



.....  
***Barracuda 1 and 2 Disc Drive***  
.....

***ST11950N/ND, ST11950W/WD***  
.....

***ST12550N/ND, ST12550W/WD***  
.....

.....  
***Product Manual, Volume 1***  
.....



.....  
***Barracuda 1 and 2 Disc Drive***  
.....

***ST11950N/ND, ST11950W/WD,***  
.....

***ST12550N/ND, ST12550W/WD***  
.....

.....  
***Product Manual, Volume 1***  
.....



© 1994 Seagate Technology, Inc. All rights reserved  
Publication number: 83327780, Rev. C  
November 1994

Seagate®, Seagate Technology®, and the Seagate logo are registered trademarks of Seagate Technology, Inc. Barracuda™ is a trademark of Seagate Technology, Inc. Other product names are registered trademarks or trademarks of their owners.

Seagate reserves the right to change, without notice, product offerings or specifications. No part of this publication may be reproduced in any form without written permission from Seagate Technology, Inc.

# Revision status summary sheet

Revision	Date	Writer/Engineer	Sheets Affected
A (preliminary-01)	04/05/93	L. Newman/J. Olson	All
A (preliminary-02)	04/20/93	L. Newman/J. Olson	All
A (preliminary-03)	05/01/93	L. Newman/J. Olson	All
A	05/11/93	L. Newman/J. Olson	All
B (preliminary-01)	09/15/93	L. Newman/J. Olson	All
B	10/18/93	L. Newman/J. Olson	All
C (draft)	10/11/94	L. Newman/J. Olson	All
C	11/04/94	L. Newman/J. Olson	All

**Note.** Product Manual 83327780 is Volume 1 of a two-volume document with the SCSI interface information in the Volume 2 SCSI-2 Interface Product Manual, part number 77738479.



## Contents

<b>1.0 Scope .....</b>	<b>1</b>
<b>2.0 Applicable standard and reference documentation .....</b>	<b>3</b>
2.1 Standards .....	3
2.2 Applicable reference documents .....	3
<b>3.0 General description .....</b>	<b>5</b>
<b>4.0 Standard features .....</b>	<b>7</b>
4.1 Performance .....	7
4.1.1 Reliability .....	7
4.2 Unformatted and formatted capacities .....	8
4.3 Options .....	8
4.4 Installation .....	9
<b>5.0 Performance characteristics .....</b>	<b>11</b>
5.1 Internal drive characteristics .....	11
5.2 SCSI seek performance characteristics .....	11
5.2.1 Seek time .....	13
5.2.2 Format drive command execution time .....	13
5.3 General performance characteristics .....	14
5.4 Start/stop time .....	14
5.5 Prefetch/multi-segmented cache control .....	15
5.5.1 Adaptive read lookahead .....	16
5.6 Caching write data .....	16
5.7 Synchronized spindle operation .....	17
<b>6.0 Reliability specifications .....</b>	<b>21</b>
6.1 Error rates .....	21
6.1.1 Environmental interference .....	21
6.1.2 Write errors .....	21
6.1.3 Seek errors .....	22
6.2 Reliability and service .....	22
6.2.1 Mean time between failures (MTBF) .....	22
6.2.2 Air flow .....	22
6.2.3 Preventive maintenance .....	28
6.2.4 Service life .....	28
6.2.5 Service philosophy .....	28
6.2.6 Installation .....	28
6.2.7 Service tools .....	28
6.2.8 Hot plugging Barracuda 1 and 2 disc drives .....	28

<b>7.0</b>	<b>Physical/electrical specifications</b>	<b>31</b>
7.1	AC power requirements	31
7.2	DC power requirements	31
7.2.1	Conducted noise immunity	33
7.2.2	Power sequencing	33
7.2.3	12V current profile	34
7.3	Heat/power dissipation	35
7.4	Environmental limits	35
7.4.1	Temperature	35
7.4.2	Relative humidity	35
7.4.3	Effective altitude (sea level)	36
7.4.4	Shock and vibration	36
7.4.5	Air cleanliness	37
7.4.6	Acoustics	37
7.5	Electromagnetic compatibility	37
7.6	Mechanical specifications	38
7.6.1	Drive orientation	40
7.6.2	Cooling	40
<b>8.0</b>	<b>Media characteristics</b>	<b>41</b>
8.1	Media description	41
<b>9.0</b>	<b>Defect and error management</b>	<b>43</b>
9.1	Defects and errors	43
<b>10.0</b>	<b>Option/configuration headers</b>	<b>45</b>
10.1	Drive ID/option select headers	45
10.1.1	ST11950N/ND and ST12550N/ND configuration	45
10.1.2	ST11950W/WD and ST12550W/WD configuration	48
10.2	Synchronized spindles interface	50
10.2.1	Electrical description	50
10.3	Grounding	52
<b>11.0</b>	<b>Interface requirements</b>	<b>53</b>
11.1	General description	53
11.2	SCSI interface messages supported	53
11.3	SCSI interface commands supported	54
11.3.1	Inquiry data	56
11.3.2	Mode sense data	56
11.4	SCSI bus conditions and miscellaneous features supported	61
11.5	Synchronous data transfer	62



11.5.1 Synchronous data transfer periods supported .....	62
11.5.2 REQ/ACK offset .....	63
11.6 DC cable and connector .....	63
11.7 SCSI physical interface .....	63
11.7.1 Physical characteristics .....	64
11.7.2 Connector requirements .....	65
11.7.3 Electrical description .....	66
11.8 SCSI non-wide physical interface .....	70
11.9 SCSI wide physical interface .....	73
11.10 Disc drive SCSI timing .....	76
<b>Index .....</b>	<b>79</b>

## Figures

1 Barracuda 1 and 2 family disc drives .....	1
2 Barracuda disc drive (exploded view) .....	5
3 OEM interruptible thermal compensation implementation .....	12
4 Synchronized drive interconnect diagram .....	17
5 Synchronized reference signal characteristics .....	18
6 Air-flow pattern .....	23
7 TYFX temperature measurement locations .....	24
8 UYFX temperature measurement locations .....	25
9 TYGX temperature measurement locations .....	26
10 PYGX temperature measurement locations .....	27
11 Temperature measurement location .....	27
12 Barracuda 1 and 2 drives typical +12V current profiles .....	34
13 Mounting configuration dimensions for N/ND drives .....	38
14 Mounting configuration dimensions for W/WD drives .....	39
15 Recommended mounting .....	40
16 ST11950N/ND and ST12550N/ND physical interface .....	45
17 ST11950N/ND and ST12550N/ND jumper connectors .....	46
18 ST11950W/WD and ST12550W/WD physical interface .....	48
19 ST11950W/WD and ST12550W/WD jumper connectors .....	48
20 SCSI reference index signal driver/receiver combination .....	50
21 ST11950N/ND and ST12550N/ND configuration select header specification .....	51
22 ST11950W/WD and ST12550W/WD configuration select header specification .....	51
23 ST11950N/ND and ST12550N/ND physical interface .....	63
24 ST11950W/WD and ST12550W/WD physical interface .....	64

25	Single-ended transmitters and receivers .....	67
26	Typical differential I/O line transmitters/receivers and terminators .....	68
27	Non-shielded SCSI device connector .....	70
28	Wide SCSI device connector .....	73

## Tables

1	DC power requirements for ST11950N/ND and ST12550N/ND drives .....	31
2	DC power requirements for ST11950W/WD and ST12550W/WD drives .....	32
3	SCSI messages supported .....	53
4	Supported commands .....	54
5	Barracuda 1 and 2 family drive inquiry data .....	56
6	Mode Sense data, ST11950 default values (SCSI-1 implementation) .....	57
7	Mode Sense data, ST11950 default values (SCSI-2 implementation) .....	58
8	Mode Sense data, ST12550 default values (SCSI-1 implementation) .....	59
9	Mode Sense data, ST12550 default values (SCSI-2 implementation) .....	60
10	SCSI bus conditions and other miscellaneous features .....	61
11	Synchronous data transfer periods for ST11950N/ND and ST12550N/ND drives .....	62
12	Synchronous data transfer periods for ST11950W/WD and ST12550W/WD drives .....	62
13	Single-ended cable pin assignments (non-shielded connector) for ST11950N and ST12550N drives .....	71
14	Differential cable pin assignments (non-shielded connector) for ST11950ND and ST12550ND drives .....	72
15	Single-ended contact assignments (P cable) for ST11950W and ST12550W drives .....	74
16	Single-ended contact assignments (P cable) for ST11950WD and ST12550WD drives ...	75
17	Disc drive SCSI timing .....	76

## 1.0 Scope

This manual describes Seagate Technology<sup>®</sup>, Inc. Barracuda<sup>™</sup> 1 and 2 disc drives.

Barracuda drives support the small computer system interface-2 (SCSI-2) as described in the ANSI SCSI and SCSI-2 interface specifications to the extent described in this manual. The *SCSI-2 Interface Product Manual* (part number 77738479) describes general SCSI interface characteristics of this and other families of Seagate drives.

ST11950N/ND and ST11950W/WD drives are classified as Barracuda 1 family drives. ST12550N/ND and ST12550W/WD drives are classified as Barracuda 2 family drives.

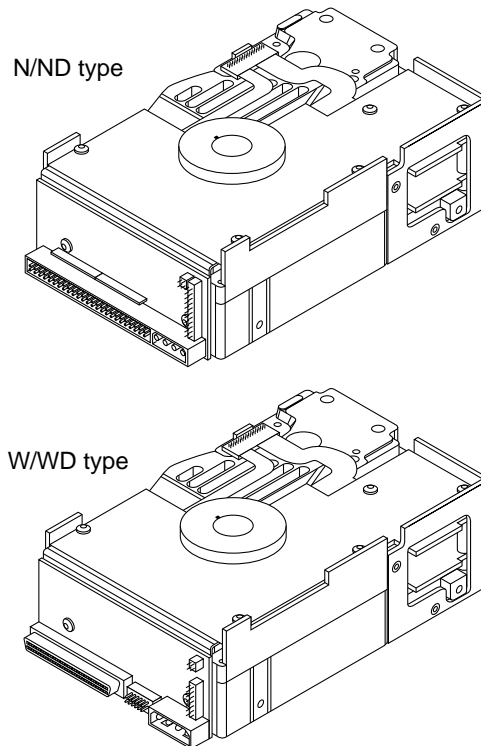


Figure 1. Barracuda 1 and 2 family disc drives



## 2.0 **Applicable standard and reference documentation**

Seagate takes all reasonable steps to ensure that its products are certifiable to currently accepted standards. Typical applications of these disc drives include customer packaging and subsystem design.

Safety agencies conditionally certify component assemblies, such as the Barracuda disc drive, based on their final acceptability in the end-use product. The subsystem designer is responsible for meeting these conditions of acceptability in obtaining safety/regulatory agency compliance in their end-use product and certifying where required by law.

### 2.1 **Standards**

The Barracuda disc drive is a UL recognized component per UL1950, CSA certified to CSA C22.2 No. 950-M89, and VDE certified to VDE 0805 and EN60950.

The Barracuda disc drive is supplied as a component part. It is the responsibility of the subsystem designer to meet EMC/regulatory requirements. Engineering test characterizations of radiated emissions are available from the Seagate safety department.

### 2.2 **Applicable reference documents**

*Barracuda Disc Drive Installation Guide*

Seagate part number: 83327770

*SCSI-2 Interface Product Manual (volume 2)*

Seagate part number: 77738479

ANSI small computer system interface (SCSI) documents

ANSI X3.131-1986 (SCSI-1)

X3T9.2/86-109 Rev. 10H (SCSI-2)

X3T9.2/91-010 Rev. 10 (SCSI-3) Parallel Interface

In case of conflict between this document and any referenced document, this document takes precedence.



## 3.0 General description

Barracuda drives are low-cost, high-performance, random-access storage devices designed to meet the needs of the original equipment manufacturer (OEM) marketplace.

The Barracuda drive's interface supports multiple initiators, disconnect/reconnect, self-configuring host software, and automatic features that relieve the host from knowing the physical characteristics of the targets (logical block addressing is used).

The head and disc assembly (HDA) is sealed at the factory. Air circulates within the HDA through a non-replaceable filter to maintain a contamination-free HDA environment.

Refer to Figure 2 for an exploded view of the drive. This exploded view is for information only—never disassemble the HDA and do not attempt to service items in the sealed enclosure (heads, media, actuator, etc.) as this requires special facilities. The drive contains no replaceable parts. Opening the HDA voids your warranty.

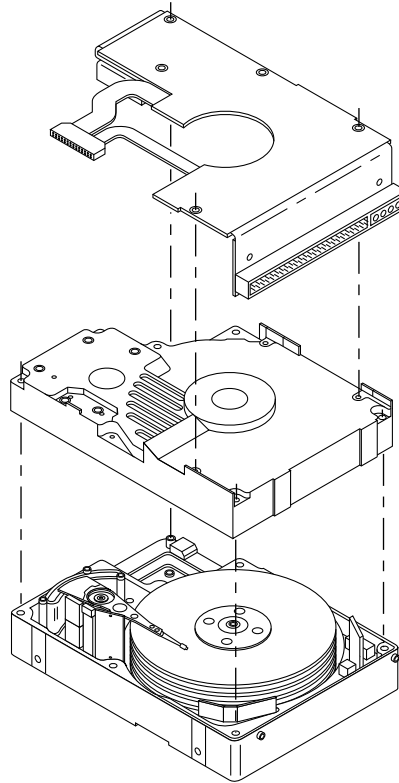


Figure 2. Barracuda disc drive (exploded view)

Barracuda drives use a dedicated landing zone at the innermost radius of the media to eliminate the possibility of destroying or degrading data by landing in the data zone. The drive automatically goes to the landing zone when the power is removed.

An automatic shipping lock prevents potential damage to the heads and discs. The shipping lock disengages when power is applied to the drive and the head load process begins.

Barracuda drives decode track 0 location data from the dedicated servo surface to eliminate mechanical transducer adjustments and related reliability concerns.

A high-performance actuator assembly with a low-inertia, balanced, patented, straight-arm design provides excellent performance with minimal power dissipation.



## 4.0 Standard features

Barracuda 1 and 2 drives have the following standard features:

- Integrated SCSI controller
- Single-ended or differential SCSI drivers and receivers
- Asynchronous and synchronous data-transfer protocols
- Firmware downloadable using a SCSI interface
- Selectable sector size from 180 to 4,096 bytes per sector
- Programmable sector-reallocation scheme
- Flawed sector reallocation at format time
- Programmable auto-write and auto-read reallocation
- Reallocation of defects on command (post format)
- 96-bit Reed-Solomon error-correction code
- Sealed head and disc assembly (HDA)
- No preventive maintenance or adjustments required
- Dedicated head-landing zone
- Automatic shipping lock
- Automatic thermal compensation
- Embedded Grey Code track address to eliminate seek errors
- Self-diagnostics performed at power-on
- 1:1 interleave
- Zone bit recording (ZBR)
- Vertical, horizontal, or top-down mounting
- Dynamic spindle brake
- Active termination with removable terminator modules
- Synchronous spindle capability
- 1,024 Kbyte data buffer (N/ND/W models)
- 512 Kbyte data buffer (WD models)
- Low audible noise for office environment
- Low power consumption

## 4.1 Performance

- Programmable multi-segmentable cache buffer
- 7,200 RPM spindle; average latency = 4.17 msec
- Command queuing of up to 64 commands
- Background processing of queue
- Supports start and stop commands
- Provides synchronized spindle capability
- Adaptive seek velocity; improved seek performance

### 4.1.1 Reliability

- 500,000 hour MTBF
- LSI circuitry
- Balanced low-mass rotary voice-coil actuator

## 4.2 Unformatted and formatted capacities

Standard OEM models are formatted to have 512-byte sectors.

The ST11950 drive has six (6) spare sectors per cylinder and one (1) spare cylinder per unit.

The ST12550 drive has nine (9) spare sectors per cylinder and one (1) spare cylinder per unit.

	Formatted	Unformatted
ST11950N/ND	1,690 Mbytes	2,030 Mbytes
ST11950W/WD	1,690 Mbytes	2,030 Mbytes
ST12550N/ND	2,139 Mbytes	2,572 Mbytes
ST12550W/WD	2,139 Mbytes	2,572 Mbytes

Users having the necessary equipment may modify the data block size before issuing a format command to obtain different formatted capacities. User-available capacity also depends on the spare reallocation scheme selected. See the Mode Select command and the Format command in the *SCSI-2 Interface Product Manual* (part number 77738479).

## 4.3 Options

The capacities shown in Section 4.2 are normally provided. Other capacities can be ordered depending on the sparing scheme and sector size requested.

The following options are incorporated at the time of production or are available separately.

- Front panel (green lens), part number 70869751  
The standard front panel is black plastic. You may order other colors. Each panel has a single rectangular green LED indicator lens that, when glowing, indicates the drive is selected.
- *Barracuda Disc Drive Installation Guide*, part number 83327770  
This manual provides basic installation information for persons not familiar with the product. It also includes information on obtaining technical support and service for the drive.
- Drive termination for single-ended drives  
Removable resistor modules (SIPs) provide ST11950N and ST12550N drive termination. Permanently mounted active terminator ICs provide ST11950W and ST12550W drive termination; however, the ICs may be disabled by removing the Enable Drive Terminator jumper from J4 pins 11 and 12. See Section 11.7.3.3.
- Single-unit shipping pack kit  
The drive is shipped in bulk packaging to provide maximum protection against transit damage. Units shipped individually require additional protection as provided by the single-unit shipping pack.
- Adapter accessory frame kit, part number 75790701  
This kit contains a frame, which allows a 3.5-inch drive to be mounted in a 5.25-inch drive bay. It includes mounting hardware, front panel with a green lens, an LED with cable that connects to the remote LED connector, and installation instructions.

## 4.4

### Installation

For option jumper locations and definitions refer to Section 10.1. Drive default mode parameters are not normally needed for installation. Refer to Section 11.3.2 for default mode parameters if you need them.

- Ensure that the SCSI ID of the drive is not the same as the host adapter.
- If multiple devices are on the bus, set the drive's SCSI ID to one that is not presently used by other devices on the bus.
- If the drive is the only device on the bus, attach it to the end of the SCSI bus cable. Internal termination is available on ST11950N, ST11950W, ST12550N, and ST12550W drives (see Sections 10.1 and 11.7.3.4).

