B 9499-3 DISK PACK ELECTRONIC CONTROLLER

(MODEL 206)

TECHNICAL MANUAL

VOLUME 1:

OPERATION and MAINTENANCE

Burroughs

FIELD ENGINEERING

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PREFACE

The 206 Disk Pack Electronic Controller (206 DPEC) technical manual provides installation, operation, and maintenance information to the field engineer. In addition, three standard appendices are included:

a. Appendix A. Glossary of Terms.
b. Appendix B. LINs.
c. Appendix C. RINs.

SECTION 1
FUNCTION AND OPERATION

INTRODUCTION

This section contains a general description of the B 9499-3 Disk Pack Electronic Controller (206 DPEC). It includes explanations of the operation codes, result descriptor information, and miscellaneous functional requirements.

GENERAL DESCRIPTION

The 206 DPEC is a hard-wired controller that includes all the hardware for synchronizing the interfaces between the B 1700 Disk Pack Control (DPC) and the 206 Disk Pack Drive (DPD) (see figures 1-1 through 1-3).

The controller is designed for a maximum configuration of one by eight spindles of disk pack drives. All DPEC's are capable of one by eight operation with no modifications. Standard 25-wire interface (parallel) is used between the DPC (host system) and the DPEC (see figure 1-4).

The DPEC acts upon I/O instructions from the DPC, performs the operation specified by the I/O descriptor and, upon completion, generates a result descriptor containing the operation completed and any error status information.

A 6-wire interface is used between the DPEC and the DPD. The interface lines consist of two bidirectional data lines (positive and negative), two clock lines (positive and negative), a controller message line, and a drive message line (refer to table 1-1).

Table 1-1. Edge Connector Wiring

Signal Description	Spindle Number	Card Edge Signal Lead	Connector Pin Ground Lead
CM	1	$D	$C
DATA POSITIVE	1	$E	$F
DATA NEGATIVE	1	$G	$F
CLOCK POSITIVE	1	$H	$I
CLOCK NEGATIVE	1	$J	$I
DM	1	$K	$L
DM	2	$M	$L
CLOCK NEGATIVE	2	$N	$P
CLOCK POSITIVE	2	$Q	$P
DATA NEGATIVE	2	$R	$S
DATA POSITIVE	2	$T	$S
CM	2	$U	$V
CM	3	#D	#C
DATA POSITIVE	3	#E	#F
DATA NEGATIVE	3	#G	#F
CLOCK POSITIVE	3	#H	#I
CLOCK NEGATIVE	3	#J	#I
DM	3	#K	#L
DM	4	#M	#L
CLOCK NEGATIVE	4	#N	#P
CLOCK POSITIVE	4	#Q	#P
DATA NEGATIVE	4	#R	#S
DATA POSITIVE	4	#T	#S
CM	4	#U	#V

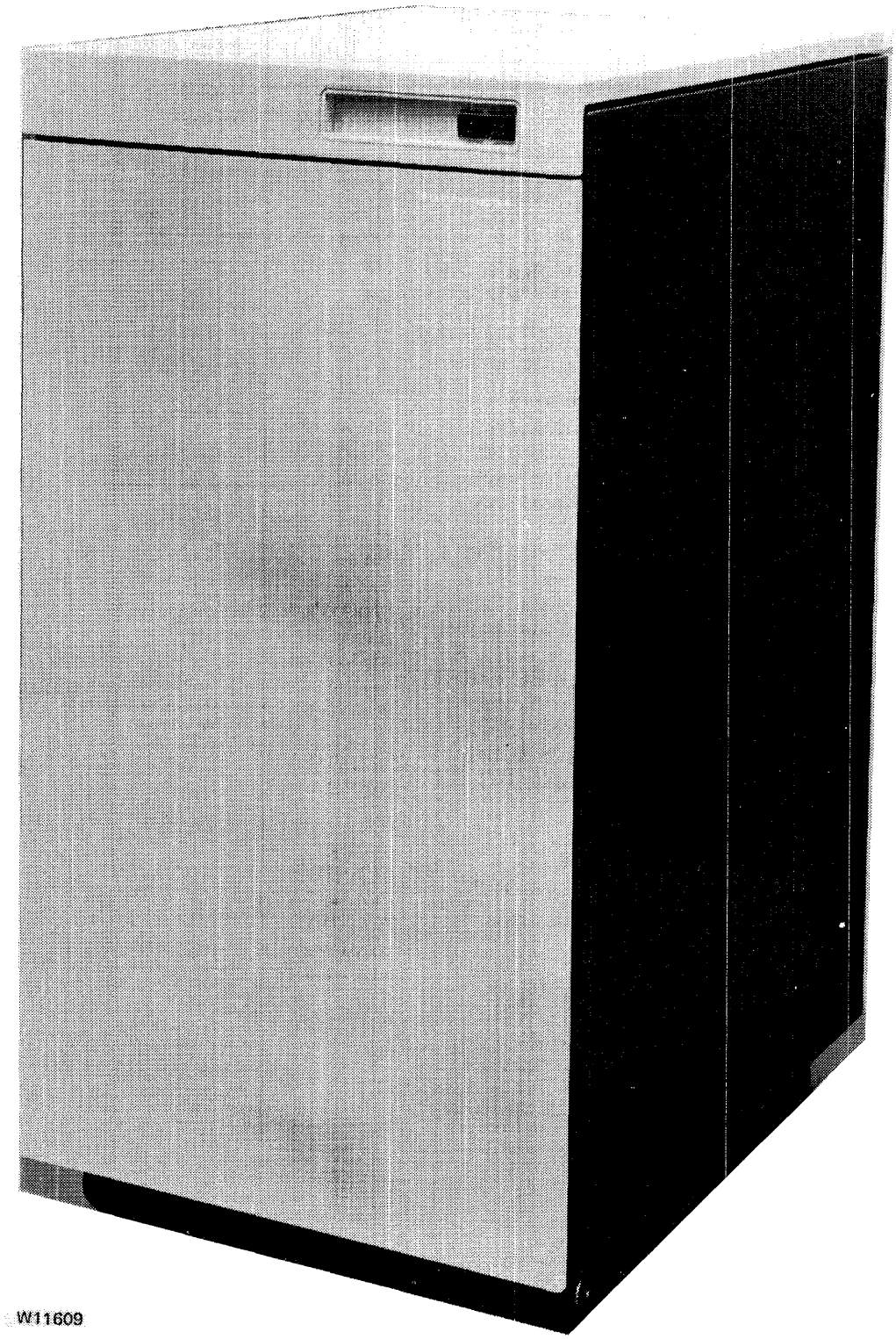


Figure 1-1. 206 Disk Pack Electronic Controller

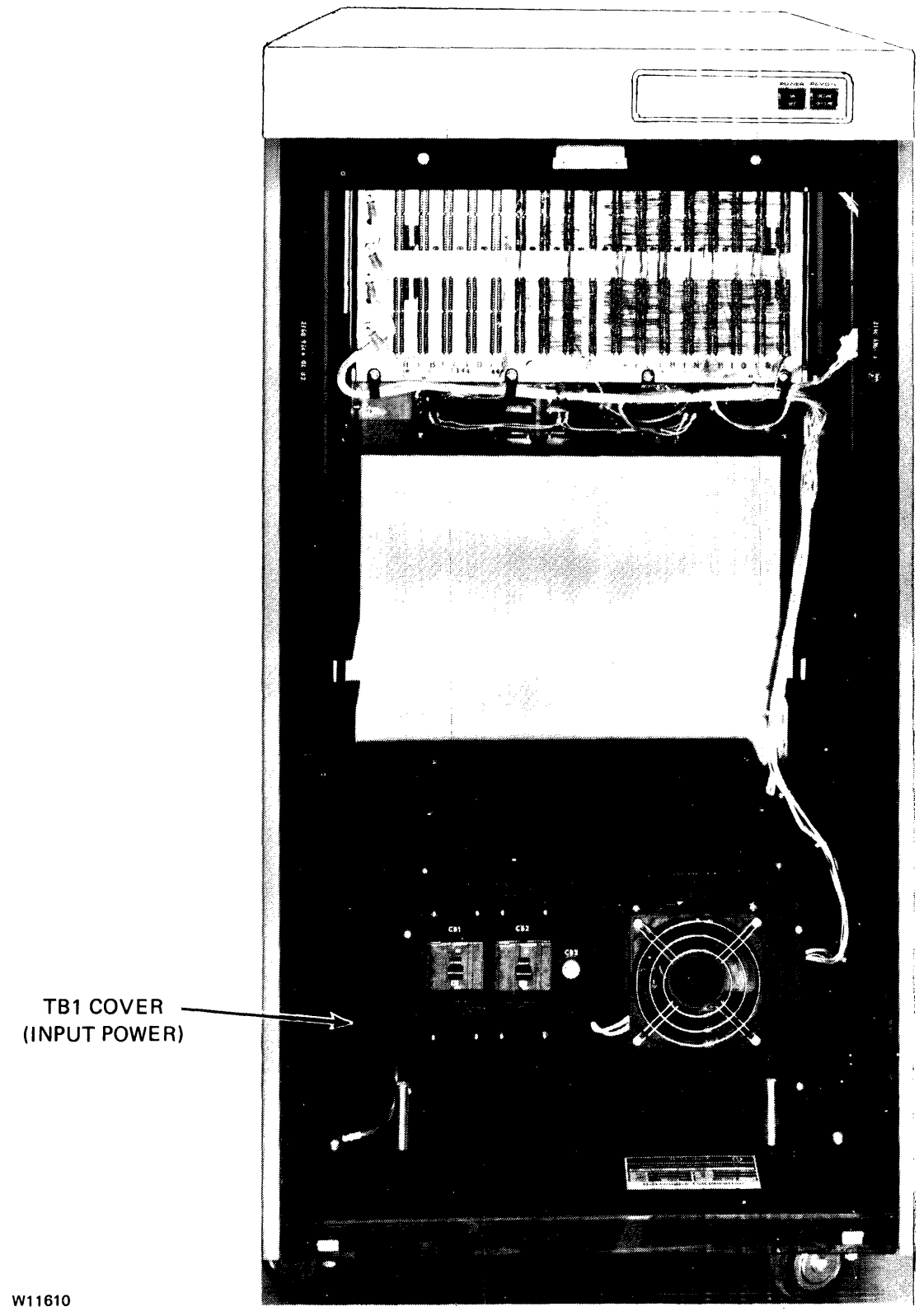


Figure 1-2. Internal Front View of 206 DPEC

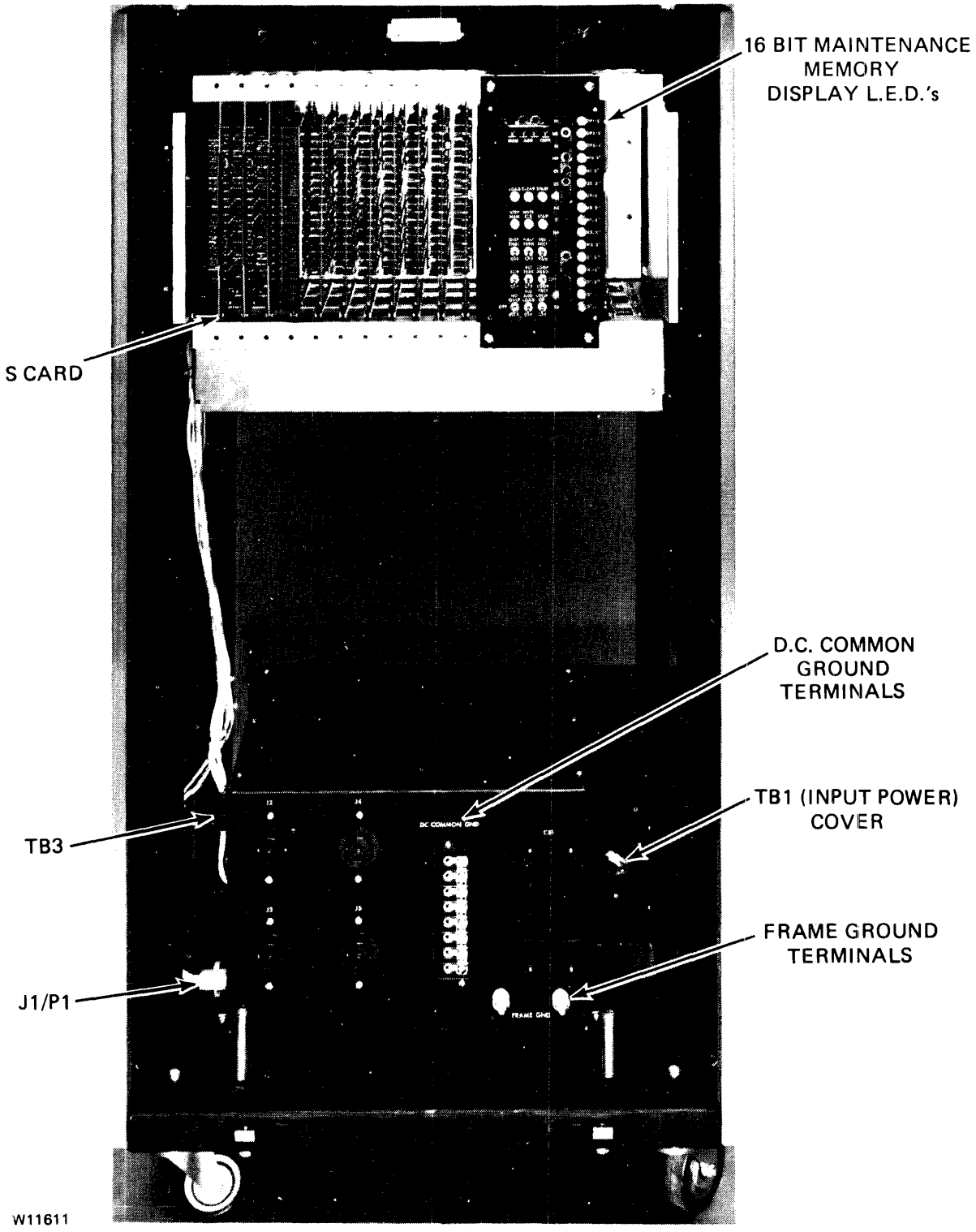


Figure 1-3. Internal Rear View of 206 DPEC

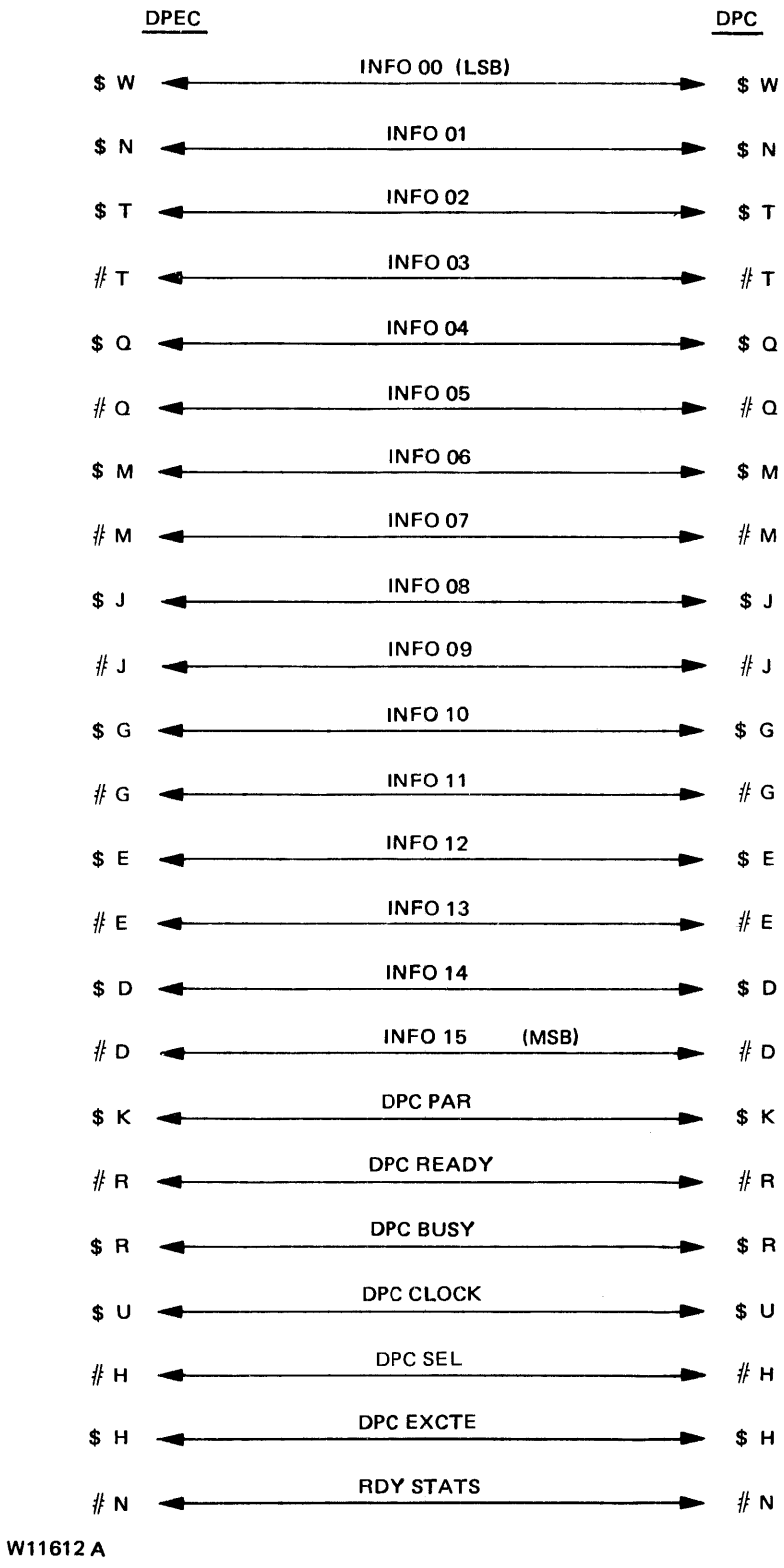


Figure 1-4. Interface Lines, DPEC to DPC ground.

DPEC OPERATION CODES

The following discussion provides a description of the operation codes used in the disk pack subsystem. Table 1-2 contains a list of the DPEC operation codes.

a. READ (000)

Read data from the disk pack starting at the beginning address specified by the initiate words and continue reading each full sector until the select line drops, informing the DPEC that the operation is terminated. No partial sector reads are permitted.

The DPEC will send 90 data words and two error code words to the DPC followed by the result descriptor in each sector read. The final result descriptor will be a composite of all previous sectors read.

b. READ MAINTENANCE (001) Unconditional Seek

Read all data bits from the designated sector, through the error protection code (EPC), by dead reckoning beginning at the index mark. Data integrity is not guaranteed.

c. READ EXTENDED STATUS (001 and N2 variant set)

A read maintenance operation code with the N2 variant set is used to clear a TRY DIAGNOSTICS condition. In local, the READ EXTENDED STATUS operation code is used to read the four extended result descriptor registers.

d. WRITE (010)

Write data on the disk pack starting at the beginning addresss specified by the initiate words and continue writing each full sector until the select line drops informing the DPEC that the operation is terminated. No partial sector writes are permitted.

The DPEC will accept 90 data words plus two dummy words. The DPEC will strip the dummy words and write the 32 check bits (Fire code) on disk. A result descriptor is sent to the DPC at the termination of the write operation.

e. INITIALIZE (011)

Write all bits according to the format shown in figure 1-5, starting after the index pulse on the specified track (head) for the entire track of pack. Spare sectors are also initialized. One data transfer takes place between the DPC and DPEC during an initialization period. The DPEC will fill the data field and write the check bits for the pattern specified by the S variant.

If the operation is terminated by the DPC (SELECT FALSE) during an initialize, the DPEC will complete the initialize to the end of the existing full track. The result descriptor will be returned at the termination of the initialize whether the DPC or DPEC caused the termination.

f. RELOCATE (100) Specified data

One data transfer takes place between the DPC and the DPEC. The DPEC writes the actual formatted address in the designated spare sector and writes the specified data pattern on a repeating basis to fill the data field. On completion of this operation, the DPEC returns a result descriptor to the DPC.

g. RELOCATE (101) Address data

No data transfer takes place between the DPC and the DPEC. The DPEC writes the actual formatted address in the designated spare sector and writes the sync byte and address repeatedly to fill the data field. On completion of this operation, the DPEC returns a result descriptor to the DPC.

During a normal read or write operation, the DPEC will perform all necessary and required operations to read the relocated sectors and then return to the previous address plus one to ensure the continuity of data transfer.

h. VERIFY (110)

The verify operation is a normal read if the N1, N2 or N3 variants are all zeros (LOW TRUE). If the N N N variants are specified, the following applies:

NNN Variant	Read Spare Sector	Head	Sector
001	1	4	85
010	2	4	86
011	3	4	87
100	4	4	88
101	5	4	89

The test pattern for verification is keyed data: sync byte plus cylinder, head, and sector information, if the S variant is not set on the initialization. If the S variant is set, then the data is specified by the processor.

i. TEST OP (111)

The DPEC will return a result descriptor for the unit specified in the test operation.

Table 1-2. DPEC 206 Operation Codes

OP1	OP2	OP3	N0	N1	N2	N3	OP DECODE
0	0	0	PLO	OF	E/L	I	READ
0	0	1	-	-	D	-	READ MAINTENANCE OR READ ERD
0	1	0	-	-	-	-	WRITE
0	1	1	-	-	S	P	INITIALIZE
1	0	0	-	N	N	N	RELOCATE 1. DATA SPECIFIED.
1	0	1	-	N	N	N	RELOCATE 2. DATA=ADDRESS FIELD.
1	1	0	-	N	N	N	VERIFY
1	1	1	-	-	C	W	TESTOP

The following are variants of the above codes.

NNN*	=	(Binary 1 to 5) Spare Sector No.
C	=	1, Clear Seek Status Flip-Flops
P	=	0, Single Track. Initialize
P	=	1, Full Pack Initialize
W	=	0, Normal Test Op
W	=	1, Remote Power Down
PLO	=	1, Enable Early/Late Strobe
PLO	=	0, Disable Early/Late Strobe
E/L	=	0, Early Strobe
E/L	=	1, Late Strobe
S	=	1, Specified Data
S	=	0, Address Data
OF	=	0, Normal
OF	=	1, Offset
D	=	0, Read Maintenance
D	=	1, Read Extended Status
I	=	0, Offset Away from Spindle
I	=	1, Offset Toward Spindle

*The binary values of the N variants are N1 = 1, N2 = 2, N3 = 4.

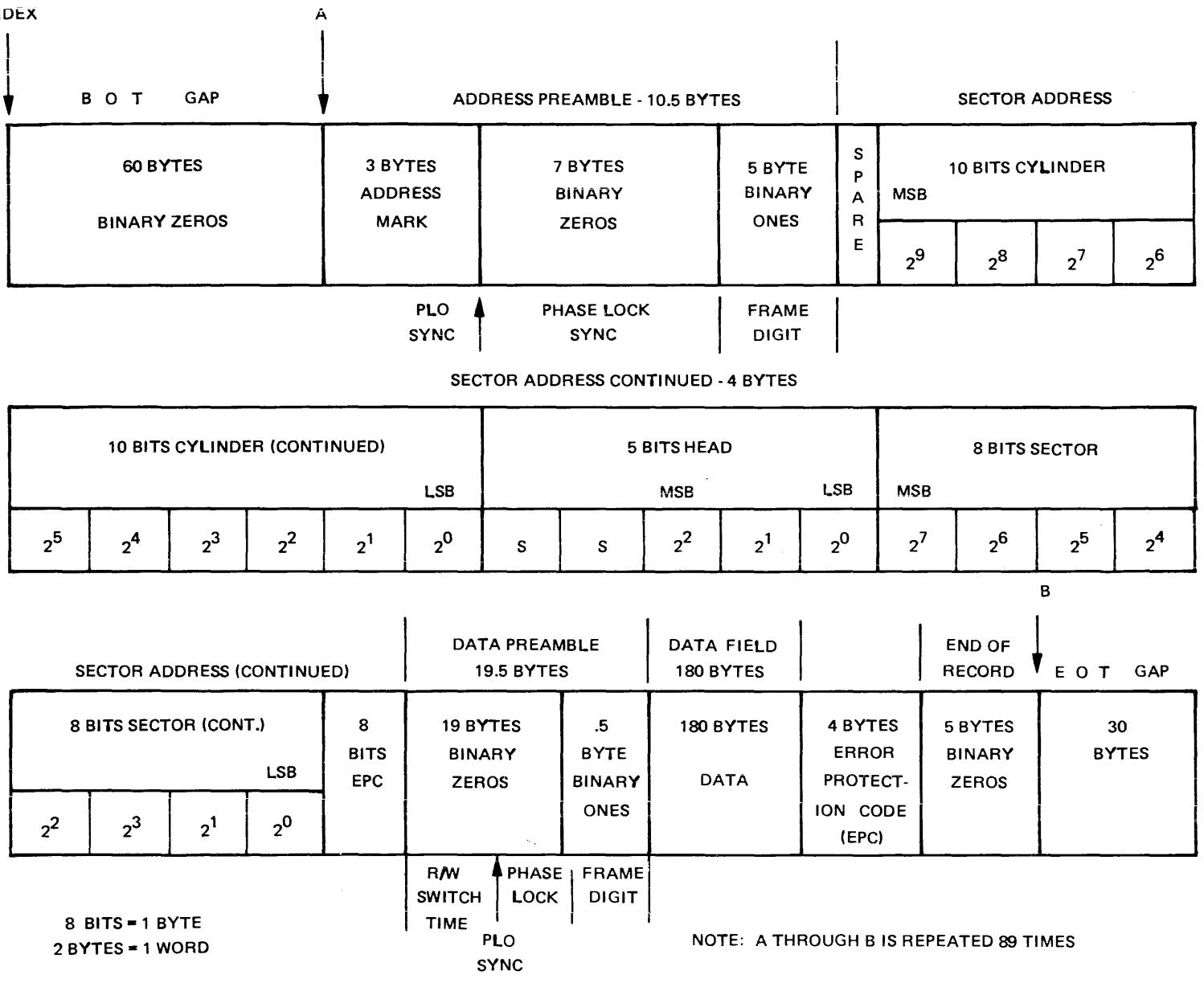


Figure 1-5. 206 Track Format

INSTRUCTION FORMAT

Each instruction format contains three data words. The first data word consists of the operation code, "N" variants, unit designations, and the five least significant bits of the file address. The second data word consists of the 14 most significant bits of the file address and two spare bits. The third data word consists of the data information used during initialize, write, and relocate operations. Refer to table 1-3.

Table 1-3. DPEC 206 Instruction Format

INFO NN	First Data Word		Initiate Phase	
(LSB)	1	OP1	9	N1
	2	OP2	10	N2
	3	OP3	11	N3
	4	NO	12	B2*0
	5	U1	13	B2*1
	6	U2	14	B2*2
	7	U4	15	B2*3
	8	U8	16	B2*4(MSB)
INFO NN	**Second Data Word**		**Initiate Phase**	
(LSB)	1	B2*5	9	B2*13
	2	B2*6	10	B2*14
	3	B2*7	11	B2*15
	4	B2*8	12	B2*16
	5	B2*9	13	B2*17
	6	B2*10	14	B2*18
	7	B2*11	15	SPARE
	8	B2*12	16	SPARE (MSB)
INFO NN	**Third Data Word**		**Initiate Phase**	
(LSB)	1	D Word, Bit 1	9	B Word, Bit 1
	2	D Word, Bit 2	10	B Word, Bit 2
	3	D Word, Bit 4	11	B Word, Bit 4
	4	D Word, Bit 8	12	B Word, Bit 8
	5	C Word, Bit 1	13	A Word, Bit 1
	6	C Word, Bit 2	14	A Word, Bit 2
	7	C Word, Bit 4	15	A Word, Bit 4
	8	C Word, Bit 8	16	A Word, Bit 8

NOTE

The first and second data words of the file address bits are identified as B2*0 (least significant bit) through B2*18 (most significant bit). For example, 2*3 indicates that 2 is to be raised to the third power, 2x2x2 = 8.

RESULT DESCRIPTOR INFORMATION

At the completion of an operation code, a result descriptor will be returned to the DPC. (In a local mode, the result descriptor will be displayed on the maintenance plug-on package on the F card.) Table 1-4 lists the definitions of the result descriptor bits.

Table 1-4. Result Descriptor Information Lines

Bit	Description
00	Read Data Error. Indicates an error in the data field or the Fire code bytes.
01	Write Lockout. Indicates the spindle is in a Read-Only mode or the DPEC failed to send a Write Enable CM during a write operation.
02	Seek Status Flip-Flop Set. Indicates the previous seek operation has not been serviced by the DPC (conditional seek capability).
03	Spindle Not Ready. Indicates the positioner is not settled, and a seek is in progress.
04	Spindle Off Line. Indicates the spindle is in an off condition and will not accept any commands.
05	Spindle Unsafe. Indicates the spindle is unsafe for use.
06	Data Sync Code Error. Indicates the data sync character was not detected.
07	Address Parity Error, EPL Error, or Sync Code Error. Indicates one of the following: a. The address was not found. b. The read data address Error Protection Logic (EPL) code is not in agreement with the actual EPL. c. The address sync character was not detected.
08	Seek Timeout. Indicates that the DPD was unable to complete a seek within 700 milliseconds after being told to do so.
09	Drive not present. Indicates that the DPD is not present.
10	NA
11	NA
12	NA
13	NA
14	Transmission Parity Error or Illegal Command. Indicates a parity error exists between the DPC and DPEC.
15	Operation Not Completed. Try diagnostics. Indicates that an exception condition (fault) occurred in the subsystem and that the data is corrupt. A Read Extended Status command is required to clear the condition.

Extended Result Descriptor Feature

The 206 DPEC contains the ability to store up to 64 bits of extended result descriptor (ERD) information in addition to the normal 16 bits of result descriptor information. Table 1-5 contains a list of the 64 bits of ERD that are used. Refer to section 4 of this volume for details on using the ERD capability.

NOTE

The information in table 1-5 is listed in the order that will be read on the maintenance display plug-on indicator on the F card when in a LOCAL mode. (In REMOTE, the contents of each word are inverted. For example, in the E log, ERD bit 1 is cylinder 512, ERD bit 17 is sector 32, ERD bit 33 is DPEC blower failure, and ERD bit 49 is spindle address error.)

