



# *Removable Cartridge Disk Drive*

SyJet Drive

Internal and External SCSI  
Technical Reference

Part Number 112857-001

Revision A

## ***Sales and Technical Assistance***

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This product meets the following national and international regulations:

- UL 1950 Standard for Safety of Information Processing and Business Equipment
- UL Standard for Safety of Information Technology
- CSA C22.2 No. 154 Data Processing Equipment
- CSA C22 No. 220 Information Processing Equipment
- IEC 435 Safety Requirements for Data Processing Equipment
- IEC 380 Safety of Electrical Energized Office Equipment
- IEC 950 Safety of Information Technology Equipment in Electrical Business Equipment



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## About This Manual

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This manual provides reference information for SyQuest SyJet internal and external (portable) SCSI removable cartridge disk drives and cartridge products.

This manual also provides instructions for quickly installing internally mounted SyJet SCSI drives in PC-compatible systems.

## Audience

We intend this manual for original-equipment manufacturers and integrators of SyQuest removable cartridge disk drives.

# Organization of This Manual

**Chapter 1** describes this manual's audience and organization.

**Chapter 2** gives an overview of SyJet SCSI products, describing their competitive advantages of availability, reliability, and maintainability. This chapter also describes basic product features, including SyQuest-provided utilities and allegiance controls for the drive and cartridge, and contamination-management functions.

**Chapter 3** provides specifications for SyJet SCSI disk drives and SyJet cartridges. Specifications range from physical and operational characteristics to performance measurements; environmental characteristics; and data on availability, reliability, and maintainability.

**Chapter 4** gives instructions for quickly installing internally mounted SyJet SCSI drives in PC-compatible systems. See the *SyJet 1.5 GB Internal SCSI Installation Guide for PC Compatible Systems* if you need more detailed instructions.

Installation guides are also available for SyQuest's Macintosh model of the SyJet internal SCSI drive, and for the PC, Macintosh, and Parallel Port models of SyJet external (portable) SCSI drives.

**Chapter 5** describes the SCSI interface protocol between PC host systems and SyJet SCSI disk drives: the standard used; the data bus and Command Descriptor Block; physical, electrical, and signal characteristics; general operational requirements; Self-Test routines; Sense Key and Error Code descriptors; message definitions; command completion status; and timing measurements.

**Chapter 6** gives command descriptions for SyJet SCSI drives.



# 2

## Features

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This chapter gives an overview of the SyJet SCSI products—their competitive advantages and basic product features.

## About the Product

The SyJet SCSI removable cartridge disk drive incorporates the finest developments of Winchester technology. Tolerances designed into the drive and cartridge, plus the use of intelligent runout cancellation algorithms, optimize the reliability of drive and cartridge functions in the harsh operating environments of interchangeable media.

The drive's breakthrough read/write performance, reliability, and interchangeability are the results of a proprietary mechanical design. This design creates the most contaminant-free operating environment available in a removable cartridge disk drive. Also, the drive's rugged servo-tracking and load/unload systems provide robust operation and extensive recovery capabilities.

Special advantages of the SyJet SCSI drive and SyJet cartridge include:

- Cartridge data availability
- Drive and cartridge reliability
- Drive and cartridge maintainability

## Availability

A fixed hard drive is dependent on the disk drive assembly or PCBA for data availability. Unlike a fixed hard drive, a SyQuest disk drive houses all data on a removable cartridge. This feature ensures the accessibility and usability of stored data.

When a fixed hard drive fails, you face an uncertain and time-consuming data recovery process that includes all the risks of electro-mechanical repairs by the vendor. If a SyJet drive fails, data recovery is usually as simple as moving the cartridge to another SyJet drive. In the rare event that the SyJet cartridge is damaged, SyQuest can usually transfer your data to another cartridge by using special firmware.

Fixed hard drives are very susceptible to head crashes, primarily due to excessive shock, stiction, or accumulated debris from constant head/disk contact. When a fixed drive is powered down, the heads are parked in the *loading zone* in contact with media surfaces. Even moderate shocks during transit can cause the heads to ding the media. During periods of inactivity, another danger is the molecular bond (or *stiction*) that readily forms between the media and parked heads. This usually results in damage to both heads and media. Finally, when a fixed drive is powered up but does not access data for long periods of time, the heads continue to *track-follow* and collect debris and lube material.

In contrast, SyQuest disk drives park the heads on a ramp away from the media during times of inactivity and when powered down. Also, once you remove the SyJet cartridge from the drive, you remove the possibility of any contact between heads and media. Since SyQuest disk drives never park heads on the media, the possibility of stiction does not exist. SyQuest quality design ensures the availability of your data on a removable cartridge when you need it.

## Reliability

*Mean Time Between Failure* (MTBF) is a term that has been used throughout the disk drive industry as a measure of how reliable a drive is expected to be. This term is often used as a basic measure of reliability for repairable items such as a CPU board or disk drive. However, in order to calculate MTBF, a system must fail, then be repaired, returned to service, and fail again. Disk drives are most often replaced, not repaired, once they fail. Therefore, MTBF is not the correct measure of reliability. SyQuest uses MTBF to mean *Mean Time to First Failure* (MTTFF) or, as it is sometimes called, *Mean Time to Failure* (MTTF).

To say that a drive has a predicted or theoretical MTBF of 250,000 hours means that, in a given large population of drives, the average time in which a drive may fail will be 250,000 hours. MTBF (or MTTF) is not a means of predicting the life of an individual drive or a small group of drives. To achieve this number, a drive would run until it reaches its end-of-life period, or fail and then be replaced by a new drive of similar reliability, and so on. In this case, it is theoretically possible that 250,000 hours would elapse before a failure would occur in a large population.

For a specific product, MTBF is calculated based on a budgeting technique where the printed circuit board assembly (PCBA) is modeled using Bellcore's Prediction Procedure for unique parts, part stress, and part count data from SyQuest's database. The head/disk assembly (HDA) mechanics are calculated with Bellcore, and then historical data containing the failure analysis of field-returned drives of similar technology is factored in. The cartridge mechanics are also calculated with Bellcore, and then historical data containing the failure analysis of field-returned cartridges of similar technology is factored in. The data from these models are combined with an analysis of the PCBA, HDA, and cartridge assembly processes to create a complete MTBF estimate.

## **Maintainability**

SyQuest drives and cartridges are designed for heavy use and long life. The drive enclosure, an advanced air filtration system, few moving parts, and intelligent firmware cleansing algorithms support an internal drive environment that is very clean. These features ensure the maintainability of the SyJet drive and cartridge.

Proper care of the drive and cartridge can further minimize the threat of contamination:

- Never operate the drive with its door open.
- Do not open the cartridge door.
- Always completely remove a cartridge once it is ejected.
- Put the cartridge in its protective case during times of inactivity and when moving the drive. Otherwise, you may damage the drive or cartridge and void your warranty.

- If contamination occurs, run the Clean Heads utility described under “Drive-Maintenance Utilities” below.

These additional precautions promote long life for the SyJet cartridge:

- Keep the cartridge away from strong magnetic forces.
- Store the cartridge in its protective case within a nonoperating temperature range of -40°C to 70°C.

## Basic Features

The SyJet product includes these features:

- Utilities that support drive-maintenance functions
- Drive-allegiance controls that are saved in the SyJet drive
- Cartridge-allegiance controls that are saved on the SyJet cartridge
- Stand-alone utilities
- Contamination-management functions

## Drive-Maintenance Utilities

These special utilities help maintain the SyJet drive:

**Update Drive Firmware:** Allows updates to the drive’s firmware for new features or drive enhancements.

**Clean Heads:** Runs special proprietary diagnostics that remove any debris that may have settled near the heads. Use this routine only if the standard data-recovery actions of running Scandisk under Windows 95 or 3.1x fail.

## Drive-Allegiance Controls

Settings for *drive-allegiance controls* affect any SyJet cartridge you use in a particular SyJet drive.

Most of these controls only need to be set once and are thereafter saved in the drive's EEPROM until changed by the user. The Lock or Unlock control, however, is saved only in the drive's RAM for the current power-on session.

### **Saved Controls**

**Sleep Time Enable/Disable:** Specifies whether the drive is allowed (enabled) to go to low-power consumption (Sleep mode). The default setting is Enabled.

**Sleep Time Limit:** Specifies the elapsed time when the drive automatically switches to Sleep mode if the drive is not accessed during this period of time. Settings include 10 minutes, 30 minutes (the default), 1 hour, 3 hours, and *disabled*.

**Eject Tone Enable/Disable:** Specifies whether the drive provides an audible tone when a cartridge is ejected and ready to be removed. The default setting is Enabled.

### **Current-Session Control**

**Lock or Unlock:** Governs the eject-button function. When the eject button is locked (disabled), you must send a software Unlock command *and* depress the eject button on the SyJet drive to remove a cartridge. (SyQuest provides this utility for Windows 3.1x, OS/2, and DOS only—this function is not required for Windows 95 or Windows NT.)

## Cartridge-Allegiance Controls

Settings for *cartridge-allegiance controls* affect only a particular SyJet cartridge, and remain valid for any SyJet drive with which you use that cartridge.

These controls only need to be set once and are thereafter saved on the cartridge until changed by the user.

**Write-Protect Enable/Disable:** Specifies whether data on the cartridge can be altered or erased. SyJet cartridges are shipped ready to record data, with write protection disabled by default.

**Write-Verify Enable/Disable:** Specifies whether data just written to the cartridge is read and compared for correctness with the original data transferred. SyJet cartridges are shipped with this data reliability feature enabled by default. To maximize performance or when operating in audio/video mode, disable this feature.

**Audio/Video Enable/Disable:** Specifies whether audio and video data is read/written with extended error recovery and automatic defect management disabled to maximize read/write performance.

Disable audio/video mode for normal data-mode operation. To prevent data errors, use only data mode when recording.

Enable audio/video mode for video playback only, and only when you manually disable Write Verify. To prevent file-system corruption, never enable audio/video mode for other types of data transfer.

## **Stand-Alone Utilities**

SyQuest provides a suite of stand-alone utilities under multiple operating systems. Here are a few examples of what these utilities do:

- Copy files, partitions, and cartridges
- Backup
- Restore
- Format cartridges
- Scan cartridges for defects
- Assign defects

## **Contamination Management**

Contamination in a removable cartridge disk drive can result in poor performance, interchangeability problems, and other malfunctions. The SyJet drive includes a proprietary labyrinth sealing door on the outside of the drive that uses system airflow to prevent contaminants from entering the drive.

Airflow within the drive works to tightly seal the drive door while it circulates through a microparticle filter located in the active, critical airflow conduits. During purge cycles and throughout continuous cleaning operations, this filter captures any particles swept off the disks or introduced into airflow cavities while the cartridge is in the drive.

## ***The Microparticle Filter***

The SyJet drive filter is test-proven to meet stringent criteria for managing contamination within the drive. Table 2-1 provides filter data.

***Table 2-1 Microparticle Filter***

Filter area	0.29 sq in
Filter materials	5-layer electrostatic, activated carbon 3.41 mm thick at 0.5 psi
Filter performance	Activated carbon for organic vapor absorption, Impregnated K CO for acid gas absorption, Absorbs Trimethylpentone and H <sub>2</sub> S, Min efficiency 94.24% on .2 micron parts at 5.3 cm/sec
Volume to purge	11.92 cu in
Continuous purge activity when cartridge is in drive (even during Sleep mode)	Heavy-particulate insertion shows 90% clean-up in 95 seconds with 0.09 to 0.2 micron particles

## ***Firmware Cleansing Algorithms***

Fewer mechanical parts and linkages to rub during drive operation, coupled with no requirement for drive adjustments during manufacturing, promote an internal drive environment that is very clean. Intelligent firmware cleansing algorithms reduce internal contaminants as well. These are the algorithms:

**Sweep:** This algorithm is applied at head load and other times during operation to move large particulates off disk surfaces and into the airflow for filtration.

**Park:** This algorithm lifts drive heads from disk surfaces after a period of no access, thus eliminating unnecessary working of disk surfaces, the depletion of lube on disk surfaces, and the vacuum-cleaner effect of gathering debris on drive heads.

**Clean:** This algorithm provides special maintenance for drive heads, actually burnishing and cleaning drive heads at slow speed to remove debris.

**Butterfly:** This is a seek algorithm that dynamically manages the media and lube for several physical conditions that occur.

**Load/Unload:** This algorithm includes a special sequence of servo, actuator arm, and disk-speed controls, accompanied by Sweep and registration functions.



# 3

## Specifications

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This chapter provides specifications for SyJet SCSI disk drives and SyJet cartridges.

### The SyJet Drive

SyJet drive specifications include:

- Physical and operational characteristics
- Performance measurements
- Environmental characteristics
- Data on reliability and maintainability

# Physical and Operational Characteristics

**Table 3-1 Capacity**

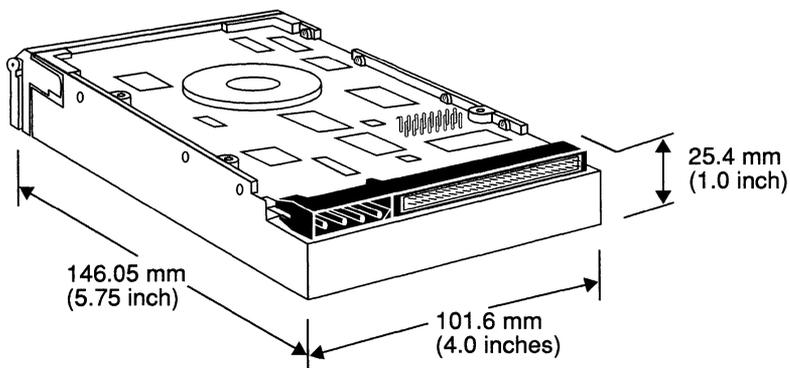
Per Cartridge	Potential
1.5 Gigabytes <sup>1</sup>	Unlimited in increments of 1.5 Gigabytes
<b>Note:</b> <sup>1</sup> 1 Gigabyte = 1 billion bytes	

**Table 3-2 Configuration**

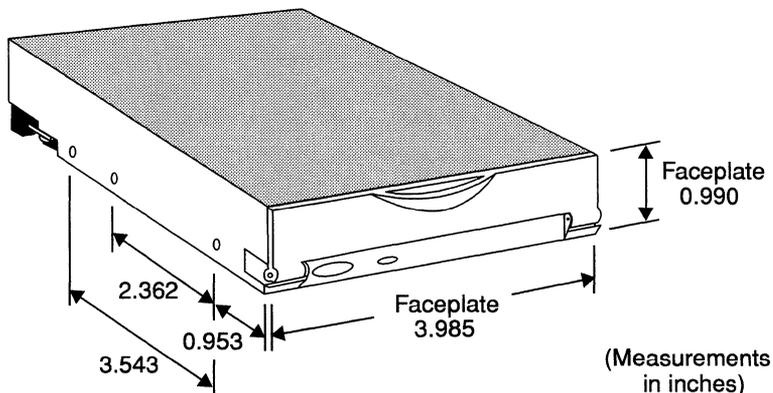
Cartridge-Removable	1
Data Heads	4
Data Surfaces	4
Servo	Embedded Sector

**Table 3-3 Physical Characteristics (internal drive)**

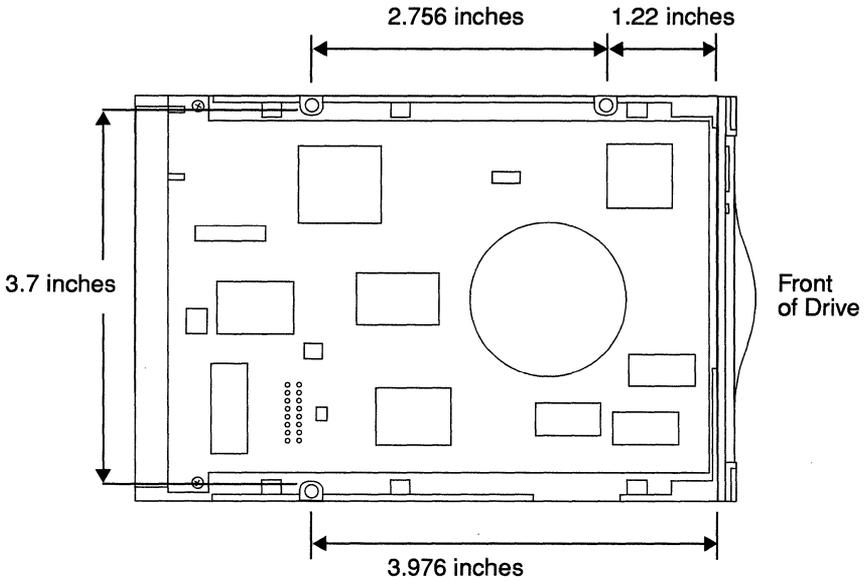
Height	1.0 inch (25.4 mm)
Length	5.75 inches (146.05 mm)
Width	4.0 inches (101.6 mm)
Weight	15 oz. (428.6 g)
Mounting (side)	6 side holes, #6-32 UNC-2B x 0.22 inch deep
Mounting for boot (bottom)	3 bottom holes, #6-32 UNC-2B x 0.16 inch deep



**Figure 3-1 Physical Dimensions of the SyJet Internal SCSI Drive (bottom, rear view)**



**Figure 3-2 Side Mounting Screw Hole Positions and Front Faceplate Dimensions of SyJet Internal SCSI Drive (top, front view)**



**Figure 3-3 Bottom Screw Hole Positions of SyJet Internal SCSI Drive for Mounting Boot (provided if you use a 5.25-inch mounting bay)**

**Table 3-4 Power Consumption**

<b>Mode</b>	<b>+5V <math>\pm 5\%</math> (avg/max) in Watts</b>	<b>+12V <math>\pm 5\%</math> (avg/max) in Watts</b>
Spin-up	2.9 / 3.5	7.5 / 9.0
Seeking	2.9 / 3.5	8 / 9.5
Read/Write	2.9 / 3.5	2.5 / 3.0
Standby Park	2.7 / 3.5	2.5 / 3.0
Ripple	100 mv peak to peak	100 mv peak to peak

## Performance

**Table 3-5 Buffer**

Buffer Size	512K bytes
-------------	------------

**Table 3-6 Seek Times (typical, including settling time)**

Track to Track	2 msec
Average	12 msec
Maximum	24 msec
Average Latency	5.55 msec
Rotational Speed ( $\pm 0.1\%$ )	5400 RPM

**Table 3-7 SCSI Data Transfer Rates (from buffer to host)**

Asynchronous	5 MB/sec
Synchronous	10 MB/sec

**Table 3-8 Sustained Read/Write Data Transfer Rates (Write-Verify Off)**

Maximum	6.9 MB/sec	Extreme OD Read large blocks
Minimum	3.7 MB/sec	Extreme ID Read large blocks
Average	5.6 MB/sec	Calculated average

**Table 3-9 Sustained Write Data Transfer Rates (Write-Verify On)**

Max/Min/Avg	1.5 MB/sec
-------------	------------

**Table 3-10 Spin Up and Spin Down**

Start Time-Spin Up-Ready (including purge and head-loading cycle)	14 sec typical
Stop Time-Spin down	9 sec typical (30 sec if no power)
Recovery from Sleep mode	9 sec

## Environmental Characteristics

**Table 3-11 Temperature (both internal and external)**

Operating	10°C to 40°C
Nonoperating	-40°C to 70°C, humidity non-condensing

**Table 3-12 Thermal Gradient**

Operating	20°C/hr maximum
Nonoperating	To below condensation

**Table 3-13 Relative Humidity**

Maximum	32° C (89° F) (max) wet bulb
Operating	8% to 90% noncondensing
Nonoperating	5% to 90% noncondensing

**Table 3-14 Altitude (relative to sea level)**

Operating	-1,000 to 10,000 ft (-305 to 3,048 m)
Nonoperating	-1,000 to 40,000 ft (-305 to 12,192 m)

**Table 3-15 Acoustical Noise (in an anechoic chamber)**

Seeking	45 dB maximum at 1 m
Idle	40 dBA maximum at 1 m
No cartridge present	0 dBA

**Table 3-16 Electromagnetic Field Immunity**

ESD	EN50082-1 IEC801-2 8KV discharge (1000-4-2)
Radiated Electric	IEC801-3 3V/m 27-1GHz (1000-4-3)
Fast Transients	IECV801-4 1kV mains, 500V other (1000-4-4)

**Table 3-17 Emissions**

FCC Radiated	Class B CFR47 Part 15 @ 3 m
CISPR Radiated	Class B @ 10 m EN55081-1
FCC Conducted	Class B 0.45-30 MHz/250mV
CISPR Conducted	Class B EN55022

**Table 3-18 Magnetic Field (1997 requirement)**

Radiated Susceptibility	IEC801-8 Limits (1000-4-8)
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# Reliability and Maintainability

**Table 3-19 Reliability and Maintainability**

MTBF	250,000 hours (POH)
Preventive Maintenance	Remove the cartridge completely after ejection, and keep the drive door closed.
Data Reliability	<1 nonrecoverable error in 10 <sup>12</sup> bits read, maximum
Drive Mechanism	20,000 cycles minimum (cartridge insertion and removal)

**Table 3-20 Shock (1/2 sine wave pulse at 11 msec)**

Operating (without nonrecoverable errors)	3 g, 11 msec, half sine (reading or writing)
Nonoperating	80 g, 11 msec, half sine (with cartridge removed)

**Table 3-21 Vibration**

Operating (without nonrecoverable errors)	8 - 10 Hz: 0.048 inch (double amplitude) 8 - 300 Hz: 0.2 g's (peak-to-peak) Sweep time: 1 octave/minute
Nonoperating	2 - 10 Hz: 0.4 inch (peak-to-peak) 10 - 500 Hz: 4 g's (peak-to-peak) Sweep time: 1 octave/minute

# The SyJet Cartridge

SyJet cartridge specifications include:

- Physical characteristics
- Environmental characteristics
- Data on reliability and maintainability

## Physical Characteristics

*Table 3-22 Capacity*

Capacity	Minimum: 1.5 Gigabytes Formatted: 512-byte sectors
----------	---

*Table 3-23 Configuration*

Number of Disks	2
Data Surfaces	4
Servo	Embedded Sector
Track Density	5,400 tracks per inch
Zones per Surface	16
Bytes per Block	512
Defects allowed	1000

*Table 3-24 Physical Characteristics (cartridge)*

Height	0.385 inch (9.78 mm)
Width	3.89 inch (98.81 mm)
Length	3.97 inch (100.84 mm)
Weight	3 oz. (85.7 g)

**Table 3-25 Physical Characteristics (cartridge cover)**

Height	0.70 inch (17.78 mm)
Width	5.16 inch (131.06 mm)
Length	4.95 inch (125.73 mm)
Weight	2.3 oz. (65.7 g)

## Environmental Characteristics

**Table 3-26 Shelf Storage**

Nonoperating	-40°C to 70°C, humidity non-condensing
Shelf Life	20 years

**Table 3-27 Shock**

Shock	20-inch (51.28 cm) drop to a linoleum floor (without physical damage or nonrecoverable data errors)
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## Reliability and Maintainability

**Table 3-28 Reliability and Maintainability**

Cartridge Insertion/Removal	10,000 cycles minimum
Preventive Maintenance	Keep the cartridge in its storage case when out of the drive, and do not open the cartridge door.

