REV	DESCRIPTION	DATE	APPROVED
A	ORIGINAL ISSUE		
B	·REWRITTEN		

CENTURY DATA

MODEL 140 FLOPPY DISK DRIVE

INTERFACE SPECIFICATIONS

Century Data
SYSTEMS, INC.

TITLE: SPECIFICATION,
INTERFACE, MODEL 140

DRAWN BY   CHECKED BY
APPD.   APPD DATE

DRAWING NO.

11651-001

REV.

B

PAGE 1 OF 35

TABLE OF CONTENTS

DRAWING NO.	REV.
11651-001	B

PAGE 2 OF 35

DRAWING NO.	REV.
11651-001	B

FORM F4500-230 9/73

LIST OF ILLUSTRATIONS

DRAWING NO.	REV.
11651-001	B

PAGE 4 OF 35

FORM F4500-230 9/73

1.0 SCOPE

This specification has been prepared to meet the needs of the Original Equipment Manufacturer (OEM) who intends to use the Model 140 Floppy Disk Drive as a component in his data storage system. This document describes detailed interface information required by the equipment designer.

2.0 RELATED DOCUMENTS

Model 140 Disk Drive Installation and Parts Manual.
Model 140 Disk Drive Operation and Maintenance Manual.
Century Data Packing and Shipping Specification.

3.0 GENERAL DESCRIPTION

The Century Data Model 140 Floppy Disk Drive is a third generation, high speed, random access, disk storage unit which utilizes a flexible disk cartridge as the storage medium. Up to 3.20 million bits of data may be stored on the single recording surface of the flexible disk. When utilizing the IBM 3740 data format, 1.94 million bits of data may be recorded. The Model 140 Floppy Disk Drive features 48 tracks-per-inch and 3200 bits-per-inch technologies to provide media interchangeability with the IBM 3740 series of data recording equipment.

Access time is 6 milliseconds track to track with 10 milliseconds required after the final step for head stabilization. The flexible disk is rotated at 360 RPM yielding a data transfer rate of 250,000 bits-per-second.

The Model 140 contains features and options whereby a systems designer may incorporate the Model 140 into his data storage system with a minimum of effort. Among these are a positive pressurized media chamber, precise media registration, write protect capability, sector outputs, and a choice of data outputs.

4.0 RELIABILITY

4.1 Service Life

The Model 140 Floppy Disk Drive is designed and constructed to provide a useful life of 7 years or 35,000 hours, whichever occurs first, before a factory overhaul or replacement is required. Repair or replacement of parts will be permitted during the lifetime of the unit.

FORM F4500-230 9/73

4.2 Mean Time Between Failure (MTBF)

Following an initial period of 200 hours, MTBF shall exceed 5,000 hours. The following expression defines MTBF:

$$MTBF = \frac{Operating\ Hours}{Number\ of\ Equipment\ Failures}$$

Operating hours mean total "power-on" hours less any maintenance time. Equipment failures mean any stoppage or substandard performance of the unit because of equipment malfunction. Equipment failure shall exclude downtime or substandard performance due to operator error, adverse environment, power failure, or other failures not caused by the disk drive. To establish a meaningful MTBF, operating hours must be greater than 2,500 hours and shall include all sites where the disk drives are used.

For the purpose of this specification, equipment failures are defined as those failures requiring repairs, adjustments or replacements on an unscheduled basis, i.e., emergency maintenance is required because of hardware failure or substandard performance.

4.3 Mean Time to Repair (MTTR)

MTTR shall be less than 0.5 hours, and is defined as the time required for an adequately trained and competent serviceman to diagnose and correct a malfunction.

4.4 Preventive Maintenance

The Model 140 Floppy Disk Drive does not require regular preventive maintenance.

4.5 Recoverable Read Error Rate

The recoverable read error rate shall be less than one error in 10^9 bits read. A recoverable read error is one which can be recovered in ten or less attempts to read the record.

Errors attributed to the flexible disk will not be included in determining the recoverable read error rate.

4.6 Non-Recoverable Read Error Rate

The non-recoverable read error rate shall be less than one error in 10^{12} bits read. A non-recoverable read error is one which remains after ten unsuccessful attempts to read the record.

DRAWING NO.	REV.
11651-001	B
PAGE 6 OF 35	

Errors attributed to the flexible disk will not be included in determining the non-recoverable read error rate.

4.7 Access Positioning Error Rate

Provided proper interface timing requirements are followed, the access positioning error rate shall be less than one position error per 10^6 access positioning operations.

5.0 ENVIRONMENTAL REQUIREMENTS

The Model 140 Floppy Disk Drive will provide satisfactory performance when operated within the following environmental parameters.

5.1 Temperature

    (a)   Operating: 60°F to 100°F, maximum gradient of 20°F per hour.

    (b)   Non-operating: -30°F to 140°F

5.2 Relative Humidity

    (a)   Operating: 20% to 80%, 78°F maximum wet bulb

    (b)   Non-operating: 5% to 98%, no condensation

5.3 Shock

Non-operating: The unit shall not suffer damage or fail to perform as specified when subjected to 18 impact shocks of 5G's (±10%) consisting of 3 shocks in opposite directions along each of 3 mutually perpendicular axes. Each shock impulse shall have a time duration of 11 (±1) milliseconds.

5.4 Vibration

    (a)   Operating: The unit shall withstand a peak displacement of ±0.005 inch for the frequency range from 5 to 60Hz and ±2G's for the range from 60 to 500Hz.

    (b)   Non-operating: The unit shall withstand 1.5G's from 5 to 55Hz for four hours on each axis with a 20 minute frequency span (no external packaging or internal bracing allowed).

FORM F4500-230 9/73

5.5 Altitude

    (a)   Operating: Mean sea level to 10,000 feet
    (b)   Non-operating: 1,000 feet below sea level to 15,000
                          feet above sea level.

5.6 Flexible Disk Environment

Flexible disks shall be in the same temperature and humidity
environment as the disk drive for a minimum of 5 minutes prior
to installation of the flexible disk into the disk drive.

5.6.1 Temperature

    (a)   Operating: 50°F to 125°F, maximum gradient of
                          20°F per hour.
    (b)   Non-operating: 50°F to 120°F

5.6.2 Relative Humidity

    (a)   Operating: 20% to 80%, 78°F maximum wet bulb
    (b)   Non-operating: 8% to 80%, 85°F maximum wet bulb

5.7 Cleanliness and Air Filter

    (a)   Cleanliness: The Model 140 Floppy Disk Drive does not
                         normally require periodic cleaning of the
chassis or read/write head. Each flexible
disk contains a special wiping tissue
within its protective jacket to remove and
trap excess oxide or foreign debris from the
surface of the flexible disk.

Should the read/write head require cleaning
due to the continued use of a fully con-
taminated flexible disk, the head should be
cleaned using lintless gauze dampened with
91% isopropyl alcohol. After cleaning,
the head should be wiped with a clean, dry
gauze to remove any residue left when
the alcohol evaporates.

    (b)   Air filter: The Model 140 is equipped with a positive
pressure air system. A fan located on
the spindle drive motor serves to draw air
through a filter located at the rear of the
unit and pass this air across the flexible
disk venting at the rear of the unit. The
function of this system is to control and
filter air within the unit in order to

DRAWING NO.	REV.
11651-001	B

provide the highest possible reliability.
The air system is in constant operation
including during flexible disk removal
and replacement.

Since the Model 140 will be used in
numerous applications with varying
environmental conditions, a recommended
air filter replacement schedule is not
provided. The systems designer or main-
tenance planner should be advised of the
positive pressure system and take action
appropriate to his particular application.

6.0   UNDERWRITER APPROVALS

The Model 140 Floppy Disk Drive is UL and CSA recognized.
The systems designer should consult appropriate regulations as a
part of implementing the Model 140 into his system.

7.0   OPERATOR CONTROL

The simplicity of the Model 140 precludes the necessity of
operator controls and indicators. A convenient method of opening
the unit for flexible disk insertion and removal is provided.
In the center of the face of the unit is a simple, thumb-
operated pushbutton which is depressed to allow the spring-
loaded front cover to open. The flexible disk may be inserted
or removed, as appropriate. The cover may then be closed
manually. The front cover is automatically locked shut (see
Figure 1).
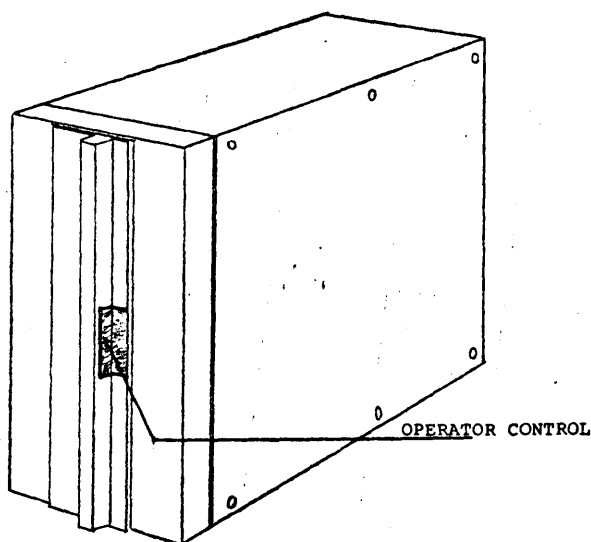
OPERATOR CONTROL