Table 1-5. 206 Extended Result Descriptor Information in a Local Mode

	ERD Word 1		ERD Word 2
1	Sector 64	1	N3 Variant bit
2	Head 1	2	N2 Variant bit
3	Head 2	3	N1 Variant bit
4	Head 4	4	N0 Variant bit
5	Spare	5	Unit 2*0
6	Spare	6	Unit 2*1
7	Cylinder 1	7	Unit 2*2
8	Cylinder 2	8	OP Code 3
9	Cylinder 4	9	OP Code 2
10	Cylinder 8	10	OP Code 1
11	Cylinder 16	11	Sector 1
12	Cylinder 32	12	Sector 2
13	Cylinder 64	13	Sector 4
14	Cylinder 128	14	Sector 8
15	Cylinder 256	15	Sector 16
16	Cylinder 512	16	Sector 32

	ERD Word 3		ERD Word 4
1	Illegal Cylinder	1	Spare
2	Illegal Head	2	Bad DM response
3	CM or Offline when seeking	3	RPM less than 3420
4	Wr Protect and Wr Enable	4	Temp critical
5	Write data missing	5	Temp warning
6	Maintenance mode	6	DC power failure
7	Spare	7	Head select fault
8	Spare	8	No write current changes
9	Spare	9	Write current, no Wr gate
10	Model 206 Drive	10	Spare
11	CM error*	11	Carriage hit end stop
12	Index Mark Missing	12	Off track and Wr enable
13	Read data not received	13	Seek incomplete
14	Missing Address mark	14	Offset during seek
15	Missing R/W clock	15	Offset during Wr enable
16	DPEC blower failure	16	Spindle address error

* When a CM error is detected in a local mode, the last CM message that was sent to the drive will be displayed in ERD registers three and four in the following manner:

	ERD Word 3 (CM Error)		ERD Word 4 (CM error)
1	Address information or PLO early		
2	Address information or Offset in		
3	Head or cylinder or Offset on	3	End bit
4	Address or Control message	4	Parity even (1-23)
5	Continue	5	Spare
6	Parity even (1-5)	6	Write enable
7	Address mark	7	Address information or Set maintenance mode
8	Read bit	8	Address information or Reset maintenance mode
9	Write bit	9	Address information or Spare
10	Mark Bit	10	Address information or Spare
		11	Address information or Find index
		12	Address information or Send status
		13	Address information or Re-zero
		14	Address information or Power down
		15	Address information or Power up
		16	Address information or PLO late

PHYSICAL REQUIREMENTS

Construction

The controller is constructed as a free-standing unit and is shipped with both side panels attached. The unit is designed to attach to a 206 disk pack drive unit.

Control Panel

A control panel incorporated on the indicator panel provides the following controls and indicators:

POWER:	ON/OFF switch and indicator.
REMOTE:	ONLINE/OFFLINE switch and indicator

Dimensions

The following are the dimensions for a 1 x 8 configuration, including front door, rear door, and side panels.

Dimensions	Inches	Cm
Height	44	112
Width, including side panels	21.5	53.5
Depth, including doors	30	76.3

Weights	Pounds	Kg
Installed Weight	220	100
Shipping Weights (not including I/O cables)		
Packaged for local shipment, polyethylene cover	225	102
Packaged for air shipment	250-260 (estimated)	113-118 (estimated)

When I/O cables are included in the shipping weight, use the following increments:

P/N	Description	Pounds	Kg
1145 7645	I/O Cable, 25 ft.	17	7.7
1147 8369	I/O Cable, 35 ft.	20	9.0
1147 8377	I/O Cable, 50 ft.	32	14.5
2105 8788	I/O Cable, 100 ft.	64	29.0

FUNCTIONAL REQUIREMENTS

Compatibility

The DPEC is compatible with the BX 387 disk pack drive controller, standard 90 sector interlaced format.

Chained I/O (DPC) Conditional Seeks

The DPEC is capable of operating with a chained I/O from the central processor unit (CPU). With chained or linked I/O, the DPEC will internally determine if a seek (positioner change) is required. If a seek is required, the DPEC performs the seek and informs the CPU (DPC) that a specific spindle is seeking. By the use of a seek status flip-flop, once a seek has been initiated, the DPEC will not again perform a seek to that specific spindle until a read or write is received for that same cylinder. However, it will accept and perform operations on other spindles.

Error Detection

The DPEC will generate the Fire code and perform the error detection for all data transfers. (Error correction will be done by CPU.)

Operational Procedure

The front panel of the DPEC contains two push-button switches. See figures 1-1 and 1-2.

The switch on the left is the POWER ON/POWER OFF switch. Pressing the switch once causes the DPEC to be powered on and the ON portion of the switch to be illuminated. There is approximately a 30 second delay after the power ON button is pressed before the DPEC is operational.

Pressing the POWER button a second time will cause the DPEC to power off, and the OFF portion of the POWER button will become illuminated. In a similar manner, the REMOTE switch is used to place the DPEC in the ONLINE (remote) or OFFLINE (local) mode.

For system operation, the DPEC must be in the ONLINE mode and OFFLINE for local operation.

The mode of the DPEC (ONLINE or OFFLINE) will be indicated by having either the upper or lower portion of the REMOTE button illuminated. To transfer the DPEC to the opposite mode, press the REMOTE button.

SECTION 2
INSTALLATION

INTRODUCTION

This section contains the information necessary to install the B 9499-3 Disk Pack Electronics Controller (206 DPEC).

PRE-INSTALLATION REQUIREMENTS

The following paragraphs explain how the 206 disk pack drives are connected to the 206 DPEC. See figure 2-1.

Physical Site Requirements

Maintenance Clearances

Front	36 inches	90 cm
Rear	36 inches	90 cm
Sides	None	None

Floor Loading

Front Wheels	50 pounds each	(100 pounds total) 45.4 kg
Rear wheels	60 pounds each	(120 pounds total) 54.5 kg

I/O Cable Information (B 1700 to DPEC)

25 feet	1145 7645
35 feet	1147 8369
50 feet	1147 8377
100 feet	2105 8788

Drive Cable Information (DPEC to 206)

The 1 x 4 cable kit, 2781 0068, is available for use with the 206 DPEC and 206 DPD. The 1 x 4 kit consists of the following:

One 1 x 4 signal cable.

Two 3.0 foot dc common cables

Two 4.5 foot dc common cables

One 3.0 foot ac frame ground cable

One 4.5 foot ac frame ground cable

Depending on the system configuration, the following quantities of the kit can be ordered from Group III Distribution. One kit can be ordered for a 1 x 2 configuration, one for a 1 x 4 configuration, two for a 1 x 6 configuration, and two for a 1 x 8 configuration.

Power Requirements

Input power is wired directly to the DPEC by the building electrician, through the access hole adjacent to terminal block TB1 on the left side of the power supply. Refer to section 5 of this volume for adjustments to the power supply to compensate for variations in input power.

Voltage	208 to 240V +5%, −10%	
Frequency	50 ± 1 Hz or 60 ± 1 Hz	
	1 x 4	1 x 8
Power (208V three phase)	3.7 KVA	7.5 KVA
Current (208V three phase)		
Line 1	4A	12A
Line 2	8A	12A
Line 3	6A	10A
Power (240V single phase std. Int'l.)	3.7 KVA	7.5 KVA
Current (240V single phase std Int'l)	18A	34A
Power factor	0.8	0.8
Power consumption (DPEC only)	300W	300W
Heat dissipation (DPEC only)	1024 BTU/Hr	1024 BTU/Hr
Air flow at a density of 0.075 lb/cubic foot (DPEC only)	300 CFM	300 CFM

Circuit Breaker Information

The DPEC and the power distribution subsystem in the DPEC are protected by time delay circuit breakers (20 amperes) that are rated at 1.75 times the current value of the 1 x 8 configuration, single phase, for a period of one minute.

Equipment Grounding

A separate equipment ground wire is required in addition to the neutral service connection. Additionally, a frame ground lug is also provided for connection to the DPD. To meet U.L. requirements, the building ground wire that is furnished by the input power cable must be connected directly to the DPEC frame ground lug. A jumper wire is connected between the frame ground lug and TP1-5 in the terminal box.

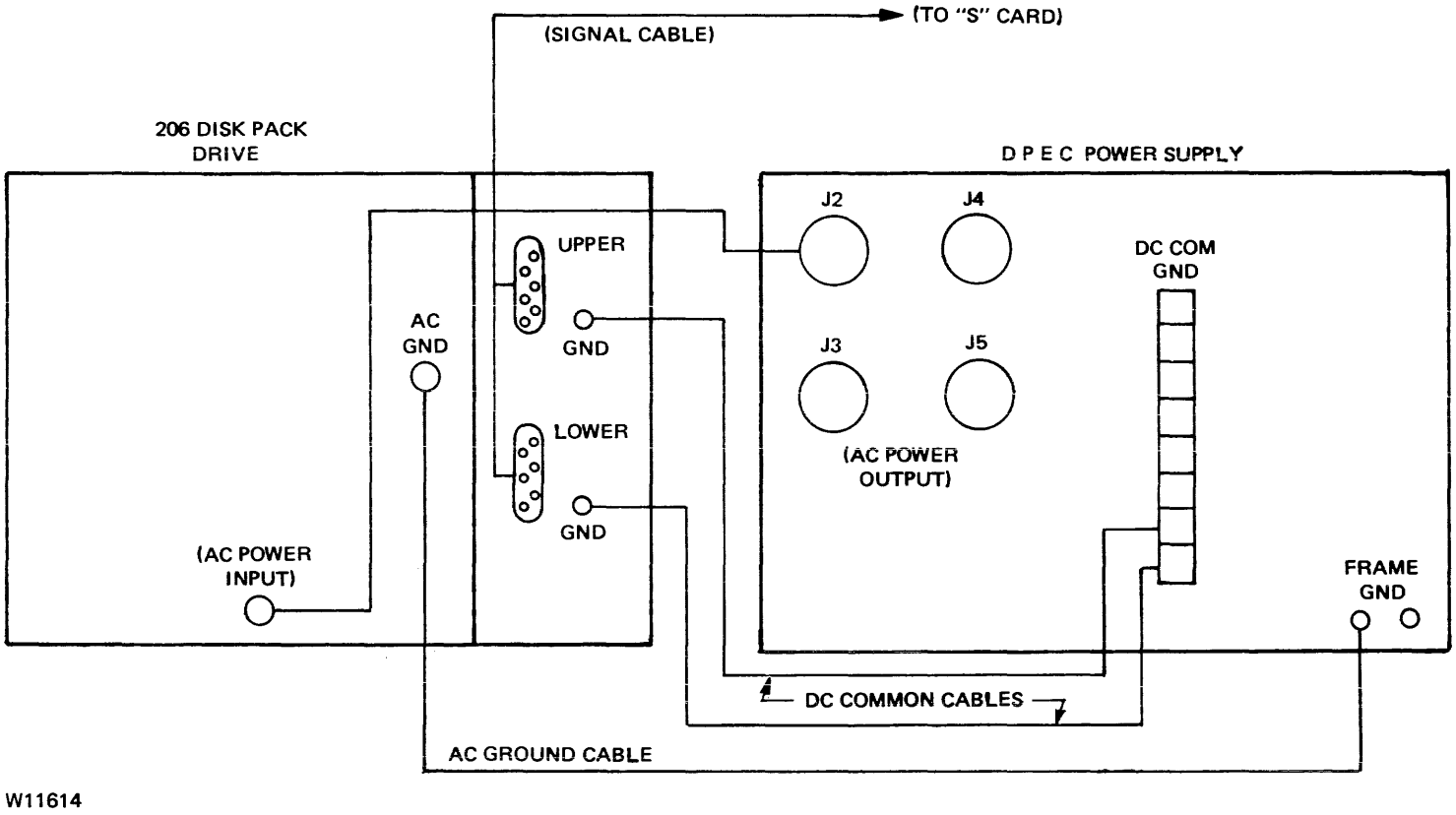


Figure 2-1. Cabling Diagram

A separate dc common lug is provided for connection to the DPD. The dc common wire is connected to the frame ground wire at a single point in the controller.

Drive Power Sequencing

AC power is distributed by the controller to the associated disk pack drives. Power-on and power-off of the disk pack drives are controlled by sequenced logic in the controller and disk pack drives.

The 206 DPEC will provide power-on sequencing to all attached units when the front panel RUN/STOP switch on the drive is activated. The sequencing will commence approximately 25 seconds after the DPEC is ready. Each unit will be commanded to power on at 8- second intervals. After this initial power-on sequence, all future power-on cycles will be done on the appropriate drive through use of the RUN/STOP switch.

Environment

Operating Environment

Temperature	60 to 100 degrees F (16 to 38 degrees C)
Relative humidity	10 to 90 percent

Shipment and Storage Environment

Temperature	50 to 160 degrees F (45 to 71 degrees C)
Relative humidity	up to 95 percent

Unpacking Instructions

All DPEC's shipped via air carrier will be in a packing crate. The crate consists of a pallet with cushion supports, tri-wall top, front, rear, and side cardboard panels. The DPEC is in a polyethylene bag. Edge protectors are used between the DPEC and the crate. The complete packing crate is then wrapped with two metal packing straps.

The following procedure is to be used to remove the DPEC from its packing crate.

a. Remove the metal packing straps.

b. Remove the crate cover.

c. Remove the edge protectors from inside the crate.

d. Carefully lift off the cardboard sleeve.

e. Lift the DPEC off the shipping pallet.

WARNING

To prevent injury, at least two field engineers must assist in removing the DPEC from the pallet.

INSTALLATION PROCEDURE

Panel Removal

To remove any DPEC panel, two bolts must be loosened under the appropriate panel. Once these bolts are loose, lifting the panel approximately one-quarter inch will allow the top of the panel to be pulled away from the DPEC frame and the panel can be removed.

The maintenance plug-on packages will be located inside the DPEC beside the power supply.

An I/O cable and T & F documentation package will also be shipped with the DPEC.

AC Input Power

AC input power is wired directly to the DPEC by an electrician. A 2.5-inch by 10-inch access hole for ac input power is provided below TB1 on the left side of the power supply. Refer to the TB1 cover or the power supply schematic for details

NOTE

To meet U.L. requirements, the fifth wire (green/building ground) in the input power cable to the DPEC must not be connected to TB1-5. It must be connected to the frame ground lug on the DPEC chassis. A wire is then connected from the frame ground lug to TB1-5.

AC power for all disk pack drive units is obtained from the back of the DPEC power supply. The receptacles on the DPEC are labeled J2, J3, J4, and J5.

There are three circuit breakers on the front of the DPEC power supply: CB1, CB2, and CB3. CB1 is used to protect J2 and J3. CB2 is used to protect J4 and J5. CB3 is used to protect the DPEC power supply.

Cables

DC Common Cable

A dc common ground cable is placed between each disk pack drive spindle and the dc common ground terminal on the rear of the DPEC power supply.

AC Ground Cable

An ac ground cable is placed between the AC GND terminal on each disk pack drive ac panel and the FRAME GND terminal on the rear of the DPEC power supply.

Signal Cable

A signal cable is placed from the "S" card (in the DPEC) for up to four disk pack drive spindles. A

second signal cable connected to the "R" card is required for spindles 5 through 8.

I/O Cable

The processor I/O cable is attached to the "Q" card in the DPEC.

Drive Installation

Regardless of the configuration used, the voltage at receptacles J2, J3, J4 and J5 must be measured before inserting the disk pack drive line cords. Refer to the B 9484-5 Disk Pack Drive technical manual Volume I, form number 1084324 for the correct input voltage requirements to prevent serious damage to the drive.

SPECIAL INSTALLATION INSTRUCTIONS

See figure 2-2, DPEC power supply schematic.

Normal Three Phase Operation

The standard power that is intended for use with the 206 DPEC is three phase power that provides 208 to 240 volts (+5 percent, 10 percent) phase to phase, four or five wire. The 206 DPEC is wired for this configuration when it is shipped from the factory. Refer to the HIGH/LOW INPUT VOLTAGE adjustment in section 5 for the input voltage that exceeds 225 volts, phase to phase.

Single Phase Operation

The DPEC is capable of single phase operation if modifications are made on the DPEC power supply (see figure 2-3).

The maximum number of drawers that can be used is four. The drive units must be wired for line-to-line operation.

CAUTION

Under no circumstances may the voltage applied to FL1 (in the DPEC power supply) between lugs 1 and 3 exceed 250 volts ac.

International Installations

Only receptacles J2 and J5 on the DPEC are used. (Line to Neutral=208 to 240 volts.)

a. Connect a jumper wire from TB1-1 to TB1-3.

b. Connect the line lead to TB1-1.

c. Connect the neutral lead to TB1-2.

d. Connect the building ground lead to the frame ground screw provided.

NOTE

There is no connection to TB1-4. Do not use DPEC power receptacles J3 or J4. Do not make any modifications to the TB4 terminal strip in the DPEC power supply.

Domestic Installations

Only receptacles J2 and J5 on the DPEC are used. (Line to Line=208 to 240 volts, Line to Neutral=110 Volts.)

a. Connect a jumper wire from TB1-1 to TB1-3.

b. Connect line one to TB1-1.

c. Connect line two to TB1-2.

d. Connect the building ground lead to the frame ground screw.

CAUTION

Do not connect the neutral lead to any TB1 terminal.

NOTE

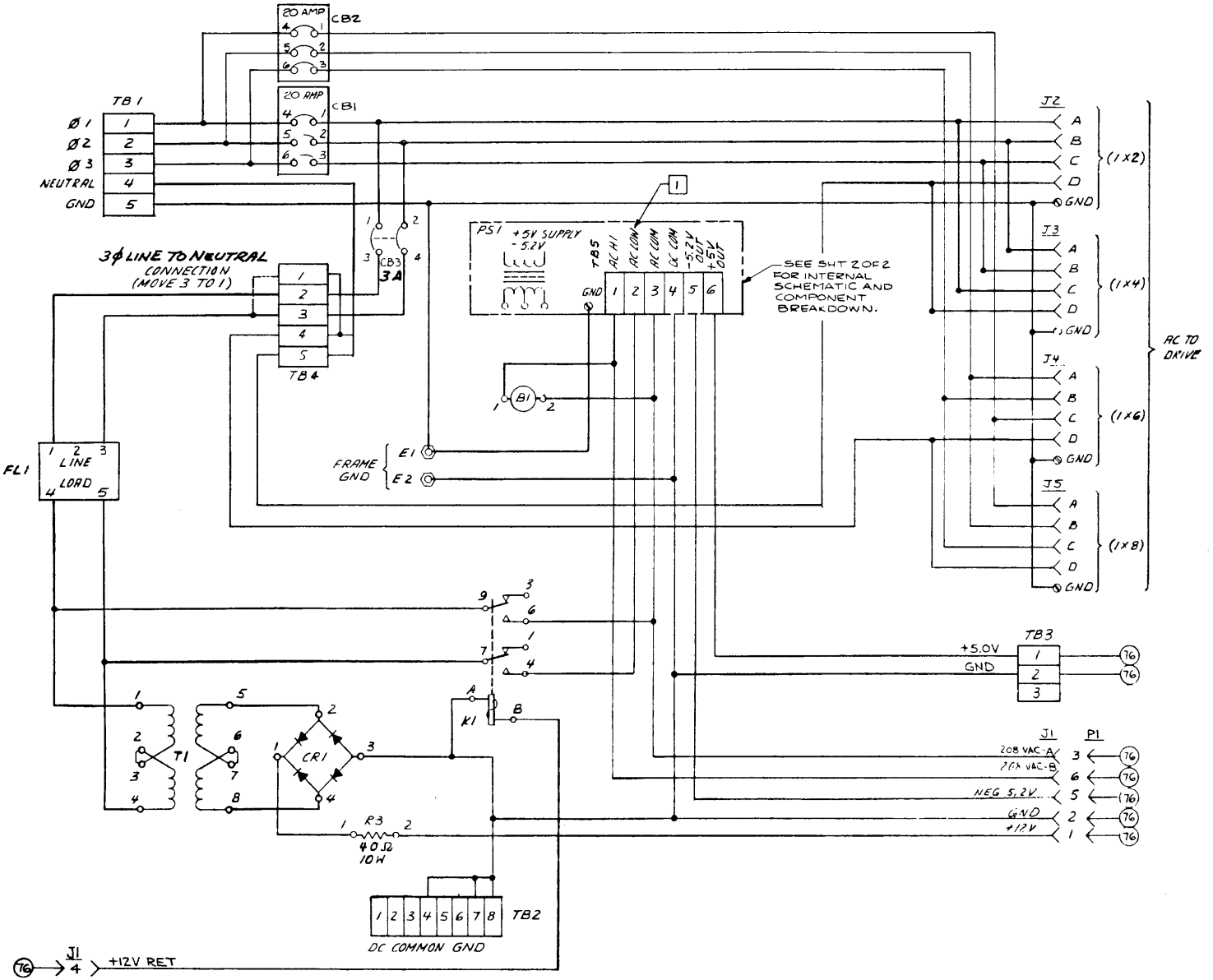
There is no conection to TB1-4. Do not use DPEC receptacles J3 or J4. Do not make any modifications to the TB4 terminal strip in the DPEC power supply.

NOTE

To meet U.L. requirements, the building ground lead in the input power cable must not be connected to TB1-5. This lead must be connected directly to the frame ground lug on the DPEC chassis. Another wire is then connected from the frame ground lug to TB1-5.

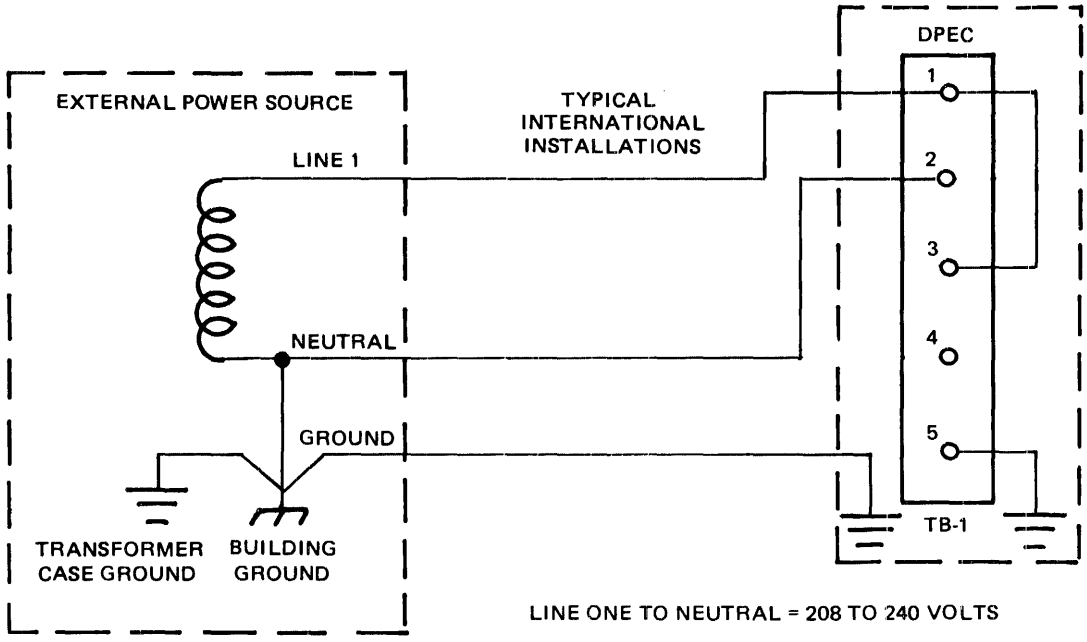
System Checkout

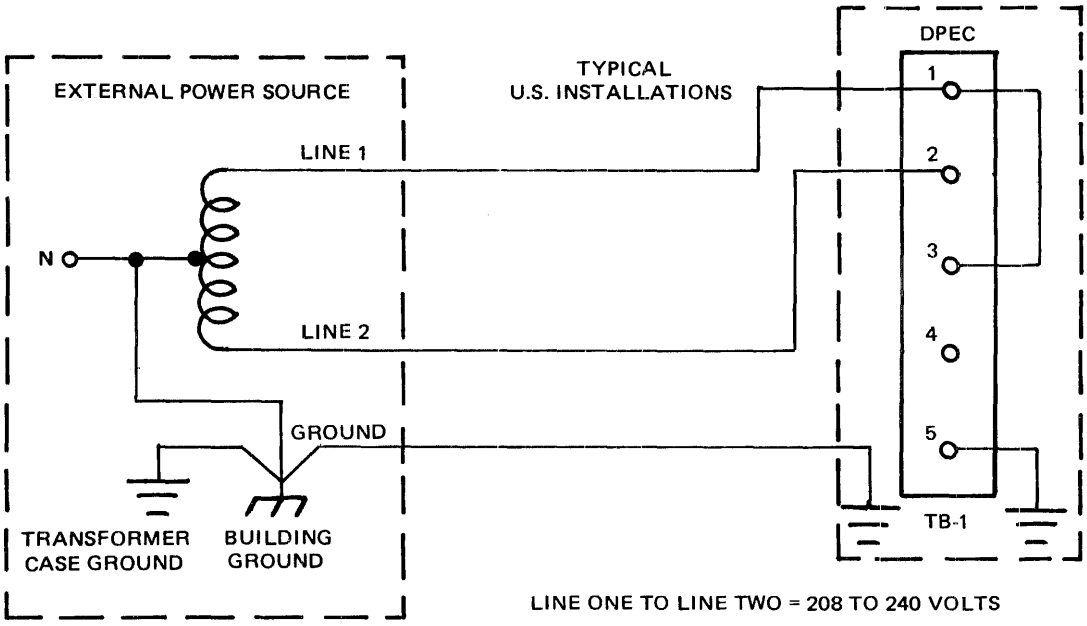
Revision AG (P/N CT 2211-0175) of the B 1700 disk pack subsystem test routine can be used to check out the disk pack subsystem. This revision is supplied with the DPC. Refer to section 4 for details.



W11615A

Figure 2-2. DPEC Power Supply Schematic





NOTE TO MEET U.L. REQUIREMENTS, THE GREEN (OR BUILDING GROUND) WIRE IN THE INPUT POWER CABLE TO THE DPEC MUST NOT BE CONNECTED TO TB1-5. IT MUST BE CONNECTED DIRECTLY TO THE FRAME GROUND LUG ON THE DPEC CHASSIS. A WIRE IS THEN CONNECTED FROM THE FRAME GROUND LUG TO TB1-5.

W11616A

Figure 2-3. Single Phase Input Power Connection

SECTION 3
DOCUMENTATION AND COMPONENTS

INFORMATION

This section contains material relating to the documentation, component location, and flow charts for the 206 DPEC.

RELATED DOCUMENTS

The following is a list of books and documents related to the operation and maintenance of the 206 DPEC.

a. B 9499-3 Disk Pack Electronic Controller Theory of Operation, form no. 1095650.

b. B 9484-5 206 Disk Pack Drive Function and Operation, form no. 1104189.

c. B 9484-5 206 Disk Pack Drive Theory of Operation, form no. 1084332.

d. B 1800/B 1700 Disk Pack Control II, form number 1098290.

e. Test and Field Document, P/N 2161 1660.

f. B 9499-3 DPEC Illustrated Parts Catalog, form no. 1104189.

PRINTED CIRCUIT CARDS

The printed circuit cards used in the DPEC are double sided boards into which 860 gold-plated socket terminals can be installed. Printed circuit wiring is used to distribute power and ground planes to the matrix terminals, and the socket terminals are configured to accept 14-pin or 16-pin dual in-line (DIL) integrated circuit packages. All of the integrated circuit modules, terminator resistors, decoupling capacitors, and potentiometers which comprise a card are pluggable; no solder is used to mount these components to the boards.

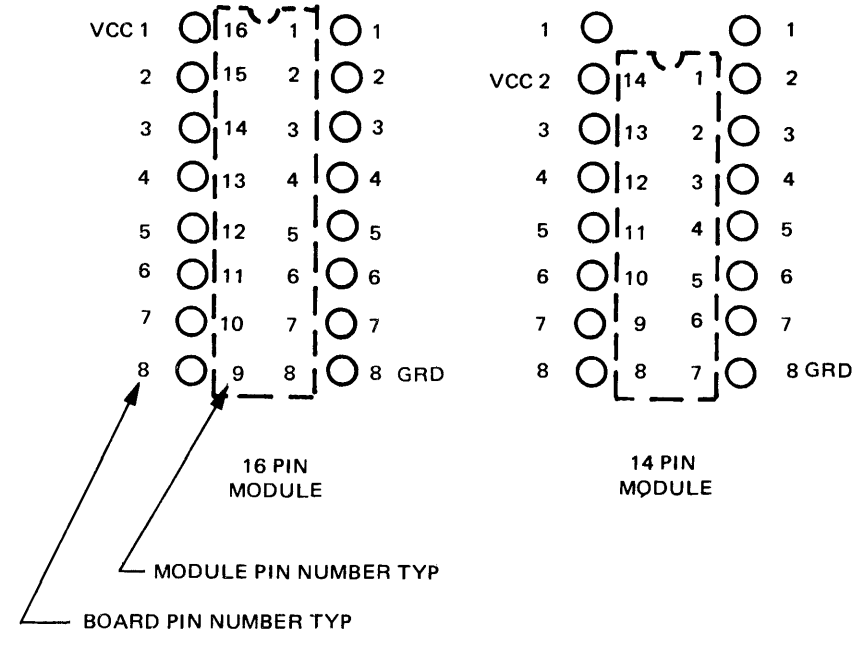
All connections on the card assembly backplane are wire wrapped. Two connections can be made on each card assembly backplane terminal.

A particular integrated circuit (IC) can be located by using the coordinate markings that appear on both sides of the cards. The IC locations will be listed on the schematics as two letters followed by a number: AB4, LM3, VW0, etc.

Figure 3-1 will be helpful in locating a particular integrated circuit leg for troubleshooting purposes.

The ground plane is the complete etching surface on the backplane or wiring side (#) of the card.

The +5.0 volts plane is the complete etching surface on the component side ($) of the card.



3-1. Integrated Circuit Leg to Card Backplane Correlation (Backplane View)

Card Backplane Pin And Connector Pad Identification

Figure 3-2 illustrates the method used in the DPEC to locate a particular backplane pin on the card. Group row "Z" will be used to make connections to the card connector pads. All cards will have a top and a bottom section of backplane connector pads.

Cable Connector Cards

There are five cards in the DPEC that have connector pads at both ends of the card. The following discussion refers to only the cable connector ends of these cards.

Q, R, S, and P Cards

The Q, R, S, and P cards contain 40-edge connector pads, 20 pads on each side. The pads on the component side will be identified with a letter between "C" and "W" and will be preceded by a "$" symbol. The pads on the wiring side will be preceded by a " " symbol.

All connector pad pins for both sides of the card will be located in group row 6 on the wiring or backplane side of the card. The coordinate method of pin identification is used in this row of pins. See figures 3-2 and 3-3.

F Card

The F card has a conventional card cage backplane connector pad array on both ends of the card. The maintenance control plug-on package is attached to this card. The plug-on package connector pad pins will be in group rows 6 and 7. See figure 3-2 for the coordinate designations.

Each DPEC is shipped with a set of Test and Field documents (T & F) which reflect the configuration of that particular DPEC. In some cases, a supplemental T & F document may also be included.

The following material will be found in the T & F package:

a. DPEC block diagrams.

b. Flow chart.

c. Schematics for the cards and the power supply.

d. Card assembly parts lists.

e. Switch panel parts list.

f. Power supply parts list and specifications.

g. Backplane wiring list, signal name.

h. Card wiring list.

DPEC MODE DEFINITIONS

The 206 DPEC operates in 16 modes. Table 3-1 lists the basic function of each mode.

Table 3-1. Mode Functions

Mode	Function
0	Spindle spin up sequence.
1	Idle halt and initiatory OP processing.
2	Non overlap positioning routine.
3	Overlap positioning routine.
4	Op branching and disk location sync.
5	Read, write or verify address search.
6	Read, write or verify data transfer.
7	Initialize operation and index mark search routine.
8	Initialize and relocate writing operation.
9	Sector location counter sync routine.
10	Dead reckoning address search (relocate and read maintenance)
11	Write relocate flag routine.
12	Read maintenance data transfer.
13	Send ERD routine.
14	Test operation processing
15	Terminate and display result descriptor.