## Installation

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This chapter gives instructions for quickly installing internally mounted SyJet SCSI drives in PC-compatible systems.

For detailed installation instructions, see the *SyJet 1.5 GB Internal SCSI Installation Guide for PC Compatible Systems*.

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**NOTE:** Installation guides are also available for SyQuest's Macintosh model of the SyJet internal SCSI drive, and for the PC, Macintosh, and Parallel Port models of SyJet external (portable) SCSI drives.

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## Overview

The Small Computer Systems Interface (SCSI) is a 50-pin electrical interface that supports devices such as SCSI-compatible CD-ROMs, hard drives, scanners, tape drives, magneto optical (MO) drives, and so on.

PC-compatible systems require a SCSI port on the motherboard or a Host Bus Adapter (HBA) to run SCSI devices. The HBA is a printed circuit card that fits in one of your PC's expansion slots. Some SCSI HBAs add BIOS information at the end of the system BIOS information. If you are using such an HBA, your computer's drive letters may be rearranged when you install the SyJet SCSI drive.

Manufacturers of SCSI-ported motherboards and HBAs usually provide an Advanced SCSI Programming Interface (ASPI) Manager that is written for their hardware and specific operating systems. The ASPI Manager allows each SCSI device to communicate with the host computer through proprietary device drivers. The ASPI Manager must be installed before you can install SyQuest's device drivers for the SyJet SCSI drive.

Each SCSI device requires a unique SCSI ID to communicate with the host computer. SyQuest provides a CHKSCSI program to verify the presence of ASPI Manager software and to help you identify an available SCSI ID for the SyJet drive. You will use the SyJet drive's jumpers to set an appropriate SCSI ID.

Correct termination is required at each end of the SCSI Bus. Three possible device-termination configurations include:

- Terminating the HBA and the last internal SCSI device, with no external devices present
- Terminating the HBA and the last external SCSI device, with no internal devices present
- Terminating the last internal SCSI device and the last external SCSI device

If the SyJet drive occupies any of these internal-device positions, then you will also use the drive's jumpers to terminate the SCSI chain at the SyJet SCSI drive.

# Required Hardware

You need this hardware to install the internally mounted SyJet SCSI drive in a PC-compatible system:

- A 386™, 486™, or Pentium™ class desktop or tower computer
- A SCSI-ported motherboard or SCSI Adapter card (also known as the Host Bus Adapter) capable of accepting an additional SCSI device
- An available 50-pin connector on the SCSI interface cable
- An empty 3.5-inch or 5.25-inch mounting bay

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**NOTE:** If you intend to use an empty 5.25-inch mounting bay, you may need a drive mounting kit that is designed for your computer. SyJet SCSI drives mount directly into any 3.5-inch mounting bay.

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# Supported Software

SyQuest supports these operating systems with the SyJet SCSI drive:

- Windows 95 (all versions)
- Windows NT (all versions)
- Windows 3.1x
- OS/2 2.1 or higher
- PC-DOS 5.0 or MS-DOS 5.0 or higher
- Novell DOS 7.0 or higher

# Install the Drive

Use this procedure to install the internally mounted SyJet SCSI drive in a PC-compatible system.

For additional details, see the *SyJet 1.5 GB Internal SCSI Installation Guide for PC Compatible Systems*.

## 1. Run SyQuest's CHKSCSI program.

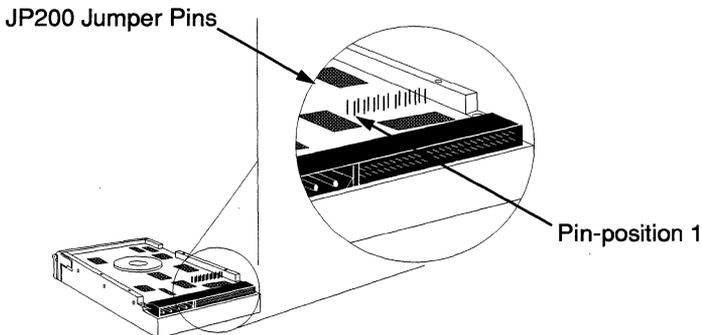
Use the CHKSCSI program on the *SyQuest Installation Diskette* to verify the presence of ASPI Manager software and identify available SCSI IDs on your computer.

## 2. Select a SCSI ID for the SyJet drive.

The SyJet drive's jumpers are configured for SCSI ID 4 by default. If SCSI ID 4 is available on your computer, you can leave the SyJet drive's jumpers as is and go to step 3.

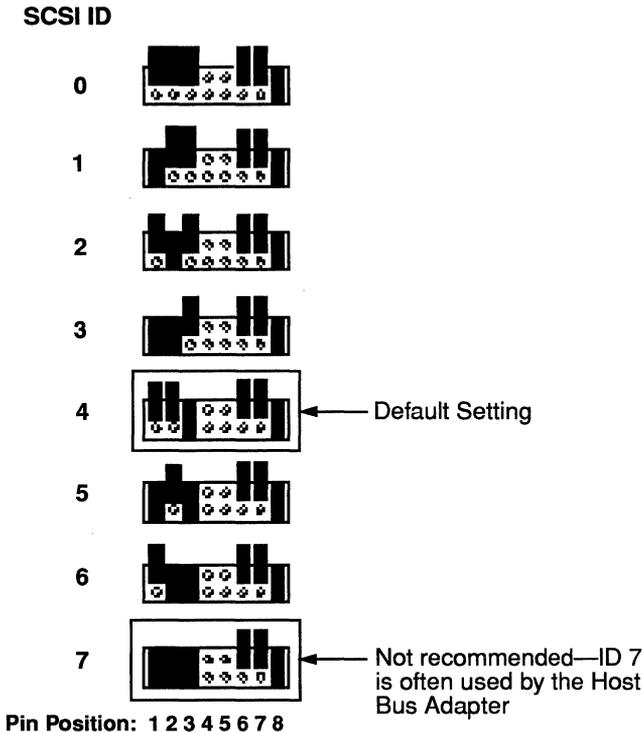
If you must select a SCSI ID other than 4 for the SyJet drive, use jumper pin-positions 1, 2 and 3 to set the SCSI ID.

Figure 4-1 shows the location of the JP200 jumper pins and pin-position 1.



**Figure 4-1** Location of the JP200 Jumper Pins

Figure 4-2 shows how to set jumpers at pin-positions 1, 2, and 3 to select a SCSI ID of 0, 1, 2, 3, 4 (the default), 5, or 6.



**Figure 4-2** SCSI ID Jumper Settings

**NOTE:** The jumpers at pin-positions 6 and 7 are spares. Optionally, use one of these jumpers to connect the pins at pin-position 4 if you wish to enable SCSI parity checking. The default setting—no jumper present at pin-position 4—is SCSI parity checking *disabled*. The jumper at pin-position 8 is discussed in step 6.

**3. Power down and open your computer.**

**4. Verify your SCSI configuration.**

Assess the locations of all internal SCSI devices on the 50-pin interface cable that extends from your SCSI-ported motherboard or SCSI Adapter card. The SCSI interface cable measures about 2.5 inches (six centimeters) in width.

If your existing hard drive is a SCSI device, it most likely connects to a SCSI port on your motherboard. If your hard drive is an EIDE device, it uses a 40-pin interface cable about two inches (five centimeters) in width. Look instead for the presence of a SCSI Adapter card.

**5. Decide where to connect the SyJet drive.**

Locate an unused 3.5-inch or 5.25-inch mounting bay that can be reached by an available 50-pin connector on the SCSI interface cable.

To install the SyJet drive in a 5.25-inch mounting bay, you need SyQuest's mounting boot. You may also need a drive mounting kit that is designed for your computer.

If there is no SCSI interface cable in your computer, or there is not an available 50-pin connector for the SyJet drive, you will need to obtain an appropriate cable.

**6. Terminate the SyJet drive if it is the last or only internal SCSI device on the SCSI interface cable.**

This usually requires that you also *unterminate* any SCSI device that was previously the last or only SCSI device on the SCSI interface cable. Possible device-termination configurations are explained on page 4-2.

To *terminate* the SyJet drive, remove the jumper at pin-position 8. See Figure 4-2 for the location of this jumper.

If you connect the SyJet between an existing SCSI device and the SCSI Adapter Card or motherboard, simply retain the *terminated* status of the existing SCSI device(s). Leave the SyJet drive *unterminated*, its default status, with the jumper in place at pin-position 8.

**7. Prepare a mounting bay and the required cabling.**

Remove the cover from the unused 3.5-inch or 5.25-inch mounting bay that you have selected. Install an appropriate SCSI interface cable if there is no existing cable, or if you need an extra connector for the SyJet drive.

**8. Mount the SyJet drive in the mounting bay.**

Slide the SyJet drive (or assembled mounting boot and drive) into the mounting bay. Verify that the selected cable connector reaches. Secure the drive (or assembled mounting boot and drive) to the mounting bay while aligning the front of the drive with your other devices.

**9. Connect the SCSI interface cable and DC power cable to the SyJet drive.**

Check that all cables are attached securely.

**10. Close and power up your computer.**

**11. Verify your SyJet drive installation.**

Slide the SyJet cartridge all the way into the drive, pressing the cartridge firmly until it drops and seats in place.

- If the drive was properly installed, it should spin up the cartridge while the Drive Activity LED flickers yellow, then finally glows green indicating *ready*. Go to step 14.
- If your computer hangs, reports a SCSI BIOS error, or reports a hard-disk configuration error after a long delay, go to step 13.
- If you see ongoing green or red LED flashes, go to step 12.

**12. Troubleshooting: check firmware-detected problems.**

- a. Recycle the computer's power and reinsert the SyJet cartridge.**
- b. Observe the SyJet drive's power-up sequence.**
- c. If LED flashes persist, note the flash code.**

A flash code containing green LED flashes means the drive firmware detected an error *after* completing the Self Test at power up.

A flash code containing red LED flashes means the drive firmware detected one of several possible errors *during* Self Test. The flashing sequence repeats continuously with a wait period of two seconds between each sequence. Table 4-1 shows the number of red LED flashes corresponding to each type of error and the action required.

***Table 4-1 Flash Codes for Power-Up Sequence***

<b>Flash Code</b>	<b>Number of Red Flashes</b>	<b>Type of Firmware-Detected Error</b>	<b>Action Required</b>
01	1	Flash Check Sum Error	Download firmware
02	2	External Ram Error	Replace unit
03	3	Buffer Test Error	Replace unit
04	4	Sequencer Error	Replace unit

- d. Call SyQuest Technology's OEM/VAR Technical Support for assistance.**

**13. Troubleshooting: check jumpers and external hardware for problems.**

**a. Recycle the computer's power and reinsert the SyJet cartridge.**

**b. If the error occurs again or the computer hangs, check the following:**

Verify jumper settings and all cabling. To resolve suspected cable problems, you can enable SCSI parity checking for all SCSI devices in your computer if your SCSI Adapter supports this feature. To enable SCSI parity checking on the SyJet drive, see the note on page 4-5 for instructions.

Run your SCSI Adapter's diagnostic program to verify that your SCSI Adapter is functioning properly.

**c. If the problem persists, call SyQuest Technology's OEM/VAR Technical Support for assistance.**

**14. Install the SyQuest device driver and utilities.**

See the *SyJet 1.5 GB Internal SCSI Installation Guide for PC Compatible Systems* for details.



## SCSI Interface Protocol

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This chapter describes the SCSI interface protocol between PC host systems and SyJet SCSI disk drives:

- The standard used
- The data bus
- The Command Descriptor Block
- Physical and electrical characteristics
- Signal characteristics
- General operational requirements
- Self-Test routines
- Sense Key and Error Code descriptors
- Message definitions
- Command completion status
- Timing measurements

See Chapter 6 for SyJet SCSI command descriptions.

# The Standard

The SyQuest SyJet drive complies fully with the SCSI standard as defined in the ANSI SCSI-2 Standard X3.131-1994 and, where applicable, in the SCSI-3 Standards X3T10/996-D, X3T10/995-D and X3T10/885-D.

# The Data Bus

SCSI is a 16-bit parallel data bus that is supported by a machine-independent message and command protocol. This independence allows SCSI devices to be connected regardless of the manufacturer.

A maximum of eight devices can connect to a SCSI bus. Only two devices may use the bus at any one time, one initiator and one target. An initiator device sends commands to other devices: a computer is an example of an initiator device. A target device executes commands sent from other devices: the SyJet drive an example of a target device.

Each device on the bus contains a SCSI controller that provides all the bus management functions necessary to arbitrate and select the bus and handle the SCSI protocol.

Commands sent from an initiator (usually the host computer) access and control peripheral devices. The ANSI SCSI-2 Standard X3.131-1994 defines a specific library of SCSI commands. The standard also permits manufacturers to create a number of vendor-specific commands.

The actual execution of the command depends on the code in the target device firmware. The result of a command given by two different devices will be the same if the devices are of the same type (for example, two hard disk drives from different manufacturers); that is, devices of the same type may accomplish their work differently, but what they return to the initiator must be the same.

The exchange of messages, commands, and transfer data across the SCSI bus occurs during one of the bus phases. There are eight (8) phases in SCSI. Specific activities take place during each phase, and any software that controls SCSI devices (for example a device driver) must be able to determine which phase is currently executing on the bus.

The devices resident on the SCSI bus connect in a daisy-chain configuration. The ANSI SCSI-2 Standard X3.131-1994 also provides the standard for the connecting cables. Table 5-1 provides concise definitions for the SCSI bus signal lines.

# The Command Descriptor Block

To initiate a command, the host sends a Command Descriptor Block (CDB) to the SyJet drive. For some commands, the CDB is accompanied by a list of parameters sent during the DATA OUT phase. The CDBs may be 6, 10, or 12 bytes in length. All reserved fields must be set to zero.

The first, second, and last bytes are used as follows:

- The first byte of each SCSI command contains an operation code.
- The second byte of each command contains the Logical Unit Number (LUN) in bits 5, 6, and 7.

The LUN should be set to zero. The SyJet drive will ignore the LUN specified within the CDB if an identify message was received.

- The last byte of each command contains the control field.

Bit one of the control field is the Flag bit. The Flag bit specifies which message the SyJet drive will return to the host if the Link bit is one and the command completes without error. The Flag bit should be set to zero if the link bit is zero.

Bit zero of the control field is the Link bit. The Link bit is used to continue the I/O process across multiple commands. If the Link bit is one, and if the command completes successfully, the SyJet drive will return to INTERMEDIATE status and send one of the messages defined by the Flag bit.

# Physical/Electrical Characteristics

This section describes the following:

- The 50-pin interface connector and 4-pin DC power connector
- Jumper configurations
- Cable configuration
- SCSI I/O cable requirements
- DC and AC characteristics of the interface signals

## The 50-Pin and 4-Pin Connectors

The 50-pin J2 connector includes nine (9) control signals and nine (9) data signals. Table 5-1 lists the SCSI signals and their pin assignments.

**Table 5-1 50-Pin Connector Interface Signals**

Signals	J2 Pin	Comment
Busy (BSY)	36	An “or-tied” signal which indicates that the bus is in use.
Select (SEL)	44	A signal used by an Initiator to select the SyJet drive or by the drive to reselect an Initiator.
Control/Data (C/D)	46	A signal driven by the SyJet drive. It indicates whether Control or Data Information is on the data bus. True indicates Control.
Input/Output (I/O)	50	A signal driven by the SyJet drive which controls the direction of data flow on the data bus, with respect to an Initiator. True indicates input to the Initiator.
Message (MSG)	42	A signal driven by the SyJet drive during the message phase.

**Table 5-1 50-Pin Connector Interface Signals (Continued)**

Signals	J2 Pin	Comment
Request (REQ)	48	A signal driven by a target to indicate a request for a REQ/ACK data transfer handshake.
Acknowledge (ACK)	38	A signal driven by an Initiator to indicate an acknowledgment for a REQ/ACK data transfer handshake.
Attention (ATN):	32	A signal driven by an Initiator to indicate the attention condition.
Reset (RST):	40	An "or-tied" signal which indicates the reset condition.
Data 0-7	2-16 (even)	The data lines.
Data Parity	18	An odd parity bit for the data lines.
Terminator Power	26	5 volt power provided through 1 Amp Schottky Diode and used as the source for the terminating resistors.

**Notes:**

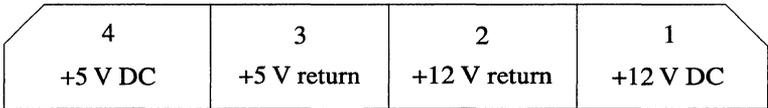
Pin 25 is left open. All other odd pins and even pins 20, 22, 24, 28, 30 and 34 are connected to ground. All signals are low true.

When the SyJet drive is connected to the 50-pin interface cable, the drive receives DC power through the 4-pin DC power connector. Table 5-2 identifies the power-line voltage for each pin of the 4-pin connector:

**Table 5-2 DC Interface Using 4-Pin Power Connector**

Power-Line Designation	Pin Number
+12 Volts	1
+12 Volt return	2
+5 Volt return	3
+5 Volts	4

Figure 5-1 shows the drive-side connector pin numbering:



**Figure 5-1 Drive-side Connector Pin Numbering**

## Jumper Configurations

The SyJet drive's JP200 jumper pins control SCSI ID settings, parity checking, and drive termination. Figure 4-1 on page 4-4 shows the location of the JP200 jumper pins and pin-position 1.

### **SCSI IDs**

Jumper pin-positions 1, 2, and 3 set the appropriate SCSI ID. The drive's jumpers are configured for SCSI ID 4 by default. Figure 4-2 on page 4-5 shows the jumper settings for selecting a SCSI ID of 0, 1, 2, 3, 4 (the default), 5, or 6.

### **Parity Checking**

The jumpers at pin-positions 6 and 7 are spares. Optionally, use one of these jumpers to connect the pins at pin-position 4 if you wish to enable SCSI parity checking. This setting can help you troubleshoot any suspected cabling problem. The default setting—no jumper present at pin-position 4—is SCSI parity checking *disabled*.

### **Drive Termination**

Pin-position 8 controls drive termination. Figure 4-2 on page 4-5 shows a jumper in place at this pin position. This is the drive's default setting—*unterminated*. To *terminate* the SyJet drive, remove the jumper at pin-position 8.

## Cable Configuration

The SyJet drive electrical specification consists of a SCSI bus cable and a power cable. The SCSI bus is connected to the SyJet drive by an ANSI-standard SCSI signal connector and cable.

## SCSI I/O Cable Requirements

The cable specification affects system-data integrity:

- The cable's total length must not exceed 6.0 m.
- The cable's capacitance must not exceed 35 pf.
- The cable's impedance must not exceed 132 ohms, with a minimum conductor size of 28 AWG.

## DC and AC Characteristics

Table 5-3 defines DC characteristics of the interface signals:

*Table 5-3 DC Characteristics*

Description		Min	Max
$I_{oL}$	Driver sink current	0.4 A	
$I_{oH}$	Driver source current	48 mA	
$V_{iH}$	Voltage input high	2.0 V DC	
$V_{iL}$	Voltage input low		0.8 V DC
$V_{oH}$	Voltage output high ( $I_{oH} = -400 \mu\text{A}$ )	2.5 V DC	
$V_{oL}$	Voltage output low ( $I_{oL} = 12 \text{ mA}$ )		0.4 V DC

Table 5-4 defines AC characteristics of the interface signals:

**Table 5-4 AC Characteristics**

Description		Min	Max
tRISE	Rise time for any signal on AT interface <sup>1</sup>	5 ns	
tFALL	Fall time for any signal on AT interface <sup>1</sup>	5 ns	
Cin	Host input capacitance		25 pf
Cout	Host output capacitance		25 pf
Cin	SyJet input capacitance		20 pf
Cout	SyJet output capacitance		20 pf
<b>Note:</b>			
<sup>1</sup> tRISE and tFALL are measured from 10 - 90% of full signal amplitude with a total capacitive load of 40 pf.			

## Signal Characteristics

Signals may assume either true or false values, as shown in Table 5-5. There are two methods of driving these signals. In both cases, the signal must be actively driven true.

In the case of the “or-tied” drivers, the driver does not drive the signal to the false state, instead, the bias circuitry of the 220/300 bus terminators pulls the signal false whenever it is “released” (not driven by the drivers at every drive).

In the case of the “non or-tied” driver, the signal may be actively driven false, or the bias circuitry will pull it false when the signal is “released.”

The BSY and RST signals are “or-tied.” In the ordinary operation of the bus, these signals are simultaneously driven true by several drivers. No other signals are simultaneously driven by two or more drivers. Any signals, other than BSY and RST, may employ “or-tied” or “non or-tied” drivers. There is no operational problem in mixing “or-tied” or “non or-tied” drivers on the same signal.

**Table 5-5 Signal Levels**

	Input Voltage	Input Current	Output Voltage	Output Current
<b>True</b>	0.0–0.8 VDC	0.4A	0.0–0.4 VDC	48 mA
<b>False</b>	2.0–5.25 VDC	—	2.5–5.25 VDC	—

**Notes:**

Input current with terminators is + 22 MA max.

## SCSI Signal Sources

Table 5-6 indicates which type of device is allowed to source each signal. No attempt is made to show if this source is driving asserted, non-asserted, or passive. All device drivers that are not active sources will be in the passive state. Note that the RST signal may be sourced by any device.

**Table 5-6 SCSI Signal Sources**

BUS PHASE	BSY	SEL	C/D, I/O MSG, REQ	ACK/ATN	DB (7-0,P)
Bus Free	None	None	None	None	None
Arbitration	All	Winner	None	None	SCSI ID
Selection	I&T	Initiator	None	Initiator	Initiator
Reselection	I&T	Drive	Drive	Initiator	Drive

**Table 5-6 SCSI Signal Sources (Continued)**

BUS PHASE	BSY	SEL	C/D, I/O MSG, REQ	ACK/ATN	DB (7-0,P)
Command	Drive	None	Drive	Initiator	Initiator
Data In	Drive	None	Drive	Initiator	Drive
Data Out	Drive	None	Drive	initiator	Initiator
Status	Drive	None	Drive	Initiator	Drive
Message In	Drive	None	Drive	Initiator	Drive
Message Out	Drive	None	Drive	Initiator	Initiator

**ALL:** The signal will be driven by all drives that are actively arbitrating.

**SCSI ID:** A unique data bit (the SCSI ID) must be driven by each SCSI drive that is actively arbitrating. The other seven data bits must be released, i.e., not driven by this device.

**I & T:** The signals are driven by the Initiator and/or the SyJet drive as specified in the Arbitration and Selection phases.

