CENTURY DATA

MODEL 140 FLOPPY DISK DRIVE

INTERFACE SPECIFICATIONS
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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.
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:

\[
\text{MTBF} = \frac{\text{Operating Hours}}{\text{Number of Equipment Failures}}
\]

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.
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: $60^\circ\text{F}$ to $100^\circ\text{F}$, maximum gradient of $20^\circ\text{F}$ per hour.

(b) Non-operating: $-30^\circ\text{F}$ to $140^\circ\text{F}$

5.2 Relative Humidity

(a) Operating: 20% to 80%, $78^\circ\text{F}$ 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 ($\pm 10\%$) 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 $\pm 0.005$ inch for the frequency range from 5 to 60Hz and $\pm 2$G'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).
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 contaminated 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...
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 maintenance 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 Diagram]
8.0 POWER REQUIREMENTS

8.1 AC Power

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

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

8.2 DC POWER

+5VDC ± 2% @ 1.5 amps
+24VDC ± 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)

Figure 2, Cable Locations
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 mating 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 identical, provisions have been made whereby each drive may be assigned a unique address and used in a bussed or daisy chained configuration. 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:
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 Pin Pin Assignments

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<th>Ground Pin</th>
<th>Signal Nomenclature</th>
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<td>P-2</td>
<td>P-1</td>
<td>+5VDC</td>
</tr>
<tr>
<td>P-4</td>
<td>P-3</td>
<td>+5VDC</td>
</tr>
<tr>
<td>P-6</td>
<td>P-5</td>
<td>DIRECTION</td>
</tr>
<tr>
<td>P-8</td>
<td>P-7</td>
<td>STEP/</td>
</tr>
<tr>
<td>P-10</td>
<td>P-9</td>
<td>+24V</td>
</tr>
<tr>
<td>P-12</td>
<td>P-11</td>
<td>+24V</td>
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<td>P-13</td>
<td>+24V</td>
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<td>P-26</td>
<td>P-25</td>
<td>INDEX/</td>
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<td>P-28</td>
<td>P-27</td>
<td>SECTOR/</td>
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<td>P-30</td>
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<td>P-34</td>
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<td>P-40</td>
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<td>PLO SYNC/</td>
</tr>
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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

<table>
<thead>
<tr>
<th>Signal Name</th>
<th>Definition</th>
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<tr>
<td>SELECT/</td>
<td>A unique signal used to enable communication between a disk drive and its controller. This line must be low (OV) to be active.</td>
</tr>
<tr>
<td>WRITE ENABLE/</td>
<td>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.</td>
</tr>
<tr>
<td>WRITE DATA/</td>
<td>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.</td>
</tr>
<tr>
<td>ABOVE TRACK 43/</td>
<td>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.</td>
</tr>
<tr>
<td>STEP/</td>
<td>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).</td>
</tr>
<tr>
<td>DIRECTION</td>
<td>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.</td>
</tr>
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</table>
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

<table>
<thead>
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<th>Definition</th>
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<tbody>
<tr>
<td>READ DATA</td>
<td>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.</td>
</tr>
</tbody>
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**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
drive, this line outputs unseparated data (clocks and data). This output is provided for the systems designer who desires to use his own encoding 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 + 100 nanosecond wide low (OV) pulse.

With One-Shot Separator

This line will output 300 + 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.
A low level (OV) on this line indicates that a write enable tab is not present on the flexible disk in the drive, thus no writing may take place.

9.2.4 Interface Circuits

9.2.4.1 Receivers

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 Drivers

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]
9.2.5 DC/Signal Cable Physical Wiring

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 termination 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.
FIGURE 5, TERMINATOR SCHEMATIC
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 preceding drive (signals being bussed to the controller).

