5.25" Floppy Disk Drive

Stock No. 237-088

1.0 Introduction

1.1 General description

This drive is a high-density, dual speed, double-sided 5.25" mini-floppy disk drive. The speed is controlled by Pin #2 of the interface connector. Normally, when this pin is at logical low, the transfer rate is low and when at logical high, the transfer rate is high. This drive can be used as a high-density 1.6Mb drive. When at logical low, this drive can be used as a standard 1.0Mb drive.

Table 1-1. Compatibility with other model drives

	Diskette written			Read by this drive	
FDD used	**Diskette**	**Capacity**	**Rotational speed**	**Rotational speed**	**Transfer rate**
Double-sided 48 t.p.i.	MD	0.5Mb	300 r.p.m.	360 r.p.m.	300Kbits/sec
				300 r.p.m.	250Kbits/sec
Double-sided 96 t.p.i.	MD	1.0Mb	300 r.p.m.	360 r.p.m.	300Kbits/sec
				300 r.p.m.	250Kbits/sec
Dual-speed	HD	1.6Mb	360 r.p.m.	360 r.p.m.	500Kbits/sec
	MD	1.0Mb	360 r.p.m.	360 r.p.m.	300Kbits/sec
				300 r.p.m.	250Kbits/sec
			300 r.p.m.	360 r.p.m.	300Kbits/sec
				360 r.p.m.	250Kbits/sec

Key features:

- Compact half-height size.
- 1.0 or 1.6Mb storage capacity (unformatted).
- Backward compatibility to 48 t.p.i.
- 3ms track to track access time.
- Brushless dual-speed direct-drive ⎓ motor.
- Low power consumption.
- 10,000 hours MTBF.
- Dual read channels.
- 250/300/500 Kbits/transfer rate.

1.2 Specification summary

1.2.1 Performance specifications

	Mini mode (Low transfer rate)	Maxi mode (High transfer rate)
Capacity (bytes)		
Unformatted (MFM)		
Per drive	1,000,000	1,666,666/1,604,167
Per surface	500,000	833,333/802,083
Per track	6,250	10,416
Unformatted (FM)		
Per drive	500,000	833,333/802,083
Per surface	250,000	416,666/401,041
Per track	3,125	5,208
IBM format (MFM)	16 sectors/track	15 sectors/track
Per drive	655,360	1,228,800/1,182,720
Per surface	327,680	614,400/591,360
Per track	4,096	7,680
Per sector	256	512
IBM format (FM)	16 sectors/track	15 sectors/track
Per drive	327,680	614,400/591,360
Per surface	163,840	307,200/295,680
Per track	2,048	3,840
Per sector	128	256
Transfer rate (Kbits/sec)		
MFM recording	250/300	500
FM recording	125/150	250
Access time (ms)		
Track to track	3	3
Settle time	15	15
Average access	94	94/91
Average latency	100/83	83
Motor start time	500	500
Motor speed change time	500	500

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1.2.2 Functional specifications

	Mini mode	Maxi mode
Rotational speed	300 r.p.m.	360 r.p.m.
Recording density (innermost track)		
MFM recording	5,922 b.p.i.	9,870/9,642 b.p.i.
FM recording	2,961 b.p.i.	4,935/4,821 b.p.i.
Flux density (innermost track)		
MFM recording	5,922 f.c.i.	9,870/9,642 f.c.i.
FM recording	5,922 f.c.i.	9,870/9,642 f.c.i.
Track density	96 t.p.i.	96 t.p.i.
Cylinders	80	80/77
Tracks	160	160/154
Read/write heads	2	2
Encoding method	FM/MFM	FM/MFM
Media requirements	Double sided/double density/ANSI SPEC	

1.2.3 Reliability specifications

MTBF	10,000 POH
Component life	15,000 POH or 5 years
Error rates	
Soft error rate	1 per 10^9 bits read
Hard error rate	1 per 10^{12} bits read
Seek error	1 per 10^6 seeks
Media life	
Number of passes per track	3.5×10^6
Number of media clamp	3.0×10^4

1.2.4 Physical specifications

	Shipping	Storage	Operating
Environmental limits			
Ambient temperature	-40 to 144°F (-40 to 62.2°C)	-8 to 131°F (-22.2 to 55°C)	41 to 115°F (5 to 46.1°C)
Relative humidity	1 to 95% RH	1 to 95% RH	20 to 80% RH
Max. wet bulb temp.	No-condensing	No-condensing	85°F(29.4°C)
Vibration	≤5G(5-55Hz)	≤5G(5-55Hz)	≤0.5G(5-55Hz)
Shock	≤40G(10ms)	≤40G(10ms)	≤0.5G(10ms)

Mechanical dimension: (excluding front plate)
- Width = 5.75 ±0.02" (146.0 ±0.5mm)
- Height = 1.65" (42.0mm) max.
- Depth = 7.95" (202mm) max.

Mechanical dimension: (including front plate)
- Width = 5.88 ±0.02" (149.4 ±0.5mm)
- Height = 1.63 ±0.02" (41.5 ±0.5mm)
- Depth = 8.15" (207.0mm) max.
- Weight = 2.21lbs (1kg)

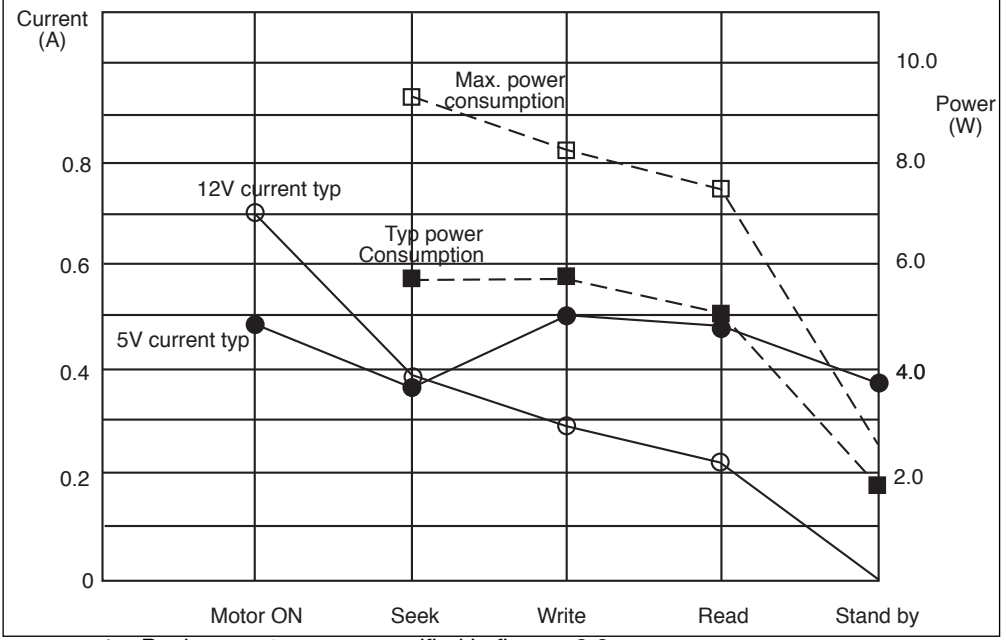
1.2.5 Power requirements

Item			Rating		
Power requirement	12V ⎓	Voltage	12V±10% Max ripple 100mVp-p		
		Current	During operation	Seek	0.54A (max.) 0.35A (typ)
				Read	0.27A (max.) 0.22A (typ)
				Write	0.35A (max.) 0.28A (typ)
			At motor start	0.9A(Max) 0.7A(Typ)	
	5V ⎓	Voltage	5V ±5% max. ripple 50mVp-p		
		Current	During operation	Seek	0.41A (max.) 0.34A (typ)
				Read	0.56A (max.) 0.48A (typ)
				Write	0.58A (max.) 0.49A (typ.)
	Power consumption		Seek	9.28W (max.) 5.88W (typ)	
			Read	6.50W (max.) 5.02W (typ)	
			Write	7.66W (max.) 5.81W (typ)	
			Stand by	2.42W (max.) 1.85W (typ)	

Note: Calculation method for power consumption:
Our voltage specification is subject to 12V ⎓ ±10% accordingly, in the case of calculating the maximum figure, it becomes larger than that of the competitor's by ±5%.
"Stand by mode" states all input signals "off".

Note:
1. At motor start: Up to 500ms after motor start.
2. Seek: For seeking after 500ms subsequent to motor start.
3. Power requirements represent the values in the case where a media with a media load of 100g/cm is used.

Figure 1-1. D.C. power profile of power consumption



4. Peak currents are as specified in figures 2-3.

1.3 Functional characteristics

This drive consists of read/write and control electronics, drive mechanism, read/write heads, and precision track position mechanism. These components perform the following functions:

a. Interpret and generate control signals.
b. Move read/write heads to the desired track.
c. Read and write data.

The interface signals and their relationship to the internal functions are shown in figure 1-2.

1.3.1 Read/write control electronics

The electronics package contains:

a. Index detector circuits.
b. Head positioning driver circuits.
c. Read/write amplifier and transition detector.
d. Write protect detector.
e. Drive select circuits.
f. Drive motor control circuits.
g. Control logic LSI.
h. Track Ø detector.
i. Media detector.

j. Low pass filter.