**INITIATOR:** If this signal is driven, it may only be driven by the active Initiator.

**NONE:** This signal must be released, i.e., not driven by any SCSI device. The bias circuitry of the bus terminator pulls the signal to the false state.

**WINNER:** This signal must be driven by the one drive that wins Arbitration.

**TARGET:** If this signal is driven, it will be driven only by an active SyJet drive.

# General Operational Requirements

This section describes the following:

- Reset responses
- The removable media feature set

## Reset Responses

The interface supports three types of reset responses:

**Power-On Reset.** Executed at power on, the SyJet drive runs a series of circuitry diagnostics, spins up the HDA, tests speed and other mechanical parameters, and sets default values.

**Hardware Reset.** Executed in response to the assertion of RESET-, the SyJet drive runs a series of electrical circuitry diagnostics and resets to default values.

**Software Reset.** Executed in response to the setting of the SRST bit in the Device Control register, the SyJet drive resets the interface circuitry.

## Removable Media Feature Set

The removable media feature set includes these commands to support the insertion and removal of media:

- Door Lock
- Door Unlock

This command set works with a variety of host PC systems. Host systems vary in level of acknowledgment for the existence of removable media disk drives such as the SyJet.

See “Prevent/Allow Medium Removal (1EH)” on page 6-77 for more details.

# Self-Test Routines

The SyJet drive firmware resides in the Flash ROM mounted on the main logic board. The firmware contains all the routines necessary to execute the supported SCSI commands, run the microcontroller, and perform the self-test routines. The SCSI commands are described in Chapter 6 of this manual. The self-test power-up test routine is described in this section.

## Power-Up Test

When power is applied to the drive, the start-up routines in the SyJet drive Flash ROM execute a series of tests on the drive's electronic components to establish the readiness of the drive.

The first test is a checksum operation on the SyJet drive Flash ROM. If this test passes, a series of reads and writes test the microcontroller registers, internal RAM, and scratch pad RAM. When these tests are completed and passed by the microcontroller, a read/write test is performed on the buffer RAM. After completion of this test, the drive performs a series of self-calibration routines and then becomes ready.

## Self-Test Routine Error Reporting

The SyJet drive provides failure error information for its power-up sequence through an LED on the drive's front panel. The Error Codes are displayed as a sequence of red flashes. The flashing sequence will repeat continuously with a wait period of two seconds between each sequence.

Table 5-7 shows the number of red LED flashes corresponding to the binary value of each flash code and the action required.

**Table 5-7 Flash Codes for Power-Up Sequence**

Flash Code	Number of Red Flashes	Type of Firmware-Detected Error	Action Required
01	1	Flash Check Sum Error	Download firmware
02	2	External Ram Error	Replace unit
03	3	Buffer Test Error	Replace unit
04	4	Sequencer Error	Replace unit

## Sense Key and Error Code Descriptors

Sense-key indications and error-code descriptions follow.

### Sense Keys

**Table 5-8 Sense Keys (0-7)**

Sense Keys		Description
0H	NO SENSE	Indicates that there is no specific Sense Key information to be reported for the designated unit.
1H	RECOVERED ERROR	Indicates that the last command was successfully completed with some recovery action performed by the SyJet drive. Details can be determined by examining the Additional Sense bytes and the Information bytes.

**Table 5-8 Sense Keys (0-7) (Continued)**

Sense Keys		Description
2H	NOT READY	Indicates that the SyJet drive cannot be accessed. Operator intervention may be required to correct this condition.
3H	MEDIUM ERROR	Indicates that the command terminated with a non recovered error condition which was probably caused by a flaw in the medium or an error in the recorded data.
4H	HARDWARE ERROR	Indicates that the SyJet drive detected a non-recoverable hardware failure (controller failure, device failure etc.) while performing the command or during a self-test.
5H	ILLEGAL REQUEST	Indicates that there was an illegal parameter in the Command Descriptor Block or in the additional parameters supplied as data for some commands.
6H	UNIT ATTENTION	Indicates that a reset Mode Select changed or a medium change has occurred since the last selection by this Initiator.
7H	DATA PROTECT	Indicates that a Write operation was attempted on a cartridge with Write Protect active.
8H	BLANK CHECK	Not supported.
9H	VENDOR UNIQUE	SyQuest-unique Code.
AH	COPY ABORTED	Not supported.
BH	ABORTED COMMAND	Indicates that the SyJet drive aborted the command. The Initiator may attempt a retry.
CH	EQUAL	Not supported.
DH	VOLUME OVERFLOW	Not supported.
EH	MISCOMPARE	Indicates that data comparison failed.
FH	Reserved	This sense key is reserved.

## Error Codes

**Table 5-9 Additional Sense Codes/Qualifiers**

<b>SK</b>	<b>ASC</b>	<b>ASCQ</b>	<b>Description</b>
0	00	00	No Additional Sense Information
	00	06	I/O Process Terminated
4	01	00	No Index/Sector Signal
4	02	00	No Seek Complete
4	03	00	Peripheral Device Write Fault
2	04	00	Logical Unit Not Ready, Cause Not Reportable
	04	01	Logical Unit is in Process Of Becoming Ready
	04	02	Logical Unit Not Ready, Initializing Command Required
	04	03	Logical Unit Not Ready, Manual Intervention Required
	04	04	Logical Unit Not Ready, Format In Progress
	05	00	Logical Unit Does Not Respond to Selection
	06	00	Reference Position Found
4	07	00	Multiple Peripheral Devices Selected
	08	00	Logical Unit Communication Failure
	08	01	Logical Unit Communication Time Out
	08	02	Logical Unit Communication Parity Error
4	09	00	Track Following Error
4	09	3	Spindle Speed Error
	0A	00	Error Log Overflow
	0B	00	Reserved
	0C	00	Reserved
	0C	01	Write Error–Recovered with Auto Reallocation

**Table 5-9 Additional Sense Codes/Qualifiers (Continued)**

<b>SK</b>	<b>ASC</b>	<b>ASCQ</b>	<b>Description</b>
	0C	02	Write Error--Auto Reallocation Failed
	0D	00	Reserved
	0E	00	Reserved
	0F	00	Reserved
3	10	00	ID CRC OR ECC Error
3	11	00	Unrecovered Read Error
	11	02	Error Too Long to Correct
	11	03	Multiple Read Errors
	11	04	Unrecovered Read Error - Auto Reallocate Failed
	11	05	Reserved
	11	06	Reserved
	11	07	Reserved
	11	08	Reserved
	11	09	Reserved
	11	0A	Miscorrected Error
	11	0B	Unrecovered Read Error - Recommend Reassignment
	11	0C	Unrecovered Read Error - Recommend Rewrite The Data
3	12	00	Address Mark Not Found for ID Field
3	13	00	Address Mark Not Found For Data Field
3	14	00	Record Entity Not Found
	14	01	Record Not Found
4	15	00	Random Positioning Error
	15	01	Mechanical Positioning Error
	15	02	Positioning Error Detected by Read of Medium

**Table 5-9 Additional Sense Codes/Qualifiers (Continued)**

<b>SK</b>	<b>ASC</b>	<b>ASCQ</b>	<b>Description</b>
	16	00	Synchronization Mark Error
1	17	00	Recovered Data with No Error Correction Applied
	17	01	Recovered Data with Retries
	17	02	Recovered Data with Positive Head Offset
	17	03	Recovered Data with Negative Head Offset
	17	05	Recovered Data using Previous Sector ID
	17	06	Recovered Data without ECC - Data Auto_reallocated
	17	07	Recovered Data without ECC - Recommend Reassignment
	17	08	Recovered Data without ECC - Recommend Rewrite
1	18	00	Recovered Data with Error Correction Applied
	18	01	Recovered Data with Error Correction & Retries Applied
	18	02	Recovered Data - Data Auto_reallocated
	18	03	Reserved
	18	04	Reserved
	18	05	Recovered Data - Recommend Reassignment
	18	06	Recovered Data - Recommend Rewrite
3	19	00	Defect List Error
	19	01	Defect List Not Available
	19	02	Defect List Error in Primary List
	19	03	Defect List Error in Grown List
5	1A	00	Parameter List Length Error
4	1B	00	Synchronous Data Transfer Error

**Table 5-9 Additional Sense Codes/Qualifiers (Continued)**

<b>SK</b>	<b>ASC</b>	<b>ASCQ</b>	<b>Description</b>
3	1C	00	Defect List Not Found
	1C	01	Primary Defect List Not Found
	1C	02	Grown Defect List Not Found
E	1D	00	Miscompare During Verify Operation
	1E	00	Recovered ID with ECC
	1F	00	Reserved
5	20	00	Invalid Command Operation Code
5	21	00	Logical Block Address Out of Range
5	22	00	Illegal Function
	23	00	Reserved
5	24	00	Invalid Field in CDB
5	25	00	Logical Unit Not Supported
5	26	00	Invalid Field in Parameter List
5	26	01	Parameter Not Supported
5	26	02	Parameter Value Invalid
	26	03	Threshold Parameters Not Supported
7	27	00	Write Protected
6	28	00	Not Ready to Ready Transition (Medium may have changed)
6	29	00	Power On Reset, or Bus Device Reset Occurred
6	2A	00	Parameters Changed
	2A	01	Mode Parameters Changed
	2A	02	Log Parameters Changed
	2B	00	Copy cannot Execute Since Host Cannot Disconnect
	2C	00	Command Sequence Error

**Table 5-9 Additional Sense Codes/Qualifiers (Continued)**

<b>SK</b>	<b>ASC</b>	<b>ASCQ</b>	<b>Description</b>
	2D	00	Reserved
	2E	00	Reserved
6	2F	00	Commands Cleared by Another Initiator
2	30	00	Incompatible Medium Installed
3	30	01	Cannot Read Medium - Unknown Format
	30	02	Cannot Read Medium - Incompatible Format
3	31	00	Medium Format Corrupted
	31	01	Format Command Failed
3	32	00	No Defect Spare Location Available
	32	01	Defect List Update Failure
	33	00	Reserved
	34	00	Reserved
	35	00	Reserved
	36	00	Reserved
	37	00	Rounded Parameter
	38	00	Reserved
5	39	00	Saving Parameters Not Supported
2	3A	00	Medium Not Present
	3B	00	Reserved
	3C	00	Reserved
5	3D	00	Invalid Bits in Identify Message
	3E	01	Logical Unit Has Not Self Configured Yet
	3F	00	Target Operating Conditions Have Changed
	3F	01	Micro Code Has Been Changed
	3F	02	Changed Operating Definition

**Table 5-9 Additional Sense Codes/Qualifiers (Continued)**

<b>SK</b>	<b>ASC</b>	<b>ASCQ</b>	<b>Description</b>
	3F	03	Inquiry Data Has changed
4	40	00	RAM Failure
	41	00	Data Path Failure
4	42	00	Power On or Self Test Failure
4	43	00	Message Error
4	44	00	Internal Target Failure
4	45	00	Select or Reselect Failure
4	46	00	Unsuccessful Soft Reset
4	47	00	SCSI Parity Error
4	48	00	Initiator Detected Error Message Received
5	49	00	Invalid Message Error
	4A	00	Command Phase Error
	4B	00	Data Phase Error
	4C	00	Logical Unit Failed Self Configuration
	4D	00	Reserved
B	4E	00	Overlapped Commands Attempted
	4F	00	Reserved
	50	00	Reserved
	51	00	Reserved
	52	00	Reserved
	53	00	Media Load or Eject Failed
	53	01	Reserved
6	53	02	Medium Removal Prevented
	54	00	Reserved
	55	00	Reserved

**Table 5-9 Additional Sense Codes/Qualifiers (Continued)**

SK	ASC	ASCQ	Description
	56	00	Reserved
	57	00	Reserved
	58	00	Reserved
	59	00	Reserved
4	5A	00	Operator Request or State Change Input (Unspecified)
	5A	01	Operator Medium Removal Request
	5A	02	Operator Selected Write Protect
	5A	03	Operator Selected Write Permit
	5B	00	Log Exception
	5B	01	Threshold Condition Met
	5B	03	Log-List Codes Exhausted
	5C	00	RPL Status Change
	5C	01	Spindles Synchronized
	5C	02	Spindles Not Synchronized
	5D-7F	XX	Reserved
	80-FF	XX	Vendor Specific
	XX	80-FF	Vendor Specific Qualification of Standard ASC

**Notes:**

SK: Sense Key, Sense Byte 2 (listed only if code is implemented)

ASC: Additional Sense Code, Sense Byte 12

ASCQ: Additional Sense Code Qualifier, Sense Byte 13



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**NOTE:** Many ASCQs used by the SyJet drive are not listed in Table 5-9.

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# Message Definitions

*Table 5-10 Message Codes*

Byte12	Description	Direction
00H	Command Complete	In
01H	Extended Message	In/Out
02H	Save Data Pointer	In
03H	Restore Pointer	In
04H	Disconnect	In
05H	Initiator Detected Error	Out
06H	Abort	Out
07H	Message Reject	In/Out
08H	No Operation	Out
09H	Message Parity Error	Out
0AH	Linked Command Complete	In
0BH	Linked Command Complete (with flag)	In
0CH	Bus Device Reset	Out
0DH	Abort Tag	Out
0EH	Clear Queue	Out
1AH	Terminate I/O Process	Out
20H	Simple Queue Tag	In/Out
21H	Head of Queue Tag	Out
22H	Ordered Queue Tag	Out
80H – FFH	Identify	In/Out

**Notes:**

In = SyJet drive to Initiator

Out = Initiator to SyJet drive

Single-byte messages from Table 5-10 are listed below.

**Command Complete 00H:** Sent from the SyJet drive to an Initiator to indicate that the execution of a command or series of linked commands has terminated and that valid status has been sent to the Initiator. After successfully sending this message the SyJet drive will go to the Bus Free phase.



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**NOTE:** The command may have been executed successfully or unsuccessfully as indicated in the status.

---

**Extended Message 01H:** This message is sent from either the SyJet drive or the Initiator as the first byte of a multiple-byte message.

**Save Data Pointer 02H:** This message is sent from the SyJet drive to direct the Initiator to save a copy of the presently active data pointer.

**Restore Pointers 03H:** This message is sent from the SyJet drive to direct the Initiator to restore the most recently saved pointer to the active state. This message is implied during reconnect.

**Disconnect 04H:** Sent from the SyJet drive to inform an Initiator that the present physical path is going to be broken (the SyJet drive will disconnect by releasing BSY) but that a later reconnect will be required in order for the SyJet drive to complete the current operation. The SyJet drive does not support a DISCONNECT message sent from an Initiator and will respond to a DISCONNECT message by sending a MESSAGE REJECT message to the Initiator.



**NOTE:** When DISCONNECT messages are used to break a long data transfer into two or more shorter transfers the SyJet drive will issue a SAVE DATA POINTER message before each DISCONNECT message.

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**Initiator Detected Error 05H:** This message is sent from an Initiator to inform the SyJet drive that an error (e.g., parity error) has occurred that does not preclude retries.

**Abort 06H:** The message is sent from the Initiator to the SyJet drive to clear the present operation. All pending data and status for the issuing Initiator will be cleared and the SyJet drive will go to the Bus Free phase. No status or ending message will be sent for the operation.



**NOTE:** It is permissible for an Initiator to select the SyJet drive while the SyJet drive is disconnected for the purpose of sending this message.

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**Message Reject 07H:** This message is sent from either the Initiator or the SyJet drive to indicate that the last message received was inappropriate or has not been implemented.

**No Operation 08H:** No operation.

**Message Parity Error 09H:** This message is sent from the Initiator to the SyJet drive to indicate that one or more bytes in the last message it received had a parity error.

In order to indicate its intentions of sending this message the Initiator will assert the ATN signal prior to its release of ACK for the REQ/ACK handshake of the message that has the parity error.

**Linked Command Complete 0AH:** Sent from the SyJet drive to an Initiator to indicate that the execution of a linked command has completed and that status has been sent.

**Linked Command Complete (with flag) 0BH:** Sent from the SyJet drive to an Initiator to indicate that the execution of a linked command (with the Flag set) has completed and status has been sent.

**Bus Device Reset 0CH:** This message can be sent from an initiator to direct the SyJet drive to reset all current commands. This message forces the SyJet drive to an initial state with no operations pending for any Initiator. Upon recognizing this message the SyJet drive will go to the Bus Free phase.

**Abort Tag 0DH:** This message is sent from the initiator to the SyJet drive to clear the current I/O process. The SyJet drive will go to the BUS FREE phase following successful receipt of this message.

**Clear Queue 0EH:** This message is sent from the initiator to the SyJet drive to indicate that all I/O processes, from all initiators, in the queue for the specified logical unit will be cleared from the queue. All active I/O processes will be terminated. The SyJet drive will go to the BUS FREE phase following successful receipt of this message.

**Terminate IO Process 11H:** This message is sent from the initiator to the SyJet drive to terminate the current I/O process. If the current I/O process involves a data phase, the SyJet drive will set the valid bit in the sense data to one, and set the information field to the difference between the number of bytes successfully transferred and the requested length.

**Simple Queue Tag 20H:** This message is sent from the initiator to specify that the I/O process be placed in the command queue. This message is sent immediately following the Identify message and must be followed by a valid queue tag identifier message. This message is also sent by the SyJet drive whenever it reconnects to an initiator to continue a tagged I/O process.

**Head of Queue Tag 21H:** This message is sent from the initiator to specify that the I/O process be placed first in the command queue. An I/O process already being executed by the SyJet drive will not be preempted. A subsequent process received with a Head of Queue Tag message will be placed at the head of the command queue for execution in last-in, first-out order. This message is sent immediately following the Identify message, and must be followed by a valid queue tag identifier message.

**Ordered Queue Tag 22H:** This message is sent from the initiator to specify that the I/O process be placed in the command queue for execution in the order received. All queued I/O processes received prior to this process will be executed before this process is executed. All queued I/O processes received after this process will be executed after this process, except for the processes received with a Head of Queue Tag message. This message is sent immediately following the Identify message and must be followed by a valid queue tag identifier message.



**NOTE:** It is permissible for an Initiator to select the SyJet drive while the SyJet drive is disconnected for the purpose of sending this message.

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**Reserved 24 H to 7FH:** Not defined. Reserved for future use.

**Identify 80H to FFH:** This message can be sent by either the Initiator or SyJet drive. It is used to establish the physical path connection between an Initiator and Target.



**NOTE:** When sent from the SyJet drive to an Initiator during re-connection an implied Restore Pointers message must be performed by the Initiator prior to the assertion of the ACK signal on the next phase.

---

**Bit 7:** This bit is always set to distinguish this message from the others.

**Bit 6:** This bit is only set by the Initiator. When it is set it indicates that the Initiator has the ability to accommodate disconnection and reconnection.

**Bits 5-3:** Reserved.

**Bits 2-0:** These bits specify a Logical Unit Number (LUN) and must be zero for the SyJet drive.

## Synchronous Data Transfer Request

The SyJet drive supports only the SYNCHRONOUS DATA TRANSFER REQUEST extended message.

**Table 5-11 Synchronous Data Transfer Request**

		B I T							
		7	6	5	4	3	2	1	0
B Y T E	0	Extended Message (1)							
	1	Extended Message Length (3)							
	2	Synchronous Data Transfer Request Code (1)							
	3	Transfer Period (times 4 nanoseconds)							
	4	REQ/ACK Offset							

A pair of SYNCHRONOUS DATA TRANSFER REQUEST messages are exchanged between the Initiator and the SyJet drive during the first SELECT sequence following a “hard” RESET condition or a BUS DEVICE RESET message. The SyJet drive will also exchange messages when requested to do so. The message exchange establishes the transfer period and the REQ/ACK offset.

**Extended Message (1):** A value of one in the first byte of a message indicates the beginning of a multiple-byte extended message.

**Extended Message Length (3):** Specifies the length in bytes of the extended message code plus the extended message arguments to follow. (The total length of the message is the Extended Message Length plus two.) A value of zero indicates a length of 256 bytes.

**Synchronous Data Transfer Request Code (1):** This byte identifies the message as a Synchronous Data Transfer Request.

**Transfer Period:** The transfer period (times 4 nanoseconds) is the minimum time between leading edges of successive REQ pulses and of successive ACK pulses.

**REQ/ACK Offset:** The REQ/ACK offset is the maximum number of REQ pulses that may be outstanding before its corresponding ACK pulse is received at the SyJet drive. A REQ/ACK offset of zero indicates asynchronous mode; a value of FFH indicates unlimited offset. The SyJet drive uses a maximum REQ/ACK offset of 15.

## Synchronous Data Transfer Request Negotiation

If the Initiator recognizes that negotiation is required it asserts ATN and sends a SYNCHRONOUS DATA TRANSFER REQUEST message indicating a REQ/ACK offset and minimum transfer period. The REQ/ACK offset is chosen to meet data handling requirements of the Initiator. The SyJet drive responds in one of the following ways:

**Table 5-12 Responses**

Response	Implied Agreement
REQ/ACK offset less than or equal to requested value.	REQ/ACK offset equal to target value.
Minimum transfer period equal to or greater than requested period.	Minimum transfer period equal to the SyJet drive value.

If the SyJet drive recognizes that negotiation is required it sends a SYNCHRONOUS DATA TRANSFER REQUEST message to the Initiator. The REQ/ACK offset is selected to prevent buffer and offset counter overflows while the minimum transfer period is chosen to meet data handling requirements. The Initiator will respond in one of the following ways when the SyJet drive selects and REQ/ACK offset is less than or equal to eight:

**Table 5-13 Initiator Responses**

<b>Initiator Response</b>	<b>Implied Agreement</b>
REQ/ACK offset less than or equal to the requested value.	REQ/ACK offset equals Initiator value.
Minimum transfer period equal to or greater than requested period.	Minimum transfer period equal to the Initiator value.
REQ/ACK offset equal to zero.	Asynchronous transfer.
MESSAGE REJECT	Asynchronous transfer.

The implied agreement will remain in effect until a BUS DEVICE RESET message is received, until a hard RESET condition occurs or until one of the two SCSI devices elects to modify the agreement. Re-negotiation at every selection is not recommended. The default mode of data transfer is asynchronous. The default mode is entered at power on after a BUS DEVICE RESET message or after a “hard” RESET condition.

The SYNCHRONOUS DATA TRANSFER REQUEST message exchange can only take place following a SELECTION phase that includes the SCSI IDs for both the Initiator and the SyJet drive. Violation of this rule may make data transfer impossible.

# Command Completion Status

Completion Status is sent from the SyJet drive to the Initiator at the termination of a command set.

**Table 5-14 Synchronous Data Transfer Request**

		B I T							
		7	6	5	4	3	2	1	0
B Y T E	0	Reserved				Status Byte Code			

## Completion Status Byte Bit Values

**Table 5-15 Completion Status Byte Bit Values**

Code	Status Represented
0H	Good Status
2H	Check Condition
8H	Busy
10H	Intermediate Status/Good Status
18H	Reservation Conflict

**Good Status:** This status indicates that the SyJet drive has successfully completed the command.

**Check Condition:** Any error, exception or abnormal condition which causes sense information to be set, will cause CHECK CONDITION status. The Request Sense Command should be issued following CHECK CONDITION status to determine the nature of the condition.

