Quantum

ProDrive® 40AT/80AT

Installation Manual

Patents

The product described in this manual is covered by or licensed under the following U.S. Patents: 4,419,701; 4,538,193; 4,625,109; 6,639,798; 4,647,769; 4,647,997; 4,661,696; 4,669,004; 4,703,176; 4,819,153; 4,882,671. Other patents pending.

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Section 1 INTRODUCTION

The Quantum *ProDrive®* 40AT and 80AT are high performance 3 1/2-inch hard disk drives with formatted capacities of 42 and 84 megabytes, respectively, and embedded IBM PC AT® controllers. These drives feature typical average seek times of 19 milliseconds and transfer rates to the AT bus of up to 4.0 megabytes per second.

The *ProDrive* 40AT/80AT also feature DisCache®, Quantum's proprietary buffer management system. Using a look-ahead prefetch strategy, *DisCache* can decrease average seek times to 12 milliseconds in typical applications. In addition, media defects and error recovery are efficiently managed within these products, fully transparent to the user.

ProDrive Series® disk drives feature an innovative design using integrated controllers, a minimum number of parts, and close control of product quality during manufacturing. The result is a series of high performance disk drives with exceptional reliability.

1.1 APPLICABLE DOCUMENTS

This document provides a brief description of the *ProDrive* 40AT/80AT, 42 and 84 megabyte disk drives. For more detailed information about principles of operation and interface command implementation, please consult the *ProDrive 40AT/80AT Product Manual* (available through your distributor).

1.2 KEY FEATURES

- Formatted storage capacity of 42 and 84 megabytes
- Industry standard 3-1/2 inch form factor
- 19 msec average seek time
- Data transfer rate of up to 4.0 megabytes/second using programmed I/O
- *DisCache* - 64K-byte look-ahead disk cache for faster data access times
- 48 bit cyclic Error Correction Code with 11 bit burst correction capability
- Automatic retry of read disk errors
- Transparent defect mapping
- High-performance in-line defective sector skipping and reassignment of new defective sectors without need to reformat
- Patented AIRLOCK® automatic shipping lock and dedicated landing zone
- Read/Write with 1:1 interleave operation
- Emulation of IBM PC AT task file register and all AT fixed disk commands
- Ability to daisy-chain two drives on the interface
- 5 1/4-inch Configuration Kit available

1.3	ADAPTER BOARD

The ***ProDrive*** 40AT/80AT drives use the standard IBM PC AT-Bus interface and are available with or without an adapter board. With the adapter board, a ***ProDrive*** 40AT/80AT can plug directly into a 16-bit expansion slot on an AT compatible computer. Without the adapter board, the drive is compatible with other AT-Bus architectures and can be plugged into an embedded AT Adapter or existing adapter board. See Chapter 3 for more information on using the ***ProDrive*** 40AT/80AT with the adapter board.

1.4	STANDARDS AND REGULATIONS

The ***ProDrive*** 40AT/80AT disk drives satisfy the following standards and regulations:

- U.L.: Standard 478, Standard for Safety, Electronic Data Processing Units and Systems
- CSA: Standard C22.2-154 Data Processing Equipment
- SDA: Standard C22.2-143 Office Equipment
- VDE: VDE 0806, (IEC 380), Standard for Office Appliances and Machines
- FCC: FCC Rules for Radiated and Conducted Emissions, Part 15, Sub Part J, For Class B Equipment
- TUV: TUV Rheinland Design Approval license requirements

Section 2 TECHNICAL INFORMATION

This section provides technical information on the *ProDrive* 40AT and 80AT including all functional, performance, environmental, and power specifications, plus information on jumpers and connectors.

2.1 Technical Specifications

Functional Specifications
Physical Format:

	ProDrive **40AT**	*ProDrive* **80AT**
Formatted capacity (MB)	42	84
Read/Write Heads	3	6
Disks	2	3
Data Cylinders	834	834
Data Tracks	2502	5004
Number of 512 byte sectors	82,029	164,058
Nominal Rotational Speed (RPM)	3662 $\pm$ 0.3%	3662 $\pm$ 0.3%
Max Recording Density (BPI)	22,055	22,055
Max Flux Density (FCI)	14,700	14,700
Track Density (TPI)	1000	1000
Encoding Scheme	RLL 2,7	RLL 2,7
Number of Data Zones	2	2
Outer Zone: Cylinders	590	590
Sectors/track	35	35
Inner Zone: Cylinders	244	244
Sectors/track	28	28

Logical Format:

Data Cylinders	965	965
Sectors/Track	17	17
Read/Write Heads	5	10

Performance Specifications

Transfer Rates:

Data Transfer Rate (Buffer to AT bus):	Up to 4.0 MB/sec using programmed I/O
Data Transfer Rate (Disk to buffer):	Up to 1.25 MB/sec in bursts

Seek/Miscellaneous Times:

	TYPICAL Nominal Condition	MAXIMUM Nominal Condition	Worst Case Condition
Average seek time (msec)	19	21	23
Track-to-Track seek (msec)	6	7	7
1/3 stroke seek (msec)	20	23	25
Full stroke seek (msec)	35	40	45
Average rotational latency (msec)	8.2	8.2	8.2
Sequential head switch (msec)	3	3	3
Power-up time (sec)	13	15	18

Seek times specified are at nominal environmental conditions and include head settling time, but do not include command overhead time or rotational latency time. Seek time is defined as the time it takes the actuator to seek and settle on track.

Power-up time is the time from the supply voltages reaching operating range to the drive being able to accept all commands.

Nominal conditions are defined as 25° ambient temperature, nominal supply voltages with no applied shock or vibration. Worst case conditions are defined as worst case extremes of temperature and supply voltages.

Reliability Specifications

MTBF (Mean Time Between Failures):	50,000 POH typical usage
PM (Preventative Maintenance):	Not required
MTTR (Mean Time To Repair):	30 minutes
Start/Stop:	10,000 cycles

Environmental Conditions

	Operating	Non-operating
Ambient Temperature	4° to 50° C 10° C/hr gradient	-40° to 65° C 20° C/hr gradient
Ambient Relative Humidity (non-condensing)	8% to 85% RH	5% to 95% RH
Altitude (relative to sea level)	-60 m to 3 km	-60 m to 12 km

Power Consumption

Average power consumption:	8	Watts
Typical power consumption (30% seeking):	9	Watts
100% Seeking:	10.5	Watts

Power Requirements

+5 Volts DC at: 0.50 Amps typical (Idle)
                            0.60 Amps typical (Seeking)
                            0.65 Amps maximum (Power up)

+12 Volts DC at: 0.50 Amps typical (Idle)
                            0.80 Amps typical (Seeking)
                            1.60 Amps maximum (Power up)

Applying or removing power during drive operation will not cause any damage. However, data may be lost in the sector being written at the time of power loss.

Acoustics

Idle Mode: 45 dBa at 1 foot maximum in any direction

Ventilation

The *ProDrive* disk drives operate without cooling fans, provided that the ambient air temperature does not exceed 122° F (50° C). Any user-designed cabinet should provide adequate air circulation to ensure that this maximum air temperature is not exceeded.

2.2	DC POWER CONNECTOR

The DC power connector (J1) is a 4-pin DuPont Connector (SK 20055-000) mounted on the back edge of the PCB (Printed Circuit Board) near the AT-Bus connector. The recommended mating connector (P2) is AMP P/N 1-480424 using AMP pins P/N 350078-4 (strip) or P/N 61173-4 (loose piece). The p are labeled on the connector. See Figure 1.

Pin 1   +12 volts DC
Pin 2   +12 volt return (ground)
Pin 3   +5   volt return (ground)
Pin 4   +5   volts DC
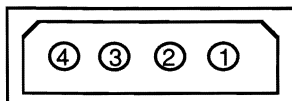
NOTE: Pins 2 and 3 are connected on the drive.

Figure 1 DC Power Connector (J1)

2.3 AT BUS CONNECTOR

One AT-Bus cable connector (J2) is required for the **ProDrive**. Details of the signals required can be found in the **ProDrive 40AT/80AT Product Manual**.

Connection to J2 is through a 40-pin universal header connector. A connector sketch is shown in Figure 2. A key slot is provided to prevent incorrect installation of the mating connector. The recommended mating connector for J2 is AMP P/N 1-499506-0 (with strain relief) or P/N 1-746193-0 (without strain relief), or the equivalent.

NOTE: Unkeyed mating connectors should not be used due to the possibility of plugging the connector in backwards.
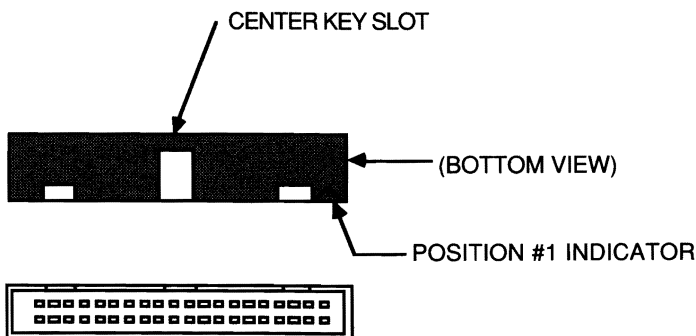

Figure 2   AT Bus Connector (J2)

2.4 PCB JUMPER OPTIONS

There are two sets of jumper pins on the Printed Circuit Board. If required, the jumpers should be set prior to installation. See Figure 3 for locations of the jumper pins.