FIGURE 1, OPERATOR CONTROL

DRAWING NO.	REV.
11651-001	B

PAGE 9	OF 35

8.0 POWER REQUIREMENTS

8.1 AC Power

(a) 50Hz = 100 VAC $\pm$ 10%, single phase
+0.5Hz 208 VAC $\pm$ 10%, single phase
220 VAC $\pm$ 10%, single phase
240 VAC $\pm$ 10%, single phase

(b) 60Hz = 100 VAC $\pm$ 10%, single phase
+0.5Hz 115 VAC $\pm$ 10%, single phase
208 VAC $\pm$ 10%, single phase
230 VAC $\pm$ 10%, single phase

8.2 DC POWER

+5VDC $\pm$ 2% @ 1.5 amps
+24VDC $\pm$ 5% @ 1.0 amp

9.0 CABLE CONNECTIONS

9.1 AC Power Cable

AC power is supplied to JO on the rear of the unit (see Figure 2). The mating connector required for connection via #18 AWG is available in a kit form. Connector information is as follows:

AC power connector (on unit)   CD P/N 90605-003
Mating connector   CD P/N 90606-003 (MOLEX 1396R)
Mating contacts (3 req)   CD P/N 90441-002 (MOLEX 1381-ATL)

JO-AC CONNECTOR

J1-DC SIGNAL/CONNECTOR

FIGURE 2, CABLE LOCATIONS

FORM F4500-230 9/73

9.1.1 PO Pin Assignments

Phase to Phase   PO-1 - 230 VAC
                                PO-2 - chassis ground
                                PO-3 - 230 VAC

Phase to Neutral   PO-1 - 115 VAC
                                 PO-2 - chassis ground
                                 PO-3 - 115 VAC return

-NOTE-

With phase to phase systems, pins 1
and 3 should be fused. With phase to
neutral systems, pin 1 should be fused.
For UL approval, the unit must draw its
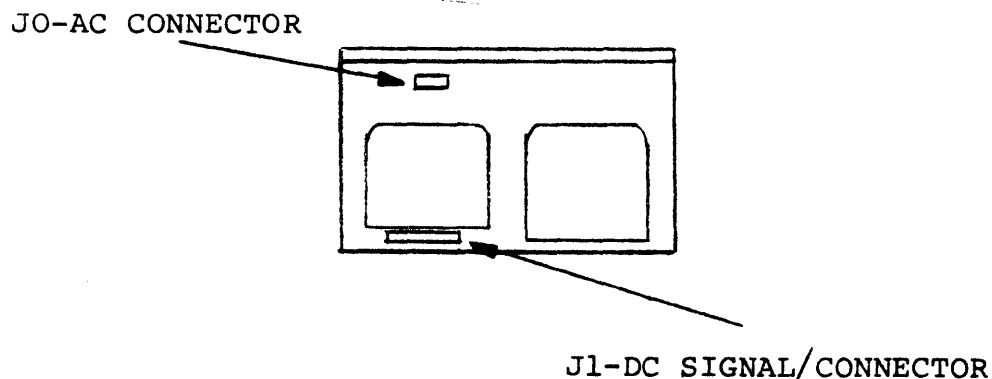power from the host system. All cable
grounds are brought together on the
drive. PWB.

9.2 DC/Signal Cable

DC power, control information, and data are transmitted between
the control unit and the drive via the DC/Signal Cable. The mat-
ing connector required to interface with twisted pairs, returns
grounded, #24 or #26 AWG wire is available in kit form. Cable
twist should be approximately 30 twists per foot, with a maximum
cable length of 20 feet. While each drive's interface is identi-
cal, provisions have been made whereby each drive may be assigned
a unique address and used in a bussed or daisy chained configura-
tion. This is accomplished by the use of a SELECT line which
enables communication between the Model 140 and its host
controller. Each drive contains the select function and may
be controlled individually in a bussed configuration by the use
of unique SELECT lines built into the DC/Signal Cable.

Another unique line is READY. This line serves as an interrupt
to the controller and is intended to reduce controller overhead.
This line is particularly useful during flexible disk changes.
All other lines are gated by SELECT, including data transfer.
In a daisy chained configuration, a terminator PWB is required
for the last unit in the chain. In a radial configuration,
the terminator PWB is not required unless the DC/Signal Cable
length exceeds 5 feet. Refer to paragraph 9.2.5 for physical
wiring details. The DC/Signal Cable is connected to J-1
located at the rear of the unit (refer to Figure 2). Connector
information is as follows:

FORM F4500-230 9/73

```
                    DC/Signal connector (on unit)     CD P/N 95359-040
                    Mating connector                  CD P/N 97421-044
                    Crimp tool                        ITT Common CCT-UCB
                    Extract tool                      ITT Common CET-UB
                    Strain relief                     CD  P/N 97230-040
```

9.2.1 P1 Pin Assignments

Signal Pin	Ground Pin	Signal Nomenclature
P-2	P-1	+5VDC
P-4	P-3	+5VDC
P-6	P-5	DIRECTION
P-8	P-7	STEP/
P-10	P-9	+24V
P-12	P-11	+24V
P-14	P-13	+24V
P-16	P-15	SELECT/
P-18	P-17	TRACK 00/
P-20	P-19	HEAD LOAD/
P-22	P-21	READY/
P-24	P-23	ABOVE TRACK 43/
P-26	P-25	INDEX/
P-28	P-27	SECTOR/
P-30	P-29	WRITE PROTECTED/
P-32	P-31	WRITE DATA/
P-34	P-33	WRITE ENABLE/
P-36	P-35	READ DATA
P-38	P-37	READ CLOCK (OR RAW DATA)
P-40	P-39	PLO SYNC/

9.2.2 Interface Signal Definitions

All interface lines are low active (OV) unless otherwise
specified. Driver and receiver circuits used within the
Model 140 are DTL and TTL. Controller driver and receiver
circuits must provide equivalent voltage and impedance levels
for proper signal transmission.

LOW – refers to the low voltage condition commonly encountered
       with TTL and DTL logic, and corresponds to a voltage in
       the range of 0.0 V to 0.4 V.

HIGH – refers to the high voltage condition commonly encountered
       with TTL and DTL logic, and corresponds to a voltage in
       the range of 2.2 V to 5.5 V.

9.2.2.1 Input Signals

Signal Name	Definition
SELECT/	A unique signal used to enable communication between a disk drive and its controller. This line must be low (OV) to be active.
WRITE ENABLE/	Enables recording of data on the flexible disk. This line must be low (OV) to be active. When this line is high (5V), reading from the flexible disk is enabled.
WRITE DATA/	This line carries low active (OV) pulses representing data to be recorded on the flexible disk. Write current reverses direction on the trailing edge of each pulse. Pulses must be 0.2 to 1.5 microseconds wide with a maximum repetition rate of 2.0 microseconds.
ABOVE TRACK 43/	This line is used to control write current amplitude, guaranteeing IBM 3740 media interchangeability. This line must be high (5V) when recording on tracks 0 through 43, and low (OV) when recording on tracks 44 through 76. ABOVE TRACK 43 must be stabilized 10 microseconds before activating WRITE ENABLE.
STEP/	This line is used in conjunction with DIRECTION and is used to cause the read/write head to be moved from track to track. A low pulse (OV) of 2US to 4MS causes the head to move one track in the direction specified by the DIRECTION line. Maximum step rate is 167 steps per second (6 milliseconds per step).
DIRECTION	This line is used in conjunction with STEP to cause the read/write head to be moved from track to track. When this line is high (5V), direction is IN (higher numbered tracks). When this line is low (OV), direction is OUT (lower numbered tracks). This line must be stable 100 nanoseconds minimum before activating STEP and remain in the appropriate state for the duration of the step period.

FORM F4500-230 9/73

| HEAD LOAD/ | This line is used to move the flexible disk against the read/write head for data recording or retrieval. This line must be low (OV) to be active. A 16 millisecond delay is required after activating this line prior to commencing data transfers to allow for media loading. |

| PLO SYNC/ | A low level (OV) pulse 12 microseconds wide will cause the PLO data separator to sync to preamble 0's for data tracking. |

9.2.2.2 Output Signals

Signal Name	Definition
READ DATA	This line transmits read data to the controller. Exact line definition and timing characteristics depend on the data separator present within the drive. When no data separator is present within the drive, this line has no function.

With Standard One-Shot Separator

This line is a NRZ data line with the one shot separator. The level of the line represents data. A one bit is represented by a low (OV) level, and a zero bit is represented by a high (5V) level. The READ CLOCK line is used to clock data into the controller. Refer to paragraph 9.2.5.2 for timing characteristics.

