



.....
Elite Disc Drive
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ST41800K
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.....
User's Manual
.....

(IPI Interface)
.....

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Section 1. General description

The Seagate Elite disc drives are high speed, random access digital data storage devices that connect to a central processor through a controller. The drive is shown in Figure 1, and its specifications are listed in Table 1 on the following page.

The drive is a component for installation in an enclosure designed for the drive. The enclosure design must ensure adequate cooling for the drive, and it must address the requirements for grounding and for shielding of emissions. The reference manual (publication 83327430) presents guidelines for designing the enclosure, but the design is your responsibility.

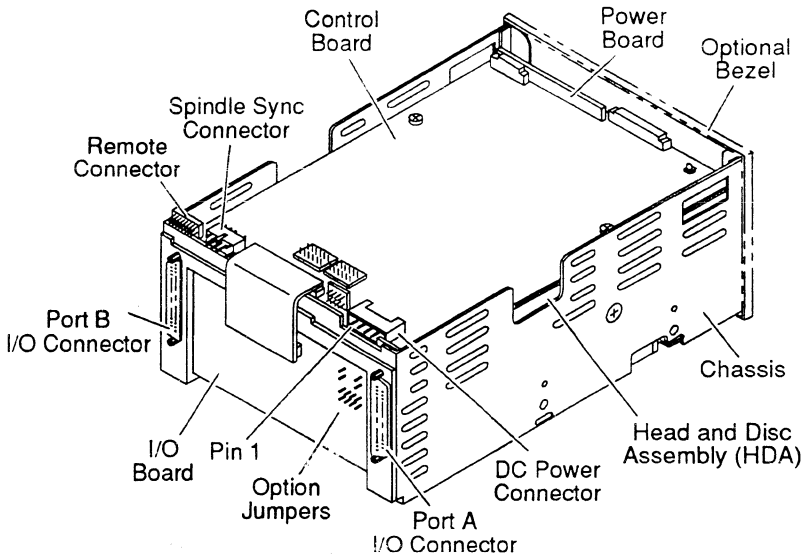


Figure 1. The ST41800K disc drive

Table 1. Drive specifications

Characteristics	Conditions	Specifications
Size	Dimensions	See "Space requirements" in section 2
	Weight (drive only)	4.1 kg (9.0 lb)
Interface	IPI-2	
Capacity—bytes (unformatted)	Per drive	1,985,968,714
	Per physical track	42,000
	Per logical track	84,000
	Per cylinder	756,000
Physical	Number of discs	11
	Read/write heads	18 (9 logical heads)
	Servo heads	1
	Physical heads per surface	1
	Cylinders per head/disc assy	2627* (0-2626 logical)
Recording	Modulation	2,7 code
Transfer rate	Disc speed at 5400 RPM	60.48 MHz (7.56 Mbytes/sec)

* Users normally reserve two cylinders for diagnostic use (cylinder 2626 for defect map and cylinder 2625 for diagnostics).

continued

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Characteristics	Conditions	Specifications
Seek time (time required to move heads to a different track address)	Typical full	22.5 msec max
	Typical average	11.5 msec max
	Typical one-track	1.7 msec max
Latency (time required to reach a particular track address after head positioning is complete)	Average	5.55 msec (disc rotation at 5400 RPM)
	Maximum	11.17 msec (disc rotation at 5373 RPM)
Start time**		30 sec max
Stop time		30 sec max

** Following the power sequence delay, once DC power is applied and start conditions are present.

The drive contains all the circuits and mechanical devices necessary to record data on and recover it from its discs. The drive requires DC voltage inputs from an external power supply, which receives its AC input power from the site main power source. A power supply and DC power cable are available as accessories if required for system installation.

The drive consists of a head and disc assembly (HDA) and several circuit boards mounted on a common chassis. The circuit boards contain the electronics required for drive operation. The HDA is a sealed unit containing the electromechanical components used for data storage and retrieval. These components include the discs, spindle, drive motor, actuator, and heads.

The eleven discs provide the recording medium for the drive. These discs are mounted on a spindle, and the spindle is coupled directly to the drive motor. The drive motor rotates the discs at 5400 RPM and also produces a circulation of air within the sealed HDA.

All functions performed by the drive are done under direction of the controller.

As shown in Figure 2, the controller communicates with the drive via the interface which consists of a number of I/O lines carrying the necessary signals to and from the drive. Refer to the reference manual for a description of interface functions.

Some interface lines, including those that carry commands to the drive, are not enabled unless the drive is selected by the controller. Unit selection allows the controller, which can be connected to more than one drive, to initiate and direct an operation on a specific drive.

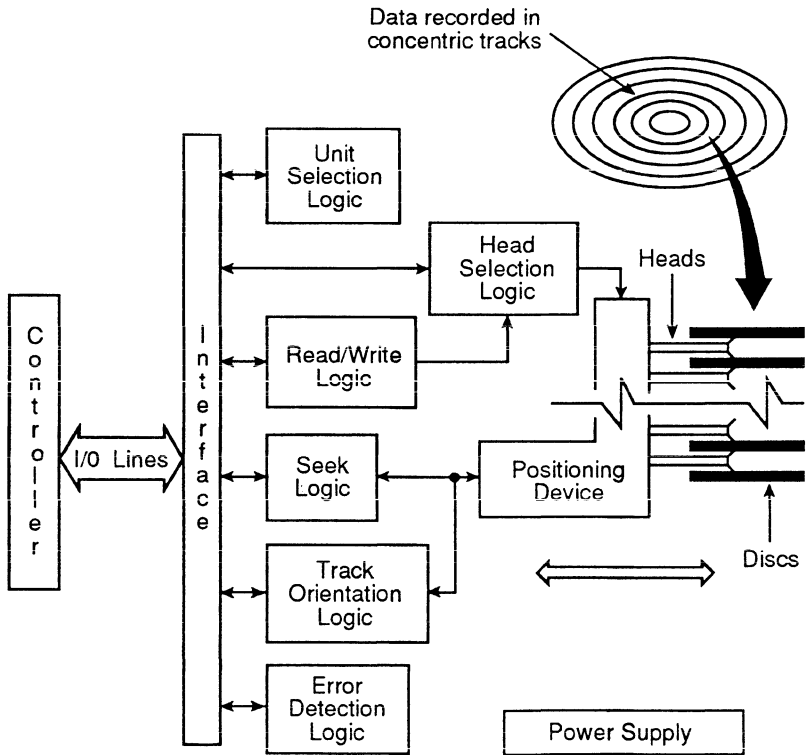


Figure 2. Drive functional block diagram

All operations performed by the drive are related to data recovery and storage (normally referred to as reading and writing). The actual reading and writing is performed by heads that are positioned over the recording surfaces of the rotating discs. There is one head for each data surface. The heads are positioned in such a way that data is written in concentric tracks around the disc surfaces (see Figure 2).