1.3.2 Drive mechanism

The ⎓ drive motor under servo speed control (using a frequency generator) rotates the spindle motor at 300 or 360 r.p.m. through a direct-drive system. An expandable collet/spindle assembly provides precision media positioning to ensure data interchange.

1.3.3 Positioning mechanics

The read/write head assembly is accurately positioned through the use of a leading screw which is attached to the head carriage assembly. Precise track location is accomplished as the head carriage is moved by the precise discrete rotation of a stepping motor.

1.3.4 Read/write heads

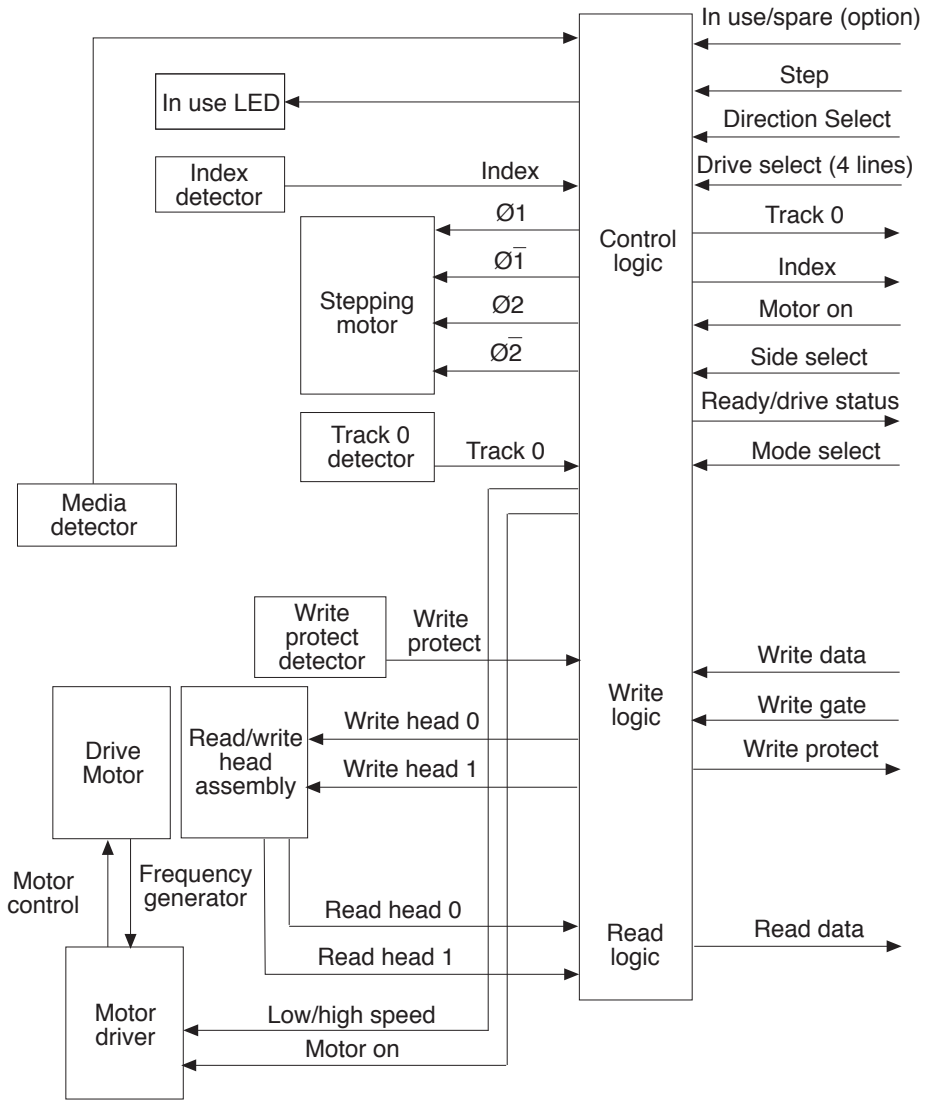
The proprietary heads are single-element ceramic read/write heads with tunnel erase elements to provide erased areas between the data tracks. Thus, normal interchange tolerances between media and drives will not degrade the signal-to-noise ratio and diskette interchangeability is ensured.

The heads are mounted on a carriage which is located on precision guide rods. The diskette is held on a plane perpendicular to the read/write heads by a plate located on the base casting. This precise registration assures perfect compliance with the read/write heads. The read/write heads are in direct contact with the diskette. The head surface has been designed to obtain maximum signal transfer to and from the magnetic surface of the diskette with minimum head/diskette wear.

1.3.5 Recording formats

The formats of the data written on the diskette are totally a function of the host system. The formats can be designed around the user's application (FM or MFM) to take complete advantage of the total available bits that can be written on any track.

Figure 1-2. Functional diagram



2.0 Electrical interface

The following section provides the electrical definition for each line. Figure 2-1 shows all of the interface connections with respect to the host system.

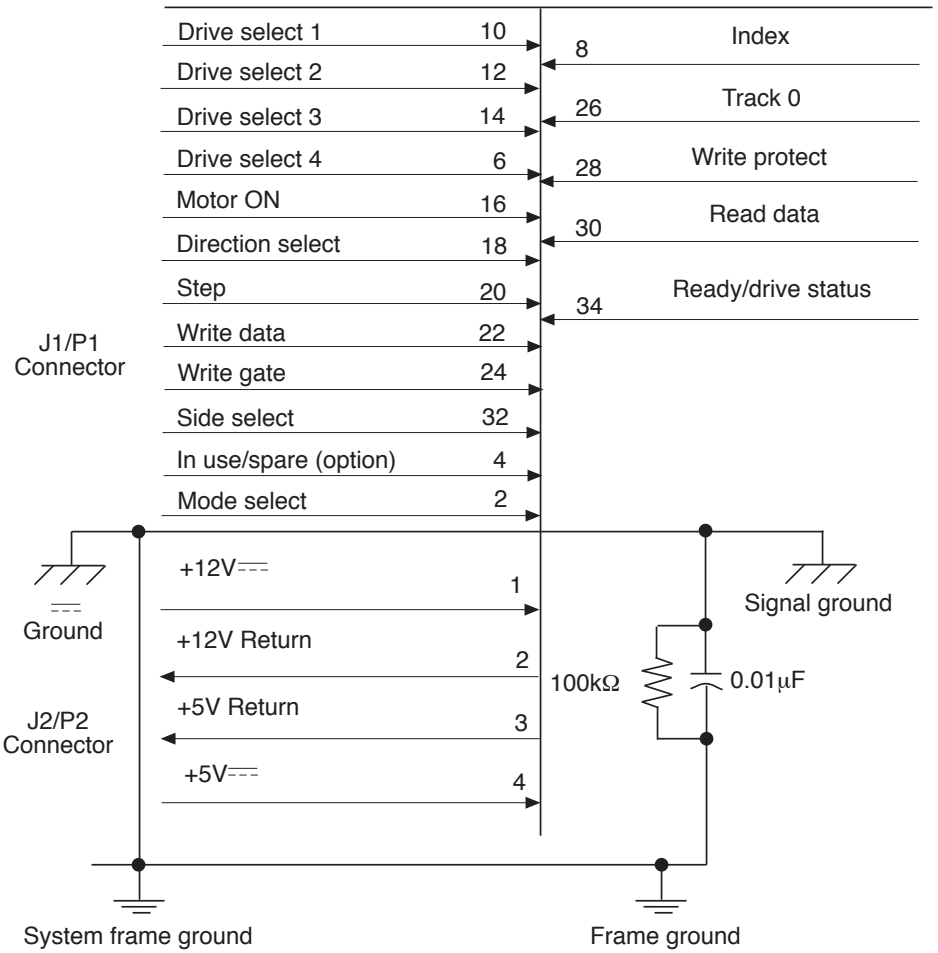
The signal interface consists of the following two categories:

a. Control lines.
b. Data transfer lines.

All lines in the signal interface are digital in nature and provide signals to the drive (input), or to the host (output), by way of the interface connector J1.

The ⎓ power connector, J2, provides +5V⎓ and +12V⎓ power.

Figure 2-1. Interface connection



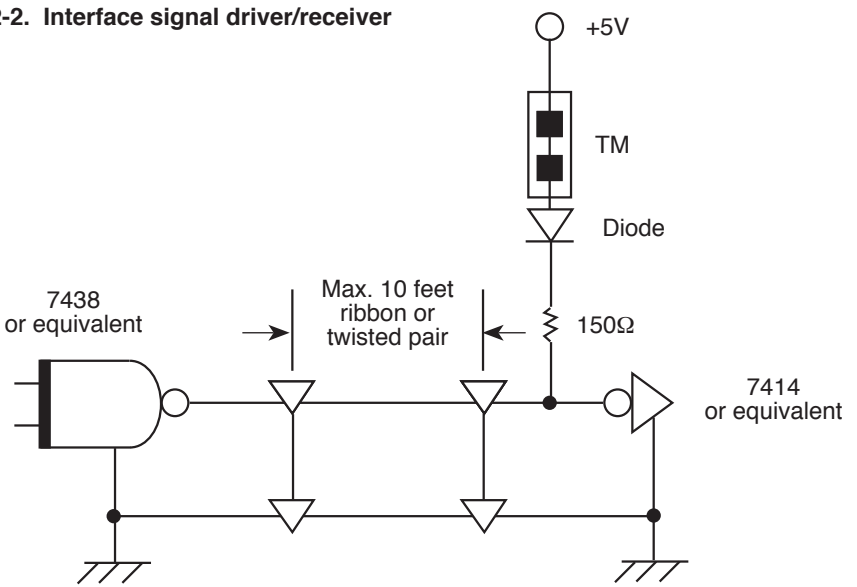
2.1 Signal interface

This drive uses the industry standard open-collector, low-level - true, multiplexed interface convention. The industry standard open-collector, 40mA TTL driver 7438 or equivalent, is used to transmit the I/O signals. The transmitted signals are detected by the hysteresis input inverter, 7414 or equivalent. A 150Ω pull-up resistor between the signal line and +5V is necessary on the receiving circuit. The input of each receiver is terminated by a 150Ω resistor and a diode. When using two or more drives on a daisy chain, remove all plug jumpers "TM" except for the last drive on the daisy chain.