With Optional PLO Data Separator

This line outputs data pulses with the PLO separator. A one bit is represented by an 800 nanosecond low (OV) level pulse. A zero bit is represented by the absence of a pulse. The READ CLOCK line is used to clock data into the controller. Refer to paragraph 9.2.5.2 for timing characteristics.

| READ CLOCK/ | Exact meaning and timing characteristics of this line depend on the data separator used within the drive. |

With No Data Separator

When no data separator is used within the

DRAWING NO.	REV.
11651-001	B

| PAGE 14 | OF 35 |

drive, this line outputs unseparated data (clocks and data). This output is provided for the systems designer who desires to use his own encloding scheme or provide data separation in the controller. This output may be used to enable detection of IBM 3740-type address marks by the controller. A modified one-shot decoder with a missing pulse detector will allow detection of 3740 address marks. Each flux reversal read from the disk is output as a 300 $\pm$ 100 nanosecond wide low (OV) pulse.

With One-Shot Separator

This line will output 300 $\pm$ 100 nanosecond wide low (OV) pulses representing separated clocks. The trailing edge of these pulses are used to strobe the READ DATA line into the controller.

With PLO Separator

This line will output 800 nanosecond wide low (OV) pulses representing separated clocks. These pulses occur simultaneously with pulses occurring on the READ DATA line.

INDEX/	The leading edge of a 450 microsecond wide low (OV) pulse on this line represents the beginning of track. This pulse occurs once per revolution of the flexible disk.
TRACK 00/	When this line is low (OV), the read/write head is positioned over track 00. This line is intended as a head position reference. When this line is active, the stepper motor drive circuits are inhibited from further outward movement.
READY/	A low level (OV) on this line indicates that the flexible disk is up to speed. This line is not gated by SELECT and is thus a unique line. This line serves as an interrupt to the controller and is particularly useful during flexible disk changes.
SECTOR/	Low level (OV) pulses on this line represent sector marks. Sector pulses are 1 millisecond wide.

CDS 4500—23 4/71

WRITE PROTECTED/   A low level (OV) on this line indicates that
                    a write enable tab is <u>not</u> present on the
                    flexible disk in the drive, thus no writing
                    may take place.

9.2.4   <u>Interface Circuits</u>

9.2.4.1   <u>Receivers</u>

Figure 3 depicts typical interface receivers. All receivers
require termination resistors and are either "7404" TTL
inverters or "836" DTL inverters. The controller drivers
must be capable of sinking 25 milliamps in the low state.
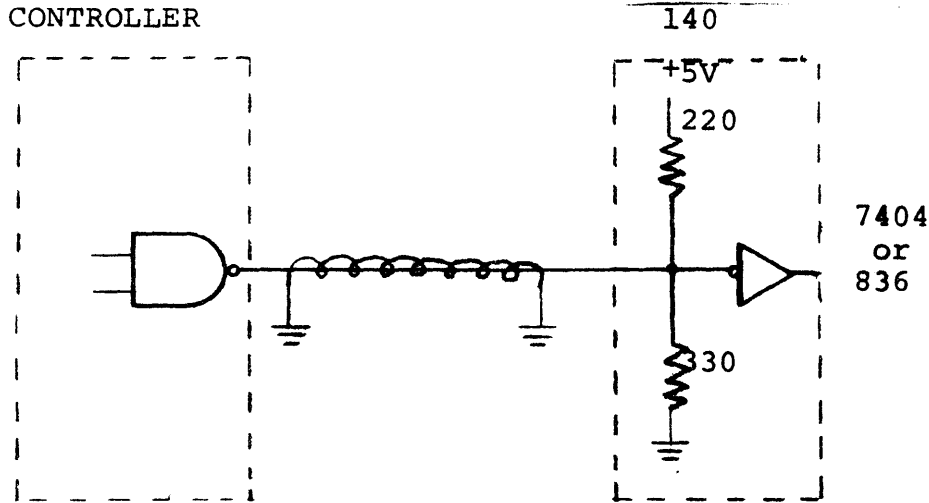
FIGURE 3, RECEIVER SCHEMATIC

9.2.4.2   <u>Drivers</u>

Figure 4 depicts typical interface drivers. All drivers are
standard DTL "844" open collector power gates. Termination
resistors are required at the controller. All driver outputs
are high when the unit is not selected. These drivers sink
36 milliamps in the low state.
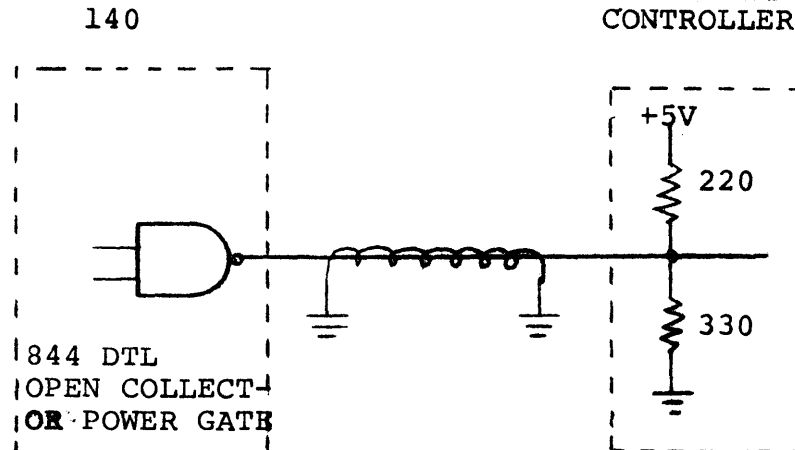
FIGURE 4, DRIVER SCHEMATIC

DRAWING NO.	REV.
11651-001	B
PAGE 16 OF 35	

9.2.5 <u>DC/Signal Cable Physical Wiring</u>

A connector PWB is available (CD P/N 12084-001) for the Model
140 which may be used as part of necessary interface cabling
between the drive and its controller. This connector PWB
serves as an interconnection connector and as a terminator in
daisy chained configurations. In this configuration, termination
resistors are present on the last drive's connector only.
Figure 5 is a schematic representation of the PWB with ter-
mination resistors.

In a radial interface, termination resistors are not needed
unless cable length exceeds 5 feet.

Information is provided which will assist the systems designer
in correct wiring of the connector in both daisy chained and
radial configurations.

FORM F4500-230 9/73
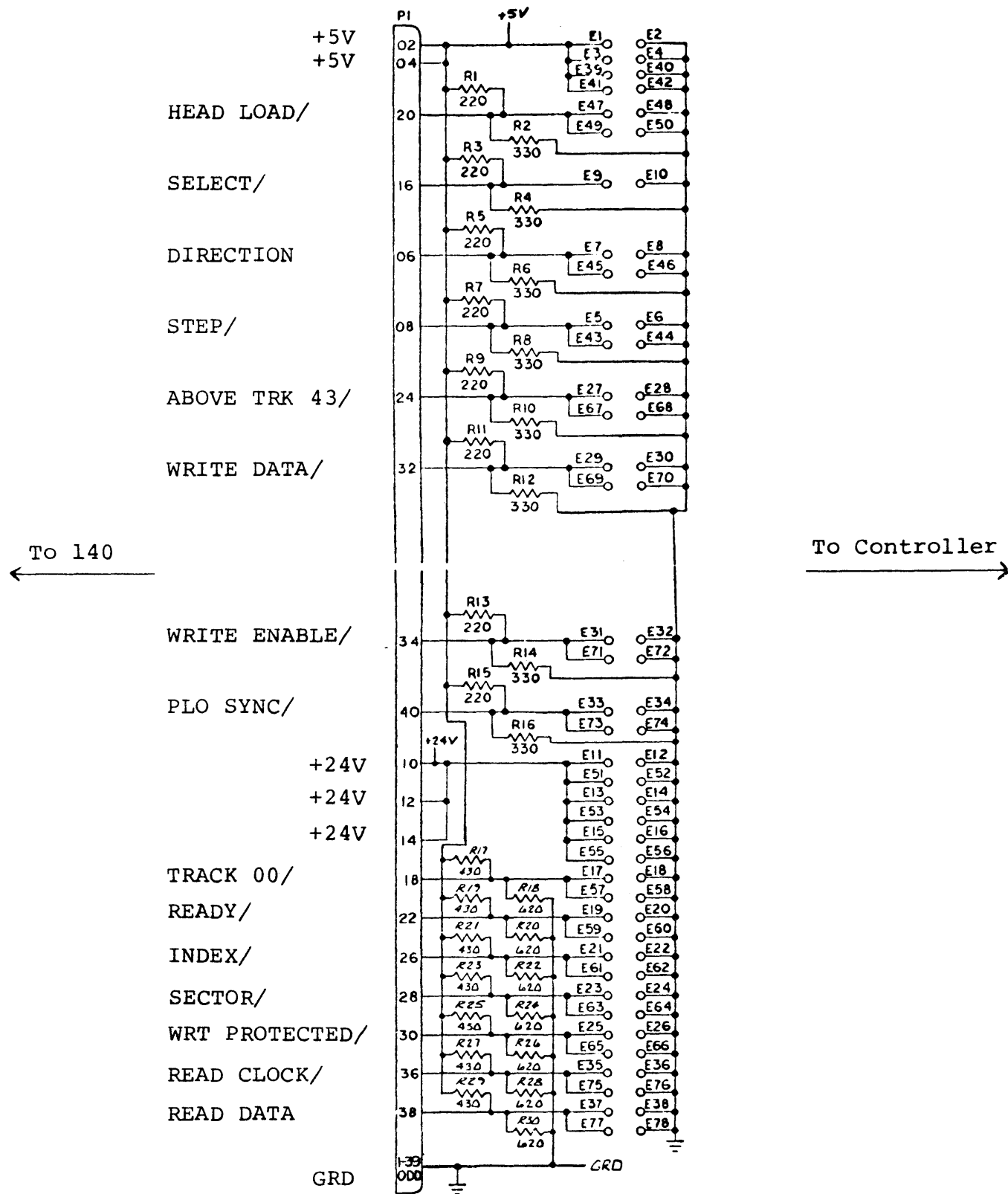
FIGURE 5, TERMINATOR SCHEMATIC

DRAWING NO.		REV.
11651-001		B
PAGE 18	OF	35

9.2.5.1 Daisy Chained Interface Wiring

All connector PWB's except the end drive should be wired as
described.