External terminators are required for ST11950ND, ST11950WD, ST12550ND, and ST12550WD drives. These external terminators must be provided by the user, systems integrator, or host equipment manufacturer.

- If you attach the drive to a bus that contains other devices, and the new drive is not attached to the end of the bus, remove termination from the new drive.
- Set all appropriate option jumpers prior to applying power to the drive. If you change jumpers after applying power, recycle the drive's power to make the new settings effective.

### Formatting

- It is not necessary to low-level format this drive. The drive is shipped from the factory low-level formatted in 512-byte sectors.
- Reformat the drive if:
  - a. You select a different sector size.
  - b. You select a different spare-sector allocation scheme.



## 5.0 Performance characteristics

This section provides performance-related characteristics and features of Barracuda 1 and 2 drives.

### 5.1 Internal drive characteristics

	<b>ST11950</b>	<b>ST12550</b>
Drive capacity, Mbytes unformatted	2,030	2,572
Read/write data heads, maximum	15	19
Bytes per track, average	49,768	49,768
Bytes per surface, Mbytes unformatted	135.7	135.7
Cylinders/tracks per surface, user accessible	2,706	2,707
Tracks per inch	3,047	3,047
Bits per inch	52,187	52,187
Servo heads	1	1
Internal data rate Mbits/sec, variable with zone	34.3 to 56.5	34.3 to 56.5
Disc rotation speed	7,200 ± 0.5%	7,200 ± 0.5%
Average rotational latency, msec	4.17	4.17

### 5.2 SCSI seek performance characteristics

All performance characteristics assume that automatic adaptive thermal compensation is not in process when the drive receives the SCSI command. Automatic adaptive thermal compensation will not interrupt an active SCSI command. If adaptive thermal compensation is in process when a SCSI command is received, the command is queued until compensation completes. When compensation completes for the head, the first queued SCSI command executes, and the drive continues compensation for the remaining head(s).

The above procedure continues until compensation for all heads has completed, or until 10 minutes have elapsed. The drive initiates an automatic adaptive thermal compensation cycle once on power-up before completing its initialization sequence, once after 1 minute from the end of initialization, and then once approximately every 10 minutes. Automatic thermal compensation occurs at other times but should be transparent to the user (e.g., during format, at Re-Zero command, at spindle-up, during read-error recovery, and during reassign-block functions). You can use the Re-Zero command to reset the thermal compensation timer to its start to let the host know when the interruption for thermal compensation will occur.

Refer to Table 17 in Section 11.10 and to the *SCSI-2 Interface Product Manual* (part number 77738479) for additional timing details.

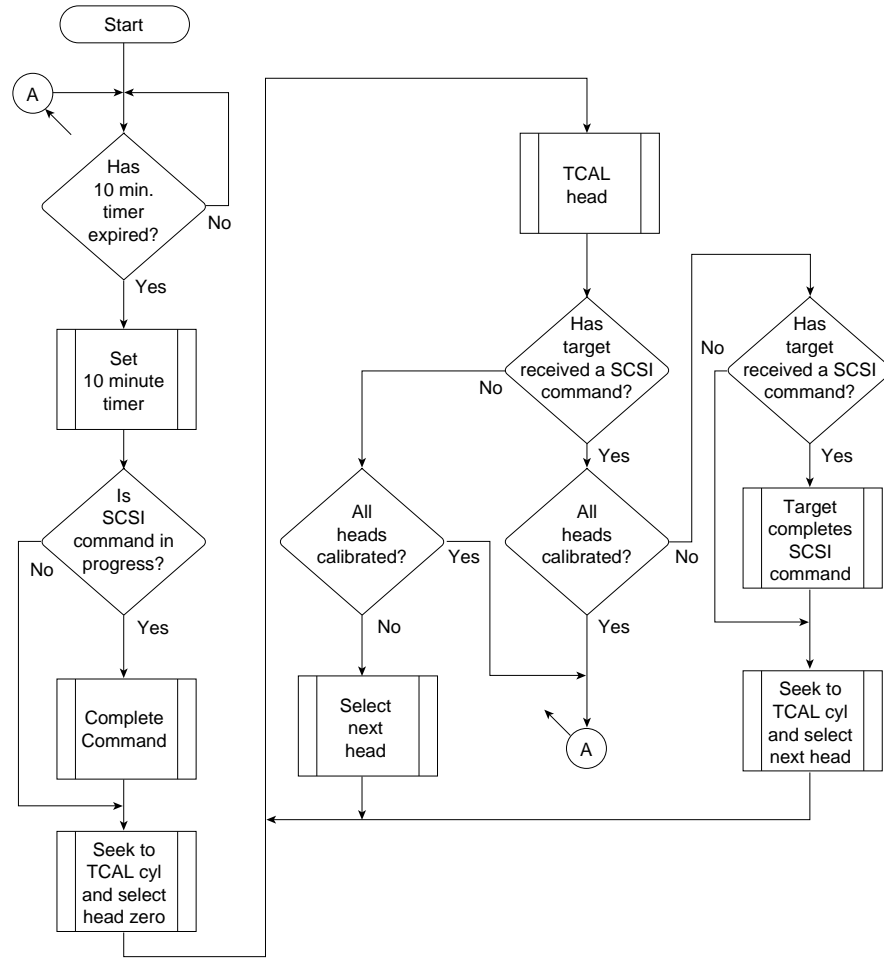


Figure 3. OEM interruptible thermal compensation implementation

### 5.2.1 Seek time

	Drive level (msec)		Drive including controller overhead without disconnect (msec)	
	read	write	read	write
Average typical*	8.0	9.0	9.0	10.0
Single track typical*	0.6	0.9	1.6	1.9
Full stroke typical*	17	19	18.0	20.0

\*Typical seek values are measured under nominal conditions of temperature, voltage, and horizontal orientation on a representative sample of drives.

### 5.2.2 Format drive command execution time for $\geq$ 512-byte sectors

	ST11950	ST12550
Maximum (with verify)	30 minutes	37 minutes
Maximum (without verify)	18 minutes	22 minutes

### 5.3

### General performance characteristics

Minimum sector interleave	1 to 1
Data buffer to/from disc media	512-byte sector
Data transfer rate ( $\leq 1$ sector)	
Minimum	4.28 Mbytes/sec*
Maximum	7.06 Mbytes/sec*
Data transfer rate ( $< 1$ track)	
Minimum	3.56 Mbytes/sec*
Maximum	5.96 Mbytes/sec*
SCSI interface data	
Asynchronous transfer rate * (maximum instantaneous)	5.0 Mbytes/sec** (non-wide) 10.0 Mbytes/sec*** (wide)
Synchronous transfer rate fast and wide (ST11950N/ND and ST12550N/ND)	0.5 to 10 Mbytes/sec
Synchronous transfer rate wide (ST11950W/WD and ST12550W/WD)	5.0 to 20 Mbytes/sec
Sector sizes	
Default	512-byte data blocks
Variable in even-sector sizes	180 to 4,096 bytes
Read/write consecutive sectors on a track	Yes
Flaw reallocation performance impact	
Spare sectors per track reallocation	Negligible
Spare sectors per cylinder reallocation	Negligible
Spare tracks per volume reallocation	35 msec (typical)
Overhead time for head switch	0.7 msec
Overhead time for one-track cylinder switch	1.6 msec (typical)
Average rotational latency	4.17 msec

\* Rate measured from the start of the first sector transfer to or from the host.

\*\* Assumes system ability to support 5.0 Mtransfers/sec and no cable loss.

\*\*\* Assumes system ability to support 5.0 Mtransfers/sec and no cable loss.

### 5.4

### Start/stop time

Disabling the Motor Start option causes the motor to start as soon as power is applied, causing the drive to become ready within 30 seconds after DC power is applied at nominal voltage. If a recoverable error condition is detected during the start sequence, the drive executes a recovery procedure which may cause the drive to become ready in excess of 30 seconds. During the start sequence the drive responds to some commands over the SCSI interface. Stop time is less than 30 seconds (maximum) from removal of DC power.

Enabling the Motor Start option causes the internal controller to accept the commands listed in the *SCSI-2 Interface Product Manual (77738479)* less than 3 seconds after applying DC power. After receiving the Motor Start command, the drive becomes ready for normal operation within 30 seconds



(excluding the error recovery procedure). The Motor Start command can also be used to command the drive to stop the spindle (see the Start/Stop command information in the *SCSI-2 Interface Product Manual*).

There is no power control switch on the drive.

## 5.5 Prefetch/multi-segmented cache control

The drive provides a prefetch/multi-segmented cache algorithm, which in many cases enhances system performance. To select this feature, the host sends the Mode Select command with the proper values in the applicable bytes in page 08h (see the *SCSI-2 Interface Product Manual*). Default is prefetch and cache operation enabled.

Of the 1,024 Kbytes physical buffer space in the ST11950N/ND/W and ST12550N/ND/W drives, approximately 960 Kbytes can be used as a cache. Of the 512 Kbytes physical buffer space in the ST11950WD and ST12550WD drives, approximately 480 Kbytes can be used as a cache. The cache can be divided into logical segments from which data is read and to which data is written.

The drive keeps track of the logical block addresses of the data stored in each segment of the cache. If the cache is enabled (see RCD bit, Table 5.2.1-27 in the *SCSI-2 Interface Product Manual*), data requested by the host with a read command is retrieved from the cache before any disc access is initiated. Data in contiguous logical blocks immediately beyond that requested by the Read command can be retrieved and stored in the cache for immediate transfer to the initiator on subsequent read commands. This is referred to as the prefetch operation. Since data that is prefetched may replace data already in the cache segment, an initiator can limit the amount of prefetch data to optimize system performance. The drive never prefetches more sectors than the number specified in bytes 8 and 9 of Mode page 08h (see the *SCSI-2 Interface Product Manual*). If the cache is not enabled, 960 Kbytes of the buffer (480 Kbytes for ST11950WD and ST12550WD drives) are used as a circular buffer for read/writes, with no prefetch operation and no segmented cache operation.

The following is a simplified description of the prefetch/cache operation:

**Case A.** A read command is received and the first logical block is already in the cache.

1. The drive transfers to the initiator the first logical block requested plus all subsequent contiguous logical blocks that are already in the cache. This data may be in multiple segments.
2. When a requested logical block is reached that is not in any segment, the drive fetches it and any remaining requested logical block addresses from the disc and puts them in a segment of the cache. The drive transfers the remaining requested logical blocks from the cache to the initiator in accordance with the "buffer-full" ratio specification given in Mode Select Disconnect/Reconnect parameters, page 02h (see the *SCSI-2 Interface Product Manual*).
3. The drive prefetches additional logical blocks contiguous to those transferred in step 2 above and stores them in the segment. The drive stops filling the segment when the maximum prefetch value has been transferred (see the *SCSI-2 Interface Product Manual*).

**Case B.** A read command is received and the first logical block address requested is not in any segment of the cache.

1. The drive fetches the requested logical blocks from the disc and transfers them into a segment, then from there to the initiator in accordance with the “buffer-full” ratio specification given in Mode Select Disconnect/Reconnect parameters, page 02h (see the *SCSI-2 Interface Product Manual*).
2. The drive prefetches additional logical blocks contiguous to those transferred in Case A, step 2 above and stores them in the segment. The drive stops filling the segment when the maximum prefetch value has been transferred.

During a prefetch, the drive crosses a cylinder boundary to fetch data only if the Discontinuity (DISC) bit is set to 1 in bit 4 of byte 2 of the Mode Select parameters page 8h. Default is zero for bit 4 (see the *SCSI-2 Interface Product Manual*).

Each cache segment is actually a self-contained circular buffer whose length is an integer number of sectors. The drive supports operation with any integer number of segments from 1 to 16. Divide the 983,040 bytes (491,520 bytes for ST11950WD and ST12550WD drives) in the buffer by the number of segments to get the segment size; default is 3 segments (see the *SCSI-2 Interface Product Manual*). The wraparound capability of the individual segments greatly enhances the cache’s overall performance, allowing a wide range of user-selectable configurations including a pure prefetch strategy.

### 5.5.1

#### Adaptive read lookahead

Read lookahead causes the drive to continue reading data from the disc following a normal read I/O until the read-ahead parameters are satisfied (prefetch). If subsequent I/O requests can be satisfied from the prefetched data in the data buffer, there is a significant improvement in performance since a disc access is eliminated. If subsequent I/O requests cannot be satisfied from the prefetched data, there is a reduction in performance due to prefetch overhead.

The adaptive read lookahead feature suspends the prefetch operation if three subsequent read I/O requests are not satisfied from the prefetched data. This improves performance because unnecessary prefetches are avoided. Prefetch is reinstated if an I/O request is sequential to a previous I/O request.

### 5.6

#### Caching write data

Write caching is a drive-write operation, which uses a drive’s buffer storage area where data to be written to the disc is stored while the drive performs the Write command.

Write caching is enabled along with read caching. Default is cache enabled. For write caching, the same buffer space and segmentation is used as set up for read functions. When a write command is issued, the cache is first checked to see if any logical blocks to be written are already stored in the cache from a previous read or write command. If there are, the respective cache segments are cleared. The new data is cached for subsequent read commands.

If a 10-byte CDB write command (2Ah) is issued with the data page out (DPO) bit set to 1, no write data is cached, but the cache segments are still checked and cleared, if needed, for any logical blocks that are being written (see the *SCSI-2 Interface Product Manual*).

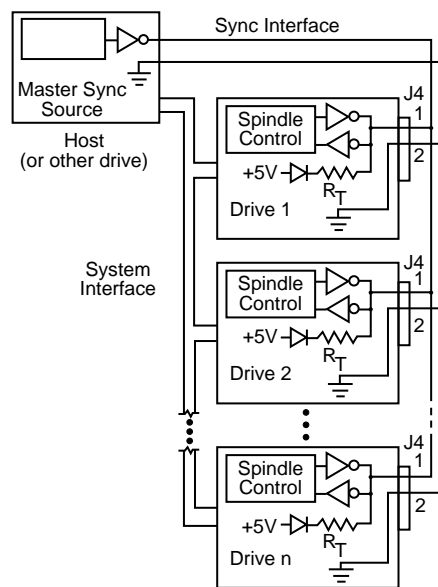
If the number of write data logical blocks exceeds the size of the segment being written into when the end of the segment is reached, data is written into the beginning of the same cache segment, overwriting data that was written there at the beginning of the operation. However, the drive does not overwrite data that has not yet been written to the disc.

## 5.7

### Synchronized spindle operation

The synchronized spindle operation allows several drives operating from the same host to operate their spindles at the same synchronized rotational rate. Drives operating in a system in synchronized mode increase the system's capacity and transfer rate in a cost-effective manner.

The interface consists of a twisted-pair cable, which connects the drives in the synchronized system in a daisy-chain configuration as shown in Figure 4.



**Figure 4. Synchronized drive interconnect diagram**

The host can reconfigure the drive any time after power-up to be the master or a slave by using the Mode Select command on the Rigid Disc Drive Geometry page. The master provides the reference signal to which all other drives phase-lock, including the master. There is only one master per system, and that can be a drive or the host computer. All drives may be configured as slaves allowing the host to provide the reference signal.

Each drive also can be configured for the non-synchronized mode in which it ignores any reference signal that might be present—this is the default mode as shipped from the factory. Connect the synchronized reference signal to the host only if the host provides the reference signal. If the host does not provide the reference signal, do not connect the host.

## Rotational position locking

**Note.** Mode Select page 4, byte 17, bits 1 and 0.

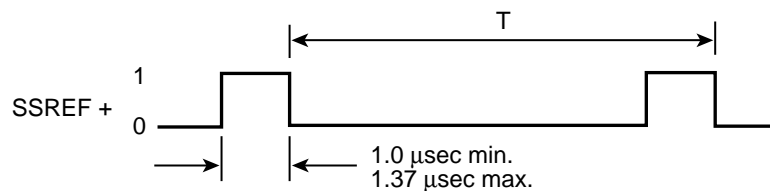
### RPL Description

00b	Spindle synchronization is disabled (default value)
01b	The target operates as a synchronized-spindle slave
10b	The target operates as a synchronized-spindle master
11b	The target operates as a synchronized-spindle master control (not supported by the disc drive)

The VIC 2 LSI on the master drive provides the reference signal (SSREF+). The index signal generates a 120 Hz signal. The signal is normally false/negated (nominal 0V) and makes a transition to the true/asserted (nominal +5V) level to indicate the reference position during the revolution period. Master and slave drives use the trailing (falling) edge of the reference signal to phase-lock their spindles. A maximum of 10 seconds is allowed for a slave to synchronize with the reference signal. Figure 5 shows the characteristics of the reference signal.

Spindle synchronization input requirements:

SSREF +:Period (T) 0.0083 seconds ( $\pm 1.0\%$  max)  
 Cycle-to-cycle variance:  $\pm 10$  microseconds  
 Phase error while synchronized:  $\pm 20$  microseconds



**Figure 5. Synchronized reference signal characteristics**

## SCSI interface factors

The Rotational Position Locking (RPL) field in byte 17 (bits 0 and 1) of the Rigid Disc Drive Geometry mode parameters page (page 04h) is used for enabling and disabling spindle synchronization mode (see the *SCSI-2 Interface Product Manual*). If the target fails to synchronize, it creates a unit attention condition to all initiators. The sense key is set to Unit Attention and the additional sense code is set to Spindle Synchronized (5C01).

After reaching synchronization, if the target detects a change of synchronization and:

1. If the logical unit is not executing an I/O process for the initiator, then the target creates a unit attention condition. The sense key is set to Unit Attention and the additional sense code is set to Spindle Synchronized (5C01) or Spindle Not Synchronized (5C02).
2. If the logical unit is executing an I/O process and no other error occurs, then the target returns Check Condition status. The sense key is set to Recovered Error if the target is able to complete the I/O process or to Hardware Error if the target is unable to complete the I/O process. The additional sense code is set to Spindle Synchronized (5C01) or Spindle Not Synchronized (5C02).