The input signal lines which are not multiplexed are MOTOR ON and IN USE. The input lines have the following electrical specifications. See figure 2-2 for the recommended circuits.

True = Logical zero = Vin = +0.0 to +0.4V @ Iin = 40mA (max.)
False = Logical zero = Vin = +2.5 to +5.25V @ Iin = 250μA (open)
Input impedance = 150Ω

Figure 2-2. Interface signal driver/receiver



2.2 Input lines

There are twelve active low TTL input lines to the drive. Individual signal line characteristics are described overleaf.

2.2.1 Drive select 1, 2, 3, or 4 (J1 pins #10, 12, 14, and 6)

Four separate input lines, drive select 1, drive select 2, drive select 3, and drive select 4 are provided so that in standard configuration, up to four drives may be multiplexed together in a system that have separate drive select lines. Traces DS1, DS2, DS3, and DS4 have been provided to select which drive select line will activate the interface signals for a unique drive. Drive select, when activated to logical zero level, enables the multiplexed I/O lines.

2.2.2 Direction select (J1 pin #18)

"Direction select" determines the direction the head-carriage assembly will move when the drive is properly selected, and when step pulses with the proper timing are sent to the drive. If "direction select" is at logic low, the head-carriage assembly will seek toward the centre of the diskette, and away from the centre when high.

"Direction select" must be stable at its correct logic state for at least 1 microsecond before each occurance of the trailing edge (a low-to-high transition) of the step pulse, as measured at the drive interface connector, J1.

If the drive is not selected or a write operation is in process, "direction select" is ignored by the drive.

2.2.3 Motor on (J1 pin #16)

The "motor on" signal causes the drive's spindle drive motor to turn on. In standard configuration (jumpers MS open), this input signal line when true (logic low), will activate the motor if +5V$\overline{\overline{\text{---}}}$ and +12V$\overline{\overline{\text{---}}}$ are applied to the drive, whether or not the drive is selected. A minimum delay of 500ms must be allowed by the host system after activating this line before attempting to read or write, to allow the diskette to attain proper speed.

When the command "motor on" is not active, the spindle drive motor stops in about 4 seconds.

It is recommended that the spindle drive motor should be turned off when the drive has not been selected for 10 revolutions or more. This will extend motor and diskette life and decrease power consumption. Host system workload must be analysed to determine optimum delay between the reselection of the drive and the turning-off of the spindle drive motor.

Even though the "motor on" signal is active, the spindle drive motor does not turn on, if the function of the media sensor status is not active.

2.2.4 Step (pin #20)

When the drive is properly selected and the trailing edge (a low-to-high transition) of the "step" signal occurs, the head-carriage assembly will move one track in the direction selected by "direction select" (J1 pin 18).

"Step" and its timing are generated by the host system controller.

First the drive should be selected and "direction select" should be set to its correct logic level, then "step" should be set to a logic low level. A minimum of 1μs is necessary before the step signal may make its low-to-high transition (trailing edge of "step") to initiate head-carriage movement. The minimum allowable time between trailing edges of "step" is 3ms. The minimum allowable pulse width for "step" is 1μs.

Any change in "direction select" must be made at least 1μs before the trailing edge of "step" and "direction select" logic level must be maintained 1μs after the trailing edge of "step".

If the drive is not properly selected or a write operation is in process, the "step" pulses from the host system will be ignored.

If "direction select" is at a logic low level and the head carriage is at the innermost track (Track 79), step pulses issued by the host system would attempt to move the head carriage assembly until it is stopped by the mechanical safety stop installed on the drive.

However, driving the head-carriage assembly of the drive into the safety stops is not recommended. The host system controller should know the position of the head-carriage assembly at all times by reading the sector or track ID address field. In the event that the controller loses track of the head-carriage assembly's location, it is recommended that "direction select" be set to a logic high level and several step pulses be issued. After every step pulse issued to the drive, "Track 00" signal's level should be checked whether it has returned to a true state (logic low). In order to assure proper positioning of the read/write heads after power-on, the head-carriage assembly will step out to Track 00 during the power-on procedure.

Thus, the read/write head assembly of the drive is automatically positioned to Track 00 after ⎓ power is switched on.

2.2.5 Write data (J1 pin #22)

This interface line provides the data to be written on the diskette in the appropriate sector. Each transition from a high logic level to a low logic level on this line causes the write current through the head to be reversed. This line is enabled by "write gate" being active. "Write data" must be inactive during a read operation. If the drive is not properly selected, a write-protected diskette is installed, a seek operation is not completed, or the drive has no diskette installed, the write data will be ignored.

2.2.6 Write gate (J1 pin #24)

The active state (logic low) of this line enables "write data" to be written on the diskette. The inactive state (logic high) enables the read data logic and seek operations.

2.2.7 Side select (J1 pin #32)

"Side select" determines which side of a double-sided diskette is to be written on or read from. A logic low (true or logic zero) selects the side 1 head; a logic high (false or one) selects the side 0 head.

When switching from one side to another, a 100μs delay is required before a read or write operation can be initiated. A 1100μs delay during MINI-MODE, and a 590μs delay during MAXI-MODE is required after a write operation is completed.

2.2.8 In use (J1 pin #4)

Using appropriate jumper options, this line can turn-on the IN USE LED. See the HA/LA jumper option section for a detailed description of the IN USE LED function.

2.2.9 Mode select (J1 pin #2)

Using the appropriate jumper option, the spindle speed can become a function of the logic level of pin #2. When a logic low is present on pin #2 and the drive is selected from a deselected state, the mode selected is a low transfer rate mode. However, when a logic high is present on pin #2 and the drive is selected from a deselected state, the mode selected is a high transfer rate mode. (Please see the OP/AT/AX/BX/1M plug option section.)

2.3 Output lines

The drive has five active signal lines for its output. Each output line is driven by a 7438 or equivalent open-collector output gate. Individual signal line characteristics are described below:

2.3.1 Index (J1 pin #8)

The "index" signal is generated once each revolution of the diskette and indicates the physical beginning of a track. When the "index" signal is true, the signal is a logic low level. The "index" signal pulse width is 4.0 ±3.0ms. When using the "index" signal, look for a leading edge or a high-to-low transition instead of a voltage level for determining the status. In the standard configuration, when the EX plug is not installed, the "index" pulses will be present at the interface connector only when:

a. The proper ⎓ power is applied to the "⎓ power" connector, J2.
b. The drive is properly selected.
c. Diskette is properly installed, clamped and rotating.
d. The "index" signal line is properly terminated at the host system controller with a 150Ω resistor to +5V⎓. When the plug EX is opened, index pulse is masked as long as the drive is "internally" not ready (i.e. either the carriage is seeking or the head has not settled on a track). See also EX plug option.

2.3.2 Track 00 (J1 pin #26)

An active low on this signal line indicates that the read/write head is positioned at track zero (the outermost track). This signal is at a logic high when the read/write head is not at track zero. When the read/write head is at track zero and an additonal step-out pulse is issued to the drive, the microprocessor logic will keep the read/write head positioned at track zero.

2.3.3 Write protect (J1 pin #28)

An active low level on this signal line idicates that a write-protected diskette has been installed. The drive will inhibit writing on a write-protected diskette and additionally notifies the host system.

2.3.4 Read data (J1 pin #30)

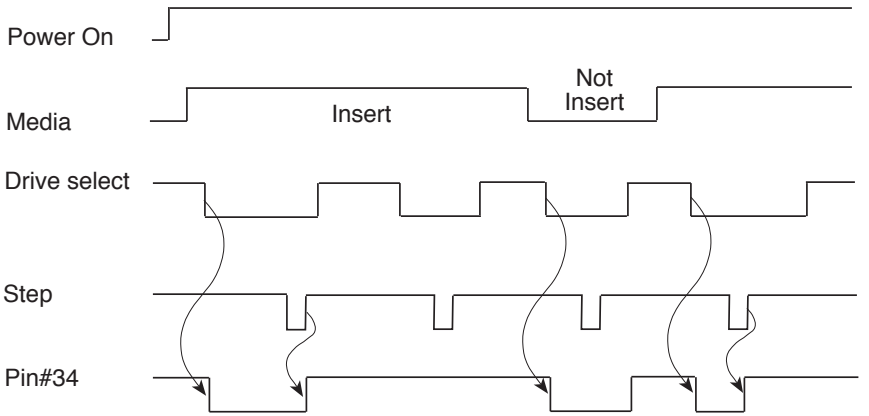
This interface line provides that the data from the diskette is outputed to the host system. Each flux reversal that is sensed on the diskette produces a transistion to an active low level. In standard configuration, when the GX plug is installed, the read data signal is inhibited as long as the drive is "internally" not ready (i.e. either the carriage is seeking or the head has not settled on a track). Please also see the GX plug option section.