Definitions:

IN   - a signal or power arriving at the drive's input
             interface.

OUT   - a signal being bussed to the next drive's input
             interface.

UNIQUE   - a signal not bussed

BUSS IN   - a signal arriving at the drive or controller from
             the preceeding drive (signals being bussed to the
             controller).

BUSS OUT   - a signal being sent from a drive towards the controller.

(continued on next page)

FORM F4500-230 9/73

```
E 1  +5V (IN)                        E 2  TWP  GND  (E1)
E 3  +5V (IN)                        E 4  TWP  GND  (E3)
E 5  STEP (IN)                       E 6  TWP  GND  (E5)
E 7  DIRECTION (IN)                  E 8  TWP  GND  (E7)
E 9  SELECT (IN, UNIQUE)             E10  TWP  GND  (E9)
E11  +24V (IN)                       E12  TWP  GND  (E11)
E13  +24V (IN)                       E14  TWP  GND  (E13)
E15  +24V (IN)                       E16  TWP  GND  (E15)
E17  TRACK 00 (BUSS OUT)             E18  TWP  GND  (E17)
E19  READY (OUT, UNIQUE)             E20  TWP  GND  (E19)
E21  INDEX (BUSS OUT)                E22  TWP  GND  (E21)
E23  SECTOR (BUSS OUT)               E24  TWP  GND  (E23)
E25  WRITE PROTECTED (BUSS OUT)      E26  TWP  GND  (E25)
E27  ABOVE TRK 43 (IN)               E28  TWP  GND  (E27)
E29  WRT DATA (IN)                   E30  TWP  GND  (E29)
E31  WRT ENABLE (IN)                 E32  TWP  GND  (E31)
E33  PLO SYNC (IN)                   E34  TWP  GND  (E33)
E35  READ CLOCK (BUSS OUT)           E36  TWP  GND  (E35)
E37  READ DATA (BUSS OUT)            E38  TWP  GND  (E37)
E39  +5V (OUT)                       E40  TWP  GND  (E39)
E41  +5V (OUT)                       E42  TWP  GND  (E41)
E43  STEP (OUT)                      E44  TWP  GND  (E43)
E45  DIRECTION (OUT)                 E46  TWP  GND  (E45)
E47  HEAD LOAD (IN)                  E48  TWP  GND  (E47)
E49  HEAD LOAD (OUT)                 E50  TWP  GND  (E49)
E51  +24V (OUT)                      E52  TWP  GND  (E51)
E53  +24V (OUT)                      E54  TWP  GND  (E53)
E55  +24V (OUT)                      E56  TWP  GND  (E55)
E57  TRACK 00 (BUSS IN)              E58  TWP  GND  (E57)
E59  NOT USED                        E60  NOT  USED
E61  INDEX (BUSS IN)                 E62  TWP  GND  (E61)
E63  SECTOR (BUSS IN)                E64  TWP  GND  (E63)
E65  WRITE PROTECTED (BUSS IN)       E66  TWP  GND  (E65)
E67  ABOVE TRK 43 (OUT)              E68  TWP  GND  (E67)
E69  WRT DATA (OUT)                  E70  TWP  GND  (E69)
E71  WRT ENABLE (OUT)                E72  TWP  GND  (E71)
E73  PLO SYNC (OUT)                  E74  TWP  GND  (E73)
E75  READ CLOCK (BUSS IN)            E76  TWP  GND  (E75)
E77  READ DATA (BUSS IN)             E78  TWP  GND  (E77)
```
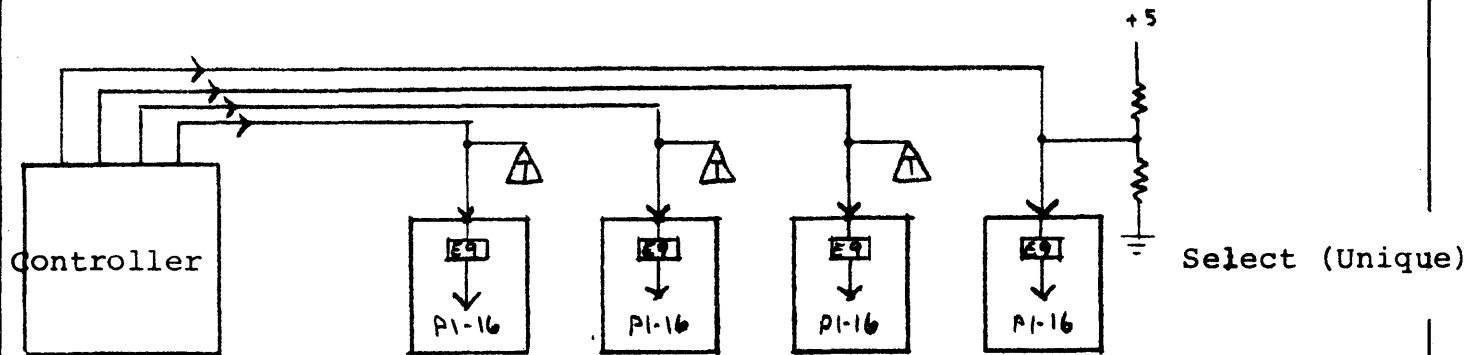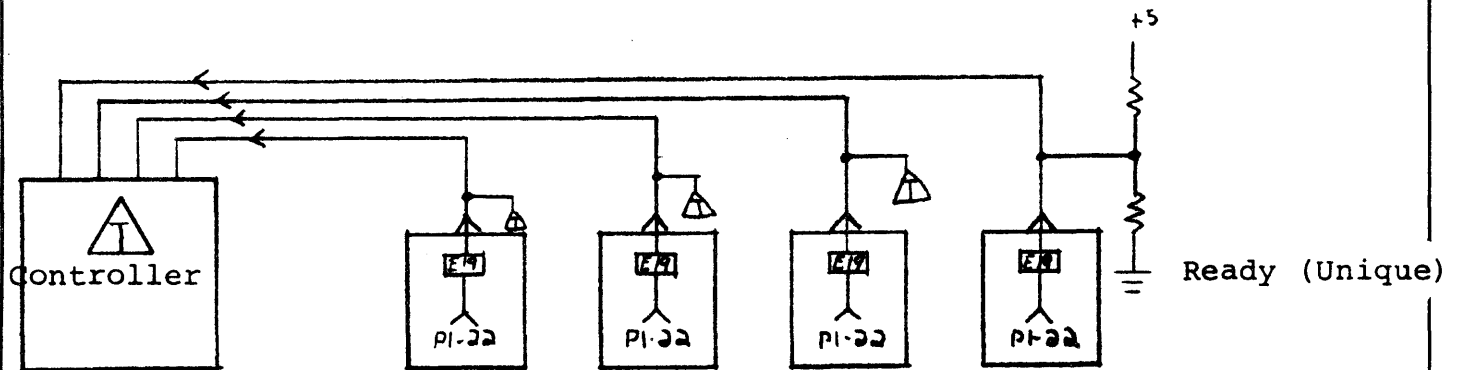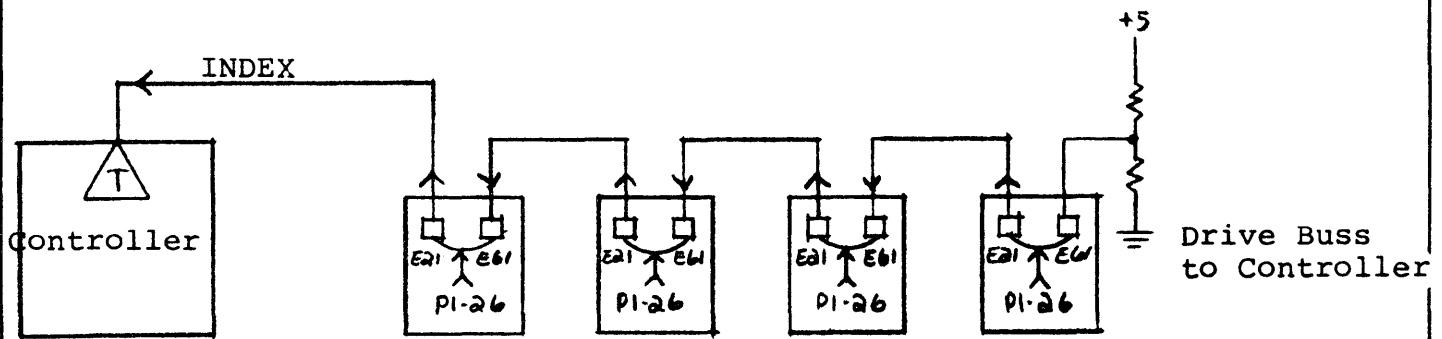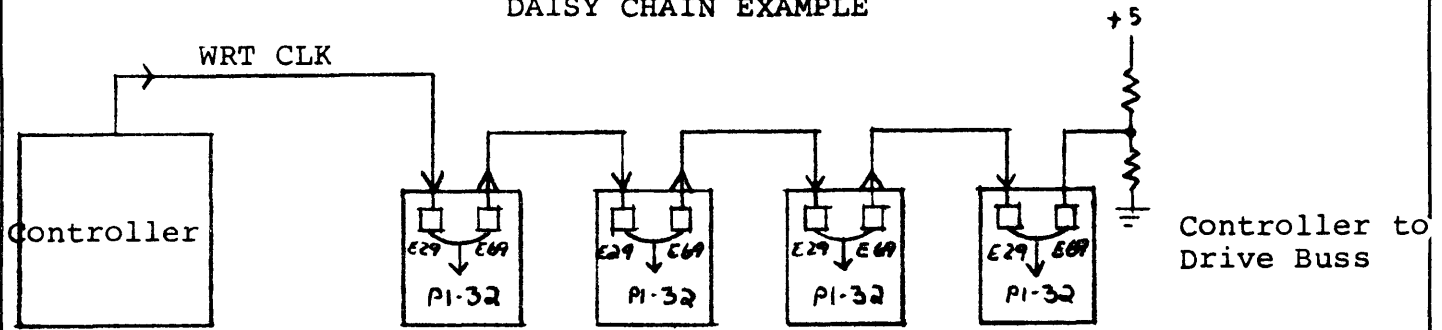
DRAWING NO.	REV.
11651-001	B