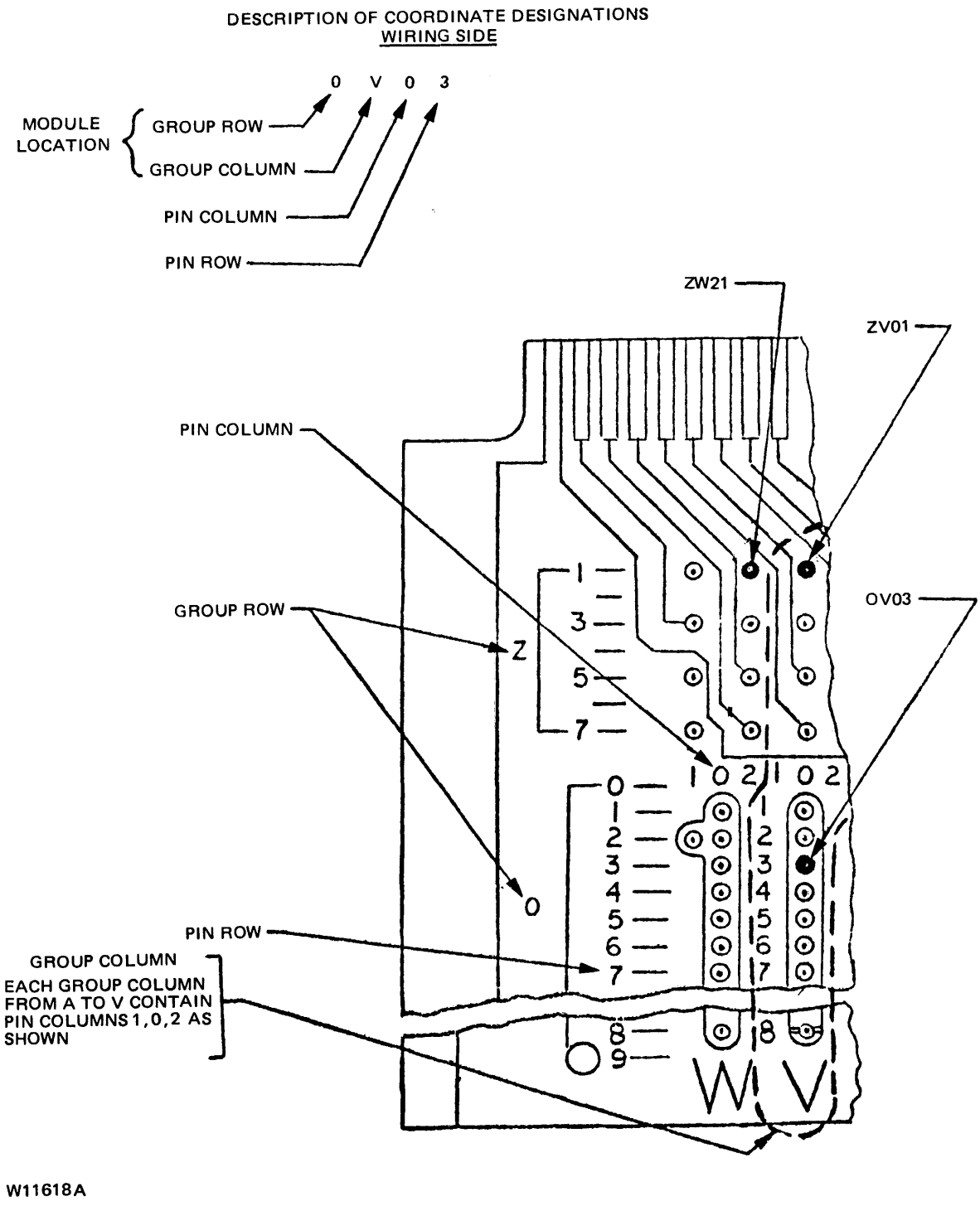


Figure 3-2. Card Backplane Pin Locating Scheme

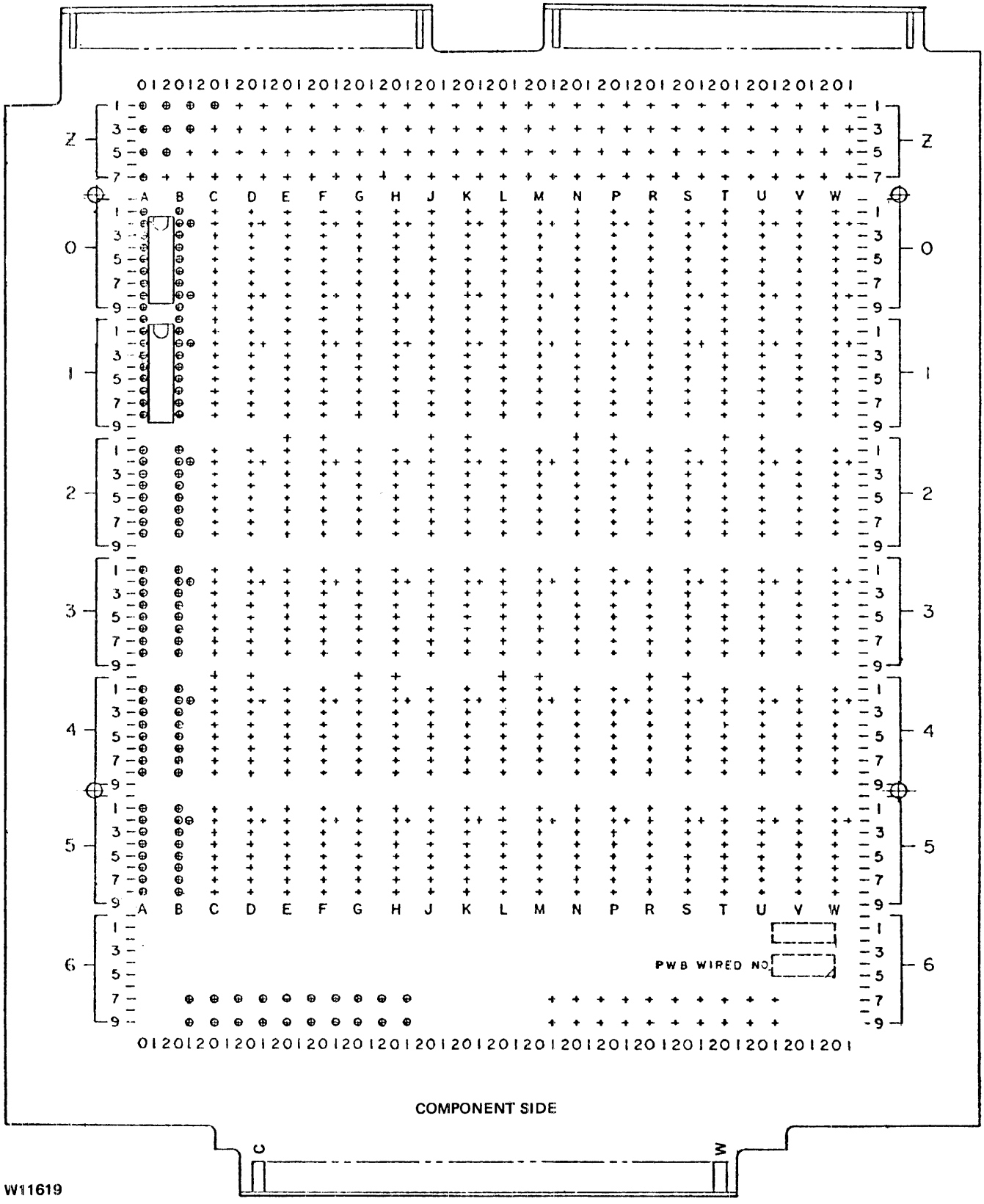


Figure 3-3. Cable Connector Type Card

DPEC FLOW CHART DESCRIPTION

The following paragraphs describe the use of the 206 DPEC detailed flow chart (see figure 3-4). The flow chart is for reference use only, refer to the flow chart in the T & F documentation package for the current revision.

The first page of the flow chart is an overall flow diagram which can be used as a guide in determining which modes can be accessed from any other mode. There is also a brief description of the operations that will take place at that particular mode.

The top half of the second page of the flow chart contains a guide to the use of the flow chart.

The abbreviations used are as follows:

Abbreviation	Meaning
HEAD	Header name
DO	Operation to be performed
MAKE	Make some particular thing happen
TEST	Condition to be tested.
GO TO	Name of header desired.
CMNT	Text of the comment
SYMBL	Symbol
EXEC TIME	Execution time
P--	Page number in schematics
YSSYM	Operation to be performed if test result is "yes."
NOSYM	Operation to be performed if test result is "no."

The actual flow chart begins on the third page. The left margin will contain the mode that the DPEC is in where the actions in that section are to take place.

There are four columns on the right side of the page. When a TEST condition is being performed, the first column will contain the mode to go to if the result of the TEST was a "yes." The second column on the right will contain the mode to go to if the result of the TEST was a "no." Other terms used during the TEST condition are NEXT, SKIP 1, AND BACK 1. NEXT indicates that the following line is to be performed, SKIP 1 indicates the next line is to be skipped and the following line performed. BACK 1 is self explanatory.

Term names in parentheses are used to identify a term that is instrumental in the PERFORM statement preceding it.

When a DO, MAKE, or TEST statement is being performed, the third column on the right will contain the time when the statement will be performed. In some cases, the GO TO MODE statement can contain a location within a certain mode, for example, M5-4. This means that the operation will be performed at part 4 time of mode 5. It may be necessary to locate this new mode by searching the left margin on another page within the flow chart.

Unless otherwise specified, when a comment contains the phrase "GO TO MODE 'n' ", the SECTOR LOCATION COUNTER is cleared and the MAIN MODE COUNTER is set to the number indicated.

Figure 3-5 is a simplified flow chart of the 206 DPEC covering the READ, WRITE, or VERIFY operation codes. This flow chart is intended only as a quick reference. When detailed descriptions and timing information are required, refer to the detailed flow chart of figure 3-5.

Figure 3-6 is a simplified flow chart of an INITIALIZE operation. It begins at Mode 4 because there are no significant differences, prior to that mode, when compared to the READ, WRITE, or VERIFY simplified flow chart.

The following table (table 3-2) illustrates the main mode jump conditions.

The first column lists the MODE that is being entered.

Column 2 is the FINAL TERM name and the schematic where the term can be found.

Column 3 contains the PARTIAL TERMS (default names) needed to derive the final term.

Column 4 has SUB PARTIAL TERMS, where applicable, and the page numbers.

Column 5, FROM MODE, lists the modes that the DPEC may be in prior to entering a particular mode.

Column 6 contains the conditions needed to produce the "GO TO MODE" term.

The final column, 7, contains the SOURCE PIN and PAGE DPEC to the opposite mode, press the REMOTE button. NUMBER for the PARTIAL TERM names.

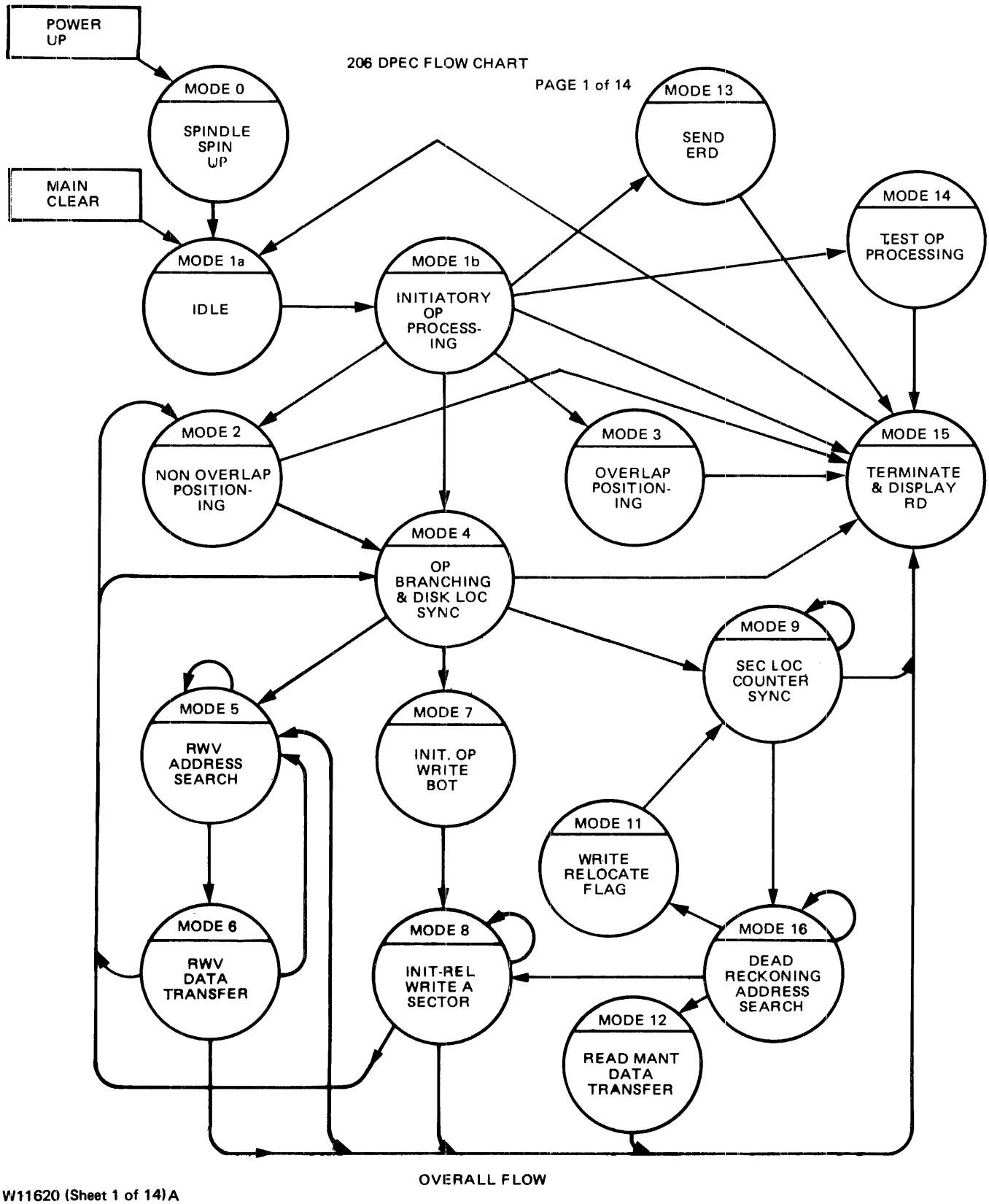


Figure 3-4. Detailed DPEC Flow Chart (Sheet 1 of 14)

```
  FLOW CHART OF THE 206 DPEC   FILE NAME = F206   2 FEB 77  1600 HR
SYMB TYPE BLOCK TEXT                                  GOTO1 GOTO2 TIME          PAG
-------------------------------------------------------------------------------
     HEAD HEADER NAME                                 ----- ----- ------------ ---
     DO   OPERATION TO BE PERFORMED                   SYMBL ----- EXEC TIME     P__
     MAKE SOME PARTICULAR THING HAPPEN                SYMBL ----- EXEC TIME     P__
     TEST CONDITION TO BE TESTED                      YSSYM NOSYM TEST TIME     P__
     GOTO NAME OF HEADER DESIRED                      SYMBL ----- ------------ ---
     CMNT TEXT OF THE COMMENT                         ----- ----- ------------ ---
-------------------------------------------------------------------------------

     CMNT MODES 0 THRU 9 ARE NAMED MDE0 THRU MDE9;
          MODES 10 THRU 15 ARE NAMED MD10 THRU MD15.
          THE CONTROL SIGNALS WHICH CAUSE THESE GOTO'S ARE NAMED
          GOTOMDE0 THRU GOTOMDE9 AND GOTOMD10 THRU GOTOMD15.      P 46-49

     CMNT SAYING "GO TO MODE N" IMPLIES (UNLESS NOTED OTHERWISE):
          1. THE CLEARING OF SECTOR LOCATION COUNTER, AND
          2. CAUSING MAIN MODE TO GO TO THE NUMBER MENTIONED.
-------------------------------------------------------------------------------

     HEAD >>>>>>>>>>>> START OF FLOW CHART <<<<<<<<<<<<

     TEST IS AC POWER ON YET?                         NEXT  SAME                P77
     DO   PWR RESET _ TO ENTIRE _ DPEC                MDE0          PWRRSYNC    P42
                                                                   (PWRRESET)  P71
-------------------------------------------------------------------------------
>>>>>>>>> MDE0  MDE0  MDE0  MDE0  MDE0  MDE0  MDE0 <<<<<<<<<<<
MDE0 HEAD SPINDLE SPIN-UP SEQUENCE - MODE 0                                    P50

     CMNT WE GET HERE FROM A POWER RESET ONLY -
          POWER RESET LASTS ABOUT 25 SECONDS                                   P71
     CMNT MAIN MODE = 0, UNIT CNTR = 0, SEC LOC CNTR = 0
          INSECLOC = HI, CLOCK = LOCAL                                         P51

SPIN HEAD SPINDLE SPIN-UP SEQUENCE
     TEST DRIVE THERE?                (DR_THERE)                 W1811        P7
     DO   MAKE CM_SEL = HI              (CM_SEL)                 W281         P55
     CMNT SETCMSEL CLEARS DM_RCVD FF
     DO   MAKE SW_TO_DR = HI  FOR ONE BIT TIME                   W281         P55
     TEST HAS A DM BEEN RECEIVED?  (DM_RCVD)  SP_1  SP_2         W5B15        P23

SP_1 CMNT DRIVE PRESENT AND POWERED ON
     DO   SEND PWR-UP CM TO DRIVE      (MDE0)   CM_LOAD AT     W5B15     P50,62
     DO   START  8-SECOND TIMER     (ST_8TIMR)                  W5B15        P56
     DO   HALT SEC LOC COUNTER   (INSECLOC=LO)                  W5B15        P54

     CMNT SEC LOC CNTR TO STAY OFF UNTIL TIMER FINISHES

     TEST  8-SEC TIMER FINISHED?   (TMOT8SEC) NEXT  SAME  TMOT8SEC        P37
     DO   FREE SEC LOC COUNTER  (INSECLOC=HI)                   TMOT8SEC     P51

     DO   MAKE CM_SEL = LO              (CM_SEL)                W6B15        P55
     DO   SWITCH TO LOCAL CLOCK     (SW_LOCAL)                  W6B15        P55
SP_2 DO   INCREMENT UNIT COUNTER    (INUNITCT)                 W6B15        P57

     TEST UNIT CNTR BIT 2*3 ON?     (UNTCT2*3) SP_3  NEXT      W8B15        P4
     DO   CLEAR SEC LOC CNTR          (CLSECLOC)               W8B15        P52
     GOTO TOP OF SPINDLE SPIN-UP SEQUENCE      SPIN            W8B15        .

SP_3 CMNT THIS IS THE END OF THE SPINDLE SPIN-UP SEQUENCE
     DO   CLEAR SEC LOC CNTR          (CLSECLOC)               W9B15        P52
     DO   HALT SEC LOC COUNTER  (INSECLOC=LO)                  W9B15        P54
     GOTO IDLE HALT,INITIATORY PROC - MODE1    MDE1            W9B15        .
-------------------------------------------------------------------------------
```

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Figure 3-4. Detailed DPEC Flow Chart (Sheet 2 of 14)

```
>>>>>>>>> MDE1  MDE1  MDE1  MDE1  MDE1  MDE1  MDE1 <<<<<<<<<<
MDE1 HEAD IDLE HALT - INITIATORY OP PROCESSING - MODE 1
     CMNT WE GET HERE EITHER FROM THE MODE 0 SEQUENCE OR
          FROM A MAIN CLEAR OR FROM FINISHING AN OP.

     TEST DPEC SELECTED YET?        (SELECT)   NEXT  SAME  SELECT        P45

     DO   FREE SEC LOC COUNTER  (INSECLOC=HI)              SELECT        P51
     DO   LATCH INITIATE WORD 1 (CK_WORD1)                 W0B11        P4,8
     CMNT ADDR DECODR MOVES INTO STATE 1 AT FRONT EDGE OF  W0B11          .
     DO   SEND FIRST CK_DPC          (CK_DPC)              W0B12-14      P66
     DO   RAISE THE READY LINE       (READY)               W0B15         P56

     DO   LATCH INITIATE WORD 2 INTO A.D. (W1B11)          W1B11         P8
     CMNT ADDR DECODR MOVES INTO STATE 2 AT FRONT EDGE OF  W1B11
          THEN STEPS AT 5MHZ RATE.                                      P7
     TEST DRIVE THERE                (DM BUF)   NEXT  NEXT  W1B11
     DO   SEND SECOND CK_DPC         (CK_DPC)              W1B12-14      P66
     DO   RAISE THE BUSY LINE        (BUSY)                W1B15         P56

     TEST IS OP A TRANSMIT ERD?      (SEND_ERD) MD13  NEXT  W2B0          P67
     TEST DRIVE THERE                           NEXT  SKIP4               P55
     DO   SWITCH TO DRIVE CLOCK      (SW_TO_DR)            W281          P55
     DO   SEND SELECT CM TO DRIVE    (CM_SEL)              W281          P55
     CMNT DM_RCVD GOES LOW AT W281                         W281          P23
     CMNT CM_BUFF GOES LOW AT W282                         W282          P22

     TEST XMTNPERR OR TRY DIAG       (XMPER+TD) MD15  NEXT  W2B14         P49

     TEST RDM+INIT+REL+OVRLAPDS/     (IMMDSEEK) NEXT  SKIP1 W2B15         P45
     DO   CLEAR SEEK STATUS FF       (CKSKSTAT)            W2B15         P55

     CMNT ADDR DECODER FINISHED    (ADSTATE0)    AT  -  -  W387 TIME.    P7
     DO   LOAD ADDRESS COUNTER     (LOAD_AC)     AT  -  -  W4B13 TIME.   P9

     CMNT INITIAL SHORT DM S/B BACK BY W431 TIME.
     TEST DRIVE OFFLINE OR NOT READY?          MD15  NEXT  W5B1          P49
     CMNT WE MUST TEST THE DRIVE FOR SPINDLE ADDRESS
          AND ALSO FOR WRITE LOCKOUT IN THE CASE OF
          A WRITING OP (WR,INIT,OR RELOC).

     TEST WR + INIT + RELOC OP?   (NEEDTOWR)  NEXT  M1_2  W5B15          P45
     DO   SEND WR EN/SPNDL ADDR CM (ENABL_WR)  CM_LOAD AT  W5B15       P60,62
     GOTO THE TEST FOR TESTOP                  M1_3

M1_2 DO   SEND SPNDL ADDR ONLY CM  (CM#2-1)     CM_LOAD AT  W5B15          P62

     CMNT SECOND DM SHOULD BE BACK BY W13B10 TIME          W13B10         P23

M1_3 TEST IS THIS OP A TESTOP?       (TESTOP)   MD14  NEXT  W13B15         P67
     TEST DOES OLD CYL = NEW CYL?    (OLD=NEW)  MDE4  NEXT  W1482          P10
     TEST RDM+INIT+REL+OVRLAPDS/     (IMMDSEEK) MDE2  NEXT  W1483          P45

     CMNT ONLY OPS READ, WRITE, AND VERIFY                              P65,67
          REMAIN AT THIS POINT IN THE FLOW.

     TEST IS OVERLAP MODE DESIRED? (NOEXCHG)  NEXT  MDE2  W1484          P67
     TEST IS SEEK STATUS FF SET?   (SKSTATUS) MD15  NEXT  W1485          P44
     GOTO OVERLAP POSITION'G ROUTINE - MODE 3 MDE3        W1486           .
```

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Figure 3-4. Detailed DPEC Flow Chart (sheet 3 of 14)

```
>>>>>>>>> MDE2  MDE2  MDE2  MDE2  MDE2  MDE2  MDE2 <<<<<<<<<<
MDE2 HEAD NON-OVERLAP POSITIONING ROUTINE - MODE 2

     TEST IS DRIVE READY?          (DR_READY) M2_1  NEXT  W0B15        P24
     DO   HALT SEC LOC COUNTER  (INSECLOC=LO)                W0B15        P54

     CMNT SEC LOC CNTR IS HALTED IN STATE   -   -   -   - W1B0         .

     TEST DRIVE READY YET?         (DR_READY) NEXT  SAME  DR_READY     P24
     DO   FREE SEC LOC COUNTER  (INSECLOC=HI)                DR_READY     P51

M2_1 DO   SEND CYLINDER CM         (MODE 3 CM)  CM_LOAD AT W1B11     P60,62

     CMNT DM SHOULD BE BACK BY W9B10 TIME                    W9B10        .

     TEST NORMAL UNSETTLED?        (NRMLUNST) NEXT  MD15  W9B13        P48
     CMNT THIS MD15 TERMINATE IS AN ERD (9ADDMRSP)
     DO   HALT SEC LOC COUNTER  (INSECLOC=LO)                W9B14        P54
     CMNT SEC LOC CNTR HALTS IN STATE   -   -   -   -   - W9B15         .

     TEST IS DRIVE READY?          (DR_READY) NEXT  SAME  DR_READY     P24
     DO   FREE SEC LOC COUNTER  (INSECLOC=HI)                DR_READY     P51


     TEST ARE WE STILL SELECTED?   (SELECT)   MDE4  NEXT  W2988        P45
     GOTO MODE 15 - TERMINATE      (PT8GM15)  MD15         MD2W30B6     P48

-------------------------------------------------------------------------
>>>>>>>>> MDE3  MDE3  MDE3  MDE3  MDE3  MDE3  MDE3 <<<<<<<<<<
MDE3 HEAD OVERLAP POSITIONING ROUTINE - MODE 3
     DO   SEND CYLINDER CM         (MODE 3 CM)  CM_LOAD AT W0B15        P62

     DO   SET SETSKSTS FF                                    W9B15        P54

     GOTO MODE 15             (PT4GMD15)        MD15         W9B15        P48

     CMNT FORCE NOT READY (PT4GMD15)

-------------------------------------------------------------------------
```

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Figure 3-4. Detailed DPEC Flow Chart (Sheet 4 of 14)

```
>>>>>>>>> MDE4  MDE4  MDE4  MDE4  MDE4  MDE4  MDE4 <<<<<<<<<<
MDE4 HEAD OP BRANCHING & DISK LOC SYNC - MODE 4

     CMNT MDE4FLOP IS SET ((MDE2*MDE8)*INITIAL)*MDE6 TO REMIND US TO   P56
          DO A HEADSWITCH BEFORE SEARCHING FOR INDEX OR
          DOING OP BRANCHING

     TEST IS MODE 4 FLOP SET?     (MDE4FLOP)    M4_1  M4_0                P53

M4_1 DO   SEND HEAD SWITCH CM     (ENABL_WR)    CM_LOAD AT  W1811     P60,62
     DO   CLEAR MODE4 FLOP        (MDE4FLOP)                W9B15       P56
     DO   CLEAR SECTOR LOC CNTR   (CLSECLOC)    M4_0        W9B15       P52

     CMNT AFTER EXECUTING THE ABOVE STATEMENTS,
          CONTROL IS RETURNED TO THE BEGINNING
          OF MDE4 WITH MDE4FLOP RESET.

M4_0 TEST READ,WRITE,VERIFY OPS?     (RWV)      M4_0B  M4_0A              P45
M4_0A HEAD NOT RWV ROUTINE
     DO   CLEAR DISK LOC CNTR      (CLDSKLOC)              W0B15         P54
     DO   START 25 MSEC TIMER      (ST25TIMR)              W0B15         P54
     DO   SEND INDEX SEARCH CM     (INDXSRCH)  CM_LOAD AT  W0B15      P53,62

     DO   HALT SEC LOC COUNTER  (INSECLOC=LO)              W0B15         P54

     CMNT THE SEC LOC CNTR NOW SITS HALTED IN THE   -   - W1B0 STATE.  .

     CMNT WE NOW WAIT FOR EITHER THE INDEX MARK DM TO RETURN
          OR FOR THE 25 MSEC TIMER TO FINISH.

     CMNT WE ARE ASSURED THAT ADDRINDX WILL BE FALSE AT THIS TIME
          BECAUSE OF THE TWO DM'S WE RECEIVED IN MODE 1, NEITHER
          OF WHICH COULD HAVE HAD THIS BIT ON.

     TEST INDEX MARK DM BACK YET?  (ADDRINDX) SKIP1 NEXT  ADRIDXUP      P24
     TEST 25 MSEC TIMER FINISHED?  (TMOT25MS) MD15  BACK1 TIME_OUT      P37
     CMNT TMOT25MS SETS TRY DIAG.

     CMNT WE WILL SEE THE UP EDGE OF THE ADDRINDX LINE SOMETHING
          LIKE EIGHT (8) BIT TIMES AFTER THE BEGINNING OF THE DM.
          WE WILL J UP THE INSECLOC FF WITH THE TERM                    P54
          GS GTO ENC * GOTOMDE1/  WHICH WAS CAUSED BY ADDRINDX.

     DO   FREE SEC LOC COUNTER  (INSECLOC=HI)              ADRIDXUP      P51
     TEST INITIALIZE OP            (INITIAL)  SKIP1 NEXT   ADRIDXUP      P47
     DO   INCREMENT DISK LOC CNTR  (INDSKLOC)              ADRIDXUP      P51

     TEST INITIALIZE OP?           (INITIAL)  MDE7  MDE9   ADRIDXUP      P47

                    ------------------------------------------------------
M4_0B HEAD RWV WAIT ROUTINE
     DO   SEND OFFSET/PLO CM       (CM#1-0)                W0B15         P62
     TEST IS DRIVE READY           (DR_READY)       NEXT   W9B14         P24
     DO   HALT SEC LOC COUNTER     (INSECLOC=LO)           W9B14         P54
     CMNT SEC LOC CNTR NOW HALTED IN THE   -   -   -   -   W9B15 STATE
     TEST IS DRIVE READY?          (DR_READY) NEXT  SAME   W9B15         P24
     DO   FREE SEC LOC COUNTER     (INSECLOC=HI)           W9B15         P51
     GO TO MODE 5                  (GOTO5FR4)       MDE5   W11B14        P73
-------------------------------------------------------------------------
```

W11620 (Sheet 5 of 14)