**Busy:** The SyJet drive is busy. This status will be sent whenever the SyJet drive is unable to accept a command from an Initiator.

**Intermediate Status Sent:** This status is returned for every command in a series of linked-commands (except for the last command) unless an error exception or abnormal condition causes CHECK CONDITION status to be sent. If this status is not returned the chain of link-commands is broken and no further commands in the series will be executed.

**Reservation Conflict:** This status is returned whenever a SCSI device attempts to access a SyJet drive that is reserved to another SCSI device.

## Contingent Allegiance Condition

The contingent allegiance condition guarantees that error information will be available to the Initiator which was returned CHECK CONDITION status.

The contingent allegiance condition will exist following the return of CHECK CONDITION status and will be preserved for the Initiator until it is cleared by the generation of a hard reset condition or by the receipt of an ABORT message, a BUS DEVICE RESET message, or any subsequent command from the Initiator except a REQUEST SENSE command. The contingent allegiance condition will be cleared following the return of the REQUEST SENSE data to the Initiator following the REQUEST SENSE command.

While the contingent allegiance condition exists the SyJet drive will respond to any other requests for access from other Initiators with a BUSY status.

## Timing

Unless otherwise indicated, the delay time measurements for each drive will be calculated from signal conditions existing at that drive's own SCSI bus connection. Normally, these measurements need not consider delays in the cable.

The paragraphs that follow list various aspects of SCSI bus timing.

**Arbitration Delay:** The minimum time that a device will wait from asserting BSY for arbitration until the data bus can be examined for an arbitration win. The SyJet drive arbitration delay is 2.4 Microsecond minimum and the initiator's delay is 2.4 Microsecond minimum, with no maximum.

**Assertion Period:** The minimum time that a SyJet drive will assert REQ while using synchronous data transfers is 20-30 nsec. Also, the minimum time that an initiator will assert ACK while using synchronous data transfers is 90 nsec.

**Bus Clear Delay:** The maximum time for a device to stop driving all bus signals after:

1. BUS FREE phase is detected (BSY and SEL both false for a Bus Settle Delay).
2. Select is received from another drive during Arbitration phase.

The Bus Clear Delay is 800 nsec. (max.) for an initiator.



**NOTE:** For the first condition above, the maximum time for a device to clear the bus from BSY and SEL first becoming false is 1200 nsec. for an initiator. If a device requires more than a Bus Settle Delay to detect Bus Free, it will clear the bus within a Bus Clear Delay minus the excess time.

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**Bus Free Delay:** The maximum time for a device to assert BSY and its SCSI ID bit on the data bus after it detects Bus Free phase (BSY and SEL both false for a Bus Settle Delay) for the purpose of entering Arbitration phase. The Initiator's Delay is 800 nsec.

**Bus Set Delay:** The maximum time for a device to assert BSY and its SCSI ID bit on the data bus after it detects Bus Free phase (BSY and SEL both false for a Bus Settle Delay) for the purpose of entering Arbitration phase. The Bus Set Delay is 1.8 microseconds for an initiator.

**Bus Settle Delay:** The time to wait for the bus to settle after changing certain control signals.

**Cable Skew Delay (10 nsec., max.):** The maximum difference in propagation time allowed between any two SCSI bus signals when measured between any two devices.

**Data Release Delay (400 nsec., max.):** The maximum time for an initiator to release the data bus signals following the transition of the I/O signal from false to true.

**Deskew Delay (45 nsec., min.):** The minimum time required for deskew of certain signals.

**Disconnection Delay (200  $\mu$ sec.):** The minimum time that a target will wait after releasing BSY before participating in an ARBITRATION phase when honoring a DISCONNECT message from the initiator.

**Hold Time (45 nsec., min.):** The minimum time added between the assertion of REQ or ACK and the changing of the data lines to provide hold time in the initiator or target, respectively, while using synchronous data transfers.

**Negation Period (90 nsec., min.):** The minimum time that a target will negate REQ while using synchronous data transfers. Also, the minimum time that an initiator will negate ACK while using synchronous data transfers.

**Power-On to Selection Time (10 sec., max):** The time from power application until the SyJet drive is able to respond with appropriate status and sense data to the TEST UNIT READY, INQUIRY and REQUEST SENSE commands.

**Reset to Selection Time (250 microsec., max.):** The time after a hard RESET until the SyJet drive is able to respond with appropriate status and sense data to the TEST UNIT READY, INQUIRY and REQUEST SENSE commands.

**Reset Hold Time (25 microsec., min., no max.):** The minimum time for which RST must be asserted.

**Selection Abort Time:** The maximum time that a Drive/Initiator will take from its most recent detection of SEL or reselect until asserting a BSY response. This time-out is required to ensure that a Drive/Initiator does not assert BSY after a selection/reselection phase has been aborted. The SyJet drive' Abort Time is 18 Microsecond and the Initiator's Abort Time is 200 Microsecond maximum.

**Selection Time-out Delay:** The minimum time that a device should wait for a BSY response during the selection/reselection phase before starting the time-out procedure. The SyJet drive Time-out Delay is 250 Microsecond and for the Initiator it is 250 Microsecond.

**SCSI Configured Automatically (SCAM):** The SCSI SyJet Drive is SCAM tolerant as defined in the ANSI SCSI-3 Parallel Interface Draft Standard X3T10/855-D.

**Transfer Period (set during an SDTR message in the Message phase):** The Transfer Period specifies the minimum time allowed between the leading edges of successive REQ pulses and of successive ACK pulses while using synchronous data transfers.

Figure 5-2 shows the timing relationships between interface signals for data transfers in a typical SCSI bus sequence:

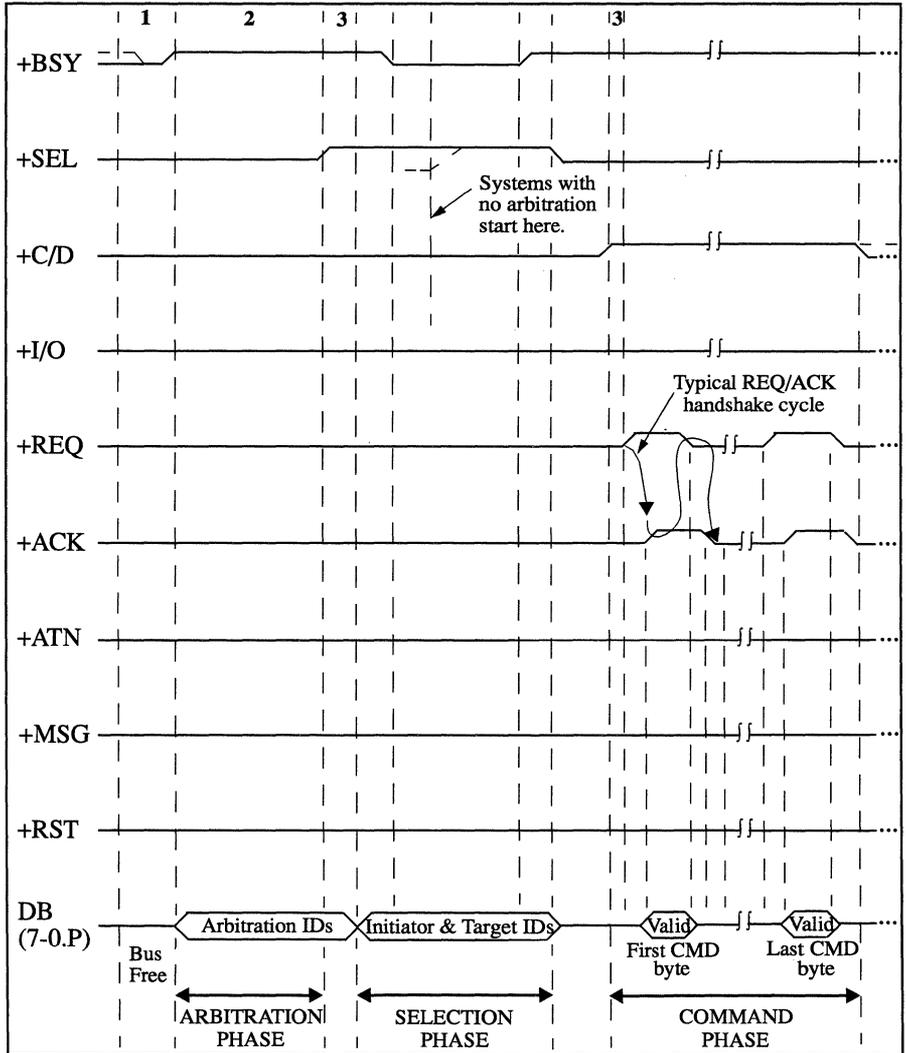
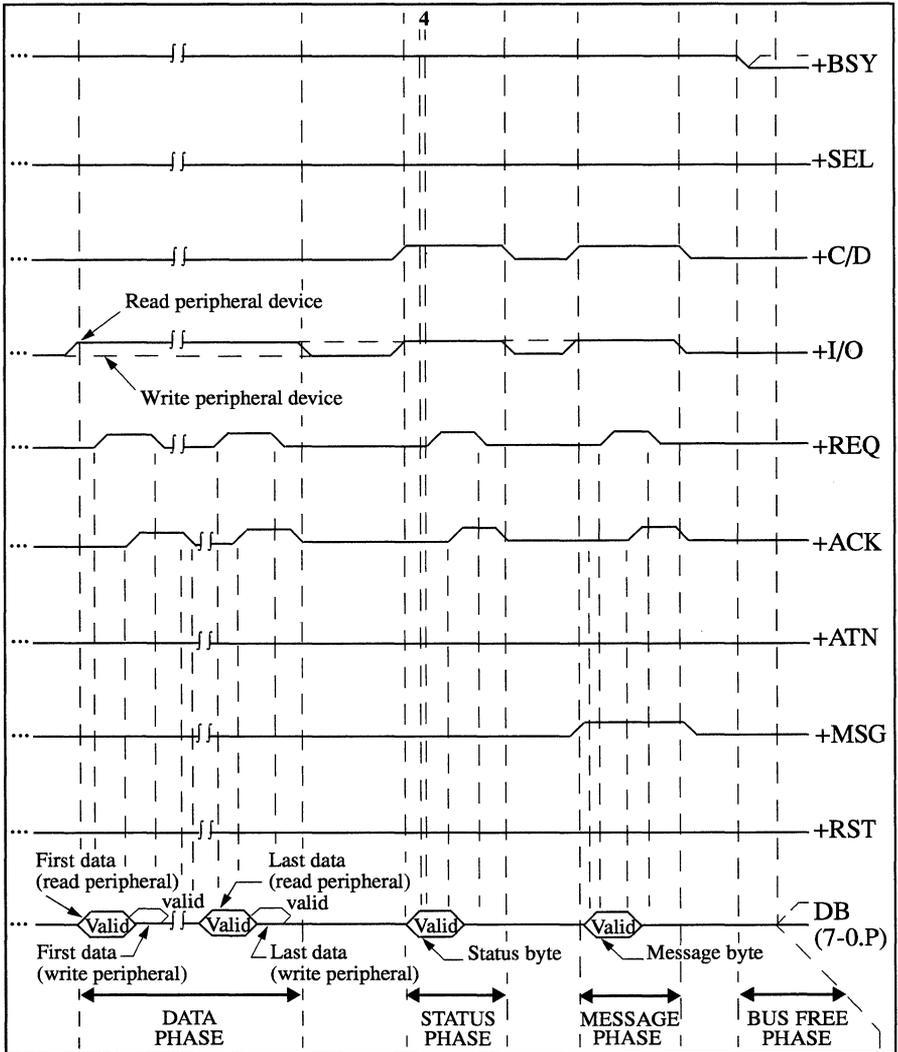


Figure 5-2 Timing Measurements



**Figure 5-2 Timing Measurements (continued)**

**Key:**

+BSY = Busy	+ACK = Acknowledge
+SEL = Select	+ATN = Attention
+C/D = Control/Data	+MSG = Message
+I/O = Input/Output	+RST = Reset
+REQ = Request	DB = Data Bit

**General:**

- Reset hold time = 25  $\mu$ S.
- SEL response timeout = 250 ms.
- MAX cable skew = 10 ns.
- DB(P) = data parity (odd). Parity is not valid during arbitration. The use of parity is a system option.

**Footnotes:**

- <sup>1</sup> Bus set delay = maximum time from check of “bus free” (BSY and SEL not asserted) until assertion of BSY and ID (1.8  $\mu$ S).  
Bus free delay = minimum time bus must be left free (800 ns).  
Bus clear delay = time to clear from bus after drop of BSY for bus free phase or assertion of SEL for arbitration phase by other device (800 ns).
- <sup>2</sup> Arbitration delay = minimum time from asserting BSY to check if arbitration is won (2.2  $\mu$ S).
- <sup>3</sup> Bus settle delay = 400 ns.
- <sup>4</sup> Deskew delay time = 45ns. This delay allows for 45 ns receiver skew and 10 ns cable skew.

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**NOTE:** For more information about the activities of each bus phase, see the *SCSI Reference Chart* published by Adaptec, Inc.

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# 6

## SCSI Command Reference

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This chapter begins with a summary that lists all commands and command codes for SyJet SCSI disk drives. Following this is a detailed description for each command that includes any information not covered by the ANSI SCSI-2 Standard X3.131-1994. For more information on these commands, see the ANSI SCSI-2 Standard X3.131-1994.

# Command Summary

Table 6-1 lists all command-operation codes with page references for finding command descriptions. Commands are presented according to the hexadecimal order of their operation codes:

**Table 6-1 Command Summary**

Operation Code	Command Type <sup>1</sup>	Command	Description
00H	M	Test Unit Ready	See page 6-4.
01H	O	ReZero Unit	See page 6-5.
03H	M	Request Sense	See page 6-6.
04H	M	Format Unit	See page 6-12.
07H	O	Reassign Blocks	See page 6-19.
08H	M	Read	See page 6-21.
0AH	M	Write	See page 6-22.
0BH	O	Seek	See page 6-23.
12H	M	Inquiry	See page 6-24.
15H	O	Mode Select	See page 6-29.
16H	M	Reserve	See page 6-59.
17H	M	Release	See page 6-61.
1AH	O	Mode Sense	See page 6-62.
1BH	O	Start/Stop	See page 6-72.
1CH	O	Receive Diagnostic Results	See page 6-74.
1DH	M	Send Diagnostic	See page 6-75.
1EH	O	Prevent/Allow Medium Removal	See page 6-77.

**Table 6-1 Command Summary (Continued)**

<b>Operation Code</b>	<b>Command Type <sup>1</sup></b>	<b>Command</b>	<b>Description</b>
25H	M	Read Capacity	See page 6-79.
28H	M	Extended Read	See page 6-81.
2AH	M	Extended Write	See page 6-83.
2BH	O	Extended Seek	See page 6-85.
2EH	O	Write Verify	See page 6-86.
2FH	O	Verify	See page 6-88.
37H	O	Read Defect Data	See page 6-90.
3BH	O	Write Buffer	See page 6-94.
3CH	O	Read Buffer	See page 6-98.
3EH	O	Read Long	See page 6-103.
3FH	O	Write Long	See page 6-104.
55H	O	Mode Select	See page 6-105.
5AH	O	Mode Sense	See page 6-106.
<b>Notes:</b> <sup>1</sup> M = SyQuest SCSI-2 Mandatory Command Set O = SyQuest SCSI-2 Optional Command Set			

## Test Unit Ready (00H)

*Table 6-2 Unit Ready Command*

		B I T							
		7	6	5	4	3	2	1	0
E T Y B	0	Operation Code (00H)							
	1	Logical Unit Number				Reserved			
	2	Reserved							
	3	Reserved							
	4	Reserved							
	5	Reserved						Flag	Link

The Test Unit Ready Command provides a means to check if the drive is ready. This is not a request for a self-test. If the SyJet drive is ready, the command is terminated with Good Status, and the sense key is set to “No Sense”. If the SyJet drive is not able to accept a medium-access command without returning CHECK CONDITION, then this command will return CHECK CONDITION with a sense key of NOT READY.

When a Request Sense command is executed following a Test Unit Ready command, the status of the front panel eject button and the write protect sensor is available in extended sense data byte eight, which is the Command Specific Information field for SCSI- 2. Refer to “Request Sense (03H)” on page 6-6.

## Rezero Unit (01H)

*Table 6-3 Rezero Unit Command*

		B I T							
		7	6	5	4	3	2	1	0
B Y T E	0	Operation Code (01H)							
	1	Logical Unit Number			Reserved				
	2	Reserved							
	3	Reserved							
	4	Reserved							
	5	Reserved						Flag	Link

The Rezero Unit Command requests that the SyJet drive move the heads to the location of logical block zero. The heads are also left positioned at block zero after power on and after a cartridge spin up sequence.

## Request Sense (03H)

**Table 6-4 Request Sense Command**

		B I T							
		7	6	5	4	3	2	1	0
E T Y B	0	Operation Code (03H)							
	1	Logical Unit Number				Reserved			
	2	Reserved							
	3	Reserved							
	4	Allocation Length							
	5	Reserved					Flag	Link	

The Request Sense Command requests that the SyJet drive transfer Sense data to the Initiator. Extended Sense is supported and will be provided if the Allocation Length is set to 5 or greater. When the Allocation Length is set to a value of 0-4 bytes, then Non-extended Sense will be generated.

The Sense data is valid for a Check Condition Status returned on the prior command. This sense data is preserved for the Initiator until retrieved by the Request Sense command, or until receipt of the next command from the Initiator. Sense will be cleared upon receipt of any subsequent command to the drive from the Initiator receiving the Check Condition Status.

The allocation length specifies the number of bytes that the Initiator has allocated for returned sense data. An Allocation Length of zero through four indicates that four bytes of Sense data will be transferred. Any other value indicates the number of bytes to be transferred. The SyJet drive will terminate the data in phase when the Allocation Length bytes have been transferred or when all available Sense data has been transferred to the Initiator.

A Check Condition Status is used only to report fatal errors for this command.

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**EXAMPLE:** The SyJet drive receives a nonzero reserved bit in the Command Descriptor Block.

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**EXAMPLE:** An unrecovered parity error occurs on the data bus.

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Following a fatal error on a Request Sense Command, the sense data may be invalid. Refer to “Sense Key and Error Code Descriptors” on page 5-14.

### ***Nonextended Sense***

***Table 6-5 Non-Extended Sense Data Format***

		B I T							
		7	6	5	4	3	2	1	0
B Y T E	0	Valid	Error Class			Sense Key			
	1	Logical Block Address (MSB)							
	2	Logical Block Address							
	3	Logical Block Address (LSB)							

Nonextended Sense is provided for compatibility with systems that do not accept Extended Sense. Extended Sense is the preferred format, allowing for the Additional Sense code and the Additional Sense code Qualifier.

**Valid:** Indicates that the information bytes specify the unsigned Logical Block Address associated with the sense key. Sense keys are described in “Sense Key and Error Code Descriptors” on page 5-14.

**Error Class:** Error class specifies a class of errors from zero (0) through six (6) that are used in Nonextended sense only.

**Sense Key:** See “Sense Key and Error Code Descriptors” on page 5-14.

**Logical Block Address:** This field points to the sector associated with the specific error.

**Table 6-6 Extended Sense Data Format**

		B I T							
		7	6	5	4	3	2	1	0
E R R O R C O D E	0	Valid	Error Class (7)			Error Class (0)			
	1	Segment Number (0)							
	2	ILI (0)		Reserved		Sense Key			
	3	Logical Block Address (MSB)							
	4	Logical Block Address							
	5	Logical Block Address							
	6	Logical Block Address (LSB)							
	7	Additional Sense Length							

**Extended Sense**

Error class seven (7) specifies extended sense. Sense Key zero (0) specifies the Extended Sense data format. Error codes 1H through 0FH are reserved.

**Valid:** Indicates that the information bytes specify the unsigned Logical Block Address associated with the sense key. Sense keys are described in “Sense Key and Error Code Descriptors” on page 5-14.

**Segment Number:** This field is not supported.

**Incorrect Length Indicator (ILI):** This field is not supported.

**Sense Key:** See “Sense Key and Error Code Descriptors” on page 5-14.

**Logical Block Address:** This field points to the sector associated with the specific error.

**Additional Sense Length:** This field indicates the number of additional sense bytes associated with this error.

**Table 6-7 Additional Sense Bytes**

		B I T							
		7	6	5	4	3	2	1	0
E T Y B	8	Command Specific Information (MSB)							
	9	Command Specific Information							
	10	Command Specific Information							
	11	Command Specific Information (LSB)							

**Command Specific Information:** The contents of this field are dependent on the command previously executed. Command Specific Information is as follows:

**Table 6-8 Command Specific Information**

Command	Reference
Test Unit Ready	“Test Unit Ready (00H)” on page 6-4
Inhibit Cartridge Removal	“Prevent/Allow Medium Removal (1EH)” on page 6-77
Start Stop Unit	“Start/Stop (1BH)” on page 6-72

These bytes are valid if one of the commands in Table 6-8 was executed immediately before the Request Sense Command:

**Table 6-9 Additional Sense Bytes**

		B I T							
		7	6	5	4	3	2	1	0
B Y T E	8	Prevent	Locked	Eject	WP	Reserved			
	9	Reserved							
	10	Reserved							
	11	Reserved							

**Prevent Media Removal (PRVNT):** A one (1) in this bit indicates that the “prevent cartridge removal” is active. See the Prevent/Allow Media Removal command in “Prevent/Allow Medium Removal (1EH)” on page 6-77.

**Door Locked (Locked):** When this bit is a one (1), the front door eject lever is locked and the cartridge may not be removed. When this bit is a zero (0), the door is unlocked and the eject lever may be pushed to remove the cartridge.

**Eject Button (EJECT):** A one (1) in this bit indicates that the front panel cartridge eject button is in the pushed or true position and indicates a request for cartridge removal if the drive has not yet spun down due to a previous issuance of the Inhibit Medium Removal command. A zero (0) in this bit indicates that the front panel eject button is in the closed or false position and indicates a request for the cartridge to be spun up if the cartridge was previously stopped via a Start/Stop Unit command.

**Write Protect (WP):** A setting of one (1) indicates that the software write protect is enabled.

**Table 6-10 Additional Sense Bytes**

		B I T							
		7	6	5	4	3	2	1	0
B Y T E	12	Additional Sense Code							
	13	Additional Sense Code Qualifier							
	14	Field Replaceable Unit Code (0)							
	15	SKSV	SCSI Reserved						
	16	Sense Key Specific (0) (MSB)							
	17	Sense Key Specific (0) (LSB)							
	18	Cylinder (MSB)							
	19	Cylinder (LSB)							
	20	Head							
21	Sector								

**Additional Sense Code:** Refer to Table 5-9 on page 5-16.

**Additional Sense Code Qualifier:** Refer to Table 5-9 on page 5-16.

**Field Replaceable Unit Code:** This field is not supported.

**Sense-Key Specific Valid (SKSV):** An SKSV value of zero (0) indicates that the Sense Key Specific field is not as defined by the SCSI-2 specification.