2.3.5 Ready/drive status (J1 pin #34)

This interface signal informs the host system about the status of the drive. By choosing appropriate plug options (RDY/DC/DD/TH plugs), the following conditions of pin #34 could be achieved. Please see section 3.2.7.

1. Ready : (RDY/TH installed, DISC CHANGE opened).
   Pin #34 is active low when a diskette is properly inserted, the drive motor is up to speed and more than two INDEX pulses are detected. This signal goes to an inactive high level when "MOTOR ON" is high (inactive).
2. Disk change 1 : (DC installed, DD/TH/RDY opened).
   Pin #34 is latched low by "DRIVE SELECT" during power-up or when a diskette is not inserted.
   Pin #34 is latched low by the first "DRIVE SELECT" after the drive is powered up and the diskette is changed. (Please refer to the diagram overleaf).
   The "step" resets pin #34 to a high level.
3. Disk change 2 : (DC/DD/TH installed, RDY opened).
   Pin # 34 is latched low during power up or when a diskette is not inserted. To unlatch the logical level, the drive has to be deselected from a selected state while a diskette is inserted and the drive is powered up.
4. Disk in : (TH installed, RDY/DC/DD opened).
   Pin #34 is a direct function of the disk-insert status. It is active low when a diskette is inserted.
5. Disk out : (RDY/DC/TH installed, DD opened).
   Pin #34 is a direct function of the disk-insert status. It is active low when a diskette is not inserted.

Figure 2-3. Timing diagram of disk change



* Pin #34 is gated by "drive select" signal when "TH" plug is opened.
Pin #34 is not gated by "drive select" signal when "TH" plug is closed.

2.4 Power interface

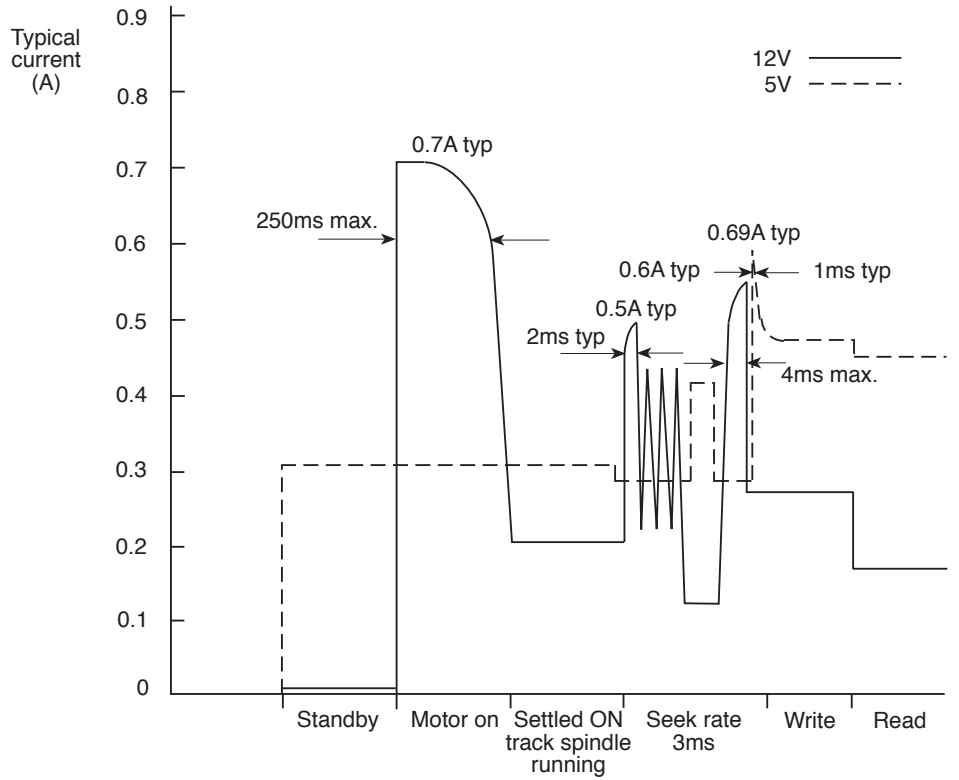
The drive only requires ⎓ power for operation. D.C. power to the drive is provided via P2/J2. The two ⎓ voltages, their specifications and their P2/J2 pin designation is outlined in table 2-1.

Table 2-1. D.C. power requirements

P2/J2 pin	⎓ Voltage	Tolerance	Current	Max ripple
1	+12V	±10% (±1.2V)	0.22A typ 0.54A max. 0.9A peak	100mV p-p
2	+12V Return	*		
3	+5V Return	*		
4	+5V	±5% (±0.25V)	0.48A typ 0.58A max.	50mV p-p

* +12V and +5V ground returns are tied together at drive PCB.

Figure 2-4. D.C. power profile



2.5 Frame ground

Frame ground for the drive is provided by a push-on tab terminal, mounted directly on the rear of the drive.

When the host system's input power is ~, the drive's frame must be grounded to the third wire safety ground. If the host system is ⎓ powered, the frame ground may be tied to the ⎓ power ground.

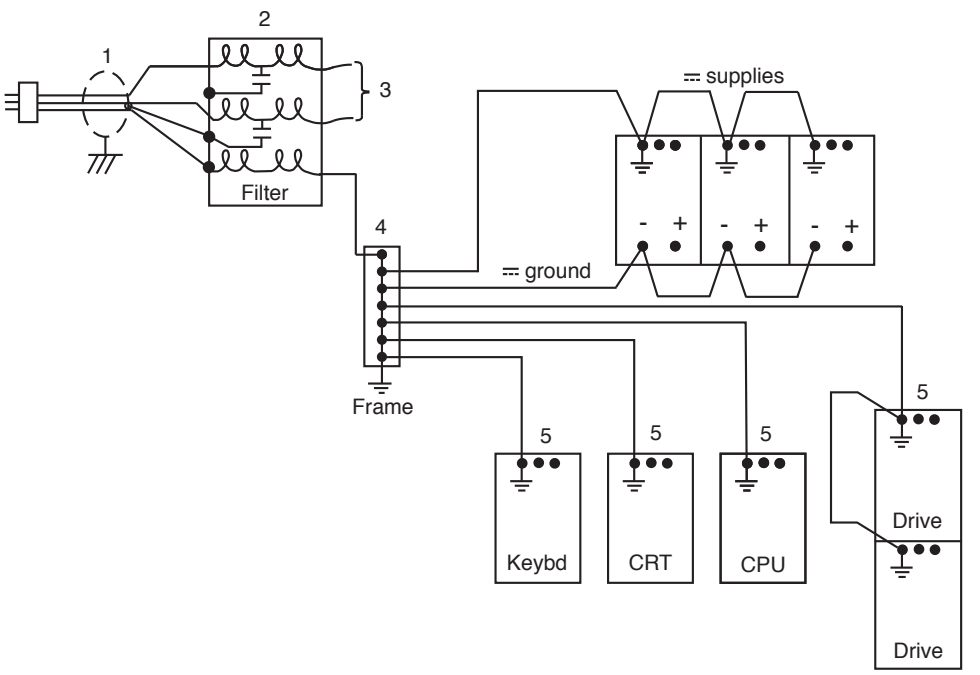
2.6 System power and ground distribution

To provide optimum performance and noise immunity, extreme care must be used to provide low noise grounds. Independent frame ground wires should run from each drive and other system components to a single point system frame ground.

The 5V and 12V return lines should be connected together at the host system, but these ⎓ power supply return lines should be isolated from the system frame (~) ground. These return lines are isolated from the frame ground on the drive PCB by a 0.01μF capacitor and 100kΩ resistor in parallel. The network is provided to suppress differential noise between the ⎓ and ~ grounds while providing a ⎓ connection.

Grounding for the TTL signal lines between the drive PCB logic ground and the host system (controller) PCB logic ground should be provided by the 17 signal ground pins of the J1 connector. All odd pins, 1 through 33, should be connected to the controller signal ground plane.

Figure 2-5. Recommended power and ground distribution



Note:

1. Shield power cable - should be only one and tied to the ground at the filter end only.

2. Line filter - isolated from the frame with the system ground filtered.

3. A.C. distribution - twisted pair cable including ground wire (as shown in 3 places). The wire size must be large enough to maintain a level less than 25mV/ft drop.

4. A.C ground TB - only one connection to the frame for all ⎓ grounds and one ~ ground.

5. D.C distribution - separate twisted pair cable from each device to the ⎓ supplies (as shown in four places). The wire size must be large enough to maintain a level less than 10mV/ft drop.