Before any read or write operation can be performed, the controller must instruct the drive to position the heads over the desired cylinder (called seeking) and use the head located over the surface (head selection) where the operation is to be performed.

The heads are mounted on the actuator, and the actuator moves the heads over the rotating discs. There are 19 heads—a servo head to sense actuator positioning and 18 physical data heads used for data transfers to and from the discs. As a two-head parallel drive, each data transfer employs two physical data heads simultaneously. Each pair of physical (read/write) heads is known as a logical head. The actuator has a voice coil that moves in a permanent magnetic field in response to signals from the servo positioning circuitry. The voice coil moves the heads in an arc across the rotating discs.

When the drive is not powered on, the heads rest on the disc surface in the preassigned landing zone (beyond the data zone). The actuator is automatically latched in this position at shutdown for moving or shipping protection. When the drive is activated to bring the discs up to speed, the heads fly on a cushion of air close to the disc surface.

After arriving at the data track and selecting a logical head, the controller must locate that portion of the track where the data is to be read or written. The controller uses track orientation information it receives on the interface.

When the head is above the desired track location, the controller commands the drive to actually read or write the data. During a read operation, the drive retrieves data from the discs, processes it, and transmits it to the controller. During a write operation, the drive receives data from the controller, processes it, and stores it on the discs.

The drive is also capable of recognizing certain errors that may occur during its operation. When an error is detected, status information is available through the controller.

Section 2. Installation

The information contained in this section describes installation and initial checkout of the drive.

Site requirements

The site requirements considered are environment, space, power, grounding, and interface.

Environmental requirements

All environmental requirements for the drive are listed in Table 2 on the following page.

Space requirements

The drive is designed to be mounted in one of the three orientations shown in Figure 3. The drive may be mounted on its base or on either side. The physical dimensions of the drive and optional power supply are shown in Figure 4. The drive itself weighs 4.1 kg (9.0 lb).

For details about designing an enclosure to match the drive mounting dimensions, refer to the drive product specification (document 64403502).

Table 2. Environmental requirements

Conditions	Specifications
Operating environment	
Temperature	Range of 10°C to 45°C (50°F to 113°F) with a maximum change of 20°C (36°F) per hour
Humidity	Range of 5% to 95% relative A maximum wet bulb temperature of 26°C (79°F) no condensation
Barometric pressure	-305 m to 3,048 m (-1,000 ft to 10,000 ft) 104 kPa to 69 kPa (30 in Hg to 20 in Hg)
Non-operating environment (unpacked)	
Temperature	Range of -40°C to 60°C (-40°F to 140°F) with a maximum change of 20°C (36°F) per hour
Humidity	Range of 5% to 85% relative A maximum wet bulb temperature of 26°C (79°F) no condensation
Barometric pressure	-305 m to 12,192 m (-1,000 ft to 40,000 ft) 104 kPa to 69 kPa (30 in Hg to 20 in Hg)
Transit and storage environment (packed)	
Temperature	Range of -40°C to 60°C (-40°F to 140°F) with a maximum change of 20°C (36°F) per hour
Humidity	Range of 5% to 95% relative
Barometric pressure	-305 m to 12,192 m (-1,000 ft to 40,000 ft) 104 kPa to 19 kPa (30 in Hg to 6 in Hg)

