS	The number of fixed heads is loaded (in decimal), and the microprocessor is setup for fixed head access.
DATA PATTERN	A sixteen-bit data pattern is entered (in hexadecimal) into the FTU memory. In write operations, this data pattern is repeated throughout the data field.

Table Continued on Next Page

TABLE 2-2. CONTROLS AND INDICATORS (Contd)

Control/Indicator	Function
STATUS BYTES	Up to sixteen different status words are displayed on row 1 LEDs. The four least significant bits of row 2 LEDs indicate the code of the status word which has been entered on the keyboard and is being displayed. 512 memory locations may be displayed by pressing CLR ENT key and entering an address. It also allows entry of error bypass bit in status, byte F. Refer to table 2-11.
SEEK INCREMENT	In sequential access modes, the FTU is programmed to command seeks to every nth cylinder after the number "n" has been entered (in decimal) on the keyboard. For example, if three is entered, the drive will seek every third cylinder. With no entry, the seek increment is one, and no cylinders are skipped in the sequence.
MPU ADDRESS	A valid MPU address can be entered via the keyboard and displayed on row 2 LEDS. When the LOAD key is pressed, the address is transferred to row 1 LEDs and the data at this address is then displayed in the right 8 bits in row 2 LEDs. This operation is for use only by an operator who is extremely knowledgeable in the microprocessor machine language.

TABLE 2-2. CONTROLS AND INDICATORS (Contd)

Control/Indicator	Function
MPU DATA	For a given MPU address, new data can be entered on the keyboard and loaded by pressing the LOAD key. Row 2 LEDs display the new data in the left eight bits and the contents of the next address in the right eight bits. The address on row 1 LEDs is incremented by one. This operation is for use only by an operator who is extremely knowledgeable in the microprocessor machine language.
B	Used to enter valid write protect code (code 5754) prior to commanding drive to write on C.E. Cylinder (innermost, highest number) cylinder only. If code is not entered the WT PROT LED will flash.
C	Ordinarily, the number of sectors used by the drive is automatically calculated by the FTU. In this position, the FTU can be programmed to operate on a different sector count.
D	A maximum data length, other than that calculated by the FTU, is loaded into the FTU memory.
E	Used to enable writing on any cylinder other than track 256 (FTU prevents writing on track 256). With switch at position E, enter, via keyboard, a hexadecimal non-zero number (1-F) into lower byte (row 1 LEDs 0-7) while preserving the number of logical records displayed in hexadecimal, in upper byte (row 1 LEDs 8-F). Note that pressing SEL DRV key destroys any information entered with DATA ENTRY switch at position E.

TABLE 2-2. CONTROLS AND INDICATORS (Contd)

Control/Indicator	Function
F	Displays maximum cylinder number in hexadecimal, which can be altered.
RD/WRT SELECT switch	This is a rotary switch which determines the operation performed by the drive after each track has been accessed. A description of each switch position follows.
WRT FORMAT	The address and data pattern is written on the selected track.
WRT/RD FORMAT	The drive alternates between writing the address and data pattern and then reading them back on a selected track.
WRITE	The data pattern is written on a selected track after the address has been read and verified. On drives that transmit MFM read data to the FTU, the address is not read. Positioning RD/WRT SELECT switch to a write position will not allow write operation if: 1. WRITE PROT/OFF switch is set to OFF. 2. The FTU write protect is overridden by rotating DATA ENTRY switch to B position and code 5754 is entered manually.
READ	The data pattern is read from a selected track after the address has been read and verified. On drives that transmit MFM read data to the FTU, the address is not read.
WRT/RD	Alternately, the data pattern is written and then read on a selected track.