| PAGE | 20 | OF | 35 |

END DRIVE PWB CONNECTOR WIRING

```
E 1  +5V (IN)                      E 2  TWP  GND  (E1)
E 3  +5V (IN)                      E 4  TWP  GND  (E3)
E 5  STEP (IN)                     E 6  TWP  GND  (E5)
E 7  DIRECTION (IN)                E 8  TWP  GND  (E7)
E 9  SELECT (IN,UNIQUE)            E10  TWP  GND  (E9)
E11  +24V (IN)                     E12  TWP  GND  (E11)
E13  +24V (IN)                     E14  TWP  GND  (E13)
E15  +24V (IN)                     E16  TWP  GND  (E15)
E17  TRACK 00 (BUSS OUT)           E18  TWP  GND  (E17)
E19  READY (OUT,UNIQUE)            E20  TWP  GND  (E19)
E21  INDEX (BUSS OUT)              E22  TWP  GND  (E21)
E23  SECTOR (BUSS OUT)             E24  TWP  GND  (E23)
E25  WRITE PROTECTED (BUSS OUT)    E26  TWP  GND  (E25)
E27  ABOVE TRK 43 (IN)             E28  TWP  GND  (E27)
E29  WRT  DATA (IN)                E30  TWP  GND  (E29)
E31  WRT ENABLE (IN)               E32  TWP  GND  (E31)
E33  PLO SYNC (IN)                 E34  TWP  GND  (E33)
E35  READ CLOCK (BUSS OUT)         E36  TWP  GND  (E35)
E37  READ DATA (BUSS OUT)          E38  TWP  GND  (E37)
E39                                E40
E41                                E42
E43                                E44
E45                                E46
E47  HEAD LOAD (IN)                E48  TWP  GND  (E47)
E49                                E50
E51                                E52
E53                                E54
E55                                E56
E57                                E58
E59                                E60
E61                                E62
E63                                E64
E65                                E66
E67                                E68
E69                                E70
E71                                E72
E73                                E74
E75                                E76
E77                                E78
```

DAISY CHAIN EXAMPLE

WRT CLK

Controller

E29 E69

PI-32   PI-32   PI-32   PI-32

+5

Controller to
Drive Buss

INDEX

Controller

T

E2I E6I

PI-26   PI-26   PI-26   PI-26

+5

Drive Buss
to Controller

Controller

E19

PI-22   PI-22   PI-22   PI-22

+5

Ready (Unique)

Controller

E9

PI-16   PI-16   PI-16   PI-16

+5

Select (Unique)

△T = Terminator

9.2.5.2 Radial Interface Wiring

IN - Signal or power coming from controller to drive.

OUT - Signal going from drive to controller.

E	1	+5V (IN)		E	2	TWP GND	(E1)
	3	+5V (IN)			4	TWP GND	(E3)
	5	STEP (IN)			6	TWP GND	(E5)
	7	DIRECTION (IN)			8	TWP GND	(E7)
	9	SELECT (IN)			10	TWP GND	(E9)
	11	+24V (IN)			12	TWP GND	(E11)
	13	+24V (IN)			14	TWP GND	(E13)
	15	+24V (IN)			16	TWP GND	(E15)
	17	TRACK 00 (OUT)			18	TWP GND	(E17)
	19	READY (OUT)			20	TWP GND	(E19)
	21	INDEX (OUT)			22	TWP GND	(E21)
	23	SECTOR (OUT)			24	TWP GND	(E23)
	25	WRITE PROTECTED(OUT)			26	TWP GND	(E25)
	27	ABOVE TRK 43 (IN)			28	TWP GND	(E27)
	29	WRT DATA (IN)			30	TWP GND	(E29)
	31	WRT ENABLE (IN)			32	TWP GND	(E31)
	33	PLO SYNC (IN)			34	TWP GND	(E33)
	35	READ CLOCK (OUT)			36	TWP GND	(E35)
	37	READ DATA (OUT)			38	TWP GND	(E37)
	39				40		
	41				42		
	43				44		
	45				46		
	47	HEAD LOAD (IN)			48	TWP GND	(E47)
	49				50		
	51				52		
	53				54		
	55				56		
	57				58		
	59				60		
	61				62		
	63				64		
	65				66		
	67				68		
	69				70		
	71				72		
	73				74		
	75				76		
	77				78		

9.2.6   Interface Timing

9.2.6.1   Track Positioning

Track positioning is accomplished by using interface lines
DIRECTION and STEP. The DIRECTION line must be set to the
proper level and be stable 100 nanoseconds minimum before the
leading edge of STEP.

Head positioning should be accomplished by activating the
STEP line at 167 pulses per second with one resultant head
position change per pulse. 10 milliseconds of head stabilization
time must be provided for after the last step prior to pro-
ceeding with data transfer.

If a data transfer is to commence upon locating the desired
track, it is recommended that the head be loaded by activating
the HEAD LOAD line at the same time as issuing the last step
pulse. Thus, the 16 millisecond time required to move the
media against the head coincides with the time required for
stepping the last track and mechanical stabilization of the
head. By using this method, only one time-out is required in
the controller (16 milliseconds) and head loading is not a
factor in latency.

Should an access position error occur, a reference may be
established by either reading the track header or by stepping
the head out until the TRACK 00 line becomes active.