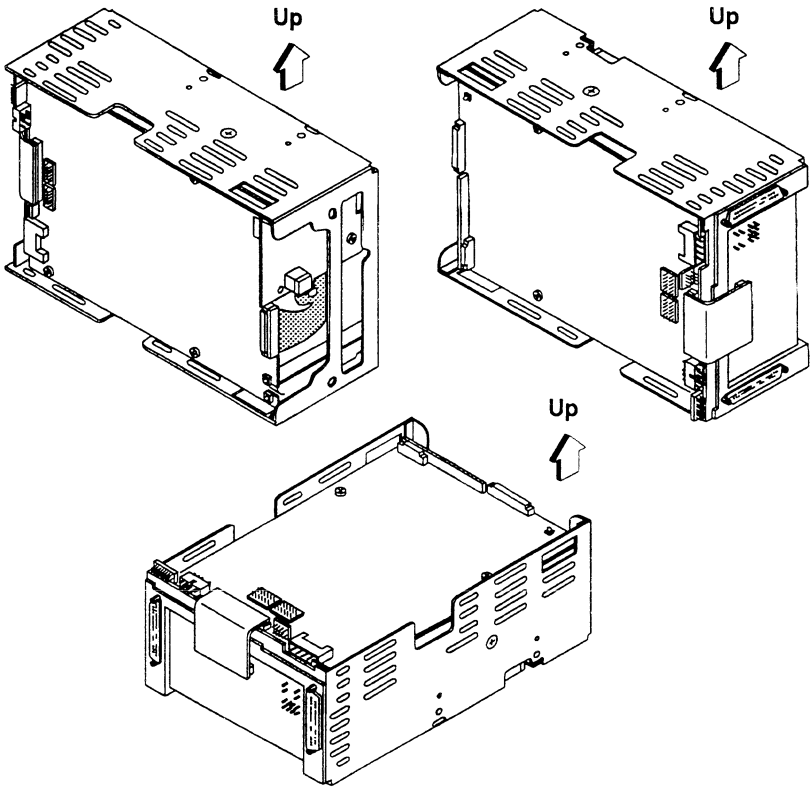


Figure 3. Mounting orientations

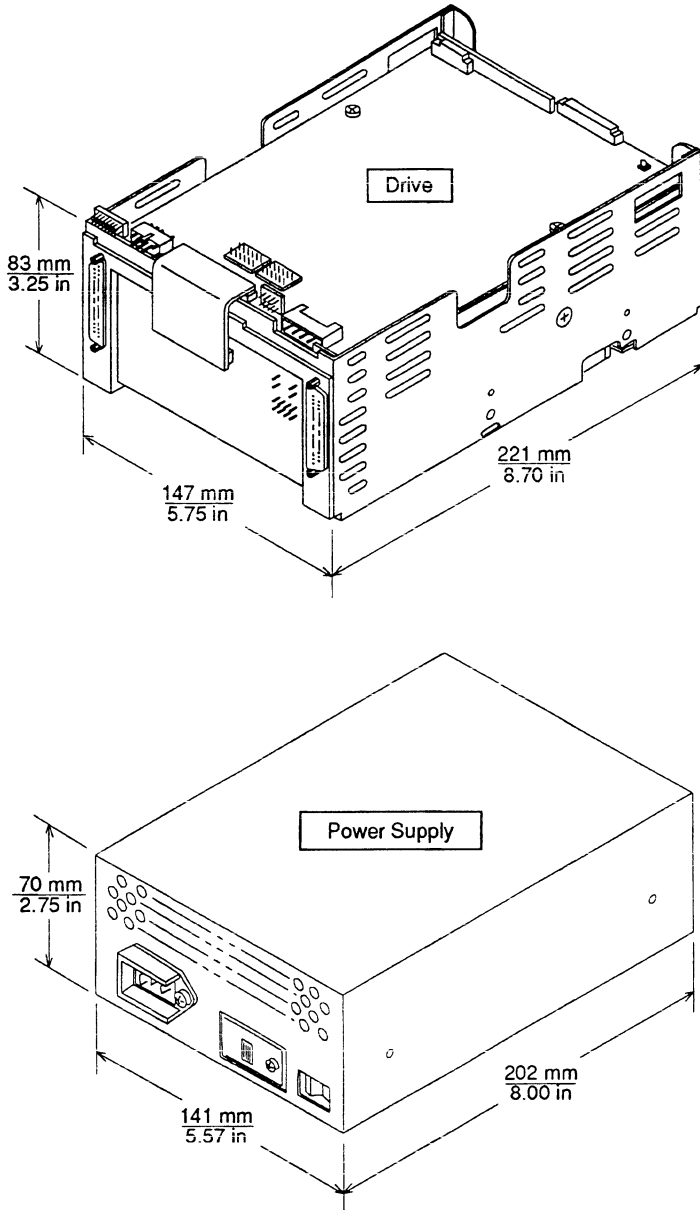


Figure 4. Dimensions of the drive

Power requirements

The voltage and current requirements for a single drive are shown in Table 3 below. Consult product specification 64403502 before selecting or designing a power supply for the drive. The product specification presents more detailed requirements including the types of overvoltage and overcurrent protection needed.

A power supply is available if required for system installation. AC power requirements are listed in Table 4. Conversion to the different line voltages is explained in the installation procedures.

Table 3. DC power requirements for the drive

Specifications	Nominal Values		
	+5.0	-5.1	+12
Allowable range* (volts)	+4.85 to +5.25	**	+11.4 to +12.6
Ripple noise (peak-to-peak millivolts)	100	**	100 (spindle motor not running) 300 (motor running but drive not seeking)
Load current range (amperes)	1.5 to 6.0	**	0.4 to 8.2

* Voltage range must allow for the effects of ripple, noise, transient response, environmental conditions, and variations in load, in line voltage, and in frequency.

** The IPI Elite disc drive does not require - 5.1 volts. The optional Seagate power supply has a - 5.1 volt channel to meet the requirements of other versions of the Elite disc drive.

Table 4. AC power requirements for the power supply

Specifications	Nominal Values	
	100–120 VAC	208–240 VAC
Voltage range	85 to 132 V	175 to 264 V
Nominal line	50/60 Hz	50/60 Hz
Frequency range	48.0 to 62.0 Hz	48.0 to 62.0 Hz
Phase requirements	single phase	single phase
Power consumed*	130 W	130 W
Line current*	1.08 A.RMS	0.625 A.RMS
Power factor*	TBD	TBD

*Measured at nominal values when discs are rotating and carriage is track-following.

Grounding requirements

A safety ground must be provided by the site AC power system. The green wire (or green wire with yellow stripe) in the AC power cord provides the safety ground connection between the power supply and the site AC power system. The site AC power system must provide the safety ground to earth ground connection.

All site AC power connection points, including convenience outlets for test equipment, must be maintained at the same safety ground potential.

Interface requirements

This drive is a two-port device, so it can be shared by two controllers if necessary. It is designed to be connected in a daisychain I/O configuration as shown in Figure 5. Table 5 shows the pin assignments and signal names for the I/O cable. Detailed information about interface lines is given in the reference manual (publication 83327430).

The two I/O connectors at the back of the drive accept the I/O cables that connect it to the system. J31 (port A) and J32 (port B) are the connectors to which daisychain I/O cables are attached. Each daisychain cable is a continuous cable having one connector for each drive it connects to.

A terminator must be installed at the end of each daisychain cable. An unused port (having no I/O cables) must be disabled as described in “Setting the circuit board switches.”

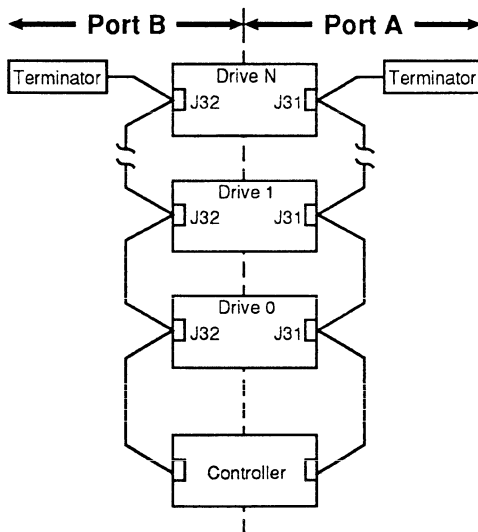


Figure 5. Daisychain configuration

Refer to the reference manual for guidelines on I/O cabling. These guidelines discuss the use of unshielded cabling inside cabinets and shielded cabling running between cabinets. They also contain information about constructing continuous daisychain cabling (including part numbers for the required cabling components).

Table 5. I/O cable pin assignments

Signal Name	(+) Pin Number	(-) Pin Number
DC Ground	1	2
Select Out	47	46
Master Out	41	40
Sync Out	23	24
Sync In	33	32
Slave In	17	18
Attention In	9	10
Bus A - Bit 0	39	38
Bus A - Bit 1	37	36
Bus A - Bit 2	15	16
Bus A - Bit 3	49	48
Bus A - Bit 4	45	44
Bus A - Bit 5	43	42
Bus A - Bit 6	11	12
Bus A - Bit 7	13	14
Bus A - Parity	35	34
Bus B - Bit 0	31	30
Bus B - Bit 1	29	28
Bus B - Bit 2	7	8
Bus B - Bit 3	19	20
Bus B - Bit 4	21	22
Bus B - Bit 5	25	50
Bus B - Bit 6	3	4
Bus B - Bit 7	5	6
Bus B - Parity	27	26

Unpacking, inspection, and repacking

After removing the packing material, inspect the drive for shipping damage. Save all packing materials for future use.