2.7 Functional operations

2.7.1 Power sequencing

Applying ⎓ power to the drive can be done in any sequence. However, during power-up, the WRITE GATE line must be held inactive or at a high level. This will prevent possible "glitching" of the media.

After the application of ⎓ power, a 700ms delay should be introduced before any operation is performed.

After power-on, the initial position of the read/write head is at Track 00. Because of this, a recalibrate operation is not required.

2.7.2 Read operation

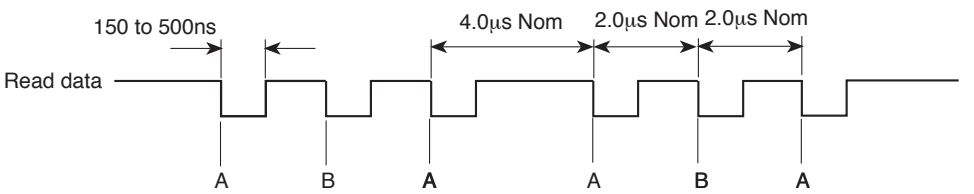
Reading data from the drive is accomplished by:

a. Activating the DRIVE SELECT line.
b. Selecting the head.
c. WRITE GATE being inactive.

The timing requirements for the read operations are shown in figures 2-6 and 2-7 repectively.

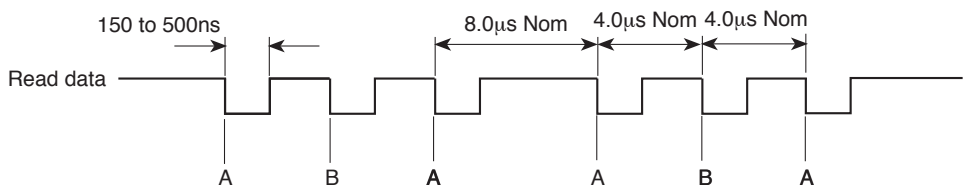
2.7.3 Write operation

Figure 2-6. High-speed read data timing (FM encoding 1.6Mb)



A = Leading edge of bit may be ±400ns from its normal position.
B = Leading edge of bit may be ±200ns from its normal position.

Figure 2-7. Low-speed read data timing (FM encoding 1.0Mb)



A = Leading edge of bit may be ±800ns from its nominal position.
B = Leading edge of bit may be ±400ns from its nominal position.

Writing data to the drive is accomplished by:

a. Activating the DRIVE SELECT line.
b. Selecting the head.
c. Activating the WRITE GATE line.
d. Pulsing the WRITE DATA line with the data to be written.

The timing specifications for the write data pulse are shown in Figure 2-8 for high speed operation, and Figure 2-9 for low-speed operation. Write data encoding can be FM or MFM.

Figure 2-8. High-speed write data timing (FM encoding 1.6Mb)

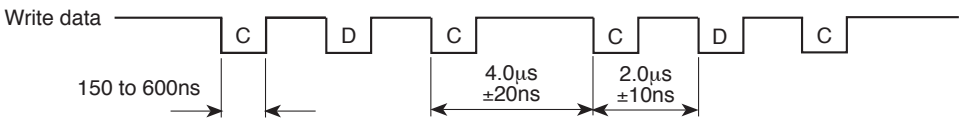
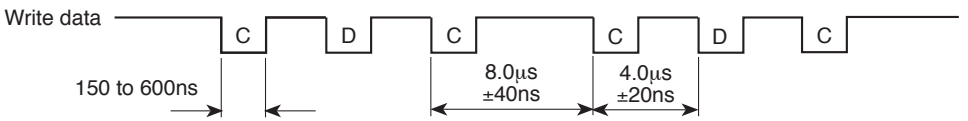


Figure 2-9. Low-speed write data timing (FM encoding 1.0Mb)



3.0 Customer installable option

This section discusses examples of modifications and how to implement them.

3.1 Plug/wire jumper

The drive can be modified by the user according to the user's requirements. These modifications can be implemented by adding, changing, or deleting connections. These changes can be accomplished by the use of shorting plugs (please see table 3-1) or wire jumpers.

Option shorting plug: 2mm centres.

Figure 3-1. Plug location

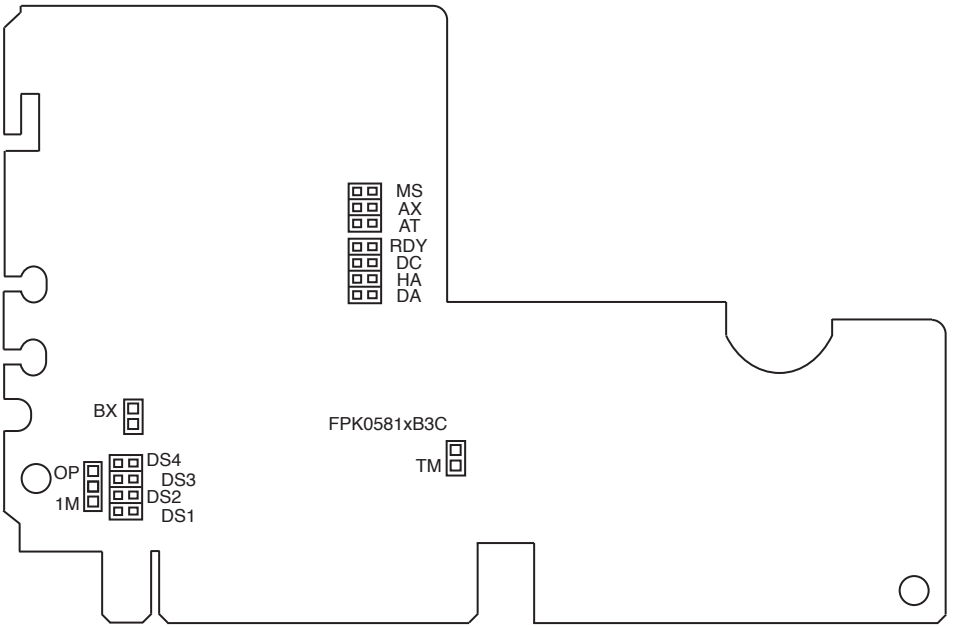


Table 3-1. Plug options

Plug designation	Description	Shipped from factory	
		Open	Short
DS2	Drive select 2		X
DS1	Drive select 1	X	
DS3,4	Drive select 3,4	X	
DA	Activity LED with "drive select"		X
HA	Activity LED with "drive select and "in use"	X	
MS	Enables drive motor with "drive select"	X	
OP	Dual mode		X
AT	Dual mode (positive high density)		X
BX	Dual speed	X	
AX	Mode select with latched by "DS"	X	
1M	Single mode (1Mb only)	X	
TM	Termination resistor		X
RDY	Standard ready	X	
DC	Disk change 1 (reset by "step")		X

Table 3-2. Wire jumper options

Plug designation	Description	Shipped from factory	
		Open	Short
1E	Switch to the 96 t.p.i. or 48 t.p.i.		X
RY	Switch to the 96 t.p.i. or 48 t.p.i.		X

Note: ST, OF ..... not used (factory use only).

3.2 Plug/wire options

3.2.1 OP/AT/AX/BX/1M plug

OP	AT	AX	BX	1M	Spindle speed	Density
Open	Closed	Open	Open	Open	360 r.p.m.	High
Open	Closed	Open	Closed	Open	360 r.p.m.	High
Closed	Closed	Closed	Open	Open	360 r.p.m.	L - #2
Closed	Closed	Closed	Closed	Open	#1	L - #2
Closed	Closed	Open	Open	Open	360 r.p.m.	#2
Closed	Closed	Open	Closed	Open	#1	#2
Open	Closed	Open	Open	Closed	360 r.p.m.	Normal
Open	Closed	Open	Closed	Closed	300 r.p.m.	Normal
Closed	Open	Closed	Open	Open	360 r.p.m.	L - #3
Closed	Open	Closed	Closed	Open	#1	L - #3
Closed	Open	Open	Open	Open	360 r.p.m.	#3
Closed	Open	Open	Closed	Open	#1	#3

Note 1: #1 : High density - 360 r.p.m., Low density - 300 r.p.m.
Note 2: #2 : The density changes according to pin #2's logic level of the J1 I/O interface. (H: high density, L: low density.)
Note 3: L - #2 : The density changes according to the latched value of pin #2's logic level. The latching operation occurs when the drive is selcted from a deselected state. (H: high density, L: low density.)
Note 4: #3 : The density changes according to pin 2's inverted logic level of the J1 I/O interface. (H: low density, L: high density.)
Note 5: L - #3 : The density changes according to the latched value of pin #2's inverted logic level. The latching occurs when the drive is selected from a deselected state. (H: low density, L: high density.)
Note 6: Closed : Plug is installed.
Note 7: Open : Plug is not installed.

3.2.2 DA/HA plugs

HA	DA	In use LED
Closed	Closed	The IN USE LED is a direct function of the "IN USE" line.
Open	Closed	The IN USE LED is a direct function of the "DRIVE SELECT" line.
Closed	Open	The IN USE LED is a function of the "DRIVE SELECT" and "IN USE" lines.
Open	Open	The IN USE LED is a direct function of the "IN USE" line. The latching operation occurs when the drive is selected from a deselected state.