**Sense-Key Specific:** This field is reserved and will be a value of zero (0).

**Cylinder/Head/Sector:** Specifies the disk physical cylinder, head and sector associated with an error.

## Format Unit (04H)

*Table 6-11 Format Unit Command*

		B I T							
		7	6	5	4	3	2	1	0
B Y T E	0	Operation Code (04H)							
	1	Logical Unit Number	FMTDATA	CMPLST	Defect List Format				
	2	Format Data							
	3	Interleave (MSB)							
	4	Interleave (LSB)							
	5	DTAVLD	Reserved					Flag	Link

The SyJet drive does not change the physical sector size of 512 bytes or the 1:1 interleave. Only the data fields of the sectors are formatted, the sector servos and headers are never rewritten.

The SyJet drive provides a manufacturer's defect list (or *P-list* for primary defect list), written on the drive that is used during the format operation to bypass defects that were identified during the manufacturing process. The P-list may not be modified by the user. Additional defects may be added to the user's defect list or G-list for Grown defect list. These defects are supplied as data to the Format Command and usually consist of logical or physical blocks.

The SyJet drive will not accept a defect consisting of a full track.

Four format modes are supported by the SyJet drive:

- Format with known defect list (P-list plus G-list).
- Format with known defect list plus supplied defect in Logical Block Format.
- Format with known defect list plus supplied defect in Physical Address Format.
- Format with original manufacturer's defect list only (delete G-list).

**Format Data (FMTDATA):** If one, indicates that format data is supplied during the data-out phase. The defect list included with this data specifies the defects that are to be entered into the defect map. The format of the defect list is determined by the 3-bit defect list format field. The FMTDATA bit, if zero (0), indicates that the data-out phase will not occur and no defect data will be supplied by the initiator. Additional defects will be added if found by the SyJet drive.

**Complete List (CMPLST):** If one (1), indicates the data supplied is the complete list of known defects in addition to the manufacturer's defect list. The G-list will be erased. Additional defects will be added by the SyJet drive if the Certify option is selected. A CMPLST bit of zero (0) indicates that the data supplied is in addition to existing defect data using the current format. When using the logical block format, the defect list refers to the current block length (and not to the new block length, if it is different) and the defect list refers to current logical block addresses (not physical addresses). Additional defects will be added if found by the SyJet drive if the Certify option is selected.

**Defect List Format:** See “ Format Unit Command Variations” on page 6-15 for descriptions.

**Format Data:** Specifies the format data pattern that will be used if the DTAVLD bit set. This field must be zero (0) if the DTAVLD bit is clear (0) or if the DCRT bit is set (1).

**Interleave:** The SyJet drive uses an interleave of 1:1, indicating that the logical blocks are in sequential physical order. An interleave value of zero (0) requests that the target use its default Interleave, which is 1:1. Any value other than zero (0) or one (1) will cause the command to be terminated with CHECK CONDITION status. The sense key will be set to ILLEGAL REQUEST and the additional sense code will be set to INVALID FIELD IN COMMAND DATA BLOCK.

**Data Valid (DTAVLD):** A value of zero (0) indicates that the default data pattern of zero(0) will be used during media certification. A value of one (1) indicates that data pattern specified by the Format Data byte (command byte) will be used during media certification. This bit cannot be set if the DCRT bit of the Defect List Header is set.

**Table 6-12 Format Unit Command Variations**

Bit References					Comments
Format Data	Complete List	Defect List Format			
4	3	2	1	0	
0	0	0	0	0	Format with no data defect list sent from the initiator to the SyJet drive. Add drive detected defects.
1	0	0	0	0	Format, adding the logical defects in the data defect list to the G-list defects, and drive detected defects to form the new G-list.
1	1	0	0	0	Delete the G-list and format combining the logical defects in the data defect list with drive detected defects to form the new G-list.
1	0	1	0	1	Format, adding the physical defects in the data defect list to the G-list defects, and drive detected defects to form the new G-list.
1	1	1	0	1	Delete the G-list and format combining the physical defects in the data defect list with drive detected defects to form the new G-list.

The defect list shown in Table 6-13 contains a four-byte header followed by one or more defect descriptors. The length of the defect descriptors varies with the format of the defect list.

## **Defect List Block Format**

**Table 6-13 Defect List Header**

		B I T							
		7	6	5	4	3	2	1	0
<b>E T Y B</b>	<b>0</b>	Reserved							
	<b>1</b>	FOV	DPRY	DCRT	STPF	IP	DSP	IMMED	VS
	<b>2</b>	Defect List Length (MSB)							
	<b>3</b>	Defect List Length (LSB)							

**Format Option Valid (FOV):** If one (1), enables the DCRT bit. If zero (0), the SyJet drive will use its default setting, (certify), and the DCRT bit must be zero.

**Disable Primary (DPRY):** This field is not supported and must be zero (0).

**Disable Media Certification (DCRT):** Bit of one along with an FOV bit of one disables drive self certification during format. This option is provided to allow rapid specification and format handling of defects without the delay of a full media certification.

**Stop Format On Error (STPF):** This field is not supported and must be zero (0).

**Initialization Pattern (IP):** This field is not supported and must be zero (0).

**Disable Saving Parameters(DSP):** This field is not supported and must be zero (0).

**Immediate (IMMED):** This field is not supported and must be zero (0)..

**Vendor Specific(VS):** This field is not supported and must be zero (0).

**Defect List Length:** In each table specifies the total length in bytes of the defect descriptors that follow. In Table 6-13, the defect list length is equal to four times the number of logical defect descriptors in Table 6-14 and Table 6-15 eight times the number of defect descriptors.

The maximum, total number of defects and reassigned blocks can not exceed the maximum number of defects listed in Table 1-23, Cartridge Specifications.

**Table 6-14 Logical Defect Descriptors**

		B I T							
		7	6	5	4	3	2	1	0
B Y T E	0	Defect Logical Block Address (MSB)							
	1	Defect Logical Block Address							
	2	Defect Logical Block Address							
	3	Defect Logical Block Address (LSB)							

**Table 6-15 Physical Defect Descriptors**

		B I T							
		7	6	5	4	3	2	1	0
B Y T E	0	Cylinder Number of the Defect (MSB)							
	1	Cylinder Number of the Defect							
	2	Cylinder Number of the Defect (LSB)							
	3	Head Number of Defect							
	4	Defect Sector Number (MSB)							
	5	Defect Sector Number							
	6	Defect Sector Number							
	7	Defect Sector Number (LSB)							

Each defect descriptor for the physical sector format specifies a physical sector-size defect location comprised of the cylinder number of the defect, the head number of the defect, and the defect sector number. For determining ascending order, the head number of the defect is considered the most significant part of the address and the defect sector number is considered the least significant part of the address.

## Reassign Blocks (07H)

**Table 6-16 Reassign Blocks Command**

		B I T							
		7	6	5	4	3	2	1	0
B Y T E	0	Operation Code (07H)							
	1	Logical Unit Number			Reserved				
	2	Reserved							
	3	Reserved							
	4	Reserved							
	5	Reserved						Flag	Link

This command requests that the SyJet drive reassign the defective Logical Blocks to an area on the drive reserved for this purpose.

Blocks that have been reassigned by this command will be added to the “Known Defect List.” Each block will cause an appropriate number of physical sectors to be added to the defect list.

The Initiator transfers a defect list that contains the Logical Block Addresses to be reassigned. The SyJet drive will reassign the physical medium used for each Logical Block address in the list. The data contained in the logical blocks specified in the defect list will be lost.

If the SyJet drive has insufficient capacity to reassign all the defective logical blocks, the command will terminate with a CHECK CONDITION status and the sense key will be set to MEDIUM ERROR and the Additional Sense Code will be sent to NO DEFECTS SPARE LOCATION AVAILABLE. The logical block address of the last Logical Block reassigned will be returned in the information bytes of the Sense data.

A maximum of 18 blocks may be reassigned at any time. The Reassign Blocks defect list contains a four-byte header followed by one or more defect descriptors. The length of each Defect Descriptor is four bytes. The Defect Descriptors must be in ascending order.

### ***Reassign Blocks Defect List***

***Table 6-17 Reassign Defect List Header***

		B I T							
		7	6	5	4	3	2	1	0
B Y T E	0	Reserved							
	1	Reserved							
	2	Defect List Length (MSB)							
	3	Defect List Length (LSB)							

The defect list length specifies the total length in bytes of the defect descriptors that follow. The defect list length is equal to four times the number of defect descriptors and does not include the defect header length.

***Table 6-18 Reassign Defect Descriptors***

		B I T							
		7	6	5	4	3	2	1	0
B Y T E	0	Defect Block Address (MSB)							
	1	Defect Block Address							
	2	Defect Block Address							
	3	Defect Block Address (LSB)							

The defect descriptor specifies a four-byte defect block address that contains the defect.

# Read (08H)

*Table 6-19 Read Command*

		B I T							
		7	6	5	4	3	2	1	0
B Y T E	0	Operation Code (08H)							
	1	Logical Unit Number			Logical Block Address (MSB)				
	2	Logical Block Address							
	3	Logical Block Address (LSB)							
	4	Transfer Length							
	5	Reserved						Flag	Link

The Read Command Requests that the SyJet drive transfer data to the Initiator.

**Logical Block Address:** Specifies the logical block number where the Read operation will begin.

**Transfer Length:** Specifies the number of contiguous logical blocks of data to be transferred. A Transfer Length of zero (0) indicates 256 logical blocks will be transferred. Any other value indicates the number of blocks to be transferred.

## Write (0AH)

*Table 6-20 Write Command*

		B I T							
		7	6	5	4	3	2	1	0
B Y T E	0	Operation Code (0AH)							
	1	Logical Unit Number			Logical Block Address (MSB)				
	2	Logical Block Address							
	3	Logical Block Address (LSB)							
	4	Transfer Length							
	5	Reserved						Flag	Link

The Write Command requests that the Target SyJet drive write the data transferred by the Initiator to the medium.

**Logical Block Address:** Specifies the logical block number where the write operation will begin.

**Transfer Length:** Specifies the number of contiguous logical blocks of data to be transferred. A Transfer Length of zero indicates 256 logical blocks will be transferred. Any other value indicates the number of logical blocks that will be transferred.

## Seek (0BH)

*Table 6-21 Seek Command*

		B I T							
		7	6	5	4	3	2	1	0
B Y T E	0	Operation Code (0BH)							
	1	Logical Unit Number				Logical Block Address (MSB)			
	2	Logical Block Address							
	3	Logical Block Address (LSB)							
	4	Reserved							
	5	Reserved						Flag	Link

This command requests that the SyJet drive seek to the specified Logical Block Address.

**Logical Block Address:** Specifies the logical block number to where the drive will seek.

## Inquiry (12H)

*Table 6-22 Inquiry Command*

		B I T								
		7	6	5	4	3	2	1	0	
B Y T E	0	Operation Code (12H)								
	1	Logical Unit Number			Reserved				EVPD (0)	
	2	Page Code (0)								
	3	Reserved								
	4	Allocation Length								
	5	Reserved						Flag	Link	

The Inquiry Command requests that information regarding parameters of the SyJet drive be sent to the Initiator.

**Enable Vital Product Data (EVPD):** A bit of zero (0) is required and specifies that the SyJet drive will return the standard INQUIRY data.

**Page Code:** This field must be zero (0) since the SyJet drive does not support vital product data.

**Allocation Length:** Specifies the number of bytes that the Initiator has allocated for Inquiry data. An Allocation Length of zero (0) indicates that no Inquiry data will be transferred. This is not considered an error condition. Any other value will indicate the maximum number of bytes to be transferred. The SyJet drive will terminate the data-in phase when Allocation Length bytes have been transferred or, when all available Inquiry data has been transferred to the Initiator. The Check Condition status is reported when the SyJet drive cannot return the Inquiry data.

The Inquiry data contains a five-byte header, followed by additional parameters, if any.

**Table 6-23 Inquiry Header and Data**

		<b>B I T</b>							
		7	6	5	4	3	2	1	0
<b>B Y T E</b>	<b>0</b>	Peripheral Qualifier				Peripheral Device Type			
	<b>1</b>	RMB (1)	Device Type Modifier						
	<b>2</b>	ISO Version (0)		ECMA Version (0)			ANSI Version		
	<b>3</b>	AENC (0)	TrmIOP	Reserved			Response Data Format		
	<b>4</b>	Additional Length (51)							
	<b>5</b>	Reserved							
	<b>6</b>	Reserved							
	<b>7</b>	RelAdr	WBUS 32	WBUS 16	Sync	Linked	0	CmdQue	SftRes
	<b>8-15</b>	SyQuest (ASCII)							
	<b>16-31</b>	SyJet-S (ASCII)							
	<b>32</b>	Firmware Revision Level (ASCII) (MSB)							
	<b>33</b>	Firmware Revision Level (ASCII)							
	<b>34</b>	Firmware Revision Level (ASCII)							
	<b>35</b>	Firmware Revision Level (ASCII) (LSB)							
	<b>36</b>	Number of Extents (MSB) (0)							
	<b>37</b>	Number of Extents (LSB) (1)							
	<b>38-45</b>	Reserved							
	<b>46-55</b>	Cartridge Serial Number							

**Table 6-24 Peripheral Qualifier**

000	Specified device type is currently connected to this logical unit
001	Not used
010	Reserved
011	Target is not capable of supporting a device on this logical unit
1XX	Not used

**Table 6-25 Peripheral Device Type**

00	Direct Access device
1F	Must be used with Peripheral Qualifier 011 (above)

**Removable Medium Bit (RMB):** A value of one (1) indicates the SyJet medium is removable. This bit will be zero (0) if mode Page 0 Hard Disk Drive bit is set.

**Device Type Modifier:** Is a seven bit user specified code. This code may be set using the mode select command. The default value is 0.

**ANSI Version:** Is the version level of the ANSI standard implemented by the SyJet drive. A value of two (2) indicates the ANSI SCSI-2 X3.131-1994 Standard.

**Asynchronous Event Notification Capability (AENC):** A value of zero (0) indicates that the SyJet drive does not support Asynchronous Event Notification Capability.

**Terminate I/O Process (TrmlOP):** A value of zero (0) indicates that the SyJet drive does not support the Terminate I/O Process message.

**Response Data Format:** A value of two (2) indicates the format is specified by the ANSI SCSI-2 X3.131-1994 Standard.

**Additional Length:** Specifies the length in bytes of additional drive parameters.

**Wide Bus 32 (WBus 32):** A value of zero (0) indicates that the SyJet drive does not support 32-bit Wide Transfers.

**Wide Bus 16 (WBus 16):** A value of zero (0) indicates that the SyJet drive does not support 16-bit Wide Transfers.

**Relative Addressing (RelAdr):** A value of zero (0) indicates that the SyJet drive does not support the Relative Addressing Mode.

**Synchronous Transfer (Sync):** A value of one (1) indicates that the SyJet drive supports Synchronous Data Transfer. This bit may be zero (0) if a PS/2 option jumper is installed.

**Linked Command (Linked):** A value of one (1) indicates that the SyJet drive supports Linked Commands.

**Command Queuing (CmdQue):** A value of one (1) indicates that the SyJet drive supports Tagged Command Queuing.

**Soft Reset (SftRes):** A value of zero (0) indicates that the SyJet drive responds to RESET with the hard RESET alternative.

**SyQuest:** Contains the left-aligned ASCII letters that make up the word "SyQuest," followed by an ASCII space characters (20H).

**SyJet:** Contains the left aligned ASCII letters that make up SyQuest's drive model designation followed by ASCII space character (20H).

The Vendor and Product IDs may be customized by using the Mode Select command to specify new ASCII strings. The new data will be active whenever the cartridge is spun up and the SyJet drive is in a Ready state. Whenever the cartridge is not spun up or if no Mode Select page 20H has been specified for the cartridge, then the Vendor and Product fields will revert to the default values. See Page Code 20H of the Mode Select command.

**Firmware Revision Level:** Contains a sub revision level of the SyJet drive's ROM in ASCII.

**ROM Revision Level:** Contains the revision level of drive ROM in ASCII.

**Number of Extents:** The SyJet drive supports one Extent. Refer to "Reserve (16H)" on page 6-59 and "Release (17H)" on page 6-61.

**Cartridge Serial Number:** The drive serial number is returned in ASCII format.

## Mode Select (15H)

**Table 6-26 Mode Select Command**

		B I T							
		7	6	5	4	3	2	1	0
B Y T E	0	Operation Code (15H)							
	1	Logical Unit Number			PF (1)	Reserved			SP
	2	Reserved							
	3	Reserved							
	4	Parameter List Length							
	5	Reserved						Flag	Link

The Mode Select Command provides a means for the Initiator to specify or change operating parameters within the SyJet drive.

**Save Parameters (SP):** If one (1), indicates that the drive will:

1. Update the Current mode values with the values defined in the following pages.
2. Save all Savable pages.
3. Report command complete with no CHECK CONDITION status when successfully completing the above.

Savable Pages are Pages for which preceding MODE SENSE commands returned the SP bit (bit 7 byte 0) of the Page Header set to one.

If zero (0), indicates that the SyJet drive:

1. Will update the Current mode values with the values defined in the following Pages.

2. Will not save the Savable Pages.
3. Will report command complete with no CHECK CONDITION status when successfully completing the above.



**NOTE:** The Audible Eject Notification bit of the Operating Parameters Page (0) and the Standby Condition Timer of the Power Condition Page (1AH) are saved on the drive. the remaining parameters are saved on the cartridge.

**Parameter List Length:** Specifies the number of bytes of Mode Select data to be transferred during the Data-Out Phase. A parameter list length of zero indicates that no data is transferred and is not an error condition.

The Mode Select Parameter list contains a 4-byte header followed by the block descriptor (if any), followed by zero (0) or more page descriptors.

**Table 6-27 Mode Select Header**

		B I T							
		7	6	5	4	3	2	1	0
B Y T E	0	Reserved							
	1	Medium Type (00)							
	2	Reserved							
	3	Block Descriptor Length							

**Medium Type (00):** Default value of zero for SyJet drive.

**Block Descriptor Length:** Specifies the length in bytes of the block descriptor. Set to eight (8) if a Block Descriptor is to be sent or to zero (0) if no Block Descriptor is to be sent.

**Table 6-28 Block Descriptors**

		B I T							
		7	6	5	4	3	2	1	0
B Y T E	0	Density Code (00)							
	1	Number of Blocks (MSB)							
	2	Number of blocks							
	3	Number of Blocks (LSB)							
	4	Reserved							
	5	Block Length (MSB)							
	6	Block Length							
	7	Block Length (LSB)							

**Density Code (00):** Specifies the default media density. This byte is zero (0) for fixed disk drives.

**Number of Blocks:** Specifies the available number of blocks to be formatted. This value will be 2929800 for the SyJet drive with a block length of 512.

**Block Length:** Specifies the length in bytes of each logical block. This value will be 512 bytes.

**Table 6-29 Page Descriptors**

		B I T							
		7	6	5	4	3	2	1	0
B Y T E	0	PS	0	Page Code					
	1	Page Length (Bytes)							
	2	Refer to page definition							
	3	Refer to page definition							

Each Page Descriptor supplies information regarding a particular class of functions. The page descriptors may be in any order and do not have to be supplied.

**Page Savable (PS):** Must be set to zero (0) for the Mode Select command. This bit is returned by the Mode Sense command.

**Page Code:** Specifies the page-code format. See Table 6-30.

**Page Length:** Indicates the number of bytes to be associated with this page and may be zero.

**Table 6-30 Page Codes**

Page Code	Description	Saveable
0H	Operating Parameters	Yes
1H	Error Recovery Parameters	Yes
2H	Disconnect/Reconnect	Yes
3H	Format Parameters (Default only)	No
4H	Geometry Parameters (Default only)	No
5H - 7H	Reserved (Ignored)	No
08H	Caching	Yes
09H	Reserved (ignored)	No
0AH	Control Mode	Yes
0BH	Reserved	No
0CH	Notch and Partition	No
0DH - 19H	Reserved (Ignored)	No
1AH	Power Condition	Yes
1BH - 1FH	Reserved (Ignored)	No
20H	Vendor/ Product Identification	Yes
21H - 3FH	Reserved (Ignored)	No

**Table 6-31 Operating Parameters**

		B I T							
		7	6	5	4	3	2	1	0
E	0	Reserved		Page Code = 00H					
	1	Page Length (3 Bytes)							
Y	2	Reserved			RST-S	HDRV	NSA	SWP	EJN
	3	Reserved							DWV
B	4	Device Type Qualifier							

**Page Length:** The number of bytes associated with this page. The Page Length may be zero (0).

**Disable Write Verify (DWV):** A default value of zero (0) indicates that the SyJet Drive will perform write verification on all SCSI write commands by reading all sectors after they are written, and then rewriting or reallocating sectors as necessary. A value of one (1) indicates that the drive will not perform reads after SCSI Write Commands (0AH) and (2AH).

**RST-S (Reset Status):** A value of one (1) specifies that the drive will not report reset status following a bus reset. Default value of zero (0) enables reset status.

**Hard Drive (HDRV):** A value of one (1) specifies that the SyJet drive will operate as a fixed disk drive, media cannot be removed. A default value of zero (0) specifies that the SyJet drive will operate as a removable cartridge disk drive.

**Insufficient Spares Available (NSA):** A value of zero (0) indicates that there are sufficient spare sectors available for automatic reallocations to be performed. A value of one (1) specifies that the number of free spares in any zone is below the minimum allowable number and write caching has been disabled. The host may not set this bit to one (1).

**Software Write Protect (SWP):** A software write protect (SWP) bit of one (1) specifies that the drive will inhibit writing to the cartridge after writing all cached or buffered write data, if any. When SWP is one (1), all commands requiring writes to the cartridge will return a CHECK CONDITION status with a sense key of DATA PROTECT and additional sense code set to WRITE PROTECTED. When SWP is one (1), the WP bit in the mode parameter header will be set to one (1) for subsequent MODE SENSE commands. A SWP bit of zero (0) specifies that the drive may allow writing to the cartridge. In this case, the WP bit in the mode parameter header is set to zero (0).

The default SWP value is zero (0).

The drive internally maintains a SWP state for both the drive and cartridge. The SWP reported by a MODE SENSE of the CURRENT pages is set to (1) if either the drive or cartridge write protect is set to one (1). If either the drive or cartridge write protect state is set, the drive will treat the cartridge as write protected.

The drive SWP state is set to a default of zero (0) after drive reset or power on. After each MODE SELECT command that sends page 0H, the drive SWP state is set to the value of SWP contained in the sent page 0H.

The cartridge SWP state is written during factory format as zero (0). If a MODE SELECT command sending Page 0H with Save Parameters (SP) of one (1) is sent to the drive, then the cartridge SWP state is set to the value of SWP contained in the sent page 0H.