The drive is shipped separately from any other items ordered for the installation.

Unpacking

1. Allow the drive temperature to approach the ambient temperature of the unpacking area. Ensure that the temperature stabilization period meets the requirements printed on the drive container.
2. Open the package and remove the drive from its conductive static shielding bag, using precautions described in “Electrostatic discharge protection” in the preface.
3. Check all items against the shipping bill for the required equipment and hardware to complete installation. Discrepancies, missing items, damaged equipment, etc., should be reported to the sales representative from whom the drive was purchased.

Inspection

Inspect the drive for possible shipping damage. All claims for shipping damage should be filed with the carrier involved.

Repacking

If it is necessary to ship the drive, repack the drive with the original packing materials (saved during unpacking). Refer to section 5 for instructions.

Installation procedures

With the site requirements completed, the enclosure designed, and the drive unpacked, you are ready to begin the installation. The following procedures are included in drive installation:

- Setting the circuit board jumpers
- Installing the power supply (if used)
- Attaching an optional bezel
- Mounting the drive
- Connecting the system I/O cabling
- Grounding the system
- Synchronizing the spindle

Setting the circuit board jumpers

Caution. Do not remove circuit boards to set jumpers.

The circuit boards inside the drive contain a number of jumpers that must be set correctly for normal operation of the drive. The following figures contain information about jumper settings:

- Figure 6—identifies jumpers, gives their locations on the I/O board, and lists the possible settings for normal drive operation for jumpers on the I/O board.
- Figure 7—identifies jumpers and gives their locations on the control board. It also lists the possible settings for normal drive operation for jumpers on the control board.