Note 1 : Closed : Plug is installed.
Note 2 : Open : Plug is not installed.

3.2.3 MS plug

MS	Spindle motor
Open	The spindle motor is a function of "MOTOR ON" line of J1 I/O. Motor is turned on when there is logical "LOW" on "MOTOR ON" signal.
Closed	The spindle motor is not a function of "MOTOR ON" line, instead the motor is turned on when the drive is selected.

Note 1 : Closed : Plug is installed.
Note 2 : Open : Plug is not installed.

3.2.4 DS 2 (1,3,4) plug

DS1 - DS4	Drive selection
Closed	The drive is selected when the DRIVE SELECT signal is low. **Note:** Among the 4 options (DS1-DS4), only one jumper plug should be mounted.

3.2.5 RDY/DC plugs

RDY	DC	Pin #34 of J1 I/O interface
Closed	Open	READY When a media is inserted, the motor is up to speed, and at least 2 INDEX pulses are detected, the READY signal becomes low. The READY signal becomes high when the MOTOR ON signal becomes high.
Open	Closed	DISK CHANGE 1 When power is supplied and a disk is not inserted, pin #34 is high whenever the DRIVE SELECT signal is high, and pin #34 is low whenever the DRIVE SELECT signal is low. When power is supplied and a disk is inserted, PIN/34 is low whenever the DRIVE SELECT signal is low. The STEP signal resets pin #34 to a high level.
Open	Open	DISK IN Pin #34 is a direct function of the media-insert status. It is active low when a media is inserted.
Closed	Closed	DISK OUT Pin #34 is a direct function of the media-insert status. It is active low when a media is not inserted.

Note 1 : Closed : Plug is installed.
Note 2 : Open : Plug is not installed.

4.0 Operation procedures and precautions

4.1 Power-on procedure

The ⎓ power supply can be turned on in any order. The write gate signal should be held at a high level so that the power-on action does not cause illegal writing. An interval of 700ms is necessary between power-on time and operation-start time. After powering on, the initial position of the read/write head is at Track 00. Because of this, a recalibrate operation is not required.

4.2 Drive selection

The drive is selected when the DRIVE SELECT signal goes to a low level. Under this operation, the input and output lines are enabled.

4.3 Drive motor turn-on

Throughout data reading and writing, the drive motor must rotate at a constant speed. The drive motor is activated when the MOTOR ON signal is set at low level, and requires 500ms to reach constant speed. When the MOTOR ON signal changes to a high level, the drive motor stops after about 4 seconds. The motor must be turned off if the drive has not received a new command by host system by deactivating the MOTOR ON signal. This ensures maximum motor and media life. When the media detector detects a change point due to insertion, the drive motor rotates for about 10 seconds. An option is available to turn it on/off with the DRIVE SELECT signal.

4.4 Precautions

1. Upon installation, pay close attention to reducing the ambient electrical noise, such as the noise from the switching power supply or CRT.

2. The drive automatically rotates the spindle motor when a diskette is inserted, for better clamping accuracy. This also prevents the diskette from being damaged upon clamping. For full use of this feature, turn the power on before inserting a diskette.

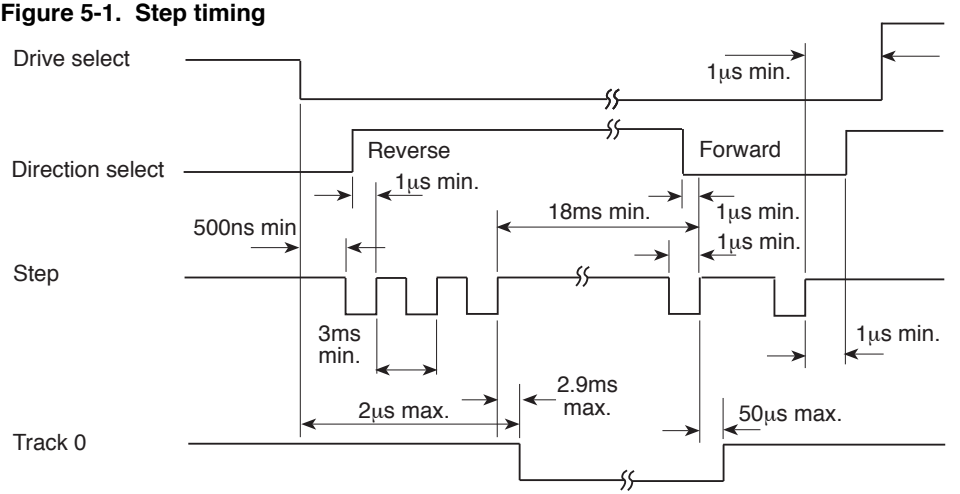
5.0 Timing diagram

The step, read, write and general control timings are given on the following pages.

Note: Min. = The minimum amount of time the controller must wait for the execution of the next operation.

Max. = The maximum amount of time required by the drive to complete an operation. The maximum amount of time delay allowed by the controller for next operation: i.e. the controller must execute (start to stop) an operation within the maximum limit amount of time.