FORM F4500-230 9/73

DIRECTION

DIRECTION = OUT
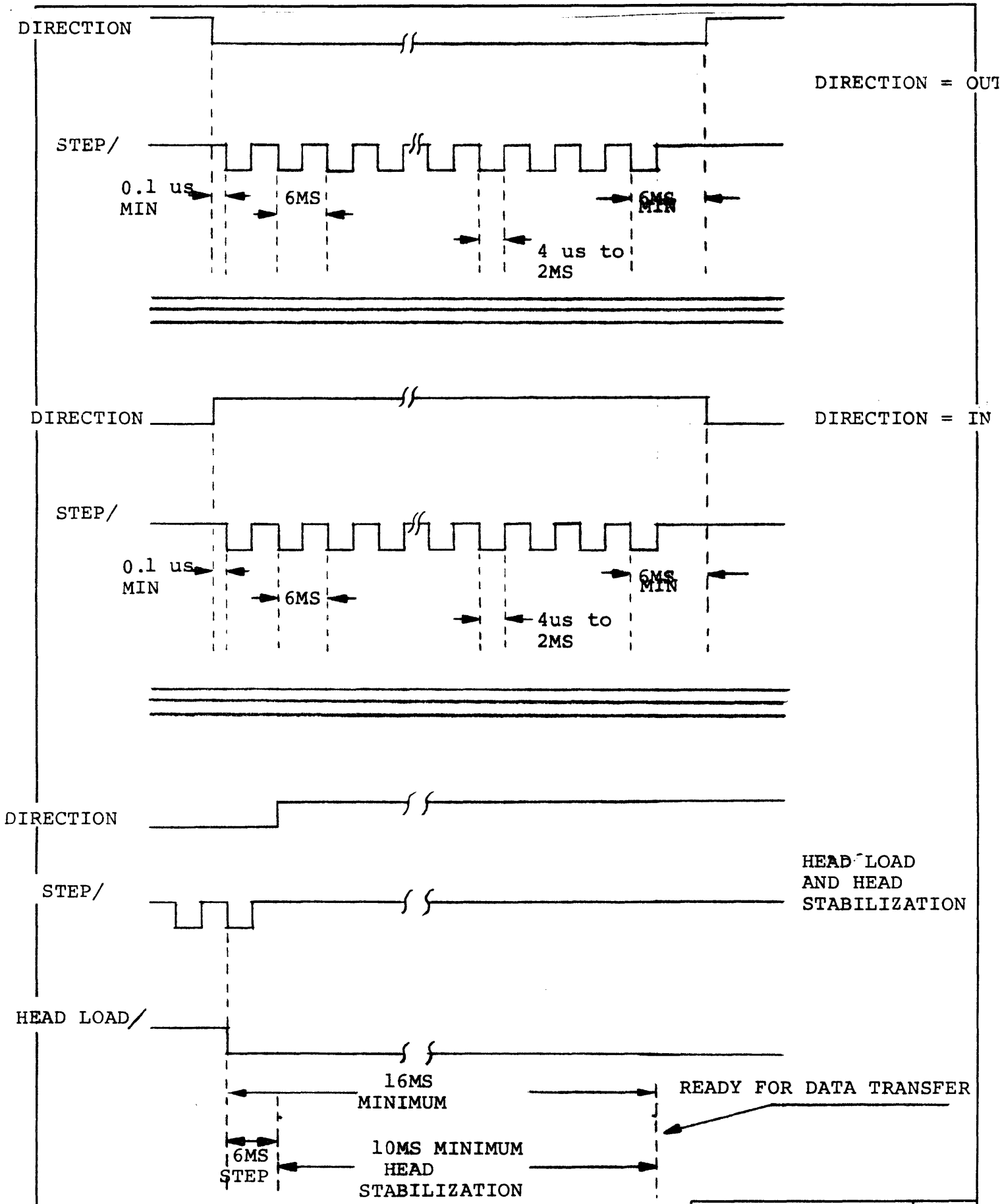
STEP/

0.1 us
MIN

6MS

6MS
MIN

4 us to
2MS

DIRECTION

DIRECTION = IN

STEP/

0.1 us
MIN

6MS

6MS
MIN

4us to
2MS

DIRECTION

STEP/

HEAD LOAD
AND HEAD
STABILIZATION

HEAD LOAD/

16MS
MINIMUM

READY FOR DATA TRANSFER

6MS
STEP

10MS MINIMUM
HEAD
STABILIZATION

FIGURE 6, TRACK ACCESSING TIMING

DRAWING NO.	REV.
11651-001	B

PAGE	25	OF	35

9.2.6.2   Read Data Timing

Read data is transferred between the control unit and the Model
140 in a serial fashion. The organization of data and data
storage capacity of the flexible disk are dependent on the
format used to record information.

A feature of the Century Data Model 140 Floppy Disk Drive
is its universal read circuits. While the expected recording
method is double frequency (FM), a systems designer may specify
no data separator with the drive and use the READ CLOCK output
which would represent unseparated data and clocks to enable
the use of another recording method which may be either more
efficient or result in a higher throughput (see Figure 7).

For those applications which do not use the IBM 3740-type
address marks, the standard one-shot data separator provides
a READ CLOCK output which is used to strobe the status of the
READ DATA line into the controller. Thus, READ CLOCK becomes
separated clock and READ DATA becomes separated data (see
Figure 8).

For the systems designer who desires IBM media compatibility,
an optional PLO Data Separator option is offered. This circuit
ensures the highest data integrity in addition to its ability
to enable detection of missing clocks as used with IBM 3740
address marks. The circuits are designed so that both outputs
coincide. During address mark detection, the PLO remains in
sync during the bit cell time in which the missing clock
is absent. READ DATA active with READ CLOCK being false sig-
nifies that a byte is being read in which a clock pulse is
missing. The systems designer simply has to decode the
data pattern of that associated byte to determine which
type of address mark has been read (see Figure 9).

For clarity, each of the read data outputs will be depicted
along with appropriate timing details (see Figures 7, 8 & 9).

FORM F4500-230 9/73

SELECT/

WRITE
ENABLE/

READ CLOCK/
(RAW DATA)

C 1 C 0 C 1 C 0 C 0 C 1 C

100 NS
MIN

300 NS
±100 NS

4US

2US

FIGURE 7, RAW DATA TIMING

SELECT/

WRITE
ENABLE/

READ
CLOCK/

C C C C 300+ C C C
100NS

READ
DATA

100 NS
MIN

4US

260 NS
±100 NS

40NS
±10NS

1 0 1 0 0 1 1
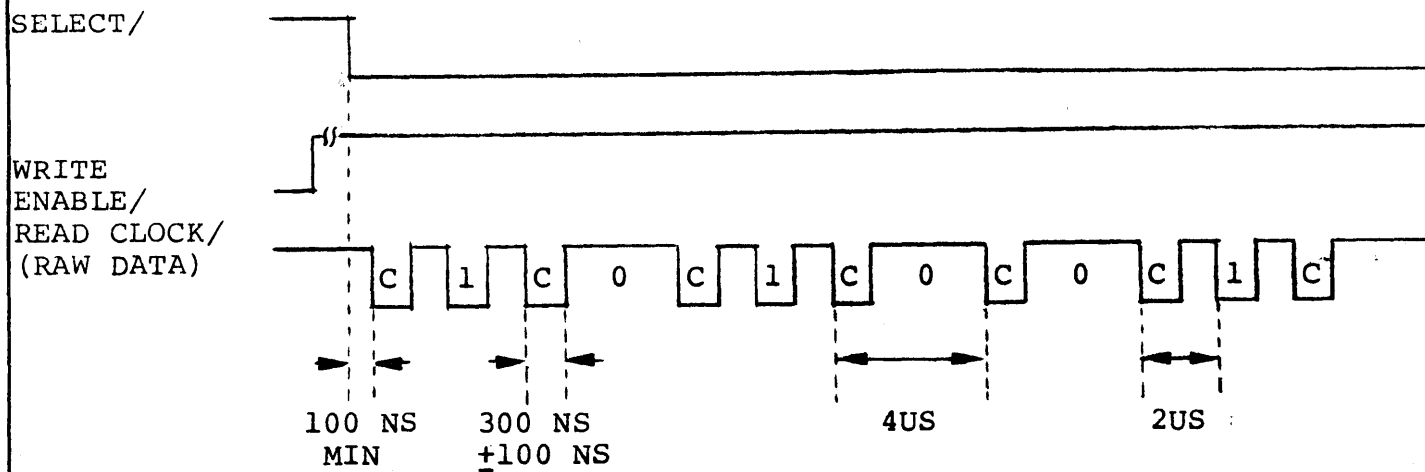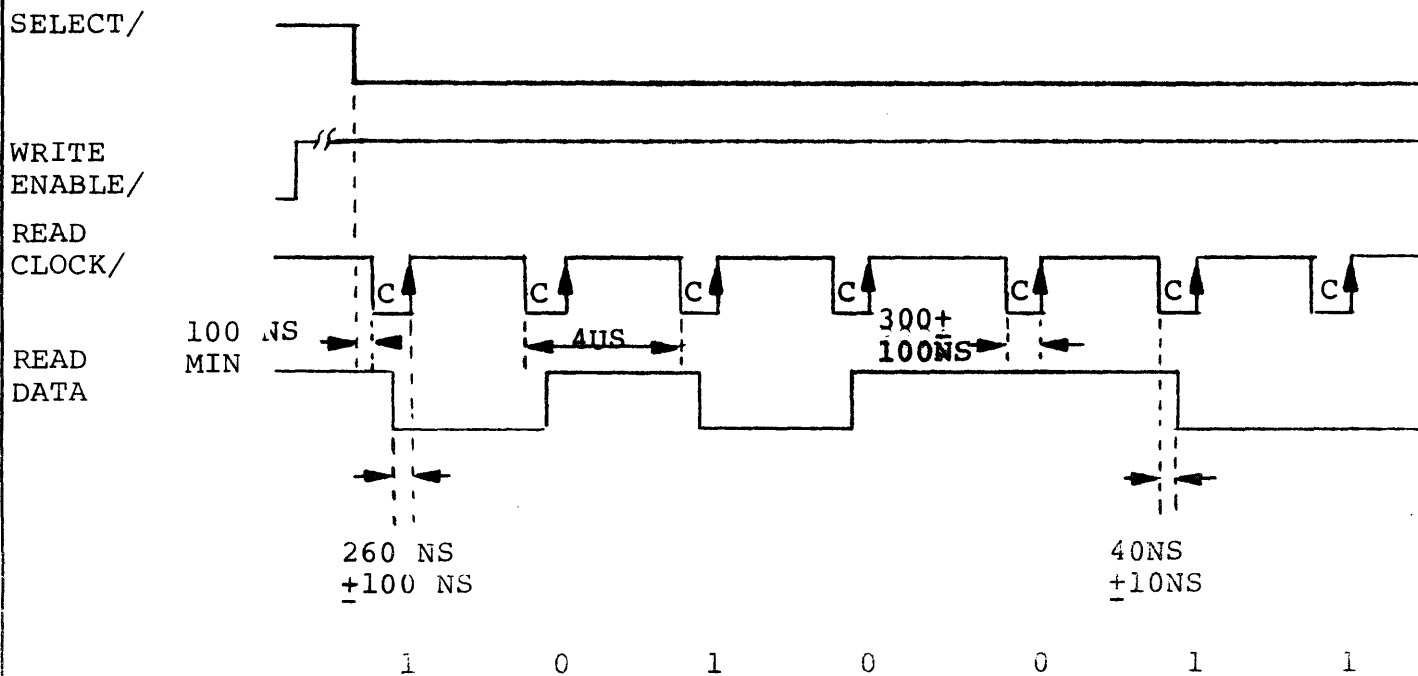
FIGURE 8, ONE-SHOT TIMING