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

(continued on next page)
E1 +5V (IN)  E2 TWP GND (E1)
E3 +5V (IN)  E4 TWP GND (E3)
E5 STEP (IN)  E6 TWP GND (E5)
E7 DIRECTION (IN)  E8 TWP GND (E7)
E9 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)
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

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DAISY CHAIN EXAMPLE

WRT CLK

Controller

INDEX

Controller

Controller to Drive Buss

Drive Buss to Controller

Ready (Unique)

Select (Unique)

\[ \Delta = \text{Terminator} \]

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REV. B

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9.2.5.2 **Radial Interface Wiring**

**IN** - Signal or power coming from controller to drive.

**OUT** - Signal going from drive to controller.

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<th>2</th>
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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 proceeding 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.
FIGURE 6, TRACK ACCESSING TIMING

DIRECTION

STEP/

0.1 us

MIN

6MS

6MS

4 us to

2MS

DIRECTION = OUT

DIRECTION = IN

STEP/

0.1 us

MIN

6MS

6MS

4 us to

2MS

HEAD LOAD AND HEAD STABILIZATION

HEAD LOAD/

16MS

MINIMUM

6MS

10MS MINIMUM

HEAD STABILIZATION

READY FOR DATA TRANSFER

DRAWING NO.
11651-001

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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 signifies 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).
**Figure 7, Raw Data Timing**

- Select/W.
- Write Enable/Read Clock (RAW DATA)
- Clock
- Data

```
100 NS 300 NS 4US 2US
MIN +100 NS
```

**Figure 8, One-Shot Timing**

- Select/W.
- Write Enable/Read Clock
- Read Data

```
100 NS 4US 300+100 NS
MIN +100 NS
260 NS 40NS +10NS
```

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

- SELECT
- WRITE ENABLE
- PLO SYNC
- READ CLOCK
- READ DATA

Time intervals:
- 12 US MIN
- 100 NS MIN
- 800 NS
- 4 US
- 800 NS

Binary code: 0 0 0 0 0 0 0 1 1 1
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.

![Write Data Timing Diagram](image-url)
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 information, refer to IBM publication GA21-9190.
IBM TRACK FORMAT

INDEX

ADDRESS MARK
1 BYTE

TRACK

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

ADDRESS MARK

GAP 1

DATA

CHECK SUM

GAP 2

NEXT ADDRESS MARK

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

EFFICIENCY = DATA BYTES / TOTAL BYTES X 100%

= 128 / 188 X 100% = 68%
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.
Approx 3.0 in. clearance for Terminator, Cable and Exhaust

Air Exhaust

Access cover

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

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

Air Inlet

J1 - Signal & DC

FIGURE 11, PHYSICAL DIMENSIONS
13.0 RECOMMENDED MOUNTING

(to be added)

FIGURE 12, RECOMMENDED MOUNTING

<table>
<thead>
<tr>
<th>DRAWING NO.</th>
<th>REV.</th>
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<tr>
<td>11651-001</td>
<td>B</td>
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</tbody>
</table>

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14.0 SUMMARY OF SPECIFICATIONS

STORAGE CAPACITY (UNFORMATTED)

PER FLEXIBLE DISK
PER TRACK
IBM 3740 FORMAT
PER FLEXIBLE DISK
PER TRACK
PER SECTOR
Number of Recording tracks
Number of Read/Write Heads
Recommended Coding Technique
Bit Transfer Rate
Tracks-per-inch

Positioning Mechanism
Positioning Time
Head Stabilization Time
Head Load Time
Media

Rotational Speed
Motor Start Time
(to ready)
Heat Dissipation
Physical Dimensions
Width
Height
Depth
Weight

3,208,128 bits/401,016 bytes
41,664 bits/5,208 bytes
1,943,552 bits/242,944 bytes
26,624 bits/3,328 bytes
1,024 bits/128 bytes
77
1, tunnel erase
Double Frequency (FM)
250,000 bits per second, nominal
48, center to center spacing nominally 0.02083 inch; data track width nominally 0.0120 inch.
Stepping Motor, electrical detent
6 milliseconds, track-to-track
10 milliseconds
16 milliseconds
IBM 3740 Diskette or Century
Data approved equivalent.
360 RPM ± 2.5%, 167 milliseconds per revolution
2 seconds maximum
540 BTU/hr
4.90 inches
8.40 inches
15.00 inches (add 3 inches for cable clearance)
16.00 pounds (18.00 pounds shipping weight)