Figure 5-1. Step timing



***Note:** Turn around time is 18ms (min.) when direction is changed.

Figure 5-2. Read initiate timing

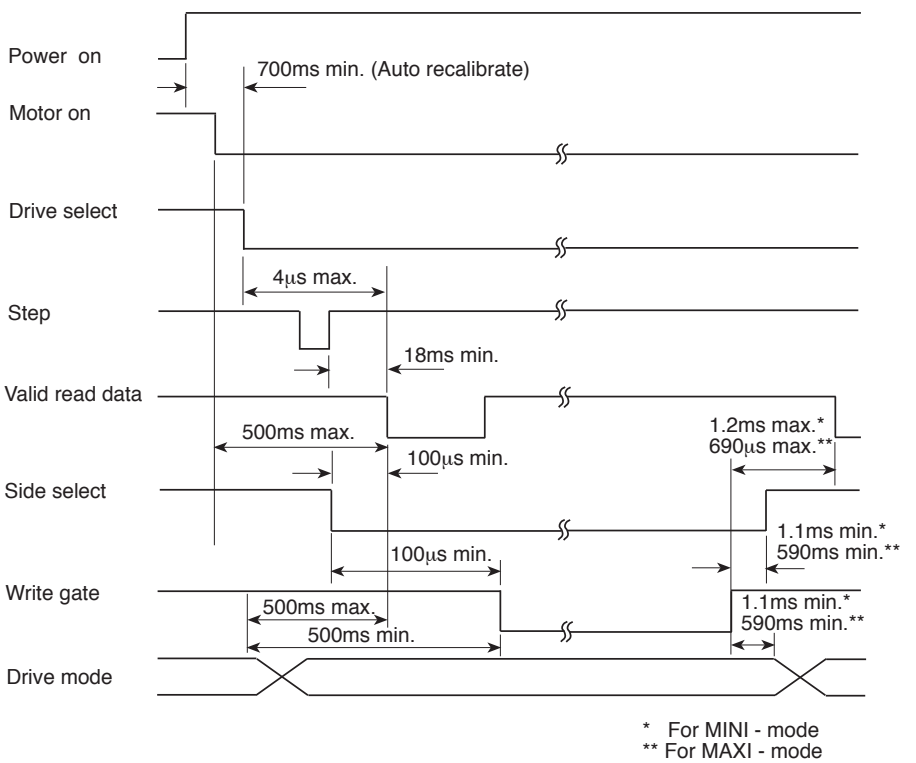


Figure 5-3. Write initiate timing

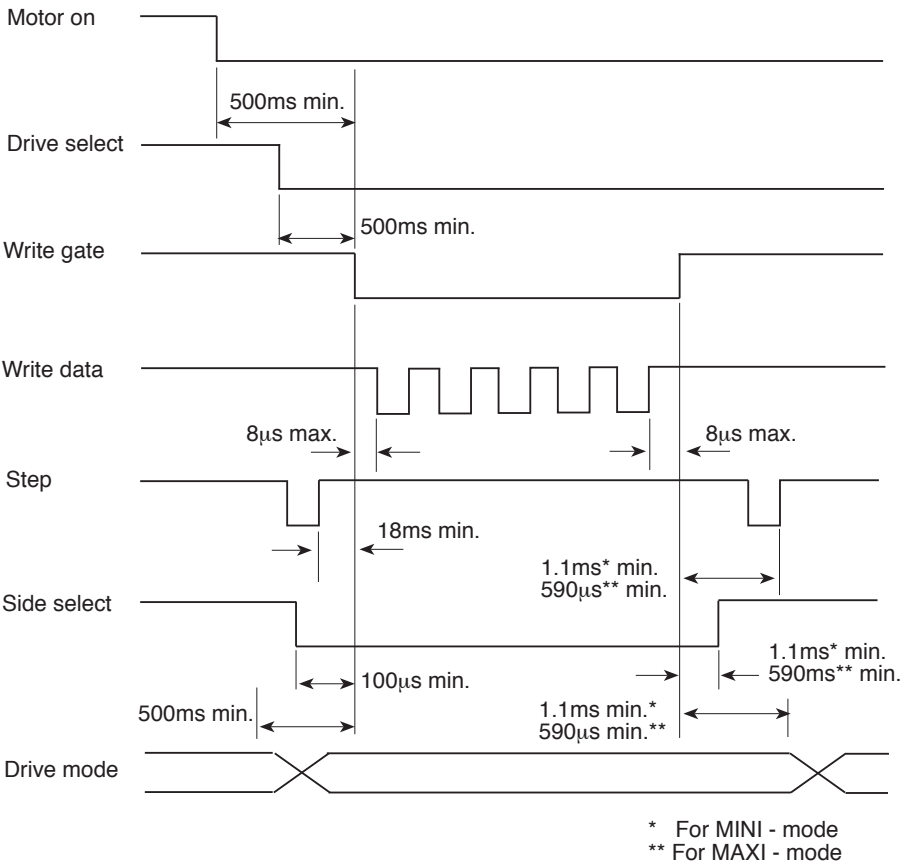


Figure 5-4. Mode selection timing

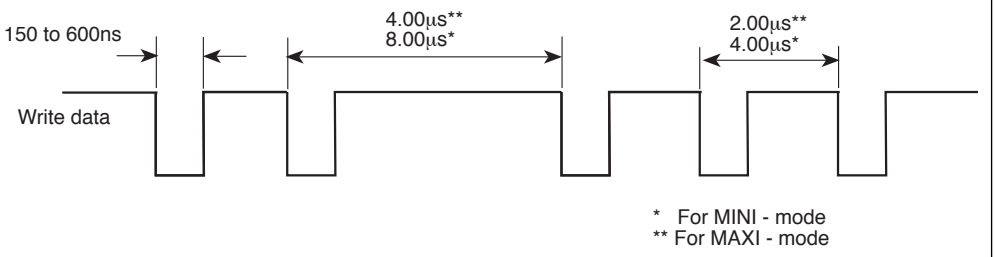


Figure 5-5.

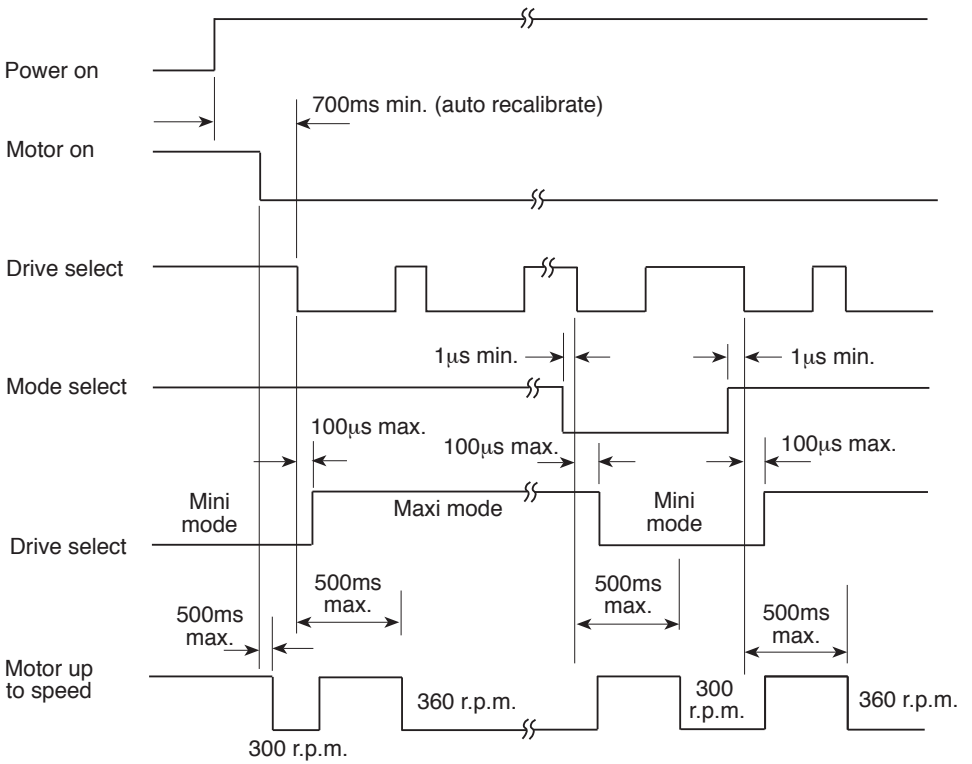
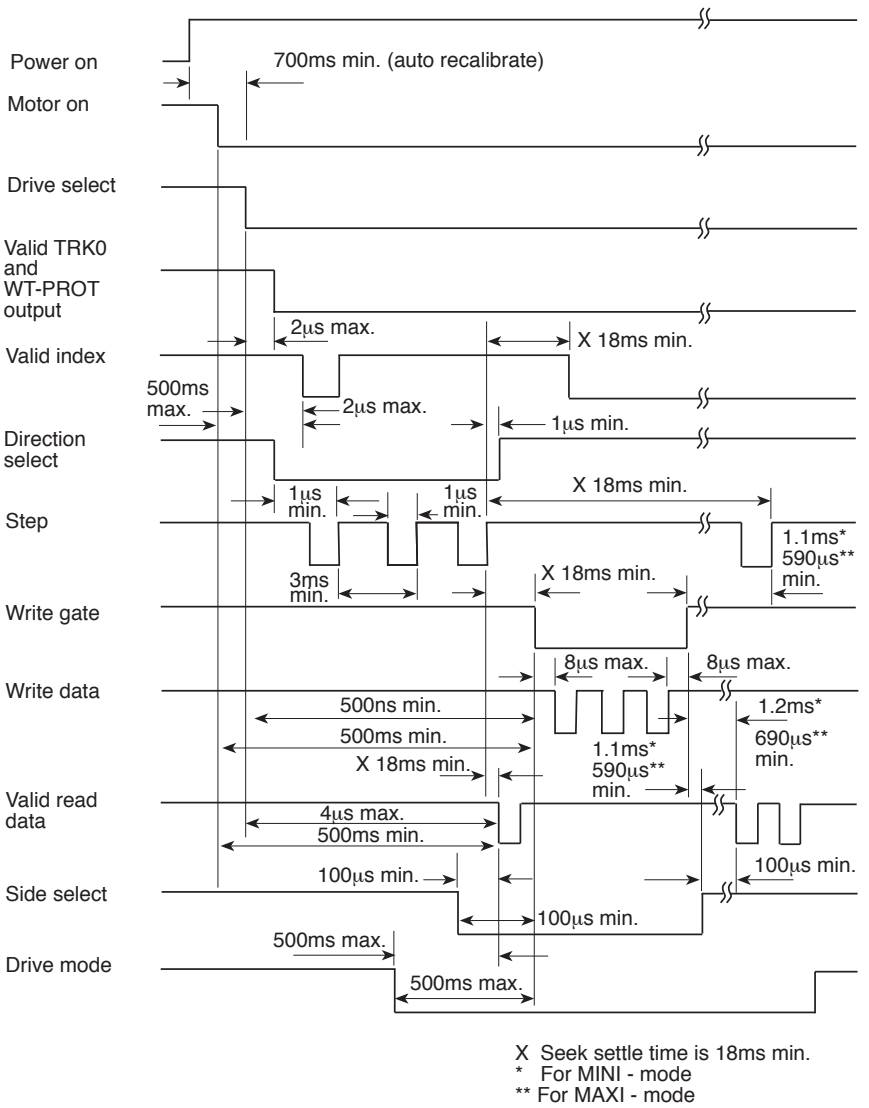

Power on
700ms min. (auto recalibrate)
Motor on
Drive select
1μs min.
1μs min.
Mode select
100μs max.
100μs max.
100μs max.
Mini mode
Maxi mode
Mini mode
Drive select
500ms max.
500ms max.
500ms max.
500ms max.
Motor up to speed
360 r.p.m.
300 r.p.m.
300 r.p.m.
360 r.p.m.
300 r.p.m.

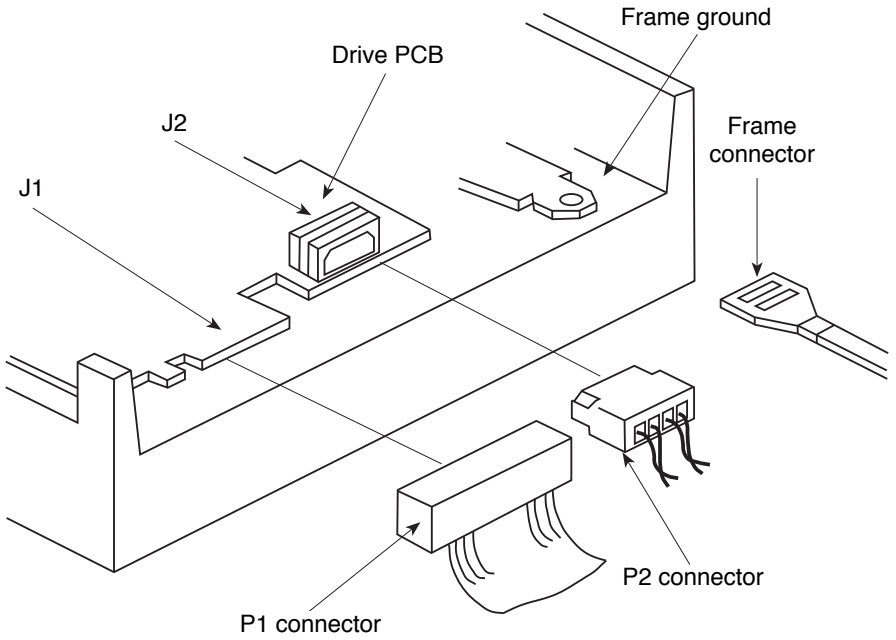
Figure 5-6. General control and data timing



6.0 Physical specification

The electrical interface between the drive and the host system is via three connectors. The first connector, J1, provides all of the TTL level I/O control signals for the host system and the drive. The second connector J2, provides ⎓ power for the drive from the host system. The third connector, a push-on tab terminal, provides a frame ground for the drive. See figure 6-1 for connector locations.