DRAWING NO.	REV.
11651-001	B
PAGE 27 OF 35	

CDS 4500-23 4/71

SELECT/

WRITE
ENABLE/

PLO SYNC/

12 US MIN

100 NS MIN

READ CLOCK/

12 US
MIN

800 NS

4 US

READ DATA

800 NS

0   0   0   0   0   1   1
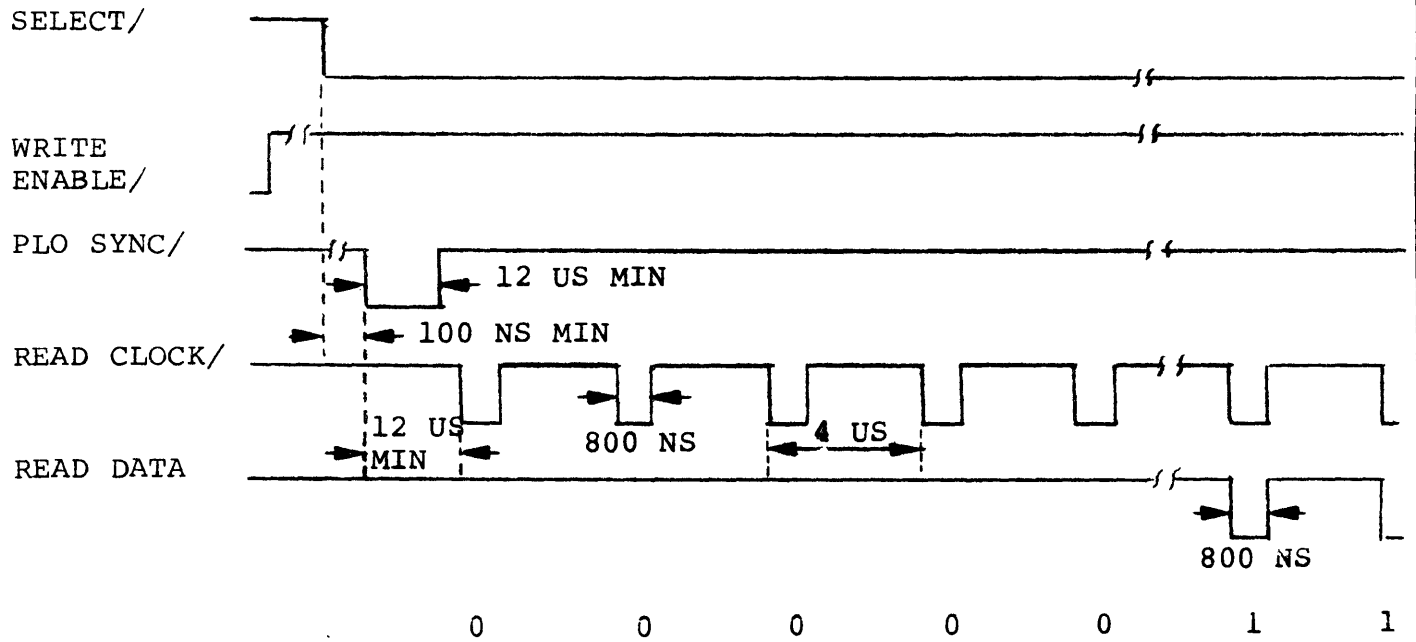
FIGURE 9, PLO TIMING

CDS 4500-23 4/71

9.2.6.3 Write Data Timing

Write data is transferred between the control unit and the
Model 140 in a serial fashion. The interface line WRITE ENABLE
controls both erase and write amplifiers. The erase amplifier
is enabled at the leading edge of WRITE ENABLE and is disabled
600 microseconds after the fall of WRITE ENABLE. This delay
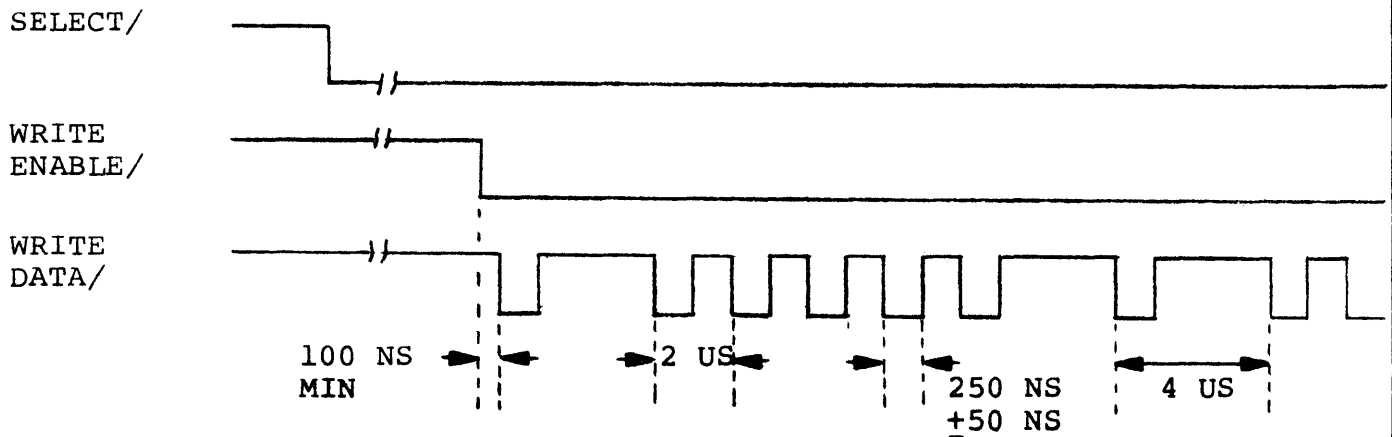is provided to ensure final trimming of the just-written data.

SELECT/

WRITE
ENABLE/

WRITE
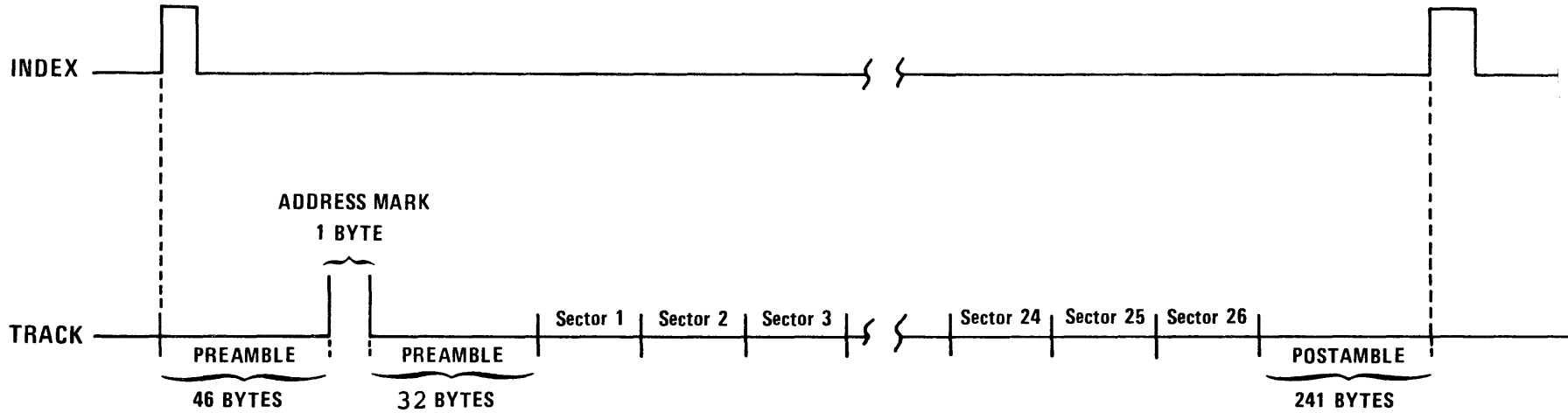DATA/

100 NS
MIN

2 US

250 NS
±50 NS

4 US

FIGURE 10, WRITE DATA TIMING

CDS 4500-23 4/71
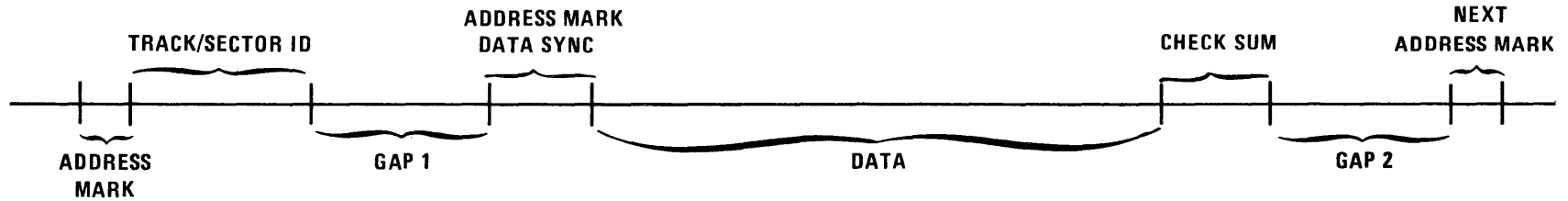
10.0 IBM 3740 DATA FORMAT

Information provided here is provided as an overview of the
3740 data format. Track 00 contains Data Set Labels which
contain descriptive information regarding the sectors of data
located on tracks 01 through 76. These sectors are referred
to as Data Sets. A data set may contain one or more sectors
and may occupy one or more flexible disks. The actual length
of a data set is defined by the appropriate data set label in
track 00. For detailed data format and initialization infor-
mation, refer to IBM publication GA21-9190.