Figure 3-4. Detailed DPEC Flow Chart (Sheet 5 of 14)

```
>>>>>>>>>> MDE5  MDE5  MDE5  MDE5  MDE5  MDE5  MDE5 <<<<<<<<<<
MDE5 HEAD RWV ADDRESS SEARCH  -  MODE 5

     TEST IS DPC IN SLIP MODE?      (EXECUTE)  NEXT  M5_1  W0B15          P3
     DO   HALT SEC LOC COUNTER  (INSECLOC=LO)                W0B15          P54

     TEST STILL IN SLIP MDE? (W180) (EXECUTE) SAME  NEXT  EXECUTE        P3
     DO   FREE SEC LOC COUNTER  (INSECLOC=HI)             EXECUTE        P51

M5_1 DO   SND RD ADDRMRK CM (CM_R/W/,CM_ADD_M/) CM_LOAD @ W1811       P61,62
     DO   START 250 USEC TIMER     (ST250TMR)            W1811          P56

     CMNT A ROGER DM SHOULD BE BACK BY W3814 TIME.                      P70
     TEST IS A ROGER DM BACK?       (ROGER_DM) NEXT  MD15  W3814          P70
     CMNT THIS MD15 JUMP SETS TRY DIAG.

     DO   HALT SEC LOC COUNTER  (INSECLOC=LO)              W3814          P54

     TEST ADDR MARK DM BACK YET?   (ADDRINDX) M5_2  NEXT  ADRIDXUP       P24
     TEST HAVE 250 USEC PASSED YET?(TMOT250U) NEXT  BACK1 --------       P37
     DO   SET ADDR MARK TIMEOUT FF (ADRMRKER)             --------       P68
                    ------------------------------------------------

M5_2 DO   FREE SEC LOC COUNTER  (INSECLOC=HI)    TMOT250U+ADRIDXUP      P51
     TEST DPEC STILL SELECTED??    (ENSELTRM) NEXT  MD15                P73


     TEST TIMEOUT 250USEC        (TMOT250U)    MDE5  BACK2              P37

     CMNT THE SEC LOC CNTR HAS BEEN HALTED IN THE W480 STATE.
          WE NEED TO CHECK THE TIME LAPSE FROM THE ADDR MARK DM
          TO WHEN THE ADDR SYNC CHAR IS TO ARRIVE.  THE LONGEST
          THAT THIS SHOULD BE IS NINE (9) WORDS.  WE WILL ALLOW
          TEN (10) WORD TIMES.  WHEN WE SEE THE ADDR SYNC CHAR,
          WE WILL LOAD THE SEC LOC CNTR TO W584 (FROM WHEREVER
          IT WAS) AND GO TO MODE 6.  IF, IN MODE 5, WE GET TO
          W11815, WE WILL SAY THAT WE HAVE OVERRUN THE ADDR SYNC
          CHAR FIELD.

     DO   ENABLE SYNC CHAR DETECTOR (ENSNCDET)             W5815          P57

     CMNT ENSNCDET IS WINDOW FOR STROBING THE SYNC CHAR.

     DO   ENABLE STUCK DATA DETECTOR (TSTSTKDT)            W9B15          P53

     CMNT THE STUCK DATA DETECT LATCH IS SAMPLED  AT THIS               P68
          BIT TIME FOR POSSIBLE DATA LINE S-A-1 OR S-A-0.

     TEST ADDR SYNC CHAR DETECTED? (STADRCMP) M5_3  NEXT  STADRCMP      P38
     TEST PASSED ADDR SYNC FIELD?  (PT2KTMSD) M5_4  BACK1 W11814        P55
                    ------------------------------------------------
```

W11620 (Sheet 6 of 14)

Figure 3-4. Detailed DPEC Flow Chart (Sheet 6 of 14)

```
M5_3 HEAD ACTUAL ADDRESS COMPARE
     CMNT THE ADDRESS COMPARE IS HANDLED AUTOMATICALLY BY THE
          ADDRESS LOGIC BLOCK'S CONTROL AND THE RESULTS OF THE
          COMPARE WILL BE AVAILABLE AT W784 TIME.

     DO   LOAD SEC LOC CNTR TO W584 (LDSECLOC)              STADRCMP     P38
     DO   SEND GO IDLE CM          (CMGOIDLE/) CM_LOAD AT W686       P60,62
     TEST HEADER ADDR = ADDR CNTR  (ADDR_EQL) MDE6  M5_4  W784         P15

     CMNT AS WE GO TO MODE 6 WE DO >>NOT<< CLEAR
          THE SECTOR LOCATION COUNTER.
          ------------------------------------------------

M5_4 HEAD NO COMPARE ROUTINE
     CMNT THE ADDR MARK COUNTER IS USED TO KEEP TRACK OF
          HOW MANY ATTEMPTS WE HAVE MADE AT FINDING THE
          DESIRED SECTOR.  IT IS CLEARED BY MODE 1 AND
          INCREMENTED AT W784 TIME IF ADDRESS COMPARE WAS
          NOT EQUAL.  WHEN ADMRK127 GOES TRUE WE
          CHECK TO SEE IF WE ARE ALREADY ON HEAD 4, AND IF NOT
          WE SWITCH THERE AND CONTINUE SEARCHING
          FOR THE CORRECT ADDRESS (AMONG THE SPARES) UNTIL
          THE ADDR MARK CNTR EQUALS 255. AT THIS POINT WE
          GO TO MODE 15 AND REPORT NO ADDRESS COMPARE.

     DO   INCREMENT ADDR MARK CNTR (INADRMRK)          W784          P45

     CMNT WE PERFORM THESE NEXT TESTS AT WORD 14 TIME TO USE
          PRODUCT TERMS IN COMMON WITH THE M1_3 ROUTINE.

     TEST ADDR MARK CNTR = 255?    (REVSDONE) MD15  NEXT  W1480      P71
     TEST IS ADDR MARK 2**7 BIT ON? (ADMRK127) NEXT  MDE5  W1481     P47
     TEST ARE WE ON HEAD 4 ?       (ACHED2*2) MDE5  NEXT  W1482      P47
     DO   FORCE HEAD=4 TO CM INPUT (CMSELHD4)             W1482      P71
     CMNT ADDRESS COUNTER REMAINS UNCHANGED. WE JUST WANT
          TO SEARCH THE RELOCATED AREA ON SURFACE 4 TO FIND
          THE SECTOR.  THE CMSELHD4 LINE WILL BE RESET
          UPON ENTERING MDE6.
     DO   SEND HEAD SW CM          (ENABL_WR) CM_LOAD AT W1483   P60,62
     CMNT LOADING OF THE CM REGISTER TAKES PLACE THROUGHOUT
          THE WHOLE W1483 TIME.  WE CAN THEREFORE BE SURE THAT
          THE HEAD=4 DATA IS STABLIZED FOR LOADING.

     TEST ROGER DM BACK?           (ROGER_DM) MDE5  MD15  W2988      P70
     CMNT IN MODE 5 WE GO TO MD15 ANYTIME THE DPC                    P72
          DESELECTS US AND ENSELTRM IS TRUE.

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```

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Figure 3-4. Detailed DPEC Flow Chart (Sheet 7 of 14)

```
>>>>>>>>>> MDE6  MDE6  MDE6  MDE6  MDE6  MDE6  MDE6 <<<<<<<<<<
MDE6 HEAD READ-WRITE-VERIFY DATA TRANSFER - MODE 6

     CMNT WE ENTER THIS MODE FROM A REAL-TIME ADDRESS COMPARE.
          THE SEC LOC CNTR IS >>NOT<< CLEARED AS WE ENTER.

     TEST IS THIS A WRITE OP?      (WRITE)    WRIT  READ                P65
                          ------------------------------------------------

READ HEAD DATA TRANSFER FOR READ AND VERIFY OPS

     DO   SEND READ DATA CM          (CM_R/W/)  CM_LOAD AT W10B14    P61,62

     CMNT THIS CM GOES ACTIVE AT THE DRIVE AT  -  -  -  - W11B12 TIME  .
          WHICH IS 9 WORD TIMES AFTER THE END
          OF THE ADDRESSS FIELD.

     DO   ENABLE SYNC DETECTOR     (ENSNCDET)              W1486         P57

     CMNT ENSNCDET SHOULD BE RESET AT W11B15 TIME.

     TEST SEEN DATA SYNC CHAR YET? (STDTAXFR) SKIP2 NEXT  STDTAXFR      P38
     TEST OVERRUN SYNC CHAR FIELD? (W2988)    NEXT  BACK1 W2988         P36
     DO   SET DATA SYNC OVERRUN FF (DTSYNCER) MD15        W2988         P56
     DO   CLEAR REVSDONE COUNTER                          W2988         P71
     DO   CLEAR ENSNCDET                                  STDTAXFR      P57
     MAKE FRMT CTRL MODE=READ DATA (FMRDDATA)             STDTAXFR      P58

     CMNT THE FORMAT CONTROL LOGIC WILL NOW HANDLE
          THE DETAILS OF THE DATA FLOW.

     MAKE FRMT CTRL MODE=READ FIRE (FMRDFIRE)             W106B15       P58
     MAKE FRMT CTRL MODE = SEND RD (FMSENDRD)             W108B15       P58
     DO   SEND A GO IDLE CM        (CMGOIDLE/) CM_LOAD AT W10981    P60,62
     CMNT FORMAT CONTROL GOES IDLE AT W109B15 AS A RESULT
          OF THE PREVIOUS FMSENDRD.

     GOTO RWV END TEST ROUTINE                 M6_1
                          ------------------------------------------------

WRIT HEAD WRITE OP DATA TRANSFER ROUTINE

     DO   SEND A WRITE DATA CM       (CM_R/W) CM_LOAD AT W8B5      P61,62
     MAKE FRMT CTRL MODE=WRIT ZERO (FMWRZERO)             W8B5          P52

     CMNT THE WRITE DATA CM GOES ACTIVE AT    -   -   -   W9B3 TIME.   .


     MAKE FRMT CTRL MODE=WRIT ONES (FMWRONES)             W16B9         P58
     MAKE FRMT CTRL MODE=WRIT DATA (FMWRDATA)             W16B13        P58
     MAKE FRMT CTRL MODE=WRIT FIRE (FMWRFIRE)             W106B13       P58
     CMNT FRMT CTRL GOES TO WRZEROES AT W108B13 AS A RESULT
          OF THE PREVIOUS WRFIRE. IF OP IS NOT INITIAL,
          FRMT CTRL GOES IDLE AFTER WRITING 1 BYTE OF ZEROES.
     DO   SEND A GO IDLE CM        (CMGOIDLE/) CM_LOAD AT W10981    P60,62

     CMNT DRIVE WILL GO IDLE AT END OF    -    -    -     W109B7 TIME. .

     CMNT WHEN THE FORMAT CTRL LOGIC IS GIVEN THE
          TERMINATE WRITE COMMAND, IT STAYS IN THE TERM WR
          MODE FROM W105B14 THRU W106B13, THEN IN THE WRITE
          FIRE MODE FROM W106B14 THRU W108B13, THEN IN THE
          WRITE ZEROS MODE FROM W108B14 THRU W109B7 AT WHICH
          TIME IT GOES BACK INTO THE IDLE MODE.

     GOTO THE RWV END TEST ROUTINE             M6_1
                          ------------------------------------------------
```

W11620 (Sheet 8 of 14)

Figure 3-4. Detailed DPEC Flow Chart (Sheet 8 of 14)

```
M6_1 HEAD THIS IS THE READ-WRITE-VERIFY END TEST ROUTINE

     CMNT IF THE DPC WANTS TO TERMINATE US, IT IS TO DROP
          THE SELECT LINE BEFORE THE 91ST DATA CLOCK.
          WE WILL CHECK THE SELECT LINE AT W109B14 TIME
          AND RESPOND ACCORDINGLY.

     DO   INCREMENT ADDRESS CNTR   (INADDRCT)              W127814    P9,51

     DO   CLEAR SEEK STATUS FF     (CKSKSTAT)              W109814      P55
     TEST IS DPEC STILL SELECTED?  (SELECT)   NEXT  MD15  W110815      P45
     TEST SPARE SECTOR VERIFY?     (SPRVRIFY) NEXT  MD15  W110815      P71

     CMNT IF ADDR CNTR CROSSED AHEAD BOUNDARY (END OF TRK),
          WE MUST DO A HEAD SWITCH CM.  IF IT CROSSED
          A CYLINDER BOUNDARY (END OFD CYL), WE MUST DO A
          CYLINDER CM ALSO.

M6_2 TEST ADDR CNTR AT END OF CYL? (ENDOFCYL) NEXT  SKIP1 W11887       P9
     DO   SEND NO OFFSET/PLO CM (EMPTY CMODE1) CM_LOAD AT W11887    P60,62
     TEST IS ADDR CNTR AT -  -  -  (ENDOFCYL) NEXT  SKIP1             P9
     GOTO NON-OVERLAP POSITIONING - MODE 2    MDE2          W127814   P9,46
     TEST IS ADDR CNTR AT -  -  -  (ENDOFTRK) MDE4  NEXT    W127814   P9,46
     TEST WAS THIS SEC RELOCATD?  (PTGT4FR67) MDE4  NEXT    W127814  P46,71

     CMNT WE NOW DELIBERATELY WAIT UNTIL WE HAVE PASSED
          THE ADDRESS MARK FIELD OF THE NEXT SECTOR (EXCEPT
          IN THE CASE OF GOING FROM LOCATION 89 TO LOCATION 0)
          BECAUSE OF THE TIME IT TAKES THE ADDR MARK DETECTOR
          TO PREPARE ITSELF FOR DETECTION.  IF THE LAST SECTOR
          WAS IN LOCATION 89 (SECTOR 44), WE WILL WANT TO READ
          SECTOR 45 NEXT (FROM LOCATION 0).  THIS IS ALLOWED BY
          THE THE 60-BYTE BOT FIELD BETWEEN THESE SECTORS.

M6_3 GOTO RWV ADDRESS SEARCH - MODE 5         MDE5          W127815      P47
-------------------------------------------------------------------------


>>>>>>>>> MDE7  MDE7  MDE7  MDE7  MDE7  MDE7  MDE7 <<<<<<<<<<
MDE7 HEAD INITIALIZE OP INDEX MARK SEARCH ROUTINE - MODE 7

     CMNT STARTING WITH CM_LOAD AT W181, WE SEND A WRITE DATA          P62
          CM THAT WILL GO ACTIVE IN THE DRIVE AT (TRUE) W189 TIME
          (SEC LOC CNTR = W280).

     DO   SEND A WRITE DATA CM          (CM_R/W) CM_LOAD AT W186     P61,62
     MAKE FRMT CTRL MODE=WRIT ZERO (FMWRZERO)              W186       P52

     TEST IS A ROGER DM BACK?       (ROGER_DM) NEXT  MD15  W4B15      P70

     DO   SND WR ADDRMRK CM (CM_R/W,CM_ADD_M/) CM_LOAD AT W2988    P61,62

     TEST TIME TO GO TO MODE 8?     (W3086)    MDE8  SAME  W3086      P36
-------------------------------------------------------------------------
```

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Figure 3-4. Detailed DPEC Flow Chart (Sheet 9 of 14)

```
>>>>>>>>> MDE8  MDE8  MDE8  MDE8  MDE8  MDE8  MDE8 <<<<<<<<<<
MDE8 HEAD INITIALIZE-RELOCATE WRITING OPERATION - MODE 8

     CMNT DURING THIS MODE, THE SECTOR LOCATION COUNTER IS
          SYNCHRONIZED TO THE ACTUAL POSITION ON DISK.
          WE WILL BE IN THIS MODE FOR ALL NINETY (90) SECTORS
          WITHOUT EXITING UNTIL WE HAVE WRITTEN THE ENTIRE
          TRACK.  THE DISK LOCATION COUNTER AND THE INTERLEAVE
          LOGIC WILL PROVIDE THE SECTOR ADDRESSES.

     CMNT WE ENTER THIS MODE FROM EITHER MODE 7 OR MODE 10.
          THE FORMAT CONTROL LOGIC IS IN THE WRITE ZEROS MODE AND   P52,68
          THE DRIVE IS WRITING AN ADDRESS MARK.

     MAKE FRMT CTRL MODE=WRIT ONES (FMWRONES)              W4813        P58
     MAKE FRMT CTRL MODE=WRIT ADDR (FMWRADDR)              W581         P58
     MAKE FRMT CTRL MODE=WRIT ZERO (FMWRZERO)              W781         P52

     CMNT WE HAVE NOW COMPLETED WRITING THE ADDRESS.

     MAKE FRMT CTRL MODE=WRIT ONES (FMWRONES)              W1689        P58
     MAKE FRMT CTRL MODE=WRIT DATA (FMWRDATA)              W16813       P58
     MAKE FRMT CTRL MODE=WRIT FIRE (FMWRFIRE)              W106813      P58

          FIRE MODE FROM W106814 THRU W108813, THEN IN THE
          WRITE ZEROS MODE FROM W108814 THRU:
          A. (IN INITIALIZE) W4813 OF THE NEXT SECTOR                  P47
             EXCEPT WHEN THE NEXT SECTOR IS IN LOCATION 0
             IN WHICH CASE WE MUST SWITCH HEADS (AND POSSIBLY
             CYLINDERS ALSO) OR TERMINATE (GO TO MODE 15);
       OR B. (IN RELOCATE) W10987 AT WHICH TIME FORMAT CONTROL
             RETURNS TO IDLE MODE AND WE GO TO MODE 15.             P58

     TEST RELOCATE OP?       (RELOC,PT2GMD15)  MD15  NEXT  W109814    P45
     TEST IS DISK LOC CNTR AT 89?  (LOC_89)    M8_1  NEXT  W11187     P13
     SEND WRITE ADDR MARK CM                                W11089
     DO   INCREMENT ADDRESS CNTR   (INADDRCT)               W11187     P51
     DO   INCREMENT DISK LOC CNTR  (INDSKLOC)               W11187     P51
     GOTO TOP OF MODE 8 AND WRITE AGAIN        MDE8         W11187     P50
                          ------------------------------------------

M8_1 HEAD INITIALIZE OP END TEST AND TERMINATE ROUTINE

     DO   SEND GO IDLE CM          (CMGOIDLE/) CM_LOAD AT W127814   P60,62
     DO   SET MDE4FLOP             (MDE4FLOP)  MDE8*INITIAL           P56
     TEST ARE WE STILL SELECTED?   (SELECT)    NEXT  MD15  W127815  P45,48
     DO   INCREMENT ADDRESS CNTR   (INADDRCT)              W127815     P51
     TEST FULL PACK INITIALIZE?    (N3)        NEXT  MD15  W127815   P4,48
     TEST END OF PACK?             (ENDOFPAK)  MD15  NEXT  W127815   P9,48
     TEST ARE WE ON HEAD 4?        (ACHED2*2)  NEXT  MDE4  W127815      P9
     GOTO NON-OVERLAP POSITIONING - MODE 2     MDE2        W127815     P46
-------------------------------------------------------------------------
```

W11620 (Sheet 10 of 14)

Figure 3-4. Detailed DPEC Flow Chart (Sheet 10 of 14)

```
>>>>>>>>> MDE9  MDE9  MDE9  MDE9  MDE9  MDE9  MDE9 <<<<<<<<<<
MDE9 HEAD SEC LOC CNTR SYNC ROUTINE - MODE 9

     CMNT IN THE RELOCATE AND READ MAINTENANCE OPS WE FIND
          THE DESIRED ADDRESS BY DEAD RECKONING (DISK LOC CNTR)
          AND MUST KNOW ONE SECTOR IN ADVANCE OF AN ADDRESS COMPARE.
          THIS IS WHY WE GIVE THE EXTRA INC DISK LOC UPON ENTERING.    P51
          WHEN WE LOOP BACK AFTER CYL-HEAD NOT EQUAL, WE INC           P15
          AGAIN TO MAINTAIN DISK SYNC.

     DO   SND RD ADDRMRK CM (CM_R/W/,CM_ADD_M/) CM_LOAD @ W1811     P61,62
     DO   START 250 USEC TIMER     (ST250TMR)          W1811         P56

     CMNT A ROGER DM SHOULD BE BACK BY   -   -   -   -   W3814 TIME.
     TEST IS A ROGER DM BACK?      (ROGER_DM) NEXT  MD15  W3814       P70
     CMNT THIS MD15 JUMP SETS TRY DIAG. (BADDMRSP)                    P73

     DO   HALT SEC LOC COUNTER  (INSECLOC=LO)          W3814         P54

     TEST ADDR MARK DM BACK YET?   (ADDRINDX) M9_1  NEXT  ADRIDXUP    P24
     TEST 250-USEC TIMER FINISHED? (TMOT250U) NEXT  BACK1 TIME_OUT    P37

     DO   SET ADDRESS MARK ERROR FF(ADRMRKER) NEXT                    P68
                    ------------------------------------------------

M9_1 DO   FREE SEC LOC COUNTER  (INSECLOC=HI)       TMOT250U+ADRIDXUP P51

     TEST TIMEOUT 250USEC        (TMOT250U)    MDE9  NEXT             P73
     CMNT THE SEC LOC CNTR HAS BEEN HALTED IN THE W480 STATE.
          WE NEED TO CHECK THE TIME LAPSE FROM THE ADDR MARK DM
          TO WHEN THE ADDR SYNC CHAR IS TO ARRIVE.  THE LONGEST
          THAT THIS SHOULD BE IS NINE (9) WORDS.  WE WILL ALLOW
          TEN (10) WORD TIMES.  WHEN WE SEE THE ADDR SYNC CHAR,
          WE WILL LOAD THE SEC LOC CNTR TO W584 (FROM WHEREVER
          IT WAS) AND GO TO MODE 10.  IF THE COUNTER GETS TO
          W11815, WE WILL SAY THAT WE HAVE OVERRUN THE ADDR SYNC
          CHAR FIELD.

     TEST ADDR SYNC CHAR DETECTED? (STADRCMP) M9_2  NEXT  STADRCMP    P38
     TEST PASSED ADDR SYNC FIELD?  (W11815)   NEXT  BACK1 W11815      .
                    ------------------------------------------------

M9_2 HEAD ACTUAL ADDRESS COMPARE

     CMNT THIS COMPARE IS BETWEEN THE HEADER ADDRESS AND THE CONTENTS
          OF THE ADDRESS COUNTER JUST AS IN RWV, BUT ONLY THE
          CYLINDER AND HEAD PORTIONS OF THE COMPARE ARE USED.

     CMNT THE ADDRESS COMPARE IS HANDLED AUTOMATICALLY BY THE
          ADDRESS LOGIC BLOCK'S CONTROL AND THE RESULTS OF THE
          COMPARE WILL BE AVAILABLE AT W734 TIME.

     DO   SEND GO IDLE CM          (CMGOIDLE/) CM_LOAD AT W686     P60,62
     TEST CYL AND HEAD COMPARE?    (CYLHDEQL) MD10  M9_3  W11814     P15

     CMNT WE >>DO NOT<< CLEAR SEC LOC CNTR WHEN GOING TO MODE 10.
                    ------------------------------------------------

M9_3 HEAD NO COMPARE ROUTINE

     CMNT THE ADDR MARK COUNTER IS USED TO KEEP TRACK OF
          HOW MANY ATTEMPTS WE HAVE MADE AT FINDING THE
          CORRECT TRACK ADDRESS.  IT IS CLEARED BY MODE 1 AND
          INCREMENTED AT W734 TIME IF ADDRESS COMPARE WAS
          NOT EQUAL.  WHEN ADMRK127 GOES TRUE WE
          GO TO MODE 15 AND REPORT NO TRACK COMPARE.

     DO   INCREMENT ADDR MARK CNTR (INADRMRK)            W11814      P45

     TEST IS ADMRK127 BIT ON?      (ADMRK127) NEXT  MDE9  W11814      P64
     DO   INDSKLOC                 (INDSKLOC)           W11814      P51
     DO   GO TO MD15               (PT3GMD15)           W13815      P48
-------------------------------------------------------------------------
```

W11620 (Sheet 11 of 14)

Figure 3-4. Detailed DPEC Flow Chart (Sheet 11 of 14)

```
>>>>>>>>> MD10  MD10  MD10  MD10  MD10  MD10  MD10 <<<<<<<<<<
MD10 HEAD DEAD RECKONING ADDRESS SEARCH - MODE 10

     CMNT THIS ROUTINE IS USED IN THE RELOCATE AND THE READ MAINTENANCE
          OPS TO FIND THE DESIRED SECTOR LOCATION.  WE ENTER THIS MODE
          AT W12815 TIME FROM MODE 9 AFTER THE DISK LOC CNTR AND THE
          SECTOR LOC CNTR HAVE BOTH BEEN SYNCHRONIZED TO THE DISK,
          OR FROM MODE 11 AFTER IT HAS WRITTEN THE RELOCATE FLAG IF
          WE WERE ALREADY ON HEAD 4 AND THEREFORE DO NOT NEED TO
          RE-SYNCHRONIZE THE SEC LOC CNTR.  THIS SYNCHRONISM TO THE
          DISK IS MAINTAINED BY THE MODULO 223 BYTE MODE OF THE
          SEC LOC CNTR.  THE SECTOR ADDRESS COMPARE IS BETWEEN
          THE OUTPUT OF THE INTERLEAVE LOGIC (DISK LOC CNTR) AND
          EITHER THE SECTOR PORTION OF THE ADDRESS COUNTER (IN
          THE FIRST PASS OF RELOCATE AND IN READ MAINTENANCE)
          OR THE 84-ADDER (IN RELOCATE PASS TWO).

     TEST DISK LOC COMPARE EQUAL?  (DSKLOCEQ) NEXT  SKIP1 W2988        P14
     TEST RELOCATE OP?             (RELOC)    M10B  M10A  W2988        P45
     DO   SET LOOP MODE 10 FF      (LOOPMD10) M10B        W2988        P56

     DO   SND RD ADDRMRK CM (CM_R/W/,CM_ADD_M/) CM_LOAD @ W2988      P61,62
     DO   START 250 USEC TIMER     (ST250TMR)             W2988        P56
M10B DO   LOAD SEC LOC TO MINUS 45 WORDS (LOC=ZERO)       W61B14       P13
     TEST DISK LOC COMPARE EQUAL?  (DSKLOCEQ) NEXT  M10C  W10889       P14
     TEST RELOCATE OP?             (RELOC)    NEXT  MD12  W10889       P45
     DO   SND WR ADDRMRK CM (CM_R/W,CM_ADD_M/) CM_LOAD AT W10889     P61,62
     MAKE FRMT CTRL MODE=WRIT ZERO (FMWRZERO)             W10889       P52

M10C DO   INCREMENT DISK LOC CNTR  (INDSKLOC)             W10B815      P51

     TEST IS LOOP MODE 10 FF SET?  (LOOPMD10) M10D  NEXT  W10987       P56

     CMNT RELOC IS ALL THAT IS LEFT FOR THE NEXT TEST.
     TEST RELOC FLAG WRITTEN YET?  (FLAGWRTN) MDE8  MD11  W10987       P57

                          ----------------------------------------------

M10D DO   CLEAR LOOP MODE 10 FF    (LOOPMD10)             W11187       P56
     GOTO TOP OF MODE 10 AGAIN                 MD10      W11187       P48

     CMNT ALL WE DO TO GET BACK TO THE TOP OF MODE 10 IS TO CLEAR
          THE SECTOR LOCATION COUNTER AT W11187 TIME.

     CMNT FOR BOTH PASSES OF THE RELOCATE OP, THE WRITTEN SECTORS
          ARE TO BE PRECESSED FORWARD BY FOUR (4) BYTES TO ASSURE
          THAT THE NEWLY-WRITTEN ADDRESS MARK WILL COVER THE
          ORIGINAL ONE.  WE SEND THE WR ADDR MARK CM SO THAT IT
          GOES ACTIVE IN THE DRIVE AT W10988 TIME.  SINCE WE BRANCH
          TO EITHER MODE 11 OR MODE 8 AT THE SAME TIME, THIS (ACTUAL)
          W10988 TIME BECOMES W080 TIME FOR THE NEW SECTOR.

-------------------------------------------------------------------------
>>>>>>>>> MD11  MD11  MD11  MD11  MD11  MD11  MD11 <<<<<<<<<<
MD11 HEAD WRITE RELOCATE FLAG ROUTINE - MODE 11

     CMNT THIS ROUTINE IS SIMILAR TO INITIALIZE FOR THE FIRST PART
          THE SECTOR.  WE ENTER MODE 11 FROM MODE 10 AFTER IT
          GAVE A WR ADDR MARK CM WHICH GOES ACTIVE IN THE DRIVE
          JUST AS WE ENTER HERE.

     MAKE FRMT CTRL MODE=WRIT ONES (FMWRONES)             W4B13        P58
     MAKE FRMT CTRL MODE=WRIT ZERO (FMWRZERO)             W791         P52
     DO   SEND GO IDLE CM          (CMGOIDLE/) CM_LOAD AT W885       P60,62
     MAKE FRMT CTRL MODE = IDLE    (FMGOIDLE)             W885         P58

     CMNT THE GO IDLE CM GOES ACTIVE IN THE DRIVE AT THE END OF ITS
          WRITE BIT (#2), THAT IS AT THE END OF W7B11 TIME.


     TEST ARE WE ON HEAD 4?        (HEAD_4)   SKIP1 NEXT  W64B14        .
     DO   SEND A HEAD SWITCH CM    (ENABL_WR) CM_LOAD AT W64B14    P60,62
     DO   GENERATE HEAD_4 ADDRESS+EPC (CM2-0*M11/)       W64B14       P62
     CMNT WHEN WE SEND THIS HEAD SWITCH CM, WE MUST FORCE THE
          CM LOGIC BLOCK TO SEE HEAD #4 EVEN THOUGH THAT IS NOT
          WHAT THE ADDRESS COUNTER SAYS.