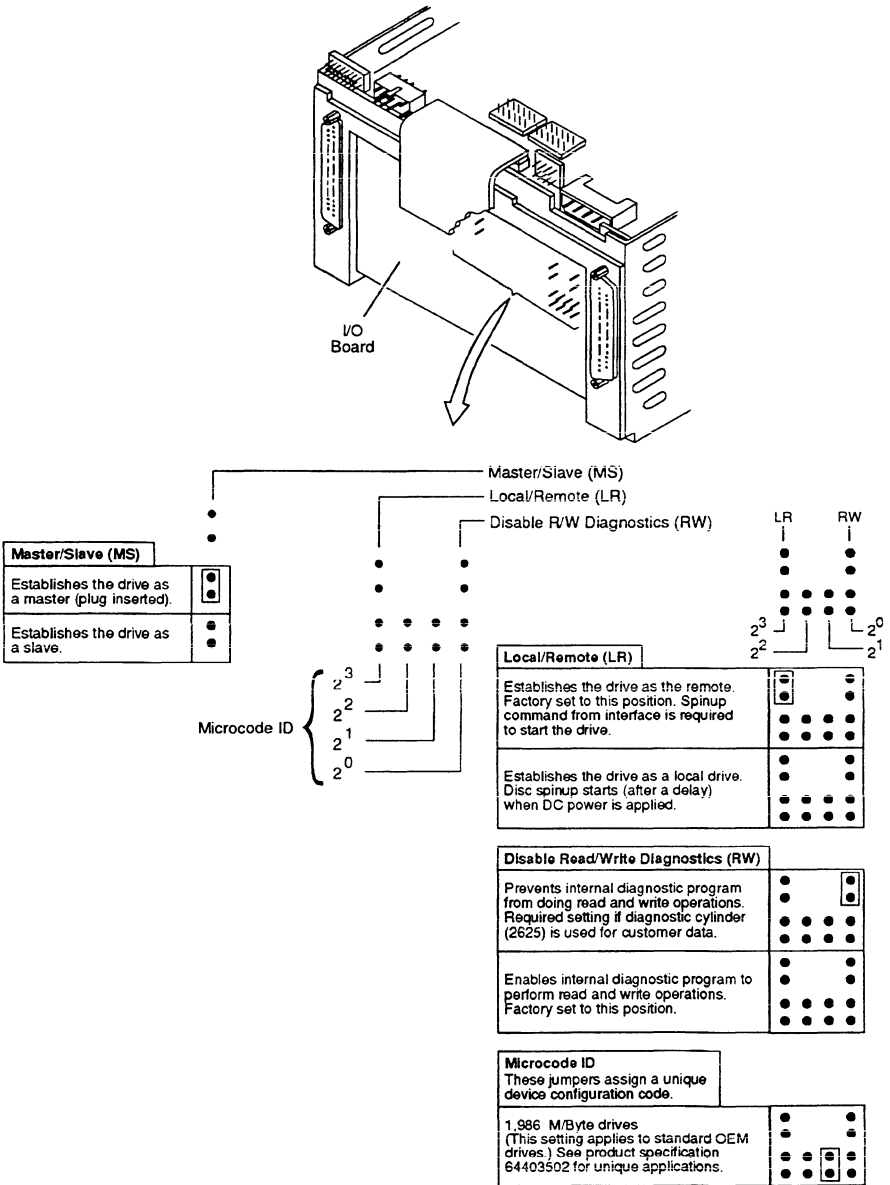


Figure 6. I/O board jumpers

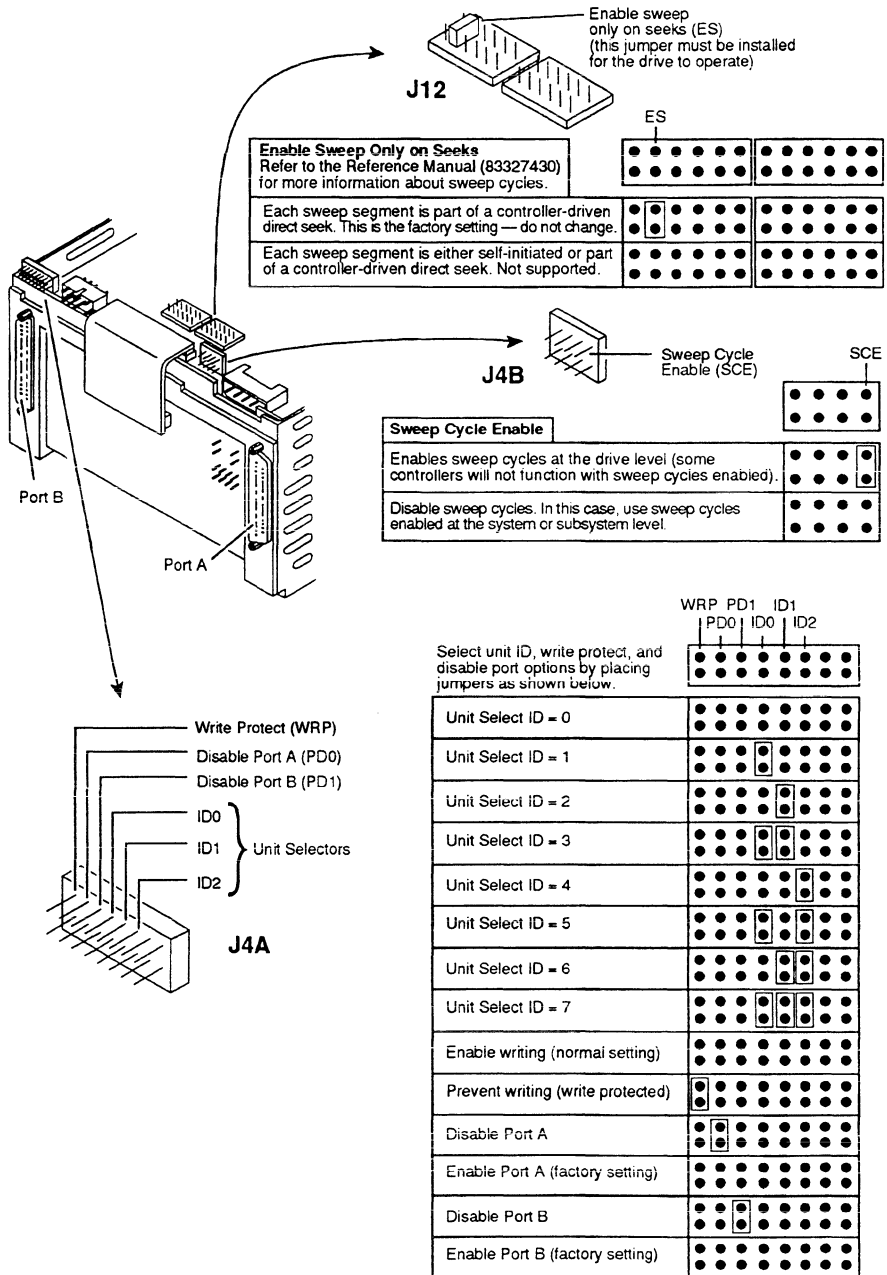


Figure 7. Control board jumpers

Installing the power supply

A power supply and AC power cord are available if desired. The power supply is configured before shipment to operate in one of two AC input voltage ranges. The voltage select plate on the power supply (see Figure 8) indicates the voltage range selected prior to shipment. The voltage range may be changed by setting the voltage select switch to the desired range.

Caution. The power supply will be damaged if the voltage select is set for the low range (100–120 VAC) and a voltage in the high range (208–240 VAC) is applied.

1. Ensure that the AC power cable is disconnected from the power supply.
2. If the correct voltage range is not selected, perform the following steps:
 - a. Remove the screw securing the voltage select plate to the power supply and remove the plate from the power supply. Retain the plate and all hardware.
 - b. Set the voltage select switch to the desired range.
 - c. Reverse the voltage select plate and install the plate on the power supply to lock the switch in the desired range.
 - d. Replace the existing AC power cable with the AC power cable specified for the new operating voltage.

Note. Mounting screws must have complete thread engagement in the power supply chassis but must not exceed the limits given in the next step.

3. Select mounting screws that meet the following criteria for insertion depth:
 - For bottom mounting—2.8 to 6.4 mm (0.110 to 0.250 in)
 - For side mounting—5.0 mm (0.2 in) maximum
4. Mount the power supply in the desired location with four 6-32 screws. Use tapped mounting holes in the bottom of the power supply or in the sides of the power supply.
5. Connect a ground strap between the chassis safety ground screw on the power supply and cabinet ground.

Caution. The AC power cord must be replaced if the voltage range is changed. Refer to section 4 for information about ordering the replacement AC power cord.

6. Attach the AC power cord to the power supply connector J1. Do not connect the power cord to site power until directed.

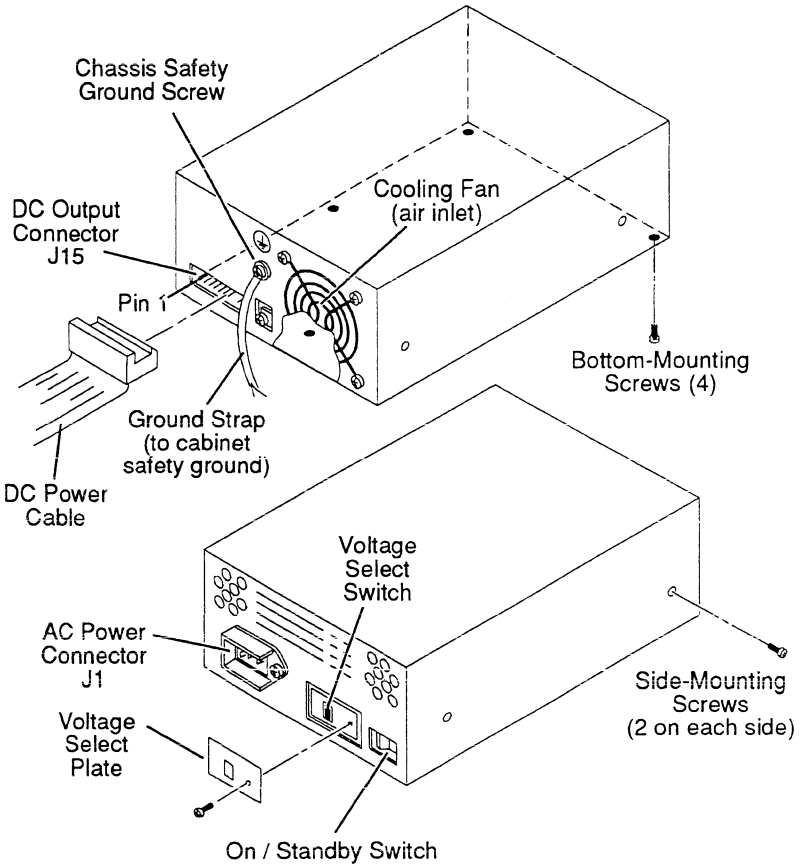


Figure 8. Power supply installation

Attaching an optional bezel

Use the following procedure to attach an optional bezel to the drive. The bezel is available as an accessory (see section 4).