TABLE 2-2. CONTROLS AND INDICATORS (Contd)

Control/Indicator	Function
ALIGNMENT	In head alignment procedures, the offset of a selected head is displayed in coded form on row 2 LEDs. Refer to table 2-12.
ACCESS ONLY	After accessing a cylinder, the FTU does not command any write or read operations.
7	After accessing each cylinder, the drive performs a Return-to-Zero seek.
8	After setting HEAD and RECORD toggle switches to RAN, the drive randomly performs either a write or a read operation on each selected track.
9	Checks write clock as if it were MFM data.
A-F	Unused
ACCESS SELECT switch	This is a rotary switch that enables selection of a number of accessing modes for the drive. These modes vary from a direct seek to a particular cylinder to a more complicated pattern of seeking between different cylinders. A description of each switch position follows.
MANUAL TAGS	The tag and bus data displayed on row 2 LEDs will be put on the I/O lines when the GO key is pushed.

TABLE 2-2. CONTROLS AND INDICATORS (Contd)

Control/Indicator	Function
DIRECT SEEK	When the GO key is pressed, the drive seeks to the particular cylinder stored in the destination register.
DIRECT CONT	The drive continuously seeks between an origin cylinder address and a destination cylinder address until the STOP key is pressed. The operator must first load the origin address, switch to DIRECT SEEK, and then press the GO key. Afterward, the operator must switch to DIRECT CONT and load the destination address. The seek operation is initiated when the GO key is pressed and continues until the STOP key is pressed. With the EOT STOP switch in the up position, 10 000 seeks will be performed.
SEQ FORWARD	The drive seeks to cylinder zero and then sequences up to the maximum cylinder. If the EOT STOP toggle switch is in the up position, the test will end. Otherwise, the drive will return to cylinder zero and continue to sequence up until the STOP key is pressed.

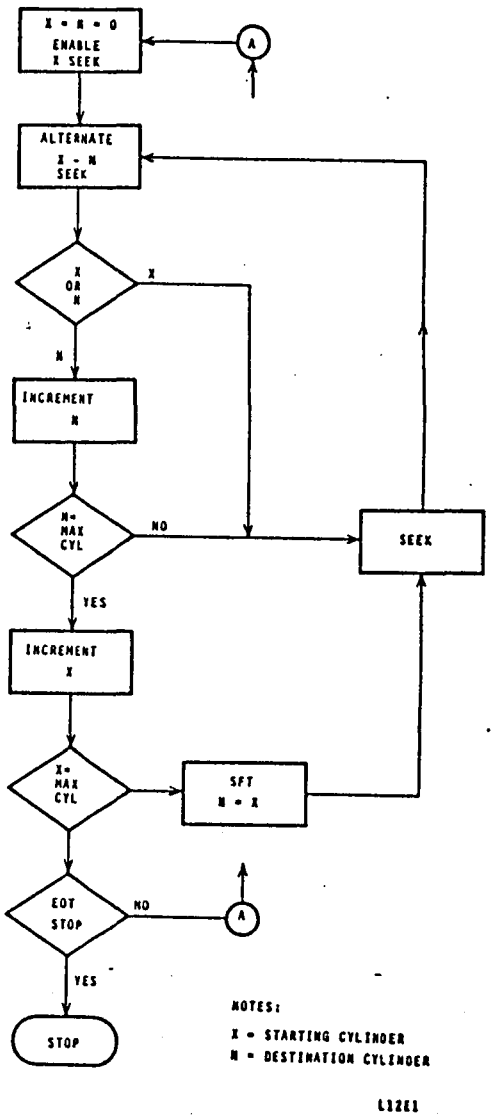


Figure 2-6. X -- N Test

TABLE 2-2. CONTROLS AND INDICATORS (Contd)