     DO   INCREMENT DISK LOC CNTR  (INDSKLOC)             W10487       P51
     GOTO MODE 9                                          W10487       P47

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Figure 3-4. Detailed DPEC Flow Chart (Sheet 12 of 14)

```
>>>>>>>>> MD12  MD12  MD12  MD12  MD12  MD12  MD12 <<<<<<<<<<
MD12 HEAD READ MAINTENANCE DATA TRANSFER - MODE 12

     CMNT THE READ MAINTENANCE OP INVOLVES THE RAW, UNFORMATTED
          TRANSMISSION TO THE PROCESSOR OF ALL OF THE ROUGHLY 220
          BYTES OF DATA BETWEEN SECTOR MARKS.
          WE WILL BEGIN BY ASKING FOR THE READING OF THE ADDRESS
          MARK WHICH WILL CAUSE THE DRIVE'S VFO TO BE SYNCHRONIZED
          AT THE CORRECT TIME, THEN WE WILL ASK FOR THE READING OF
          DATA BEFORE THE DATA FIELD.  THIS WILL CAUSE THE VFO TO
          BE SYNC'ED AGAIN.
          IF THE ADDRESS MARK IS DETECTED AT THE EARLIEST POSSIBLE
          POINT, ADDRINDX WILL GO TRUE AT ABOUT W184 TIME.  WE HAVE
          THEREFORE HALTED THE SEC LOC CNTR AT W184 AND WILL RELEASE
          IT UPON THE RISE OF ADDRINDX.

     DO   HALT SEC LOC COUNTER  (INSECLOC=LO)              W281          P54

     TEST ADDR MARK DM BACK YET?   (ADDRINDX) M12A  NEXT  ADRIDXUP      P24
     TEST 250-USEC TIMER FINISHED? (TMOT250U) NEXT  BACK1 TIME_OUT      P37
     DO   SET ADDR MARK TIMEOUT FF (ADRMRKER) MD15        TIME_OUT      P68

                    ------------------------------------------------

M12A DO   FREE SEC LOC COUNTER  (INSECLOC=HI)              ADRIDXUP      P51

     MAKE FRMT CTRL MODE=READ DATA (FMRDDATA)              W2B14         P58

     CMNT WE ARE NOW SENDING DATA TO THE PROCESSOR WITHOUT ANY
          IDEA AS TO WHERE THE REAL WORD BOUNDARIES ARE.

     DO   SEND A GO IDLE CM          (CMGOIDLE/) CM_LOAD AT W686       P60,62
     DO   SEND READ DATA CM            (CM_R/W/) CM_LOAD AT W10814     P60,62

     DO   SEND A GO IDLE CM          (CMGOIDLE/) CM_LOAD AT W11987     P61,62
     MAKE FRMT CTRL MODE = IDLE      (FMGOIDLE)            W119815       P58
     GOTO TERMINATE AND DISPLAY RD ROUTINE     MD15        W119815       P49

-------------------------------------------------------------------------------
>>>>>>>>> MD13  MD13  MD13  MD13  MD13  MD13  MD13 <<<<<<<<<<
MD13 HEAD SEND ERD ROUTINE - MODE 13

     CMNT ALL WE MUST DO IN THIS OP IS TO TELL THE ERD LOGIC TO
          START TRANSMISSION, WAIT LONG ENOUGH FOR HIM TO FINISH,
          THEN SEND AN ALL ZEROS RESULT DESCRIPTOR.

     DO   START ERD TRANSMISSION   (STERDOUT)              W0B15         P58
     MAKE FRMT CTRL MODE=READ DATA (FMRDDATA)              W0B15         P58

     CMNT THE READ BUFFER BUS ENABLE LINE (RDBFBSEN) IS USUALLY
          TRUE DURING THE FORMAT CONTROL READ DATA MODE, BUT
          WE DISABLE THIS TERM WITH THE SEND_ERD LINE.
          ALL WE ARE USING FORMAT CTRL FOR NOW IS TO PRODUCE
          CK_DPC WHICH WILL FIRST OCCUR AT   -   -   -     W2B12-14TIME P66
          AND WILL CONTINUE THEREAFTER ONCE PER WORD UNTIL ONE
          WORD AFTER WE TELL FRMT CTRL TO GO IDLE.                      P58

     TEST IS TRANSMISSION FINISHED?(ERDXMTNG) NEXT  SAME  NOT W0        P25

     MAKE FRMT CTRL MODE = IDLE    (FMGOIDLE)              ERDXMTNG/*W0/P58

     CMNT FORMAT CONTROL ENTERS THE READ DATA MODE WITH THE
          BEGINNING OF W180.  SINCE THE CK_DPC IS DELAYED BY ONE
          WORD TIME IN THE READ DATA MODE, CK_DPC WILL BE                P66
          GIVEN AT B12-14 TIME STARTING WITH W2 AND ENDING
          ONE WORD TIME AFTER THE ERDXMTNG LINE DROPS.  IF THE
          ERD LOGIC IS SET UP TO SEND FOUR WORDS OF DATA, THEN
          ITS ERDXMTNG LINE WILL DROP AT THE END OF W5B14 TIME.
          THIS WILL CAUSE FORMAT CONTROL TO ENTER ITS IDLE MODE          P58
          AT THE BEGINNING OF W680 TIME.

     GOTO TERMINATE AND DISPLAY RD ROUTINE    MD15         W11814        P49

-------------------------------------------------------------------------------
```

W11620 (Sheet 13 of 14)

Figure 3-4. Detailed DPEC Flow Chart (Sheet 13 of 14)

```
>>>>>>>>> MD14  MD14  MD14  MD14  MD14  MD14  MD14 <<<<<<<<<<<
MD14 HEAD TEST OP PROCESSING - MODE 14

     CMNT TESTOP IS MERELY TO INFORM THE PROCESSOR OF THE
          STATUS OF THE DRIVE AND OPTIONALLY TO POWER IT DOWN
          OR TO CLEAR ALL SEEK STATUS FF'S.                            P55

     TEST POWER DOWN REQUESTED?    (N3)        NEXT  SKIP1 W0B14        P4
     DO   SEND POWER DOWN CM              (MD14) CM_LOAD AT W0B14    P50,62

     TEST CLEAR ALL SKSTATUS FF?   (N2)        NEXT  SKIP1 W0B14        P4
     DO   CLEAR ALL SKSTATUS FF'S  (CLALSKST)              W0B14       P55

     GOTO TERMINATE AND DISPLAY RD - MODE 15  MD15         W0B14       P49
----------------------------------------------------------------------------
>>>>>>>>> MD15  MD15  MD15  MD15  MD15  MD15  MD15 <<<<<<<<<<<
MD15 HEAD TERMINATE AND DISPLAY RD - MODE 15

     CMNT IN ALL OPS EXCEPT TESTOP AND SEND_ERD, WE MUST ASK           P67
          THE DRIVE TO SEND THE CONTENTS OF ITS STATUS REGISTER
          SO WE CAN SEE IF IT HAS A TEMP WARNING CONDITION.

     DO   DROP READY LINE          (READY)               GTM10R15      P56
     TEST IS THIS OP A TESTOP?     (TESTOP)   M15B  NEXT  W0B14        P67
     TEST IS OP A TRANSMIT ERD?    (SEND_ERD) M15B  NEXT  W0B14        P67
     TEST DO WE NEED TO RESTORE?   (NDTORSTR) M15A  NEXT  W0B14        P57
     TEST WAS THIS A LONG DM TRM./  (LONG_DM) M15B NEXT  W0B14        P73
     DO   SEND "SEND STATUS" CM     (SEND_STS) CM_LOAD AT W0B14    P60,62

     CMNT DM SHOULD BE BACK BY -   - (DM_RCVD) -   -   -  W8B14 TIME   P23
     GOTO . . . . . . . . . . . . . . . . .   M15B        W8B15        P35
                            ------------------------------------------------

M15A HEAD THIS IS THE RESTORE ROUTINE
     DO   SND RSTR-SNDSTTS CM (SEND_STS,RESTORE) CM_LD AT W0B14  P54,60,62
     DO   UPDATE OLD CYL MEMORY     (CKADDMEM)            W0B14        P62
     DO   HALT SEC LOC COUNTER   (INSECLOC=LO)            W0B14        P54
     DO FREE SEC LOC CNTR        (INSECLOC=HI)            W0B15         .
     DO GO TO MODE15B                          M15B        W8B15       P35
                            ------------------------------------------------

M15B HEAD DISPLAY RD AND DROP BUSY SEQUENCE

     MAKE FRMT CTRL MODE = SEND RD (FMSENDRD)             W8B15        P58
     MAKE FRMT CTRL MODE = IDLE    (FMGOIDLE)             W9B15        P58

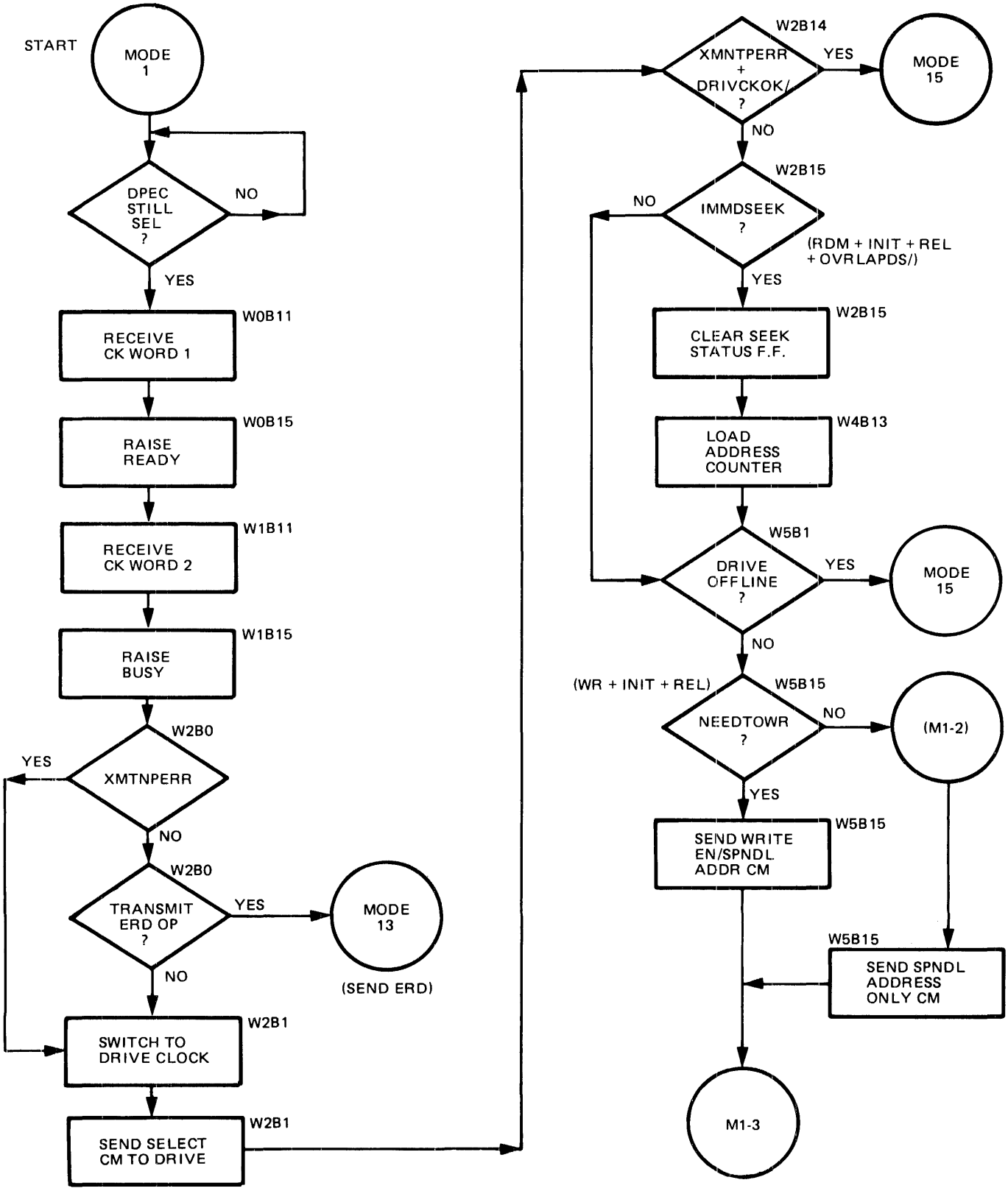
     CMNT THE ACTUAL RD CK_DPC WILL BE AT   .   .   .   . W10B12-14    P66

     DO   DROP BUSY                (KTRMBUSY)             W11B14       P56

     DO    GO IDLE                 (GOTOMDE1)  MDE1       W11B14       P46
----------------------------------------------------------------------------
```

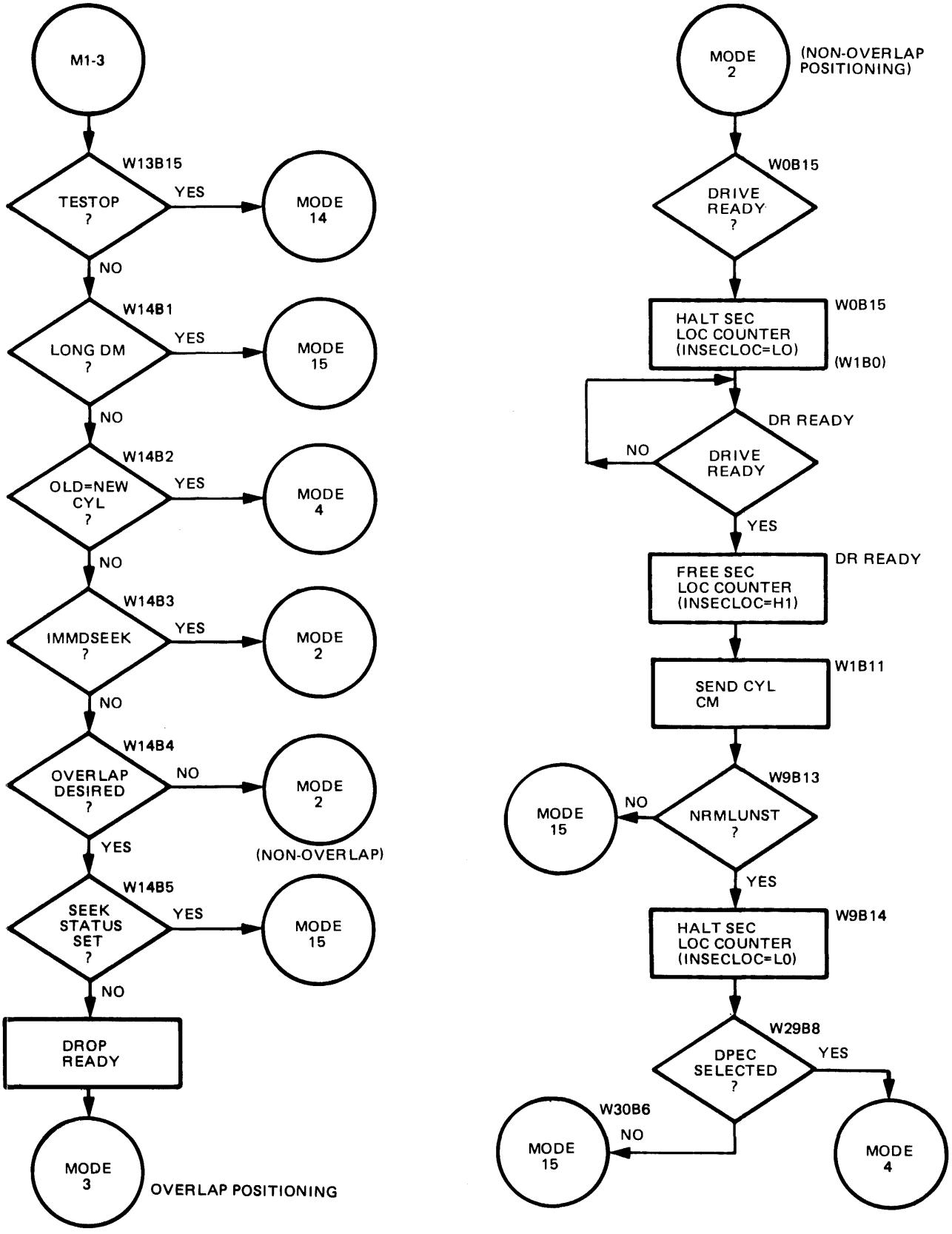
W11620 (Sheet 14 of 14)

Figure 3-4. Detailed DPEC Flow Chart (Sheet 14 of 14)



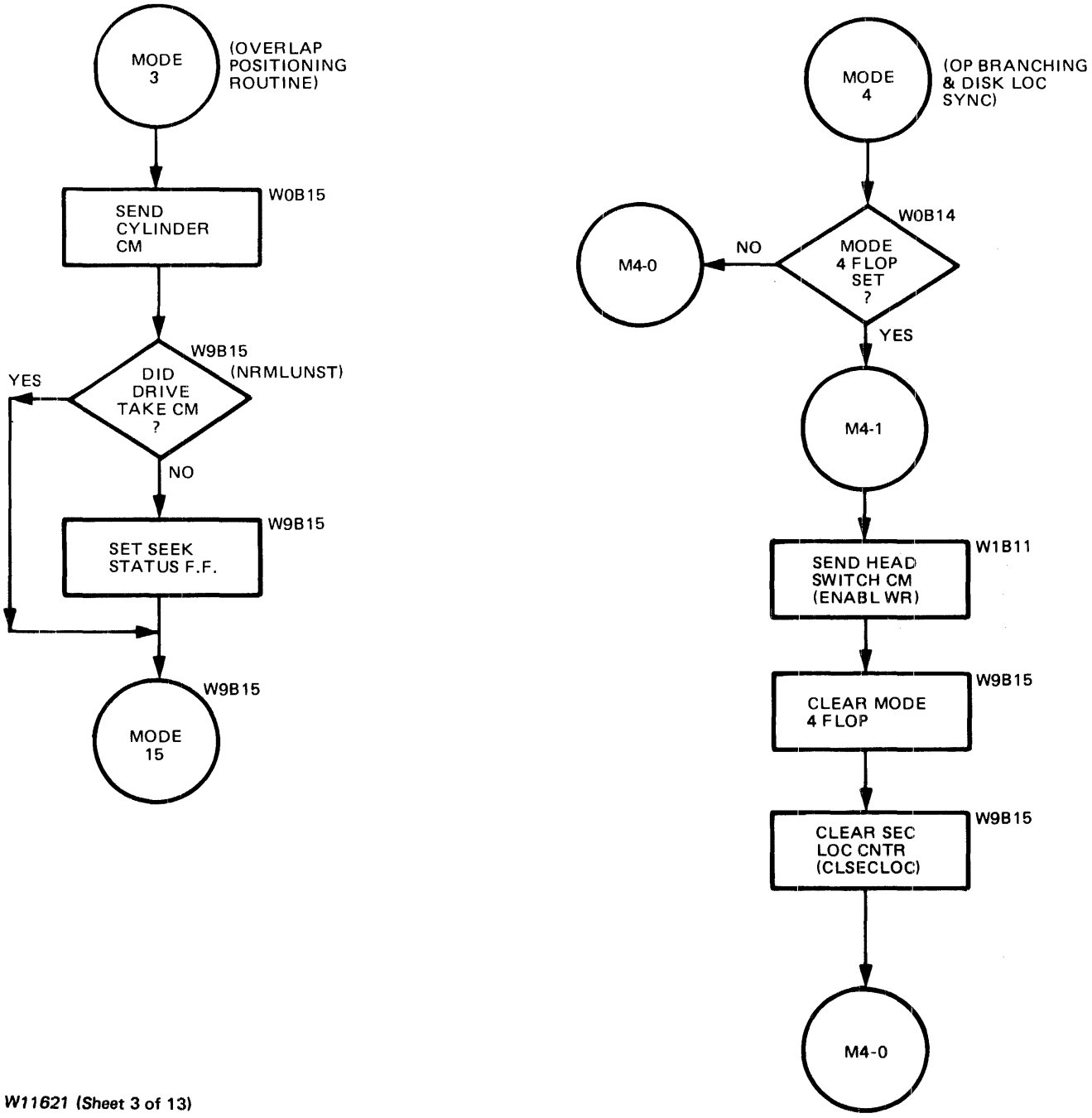
W11621 (Sheet 1 of 13)

Figure 3-5. Read and Write and Verify Operation (Sheet 1 of 13)



W11621 (Sheet 2 of 13) A

Figure 3-5. Read and Write and Verify Operation (Sheet 2 of 13)



W11621 (Sheet 3 of 13)

Figure 3-5. Read and Write and Verify Operation (Sheet 3 of 13)

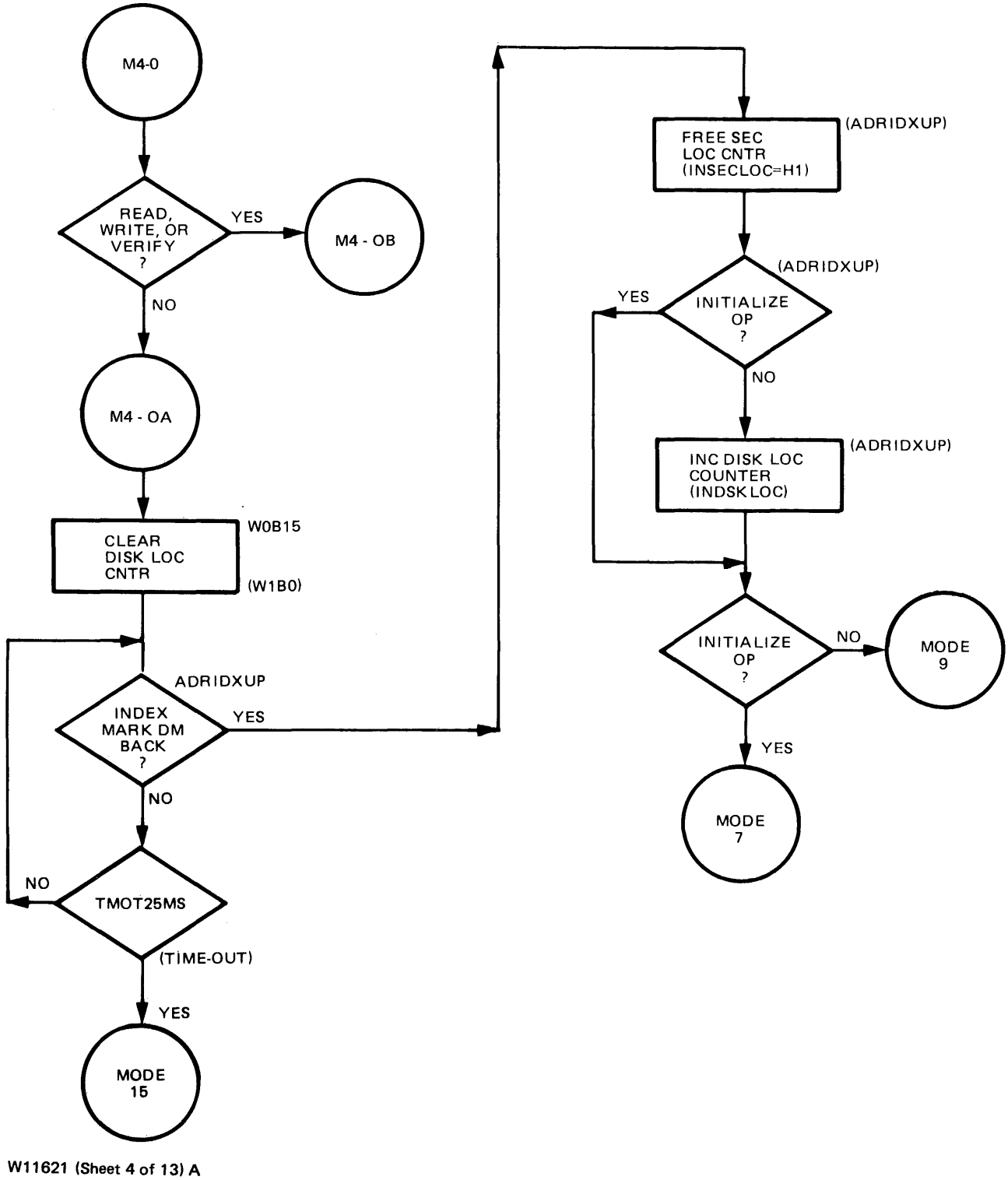
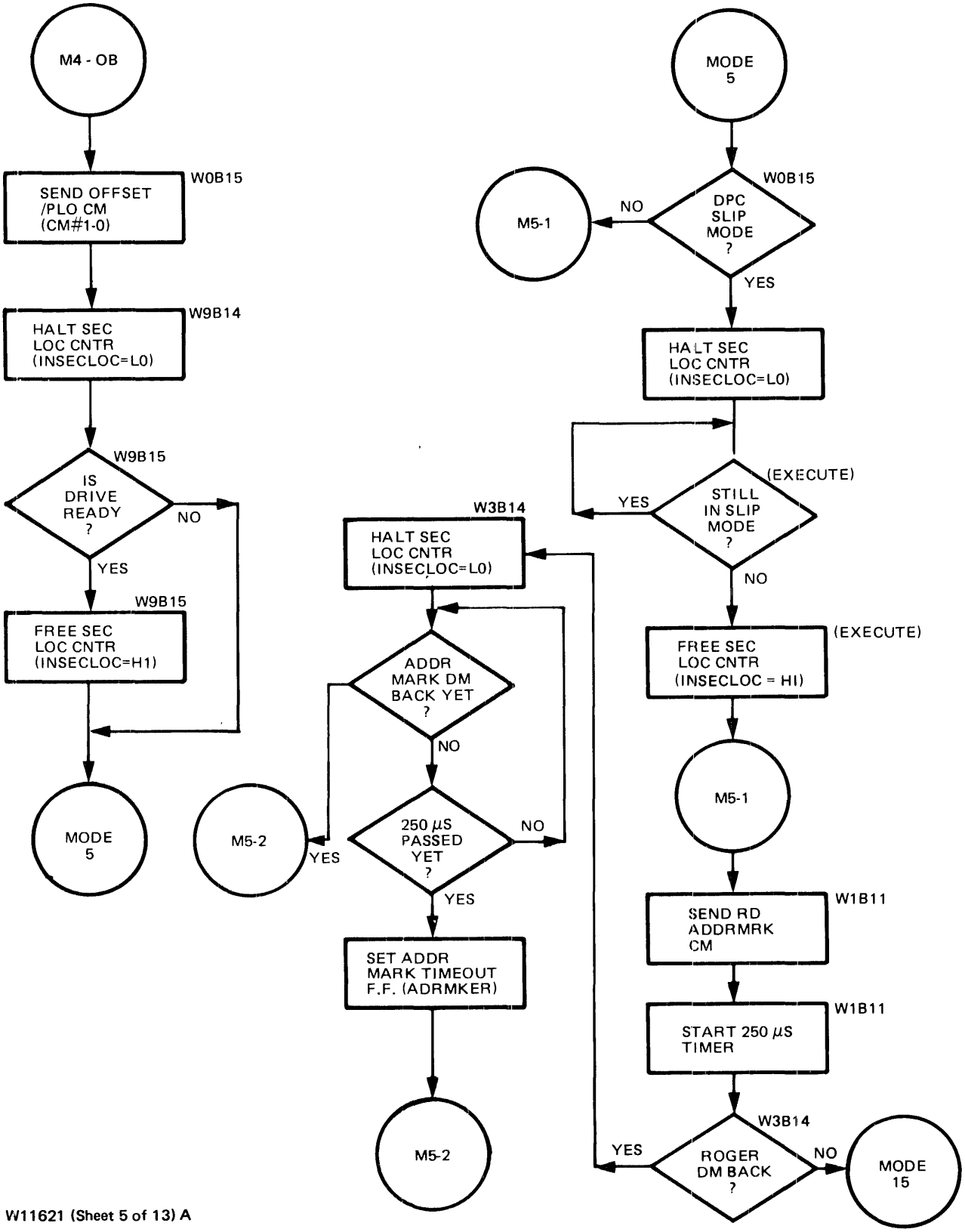
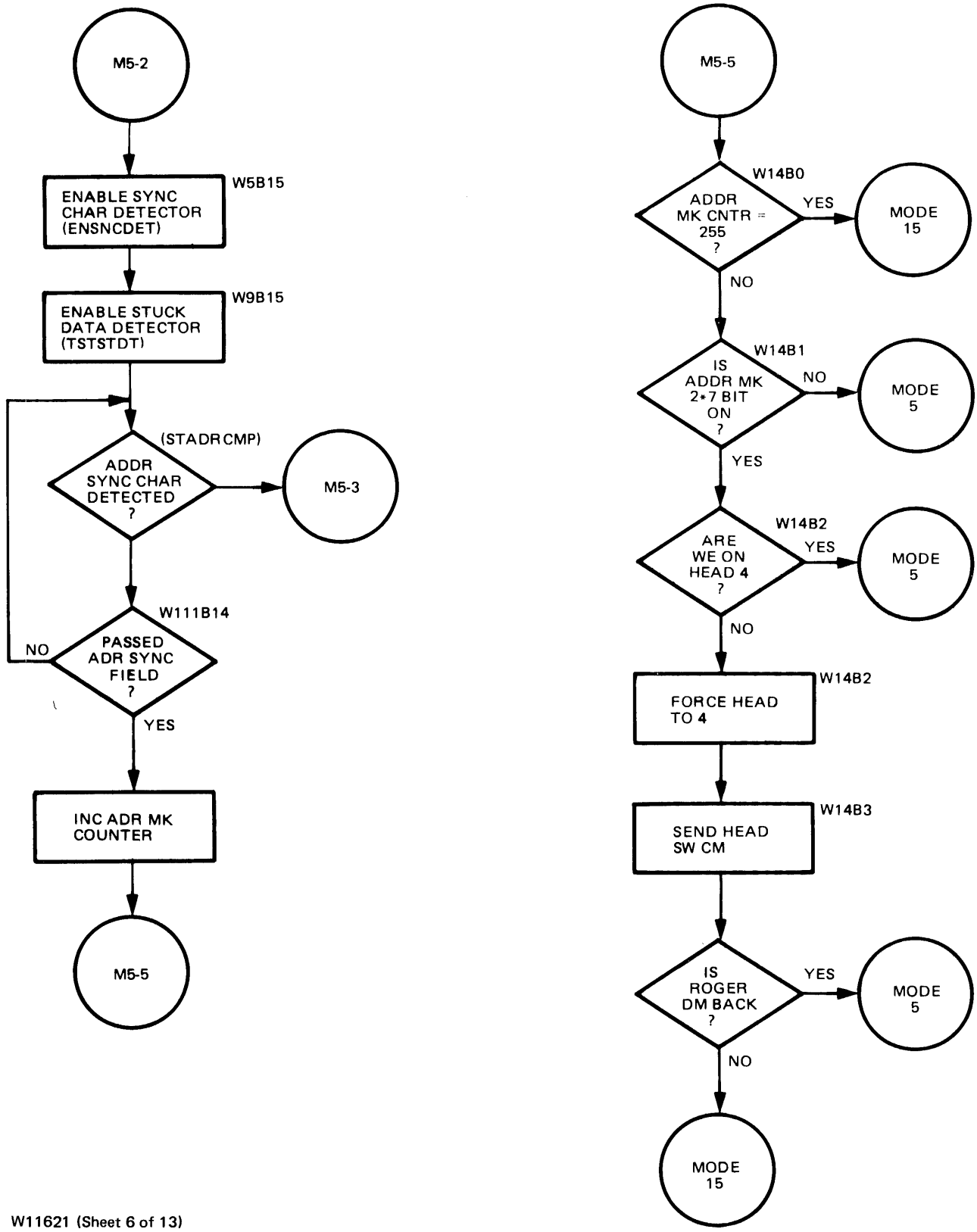


Figure 3-5. Read and Write and Verify Operation (Sheet 4 of 13)



W11621 (Sheet 5 of 13) A

Figure 3-5. Read and Write and Verify Operation (Sheet 5 of 13)



W11621 (Sheet 6 of 13)

Figure 3-5. Read and Write and Verify Operation (Sheet 6 of 13)