You may operate the drive with a rotational skew when synchronized. The rotational skew is applied in the retarded direction (lagging the synchronized-spindle master control). A rotational offset of up to 255/256 of a revolution lagging may be selected. Select the amount of offset by using the Mode Select command, Rigid Disc Drive Geometry page (page 04h), byte 18 (see the *SCSI-2 Interface Product Manual*). The value in byte 18 (0–FFh) is the numerator of a fractional multiplier that has 256 as the denominator. For example, 40h selects 40h/FFh or 1/4 of a revolution lagging skew, 80h selects 1/2 of a revolution lagging skew, etc. Since the drive supports all offset values from 0 to 255, values sent by the initiator are not rounded off. The drive's translation of the digital offset values to physical rotational offsets results in offset values whose phase error lies within the  $\pm 20$  microseconds phase error with respect to the supplied 120 Hz reference signal.

The drive does not have the capability to adjust the rotational offset value requested by the initiator to a physical offset in the drive that corresponds in any way to sector boundaries or changes in ZBR zones. The initiator must formulate these boundaries or changes, if required, to calculate the value of offset it sends to the drive.



## 6.0 Reliability specifications

The following reliability specifications assume correct host and drive interface, including all interface timings, power supply voltages, and environmental requirements.

Seek error rate	Less than 10 errors in $10^8$ seeks
Recoverable error rate	Less than 10 errors in $10^{11}$ bits transferred (using default settings)
Unrecovered data	Less than 1 sector in $10^{14}$ bits transferred
Miscorrected data	Less than 1 sector in $10^{21}$ bits transferred
MTBF	500,000 hours
Service life	5 years
Preventive maintenance	None required

## 6.1 Error rates

The error rates stated in this manual assume the following:

- The drive is operated using DC power as defined in Section 7.2.
- The drive has been formatted with SCSI format commands.
- Errors caused by media defects or host system failures are excluded from error rate computations. Refer to Section 9.0.

### 6.1.1 Environmental interference

When evaluating system operation under conditions of electromagnetic interference (EMI), the performance of the drive within the system is considered acceptable if the drive does not generate an unrecoverable condition.

An unrecoverable error or condition is defined as one that:

- is not detected and corrected by the drive itself;
- is not capable of being detected from the error or fault status provided through the drive or SCSI interface; or
- is not capable of being recovered by normal drive or system recovery procedures without operator intervention.

### 6.1.2 Write errors

Write errors can occur as a result of media defects, environmental interference, or component malfunction. Therefore, write errors are not predictable as a function of the number of bits passed.

If an unrecoverable write error occurs because of a component malfunction in the drive, the error is classified as a failure affecting MTBF. Unrecoverable write errors are those that cannot be corrected within two attempts at writing the record with a read verify after each attempt (excluding media defects).

### 6.1.3 Seek errors

A seek error is defined as a failure of the drive to position the heads at the addressed track. There must be no more than one recoverable seek error in  $10^7$  physical seek operations. After detecting an initial seek error, the drive automatically reseek to the addressed track up to three times. If a reseek is successful, the extended sense report indicates a Seek-Positioning Error (15h), No-Seek-Complete Error (02h), or Track-Follow Error (09h), and the sense key reports a recovered error (1h). If all three reseek fail, a Seek-Positioning Error (15h) is reported with a Medium (3h) or Hardware Error (4h) reported in the sense key. This is an unrecoverable seek error. Unrecoverable seek errors are classified as failures for MTBF calculations. Refer to Section 5.1.1.2 of the *SCSI-2 Interface Product Manual* (part number 77738479).

## 6.2 Reliability and service

You can enhance the reliability of Barracuda 1 and 2 disc drives by ensuring that the drive receives adequate cooling. This section provides recommended air-flow information, temperature measurements, and other information that may be used to enhance the service life of the drive.

### 6.2.1 Mean time between failures (MTBF)

The production disc drive achieves an MTBF of 500,000 hours when operated in an average local disc drive ambient temperature of 95°F (35°C) or less. Short-term excursions up to the specification limits (122°F, 50°C) of the operating environment will not affect MTBF performance.

The following expression defines MTBF:

$$\text{MTBF} = \frac{\text{Estimated power-on operating hours in the period}}{\text{Number of drive failures in the period}}$$

Estimated power-on operating hours means the estimated total power-on hours for all drives in service.

Drive failure means any stoppage or substandard performance caused by drive malfunction.

Data is calculated on a rolling-average base for a minimum period of six months.

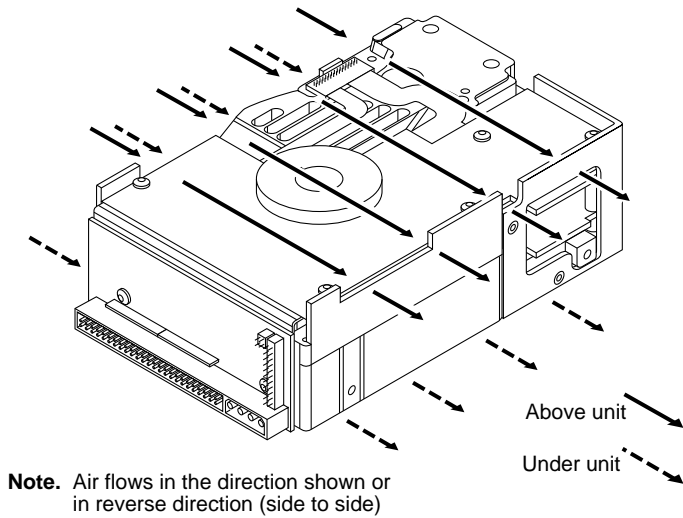
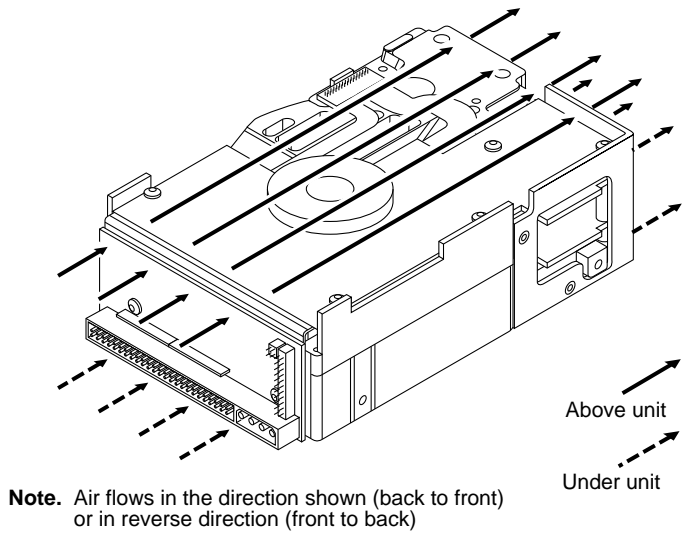
### 6.2.2 Air flow

The rack, cabinet, or drawer environment for the Barracuda 1 and 2 drive must provide cooling of the electronics and head and disc assembly (HDA). You should confirm that adequate cooling is provided using the temperature measurement guidelines described below.

Orient the drive or direct air flow so that the least amount of air-flow resistance is created while providing air flow to the electronics and HDA. Also, choose the shortest possible path between the air inlet and exit to minimize the travel length of air heated by the Barracuda 1 and 2 drive and other heat sources within the rack, cabinet, or drawer environment.

Possible air-flow patterns are shown in Figure 6. Create the air-flow patterns by using one or more fans, either forcing or drawing air as shown in the illustrations. Other air-flow patterns are acceptable as long as the temperature measurement guidelines are met.





**Figure 6. Air-flow pattern (ST11950N drive shown)**

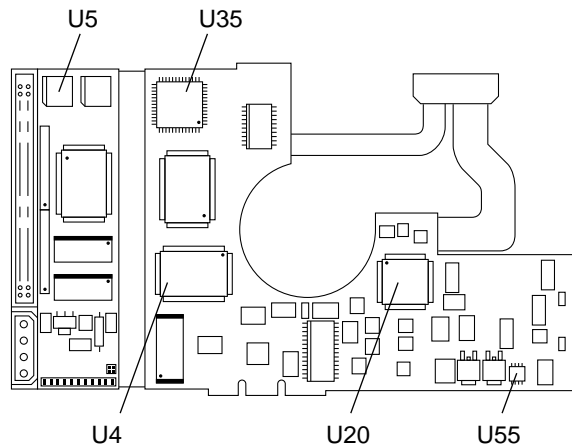
To confirm that required cooling for the Barracuda electronics and HDA is provided, place the drive in its final mechanical configuration, perform random write/read operations, and after the temperatures stabilize, measure the case temperature of the components listed below.

**Air-flow cooling**  
**ST11950N and ST12550N single-ended drives**

Card	Component	Reference	MTBF 500k hours case temperature (°C)
TYFX	Transmitter	U5	57
TYFX	Writer	U35	66
TYFX	LSI	U4	60
TYFX	VIC2	U20	59
TYFX	1021	U55	57
HDA housing		Figure 11	48

The air-flow pattern with which the temperature guidelines above were generated is shown in Figure 6 (opposite direction). Local average air velocity was 0.61 msec (120 lfpm) and inlet air temperature to the drive was 30°C (86°F).

The maximum allowable HDA case temperature is 60°C.



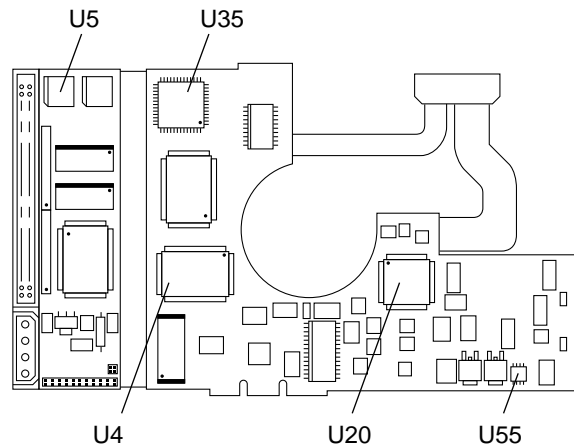
**Figure 7. TYFX temperature measurement locations**

**Air-flow cooling**  
**ST11950ND and ST12550ND differential drives**

<b>Card</b>	<b>Component</b>	<b>Reference</b>	<b>MTBF 500k hours case temperature (°C)</b>
UYFX	Transmitter	U5	57
UYFX	Writer	U35	66
UYFX	LSI	U4	60
UYFX	VIC2	U20	59
UYFX	1021	U55	57
HDA housing		Figure 11	48

The air-flow pattern with which the temperature guidelines above were generated is shown in Figure 6 (opposite direction). Local average air velocity was 0.61 msec (120 lfpm) and inlet air temperature to the drive was 30°C (86°F).

The maximum allowable HDA case temperature is 60°C.



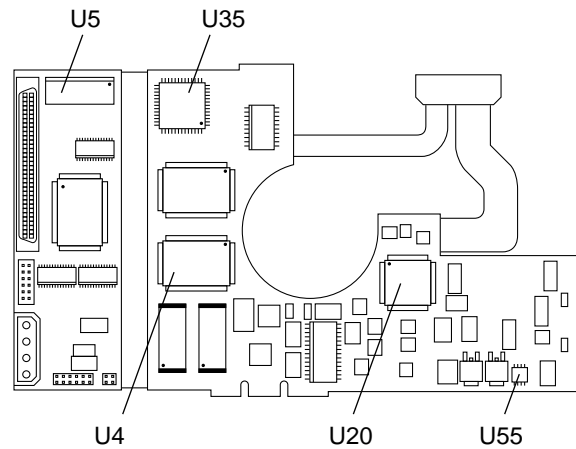
**Figure 8. UYFX temperature measurement locations**

**Air-flow cooling**  
**ST11950W and ST12550W wide single-ended drives**

<b>Card</b>	<b>Component</b>	<b>Reference</b>	<b>MTBF 500k hours case temperature (°C)</b>
TYGX	Transmitter	U5	57
TYGX	Writer	U35	66
TYGX	LSI	U4	60
TYGX	VIC2	U20	59
TYGX	1021	U55	57
HDA housing		Figure 11	48

The air-flow pattern with which the temperature guidelines above were generated is shown in Figure 6 (opposite direction). Local average air velocity was 0.61 msec (120 lfpm) and inlet air temperature to the drive was 30°C (86°F).

The maximum allowable HDA case temperature is 60°C.



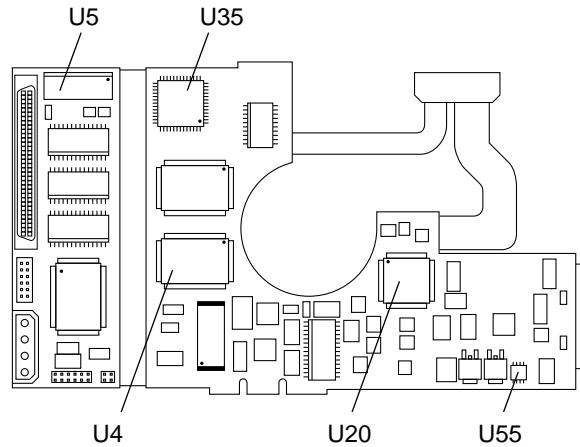
**Figure 9. TYGX temperature measurement locations**

**Air-flow cooling**  
**ST11950WD and ST12550WD wide differential drives**

Card	Component	Reference	MTBF 500k hours case temperature (°C)
PYGX	Transmitter	U5	57
PYGX	Writer	U35	66
PYGX	LSI	U4	60
PYGX	VIC2	U20	59
PYGX	1021	U55	57
HDA housing		Figure 11	48

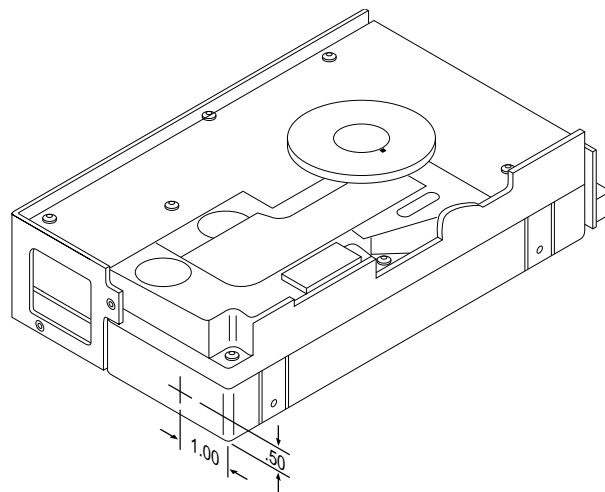
The air-flow pattern with which the temperature guidelines above were generated is shown in Figure 6 (opposite direction). Local average air velocity was 0.61 msec (120 lfpm) and inlet air temperature to the drive was 30°C (86°F).

The maximum allowable HDA case temperature is 60°C.



**Figure 10. PYGX temperature measurement locations**

Measure the HDA housing temperature at the location specified in Figure 11.



**Figure 11. Temperature measurement location**

### 6.2.3 Preventive maintenance

No preventive maintenance is required.

### 6.2.4 Service life

The drive has a useful service life of 5 years. Depot repair or replacement of major parts is permitted during this period.

### 6.2.5 Service philosophy

Special equipment is required to repair the drive's HDA. To achieve the 5-year service life, repairs must be performed only at a properly equipped and staffed service and repair facility. Troubleshooting and repair of PCBs in the field is not recommended because of the extensive diagnostic equipment required for effective servicing. Also, there are no spare parts available for this drive. The drive's warranty is voided if the HDA is opened.

### 6.2.6 Installation

The drive is designed, manufactured, and tested with a "plug in and play" installation philosophy. This philosophy minimizes the requirements for highly trained personnel to integrate the drive into the OEM's system, whether in a factory or field environment. Refer to Section 4.4 and to the *Barracuda 1 and 2 Installation Guide (83327770)* for installation instructions.

The drive has been low-level formatted at the factory and does not need to be reformatted.

### 6.2.7 Service tools

No special tools are required for site installation or recommended for site maintenance. Refer to Section 6.2.3. The depot repair philosophy of the drive precludes the necessity for special tools. Field repair of the drive is not practical because users cannot purchase individual parts for the drive.

### 6.2.8 Hot plugging Barracuda 1 and 2 disc drives

**Caution.** Hot-plug drives are not designed for simultaneous power disconnection and physical removal.

During power-up and power-down periods, the hot SCSI connect/disconnect capability does not produce glitches or any corruptions on an active SCSI bus. Barracuda 1 and 2 drives conform to the SCSI-3 standard requirements for glitch-free power-on and power-off. The drive maintains the high-impedance state of the device connector contacts during a power cycle until the transceiver is enabled.

**Note.** The systems integrator must ensure that no temperature, energy, or voltage hazard is presented during the hot connect/disconnect operation.

Procedure:

1. Configure the drive with no connection between the drive and the TRMPWR signal on the SCSI bus. To accomplish this, remove all jumpers from connector J1.
2. Ensure that all SCSI devices on the bus have receivers that conform to the SCSI-3 standard.

3. Eliminate all I/O processes for the drive.
4. Wait until the drive motor and discs have come to a complete stop prior to changing the plane of operation, ensuring data integrity.
5. Insert or remove the drive after meeting the following conditions:

**Caution.** Do not hot-plug the first or last device on the SCSI bus (the SCSI bus termination must be external to the drive you are inserting or removing).

- a. If you are inserting the drive, connect its power ground and logic ground at least 1 millisecond before coming into contact with the bus connector. Maintain these ground connections during and after connecting the device to the bus.
- b. If you are removing the device, maintain its power ground and logic ground connection for at least 1 millisecond after disconnecting the device from the bus.
- c. You may simultaneously switch the power to the electronics and mechanics of the drive with the bus contacts, if the power distribution system is able to maintain adequate power stability to other devices during the transition and if you have met the grounding requirements given in steps 5a and 5b.

**Note.** Do not remove or add terminator power or resistance to the SCSI bus while hot plugging a disc drive.





## 7.0 Physical/electrical specifications

This section provides information relating to the physical and electrical characteristics of Barracuda 1 and 2 drives.

### 7.1 AC power requirements

None.

### 7.2 DC power requirements

The voltage and current requirements for a single drive are shown in Tables 1 and 2 (table notes follow Table 2). Values indicated apply at the drive's power connector.