1. Remove the backing from the double-sticky tape attached to the rear surface of the bezel.
2. Orient the drive and bezel as shown in Figure 9.
3. Align the mounting bosses on the rear of the bezel to the matching holes in the drive chassis.
4. Press the bezel into place on the drive chassis ensuring that the mounting bosses extend through the chassis holes and that the double-sticky tape is in contact with both bezel and chassis.
5. Remove the selected LED (if present) from the LED socket on the control board and replace it with the LED plug.

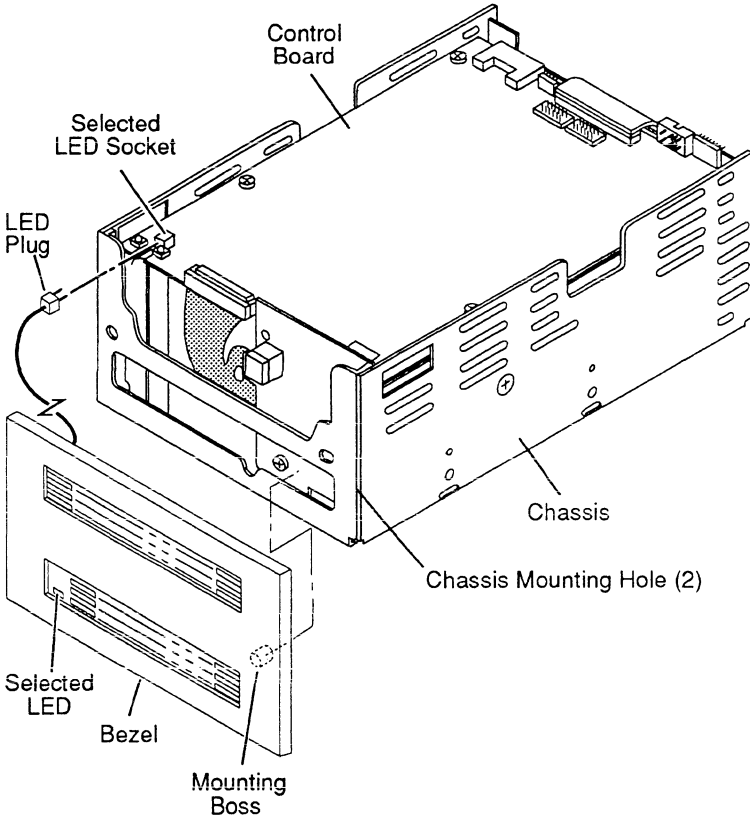


Figure 9. Attaching a bezel

Mounting the drive

Caution. When installing the drive, observe all precautions listed under “Electrostatic discharge protection” in the preface. Failure to observe these precautions can result in serious damage to electronic assemblies.

As described earlier in this section, the drive may be secured to the enclosure via tapped holes in either the sides or the bottom of the drive chassis. That topic discussed the three allowable mounting orientations. Figure 10 shows two of the three allowable orientations. You may find it convenient to make normal switch settings on the drive before mounting it in the cabinet.

Note. Mounting screws must have complete thread engagement in the drive chassis, but the portion that extends into the chassis must not exceed 3.2 mm (0.125 in) in length.

1. Place the drive into position in the enclosure and secure with four screws as shown in Figure 10.
 - For bottom mounting, use 6-32 screws.
 - For side mounting, use either 6-32 screws or M4 X .70 (metric) screws. There are tapped holes for each type.
2. Connect the 9-pin connector of the DC power cable to the output connector on the power supply. Connect the 4-pin connector of the same cable to the DC power connector J15 on the drive.
3. Connect the AC power cord to site power.

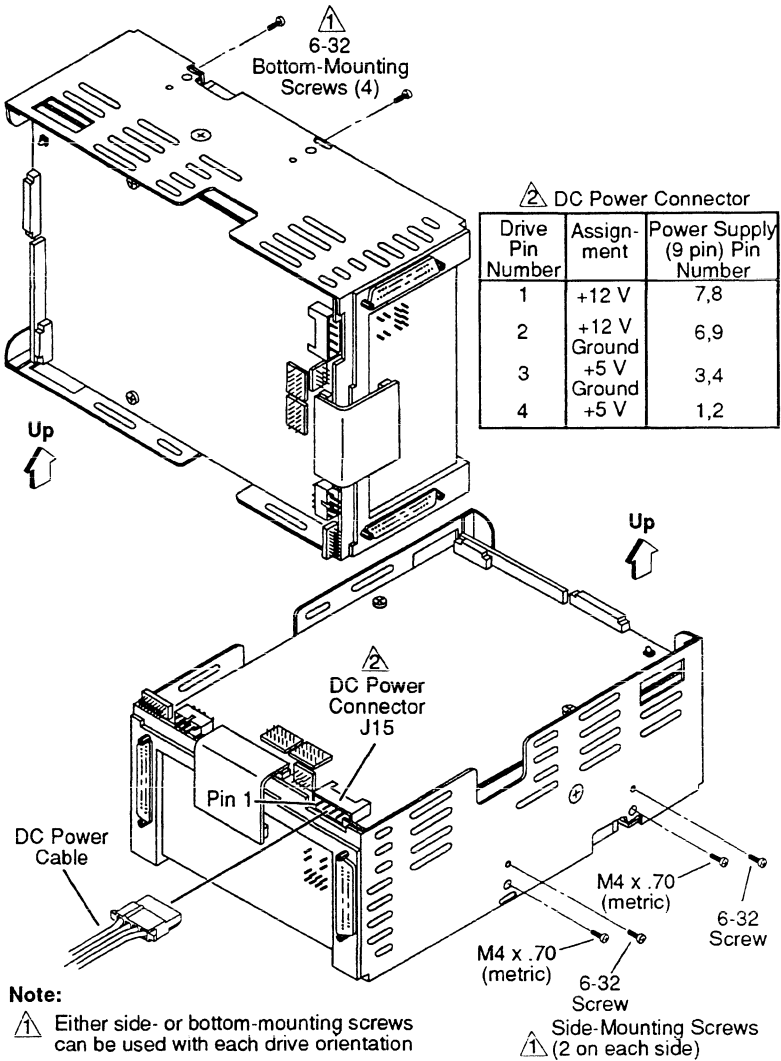


Figure 10. Mounting the drive

Connecting the system I/O cabling

Make sure the site has been prepared in accordance with the site requirements information provided earlier in this section. This procedure describes how to cable the system in a daisychain configuration.

The drives have two I/O connectors as shown in Figure 11. Both J31 (for Port A) and J32 (for Port B) are located on the I/O transceiver board. Figure 11 shows how typical I/O cables connect to the board. Each I/O cable must be terminated following the last drive in the daisychain.