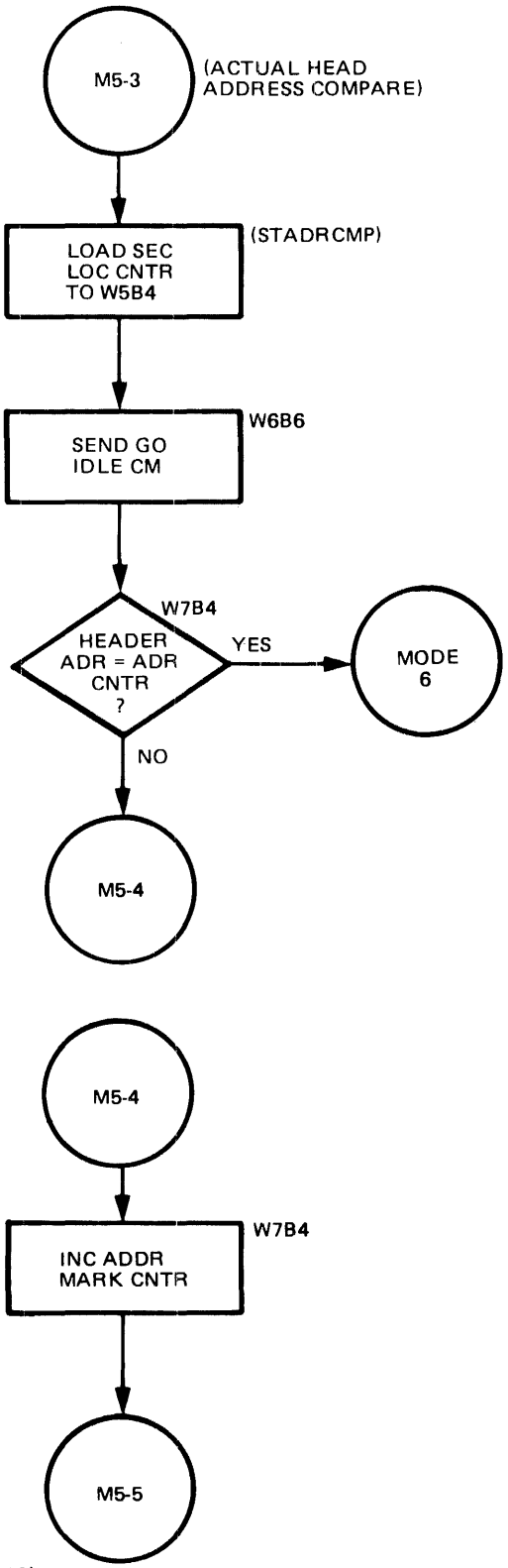


Figure 3-5. Read and Write and Verify Operation (Sheet 7 of 13)

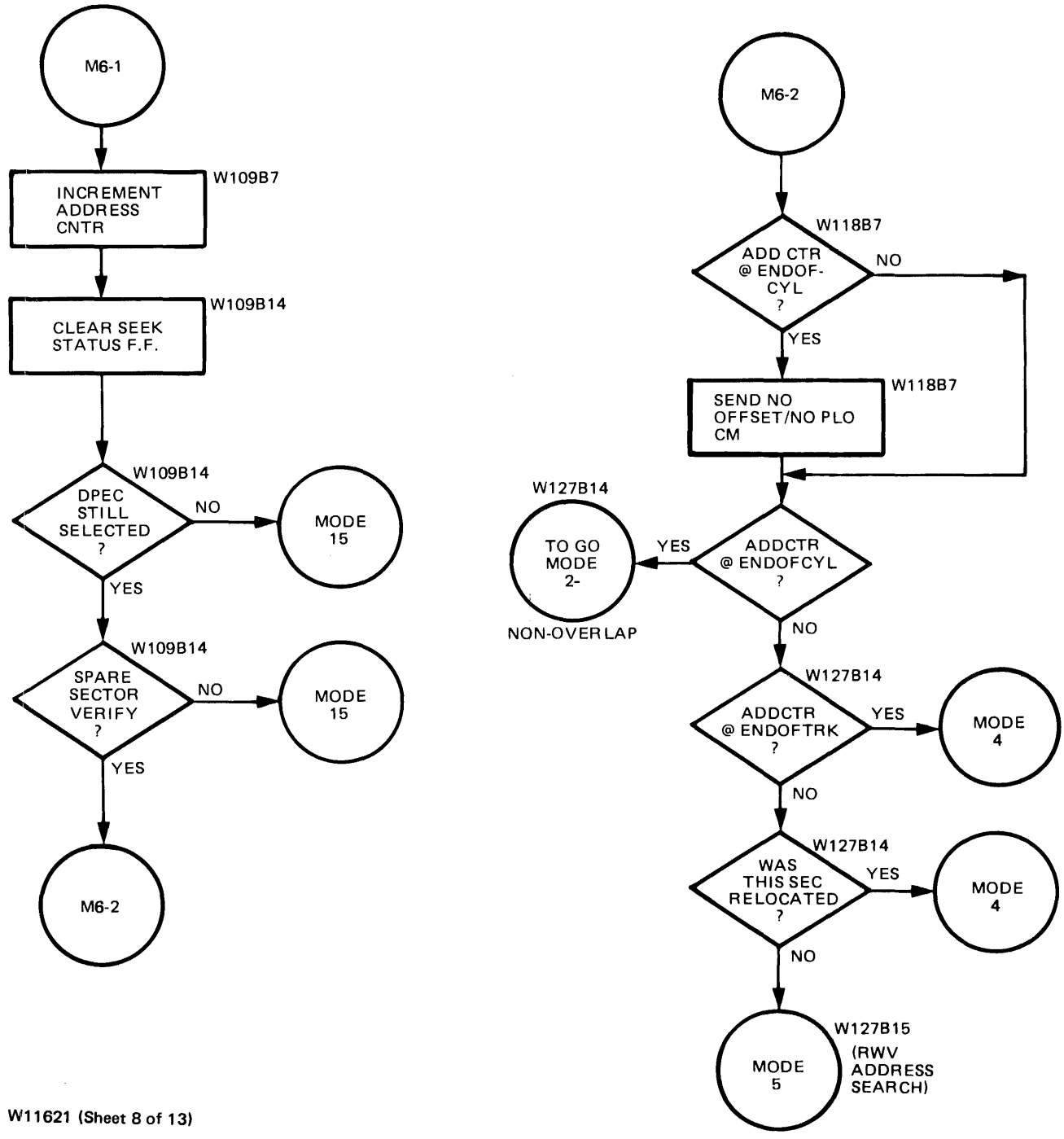


Figure 3-5. Read and Write and Verify Operation (Sheet 8 of 13)

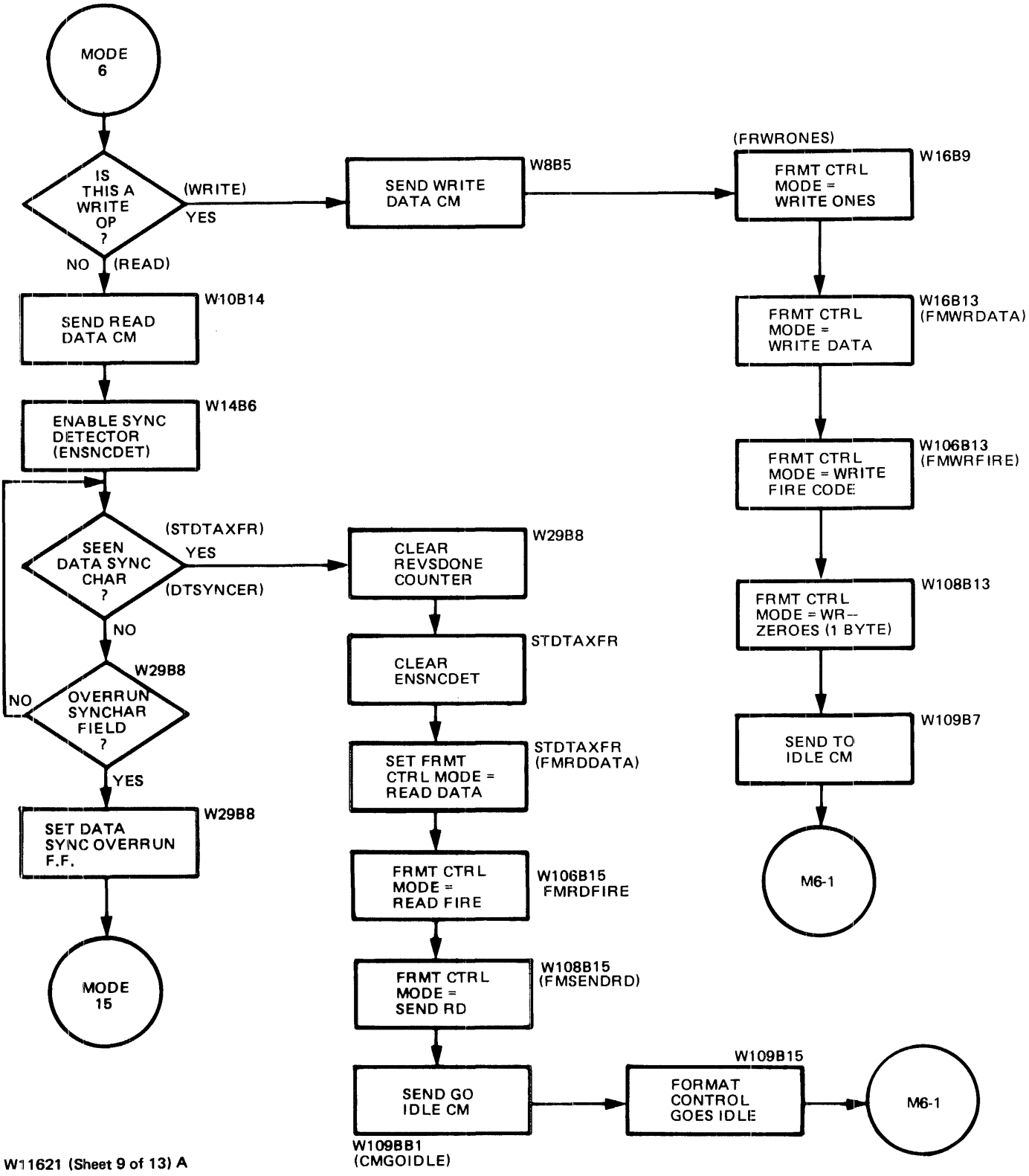
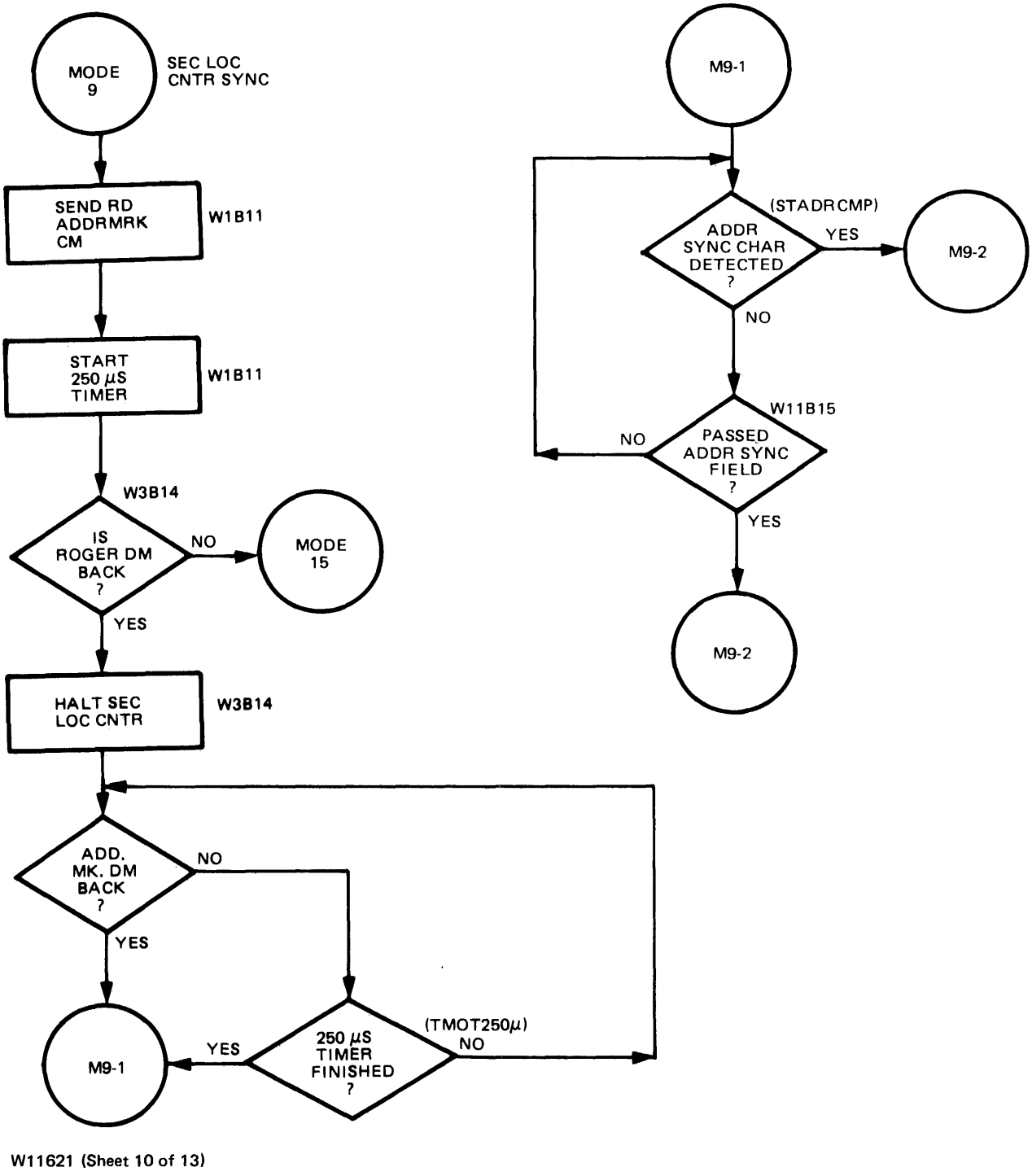


Figure 3-5. Read and Write and Verify Operation (Sheet 9 of 13)



W11621 (Sheet 10 of 13)

Figure 3-5. Read and Write and Verify Operation (Sheet 10 of 13)

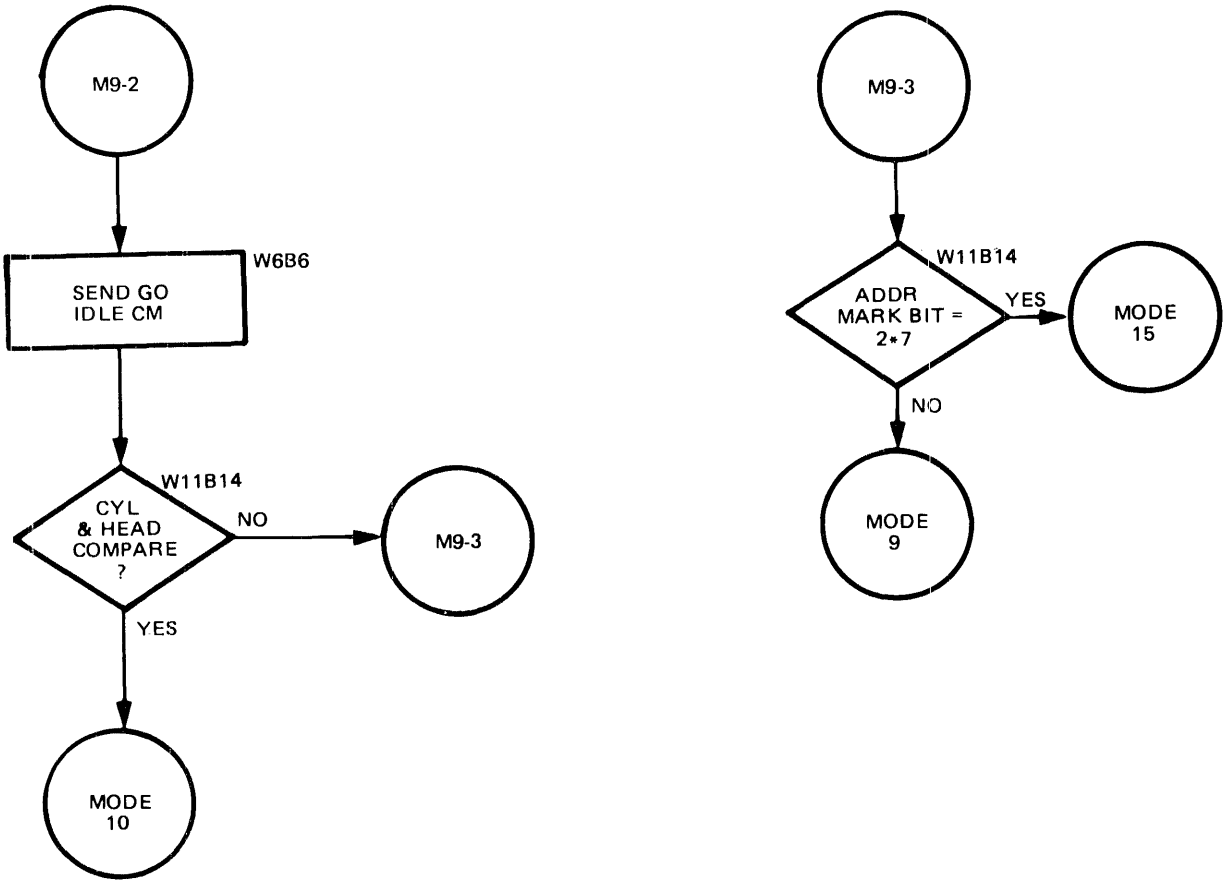
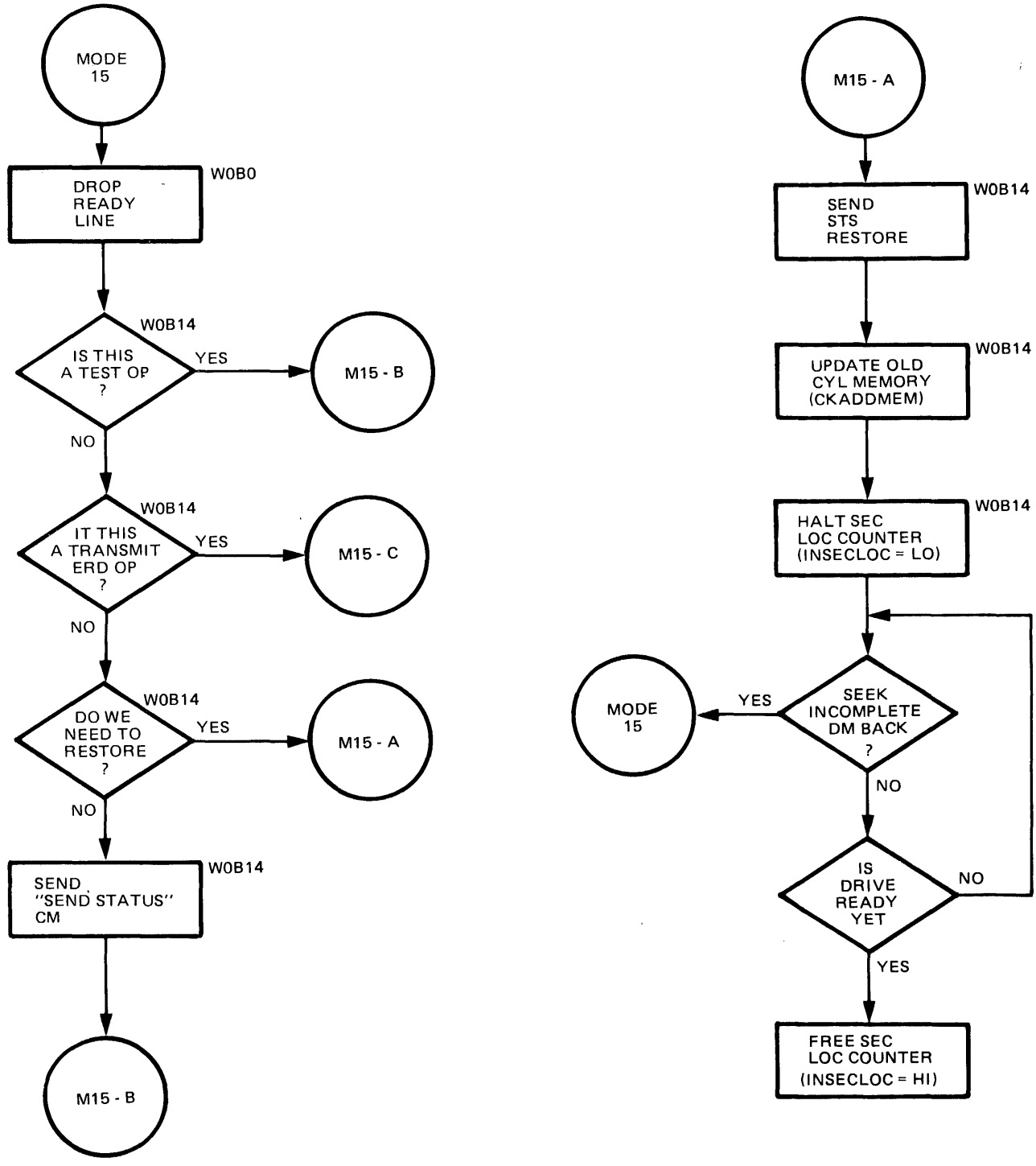
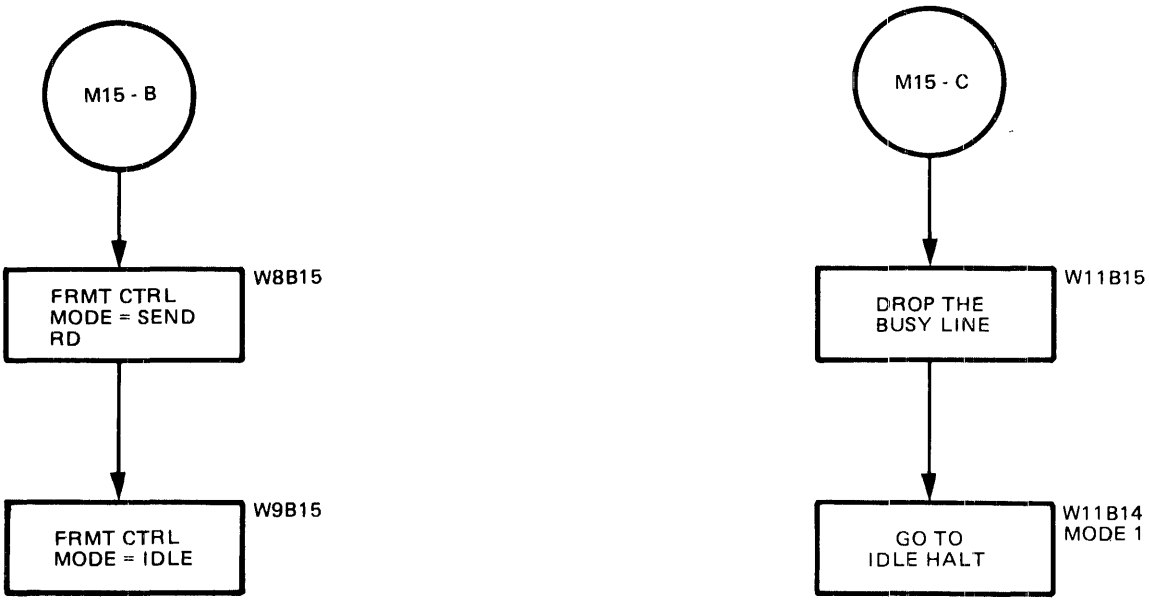


Figure 3-5. Read and Write and Verify Operation (Sheet 11 of 13)



W11621 (Sheet 12 of 13) A

Figure 3-5. Read and Write and Verify Operation (Sheet 12 of 13)



W11621 (Sheet 13 of 13) A

Figure 3-5. Read and Write and Verify Operation (Sheet 13 of 13)

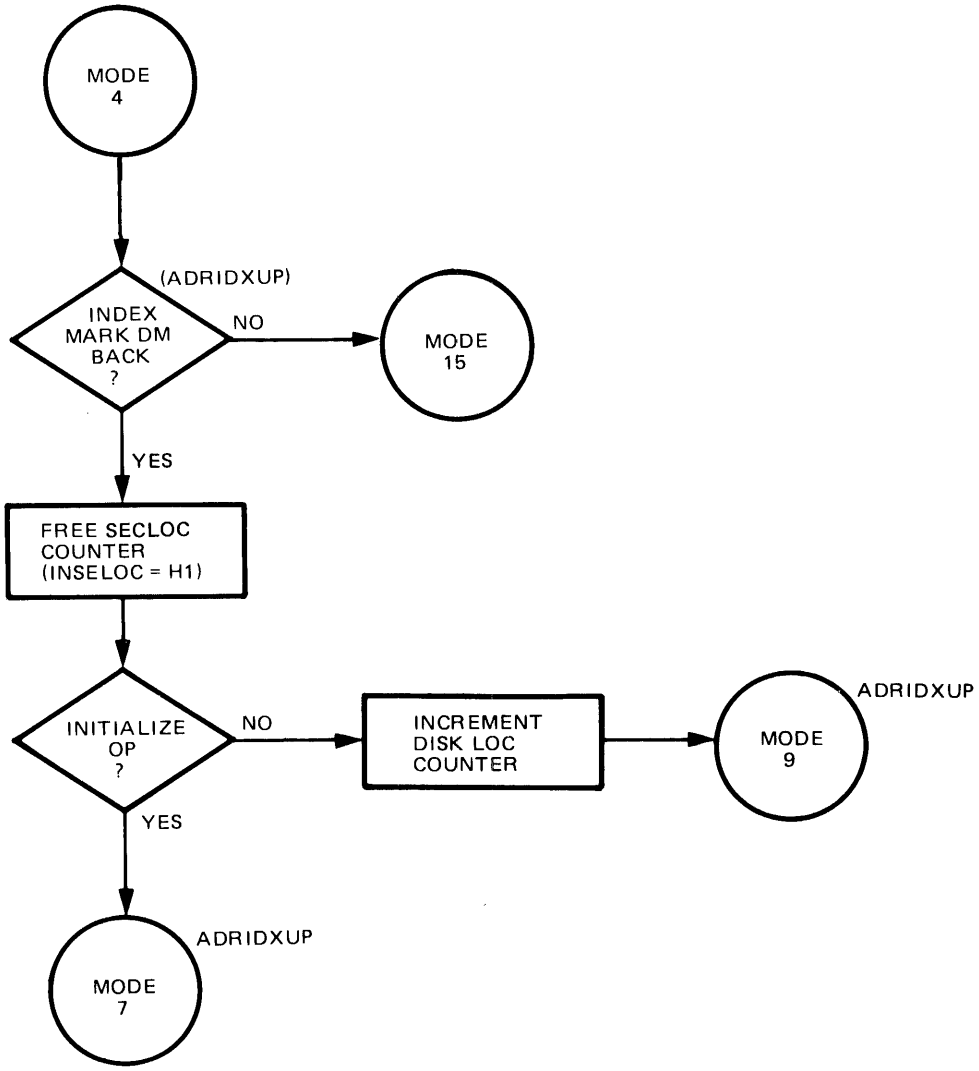


Figure 3-6. Initialize Operation (Sheet 1 of 3)

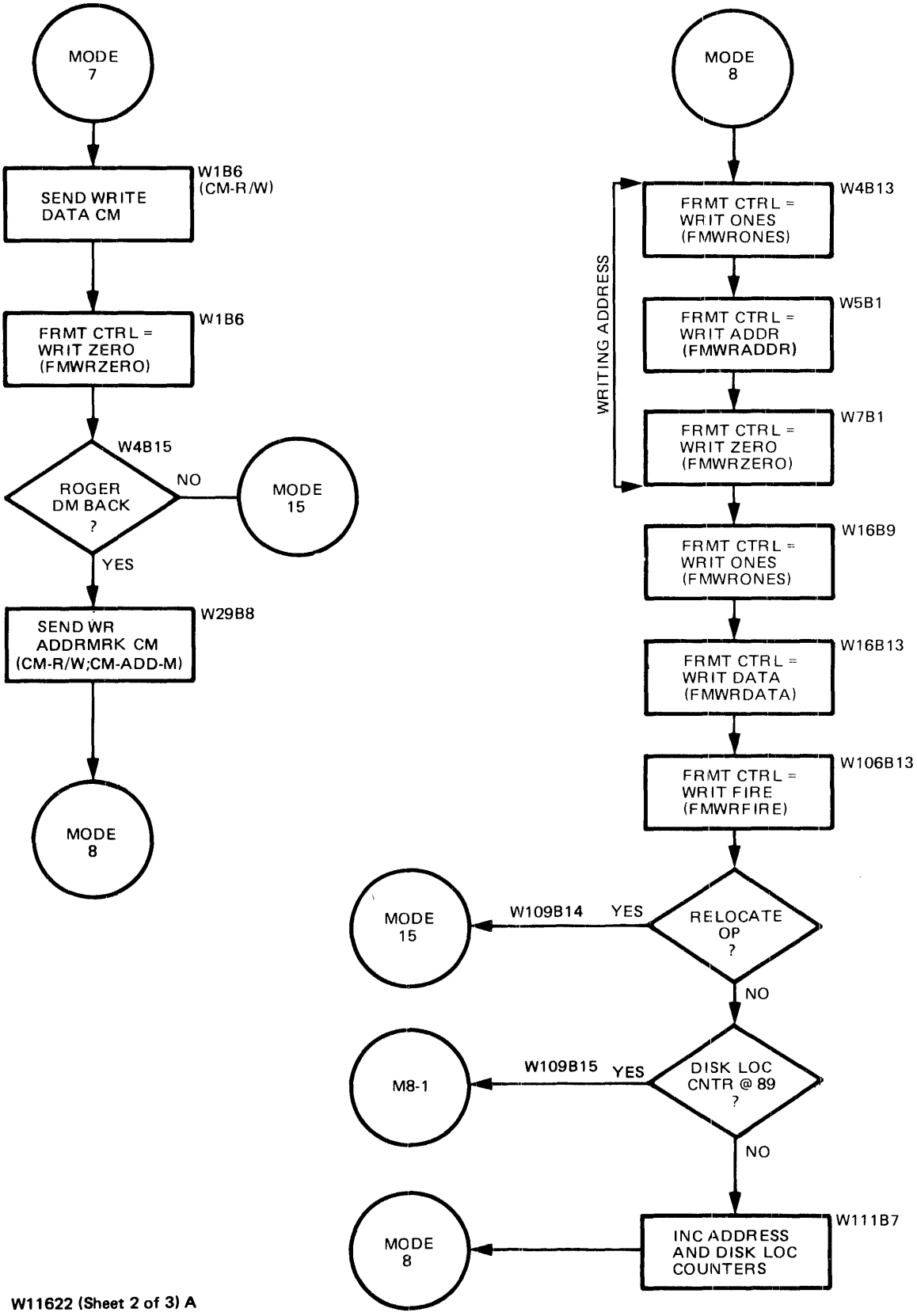
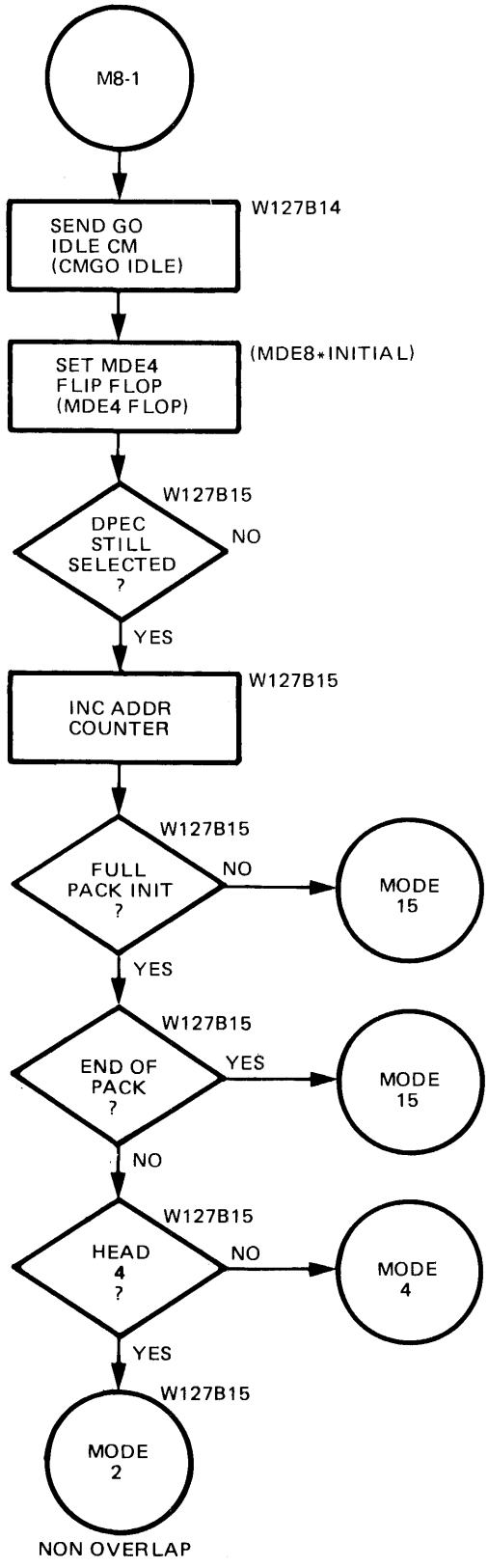