**Table 1. DC power requirements  
for ST11950N/ND and ST12550N/ND drives**

Voltage regulation <sup>[5]</sup>	Notes	ST11950N & ST12550N		ST11950ND & ST12550ND	
		5V <sup>[8]</sup> ±5%	12V ±5% <sup>[2]</sup>	5V <sup>[8]</sup> ±5%	12V ±5% <sup>[2]</sup>
Amps					
Max operating current DC 3 $\sigma$	[1]	1.1	0.95	1.5	0.95
Avg idle current OD DC $\bar{X}$	[1] [9]	1.0	0.84	1.1	0.84
Max start current					
(peak) DC 3 $\sigma$	[3] [6]	1.0	2.18	1.1	2.18
(peak) AC 3 $\sigma$	[3]	–	3.1	–	3.1
Delay motor start (max)					
DC 3 $\sigma$	[1] [4]	1.06	0.19	1.1	0.2
Peak operating current					
Typical DC $\bar{X}$	[1] [7]	1.07	0.91	1.47	0.91
Maximum DC 3 $\sigma$	[1]	1.1	0.95	1.5	0.95
Maximum (peak) AC 3 $\sigma$		1.15	1.87	1.8	1.86
Track following at					
OD DC $\bar{X}$	[1]	1.0	0.84	1.1	0.84
ID DC $\bar{X}$	[1]	1.0	0.9	1.1	0.9
Read track					
OD DC 3 $\sigma$	[1] [11]	1.1	0.85	1.6	0.85
AC 3 $\sigma$		1.2	1.2	1.8	1.2
Seeking					
Typical DC $\bar{X}$	[1] [10]	1.0	1.2	1.1	1.2
Maximum DC 3 $\sigma$	[1]	1.1	1.2	1.2	1.2
Maximum (peak) AC 3 $\sigma$		1.2	1.8	1.7	1.8

**Table 2. DC power requirements  
for ST11950W/WD and ST12550W/WD drives**

Voltage regulation <sup>[5]</sup>	Notes	ST11950W & ST12550W		ST11950WD & ST12550WD	
		5V <sup>[8]</sup> ±5%	12V ±5% <sup>[2]</sup>	5V <sup>[8]</sup> ±5%	12V ±5% <sup>[2]</sup>
		<b>Amps</b>			
Max operating current DC 3 $\sigma$ [1]		1.04	0.95	1.3	0.95
Avg idle current					
OD DC $\bar{X}$	[1] [9]	1.0	0.84	1.1	0.84
Max start current					
(peak) DC 3 $\sigma$	[3] [6]	1.0	2.18	1.1	2.18
(peak) AC 3 $\sigma$	[3]	–	3.1	–	3.1
Delay motor start (max)					
DC 3 $\sigma$	[1] [4]	1.0	0.19	1.1	0.19
Peak operating current					
Typical DC $\bar{X}$	[1] [7]	1.03	0.91	1.21	0.91
Maximum DC 3 $\sigma$	[1]	1.04	0.95	1.3	0.95
Maximum (peak) AC 3 $\sigma$		1.2	1.87	2.0	1.87
Track following at					
OD DC $\bar{X}$	[1]	1.0	0.84	1.1	0.84
ID DC $\bar{X}$	[1]	1.0	0.9	1.1	0.9
Read track					
OD DC 3 $\sigma$	[1] [12]	1.1	0.85	1.4	0.85
AC 3 $\sigma$		1.3	1.2	2.0	1.2
Seeking					
Typical DC $\bar{X}$	[1] [10]	1.0	1.2	1.1	1.2
Maximum DC 3 $\sigma$	[1]	1.1	1.2	1.2	1.2
Maximum (peak) AC 3 $\sigma$		1.2	1.8	2.0	1.8

Notes:

- [1] Measured with average reading DC ammeter. Instantaneous +12V current peaks will exceed these values.
- [2] A –10% tolerance is permissible during initial start of the spindle and must return to  $\pm 5\%$  before reaching 7,200 RPM. The  $\pm 5\%$  must be maintained after the drive signals that its power-up sequence has been completed and that it can accept selection by the host initiator.
- [3] See Figure 12.
- [4] This condition occurs when the Motor Start Option is enabled and the drive has not yet received a start motor command.
- [5] See Section 7.2.1. Specified voltage tolerance includes ripple, noise, and transient response.
- [6] At power-up, the motor current regulator limits the 12V current to an average value of less than 2.0A, although instantaneous peaks may exceed this value. These peaks should measure 5 msec duration or less.

- [7] Operating condition is defined as a third-stroke seek at OD and read one track. A command is issued every 0.07 sec.
- [8] No terminator power. See Section 11.7.3.4.
- [9] Idle is defined as track following at OD.
- [10] Seeking is defined as a third-stroke seek at OD. A command is issued every 20 msec.
- [11] Read track is defined as repeat reads of track 15 with a 91% duty cycle.
- [12] Read track is defined as repeat reads of track 15 with a 75% duty cycle.

**Notes:**

1. Minimum current loading for each supply voltage is not less than 7% of the maximum operating current shown.
2. The +5V and +12V supplies use separate ground returns.
3. Where power is provided to multiple drives from a common supply, careful consideration for individual drive power requirements should be noted. Where multiple units are powered on simultaneously, the peak starting current must be available to each device.

**7.2.1****Conducted noise immunity**

Noise is specified as a periodic and random distribution of frequencies covering a band from DC to 10 MHz. Maximum allowed noise values given below are peak-to-peak measurements and apply at the drive's power connector.

	<b>1 to 100 kHz</b>	<b>100 kHz to 10 MHz</b>
<b>+5V</b>	150 mV	100 mV
<b>+12V</b>	150 mV	100 mV

**7.2.2****Power sequencing**

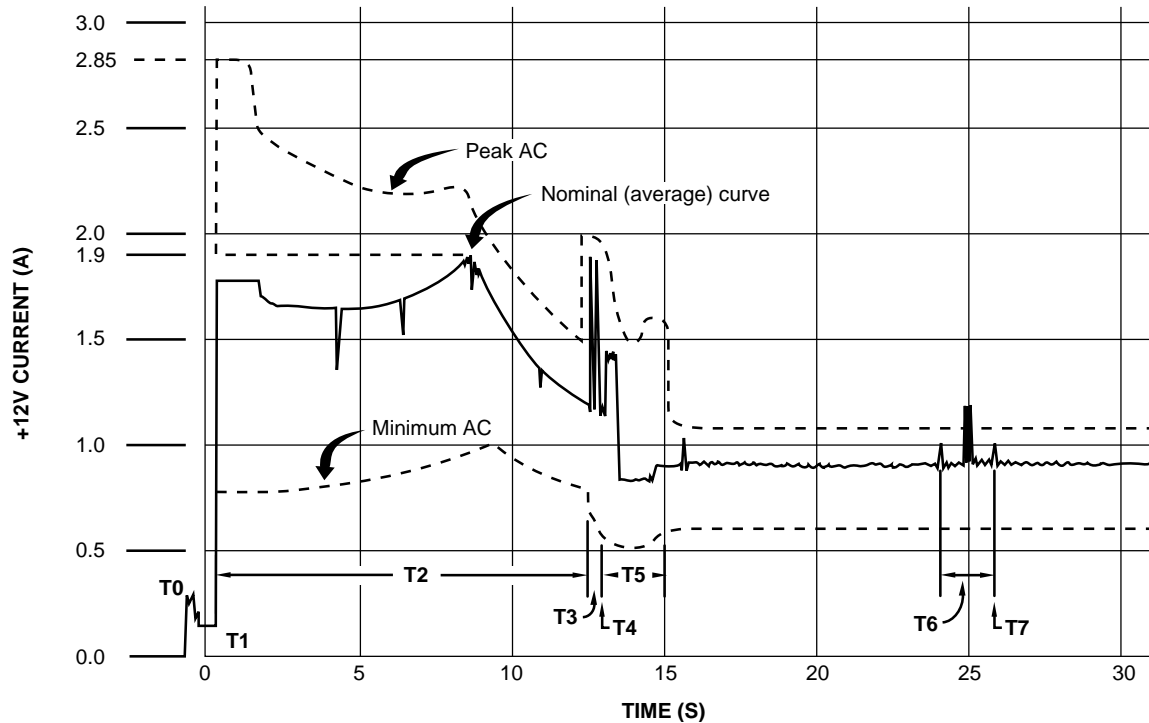
The drive does not require power sequencing. The drive protects against inadvertent writing during power-up and down. Daisy-chain operation requires that power be maintained on the terminated device to ensure proper termination of the peripheral I/O cables.

To automatically delay motor start based on the target ID (SCSI ID), select the Delay Motor Start option and deselect the Enable Motor Start option. See Section 10.1 for pin selection information.

To delay the motor until the drive receives a Start Unit command, select the Enable Motor Start option.

### 7.2.3 12V current profile

Figure 12 identifies the drive's +12V current profile. The current during the various times is as shown.



**Figure 12. Barracuda 1 and 2 drives typical +12V current profiles**

- T0 Power is applied to the drive.
- T1 Controller self-tests are performed.
- T2 The spindle begins to accelerate under current limiting after performing internal diagnostics. See Note 1 of Table 1.
- T3 The spindle is up to speed and the head-arm restraint is unlocked.
- T4 Heads move from the landing zone to the data area.
- T5 The adaptive calibration sequence is performed.
- T6 Thermal calibration.
- T7 Calibration is complete and the drive is ready for reading and writing.

**Note.** All times and currents are typical. See Tables 1 and 2 for maximum current requirements.

## 7.3 Heat/power dissipation

The heat and power dissipation values for the Barracuda 1 and 2 drives are listed below.

	<b>ST11950N/W</b>	<b>ST11950ND</b>	<b>ST11950WD</b>
	<b>ST12550N/W</b>	<b>ST12550ND</b>	<b>ST12550WD</b>
Typical seek and read power dissipation*	16W (55 BTUs/hr)	18W (62 BTUs/hr)	17W (58 BTUs/hr)
Typical power dissipation under idle conditions	15W (51 BTUs/hr)	15W (51 BTUs/hr)	15W (51 BTUs/hr)

\*DC power average at nominal voltages

## 7.4 Environmental limits

Temperature and humidity must not cause condensation within the drive. Altitude and atmospheric pressure specifications are referenced to a standard day at 58.7°F (14.8°C). Maximum wet bulb temperature is 82°F (28°C).

### 7.4.1 Temperature

#### a. Operating

The MTBF specification for the drive is based on operating at a local ambient temperature of 95°F (35°C). Occasional excursions to drive ambient temperatures of 122°F (50°C) may occur without impact to specified MTBF. The enclosure for the drive should be designed such that the temperatures at the locations specified in Section 6.2.2 are not exceeded. Air flow may be needed to achieve these temperatures. Continual or sustained operation at case temperatures above these values may degrade MTBF.

The drive meets all specifications within a 41° to 122°F (5° to 50°C) drive ambient temperature range with a maximum gradient of 36°F (20°C) per hour.

#### b. Non-operating

Non-operating temperature should remain between -40° to 158°F (-40° to 70°C) package ambient with a maximum gradient of 36°F (20°C) per hour. This assumes that the drive is packaged in the shipping container designed by Seagate.

### 7.4.2 Relative humidity

The values below assume that no condensation on the drive occurs.

#### a. Operating

5% to 95% relative humidity with a maximum gradient of 10% per hour

#### b. Non-operating

5% to 95% relative humidity

### 7.4.3 Effective altitude (sea level)

- a. Operating  
–1,000 to +10,000 feet (–305 to +3,048 meters)
- b. Non-operating  
–1,000 to +40,000 feet (–305 to +12,210 meters)

### 7.4.4 Shock and vibration

Shock and vibration limits are measured directly on the drive's chassis. Ensure that you use an enclosure that buffers and restricts the drive's movements to meet the shock and vibration requirements listed below.

The limits of shock and vibration defined within this manual are specified with the drive mounted in one of the two methods shown in Figure 15.

#### 7.4.4.1 Shock

- a. Operating in a normal environment  
The drive as installed for normal operation operates error free while subjected to intermittent shock not exceeding:  
2.0 Gs at a maximum duration of 11 msec (half-sinewave)  
Shock may be applied in the X, Y, or Z axis.
- b. Operating in an abnormal environment  
The drive as installed for normal operation does not incur physical damage while subjected to intermittent shock not exceeding:  
10 Gs at a maximum duration of 11 msec (half-sinewave)  
Shock occurring at abnormal levels may degrade operating performance during the abnormal shock period. Specified operating performance continues when normal operating shock levels resume.  
Shock may be applied in the X, Y, or Z axis. Shock must not be repeated more than two times per second.
- c. Non-operating  
The limits of non-operating shock apply to all conditions of handling and transportation. This includes both isolated drives and integrated drives.  
The drive does not cause drive damage or performance degradation while subjected to non-repetitive shock not exceeding:  
50 Gs at a maximum duration of 11 msec (half-sinewave)  
Shock may be applied in the X, Y, or Z axis.
- d. Packaged  
The drive as packaged by Seagate for general freight shipment withstands a drop test against a concrete floor or equivalent with specifications not exceeding:  
20 pounds (8.95 kg) for pack's gross weight  
42 inches (1,070 mm) for distance dropped  
The drop test applies to a single- or multiple-drive pack.

**7.4.4.2****Vibration**

## a. Operating in a normal environment

The drive as installed for normal operation operates error free while subjected to continuous vibration not exceeding:

5-400 Hz @ 0.5 G in the X and Y axis

Vibration may be applied in the X, Y, or Z axis.

## b. Operating in an abnormal environment

Equipment as installed for normal operation does not incur physical damage while subjected to periodic vibration not exceeding:

15 minutes of duration at major resonant frequency

5-400 Hz @ 0.75 G

Vibration occurring at these levels may degrade operating performance during the abnormal vibration period. Specified operating performance continues when normal operating vibration levels are resumed—this assumes system recovery routines are available.

Abnormal vibration may be applied in the X, Y or Z axis.

## c. Non-operating

The limits of non-operating vibration apply to all conditions of handling and transportation. This includes both isolated drives and integrated drives.

The drive does not incur physical damage or degraded performance as a result of continuous vibration not exceeding:

5-22 Hz @ 0.040 inches (1.02 mm) displacement

22-400 Hz @ 2.00 Gs

Vibration may be applied in the X, Y, or Z axis.

**7.4.5****Air cleanliness**

The drive is designed to operate in a typical office environment with minimal environmental control.

**7.4.6****Acoustics**

Sound power during idle mode (when the drive is not seeking, reading, or writing) is 4.7 bels typical when measured to ISO 7779 specifications.

**7.5****Electromagnetic compatibility**

As a component assembly, the drive is not required to meet any susceptibility performance requirements. The system integrator is responsible for performing tests to ensure that equipment operating in the same system as the drive does not adversely affect the performance of the drive. See Section 7.2 "DC power requirements."

## 7.6 Mechanical specifications

The following nominal dimensions do not include the decorative front-panel accessory. Refer to the appropriate figure listed below for your drive's mounting configuration dimensions.

Height 1.63 in 41.4 mm  
 Width 4.00 in 101.6 mm  
 Depth 5.97 in 151.6 mm  
 Weight 2.3 lb 1.04 Kg

ST11950N/ND and ST12550N/ND drives Figure 13

ST11950W/WD and ST12550W/WD drives Figure 14

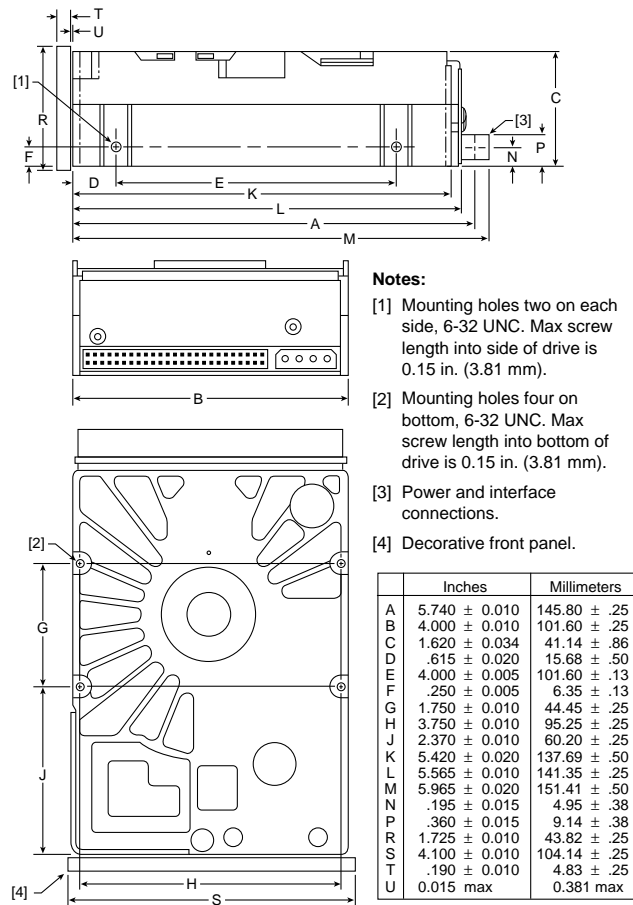


Figure 13. Mounting configuration dimensions for N/ND drives



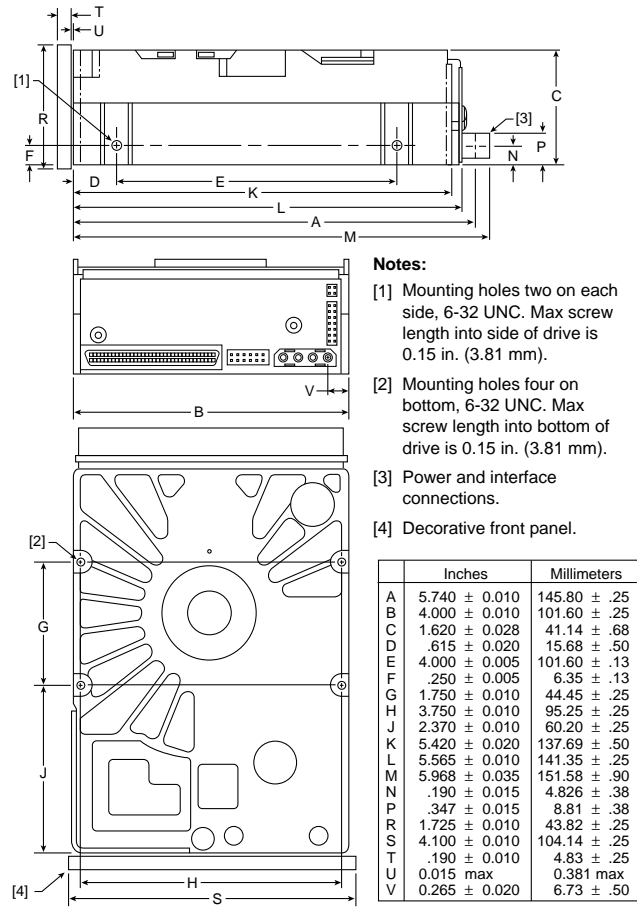


Figure 14. Mounting configuration dimensions for W/WD drives

### 7.6.1 Drive orientation

The balanced rotary arm actuator design of the drive allows it to be mounted in any orientation. All drive performance evaluations have been done with the drive in horizontal (discs level) and vertical (drive on its side) orientations, which are the two preferred mounting orientations.