Control/Indicator	Function
SEQ REVERSE	The drive seeks to the maximum cylinder and then sequences down to cylinder zero. If EOT STOP toggle switch is in the up position, the test will end. If EOT STOP switch is not set, the drive will return to the maximum cylinder and continue to sequence down until the STOP key is pressed.
SEQ FWD/REV	Starting at cylinder zero, the drive seeks sequentially upward to the maximum cylinder and then seeks sequentially downward to cylinder zero. With the EOT STOP switch in the UP position, the test ends after one complete sequence. Otherwise, it continues until the STOP key is pressed.
RANDOM SEEK	The drive seeks to cylinder addresses randomly generated by the microprocessor until the STOP key is pressed or after 10 000 seeks with the EOT STOP switch up.
X -- N SEEK	The drive seeks from each cylinder to every higher-numbered cylinder and back, thereby performing all possible seeks. This seeking continues until all possible combinations of seeks have been completed with the EOT STOP switch up or until the STOP key is pressed, refer to Figure 2-6.
FIXED VOLUME	Pressing the SEL DRV key sets the FTU to access CMD fixed volume only. Pressing the GO key sets up the FTU to access both fixed volume and removable disk pack.

TABLE 2-2. CONTROLS AND INDICATORS (Contd)

Control/Indicator	Function
LAMP TEST	Pushing the GO key causes all LEDs except the +5 or -5 LEDS to flash on and off. A +5 or -5 LED not lighted indicates that power is not being applied to the FTU, and failure of the FTU power supply, or the failure of one or both of the LEDs.
SELF TEST	The processor performs a limited self-test routine on the FTU. During the test, the RD and WT LEDs alternately flash. Failure of the self-test is indicated by the RD and DATA ERR LEDs flashing alternately. If the test is satisfactory, it ends with the RD, 2^9 and 2^{11} LEDs on steadily. Then all switch positions can be checked out; changing any switch position results in a change in the LED display. Normally self-test is performed with the HEAD, RECORD, -/+, and LATE/EARLY switches in the center position, DATA ENTRY switch set to DEVICE TYPE position, RD/WRT SELECT switch set to WRT FORMAT position, the PROCESSOR switches in the START and RUN positions, and all other toggle switches in the down position with the exception of SEQ PWR which is not tested.
B	The microprocessor program jumps to the MPU address entered on row 2 LEDs when the Go key is pressed.
C	Average access time for the drive can be measured for certain access modes by pressing the GO key. The RD/WRT SELECT switch must be in the ACCESS ONLY position. Calculation of this is done automatically after 10 000 seeks in DIRECT SEEK, DIRECT CONT, and RANDOM

TABLE 2-2. CONTROLS AND INDICATORS (Contd)

Control/Indicator	Function
SEQ	At each accessed track, record addresses are selected sequentially.
RAN	At each accessed track, one record is randomly selected for the desired operation.
PROCESSOR switches	These three toggle switches are associated with the microprocessor.
START/RESET RUN/HALT STEP	They are primarily intended for use during maintenance of the FTU and are of no concern to the operator of the FTU. In normal operation, the switches are respectively in the START and RUN positions (STEP is spring-loaded).
SINGLE/CONT switch	This toggle switch allows the choice of single or continuous accessing of tracks.
SINGLE	An access is performed only once by the drive.
CONT	An access is performed 10 000 times with the EOT STOP switch up until the STOP key is pressed.
-/+ switch	This is a three-position toggle switch that directs the drive to offset the carriage for better data recovery.
-	An offset is ordered away from the spindle.

TABLE 2-2. CONTROLS AND INDICATORS (Contd)

Control/Indicator	Function
SEQ	At each accessed track, record addresses are selected sequentially.
RAN	At each accessed track, one record is randomly selected for the desired operation.
PROCESSOR switches	These three toggle switches are associated with the microprocessor.
START/RESET RUN/HALT STEP	They are primarily intended for use during maintenance of the FTU and are of no concern to the operator of the FTU. In normal operation, the switches are respectively in the START and RUN positions (STEP is spring-loaded).
SINGLE/CONT switch	This toggle switch allows the choice of single or continuous accessing of tracks.
SINGLE	An access is performed only once by the drive.
CONT	An access is performed 10 000 times with the EOT STOP switch up until the STOP key is pressed.
-/+ switch	This is a three-position toggle switch that directs the drive to offset the carriage for better data recovery.
-	An offset is ordered away from the spindle.