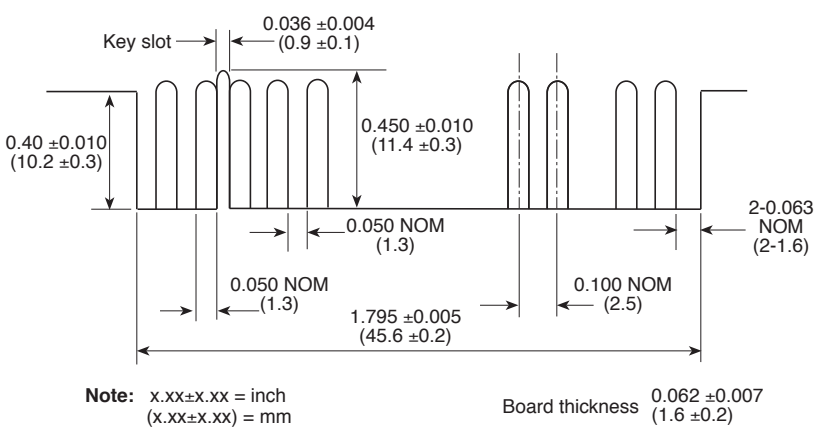
Figure 6-1. Interface connector locations



6.1 J1 Connector (signal)

Connection to J1 is through a 34 pin PCB edge connector. The dimensions for this connector are shown below. The pins are numbered 1 through 34 with the even-numbered pins containing the control and data signals and the odd pins being ground. A key slot is provided between pins 4 and 6 for optional keying.

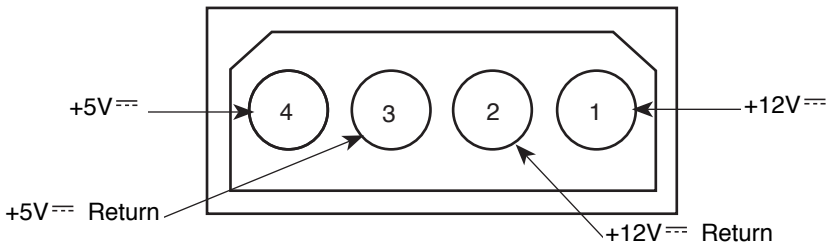
Figure 6-2. J1 Connector dimensions



6.2 J2 Connector (power)

The ⎓ power connector (J2) is located in the rear of the drive.

Figure 6-3. J2 Connector pin assignments



6.3 Frame grounding

WARNING: The drive must be frame-grounded to the host system to ensure proper operation. If the frame of the drive is not fastened directly to the frame of the host system with a good ∼ ground, a wire from the system ∼ ground must be connected to the drive. For this purpose, a fast-on tab is provided on the rear of the drive.

6.4 Description of the test points (TP)

TP 1 & TP 2	:	Differential analog read data signal
TP 7	:	Index
TP 8	:	Track 00
TP 12	:	Step
TP 6	:	Read data
TP 5, TP 10	:	Ground

6.5 Mounting

The drive is capable of being mounted in any of the following positions.

1. Front loading - mounted vertical with door opening left or right.
   mounted horizontal with PCB up.

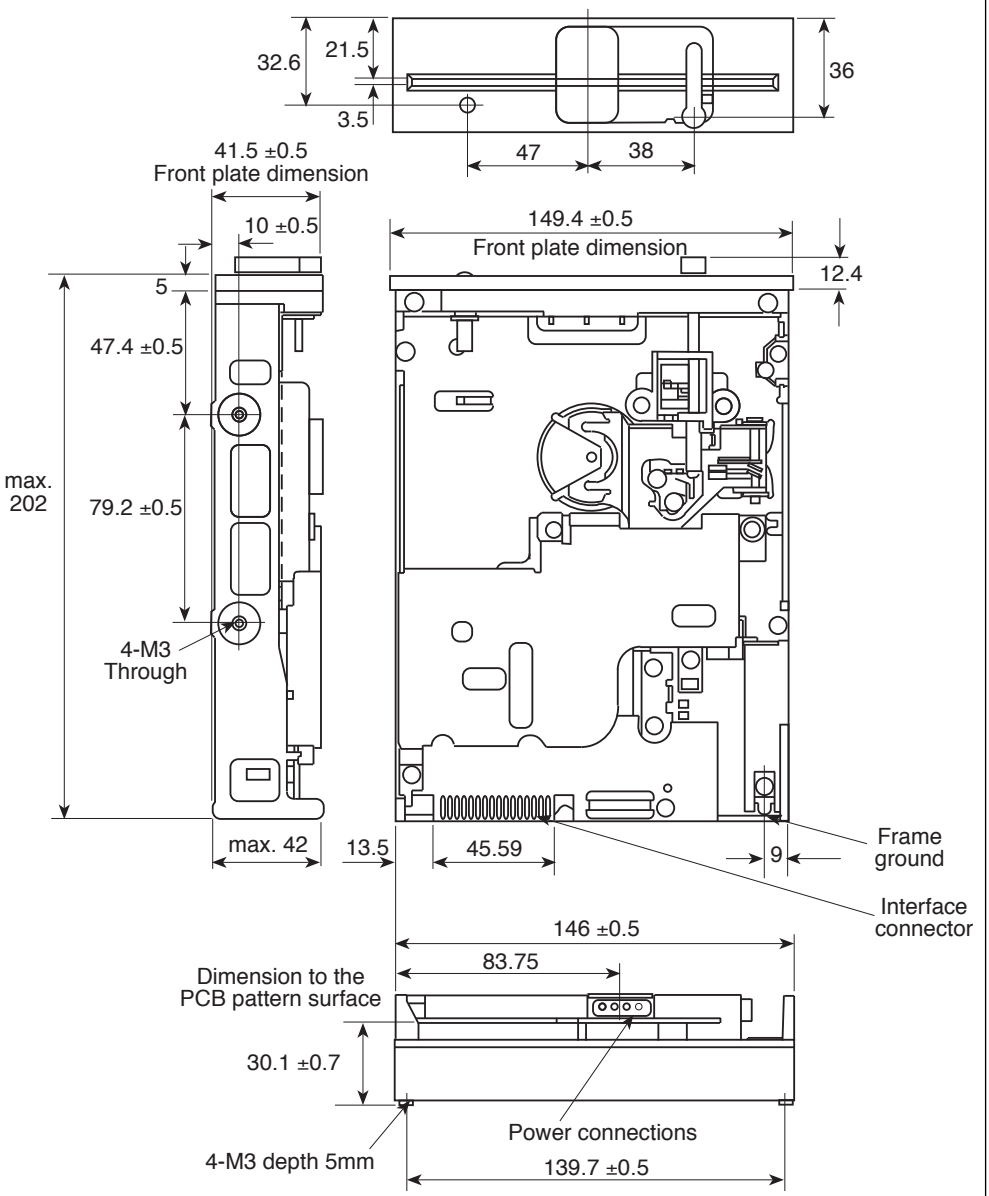
WARNING: Do not mount the drive horizontally with the PCB facing down and Top Loading (mounted upright). Such a configuration could cause damage to the drive.

The mounting hardware for the bottom and side holes is to be #3 metric.

6.6 Mechanical dimensions

See figure 6-4 for the dimensions of the drive.

Figure 6-4. Mechanical dimensions



7.0 Error recovery

7.1 Write error

If an error occurs during a write operation, it will be detected on the next revolution by doing a read operation (commonly called a "write check"). To correct the error, another write and write check operation must be done. If the write operation is not successful after ten attempts have been made, a read operation should be attempted on another track. This is done to determine if the media or the drive is failing. If the error still persists, the disk should be considered defective and discarded.

7.2 Read error

Most errors that occur will be "soft" errors. Soft errors are usually caused by the following:

a. Airborne contaminants passing between the read/write head and the disk. The contaminants will generally be removed by the cartridge self-cleaning wiper.

b. Random electrical noise which usually lasts for a few microseconds.

c. Small defects in the written data and/or track not detected during the write operation which may cause a soft error during a read.

The following procedure is recommended to recover from errors:

a. Reread the track ten times or until such time as the data is recovered.

b. If data is not recovered after using step "a" access the head to the adjacent track in the same direction it was moved previously. Return to the desired track.

c. Repeat step "a".

d. If data is not recovered, the error is not recoverable.

7.3 Seek error

Seek errors are detected by reading the ID field after the seek is completed. The ID field contains the track address. If a seek error is detected, the host system should issue a recalibrate operation (step out until the Track 00 line goes active) and seek back to the original track.