The effect of maintaining separate drive and cartridge SWP states is this:

- If a drive receives a MODE SELECT command that sets SWP, then all cartridges subsequently inserted into the drive will be write protected until the drive is reset, regardless of the write protect state of the individual cartridges.
- If a cartridge with a SWP state of one (1) is inserted into any drive, the cartridge will be write protected, regardless of the write SWP state of the drive.
- If a cartridge with SWP state of one (1) is ejected from the drive, and a cartridge with SWP state of zero (0) is inserted, then the drive SWP state will determine whether the cartridge can be written to.

**Audible Eject Notification:** A default value of one (1) indicates that the SyJet drive will emit audible notification of an eject-button press and cartridge-ejection complete through two distinct sounds. A value of zero (0) indicates that the drive will not emit audible eject notification.



**NOTE:** This bit is saved in the drive, not on the cartridge.

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**Device Type Qualifier:** Bits 6-0 of this byte may be set to further identify a device. Bit 7 will be ignored by the Inquiry command.

**Table 6-32 Error Recovery Parameters**

		B I T							
		7	6	5	4	3	2	1	0
B Y T E	0	Reserved		Page Code = 01H					
	1	Page Length (10 Bytes)							
	2	AWRE	ARRE	TB	RC	EER (0)	PER	DTE	DCR
	3	Read Retry Count							
	4	Correction Span							
	5	Head Offset Count (0)							
	6	Data Strobe Offset Count (0)							
	7	Reserved							
	8	Write Retry Count							
	9	Reserved							
	10	Recovery Time Limit (0) (MSB)							
	11	Recovery Time Limit (0) (LSB)							

**Page Code:** Refer to Table 6-30 for page codes descriptions.

**Page Length:** Indicates the number of bytes to be associated with this page and may be zero (0).

**Automatic Write Reallocation Enable (AWRE):** A value of zero (0) indicates that the target will not perform automatic reallocation of defective data blocks during write operations. A default value of one (1) indicates that automatic reallocation may be performed during write operations.



**NOTE:** If Write Cache is enabled in Mode Page 08H, then blocks may be reallocated during write commands, regardless of the value of AWRE.

**Automatic Read Reallocation Enable (ARRE):** A value of zero (0) indicates that the target will not perform automatic reallocation of defective data blocks during read operations. A default value of one (1) indicates that automatic reallocation may be performed during read operations.

**Transfer Block (TB):** If one (1), indicates that the failing data block (recovered or unrecoverable) data will be transferred to the initiator. A default of zero (0) indicates that the failing data block (recovered or unrecoverable) data will not be transferred to the Initiator.

The block address reported in the REQUEST SENSE data will be of the erring block, not of the preceding block.

**Read Continuous (RC):** A default value of zero (0) indicates that error recovery operations that cause delays are acceptable during the data transfer. Data will not be fabricated. A default value of one (1) indicates that the SyJet drive will transfer the entire requested length of data without adding delays to perform error recovery procedures. This bit takes priority over conflicting control bits in this byte.

**Enable Early Recovery (EER):** Not changeable, must be zero (0), indicates that the target will use an error recovery procedure that minimizes the risk of mis-detection or mis-correction.

**Post Error (PER):** If one (1), indicates that the SyJet drive will enable reporting of CHECK CONDITION status for firmware or hardware ECC recovered errors with the appropriate Sense Key. The CHECK CONDITION will happen during the data transfer, depending on the DTE bit value or if an unrecoverable error occurred. If multiple errors occur, the REQUEST SENSE data will report the block address of the last block on which recovered error occurred or the first unrecoverable error.

A default of zero (0) indicates that the SyJet drive will not create the CHECK CONDITION status for errors recovered within the limits established by the other Error Recovery Flags. Recovery procedures exceeding the limits established by the other Error Recovery Flags will be posted accordingly by the SyJet drive. The transfer of data may terminate prior to exhausting the Transfer Length, depending on the error and the state of the other Error Recovery Flags.

**Disable Transfer on Error (DTE):** If one (1) and the PER bit is set to one (1), indicates that the SyJet drive will create the CHECK CONDITION status and terminate the data transfer to the Initiator upon detecting a firmware correction. The Transfer Length is then not exhausted. The Data of the block in error, which is the first erring block encountered, may or may not be transferred to the Initiator, depending on the setting of the TB bit. The DTE bit can only be set to one (1) by the Initiator if the PER bit is set to one (1). The SyJet drive will create the CHECK CONDITION status with Illegal Request Sense Key, if PER receives PER bit of zero (0) and DTE bit set to one (1).

A default value of zero (0), enables data transfer for any data that can be recovered within the limits of the Error Recovery Flags. Any erring block that would be posted, which is the last recovered block encountered, is not posted until the Transfer Length is exhausted.

**Disable Correction (DCR):** A value of one (1) indicates that Firmware ECC error correction will not be applied in the course of error recovery. Other normal error recovery operations are not affected by this bit. A default of zero (0) enables Firmware ECC error correction.

**Read Retry Count:** This field indicates the number of read retry sequences. Default is 4B hex. This value has a minimum of 0A hex and the a maximum of 0FF hex. A single retry sequence is defined as one of the following, depending on the operation involved and the error encountered.



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**NOTE:** SyQuest recommends a default of 4B hex retries.

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### ***Error Recovery Retry Sequence***

Retry attempts will include reads on track center, moving up to  $\pm 20\%$  offtrack, applying firmware ECC and changing the threshold and window of the read/write channel.

**Correction Span:** This field specifies the size, in bits, of the largest data error burst for which data error correction may be attempted.

**Head Offset Count:** This field must be set to zero (0) to indicate that no offset is specified.

**Data Strobe Offset Count:** This field must be set to zero (0) to indicate that no offset is specified.

**Write Retry Count:** This field indicates the number of write retries. The default value is 4B hex. The minimum value is 0A hex, and the maximum is 0FF hex.

**Recovery Time Limit:** This field is not supported and must be zero (0).

**Table 6-33 Error Recovery Mode Summary**

PER	DTE	DCR	Description
0	0	0	<p>First retries, then Corrections are attempted (DCR off). Recovered and/or corrected data (if any) is transferred with no CHECK CONDITION status (PER off) at the end of the transfer. This is the default setting.</p> <ul style="list-style-type: none"> <li>•Transfer Length is exhausted. Data transfer stops only if an unrecoverable error is encountered. The SyJet drive will then create CHECK CONDITION status with the appropriate Sense Key.</li> <li>•The data of the unrecoverable Block (if any), may or may not be transferred to the Initiator, depending on the setting of the Transfer Block (TB) bit. The data of the unrecovered block may not be valid data.</li> </ul>
0	0	1	Same as (0 0 0) above but No Firmware Correction Applied (DCR on).
0	1	0	Invalid Request (DTE on, PER off).
0	1	1	Invalid Request (DTE on, PER off).

**Table 6-33 Error Recovery Mode Summary (Continued)**

<b>PER</b>	<b>DTE</b>	<b>DCR</b>	<b>Description</b>
1	0	0	<p>Report Last Data Block in error at the end of transfer. Retries then Correction (DCR off) are attempted and recovered data (if any) is transferred corrected.</p> <ul style="list-style-type: none"> <li>•The Transfer Length is exhausted if no unrecoverable error occurred (DTE off).</li> <li>•The SyJet drive creates CHECK CONDITION status with RECOVERED ERROR Sense Key and reports (in the Information bytes field of the Extended Sense data) the last block for which recovered error occurred, if any (PER on).</li> <li>•The data of the unrecoverable Block (if any), may or may not be transferred to the Initiator, depending on the setting of the Transfer Block (TB) bit. The data of the unrecovered block may not be valid data.</li> </ul>
1	0	1	<p>Same as (1 0 0) above but No Firmware Correction Applied (DCR on).</p>
1	1	0	<p>Stop Transfer on First Firmware ECC Recovered Error Encountered. Retries then Correction (DCR off) are attempted and recovered data (if any) is transferred corrected, but transfer stops (DTE on) after the first recovered or unrecoverable error is detected.</p> <ul style="list-style-type: none"> <li>•The SyJet drive creates CHECK CONDITION status (PER on) with RECOVERED ERROR Sense Key on the first block for which a recovered error occurred, if any. This mode will not be used if TB is set to zero (0).</li> </ul>
1	1	1	<p>Same as (1 1 0) above no Correction applied (DCR) on.</p> <ul style="list-style-type: none"> <li>•The data of the Block in error (if any), may or may not be transferred to the Initiator, depending on the setting of the TB bit.</li> </ul>

**Table 6-34 Disconnect/Reconnect Page**

		B I T								
		7	6	5	4	3	2	1	0	
<b>B Y T E</b>	<b>0</b>	Reserved	Page Code = 02H							
	<b>1</b>	Page Length (14 Bytes)								
	<b>2</b>	Buffer Full Ratio								
	<b>3</b>	Buffer Empty Ratio								
	<b>4</b>	Bus Inactivity Limit (MSB)								
	<b>5</b>	Bus Inactivity Limit (LSB)								
	<b>6</b>	Disconnect Time Limit (0) (MSB)								
	<b>7</b>	Disconnect Time Limit (0) (LSB)								
	<b>8</b>	Connect Time Limit (0) (MSB)								
	<b>9</b>	Connect Time Limit (0) (LSB)								
	<b>10</b>	Maximum Burst Size (0) (MSB)								
	<b>11</b>	Maximum Burst Size (0) (LSB)								
	<b>12</b>	Reserved						DTDC (0)		
	<b>13</b>	Reserved								
	<b>14</b>	Reserved								
<b>15</b>	Reserved									

**Page Length:** The number of bytes associated with this page. The Page Length may be zero (0).

**Buffer Full Ratio:** This field indicates how full the buffer should be prior to attempting a reselection on read operations. The default value is 20 hex. If a value of 0 is entered, the default value will be used.

**Buffer Empty Ratio:** This field indicates how empty the buffer should be prior to reselection on write operations. The default value is C0 hex. If a value of 0 is entered, the default value will be used.

**Bus Inactivity Limit:** This field is not supported and must be zero (0).

**Disconnect Time Limit:** This field is not supported and must be zero (0).

**Connect Time Limit:** This field is not supported and must be zero (0).

**Maximum Burst Size:** This field indicates the maximum amount of data that the SyJet drive will transfer before disconnecting. This field is not supported and must be zero (0).

**Data Transfer Disconnect Control (DTDC):** This field is not supported and must be zero (0).

**Table 6-35 Format Parameters (Mode Sense)**

		B I T							
		7	6	5	4	3	2	1	0
<b>B Y T E</b>	<b>0</b>	Reserved		Page Code = 03H					
	<b>1</b>	Page Length (22 Bytes)							
	<b>2</b>	Tracks per Zone (MSB)							
	<b>3</b>	Tracks per Zone (LSB)							
	<b>4</b>	Alternate Sectors per Zone (MSB)							
	<b>5</b>	Alternate Sectors per Zone(LSB)							
	<b>6</b>	Alternate Tracks per Zone (MSB)							
	<b>7</b>	Alternate Tracks per Zone (LSB)							
	<b>8</b>	Alternate Tracks per Volume (MSB)							
	<b>9</b>	Alternate Tracks per Volume (LSB)							
	<b>10</b>	Sectors per Track (MSB)							
	<b>11</b>	Sectors per Track (LSB)							
	<b>12</b>	Bytes per Physical Sector (MSB)							
	<b>13</b>	Bytes per Physical Sector (LSB)							
	<b>14</b>	Interleave (MSB)							
	<b>15</b>	Interleave (LSB)							
	<b>16</b>	Track Skew Factor (MSB)							
	<b>17</b>	Track Skew Factor (LSB)							
	<b>18</b>	Cylinder Skew Factor (MSB)							
	<b>19</b>	Cylinder Skew Factor (LSB)							
<b>20</b>	SSEC (0)	HSEC (1)	RMB (1)	SURF (1)	Reserved				
<b>20-23</b>	Reserved								

**Page Length:** The number of bytes associated with this page. The page length may be zero (0).

**Tracks Per Zone:** This indicates the number of tracks per zone.

**Alternate Sectors per Zone:** This specifies the number of sectors per zone the target will reserve for the defect handling.

**Alternate Tracks per Zone:** This specifies the number of tracks per zone the target will reserve for defect handling.

**Alternate Tracks per Volume:** This specifies the number of tracks per logical unit the target will reserve for defect handling.

**Sectors per Track:** This indicates the number of physical data sectors per track and varies based on the notch page selected.

**Bytes per Physical Sector:** Indicates the number of bytes per physical sector, always 512 bytes.

**Interleave:** The SyJet drive with a SyJet cartridge uses an interleave of one-to-one (1:1). The interleave is not a changeable value.

**Track Skew Factor:** Specifies the number of physical sectors between the last logical block of one track and the first logical block on the next track.

**Cylinder Skew Factor:** Specifies the number of physical sectors between the last logical block of one cylinder and the first logical block on the next cylinder.

**Soft Sector (SSEC):** A value of zero (0) indicates that the target does not support soft sector formatting.

**Hard Sector (HSEC):** A value of one (1) indicates that the target supports hard sector formatting.

**Removable (RMB):** A value of one (1) indicates the SyJet drive is a removable device.

**Surface (SURF):** A value of one (1) indicates that the SyJet drive allocates progressive addresses to all cylinders prior to allocating on the next surface.

**Page Length:** Indicates the number of bytes to be associated with this page and may be zero (0).

**Number of Cylinders:** A value of 148A hex indicates the number of physical cylinders used for both user and spare track assignment.

**Number of Heads:** A value of four (4) indicates the number of read/write heads.

**Starting Cylinder-Write Precompensation:** Not supported.

**Drive Step Rate:** Not supported.

**Landing Zone Cylinder:** Not supported.

**Rotational Position Locking (RPL):** Not supported.

**Rotational Offset:** Not supported.

**Medium Rotational Rate:** Indicates the speed at which the medium rotates (5400rpm).

**Table 6-36 Geometry Parameters (Mode Sense Only)**

		B I T							
		7	6	5	4	3	2	1	0
<b>B Y T E</b>	<b>0</b>	Reserved		Page Code = 04H					
	<b>1</b>	Page Length (22 Bytes)							
	<b>2</b>	Number of Cylinders (MSB)							
	<b>3</b>	Number of Cylinders							
	<b>4</b>	Number of Cylinders (LSB)							
	<b>5</b>	Number of Heads							
	<b>6</b>	Starting Cylinder-Write Precompensation (0) (MSB)							
	<b>7</b>	Starting Cylinder-Write Precompensation (0)							
	<b>8</b>	Starting Cylinder-Write Precompensation (0) (LSB)							
	<b>9</b>	Starting Cylinder-Reduced Write Current (0) (MSB)							
	<b>10</b>	Starting Cylinder-Reduced Write Current (0)							
	<b>11</b>	Starting Cylinder-Reduced Write Current (0) (LSB)							
	<b>12</b>	Drive Step Rate(MSB)							
	<b>13</b>	Drive Step Rate (LSB)							
	<b>14</b>	Landing Zone Cylinder (MSB)							
	<b>15</b>	Landing Zone Cylinder							
	<b>16</b>	Landing Zone Cylinder (LSB)							
	<b>17</b>	Reserved							RPL (0)
	<b>18</b>	Rotational Offset							
	<b>19</b>	Reserved							
	<b>20</b>	Medium Rotation Rate (1518) (MSB)							
	<b>21</b>	Medium Rotation Rate (1518) (LSB)							
<b>22-23</b>	Reserved								

**Table 6-37 Caching Page**

		B I T							
		7	6	5	4	3	2	1	0
B Y T E	0	Reserved		Page Code = 08H					
	1	Page Length (10 bytes)							
	2	Reserved					WCE	MF	RCD
	3	Read Retention Priority				Write Retention Priority			
	4	Disable Pre-fetch Transfer Length (MSB)							
	5	Disable Pre-fetch Transfer Length (LSB)							
	6	Minimum Pre-fetch (MSB)							
	7	Minimum Pre-fetch (LSB)							
	8	Maximum Pre-fetch (MSB)							
	9	Maximum Pre-fetch (LSB)							
	10	Maximum Pre-fetch Ceiling (MSB)							
	11	Maximum Pre-fetch Ceiling (LSB)							

**Write Cache Enable (WCE):** A value of zero (0) specifies that the SyJet drive will return good status for a Write command after successfully writing all of the data to the medium. A value of one (1) specifies that the SyJet drive may return good status for a write command after successfully receiving the data prior to having successfully written it to the medium.



**NOTE:** A value of one (1) means that the disk will perform auto-reallocation of write commands regardless of the setting of the AWRE bit in byte 1 of the Mode page 02H, Error Recovery Parameters.

**Multiplication Factor (MF):** A default value of zero (0) specifies that the SyJet drive will interpret the minimum and maximum pre-fetch fields in terms of the number of logical blocks for each of the respective types of pre-fetch. A value of one (1) specifies that the drive will interpret the pre-fetch fields in terms of a scalar number.

**Read Cache Disable (RCD):** A default value of zero specifies that the SyJet drive may return data requested by a READ command by accessing either the cache or media. A RCD bit of one specifies that the SyJet drive will transfer all of the data requested by a Read command from the medium (data cannot be transferred from the cache).

**Demand Read Retention Priority:** This field advises the SyJet drive on the retention priority to assign data read into the cache that has also been transferred from the SyJet drive to the host.

A default value of zero (0) indicates the SyJet drive should not distinguish between retaining the indicated data and data placed into the cache memory by other means (pre-fetch). A value of one (1) indicates that data put into the cache via a Read command should be replaced sooner than data placed into the cache by other means. A value of 0F hex indicates that data put into the cache via a Read command should not be replaced if there is other data in the cache that was placed there by other means.

**Write Retention Priority:** This field advises the SyJet drive on the retention priority to assign data written into the cache that has also been transferred from the cache memory to the medium. A default value of zero (0) indicates the SyJet drive should not distinguish between retaining the indicated data and data placed into the cache memory by other means (pre-fetch). A value of one (1) indicates that data put into the cache via a Write or Write Verify command should be replaced sooner than data placed into the cache by other means. A value of 0F hex indicates that data put into the cache via a Write or Write Verify command should not be replaced if there is other data in the cache that was placed there by other means.

**Disable Pre-fetch Transfer Length:** This field specifies the selective disabling of pre-fetch on long transfer lengths. This value is compared to the number of blocks requested by the current Read command. If the number of blocks is greater than the disable pre-fetch transfer length, then a pre-fetch is not done for the command. Otherwise, the SyJet drive will attempt a pre-fetch. If this field is set to zero (0) then all pre-fetching is disabled. This field must be set to FFFF hex for pre-fetching to be permanently enabled.

**Minimum Pre-fetch:** This field indicates either a number of blocks or a scalar multiplier of the transfer length, depending on the setting of the MF bit. The resulting number of blocks is the number to pre-fetch, regardless of the delays that might result during subsequent commands. The default value is 0.

**Maximum Pre-fetch:** This field indicates either a number of blocks or a scalar multiplier of the transfer length, depending on the setting of the MF bit. The resulting number of blocks is the number to pre-fetch without causing delays in subsequent executed commands. The default value is C0 hex.

**Maximum Pre-fetch Ceiling:** This field specifies an upper limit on the number of logical blocks computed as the maximum pre-fetch. If the number of blocks is greater than the maximum pre-fetch, then the number of logical blocks will be truncated to the value stored in the maximum pre-fetch ceiling field. The default value is C0 hex.

**Table 6-38 Control Mode Page**

		B I T							
		7	6	5	4	3	2	1	0
B Y T E	0	Reserved		Page Code = 0AH					
	1	Page Length (6 bytes)							
	2	Reserved							RLEC
	3	Queue Algorithm Modifier			Reserved		QErr	DQue	
	4	EECA	Reserved			RAENP	UAAENP	EAENP	
	5	Reserved							
	6	Ready AEN Holdoff Period (MSB)							
	7	Ready AEN Holdoff Period (LSB)							

**Page Length:** The number of bytes associated with this page. The page length may be zero (0).

**Report Log Exception Condition (RLEC):** This field is not supported and must be zero.

**Queue Algorithm Modifier:** A default value of zero (0) indicates that the SyJet drive will order the actual execution sequence of the commands with a SIMPLE QUEUE such that data integrity is maintained for that initiator. A value of one (1) specifies that the SyJet drive can reorder the actual execution sequence of the commands with a SIMPLE QUEUE tag.

**Queue Error Management (QErr):** A default value of zero (0) indicates that remaining I/O processes will resume after the contingent allegiance condition or extended allegiance condition. A value of one (1) indicates that all remaining suspended I/O processes will be aborted after the contingent allegiance condition.

**Enable Extended Allegiance Condition (EECA):** This field is not supported and must be zero (0).

**Ready Asynchronous Event Notification Permission (RAENP):**  
This field is not supported and must be zero (0).

**Unit Attention AEN Permission (UAAENP):** This field is not supported and must be zero (0).

**Error AEN Permission:** This field is not supported and must be zero (0).

**Ready AEN Holdoff Period:** This field is not supported and must be zero (0).

**Table 6-39 Notch and Partition Page**

		B I T							
		7	6	5	4	3	2	1	0
<b>B Y T E</b>	<b>0</b>	Reserved		Page Code = 0CH					
	<b>1</b>	Page Length (22 bytes)							
	<b>2</b>	ND (1)	PLN (0)	Reserved					
	<b>3</b>	Reserved							
	<b>4</b>	Maximum Number of Notches (MSB)							
	<b>5</b>	Maximum Number of Notches (LSB)							
	<b>6</b>	Active Notch (MSB)							
	<b>7</b>	Active Notch (LSB)							
	<b>8</b>	Starting Boundary (MSB)							
	<b>9</b>	Starting Boundary							
	<b>10</b>	Starting Boundary							
	<b>11</b>	Starting Boundary (LSB)							
	<b>12</b>	Ending Boundary (MSB)							
	<b>13</b>	Ending Boundary							
	<b>14</b>	Ending Boundary							
	<b>15</b>	Ending Boundary (LSB)							
	<b>16-22</b>	Pages Notched (00H)							
<b>23</b>	Pages Notched (LSB)								

The SyJet drive, when used with a SyJet cartridge, uses zoned recording techniques causing the number of sectors per track to be different in each zone. There are sixteen (16) zones on the SyJet cartridge.

**Page Length:** The number of bytes associated with this page. The Page Length may be zero (0).

**Notched Drive (ND):** A one (1) will be returned, indicating that the SyJet drive is a notched drive.

**Physical or Logical Notch (PLN):** Zero (0) indicates that the boundaries are based on physical parameters. The cylinder is the most significant and the head is the least significant.

**Maximum Number of Notches:** The SyJet cartridge has sixteen (16) notches. This is a Mode Sense value only and will be reported as unchangeable.