TABLE 2-2. CONTROLS AND INDICATORS (Contd)

Control/Indicator	Function
AM/SECTOR switch	This toggle switch allows the choice of address mark or sector mode of operation.
AM	This drive writes or reads an address mark.
SECTOR	The writing and reading of data is referenced to the sector count.
EOT STOP/OFF switch	With this switch in the up position, in sequential seeks, the test will stop after one complete sequence. Placed in the up position during self-test, this switch causes the error display to be bypassed which facilitates troubleshooting the FTU with an oscilloscope.
DATA ERROR OVERRIDE/OFF switch	With this switch in the up position, the FTU will not stop an access sequence when a data error is discovered. In self-test a data error in the MPU is bypassed; with the switch up, the MPU continually loops when there is a data error.
ADDR ERROR OVERRIDE/OFF switch	With this switch in the up position, the FTU will not stop an access sequence when an address error is discovered. In self-test, if there is a data error, that address will be skipped, the address counter will be incremented and the program will continue.

TABLE 2-2. CONTROLS AND INDICATORS (Contd)

Control/Indicator	Function
AM/SECTOR switch	This toggle switch allows the choice of address mark or sector mode of operation.
AM	This drive writes or reads an address mark.
SECTOR	The writing and reading of data is referenced to the sector count.
EOT STOP/OFF switch	With this switch in the up position, in sequential seeks, the test will stop after one complete sequence. Placed in the up position during self-test, this switch causes the error display to be bypassed which facilitates troubleshooting the FTU with an oscilloscope.
DATA ERROR OVERRIDE/OFF switch	With this switch in the up position, the FTU will not stop an access sequence when a data error is discovered. In self-test a data error in the MPU is bypassed; with the switch up, the MPU continually loops when there is a data error.
ADDR ERROR OVERRIDE/OFF switch	With this switch in the up position, the FTU will not stop an access sequence when an address error is discovered. In self-test, if there is a data error, that address will be skipped, the address counter will be incremented and the program will continue.

TABLE 2-2. CONTROLS AND INDICATORS (Contd)

Control/Indicator	Function
SHIFT PATT/DATA PATT switch	In the DATA PATT position, the same data pattern is repeated throughout the entire accessing sequence. In the SHIFT PATT position, each time the drive seeks a new track, the data pattern is shifted one bit to left, and the sixteenth bit becomes the first bit. This function is used when performing a write/read operation.
SEQ PWR switch	In the SEQ PWR position, the FTU commands the drive to power up, provided that a. The drive is in the REMOTE mode. b. Primary power is available at the drive. c. The drive START switch is ON (indicator lighted).
Keyboard Panel	The result of pressing each keyboard key is given in the following description:
Data Keys 0-F	New data can be entered with these keys. Entered data is displayed on row 1 LEDs.
HEX key	Pressing this key results in the conversion of the BCD number in the lower display to hexadecimal form.

TABLE 2-2. CONTROLS AND INDICATORS (Contd)

Control/Indicator	Function
DISP key	The hexadecimal data, in row 1 LED, is transferred into row 2 LED. The hexadecimal/decimal data, in row 2 LED, is transferred, in hexadecimal, into row 1 LED.
CLR ENT key	This key is used to clear the entry displayed in row 2 LEDs when an incorrect entry has been made.
LOAD key	Pressing the LOAD key transfers the data entry in the second row of 16 LEDs to row 1 LEDs and loads it into memory via the DATA ENTRY switch while clearing the second row.
DEC key	The hexadecimal number in the lower display is converted to decimal.
BIT key	When pressed prior to a data entry, the data will be entered bit-by-bit in binary form.
SEL DRV key	Pressing this key initiates a drive selection sequence. Note that pressing SEL DRV Key destroys any information that may have been entered with DATA ENTRY switch at position E.
CLR FLT key	Pressing this key initiates a fault clearing sequence.
RTZ key	Pressing this key initiates the drive by commanding a return-to-zero seek.