Figure 3-6. Initialize Operation (Sheet 2 of 3)



W11622 (Sheet 3 of 3)A

Figure 3-6. Initialize Operation (Sheet 3 of 3)

Table 3-2. Main Mode Jump Conditions

TO MODE	FINAL TERM	PAGE NO.	PARTIAL TERMS	PAGE NO.	SUB-PART TERMS	PAGE NO.	FROM MODE	UNDER THE FOLLOWING CONDITIONS:	SOURCE PIN	PAGE NO.
MDE0	PWR R SYNC	P42					PWR OFF	APPLICATION OF A.C. POWER - HOLDS 25 SEC.	0B07	P12
MDE1	GOTOMDE1	P46	L0A04	P46			MDE0	W9B15 } * PWR R SYNC/	0A04	P46
			L0A07	P46			MD15	W11B14 }	0A07	P46
			PBMN CLR	P42			ANY	ALL EXCEPT PWR R SYNC	0A06	P42
MDE2	GOTOMDE2	P46	L2C07	P46	LOB08	P46	MDE1	W14B3 * IMMDSEEK	0B08	P46
					LOB05	P46	MDE1	W14B4 * NOEXCHNG/	0B05	P46
			L0R04	P46			MDE6	W127B14 * ENDOFTRK * ENDOFCYL	0B04	P46
			L1B08	P46			MDE8	W127B15 * ACHED2*2 * MDE8TERM/	1B08	P46
MDE3	GOTOMDE3	P46					MDE1	W14B6	2J04	P46
MDE4	GOTOMDE4	P46	L0D04	P46			MDE1	W14B2 * OLD=NEW	0D04	P46
			L0D07	P46			MDE2	W29B8 * SELECT	0D07	P46
			PTGT4FR6	P71			MDE6	W127B14 * FCD HD TO 4	2D04	P71
			L2W03	P46			MDE6	W127B14 * ENDOFTRK * ENDOFCYL/	2W03	P46
			L1C07	P46			MDE8	W127B15 * ACHED2*2/ * MDE8TERM/	1C07	P46
MDE5	GOTOMDE5	P47	GOTO5FR4	P73			MDE4	W11B14 * RWV * MDE4FLOP/	3P04	P73
			L0E07	P47			MDE5	W14B1 * ADMRK127/	0E07	P47
			L0F08	P47			MDE5	W14B2 * ACHED2*2	0F08	P47
			L0F05	P47			MDE5	W29B8 * ROGER DM	0F05	P47
			L1H08	P47			MDE6	W127B15	1H08	P47
MDE6	GOTOMDE6	P46					MDE5	W7B4 * ADDR EQL * ADSNCSTF * SELECT	1D08	P46
MDE7	GOTOMDE7	P47					MDE4	ADRIDXUP * INITIAL	3H04	P47
MDE8	GOTOMDE8	P47	L2K08	P47			MDE7	W30B6	2K08	P47
			L3E07	P47			MDE8	W111B7 * LOC 89/	3E07	P47
			L0G07	P47			MD10	W109B7 * FLAGWRTN * LOOPMD10	0G07	P47
MDE9	GOTOMDE9	P47	L3G07	P47			MDE4	ADRIDXUP * INITIAL/	3G07	P47
			P2INADMK	P47			MDE9	W11B14 * ADMRK127/ * (ADSNCSTF/ + CYLHDEQL/)	0H08	P47
			L1K04	P47			MD11	W104B7	1K04	P47
MD10	GOTOMD10	P48					MDE9	W11B1 * CYLHDEQL * ADSNCSTF	3C07	P48

Table 3-2. Main Mode Jump Conditions (Cont)

TO MODE	FINAL TERM	PAGE NO.	PARTIAL TERMS	PAGE NO.	SUB-PART TERMS	PAGE NO.	FROM MODE	UNDER THE FOLLOWING CONDITIONS:	SOURCE PIN	PAGE NO.
MD11	GOTOMD11	P48					MD10	W109B7 * FLAGWRTN/ * LOOPMD10/	3D08	P48
MD12	GOTOMD12	P48					MD10	W108B9 * DSKLOCEQ * RELOC/	0J07	P48
MD13	GOTOMD13	P46					MDE1	W2B0 * SEND ERD	1F08	P46
MD14	GOTOMD14	P48					MDE1	W13B15 * TESTOP	1J07	P48
MD15	GOTOMD15	P49					NOTE: THE FINAL TERM IS BLOCKED WITH (MDE0 + MD15).		3U08	P49
			L3S08	P49	L0S08	P49	MDE1	W2B14 * XMPER + TD	0S08	P49
					L1S08	P49	MDE1	W5B1 * (DR READY/ + DRONLINE/)	1S08	P49
					L0R07	P49	MDE1	W14B5 * SKSTATUS	0R07	P49
			PT8GMD15	P48	L1K08	P48	MDE2	W9B13 * NRMLUNST/	1K08	P48
					MD2W30B6	P47	MDE2	W30B6	4E07	P47
			PT4GMD15	P48			MDE3	W9B15	3R04	P48
			PT5GMD15	P72	G3N07	P72	MDE4+5	ENSELTRM * SELECT/	3N07	P72
					PT59TO15	P73	MDE5+9	(W3B14+W29B8) * ROGER DM/	2H08	P73
					PTM6TO15	P73	MDE6	W29B8 * WRITE/ * DTSNCSTF/	0S08	P73
					G3P08	P72	MDE6	W109B14 * ENDOFPAK/	3P08	P72
					PTM9TO15	P73	MDE9	W11B14 * ADMRK127	2D08	P73
					G2G04	P72	ANY	LONG DMS * W14B0 FF	2G04	P72
					NOROG DM	P72	ANY	DOWN-EDGE DETECT OF 65 MS TIMER TRIGGERED BY CM START CLEARED BY (ROGER DM + IDLE)	0K05	P72
					TIME OUT	P73	ANY	TMOT25MS	0S06	P37
			PT7GMD15	P71	L0M04	P71	MDE5	W14B0 * REVSDONE	0M04	P71
					L0M08	P71	MDE6	W109B14 * (SELECT/ + SPRVRIFY)	0M08	P71
			PT2GMD15	P48			MDE8	W109B14 * RELOC	4H08	P48
			PT1GMD15	P48			MDE8	W127B15 * LOC 89 * MDE8TERM	0K08	P48
			PT3GMD15	P48			MDE9	W13B15	1U04	P48
			L1R04	P49			MD12	W109B15	1R04	P49
			L1S05	P49			MD13	W11B14	1S05	P49
			PTCASKST	P49			MD14	W0B14	1R07	P49
			L1V07	P49			MD15	W0B15 * SEEKINCL * DM RCVD (SUPERFLUOUS TERM)	1V07	P49
			PT6GMD15	P69			ANY	SYNCHRONIZED DPEC EXC	4U08	P69

SECTION 4
MAINTENANCE

INTRODUCTION

This section explains the use of the maintenance control panel, and provides an overall maintenance guide to the 206 DPEC.

USE OF MAINTENANCE CONTROL PANEL

The maintenance control panel is used in the local mode. It can be used to perform maintenance on the disk pack drive as well as on the DPEC (see figure 4-1).

Switch Functions (Local Mode Only)

a. LOAD

Allows the contents of the 16 (vertical) data bits to be loaded into the maintenance memory location being indicated by the four (horizontal) memory address lamps. Pressing this button will load the memory and increment the memory location by 1.

b. CLEAR

1. DISP ENBL Switch ON. Clears the contents of the 16 data bits being displayed and loads zeros into that memory location. It does not affect the contents of the other 15 memory words.

2. DISP ENBL Switch Resets the maintenance memory to location 0, clears the 16 data bits, but does not affect the contents of the maintenance memory.

c. START

Initiates the instruction at one of the two maintenance memory locations.

d. STEP MEM (Step memory)

1. DISP ENBL OFF. No effect.

2. DISP ENBL ON. When the STEP MEM button is pressed (while the DPEC is in the idle state), the maintenance memory word (horizontal lamps) will be incremented, and the next memory location will be displayed in the 16 data bit registers.

e. DISP ENBL
Affects the operation of the CLEAR and STEP MEM buttons (see previous descriptions).

f. HALT FERR

When in the ON position, allows the DPEC to halt when a Fire code error is detected.

g. SGL SECT (Single Sector)

1. LOOP OP OFF. Allows the execution of a single instruction on a single sector and terminates.

2. LOOP OP ON. Allows the continuous execution of one operation code on a single sector.

h. SLIP

Simulates the slip operation generated by the processor to interrupt the transfer of data from the DPEC to the DPC.

i. ALT SEEK

1. ALT SEEK ON, LOOP OP OFF, SGL SECT OFF

The Field Engineer can selectively initiate one maintenance memory instruction and then the other by using the START and STOP buttons. (The CLEAR button must not be used in this sequence.)

2. ALT SEEK ON, LOOP OP ON, SGL SECT ON

This mode is primarily used to alternate between two different cylinders to check servo operation. A different address is loaded at each maintenance memory instruction.

3. ALT SEEK ON, LOOP OP ON, SGL SECT OFF

This mode can be used to perform serial instructions without operator intervention. An example is to load an initialize operation code in one maintenance memory location and a read or verify operation code in the other. Pressing the START button will execute one instruction. Upon termination, the other operation code will be executed until it terminates.

W11623

Figure 4-1. Maintenance Control Panel

CAUTION

If an error occurs during a read or verify, and the HALT ERR switch is ON, the operation will terminate and the other operation code will be performed.

j. LOOP HEAD/LOOP SECT

Allows the DPEC to loop on a particular head or sector.

k. NO OVRLP (No Overlap)

Disables the overlapping seek function in the local mode.

l. NO ADD LOAD (No Address Load)

Prevents the address register from being reset to 0 when a maintenance memory instruction is re-initiated.

For example, a pack is being read in a local mode and a Fire code error is detected at cylinder 256, head 1, sector 10. Since the HALT ERR switch was on, the operation terminates. With the NO ADD LOAD switch ON, the operation can be continued from this point. If the NO ADD LOAD switch is OFF, restarting the operation will reset the address register to 0.

m. LOOP OP

Used primarily with the SGL SECT or ALT SEEK switches to continuously execute an operation.

Indicator Functions

Sixteen vertical LEDs (light-emitting diodes) are used to display the contents of one word of maintenance memory. The four horizontal memory address counter (MEM ADR CNTR) LEDs are used to identify which of the 16 words are being displayed in the vertical LEDs.

Maintenance Memory Loading

Operation codes are entered into the DPEC maintenance memory using the 16 vertical pushbuttons and the LOAD pushbutton. The memory contains 16 words of 16 bits each. Refer to section I of this manual for the operation codes, tables 1-2 and 1-3.

The 16 maintenance memory words will be used in the following manner:

Table 4-1. Maintenance Memory Loading Descriptions

Memory Address Counter	Mode	Description
0	All	Word 1 of instruction 1. OPERATION CODE, "N" variants, unit designations and the five least significant bits of the file address.
1	All	Word 2 of instruction 1. Fourteen most significant bits of the file address and two spare bits.
2	All	Word 3 of instruction 1. Data information used during initialize, write and relocate operations.
3	Read Extended Status	ERD word 1 from either instruction. Refer to table 1-5 for the contents of the register.
	Alternate Seek/Loop Op	First 16 bits of Fire code information. The most significant of the 32 bits will be displayed in the bottom LED.
4	Read Extended Status	ERD word 2 from either instruction. Refer to table 1-5 for the contents of the register.
	Alternate Seek/Loop Op	Second 16 bits of Fire code information. The least significant of the 32 bits will be displayed in the top LED.
5	Read Extended Status	ERD word 3 from either instruction. Refer to table 1-5 for the contents of the register.
6	Read Extended Status	ERD word 4 from either instruction. Refer to table 1-5 for the contents of the register.
7	All	Not used.
8	All	Word 1 of instruction 2.
9	All	Word 2 of instruction 2.
10	All	Word 3 of instruction 2.
11	Alternate Seek/Loop Op	First 16 bits of Fire code information from the second instruction. The most significant of the 32 bits of Fire code will be displayed in the bottom LED.
12	Alternate Seek/Loop Op	Last 16 bits of Fire code information from the second instruction. The least significant of the 32 bits of Fire code will be displayed in the top LED.
13	All	Not used.
14	All	Not used.
15	All	Not used.

Memory Address Counter Indicators

The memory address counter indicators on the maintenance control panel are the four horizontal lamps in the upper left of the panel. These lamps can be used to determine the state of the DPEC while in a local mode.

Memory Address 2 (2*1)	Normal running state while executing an instruction located at memory address 0, 1, and 2.
Memory Address 3, 5, 7 or 13	Halt conditions.
Memory Address 4 (2*2)	Executing the instruction at the beginning of maintenance memory while using the ALT SEEK mode.
Memory Address 10 (2*1 and 2*3)	Executing the instruction at location 8, 9, and 10 maintenance memory instruction while in the ALT SEEK mode.
Memory Address 12 (2*2 and 2*3)	Executing instruction number 2 with ALT SEEK off.

For example, if the DPEC is in an operating state, and the memory address lamp 2 is illuminated, the DPEC is in a normal running state and executing an instruction at the first operation code location.

P CARD PLUG-ON INDICATOR

Figure 4-2 illustrates the P-card plug-on indicator. This indicator will display the cylinder, head, sector, and unit being addressed (or addressed on the last operation).

The address information that is being displayed is the output of the address counter.

TROUBLESHOOTING AIDS

Several aids are available to assist the field engineer in troubleshooting DPEC problems. Depending on the particular problem and the individual field engineer's preference in troubleshooting, various methods can be used. Some of the aids available to the field engineer are listed in the following subsections.

Local Maintenance Aids

The switch control package and the indicator display package have been described earlier in this section. These aids can be used to determine whether a problem exists only in a remote mode or in both local and remote modes. The aids can also be used to perform spindle alignments when an exerciser is not available.

The following procedure can be used to seek to a particular address by loading the desired address into the first and second data words of either instruction word. Refer to table 1-4. As an example, a seek to cylinder 496, head 4 on the disk pack drive: Using the "Disk Pack Address Scheme in Hex" table (that is available from the Disk Pack Test Routine tape, PACK option), determine the hex address that corresponds to the desired cylinder and head. In this example, cylinder 496, head 4 is 035F98. This hex address is entered in LSD to MSD order.

The first word will contain the five least significant bits of the file address. The information is loaded from right to left. Using the file address 035F98, the

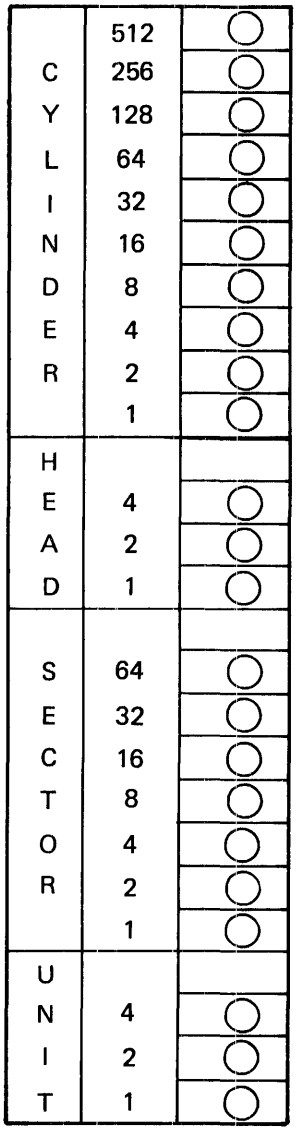


Figure 4-2. P-Card Plug-on Indicator

LSD digit, 8, would be loaded into position 2*3. (2*0, 2*1 and 2*2 are blank.) See figure 4-1. The one bit from the 9 digit will be loaded into the 2*4 position.

The second word will contain the remaining 14 bits of the file address. The eight bit from the 9 digit will be loaded into the 2*7 location.

Block Diagrams

The block diagrams can be used to determine the relation between one basic DPEC circuit and another within the DPEC, with definable results. In many cases, the cause of a solid malfunction can be isolated to a specific circuit by studying the block diagrams, either the overall diagram or the individual circuit diagrams.

Flow Charts

Two flow charts are included; one is a simplified flow chart, the other a detailed flow chart. The detailed flow chart should be studied to refresh a field engineer's memory as to what functions take place during a particular mode and the details of that mode. A good starting point would be page 1 of the detailed flow chart. From this page, the field engineer can determine which modes will be accessed, and their sequence during a given operation.

B 1700 Disk Pack Subsystem Test Routine

Revision AG (P/N CT 2211 0175) of the Disk Pack Subsystem test routine can be helpful in determining the confidence of the complete disk pack subsystem. Refer to the documentation that is included with the B 1700 Disk Pack Control for operating instructions.

Extended Result Descriptor

Local

When the try diagnostics bit is set during a local operation, the contents of the ERD registers can be read in the following manner.

The Read Maintenance OP code is used with the N2 variant set to load the contents of the ERD registers into the DPEC Maintenance Memory. Once this has been done, the maintenance memory words will contain the following information:

Word 3: First ERD word, first 16 bits
Word 4: Second ERD word, second 16 bits
Word 5: Third ERD word, third 16 bits
Word 6: Fourth ERD word, fourth 16 bits

Refer to table 1-6 for the contents and sequence of each word.

Remote

Refer to the instructions included with Section 9, part 3 of the disk pack test routine (part number CT 2211 0175) included with the DPC for using the ERD option under test conditions.

Using the E Log

The following discussion can be used as a guide to using the ERD information from the E log to troubleshoot intermittent or potential problem areas.

Figure 4-3 is a copy of a typical E log using MCP II Mark VI.0.0.

Refer to the underlined area in the figure. This is the ERD information in a 16-digit format. The information can be decoded in the following manner.

Each group of four digits is the contents of one word of ERD information.

ERD Word	Contents
1	17C6
2	3C30
3	2000
4	0000 (No data)

This information must be converted to its binary equivalent:

	(1)	(7)	(C)	(6)
17C6 =	0001	0111	1100	0110
	(3)	(C)	(3)	(0)
3C30 =	0011	1100	0011	0000
	(2)	(0)	(0)	(0)
2000 =	0010	0000	0000	0000

The binary equivalent must contain 64 bits of ERD information. The bits are numbered from 1 to 64, from left to right.

In the above example, the ERD bits that are present are: 4, 6, 7, 8, 9, 10, 14, 15, 19, 20, 21, 22, 27, 28 and 35.

Cylinder:	64, 16, 8, 4, 2 and 1 = 95
Head:	2 and 1 = 3
Sector:	8, 4, 2 and 1 = 15
Unit:	2 and 1 = 3, UNIT D
Other information:	Missing Sector Pulse

Table 4-2. 206 Extended Result Descriptor (Remote)

Bit	Description
1	Cylinder 512
2	Cylinder 256
3	Cylinder 128
4	Cylinder 64
5	Cylinder 32
6	Cylinder 16
7	Cylinder 8
8	Cylinder 4
9	Cylinder 2
10	Cylinder 1
11	Spare
12	Spare
13	Head 4
14	Head 2
15	Head 1
16	Sector 64
17	Sector 32
18	Sector 16
19	Sector 8
20	Sector 4
21	Sector 2
22	Sector 1
23	OP code 1
24	OP code 2

Table 4-2. 206 Extended Result Descriptor (Remote) (Cont)

Bit	Description
25	OP code 3
26	Unit 2*2
27	Unit 2*1
28	Unit 2*0
29	N0 variant bit
30	N1 variant bit
31	N2 variant bit
32	N3 variant bit
33	DPEC blower failure
34	Missing R/W clock
35	MIssing address mark
36	Read data not received
37	No index mark
38	CM error*
39	Model 206 drive
40	Spare
41	Spare
42	Spare
43	Maintenance mode
44	Write data missing
45	Write protect and write enable
46	CM or offline when seeking
47	Illegal head
48	Illegal cylinder
49	Spindle address error
50	Offset during write enable
51	Offset during seek
52	Seek incomplete
53	Off track and write enable
54	Carriage hit end stop
55	Spare
56	Write current, no write gate
57	No write current changes
58	Head select fault
59	DC power failure
60	Temperature warning
61	Temperature critical
62	Rpm less than 3420
63	Bad DM response
64	Spare

* When a CM error is detected in a Remote mode, ERD bits 39 through 62 will contain the last CM mesage that was sent to the drive. The information will be displayed in the following manner.

Bit	Description
39	Mark bit
40	Write bit
41	Read bit
42	Address mark
43	Parity even (1-5)
44	Continue bit
45	Address or Control message
46	Head or cylinder, or Offset on
47	Address information (LSB) or Offset in
48	Address information (LSB) or PLO early
49	Address information (LSB) or PLO late
50	Address information (LSB) or Power up
51	Address information (LSB) or Power down
52	Address information (LSB) or Re-zero
53	Address information (LSB) or Send status
54	Address information (LSB) or Check index
55	Address information (LSB) or Spare
56	Address information (LSB) or Spare
57	Address information (LSB) or Reset maintenance mode
58	Address information (MSB) or Set maintenance mode
59	Write enable
60	Spare
61	Parity even (1-23)
62	End bit

LOGIC LEVELS

True

A signal level is considered a logical TRUE (ONE) if it is in the range of +2.4 to +5.0 volts. A signal level is measured at the receiving end of its line with a termination resistance of 100 ohms to ground.

False

A signal level is considered a logical FALSE (ZERO) if it is in the range of 0.0 to +0.4 volt. A signal level is measured at the receiving end of its line, with a termination resistance of 100 ohms to ground.

```
08:14:43.9    DPO        PORT 7   CHANNEL 09       02 RETRIES
              DESCRIPTOR ENDING     RESULT DESCRIPTOR          LINK              BEGIN     END       C
               ADDRESS   ADDRESS 012345678901234567890123 ADDRESS I O OP ADDRESS ADDRESS ADDRESS
               0484F2    053A02  110100000100000010000000 0757A1  04A003 048602  053A02  006CE0
      LABEL T1                      SERIAL NO. 111111 HARDWARE 01E0 JOB.NO. 00052 EXTENDED RESULT @000000000000000@
08:14:51.1    DPO        PORT 7   CHANNEL 09       02 RETRIES
              DESCRIPTOR ENDING     RESULT DESCRIPTOR          LINK              BEGIN     END       C
               ADDRESS   ADDRESS 012345678901234567890123 ADDRESS I O OP ADDRESS ADDRESS ADDRESS
               0484F2    048602  110100000000000010000000 0757A1  000003 048602  053A02  003860
      LABEL T1                      SERIAL NO. 111111 HARDWARE 01E0 JOB.NO. 00052 EXTENDED RESULT @000000000000000@
08:14:52.2    DPO        PORT 7   CHANNEL 09       02 RETRIES
              DESCRIPTOR ENDING     RESULT DESCRIPTOR          LINK              BEGIN     END       C
               ADDRESS   ADDRESS 012345678901234567890123 ADDRESS I O OP ADDRESS ADDRESS ADDRESS
               0484F2    048602  110100000000000010000000 0757A1  040003 048602  053A02  003860
      LABEL T1                      SERIAL NO. 111111 HARDWARE 01E0 JOB.NO. 00052 EXTENDED RESULT @000000000000000@
08:14:52.3    DPO        PORT 7   CHANNEL 09       01 RETRIES
              DESCRIPTOR ENDING     RESULT DESCRIPTOR          LINK              BEGIN     END       C
               ADDRESS   ADDRESS 012345678901234567890123 ADDRESS I O OP ADDRESS ADDRESS ADDRESS
               0484F2    053A02  110100000000000010000000 0757A1  044003 048602  053A02  003860
      LABEL T1                      SERIAL NO. 111111 HARDWARE 01E0 JOB.NO. 00052 EXTENDED RESULT @000000000000000@
08:14:54.2    DPO        PORT 7   CHANNEL 09       02 RETRIES
              DESCRIPTOR ENDING     RESULT DESCRIPTOR          LINK              BEGIN     END       C
               ADDRESS   ADDRESS 012345678901234567890123 ADDRESS I O OP ADDRESS ADDRESS ADDRESS
               0484F2    048602  110100000100000010000011 0757A1  000003 048602  053A02  00A640
      LABEL T1                      SERIAL NO. 111111 HARDWARE 01E0 JOB.NO. 00052 EXTENDED RESULT @17C63C3020000000@
08:14:54.5    DPO        PORT 7   CHANNEL 09       01 RETRIES
              DESCRIPTOR ENDING     RESULT DESCRIPTOR          LINK              BEGIN     END       C
               ADDRESS   ADDRESS 012345678901234567890123 ADDRESS I O OP ADDRESS ADDRESS ADDRESS
               0484F2    053A02  110100000100000010000011 0757A1  04A003 048602  053A02  00A640
      LABEL T1                      SERIAL NO. 111111 HARDWARE 01E0 JOB.NO. 00052 EXTENDED RESULT @17C63C3020000000@
08:14:56.4    DPO        PORT 7   CHANNEL 09       02 RETRIES
              DESCRIPTOR ENDING     RESULT DESCRIPTOR          LINK              BEGIN     END       C
               ADDRESS   ADDRESS 012345678901234567890123 ADDRESS I O OP ADDRESS ADDRESS ADDRESS
               0484F2    048602  110100000100000010000000 0757A1  00A003 048602  053A02  008040
      LABEL T1                      SERIAL NO. 111111 HARDWARE 01E0 JOB.NO. 00052 EXTENDED RESULT @000000000000000@
08:14:57.5               PORT 1   CHANNEL 03       MCP DISK ERROR
              DESCRIPTOR ENDING     RESULT DESCRIPTOR          LINK              BEGIN     END       C
               ADDRESS   ADDRESS 012345678901234567890123 ADDRESS I O OP ADDRESS ADDRESS ADDRESS
               07587D    078BCF  110000000100000010000011 07447F  000003 078BCE  07C16E  000000
      LABEL                         SERIAL NO. 000000 HARDWARE 0000 JOB.NO. 00000 EXTENDED RESULT @00000302000000@
08:15:00.9    DPO        PORT 7   CHANNEL 09       02 RETRIES
              DESCRIPTOR ENDING     RESULT DESCRIPTOR          LINK              BEGIN     END       C
               ADDRESS   ADDRESS 012345678901234567890123 ADDRESS I O OP ADDRESS ADDRESS ADDRESS
               0484F2    04E842  110100000100000010000011 0757A1  000003 048602  053A02  007840
      LABEL T1                      SERIAL NO. 111111 HARDWARE 01E0 JOB.NO. 00052 EXTENDED RESULT @11413C3002000002@
08:15:01.0    DPO        PORT 7   CHANNEL 09       01 RETRIES
              DESCRIPTOR ENDING     RESULT DESCRIPTOR          LINK              BEGIN     END       C
               ADDRESS   ADDRESS 012345678901234567890123 ADDRESS I O OP ADDRESS ADDRESS ADDRESS
               0484F2    053A02  110100000100000010000011 0757A1  040003 048602  053A02  007840
      LABEL T1                      SERIAL NO. 111111 HARDWARE 01E0 JOB.NO. 00052 EXTENDED RESULT @11413C3002000002@
08:15:01.9    DPO        PORT 7   CHANNEL 09       02 RETRIES
              DESCRIPTOR ENDING     RESULT DESCRIPTOR          LINK              BEGIN     END       C
               ADDRESS   ADDRESS 012345678901234567890123 ADDRESS I O OP ADDRESS ADDRESS ADDRESS
               0484F2    053A02  110100000000000010000000 0757A1  002003 048602  053A02  000430
      LABEL T1                      SERIAL NO. 111111 HARDWARE 01E0 JOB.NO. 00052 EXTENDED RESULT @000000000000000@
08:15:03.2    DPO        PORT 7   CHANNEL 09       02 RETRIES
              DESCRIPTOR ENDING     RESULT DESCRIPTOR          LINK              BEGIN     END       C
               ADDRESS   ADDRESS 012345678901234567890123 ADDRESS I O OP ADDRESS ADDRESS ADDRESS
               0484F2    048602  110100000000000010000000 0757A1  000003 048602  053A02  008020
      LABEL T1                      SERIAL NO. 111111 HARDWARE 01E0 JOB.NO. 00052 EXTENDED RESULT @000000000000000@
08:15:03.8    DPO        PORT 7   CHANNEL 09       02 RETRIES
              DESCRIPTOR ENDING     RESULT DESCRIPTOR          LINK              BEGIN     END       C
               ADDRESS   ADDRESS 012345678901234567890123 ADDRESS I O OP ADDRESS ADDRESS ADDRESS
               0484F2    048602  110100000000000010000000 0757A1  040003 048602  053A02  008020
      LABEL T1                      SERIAL NO. 111111 HARDWARE 01E0 JOB.NO. 00052 EXTENDED RESULT @000000000000000@
08:15:04.4    DPO        PORT 7   CHANNEL 09       01 RETRIES
              DESCRIPTOR ENDING     RESULT DESCRIPTOR          LINK              BEGIN     END       C
               ADDRESS   ADDRESS 012345678901234567890123 ADDRESS I O OP ADDRESS ADDRESS ADDRESS
               0484F2    053A02  110100000000000010000000 0757A1  04E003 048602  053A02  008020
      LABEL T1                      SERIAL NO. 111111 HARDWARE 01E0 JOB.NO. 00052 EXTENDED RESULT @000000000000000@
08:15:24.4    DPO        PORT 7   CHANNEL 09       02 RETRIES
              DESCRIPTOR ENDING     RESULT DESCRIPTOR          LINK              BEGIN     END       C
               ADDRESS   ADDRESS 012345678901234567890123 ADDRESS I O OP ADDRESS ADDRESS ADDRESS
```

W11625

Figure 4-3. Example of an E Log

SECTION 5
SUBASSEMBLY MAINTENANCE ADJUSTMENTS

INTRODUCTION

This section contains the procedures needed to make the 206 DPEC adjustments.

10 MEGAHERTZ CLOCK ADJUSTMENT

The 10-megahertz clock frequency adjustment potentiometer is located on the bottom of the "N" card.