**Active Notch:** Specifies the notch that this and subsequent Mode Select and Mode Sense commands will refer to, until changed by a later Mode Select command. The value of the active notch will be greater than or equal to zero (0) and less than sixteen (16) for the SyJet cartridge. If no notch is specified, or if the active notch is specified as a value of zero (0) then this and subsequent Mode Select and Mode Sense commands refer to the parameters that apply across notches. Page-code three (3) will return values for notch one (1) as a default.

**Starting Boundary:** Indicates the beginning of the active notch or, if the active notch is zero (0), the logical unit, which will be zero (0). The three most significant bytes will represent the cylinder and the least significant byte will represent the head. This field is a Mode Sense value only and will be reported as unchangeable. This field may be set to zero (0) or the default value of 89 hex.

**Ending Boundary:** Indicates the ending of the active notch or, if the active notch is zero (0), the logical unit, which will be zero (0). Then the three most significant bytes will represent the cylinder and the least significant byte will represent the head. This field is a Mode Sense value only and will be reported as unchangeable. This field may be set to zero (0) or the default value of 26B hex.

**Pages Notched:** This field is a bit map of Page Codes that indicates which mode page(s) contains parameters that may be different for different notches. If the sixty-four (64) bits are numbered 0...3FH, from the least significant bit to the most significant bit, then each bit corresponds to a mode page from 0...3FH inclusive. If a bit is one (1), then the corresponding mode page may contain parameters that are different for different notches. If a bit is zero (0), then the corresponding mode page contains parameters that will hold constant across all notches. This is a Mode Sense value only and will be reported as unchangeable. A value of 08 hex indicates that page 3 (the fourth page) contains parameters that may change if the active notch changes.

The only page that may have different values for different notches is page three (3). If no notch is specified or notch zero (0) is selected, page three (3) will return default values that are the values for notch one (1).

**Table 6-40 Power Condition Page**

		B I T								
		7	6	5	4	3	2	1	0	
B Y T E	0	PS	Reserved	Page Code = 1AH						
	1	Page Length (0AH)								
	2	Reserved								
	3	Reserved						Idle=0	Standby	
	4	Idle Condition Timer (MSB=0)								
	5	Idle Condition Timer (Byte 2=0)								
	6	Idle Condition Timer (Byte 1=0)								
	7	Idle Condition Timer (LSB=0)								
	8	Standby Condition Timer (MSB)								
	9	Standby Condition Timer (Byte 2)								
	10	Standby Condition Timer (Byte 1)								
	11	Standby Condition Timer (LSB)								

**Page Length:** The number of bytes to be associated with this page. Page Length may be zero (0).

**Idle:** This bit must be zero (0) to indicate that the drive will not enter the idle condition.

**Standby:** A default value of one (1) indicates that the drive will set the timeout for parking the heads equal to the standby condition timer value. A value of zero (0) indicates that the drive will not enter the standby condition.

**Idle Condition Timer:** This field is not supported, and must be set to zero (0).

**Standby Condition Timer:** This field indicates the inactivity time in 100 msec increments that the drive will wait from completion of the previous host command to enter the standby condition and park the heads. The allowable values are 1770 hex (10 minutes)—the default value of 4650 hex (30 minutes), 8CA0 hex (one hour), and 1A5E0 hex (three hours).



**NOTE:** The information from this page will be saved to the drive, not the cartridge.

**Table 6-41 Vendor/Product Identification**

		B I T							
		7	6	5	4	3	2	1	0
E	0	Reserved		Page Code = 20H					
	1	Page Length (24 bytes)							
Y	2-9	Vendor Identification							
B	10-25	Product Identification							

**Page Length:** Indicates the number of bytes to be associated with this page and may be zero.

**Vendor Identification:** These eight (8) bytes contain a Vendor ID in ASCII. The default value is “SyQuest.” The vendor identification will be returned by the Inquiry command in bytes 8-15. Refer to “Inquiry (12H)” on page 6-24.

**Product Identification:** These sixteen (16) bytes contain a product ID in ASCII. The default value is “SyJet-S.” The Product Identification will be returned by the Inquiry command in bytes 16-31. Refer to “Inquiry (12H)” on page 6-24.

The “SyQuest SyJet-S” default will be returned whenever a cartridge is not ready in the SyJet drive. If the cartridge is ready, but page 20H has not been specified for the cartridge, the SyQuest SyJet drive will be returned for the SyJet cartridge. Whenever a cartridge is spun up and ready that has had a Vendor and Product Identification specified, then the data returned will be Vendor Identification and Product Identification taken from the cartridge parameter area.

# Reserve (16H)

*Table 6-42 Reserve Command*

		B I T							
		7	6	5	4	3	2	1	0
E T Y B	0	Operation Code (16H)							
	1	Logical Unit Number	3rd Party	Third Party Device ID		Extent			
	2	Reservation Identification							
	3	Extent List Length (MSB) (0)							
	4	Extent List Length (LSB) (0)							
	5	Reserved						Flag	Link

The Reserve command is used to reserve the SyJet drive for the use of the Initiator. In the third-party reservation option, the logical units or extents may be reserved for another specified SCSI device. The Reserve and Release commands provide the basic mechanism for contention resolution in multiple-initiator systems.

**3rd Party:** If set to one (1), indicates this is a third party reservation.

**Third Party Device ID:** Indicates the third party SCSI ID when 3RDPTY is set.

**Extent:** Must be a value of zero (0) to indicate that no extent list follows.

**Reservation Identification:** Allows identification of individual reservations by the same Initiator; later used to identify these reservations in the Release command.

This command requests that the entire SyJet drive be reserved for the exclusive use of the Initiator until the reservation is superseded by another valid Reserve command from the same Initiator or until released by a release command from the same Initiator, by Send Diagnostic Self-Test, by a Bus Device Reset message from any Initiator, or by a “hard” Reset condition. A reservation will not be granted if the drive is reserved by another Initiator. It is permissible for an Initiator to reserve a drive that is currently reserved by that Initiator. With the extent bit zero (0), the reservation identification and the extent list length are ignored.

If the drive is reserved for another Initiator, the SyJet drive will respond by returning Reservation Conflict status.

If, after honoring the reservation, any other Initiator then subsequently attempts to perform any command on the reserved drive, the command will be rejected with Reservation Conflict status.

### ***Superseding Reservations***

An Initiator that holds a current reservation may modify that reservation by issuing another Reserve command. The superseding Reserve command releases the previous reservation state when the new reservation request is granted. The previous reservation will not be modified if the new reservation request cannot be granted. If the superseding reservation cannot be granted because of conflicts with a previous active reservation (other than the reservation being superseded), then the SyJet drive will return Reservation Conflict status.

## Release (17H)

**Table 6-43 Release Command**

		B I T							
		7	6	5	4	3	2	1	0
B Y T E	0	Operation Code (17H)							
	1	Logical Unit Number		3rd Party	Third Party Device ID		Extent		
	2	Reservation Identification							
	3	Reserved							
	4	Reserved							
	5	Reserved						Flag	Link

The Release command is used to release a previously reserved SyJet drive. It is not an error for an Initiator to attempt to release a reservation that is not currently active.

**3rd Party:** If set to one (1), indicates this is a third party release.

**Third Party Device ID:** Indicates the third party SCSI ID when 3RDPTY is set.

**Extent:** Must be a value of zero (0) to indicate that no extent list follows.

**Reservation Identification:** Allows identification of individual reservations by the same Initiator; previously specified in the Reserve command.

## Mode Sense (1AH)

*Table 6-44 Mode Sense Command*

		B I T							
		7	6	5	4	3	2	1	0
E T Y B	0	Operation Code (1AH)							
	1	Logical Unit Number			0	DBD	Reserved		
	2	PC		Page Code					
	3	Reserved							
	4	Allocation Length							
	5	Reserved					Flag	Link	

The Mode Sense Command provides a means for the SyJet drive to report its device parameters. It is a complementary command to the Mode Select Command.

**Disable Block Descriptor (DBD):** Set to zero (0) indicates that the SyJet drive will return one (1) block descriptor in the returned MODE SENSE data. The DBD bit set to one (1) specifies that the SyJet drive will not return any block descriptor in the returned MODE SENSE data.

**Page Control Field (PC):** Defines the type of page parameter values to be returned. Refer to Table 6-49.

**Page Code:** Refer to Table 6-48 for page-code function definitions.

**Allocation Length:** Specifies the number of bytes that the Initiator has allocated for returned sense data. An Allocation Length of zero (0) indicates no sense data will be transferred. This is not considered an error condition. Any other value indicates the number of bytes to be transferred. The SyJet drive will terminate the data-in phase when Allocation Length bytes have been transferred or when all available sense data has been sent to the Initiator.

The Mode Sense data contains a 4-byte header (following table), followed by an 8-byte Block Descriptors, followed by the additional Page descriptors, if any.

**Table 6-45 Mode Sense Header**

		B I T							
		7	6	5	4	3	2	1	0
B Y T E	0	Sense Data Length							
	1	Medium Type (00)							
	2	WP	Reserved						
	3	Block Descriptor Length							

**Sense Data Length:** This field specifies the length in bytes of all following data.

**Medium Type:** Set to zero for the SyJet drive.

**Write Protect (WP):** A one (1) indicates the SyJet drive write protect is active. A zero (0) indicates the SyJet drive is write enabled.

**Block Descriptor Length:** Specifies either eight (8) or zero (0) bytes for the length of the returned block descriptor.

**Table 6-46 Block Descriptors**

		B I T							
		7	6	5	4	3	2	1	0
B Y T E	0	Density Code (00)							
	1	Number of Blocks (MSB)							
	2	Number of Blocks							
	3	Number of Blocks (LSB)							
	4	Reserved							
	5	Block Length (MSB)							
	6	Block Length							
	7	Block Length (LSB)							

**Density Code:** Specifies a media density of zero (0) for the SyJet drive.

**Number of Blocks:** Specifies the available number of blocks.

**Block Length:** Specifies that the length of logical blocks is 512 bytes.

**Table 6-47 Mode Page Descriptors**

		B I T							
		7	6	5	4	3	2	1	0
B Y T E	0	PS	0	Page Code					
	1	Page Length (bytes)							
	2	Refer to page definition							
	n	See Mode Select command							

**Page Savable:** A value of one (1) indicates that this page is savable. Refer to Table 6-30.

**Page Code:** See Table 6-48 for page-code functions.

**Page Length:** Specifies the number of bytes to be associated with this page and may be zero (0).

**Table 6-48 Page Codes**

<b>Page Code</b>	<b>Description</b>
0H	Operating Parameters (Selectable)
1H	Error Recovery Parameters
2H	Disconnect/Reconnect
3H	Format Parameters (Default only)
4H	Geometry Parameters (Default only)
05H – 07H	Reserved
08H	Caching
09H	Reserved
0AH	Control Mode
0BH	Reserved
0CH	Notch and Partition
0DH – 19H	Reserved
1AH	Power Condition
1BH - 1FH	Reserved
20H	Vendor/Product Identification
21H – 3EH	Reserved (Ignored)
3FH	Report current values: All pages are returned with their currently selected or default values

**Table 6-49 Page Control Field, Bit 7 and Bit 6 of Command Descriptor Block Byte 2**

Bit 7	Bit 6	Report	Description
0	0	Current Values	If the Page Code is equal to 3FH, all Pages implemented by the SyJet drive will be returned to the Initiator with fields and bits set to Current values.
			If the Page Code is different than 3FH, the Page defined by the Page Code (if supported) will be returned with fields and bits set to Current values.
			<p>The Current values are one of the following:</p> <ul style="list-style-type: none"> <li>• As set in the last successfully completed MODE SELECT command</li> <li>• Identical to the Saved values if saving is available and if no MODE SELECT command was issued since the last power on</li> <li>• Identical to the Default values if no saving is available or if no Saved values are available</li> </ul>
			Field and bits not supported will be set to zero (0). The Page Length byte value of each Page returned by the SyJet drive indicates which fields are supported within the particular Page.

**Table 6-49 Page Control Field, Bit 7 and Bit 6 of Command Descriptor Block Byte 2 (Continued)**

Bit 7	Bit 6	Report	Description
0	1	Changeable Values	<p>If the Page Code is equal to 3FH, all Pages implemented by the SyJet drive will be returned to the Initiator with bits and fields that are allowed to be changed by the Initiator set to one (1). Fields and bits not allowed to be changed by the Initiator will be set to zero (0).</p>
			<p>If the Page Code is different than 3FH, the Page defined by the Page Code (if supported) will be returned to the Initiator with bits and fields that are allowed to be changed by the Initiator set to one (1). Fields and bits not allowed to be changed by the Initiator will be set to zero (0).</p>
			<p>If no bits or fields are changeable within a Page, the SyJet drive will only return bytes 0 and 1 of the Page.</p>
			<p>The Page Length byte value of each Page returned by the SyJet drive indicates which fields are supported within the particular page.</p>

**Table 6-49 Page Control Field, Bit 7 and Bit 6 of Command Descriptor Block Byte 2 (Continued)**

Bit 7	Bit 6	Report	Description
1	0	Default Values	<p>If the Page Code is equal to 3FH, all Pages Implemented will be returned to the Initiator with fields and bits set to the default values.</p> <p>If the Page Code is other than 3FH, the page defined by the Page Code (if supported) will be returned to the Initiator with fields and bits set to the default values.</p> <p>Fields and bits not supported will be set to zero (0). The Page Length byte value of each Page returned by the SyJet drive indicates which fields are supported within the particular page.</p> <p>The value of the fields returned with this code is intended to avoid confusion over whether the value of zero (0) is the default or the non supported value.</p>

**Table 6-49 Page Control Field, Bit 7 and Bit 6 of Command Descriptor Block Byte 2 (Continued)**

Bit 7	Bit 6	Report	Description
1	1	Saved Values	<p>If the Page Code is equal to 3FH, all Pages implemented will be returned to the Initiator with fields and bits set to the saved values.</p> <p>If the Page Code is other than 3FH, the Page defined by the Page Code (if supported), will be returned to the Initiator with fields and bits set to the saved values.</p> <p>The Saved values are one of the following:</p> <ul style="list-style-type: none"> <li>• The values saved during the last successfully completed MODE SELECT command</li> <li>• Identical to the Default values if no saving possibility is available</li> </ul> <p>Fields and bits not supported will be set to zero (0). The Page Length byte value of each Page returned by the SyJet drive indicates which fields are supported within the particular page.</p>

Current and Saved values may be modified by successful MODE SELECT commands.

An Initiator may request a particular Page to be returned by the SyJet drive by selecting its code in byte two of the CDB.

**Table 6-50 Page Code Meaning**

Page Code	Number of Bytes To Be Returned (+2 per page)	Page Code			
		CUR 0 0	CHG 0 1	DEF 1 0	SAV 1 1
0H	Operating Parameters	3	3	3	3
1H	Error Recovery Parameters	10	10	10	10
02H	Disconnect/Reconnect Control Parameters	14	14	14	14
3H	Direct Access Device Format Parameter	22	0	22	22
4H	Rigid Disk Drive Geometry Parameters	22	0	22	22
5H-07H	Reserved	-	-	-	-
08H	Caching	10	10	10	10
09H	Reserved	-	-	-	-
0AH	Control Mode	6	6	6	6
0BH	Reserved	-	-	-	-
0CH	Notch and Partition Data	22	6	22	22
0DH - 19H	Reserved	-	-	-	-
1AH	Power Condition	10	10	10	10

**Table 6-50 Page Code Meaning (Continued)**

Page Code	Number of Bytes To Be Returned (+2 per page)				
1BH - 1FH	Reserved	–	–	–	–
20H	Vendor/Product ID	24	24	24	24
21H–3EH	Reserved	–	–	–	–
3FH	Return all Pages to the Initiator	143	83	143	143

**Note:**

See Page Code bit configuration. Page Control valid for MODE SENSE commands only.

**Table 6-51 Page Code Abbreviation Meanings**

Page Code	Meaning
CUR	Current values
CHG	Changeable values
DEF	Default values
SAV	Saved values

The SyJet drive will return the Page Length value in each Page that it supports with the 3FH Page Code according to the PC field.

## Start/Stop (1BH)

**Table 6-52 Start/Stop Commands**

		B I T							
		7	6	5	4	3	2	1	0
B Y T E	0	Operation Code (1BH)							
	1	Logical Unit Number			Reserved				IMMED
	2	Reserved							
	3	Reserved							
	4	Reserved					LoEj	START	
	5	Reserved					Flag	Link	

The Start/Stop command requests the SyJet drive to start the spindle and move the R/W heads to logical block zero (0), or move the heads to the outside diameter of the media and stop the spindle.

**IMMED:** If one (1), indicates status will be returned as soon as the operation is initiated. If zero (0), indicates that status will be presented when the operation is completed.

**LoEj:** A Load Eject (LoEj) bit of zero (0) requests that no action be taken regarding loading or ejecting the medium. A LoEj bit of one (1) requests that the medium be unloaded if the start bit is zero (0). Loading of media is not supported by the SyJet drive. The Load Eject bit is not valid if the Hard Disk Drive Option of Mode Page 0 has been set (see page 6-33).

**START:** If one (1), and a cartridge is loaded, the SyJet drive will go to idle mode. The SyJet drive will first spin up the cartridge and then position the heads at logical block zero (0).

If zero (0) and PREVENT MEDIUM REMOVAL is not active, the drive will move the heads to the outer diameter and spin down the cartridge. The cartridge will then be ejected if the LoEj bit is set to one (1). If start is zero (0) and LoEj is zero (0) the SyJet drive will go to sleep mode.

If zero (0) and PREVENT MEDIUM REMOVAL is active, the SyJet drive will terminate the command with CHECK CONDITION status. The sense key will be set to UNIT ATTENTION and the additional sense code will be set to MEDIA REMOVAL PREVENTED. See the Prevent/Allow Medium Removal command.

If the Start bit is zero (0) and the Immed bit is zero (0), then the second timer will be activated. If the SyJet drive does not complete the stop command with ten seconds, the drive will return CHECK CONDITION status. The sense key will be set to HARDWARE ERROR, and the sense code will be set to EJECT FAILURE. After the timer has expired, the drive will continue to exhaust its retry sequence, after which it will not recognize media in the drive until the media is reinserted or a start command completes successfully.

## Receive Diagnostic Results (1CH)

*Table 6-53 Receive Diagnostic Results Command*

		B I T							
		7	6	5	4	3	2	1	0
B Y T E	0	Operation Code (1CH)							
	1	Logical Unit Number				Reserved			
	2	Reserved							
	3	Allocation Length (MSB)							
	4	Allocation Length (LSB)							
	5	Reserved						Flag	Link

The Receive Diagnostic Results Command requests that analysis data be sent to the Initiator after completion of a Send Diagnostic Command.

**Allocation Length:** Zero through Four bytes of result data, conforming to the Non-extended Sense format, will be returned according to Allocation Length. The diagnostic data returned depends on the Diagnostic Command.

## Send Diagnostic (1DH)

**Table 6-54 Send Diagnostic Command**

		B I T							
		7	6	5	4	3	2	1	0
B Y T E	0	Operation Code (1DH)							
	1	Logical Unit Number		PF	Reserved	SLFTST	DevOfL	UnitOfL	
	2	Reserved							
	3	Parameter List Length (MSB) (00)							
	4	Parameter List Length (LSB)							
	5	Reserved					Flag	Link	

The Send Diagnostic Command requests that the SyJet drive perform self-diagnostic tests. The Head Cleaning Diagnostics Page is supported. When this page is transferred, the head cleaning algorithm will be activated.

**Page Format (PF):** This field should be one (1) to indicate that the parameters conform to the SCSI-2 specification.

**Self Test (SLFTST):** If one (1), directs the SyJet drive to complete its default self-test. If this test is requested, the Parameter List Length must be set to zero (0). A Receive Diagnostic Results Command, or Request Sense Command (preferred) is required to receive self-test results. If zero (0), this command will always return with Good Status (no operation).

**Device Off-Line (DevOfL):** This field is not supported and must be zero (0).

**Unit Off-Line (UnitOfL):** This field is not supported and must be zero (0).

**Parameter List Length:** The Parameter List length must be zero (0) or four (4). A value of four indicates that a diagnostics page will be transferred to the Initiator.



**NOTE:** The Send Diagnostic command allows the operating system to be independent of vendor-unique diagnostic commands. The diagnostic software then becomes more portable to various operating systems.

**Table 6-55 Head Cleaning Page**

		B I T							
		7	6	5	4	3	2	1	0
B Y T E	0	Page Code = 80H							
	1	Reserved							
	2	Page Length (MSB) (0)							
	3	Page Length (LSB) (0)							

The Parameter List Length must be four (4) for this page to be transferred. This will activate the head cleaning algorithm.

## Prevent/Allow Medium Removal (1EH)

**Table 6-56 Prevent/Allow Medium Removal Command**

		B I T							
		7	6	5	4	3	2	1	0
B Y T E	0	Operation Code (1EH)							
	1	Logical Unit Number				Reserved			
	2	Reserved							
	3	Reserved							
	4	Reserved							PRVNT
	5	CDS	Reserved					Flag	Link

The Prevent/Allow Medium Removal command requests that the SyJet drive enable/disable spin down and the removal of the cartridge.

**Prevent (PRVNT):** A one (1) causes the SyJet drive to ignore the front panel eject button, except for status posting, thus preventing removal of the cartridge. If zero (0), testing of the eject button will be enabled allowing subsequent spin down and removal of the cartridge.

If PRVNT is one (1) and the cartridge is already removed, or the eject button has already been pushed, the SyJet drive will terminate the command with CHECK CONDITION. The sense key will be set to ILLEGAL REQUEST with an additional Sense Code of ILLEGAL FUNCTION.

**Check Door Switch (CDS):** If zero (0), the state of the door switch will not affect the termination status of the command. If one (1), the response will depend on the setting of the PRVNT bit as follows:

**Table 6-57 PRVNT Bit Settings**

CDS	PRVNT	Description
1	0	Returns a Sense Key of 05H (Illegal Request) with an additional Sense Code of 24H (Illegal Field in CDB)
1	1	Causes the command completion status to be dependent on the state of the door button. If the door button is not in the “pushed” position, the completion status will not be affected. If the door button <u>is</u> in the “pushed” position the SyJet command will return a Check Condition. A Request Sense command will return a Sense Key (Vendor Unique) with an Additional Sense Code and Additional Sense Code Qualifier of Operator Medium Removal Request.

If the Prevention of Medium Removal condition is active and a Start/Stop Unit command is issued requesting the SyJet drive to stop the cartridge, the SyJet drive will terminate Start/Stop Unit command with CHECK CONDITION status. The sense key will be set to UNIT ATTENTION and the additional sense code will be set to MEDIA REMOVAL PREVENTED.

The Prevention of Medium Removal condition will terminate upon receipt of a Prevent/Allow Medium Removal command with the Prevent (PRVNT) bit set to zero (0), or by the receipt of a Bus Device Reset message from any Initiator or by a “hard” reset condition.