TABLE 2-2. CONTROLS AND INDICATORS (Contd)

Control/Indicator	Function
UNIT RUN LED	The drive is in the process of performing a commanded operation.
ON CYL LED	The FTU is receiving an On Cylinder signal from the drive. The On Cylinder LED flashes when an On Cylinder condition is disrupted.
RDY LED	The FTU is receiving a Unit Ready signal from the drive.
WT PROT LED	The FTU is receiving a Write Protect signal from the drive.
SELD LED	The FTU is receiving a Unit Selected signal from the drive.
SEEK ERROR LED	The FTU is receiving a Seek Error signal from the drive.
FLT LED	The FTU is receiving a Fault signal from the drive.
BUSY LED	The FTU is receiving a Busy signal from the drive. The BUSY LED will also flash while the FTU is waiting for a Ready signal during a select drive command.
FLAG LED	This LED lights when a flag is read. If the WRITE FLAG switch is OFF the FLAG LED goes off when the next head is selected. If the WRITE FLAG switch is ON, the FLAG LED stays on and the test stops, until the CLR key is pressed.
DATA ERR LED	This LED lights when the FTU has detected a discrepancy between the data pattern written by the drive and the data pattern read by the drive. If the DATA ERROR OVERRIDE switch is on, the DATA ERR LED goes off when the next head is selected. If the DATA ERROR OVERRIDE switch is off, this LED stays lighted and the test halts. A time out during

TABLE 2-2. CONTROLS AND INDICATORS (Contd)

Control/Indicator	Function
UNIT RUN LED	The drive is in the process of performing a commanded operation.
ON CYL LED	The FTU is receiving an On Cylinder signal from the drive. The On Cylinder LED flashes when an On Cylinder condition is disrupted.
RDY LED	The FTU is receiving a Unit Ready signal from the drive.
WT PROT LED	The FTU is receiving a Write Protect signal from the drive.
SELD LED	The FTU is receiving a Unit Selected signal from the drive.
SEEK ERROR LED	The FTU is receiving a Seek Error signal from the drive.
FLT LED	The FTU is receiving a Fault signal from the drive.
BUSY LED	The FTU is receiving a Busy signal from the drive. The BUSY LED will also flash while the FTU is waiting for a Ready signal during a select drive command.
FLAG LED	This LED lights when a flag is read. If the WRITE FLAG switch is OFF the FLAG LED goes off when the next head is selected. If the WRITE FLAG switch is ON, the FLAG LED stays on and the test stops, until the CLR key is pressed.
DATA ERR LED	This LED lights when the FTU has detected a discrepancy between the data pattern written by the drive and the data pattern read by the drive. If the DATA ERROR OVERRIDE switch is on, the DATA ERR LED goes off when the next head is selected. If the DATA ERROR OVERRIDE switch is off, this LED stays lighted and the test halts. A time out during

TABLE 2-2. CONTROLS AND INDICATORS (Contd)

Control/Indicator	Function
DATA ERR LED (Contd)	a read or write in the data field is indicated when DATA ERROR indicator is ON and row 3 LEDs continually flash.
ADDR ERR LED	This LED lights when the address information received from the drive differs from the requested address. If the ADDR ERROR OVERRIDE switch is on, the ADDR ERROR LED goes off when the next head is selected. If the ADDR ERROR OVERRIDE switch is off, this LED stays lighted and the test halts. A time out in the address field is indicated when ADDR ERR indicator is ON and row 3 LEDs continually flash.
RD LED	The FTU is commanding a read operation.
WT LED	The FTU is commanding a write operation.
CLK LED	The Read Clock signal is coming from the drive.
+5 LED	The power supply in the FTU has a +5 volt output.
-5 LED	The power supply in the FTU has a -5 volt output.
RUN LED	The microprocessor in the FTU is running.