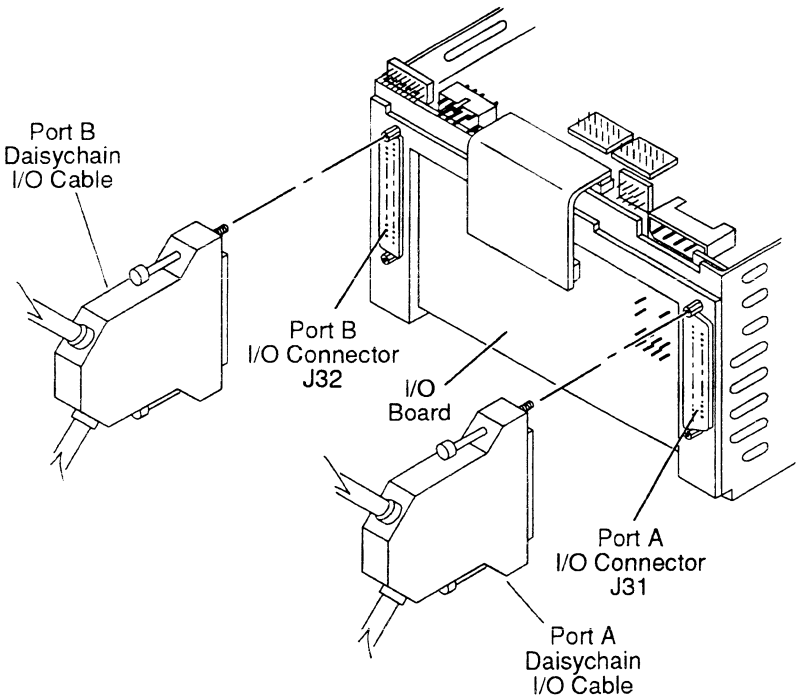


Figure 11. I/O cable attachment

Grounding the system

Grounding the system through the power cables and I/O cables is usually sufficient to protect against noise and emissions. No additional grounding protection is required.

Synchronizing the spindle

The spindle sync feature makes it possible to synchronize the spindle rotation of a group of disc drives. This reduces the latency normally encountered when the controller switches between multiple disc drives.

Figure 12 shows two system configurations. In one type of system, one of the disc drives in the system provides the reference clock. In the other type, an external signal source provides the reference clock.

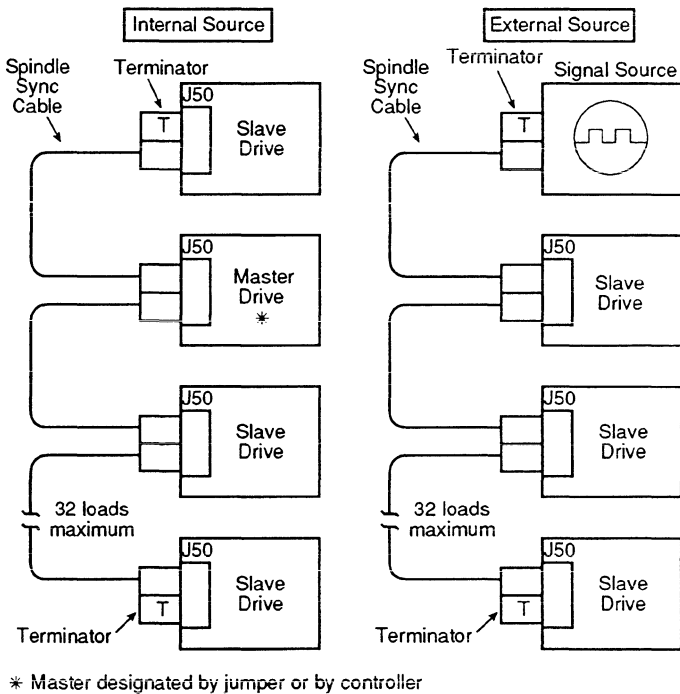


Figure 12. System diagram for spindle sync

To enable the feature, it is necessary to run an additional daisychain cable from drive to drive and to make a master/slave selection for each drive. Connector J50 on the control board handles both the cable connections. A jumper for master/slave selection is provided on the I/O board. Figure 13 shows the J50 connections and jumper location.

For a drive at the end of the daisychain, the cable connects to one row of pins in J50, and a terminator connects to the other row of pins in J50. Both ends of the cable must be terminated.

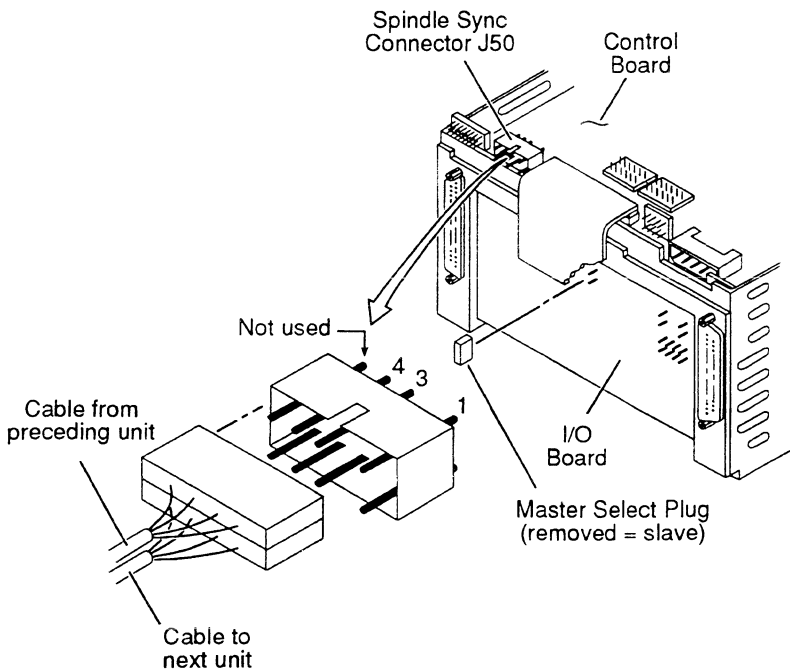


Figure 13. Making spindle sync connections

For each drive in the middle of the daisychain, the cable from the preceding unit connects to one row of pins in J50, and the cable to the next unit connects to the other row of pins in J50.

There are two ways to establish a drive as a master (supplying the sync reference signal to all drives connected for spindle sync).