The 10 megahertz clock can be monitored at card cage backplane location ENCB. The time between clock pulse leading edges should be 0.1 microsecond. If it is not at this value, the potentiometer on the "N" card must be adjusted.

POWER SUPPLY ADJUSTMENTS

Refer to the installation section for instructions on removing DPEC panels.

The DPEC power supply chassis contains an OEM power supply subassembly.

This subassembly contains three potentiometers. To gain access to these potentiometers, the DPEC power supply cover must be removed. Two of the potentiometers (OL ADJ and VOLT ADJ) can be reached from the top of the power supply subassembly. The third potentiometer can be reached from the side of the subassembly.

NOTE

Only the VOLT ADJ potentiometer requires adjustment in the field. The other two potentiometers were adjusted at the factory and should not require further adjustment.

Overload Protection

The OL ADJ (Overload Current Adjustment) potentiometer is adjusted at the factory to limit the power supply maximum current to between 20 and 22 amperes at +5.0 volts dc.

Overvoltage Protection

The potentiometer on the side of the power supply subassembly is not labeled. It is the overvoltage adjustment potentiometer. It was adjusted at the factory to prevent the output voltage of the power supply from exceeding approximately 6.0 volts.

+5.0 Volts Supply

Using a digital voltmeter, monitor card cage backplane pin CSAQ. The voltage at this location should be +5.0 volts dc with the DPEC in an operational mode. If this voltage is not within ±0.1 volts, remove the power supply chassis cover and adjust the VOLT ADJ potentiometer to obtain +5.0 volts ±0.1 volt at CSAQ.

High/Low Input Voltage Adjustment

CAUTION

Remove power from the DPEC before attempting to move any power supply terminal connections.

The following procedure must be used to modify the input power circuitry of the DPEC. The subassembly is wired at the factory for an input voltage of 208 to 225 volts ac. Measure the input voltage between phases 1 and 2 at TB1 in the DPEC power supply. If the voltage is greater than 225 volts, the following modification is required.

a. Remove the DPEC power supply cover.

b. Locate the OEM power supply subassembly terminal strip.

c. Move the lead from the AC LOW terminal to the AC HIGH terminal.

d. Replace the power supply cover.

DRIVE PRESENT AND FORMAT OPTION ADJUSTMENTS

The H card contains a switch package integrated circuit at location CD4. See figures 5-1 and 5-2. This integrated circuit is used to notify the system of the number of spindles that will be used. The system will then allocate memory for these spindles. For proper system operation, the switches must be set to reflect only the number of spindles on the disk pack subsystem.

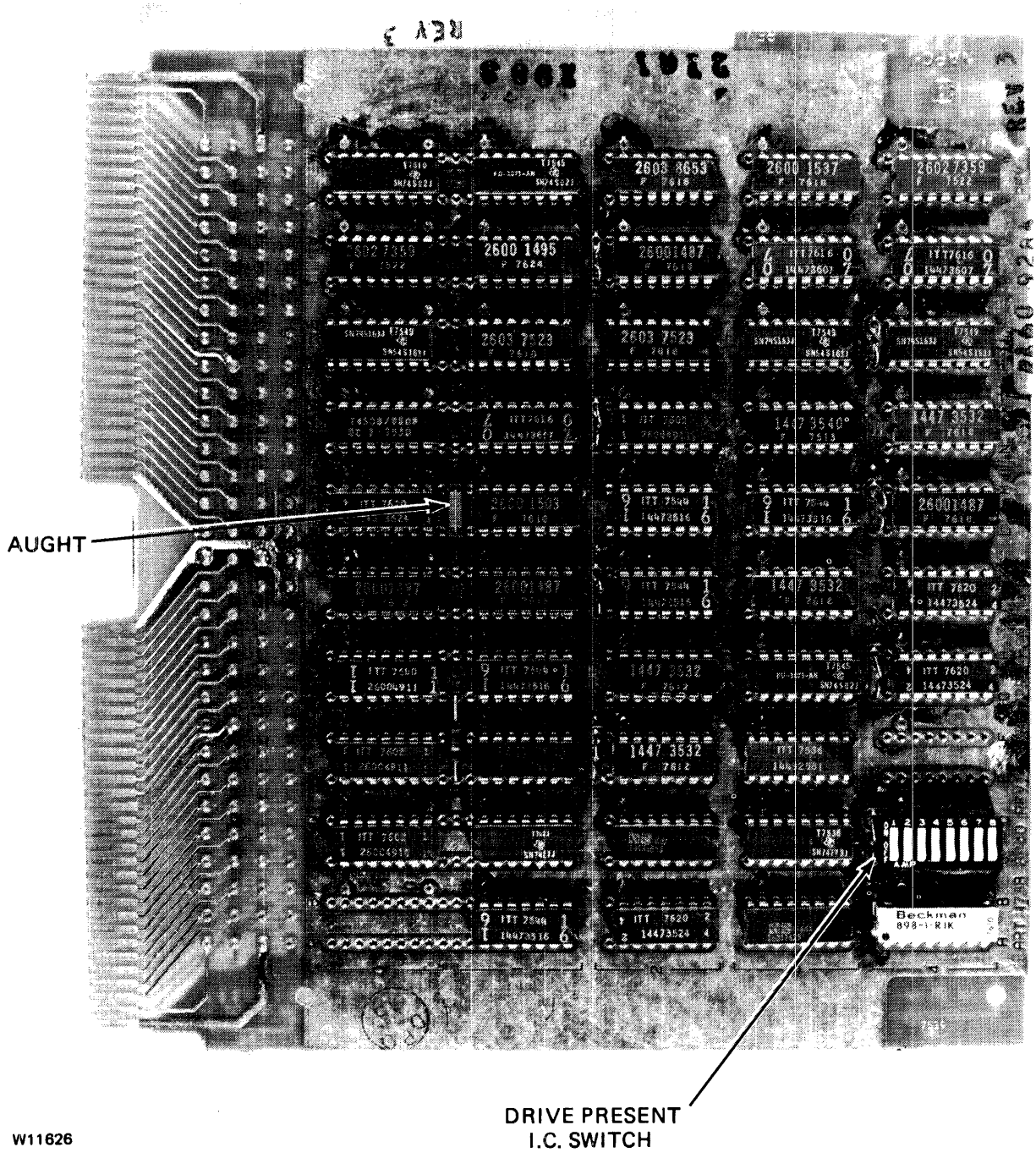
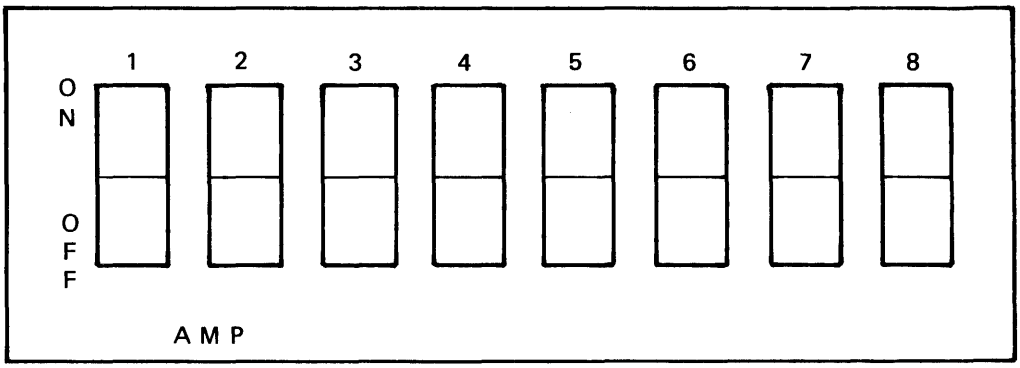


Figure 5-1. H-Card



W11627

Figure 5-2. Drive Present Integrated Circuit Switch Assembly

The switches are numbered from one to eight, and the OFF and ON positions are labeled. To make the adjustment, use the following procedure:

a. Power off the DPEC.

b. Remove the H card.

c. Transfer the appropriate switches to the ON position to reflect the number of spindles that will be in the system.

d. Ensure that there is a jumper bar (AUGHT) between locations 1LOO and 1MOO. The jumper will be physically located between chip LM0 and LM1. (This jumper is necessary to enable the gated unit [GUNIT 2* n] logic. See schematic page 67 for the H card. There should be NO jumper from 1N00 to 1P00.) See figure 5-1.

e. Replace the H card.

APPENDIX A. GLOSSARY OF TERMS

Any signal name followed by a slash (/) indicates the signal is low active.

Signal Name	Backplane Pin No.	Schematic Page No.	Description
ACCYL2*0	CPCF	9	Address counter cylinder output
ACCYL2*1	CPCG	9	Address counter cylinder output
ACCYL2*2	CPCH	9	Address counter cylinder output
ACCYL2*3	CPCJ	9	Address counter cylinder output
ACCYL2*4	CPCL	9	Address counter cylinder output
ACCYL2*5	CPCM	9	Address counter cylinder output
ACCYL2*6	CPCN	9	Address counter cylinder output
ACCYL2*7	CPCP	9	Address counter cylinder output
ACCYL2*8	EPCE	9	Address counter cylinder output
ACCYL2*9	EPCF	9	Address counter cylinder output
ACHED2*0	CPCC	9	Address counter head output
ACHED2*1	CPCD	9	Address counter head output
ACHED2*2	CPCE	9	Address counter head output
ACSEC2*0	BPCB	9	Address counter sector output
ACSEC2*1	BPCC	9	Address counter sector output
ACSEC2*2	BPCD	9	Address counter sector output
ACSEC2*3	BPCE	9	Address counter sector output
ACSEC2*4	BPCF	9	Address counter sector output
ACSEC2*5	BPCG	9	Address counter sector output
ACSEC2*6	BPCH	9	Address counter sector output
ADDR-EQL	CRAH	15	Address equal
ADDR-EQL/	CRAN	15	Address equal
ADDRINDX	ESCK	24	Address index
ADMRK127/	EHCC	64	127 address marks have been counted
ADRIDXUP/	CLCK	51	Sector mark or index pulse
ADRMRKER	CHCP	68	Address mark error
ADSNCSTF	FMCL	38	Address sync start flip-flop
ALTGOWRZ/	EHAK	66	Alternate go write zeros
BADDMRSP	FGAJ	73	Bad DM response
BIT-11	BMAJ	35	Bit 11
BIT-14/	BMAG	33	Bit 14
BUFDATA	FSAB	19	Buffered data
BUFDCM/	FSCK	20	Buffered CM
BUSY	EKCC	56	Busy
BUSY/	EKCL	56	Busy
CK-DPC	EHAB	66	Clock to the disk pack control (DPC)
CK-DPC/	EHAC	66	Clock to the disk pack control (DPC)
CKADDMEM/	FJAN	62	Clock address memory
CKINTWRD/	EKAQ	57	Clock initiate word
CKSKSTAT/	EKAL	55	Clock seek status flip-flop
CKWORD1/	CPAM	7	Clock word 1
CK10DRV	CSCK	19	10 MHz clock from the drive
CK10MHz	ENCB	32	DPEC 10 MHz clock
CK10MHz/	ENAB	32	DPEC 10 MHz clock
CK10MHz1	ENAN	32	DPEC 10 MHz clock one
CK10MHz2	FNAP	32	DPEC 10 MHz clock 2
CK5MHz	ENAG	32	DPEC 5 MHz clock
CLALSKST/	FKCE	55	Clear all seek status flip-flops
CLDSKLOC/	EKAD	54	Clear disk location counter
CLFMCNTR/	FJAF	59	Clear format counter
CLSECLOC/	FLAN	52	Clear sector location counter
CM-ADD-M/	CJAP	61	Address controller message
CM-ENABL	FGCG	72	Controller message enable

Signal Name	Backplane Pin No.	Schematic Page No.	Description
CM-ERROR	FSCD	24	Controller message error
CM-ERROR/	FSCE	24	Controller message error
CM-LOAD/	EJAL	62	Controller message load
CM-R/W	EJAF	61	Controller message write
CM R/W/	CJCP	61	Controller message read
CM-SEL	CKCH	55	Controller message select
CM-START	FJAC	62	Controller message start
CM-START/	CJAD	62	Controller message start
CMGOIDLE/	CJCE	60	Controller message go to idle
CML09	EPAH	12	Controller message line 09
CML10	EPAJ	12	Controller message line 10
CML11	EPAK	12	Controller message line 11
CML12	EPAL	12	Controller message line 12
CML13	FPAD	12	Controller message line 13
CML14	FPAE	12	Controller message line 14
CML15	FPCL	12	Controller message line 15
CML16	FPCM	12	Controller message line 16
CMODE2*0	BJCN	60	Controller mode 2 0
CMODE2*0/	CJAF	60	Controller mode 2 0
CMODE2*1	CJCD	60	Controller mode 2 1
CMODE2*1/	CJCC	60	Controller mode 2 1
CMSELHD4	FGCC	71	Controller message, select head 4
CM2-OM11/	EJCE	62	Controller message 2 0, in mode 11
CYLHDEQL	CRAJ	15	Cylinder and head equal
DATA 00	BNCB	27	DPEC internal data bus line 00
DATA 01	BNAB	27	DPEC internal data bus line 01
DATA 02	BNCC	27	DPEC internal data bus line 02
DATA 03	BNAC	27	DPEC internal data bus line 03
DATA 04	BNCG	27	DPEC internal data bus line 04
DATA 05	BNAG	27	DPEC internal data bus line 05
DATA 06	BNCH	27	DPEC internal data bus line 06
DATA 07	BNAH	27	DPEC internal data bus line 07
DATA 08	BNCN	27	DPEC internal data bus line 08
DATA 09	BNAN	27	DPEC internal data bus line 09
DATA 10	BNCP	27	DPEC internal data bus line 10
DATA 11	BNAP	27	DPEC internal data bus line 11
DATA 12	CNCD	27	DPEC internal data bus line 12
DATA 13	CNAD	27	DPEC internal data bus line 13
DATA 14	CNCE	27	DPEC internal data bus line 14
DATA 15	CNAE	27	DPEC internal data bus line 15
DM-RCVD	ESCD	23	Drive message received
DMBUF	ESCM	23	Drive message buffer enable
DMBUF/	ESCL	23	Drive message buffer enable
CMCNTNUE	ESCF	24	Drive message continue
DMFAULT	ENCD	26	Drive message fault
DMSRCK	ESAN	23	Drive message shift register clock
DMSRCLR/	ESAQ	23	Drive message shift register clear
DMSRCLRT	FNCJ	26	Drive message shift register clear
DMSRENB	ESCH	23	Drive message shift register enable B
DMSTAS 7	ENAM	31	Drive message STATUS register line 7
DMSTAS10	ENCM	31	Drive message STATUS register line 10
DMSTAS14	ENAL	31	Drive message STATUS register line 14
DMSTAS16	ENAK	31	Drive message STATUS register line 16
DMSTAS20	ENCK	31	Drive message STATUS register line 20

Signal Name	Backplane Pin No.	Schematic Page No.	Description
DMSTAS21	ENCJ	31	Drive message STATUS register line 21
DMSTAS23	ENAH	31	Drive message STATUS register line 23
DMSTAS24	ENCG	31	Drive message STATUS register line 24
DPC-RMOT/	FKCJ	55	DPEC is in remote
DPEC-EXC	FHCP	68	DPEC exception
DR-READY	ESCN	24	Drive ready
DR-READY/	FSCB	24	Drive ready
DR-THERE	BPAC	7	Drive there
DR-THRCK/	FKCK	53	Drive there clock
DRIVEKOK	FNAM	32	Drive okay
DRIVCKOK/	ENCN	32	Drive okay
DRNPRSNT	BHAB	67	Drive not present
DRONLINE	ESCG	24	Drive on line
DRONLINE/	ESAG	24	Drive on line
DRUNSAFE	CGCL	70	Drive unsafe
DRXMITEN	FHAM	65	Drive transmit enable
DR4CLK	BRAD	18	Drive 4 clock.
DR4DM	CRCM	18	Drive 4 drive message
DR4DTA	BRCB	18	Drive 4 data
DR5CLK	FRAF	18	Drive 5 clock
DR5DM	ERAE	18	DRive 5 drive message
DR5DTA	FRAD	18	Drive 5 data
DR6CLK	BRAJ	18	Drive 6 clock
DR6DM	CRCK	18	Drive 6 drive message
DR6DTA	BRAG	18	Drive 6 data
DR7CLK	FRAP	18	Drive 7 clock
DR7DM	CRCN	18	Drive 7 drive message
DR7DTA	FRAL	18	Drive 7 data
DSKLOCEQ	ERCE	14	Disk location equal
DTSNCSTF/	FMCN	38	Data sync start flip-flop
DTSYNCER	FHAH	68	Data sync error
ENABL-WR	BJAM	60	Enable write
ENADDRCT/	BPAB	7	Enable address counter
CNCKDET	BKCD	56	Enable clock detector
ENDOFCYL	CPCK	9	End of cylinder
ENDOFPAK/	EPCJ	9	End of pack
ENDOFTRK	FPCE	9	End of track
ENDSCXFR	EGAK	71	End of transfer
ENSNCDET	FKCG	57	Enable sync detector
EPCEQL	CRCG	15	Error protection code equal
ERD-ENRD	BHCJ	66	Extended result descriptor, enable result descriptor
ERDXFREN/	ENCH	25	Extended result descriptor, transfer enable
ERDXMTNG	ENAE	25	Extended result descriptor transmitting
EXECUTE	BQCJ	3	Execute
FAN-FAIL	FHCE	69	Fan failure
FIRCDERR	EQCN	6	Fire code error
FIRCMPEN	FJCF	59	Fire code compare enable
FIRENCEN	FHAP	65	Fire code enable
FIREOUT	EQAC	6	Fire code out
FIRESHEN	CHAP	65	Fire code shift enable
FLAGWRTN	CLCC	52	Writing relocate flag bit
FMCNTF	FHCG	64	Format control counter F
FMCNT9	FHAD	64	Format control counter equal to 9
FMIDLING	EJCN	59	Format idling
FMWRONES/	FJCE	58	Format control term: write all 1's
FMWRZERO	FLAM	52	Format control term: write zeros
GOTO5FR4/	CGAM	73	Go to mode 5 from mode 4
GTM1OR15/	ELAE	49	Go to mode 1 or 15
GTM8FR10/	CLCG	47	Go to mode 8 from mode 10
GUNIT2*0	BHCE	67	Gated unit number 1
GUNIT2⅛1	BHCD	67	Gated unit number 2
GUNIT2*2	BHCC	67	Gated unit number 4
HDR-ERR	FNCN	32	Header error
HEAD-ERR	FGCA	70	Drive exception condition head error
IDLE	BKCF	55	Idle
IDLE/	CKCG	55	Idle
IDXMRKER	CGCF	70	Index mark error
ILL-CYL	EGAN	70	Illegal cylinder
IMMDSEEK	BFCM	45	Immediate seek

Signal Name	Backplane Pin No.	Schematic Page No.	Description
IMMDSEEK/	CFAC	45	Immediate seek
INADDRCT	FLCD	51	Increment address counter
INADRMRK	BFCP	45	Increment address mark
INDSKLOC	FLCF	51	Increment disk location counter
INITIAL	ELAG	47	Initialize operation
INITIAL/	BHCQ	67	Initialize operation
INSECLOC	BKAQ	54	Increment sector location counter
INSLWORD	EKAH	55	Increment sector location counter, word portion
INUNITCT	FKAK	57	Increment unit count
JTRMINSC	FLAK	51	J flip-flop input term to increment sector counter
KTRMBUSY/	BLAB	46	K flip-flop input term for busy flip-flop
LDPSPREG/	CHCK	65	Load parallel-serial-parallel register
LDRDBFFR	FHAN	65	Load read buffer
LDWRBFFR	EHCL	65	Load write buffer
LOAD-AC/	BRCE	17	Load address counter
LOC-EXEC/	FFAE	42	Local execute (in slip mode)
LOC-89/	ERAQ	13	Sector location 89
LOC=ZERO	BRAE	13	Disk location counter at zero
LONG-DM	FSCF	24	Long drive message
LOOPHEAD/	FFCE	42	Maintenance switch enabled causing loop on head to be true
LOOPMD10/	FKCA	56	Loop on mode 10
LOOPSEC/	FFCD	42	Maintenance switch enabled causing loop on sector to be true
MAIN-CLR	EFCD	42	Main clear term
MAIN-CLR/	FFCA	42	Main clear term
MAIN-CL1/	BFAL	42	Main clear one term
MAINMD*0	ELAD	50	Main mode zero (2*0)
MAINMD*1	ELAC	50	Main mode 1 (2*1)
MAINMD*2	ELCE	50	Main mode 2 (2½2)
MAINMD*3	ELCC	50	Main mode 3 (2*3)
MANTRECV	BHAG	69	Maintenance received
MDEO	ELCG	50	Mode zero
MDEO*W1/	FKCN	57	Mode zero word 1
MDE1	ELCH	50	Mode 1
MDE4A	CKAE	54	Mode 4 A
MDE4FLOP	EKAF	56	Mode 4 flip-flop
MDE5A	BKCK	53	Mode 5 A
MDE6	ELAF	50	Mode 6
MDE6OR8	ELCK	50	Mode 6 or 8
MDE9B	BJCD	63	Mode 9 B
MD11	ELCJ	52	Mode 11
MD14	ELAB	50	Mode 14
MD15A	BKCH	53	Mode 15 A
MD6*NOWR	EJCQ	58	Mode 6 and no write
MD6*WR	CJAM	58	Mode 6 and write operation
MEMUN2*0	FPCC	10	Memory unit zero-(Binary 1)
MEMUN2*1	FPCB	10	Memory unit two-(Binary 2)
MEMUN2*2	FPCA	10	Memory unit four-(Binary 4)
MEMWRTEN/	EPCQ	10	Memory write enable
MNCLRRAW/	FFAH	42	Raw maintenance clear
MNERDWD1/	FNCH	25	Maintenance extended result descriptor
M15DSPRD	BHAH	69	Mode 15 display result descriptor
M4 0*RWV	BKAH	53	Mode 4, part zero and read, write or verify
NEEDTOWR	BFAM	45	Need to write
NEEDTOWR/	CFAG	45	Need to write
NOADDRLD/	FFCC	42	No address load
NOEXCHNG/	BHAM	67	No exchange
NRMLUNST/	FKAG	57	Normal and unsettled
NO	FQCD	4	N zero variant
N1	FQAD	4	N one variant
N2	FQCF	4	N two variant
N3	FQAG	4	N three variant
N3/	FQCG	4	N three variant
OFFSETEN	BHCG	68	Offset enabled
OFFSETIN	EHCJ	68	Offset toward the spindle
OLD=NEW/	EPAG	10	New cylinder address is equal to the old cylinder address

Signal Name	Backplane Pin No.	Schematic Page No.	Description
OP1	FQCE	4	Operation code 1
OP2	FQAE	4	Operation code 2
OP3	FQAH	4	Operation code 3
PARERR	EQAB	3	Parity error
PBMN-CLR/	BFCE	42	Pushbutton main clear
PJTRMINC	CGCD	72	Part of J flip-flop term to increment sector location counter
PLO-LATE	CHAD	67	Phase lock loop term to the drive causing late strobe pulses
PLOEARLY	CHAC	67	Phase lock loop term to the drive causing early strobe pulses
PTCASKST/	ELAH	49	Part of clock for seek status
PTGT4FR6/	BGCL	71	Part of go to mode 4 from mode 6
PTINADMK/	EGAJ	71	Part of increment address mark
PTJTRMSD/	BGCQ	73	Part of J input flip-flop term
PTLDSLOC/	BKAP	57	Part of load sector location counter
PTM6TO15/	FGAE	73	Part of go to mode 15 from mode 6
PT1CLSCL	CKAK	54	Part 1, clear sector location counter
PT2CMLOD	FKCB	56	Part 2, controller message load
PT4GMD15/	FLAG	48	Part 4, go to mode 15
PT5GMD15/	CGAD	72	Part 5, go to mode 15
PT6GMD15/	FHCD	69	Part 6, go to mode 15
PT7GMD15/	EGAC	71	Part 7, go to mode 15
PWRRESET/	FGCD	71	Power reset
PWRRSYNC/	BFCF	42	Synchronized power reset
P2INADMK/	CLCA	47	Part two of increment address mark
RAWDTAIN	ESCB	19	Raw data input
RD-BIT15	EHCH	68	Result descriptor bit 15
RDATA	FJCG	59	Read data
RDBUFEN/	EHAG	66	Read buffer enable
RDMANT	BHAL	67	Read maintenance
READ	CHCC	67	Read operation
READY	EKCD	56	Ready
RELADDR	CHCJ	67	Relocate, address information used as data
RELDATA	BHCL	67	Relocate, data information used as data
RELOC	EFCH	45	Relocate operation
RELOC/	EFCC	45	Relocate operation, low true
RELPASS2/	CFCE	45	RElocate pass 2
REMOTE	EFCB	45	Remote
RESDESEN	CHCH	66	Result descriptor enable
RESDESEN/	EHAJ	66	Result descriptor enable
RESTORE	CKAM	54	Restore
RESTORE/	FPAG	12	Restore, low true
RESTOREN/	BHAK	67	Restore enable
REVSDONE/	EHAF	64	Revolution counter completed, Count 255
ROGER-DM	CGAP	70	A drive message indicating no errors existed on the last CM
RSELECT	BQCP	3	Raw select
RWV	BFAP	45	Read, write, or verify
SECHDEQL	CRCF	15	Sector and header address equal
SEEKINCL	EGAM	70	Seek incomplete
SELECT	FFCK	45	Select
SEL84ADR	CFAE	45	Select 84 adder
SEND-ERD	CHCF	67	Send extended result descriptor
SEND-ERD/	CHCN	66	Send extended result descriptor
SEND-STS	CJAJ	60	Send status
SER-HEDR	CRAG	16	Serial header
SERDTA=0	FHCL	65	Serial data equal to zero
SERDTAIN	FNCP	32	Serial data in
SERDTAOT	EQCQ	4	Serial data out
SERMPXRO	CHAN	65	Serial multiplexer 0
SERMPXR1	CHAG	65	Serial multiplexer 1
SETSKSTS	BKCP	54	Set seek status
SKSTATUS	EFCM	44	Seek status
SPRVRIFY/	CFCG	45	Spare sector verify

Signal Name	Backplane Pin No.	Schematic Page No.	Description
SRD	FJAH	59	Send result descriptor
ST-8TIMR/	FKAB	56	Start 8 second timer
STADRCMP	FMCF	38	Start address compare
STBLKRDY	FLCL	49	Start block ready
STDTAXFR	EMCB	38	Start data transfer
STERDOUT	FJAL	58	Start extended result descriptor output
STLSKTRM/	ELAK	48	Settled seek terminate
STROB-AD/	EHCE	68	Strobe address portion of extended result descriptor
STUKDATA	EHCQ	68	Stuck data; No data transfer on a read
ST25T1MR/	BKAL	54	Start 25 millisecond timer
ST25OTMR/	FKCC	56	Start 250 microsecond timer
SW-LOCAL	CKAC	55	Switch to local oscillator 10 MHz clock
SW-TO-DR	CKAH	55	Switch to 10 MHz drive clock
TESTOP/	CHAE	67	Operation code equal to 7 (Test operation code)
TIME-OUT/	FMAB	37	Time out, low true
TMOT25MS	FMAA	37	Time out after 25 milliseconds (NO INDEX detected)
TMOT25OU	FMCA	37	Time out after 250 microseconds (NO ADDRESS MARK detected)
TMOT8SEC	FMCB	37	Time out after 8 seconds (Remote power up)
TRY-DIAG/	CNCP	25	Try diagnostics
TSTSTKDT/	BKAK	53	Test for stuck data (no data transfer on a read)
UNIT2*0	FQCP	4	Unit 0
UNIT2*1	FQAP	4	Unit 2
UNIT2*2	FQCN	4	Unit 4
UNIT2*3	FQCM	4	Unit 8
UNIT4SEL	FSCJ	19	Select unit 4
UNIT5SEL	FSCH	19	Select unit 5
UNIT6SEL	FSAJ	19	Select unit 6
UNIT7SEL	FSAH	19	Select unit 7
VERIFY/	BHCM	67	Verify operation

Signal Name	Backplane Pin No.	Schematic Page No.	Description
WRADR	FJCN	59	Write address
WRD	FJCM	59	Write data
WRFIR	FJAM	59	Write firecode
WRITE	CHAL	65	Write operation
WRITE/	CHCA	67	WRite low true
WRLOCKOT	EGCM	70	Write lock out
WRZ	FJAG	59	Write zeros
WR1	FJCP	59	Write 1's
WR32HEDR	CHAH	65	Write 32 bits of header information

The terms that follow that have the WnnBnn format are WORD and BIT times. Their definitions are self explanatory and will not be listed.

WO/	BMAD	33
WOBO	BMCB	35
WOB11	BMAE	35
WOB12	EMCF	35
WOB13	BMCD	35
WOB14	BMCE	35
WOB15	BMCF	35
W1/	BMCC	33
W1B0	BMAF	35
W1B11	BMCG	35
W1B15	BMCH	35
W1B6	BMAH	35
W10/	CMCF	34
W10B14	CMCK	36
W10B4	CMCL	36
W104B7	FMAC	36
W106B13	EMCK	36
W106B15	EMAJ	36
W108/	EMCC	34
W108B15	EMAK	36
W108B9	EMAH	36
W109/	EMAC	34
W109B1	EMCM	36
W109B14	EMAM	36
W109B7	EMAL	36
W11B14	CMCN	36
W110/	FMCE	34
W110B9	CMAE	36
W111B7	FMCC	36
W118/	CMAJ	38
W118B7	EMCJ	38
W119B15	EMCQ	36
W127B14	CMCJ	34
W127B15	CMAM	34
W13B15	FMCD	36

Signal Name	Backplane Pin No.	Schematic Page No.	Description
W14/	CMAF	34	
W14B0	CMCP	36	
W14B1	CMAL	36	
W14B2	CMAK	36	
W14B3	EMCE	36	
W14B4	EMAE	36	
W14B5	EMCG	36	
W14B6	EMCH	36	
W16/	CMAP	34	
W16B13	EMAD	36	
W16B9	EMCD	36	
W2B0	BMCK	35	
W2B1	BMCL	35	
W2B14	BMAK	35	
W2B15	BMAL	35	
W29/	CMCM	34	
W29B8	EMAF	36	
W3B14	BMCM	35	
W30B6	EMCL	36	
W4B13	BMAM	35	
W4B15	BMCN	35	
W5B1	BMAN	35	
W5B15	BMCP	35	
W6/	BMAC	33	
W6B15	BMCQ	35	
W6B6	BMAP	35	
W61B14	CMCA	36	
W64/	CMAD	34	
W64B14	EMAG	36	
W7B1	BMAQ	35	
W7B4	CMAA	35	
W8/	BMAB	34	
W8B15	CMAG	35	
W8B5	CMAC	35	
W9B13	CMCD	36	
W9B14	CMCE	36	
W9B15	CMAH	36	
XMPER+TD	FGAH	70	Transmission parity error or try diagnostics
XMTNPERR	CGCE	70	Transmission parity error
XMENABLE	EHAH	66	Transmission enable

NOTE

The symbol "*" indicates that the number to the left of the symbol is to be raised to the power of the number to the right. For example, 2 * 3 = 8.