**NOTE:** This is an illegal command if issued when the Hard Disk Drive Option is set in Mode Page 0 (see page 6-33).

# Read Capacity (25H)

*Table 6-58 Read Capacity Command*

		B I T							
		7	6	5	4	3	2	1	0
B Y T E	0	Operation Code (25H)							
	1	Logical Unit Number			Reserved				RelAdr
	2	Logical Block Address (MSB)							
	3	Logical Block Address							
	4	Logical Block Address							
	5	Logical Block Address (LSB)							
	6	Reserved							
	7	Reserved							
	8	Reserved							PMI
	9	Reserved						Flag	Link

The Read Capacity Command provides a means for the Initiator to request information regarding the capacity of the drive. If a cartridge is not installed, this command will terminate with CHECK CONDITION. The sense key will be set to DRIVE NOT READY and the additional sense code will be set to MEDIUM NOT PRESENT.

**Relative Address (RelAdr):** This field must be zero (0) to indicate that the logical block address field specifies the first logical block of the range of logical blocks to be used when PMI equals one.

**Partial Medium Indicator (PMI):** A value of zero (0) indicates that the information returned in the Read Capacity Data will be the Logical Block Address and Block Length of the last logical block of the drive. The Logical Block Address in the Command Descriptor Block must be set to zero for this option.

A value of one (1) indicates that the information returned will be the Logical Block Address and Block Length of the last logical block after the Logical Block address specified in the Command Descriptor Block before a substantial delay in data transfer (e.g., a cylinder boundary).

The following eight bytes of Read Capacity data are sent during the data-in phase of the command.

**Table 6-59 Read Capacity Data**

		B I T							
		7	6	5	4	3	2	1	0
B Y T E	0	Logical Block Address (MSB)							
	1	Logical Block Address							
	2	Logical Block Address							
	3	Logical Block Address (LSB)							
	4	Block Length (MSB)							
	5	Block Length							
	6	Block Length							
	7	Block Length (LSB)							

**Logical Block Address:** Specifies the last logical block address available as requested by the PMI bit. The default assumes the PMI bit set to zero (0), is block 2,929,799 for the SyJet cartridge.

**Block Length:** Specifies that the length of the logical block is 512 bytes.

## Extended Read (28H)

**Table 6-60 Extended Read Command**

		B I T							
		7	6	5	4	3	2	1	0
<b>E T Y B</b>	<b>0</b>	Operation Code (28H)							
	<b>1</b>	Logical Unit Number		DPO	FUA	Reserved		RelAdr	
	<b>2</b>	Logical Block Address (MSB)							
	<b>3</b>	Logical Block Address							
	<b>4</b>	Logical Block Address							
	<b>5</b>	Logical Block Address (LSB)							
	<b>6</b>	Reserved							
	<b>7</b>	Transfer Length (MSB)							
	<b>8</b>	Transfer Length (LSB)							
	<b>9</b>	Reserved						Flag	Link

The Extended Read Command requests that the SyJet drive transfer data to the Initiator.

**Disable Page Out (DPO):** This field is not supported, and must be zero (0).

**Force Unit Access (FUA):** This field is not supported, and must be zero (0).

**Relative Address (RelAdr):** This field must be zero (0) to indicate that the logical block address field specifies the first logical block of the range of blocks to be read.

**Logical Block Address:** Specifies the Logical Block where the Read operation will begin.

**Transfer Length:** Specifies the number of contiguous blocks of data to be transferred. A transfer length of zero indicates that no logical blocks will be transferred. This will not be considered an error condition. Any other value indicates the number of logical blocks to be transferred. The most recently written data value will be returned.

## Extended Write (2AH)

**Table 6-61 Extended Write Command**

		B I T							
		7	6	5	4	3	2	1	0
E T Y B	0	Operation Code (2AH)							
	1	Logical Unit Number			DPO	FUA	Reserved		RelAdr
	2	Logical Block Address (MSB)							
	3	Logical Block Address							
	4	Logical Block Address							
	5	Logical Block Address (LSB)							
	6	Reserved							
	7	Transfer Length (MSB)							
	8	Transfer Length (LSB)							
	9	Reserved						Flag	Link

The Extended Write Command requests that the SyJet drive write the data transferred by the Initiator to the medium.

**Disable Page Out (DPO):** This field is not supported, and must be zero (0).

**Force Unit Access:** This field is not supported, and must be zero (0).

**Relative Address (RelAdr):** This field must be zero (0) to indicate that the logical block address field specifies the first logical block of the range of blocks to be written.

**Logical Block Address:** Specifies the Logical Block where the Write operation will begin.

**Transfer Length:** Specifies the number of contiguous blocks of data to be transferred. A Transfer Length of zero (0) indicates that no logical blocks will be transferred. This is not considered an error condition. Any other value indicates the number of logical blocks to be transferred.

# Extended Seek (2BH)

*Table 6-62 Extended Seek Command*

		B I T							
		7	6	5	4	3	2	1	0
E T Y B	0	Operation Code (2BH)							
	1	Logical Unit Number				Reserved			
	2	Logical Block Address (MSB)							
	3	Logical Block Address							
	4	Logical Block Address							
	5	Logical Block Address (LSB)							
	6	Reserved							
	7	Reserved							
	8	Reserved							
	9	Reserved						Flag	Link

The Extended Seek command requests that the SyJet drive seek to the specified logical block address.

**Logical Block Address:** Specifies the logical block number that the drive will seek to.

## Write Verify (2EH)

*Table 6-63 Write Verify Command*

		B I T							
		7	6	5	4	3	2	1	0
B Y T E	0	Operation Code (2EH)							
	1	Logical Unit Number		DPO	Reserved		BYTCHK	RelAdr	
	2	Logical Block Address (MSB)							
	3	Logical Block Address							
	4	Logical Block Address							
	5	Logical Block Address (LSB)							
	6	Reserved							
	7	Transfer Length (MSB)							
	8	Transfer Length (LSB)							
	9	Reserved					Flag		Link

The WRITE VERIFY command requests that the SyJet drive write the data transferred from the Initiator to the medium and then verify that the data is correctly written. The data is only transferred once from the Initiator to the SyJet drive.

**Disable Page Out (DPO):** This field is not supported, and must be zero (0).

**Relative Address (RelAdr):** This field must be zero (0) to indicate that the logical block address field specifies the first logical block of the range of blocks to be written.

**Byte Check (BYCHK):** This field must be zero (0) to indicate that the verification is to be a medium verification by checking for a good ECC code.

**Logical Block Address:** Specifies the logical block at which the Write Verify operation will begin.

**Transfer Length:** Specifies the number of contiguous logical blocks of data to be transferred. A transfer length of zero (0) indicates that no logical blocks will be transferred and is not an error condition. Any other value indicates the number of logical blocks that will be written and verified.

## Verify (2FH)

**Table 6-64 Verify Command**

		B I T							
		7	6	5	4	3	2	1	0
B Y T E	0	Operation Code (2FH)							
	1	Logical Unit Number		DPO	Reserved		BYTCHK	RelAdr	
	2	Logical Block Address (MSB)							
	3	Logical Block Address							
	4	Logical Block Address							
	5	Logical Block Address (LSB)							
	6	Reserved							
	7	Verification Length (MSB)							
	8	Verification Length (LSB)							
	9	Reserved					Flag		Link

The VERIFY command requests that the SyJet drive verify the data written on the medium.

**Disable Page Out (DPO):** This field is not supported, and must be zero (0)

**Byte Check (BYCHK):** This field must be zero (0) to indicate that the verification is simply a medium verification by checking for a good ECC code.

**Relative Address (RelAdr):** This field must be zero (0) to indicate that the logical block address field specifies the first logical block of the range of blocks to verified.

**Logical Block Address:** Specifies the logical block at which the verify operation will begin.

**Verification Length:** Specifies the number of contiguous logical blocks of data that will be verified. A transfer length of zero (0) indicates that no logical blocks will be verified. This condition will not be considered as an error. Any other value indicates the number of logical blocks that will be verified.

## Read Defect Data (37H)

**Table 6-65 Read Defect Data Command**

		B I T							
		7	6	5	4	3	2	1	0
B Y T E	0	Operation Code (37H)							
	1	Logical Unit Number			Reserved				
	2	Reserved			P	G	Defect List Format		
	3	Reserved							
	4	Reserved							
	5	Reserved							
	6	Reserved							
	7	Allocation Length (MSB)							
	8	Allocation Length (LSB)							
	9	Reserved					Flag	Link	

The READ DEFECT DATA command requests that the SyJet drive transfer the medium defect data to the initiator.

**Table 6-66 P & G Lists**

P Bit	G Bit	Description
1		Initiator requests that the primary list of defects be returned
0		Drive will not return the primary list of defect
	1	Initiator requests that the growing list of defects be returned
	0	Drive will not return the growing list of defects
1	1	Drive is requested to return the primary and the growing list of defects
0	0	Defect List Header is only to be returned

**Defect List Format:** This field must be set to a five (5) indicating physical format (see Format Unit command). If any other value is specified the SyJet drive will terminate the command with CHECK CONDITION. The sense key will be set to ILLEGAL REQUEST with an additional sense code of INVALID FIELD IN CDB.

**Allocation Length:** Specifies the number of bytes that the initiator has allocated for returned READ DEFECT DATA. An Allocation Length of zero (0) indicates that no READ DEFECT DATA will be transferred. Any other value indicates the maximum number of bytes that will be transferred. The drive will terminate the data-in phase when the Allocation Length has been transferred or when all available READ DEFECT DATA has been transferred to the initiator, whichever is less.

The READ DEFECT DATA contains a four byte header followed by zero (0) or more defect descriptors.

The bits P, G, and the Defect List Format indicate which defect list is actually returned. The format of the physical defect descriptors, if the Defect List length is different than zero (0), are shown in the FORMAT UNIT command. The length of each defect descriptor is eight bytes. The defect list length specifies the total length in bytes of the defect descriptors that follow. The Defect List Length is equal to eight (8) times the number of defect descriptors.

If the Allocation Length of the CDB is too small to transfer all of the defect descriptors, the Defect List Length will not be adjusted to reflect the truncation. The drive will not create a CHECK CONDITION status. It is recommended that the Initiator compare the Defect List Length to the Allocation Length to ensure that it did not receive a partial list due to a too small Allocation Length.

The defect descriptors may or may not be sent in ascending order. The Initiator may be informed about the exact number of defects by dividing the Defect List Length by the Defect Descriptor Length.

**Table 6-67 Defect List Header**

		B I T							
		7	6	5	4	3	2	1	0
E	0	Operation Code							
	1	Reserved			P	G	Reserved		
Y	2	Defect List Length (MSB)							
B	3	Defect List Length (LSB)							

**Table 6-68 Defect Descriptor**

		B I T							
		7	6	5	4	3	2	1	0
E	0	Cylinder Number of Defects (MSB)							
	1	Cylinder Number of Defects							
	2	Cylinder Number of Defects (LSB)							
Y	3	Head Number of Defect							
	4	Defect Sector Number (MSB)							
	5	Defect Sector Number							
	6	Defect Sector Number							
	7	Defect Sector Number (LSB)							

## Write Buffer (3BH)

**Table 6-69 Write Buffer Command**

		B I T							
		7	6	5	4	3	2	1	0
B Y T E	0	Operation Code (3BH)							
	1	Logical Unit Number			Reserved			Mode	
	2	Buffer ID							
	3	Buffer Offset (MSB)							
	4	Buffer Offset							
	5	Buffer Offset (LSB)							
	6	Parameter List Length (MSB)							
	7	Parameter List Length							
	8	Parameter List Length (LSB)							
	9	Reserved						Flag	Link

The WRITE BUFFER command is used in conjunction with the READ BUFFER command as a diagnostic function for testing SyJet drive memory and the SCSI bus integrity. This command will not alter the medium. The function of this command and the meaning of fields within the command descriptor block depend on the contents of the mode field.

The mode field is defined as follows:

**Table 6-70 Mode Field**

Mode			Functional Description
0	0	0	Combined Header and Data
0	1	0	Data
1	0	0	Download Microcode
1	0	1	Download Microcode and Save.

**Mode 000 - Combined Header and Data:** In this mode data to be transferred is preceded by a four-byte header. See Table 6-69. The 4-byte header consists of all reserved bytes. The buffer ID and the Buffer Offset will be zero (0). The Parameter List Length specifies the maximum number of bytes that will be transferred during the DATA OUT phase. This number includes four bytes of header, so the data length to be stored in the drive's buffer is the Parameter List Length minus four (4). The Initiator should attempt to ensure that the Parameter List Length is not greater than four (4) plus the available length that is returned in the header of the READ BUFFER command (mode 00). If the Parameter List Length exceeds the available length plus four (4) the drive will return CHECK CONDITION status and will set the sense key to ILLEGAL REQUEST.

**Table 6-71 Write Buffer Header**

		B I T							
		7	6	5	4	3	2	1	0
B Y T E	0	Reserved							
	1	Reserved							
	2	Reserved							
	3	Reserved							

**Mode 010–Data:** In this mode the DATA-OUT phase contains buffer data. The buffer ID field will be zero (0). If a non-zero buffer ID code is selected the SyJet drive will return CHECK CONDITION status and will set the sense key to ILLEGAL REQUEST with an additional sense code of INVALID FIELD IN CDB.

**Mode 100-Download Microcode:** In this mode, vendor-specific microcode will be transferred to the control memory space of the SyJet drive. The buffer ID must be zero (0). This mode must be used repeatedly with incrementing offsets to transfer one block at a time.

**Mode 101-Download Microcode and Save:** In this mode, the last block of the vendor-specific microcode will be transferred to the control memory space of the SyJet drive. The buffer ID must be zero (0). When the microcode download has completed successfully, the SyJet drive generates a unit attention condition for all initiators. The additional sense code will be set to BUS DEVICE RESET OCCURRED.

**Buffer Offset:** The buffer offset is the byte offset within the specified buffer where data will be stored. The Initiator should conform to the offset boundary requirements returned in the READ BUFFER descriptor. If the SyJet drive is unable to accept the specified buffer offset it will return CHECK CONDITION status and it will set the sense key to ILLEGAL REQUEST with an additional sense code of INVALID FIELD IN CDB.

**Parameter List Length:** Specifies the maximum number of bytes that will be transferred during the DATA OUT phase to be stored in the specified buffer beginning at the buffer outset. The Initiator should attempt to ensure that the Parameter List Length plus the Buffer Offset does not exceed the capacity of the specified buffer. (The capacity of the buffer can be determined by the buffer capacity field in the READ BUFFER descriptor.) If the Buffer Offset and Parameter List Length field specify a transfer that would exceed the Buffer capacity the SyJet drive will return CHECK CONDITION status and will set the sense key to ILLEGAL REQUEST with an additional sense code of INVALID FIELD IN CDB.

## Read Buffer (3CH)

*Table 6-72 Read Buffer Command*

		B I T							
		7	6	5	4	3	2	1	0
B Y T E	0	Operation Code (3CH)							
	1	Logical Unit Number			Reserved			Mode	
	2	Buffer ID							
	3	Buffer Offset (MSB)							
	4	Buffer Offset							
	5	Buffer Offset (LSB)							
	6	Allocation Length (MSB)							
	7	Allocation Length							
	8	Allocation Length (LSB)							
	9	Reserved						Flag	Link

The Read Buffer Command returns data from the SyJet drive's internal buffer and is used in conjunction with the WRITE BUFFER command as a diagnostic function for SyJet drive data memory and the SCSI bus integrity. This command will not alter the medium.

The function of this command and the meaning of fields within the command descriptor block depend on the contents of the mode field. The mode field is defined in Table 6-73.

**Buffer Offset:** Is a byte offset within the buffer where data will be stored. The Initiator should conform to the offset boundary requirements returned in the READ BUFFER descriptor. If the SyJet drive is unable to accept the specified buffer offset it will return a CHECK CONDITION status and a Sense Key of ILLEGAL REQUEST with an additional sense code of INVALID FIELD IN CDB.

**Allocation Length:** Specifies the maximum number of bytes that will be transferred during DATA OUT phase to be stored in the buffer beginning at the buffer offset. The Initiator should attempt to ensure that the transfer length plus the buffer offset does not exceed the capacity of the specified buffer. If the buffer offset and transfer length fields specify a transfer that would exceed the buffer capacity the SyJet drive will return CHECK CONDITION status and a Sense Key of ILLEGAL REQUEST with an additional sense code of INVALID FIELD IN CDB.

The function of this command and the meaning of fields within the command descriptor block depend on the contents of the mode field. The mode field supported functions are defined as follows:

**Table 6-73 Read Buffer Mode Field Table**

Mode			Functional Description
0	0	0	Combined Read Buffer Header & Data
0	1	0	Data
0	1	1	Descriptor

**Mode 000 – Combined Header and Data:** In this mode a four-byte header followed by data bytes are returned to the Initiator during the DATA IN phase. The buffer ID and the Buffer Offset are reserved. The Allocation Length specifies the maximum number of bytes that the Initiator has allocated to returned header and data. An Allocation Length of zero indicates that no header or data will be transferred. Any other value indicates the maximum number of bytes that will be transferred. The SyJet drive will terminate the DATA IN phase when Allocation Length bytes of header plus data have been transferred or when all available header and data have been transferred to the Initiator, whichever is less. The four-byte READ BUFFER header is followed by data bytes from the SyJet drive's data buffer.

**Table 6-74 Read Buffer Header**

		B I T							
		7	6	5	4	3	2	1	0
B Y T E	0	Reserved							
	1	Available Length (MSB)							
	2	Available Length							
	3	Available Length (LSB)							

**Available Length:** Specifies 261,120 as the total number of data bytes that are available in the SyJet drive's data buffer. This number is not reduced to reflect the allocation length nor is it reduced to reflect the actual number of bytes written using the WRITE BUFFER command. Following the READ BUFFER header the SyJet drive will transfer data from its data buffer. The number of data bytes transferred following the READ BUFFER header will be the lesser of allocation length minus four (4) or available length.

**Mode 010 – Data:** In this mode the DATA IN phase contains buffer data. The buffer ID field will be zero (0). If an unsupported buffer ID code is selected the SyJet drive will return CHECK CONDITION status and will set the sense key to ILLEGAL REQUEST with an additional sense code of INVALID FIELD IN CDB.

The Buffer Offset is the byte offset within the specified buffer where data will be stored. The Initiator should conform to the offset boundary requirements returned in the READ BUFFER descriptor. If the SyJet drive is unable to accept the specified buffer offset it will return CHECK CONDITION status and it will set the sense key to ILLEGAL REQUEST with an additional sense code of INVALID FIELD IN CDB.

**Mode 011 – Descriptor:** In this mode a maximum of four (4) bytes of READ BUFFER descriptor information are returned. The SyJet drive will return the descriptor information for the buffer specified by the buffer ID. If there is no buffer associated with the specified buffer ID the SyJet drive will return all zeros in the READ BUFFER descriptor (only buffer ID zero (0) is valid).

The Buffer Offset is reserved in this mode. The Allocation Length should be set to four (4) or greater. The SyJet drive will transfer the lesser of Allocation Length or four (4) bytes of READ BUFFER descriptor. The READ BUFFER descriptor is defined as shown in Table 6-75.

**Table 6-75 Read Buffer Descriptor**

		B I T							
		7	6	5	4	3	2	1	0
B Y T E	0	Offset Boundary (FFH)							
	1	Buffer Capacity (MSB)							
	2	Buffer Capacity							
	3	Buffer Capacity (LSB)							

**Offset Boundary:** Returns FFH indicating a zero boundary alignment within the buffer.

**Buffer Capacity:** This field will return the size of the selected buffer in bytes and will be zero (0) for buffers other than buffer ID zero (0).

## Read Long (3EH)

*Table 6-76 Read Long Command*

		B I T							
		7	6	5	4	3	2	1	0
B Y T E	0	Operation Code (3EH)							
	1	Logical Unit Number			Reserved			CORRCT	RelAdr
	2	Logical Block Address (MSB)							
	3	Logical Block Address (LSB)							
	4	Reserved							
	5	Byte Transfer Length (MSB)							
	6	Byte Transfer Length							
	7	Byte Transfer Length							
	8	Byte Transfer Length (LSB)							
	9	Reserved					Flag		Link

The Read Long command requests that the SyJet drive transfer both data and ECC bytes from the medium to the Initiator.

**Correction (CORRCT):** This bit must be zero (0) specifying that the logical block will be read without any correction.

**Relative Address (RelAdr):** This field must be zero (0).

**Logical Block Address:** Specifies the Logical Block where the Read Long operation will begin.

**Byte Transfer Length:** Must specify the exact number of bytes to be transferred. A transfer length of zero (0) indicates that no data will be transferred and is not an error condition.

Thirty-eight (38) ECC bytes will be read and appended to the physical sector data read for a total of 550 data bytes. Only a single logical block may be read in this mode.

# Write Long (3FH)

*Table 6-77 Write Long Command*

		B I T							
		7	6	5	4	3	2	1	0
B Y T E	0	Operation Code (3FH)							
	1	Logical Unit Number				Reserved			
	2	Logical Block Address (MSB)							
	3	Logical Block Address							
	4	Logical Block Address							
	5	Logical Block Address (LSB)							
	6	Reserved							
	7	Transfer Length (MSB)							
	8	Transfer Length (LSB)							
	9	Reserved						Flag	Link

The Write Long command requests that the SyJet drive write both the data and ECC bytes from the Initiator onto the medium.

**Logical Block Address:** Specifies the Logical Block where the Write operation will begin.

**Byte Transfer Length:** Must specify the exact number of bytes to be transferred. A transfer length of zero (0) indicates that no data will be transferred and is not an error condition.

Thirty-eight (38) ECC bytes must be appended to the physical sector data for a total of 550 bytes.

Hardware ECC generation will be disabled. Only a single logical block may be written in this mode.

## Mode Select (55H)

**Table 6-78 Mode Select Command**

		B I T							
		7	6	5	4	3	2	1	0
B Y T E	0	Operation Code (55H)							
	1	Logical Unit Number			PF (1)	Reserved			SP
	2	Reserved							
	3	Reserved							
	4	Reserved							
	5	Reserved							
	6	Reserved							
	7	Parameter List Length (MSB)							
	8	Parameter List Length (LSB)							
	9	Reserved						Flag	Link

The Mode Select Command provides a means for the Initiator to specify or change operating parameters within the SyJet drive. See the Mode Select 6-byte command for a description of the fields in this command.

# Mode Sense (5AH)

*Table 6-79 Mode Sense Command*

		B I T								
		7	6	5	4	3	2	1	0	
B Y T E	0	Operation Code (5AH)								
	1	Logical Unit Number			0	DBD		Reserved		
	2	PC		Page Code						
	3	Reserved								
	4	Reserved								
	5	Reserved								
	6	Reserved								
	7	Allocation Length (MSB)								
	8	Allocation Length (LSB)								
	9	Reserved						Flag	Link	

The Mode Sense Command provides a means for the SyJet drive to report its device parameters. It is a complementary command to the Mode Select Command. See the Mode Select 6-byte command for a description of the fields in this command.