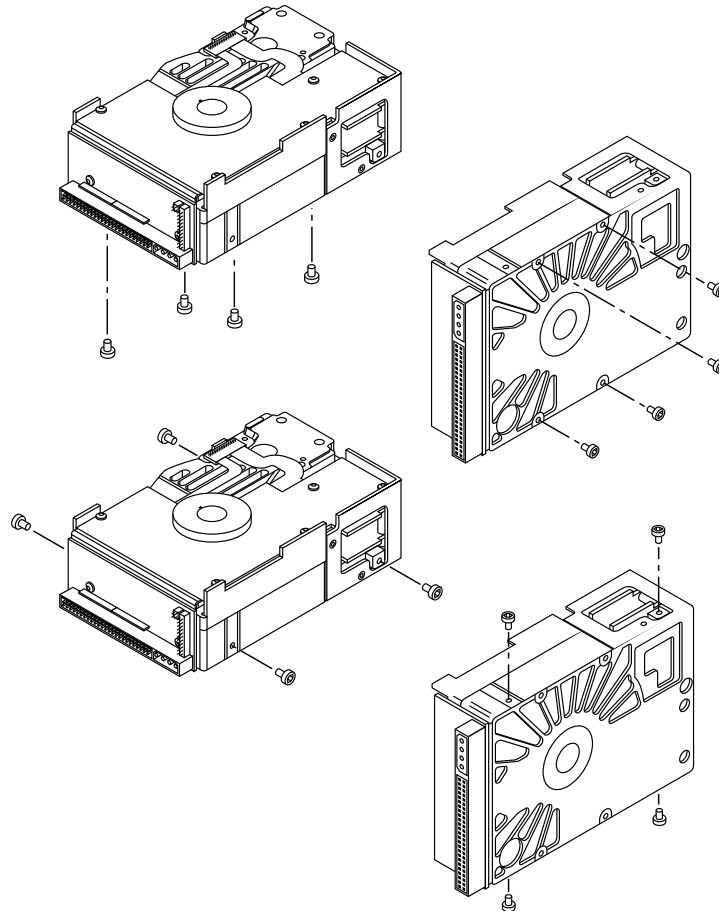


Figure 15. Recommended mounting (ST11950N shown)

### 7.6.2 Cooling

#### Cooling

Ensure that the enclosure you use provides adequate cooling so that the ambient temperature immediately surrounding the drive does not exceed temperature conditions specified in Section 7.4.1. Ensure that you provide adequate air circulation around the printed circuit boards (PCBs) to meet the requirements of Section 6.2.2.

## **8.0 Media characteristics**

This section provides information regarding the media used in Barracuda 1 and 2 disc drives.

### **8.1 Media description**

The media used on the drive has a diameter of approximately 95 mm (3.7 inches). The aluminum substrate is coated with a thin-film magnetic material, which has a proprietary protective layer for improved durability and environmental protection.



## 9.0 Defect and error management

The drive, as delivered, complies with this product manual. The read error rates and specified storage capacities are not dependent on using defect-management routines by the host (initiator).

Defect and error management in the SCSI system involves the drive's internal defect/error management and SCSI system error considerations (errors in communications between the initiator and the drive). Tools for designing a defect/error management plan are briefly outlined in this section. References to other sections are provided when necessary.

### 9.1 Defects and errors

Identified defects are recorded on the drive's defects list (referred to as the primary or ETF defect list). These known defects are reallocated during the initial drive format at the factory. (See Format Unit command Section 5.2.1.2 in the *SCSI-2 Interface Product Manual*, part number 77738479.) Data correction by ECC recovers data from additional flaws if they occur.

Details of the SCSI commands supported by the drive are described in the *SCSI-2 Interface Product Manual*. Also, more information about the drive's Error Recovery philosophy is presented in Section 6 of the *SCSI-2 Interface Product Manual*.



## 10.0 Option/configuration headers

This section describes how to configure Barracuda 1 and 2 drives using the option headers on the drives. These option headers may be used to customize many functions of the drives for your particular system.

### 10.1 Drive ID/option select headers

The headers described in this section enable you to configure the drive to meet specific functionality requirements.

#### 10.1.1 ST11950N/ND and ST12550N/ND configuration

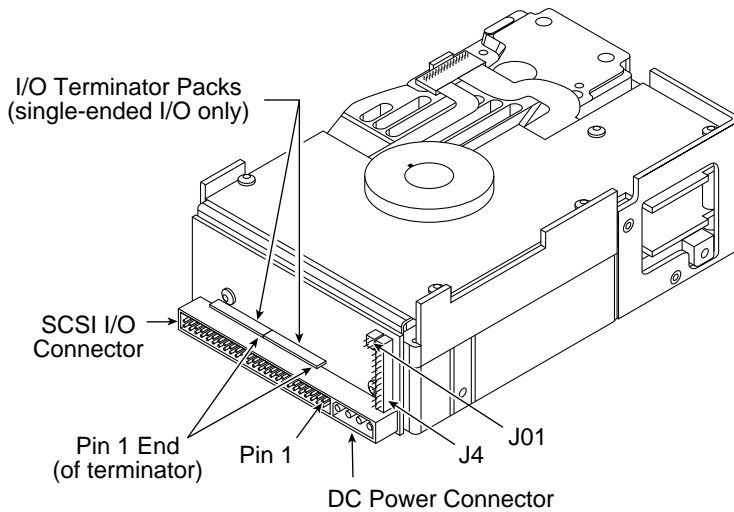


Figure 16. ST11950N/ND and ST12550N/ND physical interface

Figure 17 illustrates ST11950N/ND and ST12550N/ND SCSI ID and option select jumper connectors.

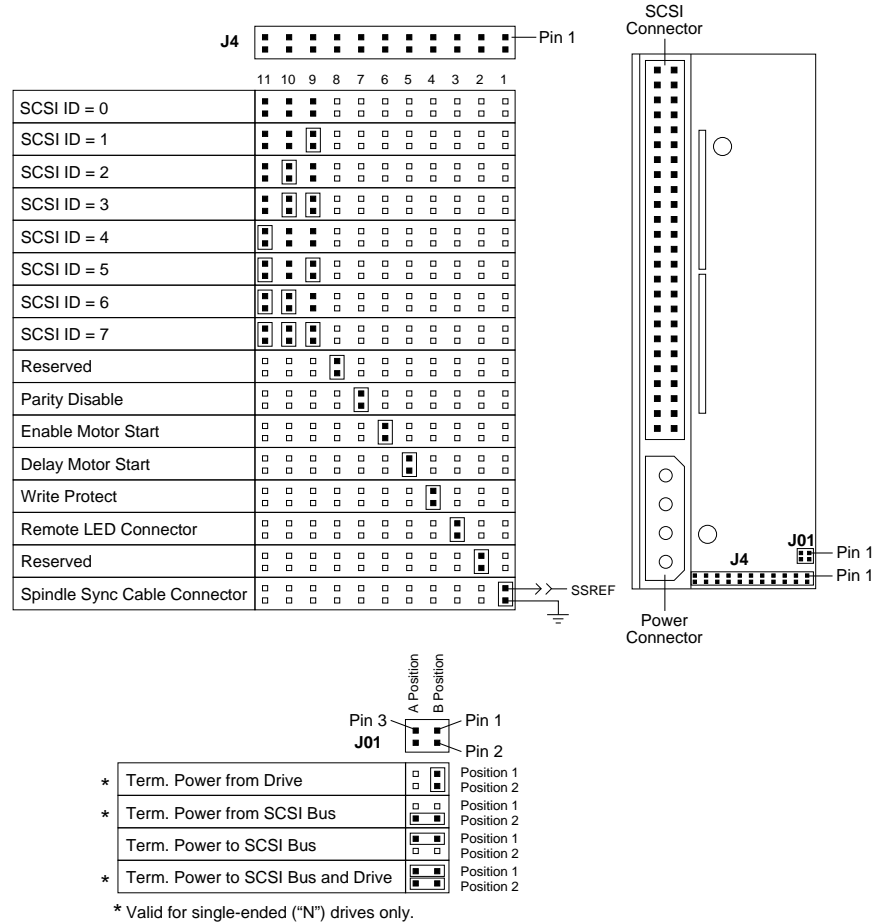


Figure 17. ST11950N/ND and ST12550N/ND jumper connectors



	<b>Block</b>	<b>Pins</b>	<b>Function</b>
<b>ST11950N and ST12550N</b>	J01	1&2	Terminator power from the drive
		1&3	Terminator power to the SCSI bus
		2&4	Terminator power from the SCSI bus
		1&3 and 2&4	Terminator power to the SCSI bus and drive
<b>ST11950ND and ST12550ND</b>	J01	1&3	Terminator power to the SCSI bus
<b>ST11950N/ND and ST12550N/ND</b>	J4	1 & 2	Spindle sync cable connector Pin 1 is SSREF+ Pin 2 is ground
		3&4	Reserved
		5&6	Remote LED connector Pin 5 is cathode (negative) Pin 6 is anode (positive)
		7&8	Write Protect option. Jumper installed write protects the entire disc drive. Default is no jumper.
		9&10	Delay Motor Start option. Jumper installed causes the drive to wait ten (10) seconds for each target ID number before starting the spindle automatically. Default is no jumper.  Example: Target ID is equal to three (3) $3 \times 10 = 30$ Target spindle motor starts after thirty (30) seconds
		11&12	Enable Motor Start option. Jumper installed causes the target to wait for the Start Unit command from the SCSI host. No jumper installed causes the unit to start according to the Delay Motor Start option (J4 pins 9 and 10). Default is no jumper.
		13&14	Parity Disable option. Jumper installed causes parity checking and error reporting to be disabled. Default is no jumper.
		15&16	Reserved
		17&18*	SCSI ID bit 0
		19&20*	SCSI ID bit 1
21&22*	SCSI ID bit 2		

\*See Figure 17 to set the SCSI ID.

### 10.1.2 ST11950W/WD and ST12550W/WD configuration

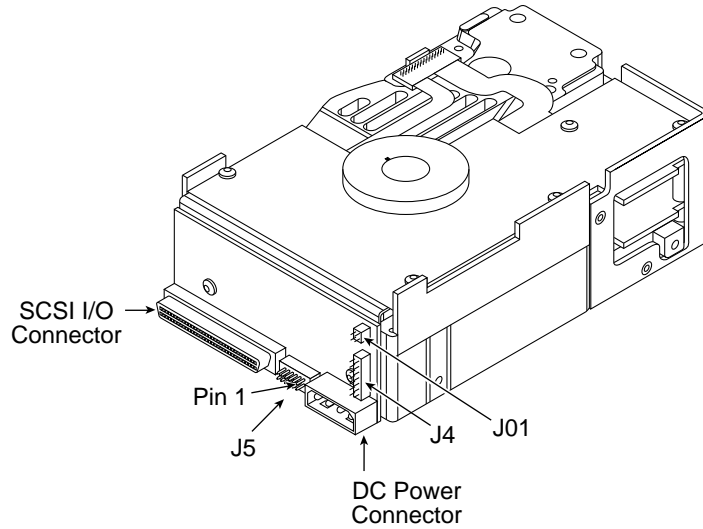


Figure 18. ST11950W/WD and ST12550W/WD physical interface

Figure 19 illustrates ST11950W/WD and ST12550W/WD SCSI ID and option select jumper connectors.

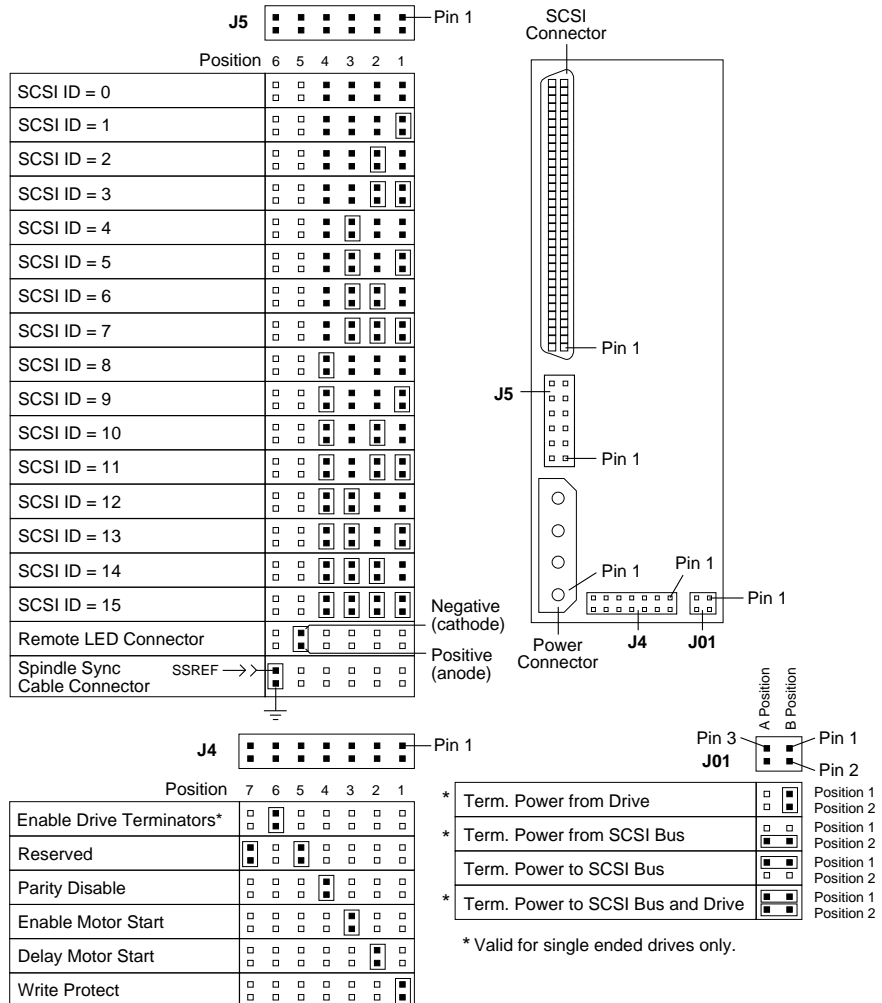


Figure 19. ST11950W/WD and ST12550W/WD jumper connectors

	<b>Block</b>	<b>Pins</b>	<b>Function</b>	
<b>ST11950W and ST12550W</b>	J01	1&2	Terminator power from the drive	
		1&3	Terminator power to the SCSI bus	
		2&4	Terminator power from the SCSI bus	
		1&3and 2&4	Terminator power to the SCSI bus and drive	
<b>ST11950WD and ST12550WD</b>	J01	1&3	Terminator power to the SCSI bus	
<b>ST11950W/WD and ST12550W/WD</b>	J4	1&2	Write Protect option. Jumper installed write protects the entire disc drive. Default is no jumper.	
		3&4	Delay Motor Start option. Jumper installed causes the drive to wait ten (10) seconds for each target ID number before starting the spindle automatically. Default is no jumper.  Example: Target ID is equal to three (3) $3 \times 10 = 30$ Target spindle motor starts after thirty (30) seconds	
		5&6	Enable Motor Start option. Jumper installed causes the target to wait for the Start Unit command from the SCSI host. No jumper installed causes the unit to start according to the Delay Motor Start option (J4 pins 3 and 4). Default is no jumper.	
		7&8	Parity Disable option. Jumper installed causes parity checking and error reporting to be disabled. Default is no jumper.	
		9&10	Reserved	
		11&12	Enable Drive Terminator. Jumper installed enables the Drive Terminator. Default is no jumper.	
		13&14	Reserved	
		J5	1&2*	SCSI ID bit 0
			3&4*	SCSI ID bit 1
			5&6*	SCSI ID bit 2
7&8*	SCSI ID bit 3			
9&10	Remote LED connector Pin 9 is cathode (negative) Pin 10 is anode (positive) and is current limited through a 1K ohm, 1/10W resistor			
11&12	Spindle sync cable connector Pin 11 is SSREF+ Pin 12 is ground			

\*See Figure 19 to set the SCSI ID.

## 10.2 Synchronized spindles interface

The synchronized spindles interface (SSI) allows several drives operating from the same host to operate their spindles at a synchronized rotational rate. Details of the electrical and physical interfaces follow in Section 10.2.1. The system operation is described in Section 5.7.

### 10.2.1 Electrical description

The electrical interface consists of one digital TTL reference index signal and ground. The reference index signal (SSREF+) is an output if the drive is configured as a master and is an input otherwise. The reference index signal is connected from drive to drive in a daisy-chain fashion as shown in Figure 4.