DRAWING NO.	REV.
11651-001	B
PAGE 30 OF 35	

IBM TRACK FORMAT

INDEX

TRACK

ADDRESS MARK
1 BYTE

PREAMBLE
46 BYTES

PREAMBLE
32 BYTES

Sector 1 | Sector 2 | Sector 3

Sector 24 | Sector 25 | Sector 26

POSTAMBLE
241 BYTES

IBM SECTOR FORMAT

TRACK/SECTOR ID

ADDRESS MARK
DATA SYNC

CHECK SUM

NEXT
ADDRESS MARK

ADDRESS
MARK

GAP 1

DATA

GAP 2

FIELD	LENGTH	
ADDRESS MARK	1	BYTE
TRACK/SECTOR ID	6	BYTES
GAP 1	17	BYTES
DATA SYNC	1	BYTE
DATA	128	BYTES
CHECK SUM	2	BYTES
GAP 2	33	BYTES
TOTAL	188	BYTES

$$\text{EFFICIENCY} = \frac{\text{DATA BYTES}}{\text{TOTAL BYTES}} \times 100\%$$

$$= \frac{128}{188} \times 100\% = 68\%$$

DRAWING NO. 11651-001

REV. B

11.0 POWER SEQUENCING

11.1 Power-On Sequence

The following is the recommended power-on sequence for the Model 140 Disk Drive.

1. Set WRITE ENABLE to the false state (5V).
2. Apply AC and DC voltages in any sequence.
3. Set the DIRECTION line to the low state (OV) and apply a 167 pulse-per-second pulse train to the STEP line. Discontinue STEP pulses when the TRACK 00 line goes low (OV).

The Model 140 is now ready for flexible disk insertion (if not present) and operation.

11.2 Power-Off Sequence

The following is the recommended power-off sequence for the Model 140 Disk Drive.

1. Remove flexible disk.
2. Set WRITE ENABLE to the false state (5V).
3. Remove AC and DC voltages in any sequence.

12.0 PHYSICAL DIMENSIONS

Figure 11 is provided as a reference for physical dimensions and is intended to assist in physical planning activities needed to incorporate the Model 140 into an OEM system.

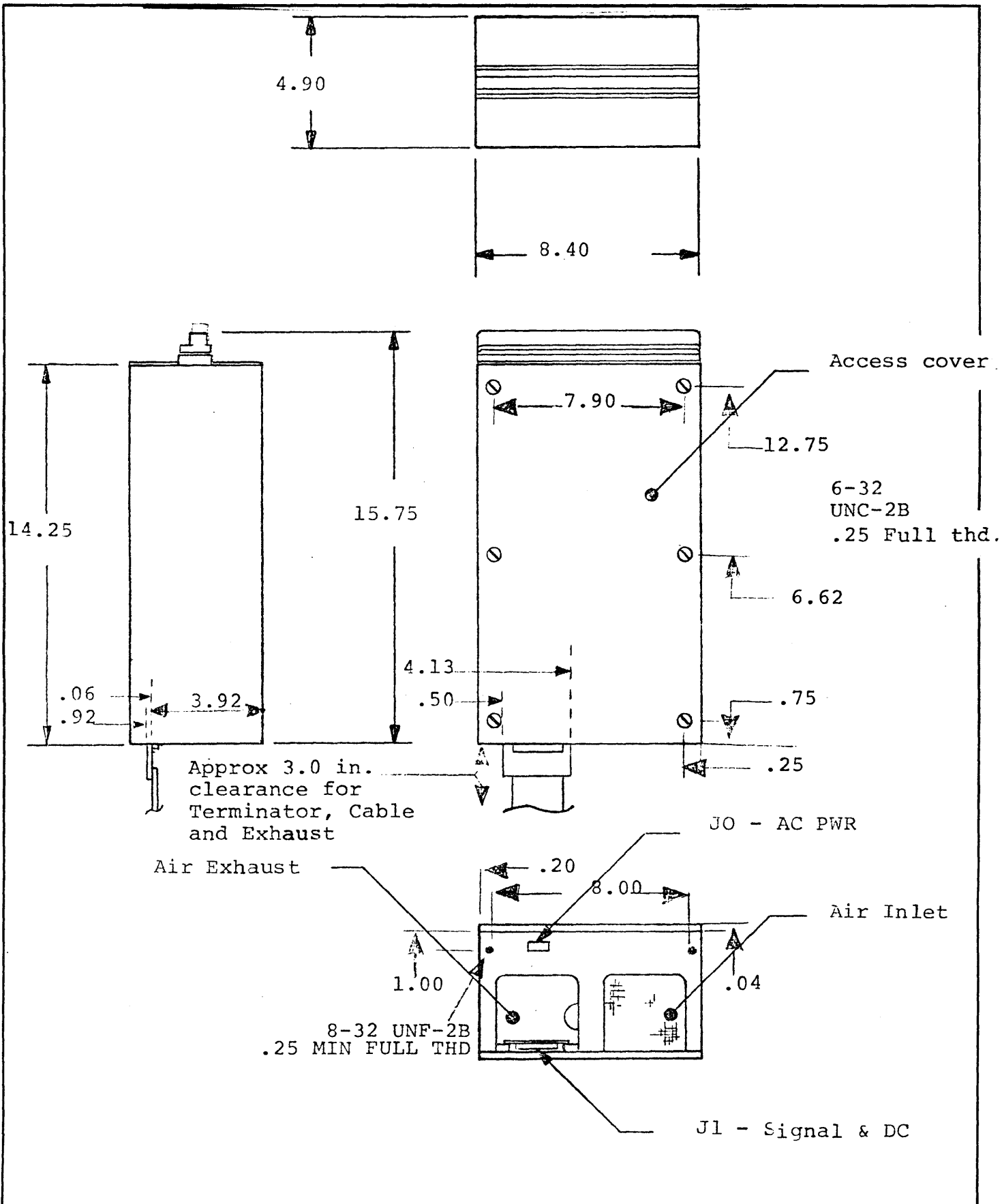| DRAWING NO.	REV.
11651-001	B
PAGE 32 OF 35	

4.90

8.40

Access cover

7.90

12.75

6-32
UNC-2B
.25 Full thd.

14.25

15.75

6.62

4.13

.06
.92

3.92

.50

.75

Approx 3.0 in.
clearance for
Terminator, Cable
and Exhaust

.25

JO - AC PWR

.20

Air Exhaust

8.00

Air Inlet

1.00

.04

8-32 UNF-2B
.25 MIN FULL THD

J1 - Signal & DC

FIGURE 11, PHYSICAL DIMENSIONS

DRAWING NO.	REV.
11651-001	B
PAGE 33 OF 35	

13.0 RECOMMENDED MOUNTING

(to be added)

FIGURE 12, RECOMMENDED MOUNTING

FORM F4500-230 9/73

14.0 SUMMARY OF SPECIFICATIONS

STORAGE CAPACITY (UNFORMATTED)

PER FLEXIBLE DISK	3,208,128 bits/401,016 bytes
PER TRACK	41,664 bits/5,208 bytes
IBM 3740 FORMAT	
PER FLEXIBLE DISK	1,943,552 bits/242,944 bytes
PER TRACK	26,624 bits/3328 bytes
PER SECTOR	1,024 bits/128 bytes
Number of Recording tracks	77
Number of Read/Write Heads	1, tunnel erase
Recommended Coding Technique	Double Frequency (FM)
Bit Transfer Rate	250,000 bits per second, nominal
Tracks-per-inch	48, center to center spacing nominally 0.02083 inch; data track width nominally. 0.0120 inch.
Positioning Mechanism	Stepping Motor, electrical detent
Positioning Time	6 milliseconds, track-to-track
Head Stabilization Time	10 milliseconds
Head Load Time	16 milliseconds
Media	IBM 3740 Diskette or Century Data approved equivalent.
Rotational Speed	360 RPM + 2.5%, 167 milliseconds per revolution
Motor Start Time (to ready)	2 seconds maximum
Heat Dissipation	540 BTU/hr
Physical Dimensions	
Width	4.90 inches
Height	8.40 inches
Depth	15.00 inches (add 3 inches for cable clearance)
Weight	16.00 pounds (18.00 pounds shipping weight)