- Connect the master select plug. The drives are shipped with the plug connected.
- Issue that drive an Enable Master Sync command on the IPI interface. (The master select plug must be disconnected.) The IPI commands for spindle sync are discussed in the reference manual.

Only one drive in the daisychain can be established as the master. The master drive can be located anywhere along the daisychain cable as long as both ends of the cable are terminated.

Verification

After completing installation of the drive, follow the sequence outlined below for initial startup in either remote or local mode.

1. Apply DC power to the drive.
 - If the Local/Remote jumper on the I/O board was set in the Local position, the power on sequence delay begins immediately.
 - If the Local/Remote jumper on the I/O board was set in the Remote position, the power on sequence delay begins when the controller issues a spin-up function code.
The power on sequence delay is 10 seconds multiplied by the logical address number of the unit (0 through 7).
2. Observe that the Ready LED (the green LED on the control board) flashes from the time DC power is applied until the power sequence delay is complete.
3. When the power sequence delay is complete, observe that the Ready LED lights steadily within 60 seconds. This indicates that the drive motor is up to speed and that the heads are positioned at track 0.

If all of these events occurred, the drive is now ready for online operation. If any event did not occur, a problem exists in the drive—refer to maintenance information in section 5.

Section 3. Operation

This section provides the information and instructions to operate the drive. It is arranged as follows:

- Switches and indicators—locates and describes the switches and indicators used for normal drive operation.
- Operating instructions—describes procedures for operating the drive.

Switches and indicators

Following initial checkout, the drive normally requires no attention from the operator. Although power is usually left on, as the operator you should know where the On/Standby switch is located on the power supply. Also, you may be asked to examine the maintenance LEDs.

One of the maintenance LEDs is located on the drive's control board. The second maintenance LED is located either on the control board or on an optional bezel (if the bezel is installed). Figure 14 shows these switches and indicators. They are explained in Table 6.

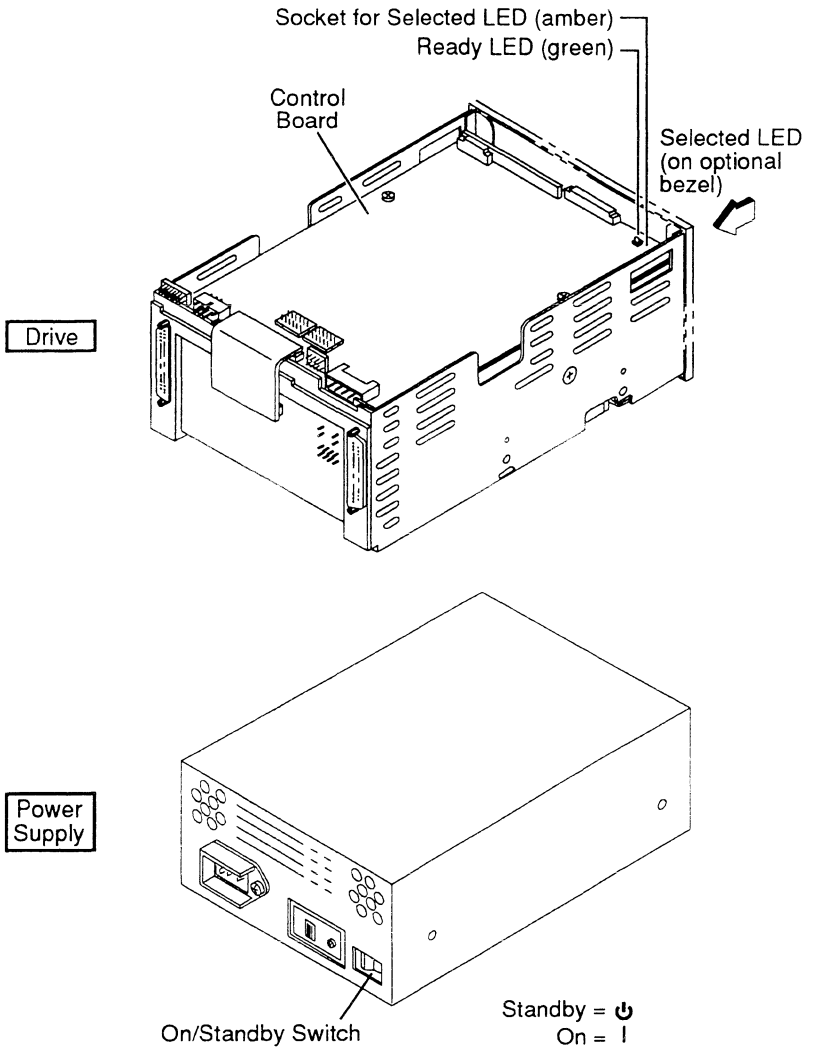



Figure 14. Switches and indicators

Table 6. Switches and indicators

Switch or Indicator	Function
Power supply On/Standby switch (I/ )	Applies DC operating voltages to the drive electronics and power supply fan when placed in the On (I) position.
Drive control board Selected (amber) LED	This optional LED indicates that the drive is selected by a controller.
Ready (green) LED	<p>During the power-on sequence, this LED flashes until the discs are up to speed and the heads are loaded. The power-on sequence begins when DC power is applied to the drive (local operation) or when a spin-up function code is received (remote operation).</p> <p>It is on steady with power-on complete, assuming that there are no fault conditions.</p> <p>It flashes during a power-off sequence. This occurs after a spin-down function code is received (remote operation). The LED stays off when remote power-off is complete.</p>
Optional bezel on drive Selected (red or green) LED	This LED indicates that the drive is selected by a controller.

Operating instructions

Following initial checkout, the drive normally requires no attention from the operator. DC power is available to the drive, as the On/Standby switch on the power supply is normally left in the On (I) position.

If you wish to verify that the drive has completed its power on sequence, access the drive and check that its Ready LED is on steady (see Figure 14). Another way to verify that the drive is ready is to use the interface. After selecting the drive, check the status bit for Unit Ready.

If the Local/Remote jumper is set for Remote operation, the controller can control the spin-up sequence with the spin-up function code. It can control the spin-down sequence with the spin-down function code.

Section 4. Parts data

This section lists part numbers of options and accessories that can be used in a drive installation. Because the drive is depot repairable, there are no field-replaceable parts. If the drive requires maintenance, refer to the instructions in section 5.

Within the continental U.S., the accessories can be ordered from:

Seagate Technology, Inc.
Customer Services
7801 Computer Avenue South
Minneapolis, MN 55435

Phone: 1-800-382-6060 (outside Minnesota)

Phone: (612) 844-8080 (inside Minnesota)

Fax: (612) 844-7017



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