#### 10.2.1.1 Drivers and receivers

Figure 20 shows a diagram of the driver/receiver circuit. The driver circuits have the following electrical specifications:

- Negated (false): 0.0V to +0.4V @ I = -24 mA (max)
- Asserted (true): +2.24V to +5.25V @ I = +250  $\mu$ A

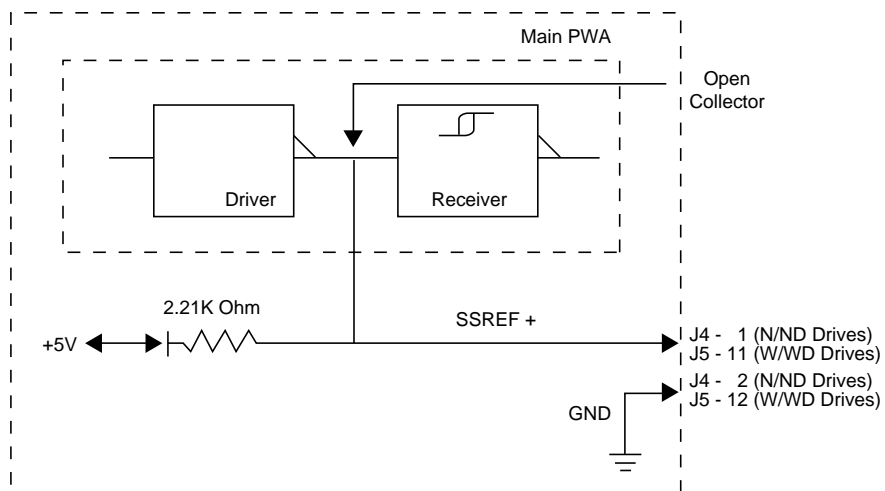


Figure 20. SCSI reference index signal driver/receiver combination

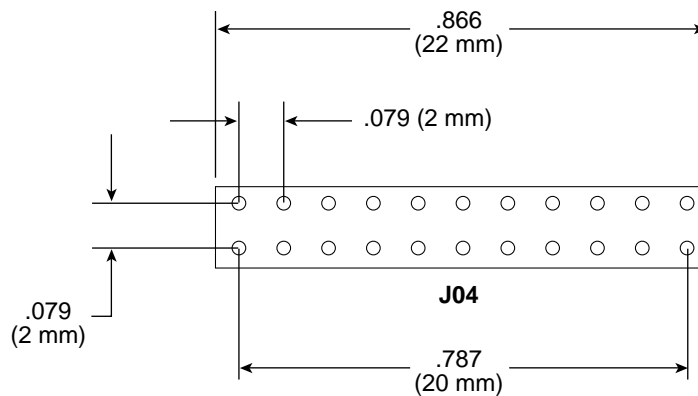
### 10.2.1.2 Termination

The reference index signal (SSREF+) is terminated with a 2.21K ohm resistor. Each single-ended drive has a terminator resistor located on the main PCB. The terminator resistor is not removable and is always in the circuit. A diode prevents current backfeed.

### 10.2.1.3 Physical interface

ST11950N/ND and ST12550N/ND drives

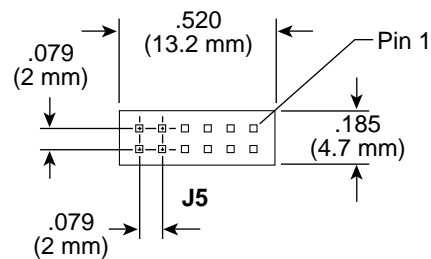
Dimensions of the ST11950N/ND and ST12550N/ND J4 connector mounted on the main PCB to interconnect the drives are shown in Figure 21. It is a 22-pin, 11-position gold header type connector. Only pins 1 and 2 are used for connecting the reference index signal cable, as shown in Figure 17. Pin 1 is SSREF+ and pin 2 is ground.



**Figure 21. ST11950N/ND and ST12550N/ND configuration select header specification**

ST11950W/WD and ST12550W/WD drives

Dimensions of the ST11950W/WD and ST12550W/WD J5 connector mounted on the main PCB to interconnect the drives are shown in Figure 22. It is a 12-pin, 6-position gold header type connector. Only pins 11 and 12 are used for connecting the reference index signal cable, as shown in Figure 19. Pin 11 is SSREF+ and pin 12 is ground.



**Figure 22. ST11950W/WD and ST12550W/WD configuration select header specification**

## 10.3

### Grounding

Signal ground (PCB) and HDA ground are connected together in the Barracuda 1 and 2 family drives—do not separate this connection. Maximizing the conductive contact area between HDA ground and system ground may reduce radiated emissions. If you do not want to connect HDA ground to the system chassis, you must provide a nonconductive (electrically isolating) method of mounting the drive in the host equipment. This may increase radiated emissions and is the system integrator's responsibility.

## 11.0 Interface requirements

This section describes the Barracuda 1 and 2 interface requirements.

### 11.1 General description

This section contains drive-specific interface information. The major portion of the interface requirements/implementation is described in the *SCSI-2 Interface Product Manual* (part number 77738479).

### 11.2 SCSI interface messages supported

Table 3 lists the messages supported by the Barracuda SCSI-1 and SCSI-2 modes.

**Table 3. SCSI messages supported**

Message name	Msg code	Supported by	
		SCSI-1	SCSI-2
Abort	06h	Y	Y
Abort tag	0Dh	Y	Y
Bus device reset	0Ch	Y	Y
Clear queue	0Eh	N	Y
Command complete	00h	Y	Y
Continue I/O Process	12h	N	N
Disconnect	04h	Y	Y
Extended messages	01h***	Y	Y
Identify	80h-FFh	Y	Y
Ignore wide residue (two bytes)	23h	N	N
Initiate recovery	0Fh	N	N
Initiator detected error	05h	Y	Y
Linked command complete	0Ah	Y	Y
Linked command complete with flag	0Bh	Y	Y
Message parity error	09h	Y	Y
Message reject	07h	Y	Y
Modify data pointer	***	N	N
No operation	08h	Y	Y
Queue tag messages (two bytes)			
Head of queue tag	21h	N	Y
Ordered queue tag	22h	N	Y
Simple queue tag	20h	N	Y
Release recovery	10h	N	N
Restore pointers	03h	Y	Y
Save data pointer	02h	Y	Y
Synchronous data transfer request	***	Y	Y
Target transfer disable	13h	N	N
Terminate I/O process	11h	N	N
Wide data transfer request	***	N	Y

\*\*\* Extended messages (see the *SCSI-2 Interface Product Manual*)

## 11.3

### SCSI interface commands supported

Table 4 lists the SCSI interface commands supported in SCSI-1 and SCSI-2 modes. Barracuda 1 and 2 family drives can be changed back and forth between SCSI-1 and SCSI-2 modes, using the Change Definition command. Standard OEM drives are shipped set to operate in SCSI-2 mode.

**Table 4. Supported commands**

Command name	Command code	Supported by	
		SCSI-1	SCSI-2
Change Definition	40h	Y	Y
Compare	39h	N	N
Copy	18h	N	N
Copy and Verify	3Ah	N	N
Format Unit [1]	04h	Y	Y
Inquiry	12h	Y	Y
Date Code Page		N	Y
Firmware Numbers Page		N	Y
Implemented Operating Def. Page		N	Y
Jumper Settings Page		N	Y
Unit Serial Number Page		N	Y
Vital Product Data Page		N	Y
Lock-Unlock Cache	36h	N	Y
Log Select	4Ch	N	N
Log Sense	4Dh	N	N
Mode Select	15h	Y	Y
Same pages as Mode Sense command			
Mode Select (10)	55h	N	Y
Mode Sense	1Ah	Y	Y
Caching Parameters Page (08h)		N	Y
Control Mode Page (0Ah)		N	Y
Disconnect/Reconnect Control Page (02h)		Y	Y
Error Recovery Page (01h)		Y	Y
Format Page (03h)		Y	Y
Notch and Partition Page (0C) (media zones)		N	Y
Rigid Disc Drive Geometry Page (04h)		Y	Y
Unit Attention Page (00h)		Y	Y
Verify Error Recovery Page (07h)		N	Y
Mode Sense (10)	5Ah	N	Y
Not used	42–4Bh	N	N
Not used	4E–54h	N	N
Not used	56–59h	N	N
Not used	5B–5Fh	N	N
Not used	60–BFh	N	N
Not used	C0–DFh	N	N
Not used	E0–FFh	N	N
Prefetch	34h	N	N

*continued*



*continued from previous page*

Command name	Command code	Supported by	
		SCSI-1	SCSI-2
Read	08h	Y	Y
Read Buffer	3Ch	Y	Y
Read Capacity	25h	Y	Y
Read Defect Data	37h	Y	Y
Read Extended	28h	Y	Y
Read Long	3Eh	Y	Y
Reassign Blocks	07h	Y	Y
Receive Diagnostic Results	1Ch	Y	Y
Supported Diagnostics Pages		Y	Y
Translate Page		Y	Y
Release	17h	Y	Y
Request Sense	03h	Y	Y
Actual Retry Count Bytes		N	N
Extended Sense		Y	Y
Field Pointer Bytes		Y	Y
Reserve	16h	Y	Y
Extent Reservation		N	N
Third Party Reserve		Y	Y
Rezero Unit	01h	Y	Y
Search Data Equal	31h	N	N
Search Data High	30h	N	N
Search Data Low	32h	N	N
Seek	0Bh	Y	Y
Seek Extended	2Bh	Y	Y
Send Diagnostics Page	1Dh	Y	Y
Supported Diagnostics Pages		Y	Y
Translate Page		Y	Y
Set Limits	33h	N	N
Start Unit/Stop Unit	1Bh	Y	Y
Synchronize Cache	35h	N	N
Test Unit Ready	00h	Y	Y
Verify	2Fh	Y	Y
Write	0Ah	Y	Y
Write and Verify	2Eh	Y	Y
Write Buffer	3Bh	Y	Y
Write Extended	2Ah	Y	Y
Write Long	3Fh	Y	Y
Write Same	41h	N	Y

[1] Format to any even number of bytes per sector from 180 to 4,096.

### 11.3.1 Inquiry data

Table 5 lists the Inquiry command data that the drive should return to the initiator per the format provided in the *SCSI-2 Interface Product Manual*.

**Table 5. Barracuda 1 and 2 family drive inquiry data**

Bytes	Data (hex)																
0-15	00	00	**	***	8F	00	00	(1A)	53	45	41	47	41	54	45	20	Vendor ID
16-31	[53	54	31	31	39	35	30	20	20	20	20	20	20	20	20]	Product ID	
32-47	R#	R#	R#	R#	S#	S#	S#	S#	S#	S#	S#	S#	00	00	00	00	
48-63	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	
64-79	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	
80-95	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	
96-111	00	43	6F	70	79	72	69	67	68	74	20	28	63	29	20	31*	*Copyright
112-127	39*	39*	34*	20	53	65	61	67	61	74	65	20	41	6C	6C	20	notice
128-143	72	69	67	68	74	73	20	72	65	73	65	72	76	65	64	20	
144-147	D#	D#	D#	D#													

\* Copyright year (changes with actual year)

\*\* 01 = SCSI-1 implemented

02 = SCSI-2 implemented (default)

The drive can be changed between these two configurations.

\*\*\* 01 = Response data is in SCSI-1 format and has compatibility with Common Command Set data

02 = Response data is in SCSI-2 format (default)

The drive can be changed between these two configurations.

R# Four ASCII digits representing the last four digits of the product firmware release number

S# Eight ASCII digits representing the eight digits of the product serial number

D# Reserved 0000

() Byte 7 is 1A for N/ND drives and 3A for W/WD drives.

[] Bytes 16 through 31 identify the product ID including the model number (ST11950N/ND drive shown).

ST11950W/WD codes: 53 54 31 31 39 35 30 20 20 20 20 20 20 20 20 20

ST12550N/ND codes: 53 54 31 32 35 35 30 20 20 20 20 20 20 20 20 20

ST12550W/WD codes: 53 54 31 32 35 35 30 20 20 20 20 20 20 20 20 20

**Note.** Code 20 indicates an empty-character position.

### 11.3.2 Mode sense data

Tables 6, 7, 8, and 9 list the data-byte values the drive returns in response to the Mode Sense command pages for SCSI-1 and SCSI-2 implementation (see the *SCSI-2 Interface Product Manual*).

Definitions:

DEF = Default value. Standard drives are shipped configured this way.

CHG = Changeable bits; indicates if the default value is changeable.









## 11.4 SCSI bus conditions and miscellaneous features supported

Asynchronous SCSI bus conditions supported by the drive are listed in Table 10. These conditions cause the SCSI device to perform certain actions and can alter the phase sequence. Other miscellaneous operating features supported are also listed here.

**Table 10. SCSI bus conditions and other miscellaneous features**

**Condition/feature supported by:**

SCSI-1	SCSI-2	Conditions or feature
N	N	Adaptive caching
Y	Y	Adaptive read lookahead
Y	Y	Arbitrating system
Y	Y	Asynchronous data transfer
N	Y	Asynchronous event notification
Y	Y	Attention condition
N	Y	Contingent allegiance condition
N	Y	Deferred error handling
Y	Y	Differential interface circuits available
Y	Y	Disconnect/reconnect
Y	Y	Parameter rounding (controlled by round bit in Mode Select page 0)
N	Y	Queue tagging (up to 64 queue tags supported)
N	N	Reporting actual retry count in extended sense bytes 15, 16, and 17
Y	Y	Reset condition
Y	Y	SMP = 1 in Mode Select command needed to save RPL and rotational offset bytes (in Table 5.2.1-25 of the <i>SCSI-2 Interface Product Manual, Vol. 2</i> )
Y	Y	Synchronous data transfer
Y	Y	Synchronized (locked) spindle operation
Y	Y	Segmented caching
N	N	Zero latency read

SCSI-1	SCSI-2	Status supported
Y	Y	Busy
Y	Y	Check condition
Y	Y	Condition met/good
Y	Y	Good
Y	Y	Intermediate/condition met/good
Y	Y	Intermediate/good
Y	Y	Reservation conflict
Y	Y	Queue full

## 11.5 Synchronous data transfer

The data transfer period to be used by the drive and the initiator is established by an exchange of messages during the Message Phase of operation. See the section on message protocol in the *SCSI-2 Interface Product Manual*.

### 11.5.1 Synchronous data transfer periods supported

Tables 11 and 12 list the synchronous data transfer periods supported by the drives.

**Table 11. Synchronous data transfer periods  
for ST11950N/ND and ST12550N/ND drives**

<b>M (decimal)</b>	<b>Transfer period (M times 4 nanoseconds)</b>	<b>Transfer rate (mega transfers/second)</b>
25	100	10.0
31	125	8.0
37	150	6.66
50	200	5.0
62	250	4.0
75	300	3.33
87	350	2.85
100	400	2.5
112	450	2.22
125	500	1.81
137	550	1.81
150	600	1.66
162	650	1.53
175	700	1.42
187	750	1.33
200	800	1.25

**Table 12. Synchronous data transfer periods  
for ST11950W/WD and ST12550W/WD drives**

<b>M (decimal)</b>	<b>Transfer period (M times 4 nanoseconds)</b>	<b>Transfer rate (mega transfers/second)</b>
25	100	10.0
31	125	8.0
37	150	6.66
50	200	5.0
62	250	4.0
75	300	3.33
87	350	2.85
100	400	2.5
112	450	2.22



### 11.5.2 REQ/ACK offset

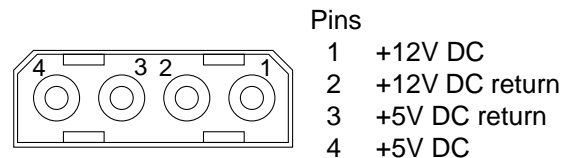
The maximum REQ/ACK offset supported by Barracuda 1 and 2 drives is 15 (0Fh).

## 11.6 DC cable and connector

The drive receives DC power through a 4-pin connector mounted at the rear of the main PCB (see Figure 23). Recommended part numbers of the mating connector are listed below, but equivalent parts may be used.

Type of cable	Connector	Contacts (20-14 AWG)
14 AWG	AMP 1-480424-0	AMP 60619-4 (loose piece) AMP 61117-4 (strip)

**Note.** The output of a power supply must meet SELV (safety extra low voltage) as defined in IEC 950.



## 11.7 SCSI physical interface

Figures 23 and 24 illustrate the physical interface on Barracuda 1 and 2 drives. Locations of the DC power connector, the SCSI interface connector, the I/O line terminators, and the drive select and option select headers are shown.

Details of the physical, electrical, and logical characteristics are given below. The SCSI operational aspects of Seagate drive interfaces are provided in the *SCSI-2 Interface Product Manual*.

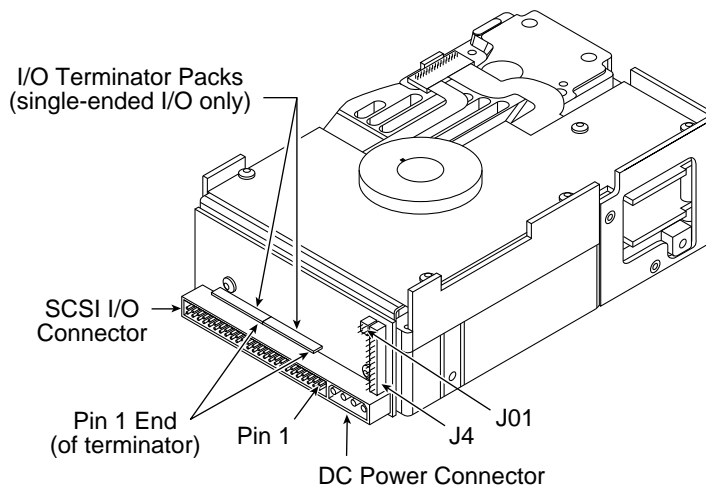
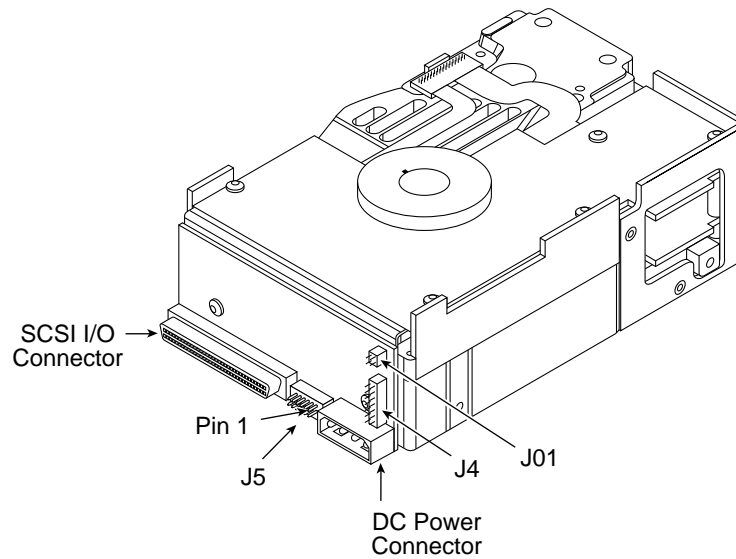


Figure 23. ST11950N/ND and ST12550N/ND physical interface



**Figure 24. ST11950W/WD and ST12550W/WD physical interface**

## 11.7.1 Physical characteristics

This section defines the connectors, cables, signals, and terminators needed to implement the SCSI interface.

### 11.7.1.1 Physical description

You can daisy chain multiple SCSI devices on a common cable if each device has the same types of drivers and receivers (all single-ended or all differential). Devices having single-ended interface circuits cannot be on the same daisy chain with devices having a differential interface circuit. All signals are common between SCSI devices. A maximum of 8 SCSI devices (including the host) may be daisy chained together when using a non-wide bus and ST11950N/ND or ST12550N/ND drives. A maximum of 16 SCSI devices (including the host) may be daisy chained together when using a wide bus and ST11950W/WD or ST12550W/WD drives.

Terminate both ends of the daisy chain, but do not terminate any intermediate SCSI device. The single-ended (ST11950N, ST11950W, ST12550N, and ST12550W) drives are equipped with permanently mounted IC terminators, which you can turn on or off using the Enable SCSI Terminator jumper. See Section 10.1 to locate the Enable SCSI Terminator jumper for each drive model. The differential (ST11950ND, ST11950WD, ST12550ND, and ST12550WD) drives do not have on-board terminators. You must provide external termination to terminate a differential drive.

### 11.7.1.2 Cable requirements

Sections 11.7.1.2.1, 11.7.1.2.2, and 11.7.1.2.3 describe the single-ended, differential, and general cable requirements for Barracuda 1 and 2 drives.

**11.7.1.2.1****Single-ended I/O circuits (ST11950N, ST11950W, ST12550N, and ST12550W drives)**

The maximum total cable length for use with drives having single-ended I/O driver and receiver circuits is 6 meters (19.7 feet) when operating at transfer rates of 5 Mbytes/second or less, and 3 meters (9.85 feet) when operating at transfer rates greater than 5 Mbytes/second (fast SCSI). A stub length of no more than 0.1 meter (0.33 feet) is allowed off the mainline interconnection with any connected equipment. An ideal impedance match with cable terminators implies a cable characteristic impedance of 132 ohms. Single-ended I/O cable pin assignments for ST11950N and ST12550N drives are shown in Table 13. Single-ended I/O cable pin assignments for ST11950W and ST12550W drives are shown in Table 15.

**11.7.1.2.2****Differential I/O circuits (ST11950ND, ST11950WD, ST12550ND, and ST12550WD drives)**

The maximum total cable length for use with drives having differential I/O drivers and receiver circuits is 25 meters (82 feet). A stub length of no more than 0.2 meter (0.66 foot) is allowed off the mainline interconnection with any connected equipment. An ideal impedance match with cable terminators implies a cable characteristic impedance of 122 ohms. Differential I/O cable pin assignments for ST11950ND and ST12550ND drives are shown in Table 14. Differential I/O cable pin assignments for ST11950WD and ST12550WD drives are shown in Table 16.

**11.7.1.2.3****General cable characteristics**

**Note.** Use only non-shielded cable connectors with ST11950N/ND and ST12550N/ND drives. Use a 50-conductor flat cable or 25-conductor twisted-pair cable. Use a minimum conductor size of 28 AWG to minimize noise effects. The following non-shielded flat cables (or equivalents) may be used:

Flat cable	35M-3365-50
Twisted-pair cable	Spectra twist in flat 455-248-50

In general, cables having the characteristic impedances given in Sections 11.7.1.2.1 and 11.7.1.2.2 are not available; however, impedances that are lower are satisfactory. A characteristic impedance of 100 ohm +10% is recommended for unshielded flat or twisted-pair ribbon cable. To minimize discontinuities and signal reflections, cables of different impedances should not be used in the same bus. Your specific setup may require tradeoffs in shielding effectiveness, cable length, number of loads, transfer rates, and cost to achieve satisfactory system operation. If shielded and unshielded cables are mixed within the same SCSI bus, the effect of impedance mismatch must be carefully considered. Proper impedance matching is especially important to maintain adequate margin at fast SCSI transfer rates.

**11.7.2****Connector requirements****ST11950N/ND and ST12550N/ND drives**

Use a non-shielded 50-conductor cable connector consisting of two rows of 25 female contacts with adjacent centers 100 mils apart. The connector is keyed (see Figure 27).

Recommended mating flat cable connector part numbers:

Closed end (for cable ends)	3M-3425-7000	Without strain relief, no center key
	3M-3425-7050	With strain relief, no center key
Open end (in daisy chain)	Dupont-66900-290	With strain relief and center key
	3M-3425-6000	Without strain relief, no center key
	3M-3425-6050	With strain relief, no center key
	Dupont-66900-250	With strain relief and center key

### **ST11950W/WD and ST12550W/WD drives**

Recommended mating wide cable connector part numbers:

AMP 786096-7, female 68-pin  
AMP 786090-7, male 68-pin

## **11.7.3**

### **Electrical description**

ST11950N, ST11950W, ST12550N, and ST12550W drives use single-ended interface signals. These signals must be terminated with 110 ohm active terminator circuits at each end of the total cable. Single-ended circuits use open collector or three-state drivers. ST11950N, ST11950W, ST12550N, and ST12550W drives can be configured to provide SCSI termination (see Section 11.7.3.3).

ST11950ND, ST11950WD, ST12550ND and ST12550WD drives use differential interface signals. Each of these signals must be terminated at each end of the total cable with 330 ohms to +5V and 330 ohms to ground with 150 ohms between each differential pair. All I/O circuits are open collector, three-state drivers. Differential I/O drives are shipped without terminators and have no provisions for adding terminator sockets on the PCB. You must provide external termination for these drives.

### **11.7.3.1**

#### **Single-ended drivers and receivers**

**Note.** All single-ended terminators must be ANSI SCSI-2 alternative 2 active terminators.

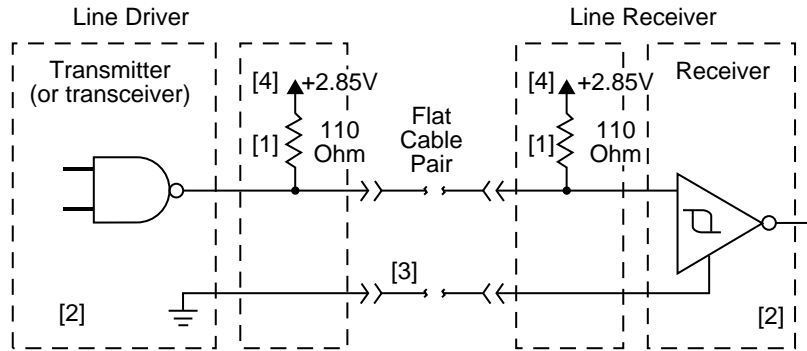
Typical single-ended driver and receiver circuits for the Barracuda 1 and 2 family are shown in Figure 25. Use terminator circuits only when the disc drive is first or last on the daisy chain. (See Note 1 following Figure 25.)

#### **Transmitter characteristics**

Single-ended drives use an ANSI SCSI compatible open-collector single-ended driver. This driver is capable of sinking a current of 48 mA with a low-level output voltage of 0.4V.

#### **Receiver characteristics**

Single-ended drives use an ANSI SCSI single-ended receiver with hysteresis gate or equivalent as a line receiver.



**Figure 25. Single-ended transmitters and receivers**

**Notes:**

[1] Part of active terminator circuits. Enable drive termination when it is first or last on the daisy chain.

Interface signal levels and logical sense at the drive I/O connector are defined as follows:

Logic level	Driver output	Receiver input
Negated (0)	$\geq 2.5V : \leq 5.25V$	$\geq 2.0V : < 5.25V$
Asserted (1)	$\leq 0.4V : \geq 0.0V$	$\leq 0.8V : > 0.0V$

The difference in the voltages between input and output signals is due to losses in the cable.

[2] ANSI SCSI compatible circuits.

[3] Total interface cable length should not exceed that specified in Section 11.7.1.2.1.

[4] Source of drive terminator power is VR1 which has an input source voltage selected by a jumper.

### 11.7.3.2

#### Differential drivers and receivers

Typical differential driver and receiver circuits used by ST11950ND, ST11950WD, ST12550ND and ST12550WD drives are shown in Figure 26. The differential drives have no provisions for terminator circuits.

#### Differential signals

All differential interface signals consist of two lines denoted +SIGNAL and -SIGNAL. A signal is true when +SIGNAL is more positive than -SIGNAL, and a signal is false when -SIGNAL is more positive than +SIGNAL. Terminate all assigned signals at each end of the cable as shown in Table 14. You must provide external termination for the differential drives.

#### Output characteristics

Each signal driven by differential interface drives should have the following output characteristics when measured at the disc drive's SCSI connector:

- Low-level output voltage\*
  - = 2.0V maximum at low-level output current
  - = 55 milliamps

**High-level output voltage\***

- = 3.0V minimum at high-level output current
- = -55 milliamps

**Differential voltage**

- = 1.0V minimum with common-mode voltage ranges from -7V DC to +12V DC

\* Measure these voltages between the output terminal and the SCSI device's logic ground reference.

The output characteristics must conform to EIA RS-485-1983.

**Input characteristics**

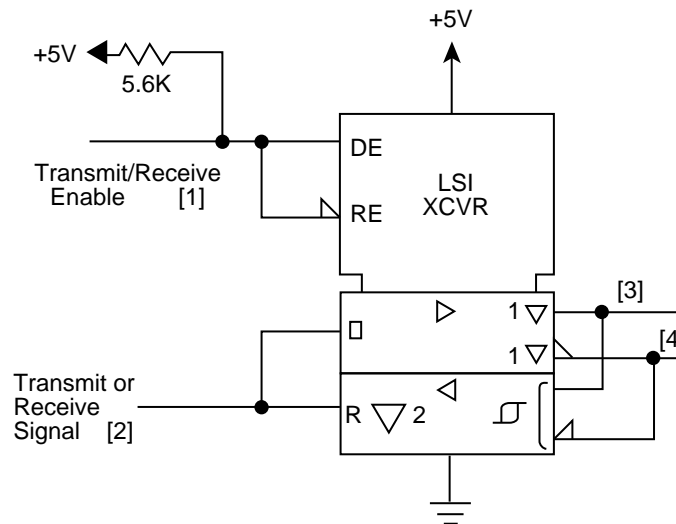
Each signal received by differential interface drives should have the following input characteristics when measured at the disc drive's SCSI connector:

**Input current on either input**

- = +2.0 milliamps maximum  
(includes both receivers and passive drivers)

This requirement is met with the input voltage varying between -7V DC and +12V DC, with power on or off, and with the hysteresis equaling 35 mV minimum.

The input characteristics must conform to EIA RS-485-1983.



**Figure 26. Typical differential I/O line transmitters/receivers and terminators**

**Notes:**

- [1] Positive logic enables transmitters (+5V = asserted).  
Negative logic enables receivers (0V = asserted).
- [2] Negative logic signal (0V = asserted).
- [3] Total interface cable length should not exceed 82.1 feet (25 meters) from the host to the end of the daisy chain.
- [4] You must provide terminators.

### 11.7.3.3

#### Terminator requirements

##### ST11950N and ST12550N drives

Internal disc drive I/O termination consists of active circuits with resistor modules that plug into sockets on the main PCB (see Figure 16). You may order ST11950N and ST12550N drives with or without the resistor modules installed to facilitate a particular application. All single initiator/single target (non-daisy-chain) applications require you to terminate the initiator and disc drive. Daisy-chain applications require you to terminate only the units at each end of the daisy chain. All other peripherals on the chain should not be terminated.

**Note.** Remove terminator resistor modules where terminators are not required. Removal of terminator power source selection jumper (see Figure 16) does not disconnect the terminator resistors from the circuit.

For single-ended I/O Barracuda applications, the SCSI bus must be terminated at both ends with ANSI SCSI-2 alternative 2 termination (active termination), especially if the bus will be operated at fast SCSI transfer rates. Barracuda drives provide active termination as the on-board termination option.

**Note.** All terminators used in the daisy chain must be active terminators as described above.

##### ST11950W and ST12550W drives

Internal disc drive I/O termination consists of active circuits contained in permanently mounted IC terminator packs on the main PCB (see Figure 18). All single initiator/single target (non-daisy-chain) applications require you to terminate the initiator and drive.

Daisy-chain configurations require you to terminate only the units at each end of the daisy chain. Do not terminate any other peripheral on the chain.

**Note.** Remove the Enable Drive Terminator jumper on J4 pins 11 and 12 when terminators are not required.

##### ST11950ND, ST12550ND, ST11950WD, and ST12550WD drives

Differential I/O Barracuda drives do not have provisions to add terminator sockets on the PCB. You must provide external termination.

### 11.7.3.4

#### Terminator power

You can configure terminator power in four different ways. See Section 10.1 for illustrations that show how to place jumpers enabling each of the following terminator power configurations:

1. Drive accepts terminator power through SCSI bus pins

ST11950N and ST12550N	Pin 26
ST11950W and ST12550W	Pins 17, 18, 51, and 52
2. Drive supplies power to the SCSI bus.
3. Drive provides terminator power for optional internal terminator resistors using the drive's power connector.
4. Drive provides power to its own terminators and to the SCSI bus terminator power line (pin 26).

SCSI devices providing terminator power (TERMPWR) must have the following characteristics:

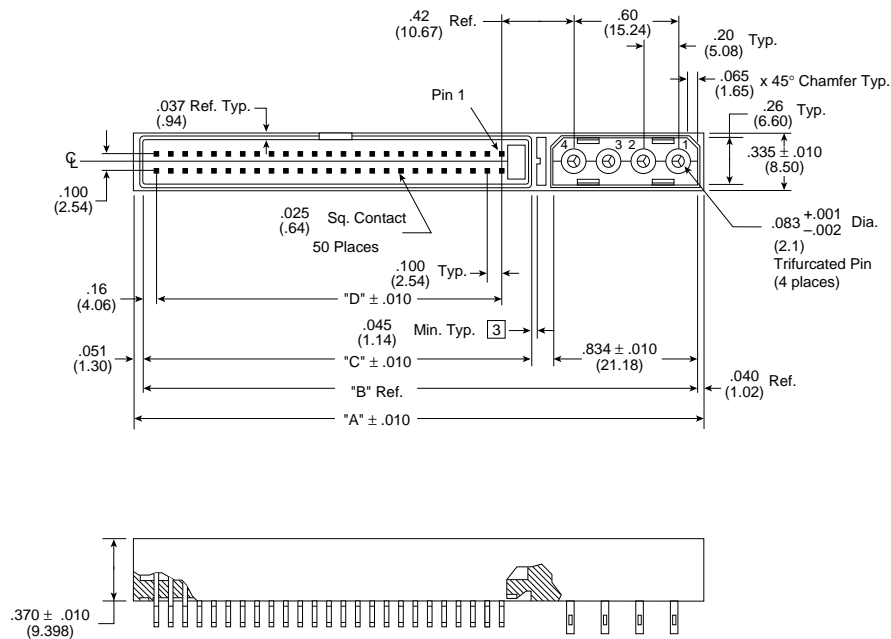
- V TERM = 4.50V to 5.25V
- 800 mA minimum source drive capability
- 1.0A maximum

### ST11950ND, ST11950WD, ST12550ND and ST12550WD drives

You can configure terminator power only from the drive to the SCSI bus (see Section 10.1).

## 11.8

### SCSI non-wide physical interface



No. Pos.	"A"	"B"	"C"	"D"
50	3.767 (95.68)	3.697 (93.90)	2.720 (69.09)	2.400 (60.96)

Figure 27. Non-shielded SCSI device connector



**Table 13. Single-ended cable pin assignments  
(non-shielded connector)  
for ST11950N and ST12550N drives**

Signal	Pin number	Signal	Pin number
-DB (0)	2	GROUND	28
-DB (1)	4	GROUND	30
-DB (2)	6	-ATN	32
-DB (3)	8	GROUND	34
-DB (4)	10	-BSY	36
-DB (5)	12	-ACK	38
-DB (6)	14	-RST	40
-DB (7)	16	-MSG	42
-DB (P)	18	-SEL	44
GROUND	20	-C/D	46
GROUND	22	-REQ	48
GROUND	24	-I/O	50
TERMPWR	26		

**Notes:**

1. All odd pins except pin 25 are connected to ground. Pin 25 is left open.  
**Caution.** Do not connect pin 25 to ground at the host end or the drive end of the cable. If you accidentally plug in the I/O connector upside down, terminator power on pin 26 will be shorted to ground.
2. The minus sign next to a signal indicates asserted state is the low voltage of the two levels used for logic signals.

**Table 14. Differential cable pin assignments  
(non-shielded connector)  
for ST11950ND and ST12550ND drives**

<b>+Signal name*</b>	<b>Pin number</b>		<b>-Signal name*</b>
SHIELD GND	1	2	GROUND
DB (0)	3	4	-DB (0)
DB (1)	5	6	-DB (1)
DB (2)	7	8	-DB (2)
DB (3)	9	10	-DB (3)
DB (4)	11	12	-DB (4)
DB (5)	13	14	-DB (5)
DB (6)	15	16	-DB (6)
DB (7)	17	18	-DB (7)
DB (P)	19	20	DB (P)
DIFFSENS	21	22	GROUND
GROUND	23	24	GROUND
TERMPWR	25	26	TERMPWR
GROUND	27	28	GROUND
ATN	29	30	-ATN
GROUND	31	32	GROUND
BSY	33	34	-BSY
ACK	35	36	-ACK
RST	37	38	-RST
MSG	39	40	-MSG
SEL	41	42	-SEL
C/D	43	44	-C/D
REQ	45	46	-REQ
I/O	47	48	-I/O
GROUND	49	50	GROUND

\*See Section 11.7.3 for detailed electrical characteristics of these differential signals.

# 11.9

## SCSI wide physical interface

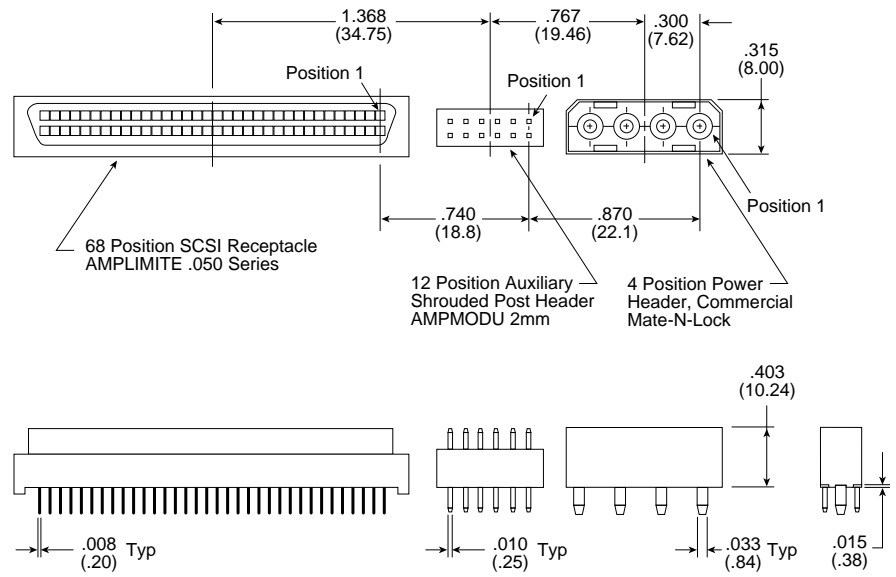


Figure 28. Wide SCSI device connector

**Table 15. Single-ended contact assignments (P cable)  
for ST11950W and ST12550W drives**

Signal name	Connector contact number	Connector contact number	Signal name
GROUND	1	35	-DB (12)
GROUND	2	36	-DB (13)
GROUND	3	37	-DB (14)
GROUND	4	38	-DB (15)
GROUND	5	39	-DB (P1)
GROUND	6	40	-DB (0)
GROUND	7	41	-DB (1)
GROUND	8	42	-DB (2)
GROUND	9	43	-DB (3)
GROUND	10	44	-DB (4)
GROUND	11	45	-DB (5)
GROUND	12	46	-DB (6)
GROUND	13	47	-DB (7)
GROUND	14	48	-DB (P)
GROUND	15	49	GROUND
GROUND	16	50	GROUND
TERMPWR	17	51	TERMPWR
TERMPWR	18	52	TERMPWR
RESERVED	19	53	RESERVED
GROUND	20	54	GROUND
GROUND	21	55	-ATN
GROUND	22	56	GROUND
GROUND	23	57	-BSY
GROUND	24	58	-ACK
GROUND	25	59	-RST
GROUND	26	60	-MSG
GROUND	27	61	-SEL
GROUND	28	62	-C/D
GROUND	29	63	-REQ
GROUND	30	64	-I/O
GROUND	31	65	-DB (8)
GROUND	32	66	-DB (9)
GROUND	33	67	-DB (10)
GROUND	34	68	-DB (11)

**Notes:**

1. The hyphen preceding a signal name indicates that signal is active low.
2. Eight-bit devices that connect to the P cable should leave the following signals open: -DB(8)-DB(9)-DB(10)-DB(11)-DB(12)-DB(13)-DB(14)-DB(15) -DB(P1). All other signals should be connected as defined.

**Table 16. Differential contact assignments (P cable)  
for ST11950WD and ST12550WD drives**

Signal name	Connector contact number	Connector contact number	Signal name
DB (12)	1	35	–DB (12)
DB (13)	2	36	–DB (13)
DB (14)	3	37	–DB (14)
DB (15)	4	38	–DB (15)
DB (P1)	5	39	–DB (P1)
GROUND	6	40	GROUND
DB (0)	7	41	–DB (0)
DB (1)	8	42	–DB (1)
DB (2)	9	43	–DB (2)
DB (3)	10	44	–DB (3)
DB (4)	11	45	–DB (4)
DB (5)	12	46	–DB (5)
DB (6)	13	47	–DB (6)
DB (7)	14	48	–DB (7)
DB (P)	15	49	–DB (P)
DIFFSENS	16	50	GROUND
TERMPWR	17	51	TERMPWR
TERMPWR	18	52	TERMPWR
RESERVED	19	53	RESERVED
ATN	20	54	–ATN
GROUND	21	55	GROUND
BSY	22	56	–BSY
ACK	23	57	–ACK
RST	24	58	–RST
MSG	25	59	–MSG
SEL	26	60	–SEL
C/D	27	61	–C/D
REQ	28	62	–REQ
I/O	29	63	–I/O
GROUND	30	64	GROUND
DB (8)	31	65	–DB (8)
DB (9)	32	66	–DB (9)
DB (10)	33	67	–DB (10)
DB (11)	34	68	–DB (11)

**Notes:**

1. The hyphen preceding a signal name indicates that signal is active low.
2. Eight-bit devices that connect to the P cable should leave the following signals open: –DB(12) –DB(13) –DB(14) –DB(15) –DB(P1) –DB(8) –DB(9) –DB(10) –DB(11) DB(12) DB(13) DB(14) DB(15) DB(P1) DB(8) DB(9) DB(10) DB(11). All other signals should be connected as defined.

## 11.10 Disc drive SCSI timing

**Table 17. Disc drive SCSI timing**

Description	Waveform symbol [1]	Waveform table [1]	Typical	Max
Target select time (no arbitration)	T00	N/A	< 1 $\mu$ s	< 250 $\mu$ s
Target select time (with arbitration)	T01	4.5-1,2	2.31 $\mu$ s	2.36 $\mu$ s
Target select to command	T02	4.5-1	3.33 $\mu$ s	3.34 $\mu$ s
Target select to MSG out	T03	4.5-2	1.51 $\mu$ s	1.54 $\mu$ s
Identify MSG to command	T04	4.5-3	3.34 $\mu$ s	3.36 $\mu$ s
Command to status	T05	4.5-5	Command dependent	
Command to data (para. in)	T06	4.5-9	Command dependent	
Command to data (para. out)	T07	4.5-10	Command dependent	
Command to data (write to data buffer)	T08	4.5-10	Command dependent	
Command to disconnect MSG	T09	4.5-6	Command dependent	
Disconnect MSG to bus free	T10	4.5-6,14	0.64 $\mu$ s	0.68 $\mu$ s
Disconnect to arbitration (for re-select)	T11	4.5-6	Command dependent	
This measures disconnected CMD overhead				
Target win arbitration (for re-select)	T12	4.5-7		2.8 $\mu$ s
Arbitration to re-select	T13	4.5-7		1.8 $\mu$ s
Re-select to Identify MSG in	T14	4.5-7		1.34 $\mu$ s
Re-select Identify MSG to status	T15	4.5-8	Command dependent	
Re-select Identify MSG to data (media)	T16	4.5-11	Command dependent	
Data to status	T17	4.5-15	Command dependent	
Status to command complete MSG	T18	4.5-5,8,15		1.0 $\mu$ s
Command complete MSG to bus free	T19	4.5-5,8,15		0.75 $\mu$ s
Data to save data pointer MSG	T20	4.5-14		4.5 $\mu$ s
Save data pointer MSG to disconnect MSG	T21	4.5-14		0.75 $\mu$ s
Command byte transfer	T22	4.5-4		0.04
Next command byte access		4.5-4		
Next CDB byte access (byte 2 of 6)	T23.6.2	4.5-4	0.55 $\mu$ s	0.56 $\mu$ s
Next CDB byte access (byte 3 of 6)	T23.6.3	4.5-4	0.10 $\mu$ s	0.10 $\mu$ s
Next CDB byte access (byte 4 of 6)	T23.6.4	4.5-4	0.09 $\mu$ s	0.10 $\mu$ s
Next CDB byte access (byte 5 of 6)	T23.6.5	4.5-4	0.13 $\mu$ s	0.14 $\mu$ s
Next CDB byte access (byte 6 of 6)	T23.6.6	4.5-4	0.13 $\mu$ s	0.14 $\mu$ s
Next CDB byte access (byte 2 of 10)	T23.10.2	4.5-4	0.59 $\mu$ s	0.60 $\mu$ s
Next CDB byte access (byte 3 of 10)	T23.10.3	4.5-4	0.14 $\mu$ s	0.14 $\mu$ s
Next CDB byte access (byte 4 of 10)	T23.10.4	4.5-4	0.13 $\mu$ s	0.14 $\mu$ s
Next CDB byte access (byte 5 of 10)	T23.10.5	4.5-4	0.12 $\mu$ s	0.12 $\mu$ s
Next CDB byte access (byte 6 of 10)	T23.10.6	4.5-4	0.11 $\mu$ s	0.12 $\mu$ s
Next CDB byte access (byte 7 of 10)	T23.10.7	4.5-4	0.10 $\mu$ s	0.10 $\mu$ s
Next CDB byte access (byte 8 of 10)	T23.10.8	4.5-4	0.09 $\mu$ s	0.10 $\mu$ s
Next CDB byte access (byte 9 of 10)	T23.10.9	4.5-4	0.13 $\mu$ s	0.14 $\mu$ s
Next CDB byte access (byte 10 of 10)	T23.10.10	4.5-4	0.12 $\mu$ s	0.12 $\mu$ s

*continued*

continued from previous page

<b>Description</b>	<b>Waveform symbol [1]</b>	<b>Waveform table [1]</b>	<b>Typical</b>	<b>Max</b>
Data in byte transfer (parameter)	T24	4.5-12		0.04 $\mu$ s
Data out byte transfer (parameter)	T25	4.5-13		0.04 $\mu$ s
Next data in byte access (parameter)	T26	4.5-12	0.10 $\mu$ s	0.12 $\mu$ s
Next data out byte access (parameter)	T27	4.5-13	0.10 $\mu$ s	0.12 $\mu$ s
Data in byte transfer (media) [2]	T28	4.5-12	0.03 $\mu$ s	0.04 $\mu$ s
Data out byte transfer (media) [2]	T29	4.5-13	0.03 $\mu$ s	0.04 $\mu$ s
Next data in byte access (media) [2]	T30	4.5-12	0.10 $\mu$ s	0.12 $\mu$ s
Next data out byte access (media) [2]	T31	4.5-13	0.10 $\mu$ s	0.12 $\mu$ s
MSG IN byte transfer	T32	4.5-5,7 4.5-8,14,15	0.09 $\mu$ s	0.04 $\mu$ s
MSG OUT byte transfer	T33	4.5-2		0.04 $\mu$ s
STATUS byte transfer	T34	4.5-5,8 4.5-15		0.04 $\mu$ s
Synchronous data transfer characteristics:				
Request signal transfer period [3]	–	–	various	800 ns

**Notes:**

[1] See the *SCSI-2 Interface Product Manual* (part number 77738479), Section 4.5.

[2] Maximum SCSI asynchronous interface transfer rate is given in Section 5.3.

[3] Synchronous transfer period is determined by negotiations between an initiator and a drive. The drive is capable of setting periods as given in Section 11.5 in this manual. See also Sections 3.1.5.2 and 3.5.3.2 of the *SCSI-2 Interface Product Manual* for a description of synchronous data transfer operation.

General timing diagrams for SCSI interface operation are shown in the *SCSI-2 Interface Product Manual*, Section 4.5.





## Index

### Symbols

- 12V current profile 34
- 96-bit Reed-Solomon error correction code 7

### A

- AC power requirements 31
- acoustics 37
- active termination 69
- active terminator circuits 66
- actuator assembly 6
- adapter accessory frame kit 8
- adaptive read lookahead 16
- air cleanliness requirements 37
- air flow 22
- altitude, effective limits 36
- ambient temperature range 35
- ANSI, documents 3
- asynchronous
  - data transfer protocol 7
  - SCSI bus conditions supported 61
- automatic
  - adaptive thermal compensation 11
  - shipping lock 6, 7
  - thermal compensation 7, 11
- autowrite and read reallocation 7

### B

- Barracuda Installation Guide 8
- bits per inch, number of 11
- bytes
  - per sector, allowable range 7
  - per surface, number of 11
  - per track, number of 11

### C

- cable pin assignments
  - differential 72
  - single-ended 71
- cable requirements 64
- cache control 15
- caching write data 16
- capacities

- formatted 8
- unformatted 8
- conducted noise immunity 33
- contact assignments
  - differential (P cable) 75
  - single-ended (P cable) 74
- cooling, mechanical 40
- current requirements 31

### D

- data block size, modifying the 8
- data buffer to/from disc media 14
- data heads, number of 11
- data transfer rate 14
- data zone 6

### DC

- cable and connector 63
- power requirements 31
- defect and error management 43
- defects and errors
  - ETF defect list 43
  - primary defect list 43
- Delayed Motor Start option 49
- diameter, media (disc) 41
- differential
  - I/O, cable requirements 65
- differential drivers/receivers 67
  - terminating 67
- differential I/O
  - cable requirements 65
- digital offset values 19
- dimensions
  - N/ND J4 connector 51
  - W/WD J5 connector 51
- disc rotation speed 11
- disconnect/reconnect 5
- drive
  - failure, defined 22
  - orientation 40
- drivers and receivers 50

### E

- effective altitude (sea level) 36
- electromagnetic
  - compatibility 37
  - interference (EMI) 21

EMC/regulatory requirements, meeting 3  
 Enable Drive Terminator 49  
 Enable Motor Start option 47, 49  
 environmental interference 21  
 environmental limits  
   effective altitude 36  
   shock and vibration 36  
   temperature 35  
 error correction code 7  
 error rates 21

## F

fans, positioning for cooling 22  
 features  
   listed 7  
 firmware 7  
 flaw reallocation performance impact 14  
 flawed sector reallocation 7  
 format drive command execution time 13  
 formatting 9  
 front panel 8

## G

grounding 52

## H

head and disc assembly (HDA) 5  
   cooling 22  
   measuring the temperature of the 27  
 head switch, overhead time 14  
 heat/power dissipation 35  
 hot plugging Barracuda disc drives 28  
 humidity 35  
 HYHX temperature, measuring 25

## I

index signal 18  
 inquiry data 56  
 installation 28  
   instructions 9  
   plug in and play 28  
   service tools 28  
 interface  
   physical 51  
   requirements 53  
 interleave 7  
   minimum sector 14

internal data rate 11

## J

J01, jumper connector 47, 49  
 J2, jumper connector 47  
 J5  
   jumper connector 49  
 jumper connectors  
   explained 47, 49  
 JYHX temperature, measuring 26

## K

KYHX temperature, measuring 27

## L

landing zone 6

## M

mean time between failures (MTBF) 22  
 mechanical specifications  
   depth 38  
   height 38  
   weight 38  
   width 38  
 media  
   characteristics 41  
   description 41  
   diameter 41  
 misc. operating features supported 61  
 miscorrected data transferred 21  
 Mode Select command 15  
 Mode Sense data 56  
 Motor Start command 14  
 MTBF 21  
 multiple initiators 5

## N

noise  
   defined 33  
   maximum allowed 33

## O

offset values 19  
 one track cylinder switch, overhead time 14  
 operating current 31, 32  
 option/configuration headers 45

**P**

panel, front 8  
 Parity Disable option 49  
 performance  
   general 7, 14  
   list of characteristics 11  
 physical  
   interface 51  
   rotational offsets 19  
 physical/electrical specifications 31  
 power  
   control switch 15  
   dissipation 6  
   requirements, AC and DC 31  
 prefetch/multi-segmented cache control 15  
 preventive maintenance 7, 21, 28

**R**

radiated emissions, characterizations 3  
 reallocation of defects  
   on command (post format) 7  
 recoverable error rate 21  
 Reed-Solomon error correction code 7  
 reference documents  
   Barracuda 1 and 2 Installation Guide 3, 8  
   SCSI-2 Reference Manual 3  
 reference index signal 50  
   termination 51  
 reference signal 18, 19  
 relative humidity  
   non-operating 35  
   operating 35  
 reliability  
   general characteristics 7  
   service, and 22  
   specifications 21  
 REQ/ACK offset 63  
 resistor modules 69  
 rotation speed 11  
 rotational  
   latency, average 11  
   position locking 18  
   skew, operating the drive with 19

**S**

safety agencies, certification 3

safety/regulatory agency compliance 3  
 SCSI  
   bus conditions and misc. features 61  
   drivers and receivers 7  
 SCSI interface  
   cable connector requirements 65  
   electrical description  
     differential drivers/receivers 66  
     single-ended drivers/receivers 66  
   messages supported by the 53  
   physical connections 63  
   terminator requirements 69  
   transfer rate 14  
 SCSI physical interface 63  
   non-wide 70  
   wide 73  
 SCSI timing 76  
 sector  
   reallocation scheme 7  
   size, allowable range 7, 14  
 seek  
   error rate 21  
   errors, defined 22  
   times, listed 13  
 seek errors 22  
 self-configuring host software 5  
 service  
   life 21, 28  
   philosophy 28  
   tools 28  
 servo heads, number of 11  
 shock  
   non-operating 36  
   operating  
     abnormal 36  
     normal 36  
   packaged 36  
   vibration, and 36  
 single-ended  
   drivers/receivers 66  
   I/O, cable requirements 65  
   SCSI drivers and receivers 7  
 single-ended I/O  
   cable requirements 65  
 single-unit shipping pack kit 8  
 spare reallocation scheme 8  
 spindle

- brake 7
- enabling and disabling 18
- stopping with the Motor Start command 15
- synchronization mode 18
- start current 31, 32
- start/stop time 14
- synchronized
  - drive interconnect diagram 17
  - spindle operation 17
  - spindles interface 50
  - spindles interface, electrical description 50
- synchronous
  - data transfer
    - periods supported 62
    - protocol 7
  - spindle 7

## T

- temperature, operating 35
- terminating
  - differential drivers/receivers 66
  - SCSI devices 64
  - single-ended drivers/receivers 66
- terminator
  - power 47, 49, 69
  - requirements 69
- terminator power
  - options 47, 49
- timing 76
- tracks
  - per inch, number of 11
  - per surface, number of 11

## U

- UL 3
- unit attention 18
- unrecoverable
  - error, defined 21
  - write errors, defined 21
- unrecovered data transferred 21

## V

- vibration
  - non-operating 37
  - operating

- abnormal 37
- normal 37
- voltage requirements 31

## W

- write data, caching 16
- write errors 21
- WYGX temperature, measuring 24

## Z

- zone bit recording (ZBR) 7





***Seagate Technology, Inc.***

***920 Disc Drive, Scotts Valley, California 95066-4544, USA***

*Publication Number: 83327780, Rev. C, Printed in USA*