NOTES: Additional jumper options are provided on the adapter board for systems which require the adapter board with the drive. See Section 3.2 for descriptions of these options.

Some versions of the drive PCB contain a third set of jumper pins. No jumper should be installed on these pins.
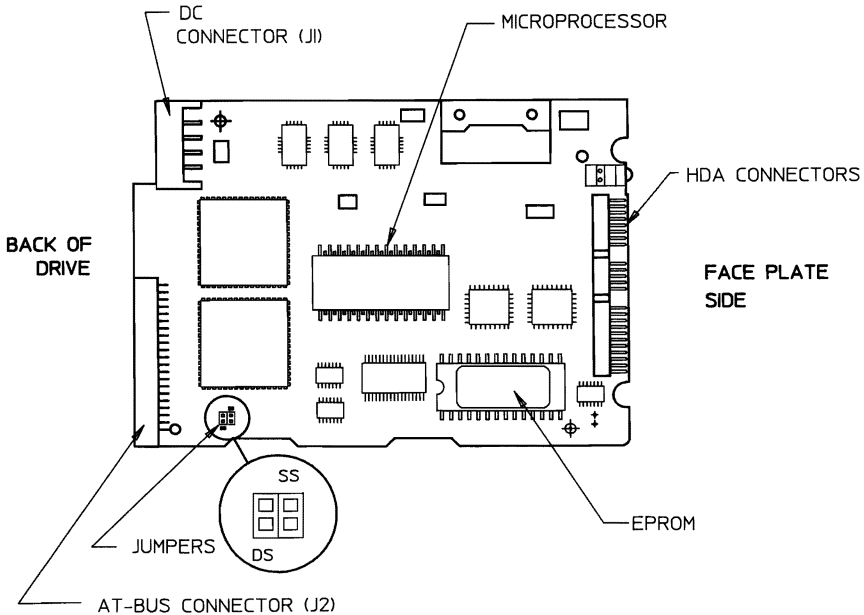

FIGURE 3   Jumper Pin Locations on the Drive PCB

Drive Select (DS) Jumper Option

Two drives can be daisy-chained on the AT-Bus interface. When two drives are attached, one must be configured as the MASTER, and the other as the SLAVE, using the Drive Select (DS) jumper. With a jumper installed on the DS jumper pins, the drive is configured as the MASTER (Drive 0); with no jumper on the DS pins, the drive is configured as the SLAVE (Drive 1). The order of the connection of drives in the daisy chain is not significant.

The *ProDrive* 40AT/80AT drives are sent from the factory with the DS jumper installed (Drive 0).

Self-Seek Test (SS) Jumper Option

The self seek (SS) jumper has two meanings, depending on the setting of the DS (Drive Select) jumper.

- If the drive is configured as a MASTER (DS installed), the SS jumper informs the drive of the presence of a SLAVE drive. If a SLAVE drive is present, a jumper should be installed on the SS jumper pins on the master; if no SLAVE is present, the SS jumper should not be installed on the master drive.

- If the drive is configured as a SLAVE (DS not installed), the SS jumper is used to select the self seek test. The self seek test continuously exercises the actuator of the drive. When the jumper is installed on the SS jumper pins, the drive performs random seek patterns, verifying track IDs after every seek. The pattern will repeat as long as power is applied to the drive, until the jumper is removed, or until an error has occurred. When the SS jumper is not installed, the drive is simply configured as the SLAVE in a dual drive environment; no self seek tests will be performed.

The *ProDrive* 40AT/80AT drives are sent from the factory with the SS jumper not installed (Self Seek Test disabled).

Jumper Setting Options:

Jumper Position		Meaning
DS	**SS**	
1	0	Single drive configuration
1	1	MASTER Drive in dual drive configuration
0	0	SLAVE Drive in dual drive configuration
0	1	Self-Seek test selected

1 = jumper installed on jumper pins
0 = no jumper installed

2.5   FACEPLATE LED OPERATION

The green LED located on the *ProDrive* 40AT/80AT faceplate illuminates when the drive is executing a command. It lights at the beginning of a command and does not go off until the command is completed or aborted.

Section 3   INSTALLATION

This section contains information on unpacking and installing the *ProDrive* 40AT/80AT disk drives, including dimensions and required mounting screw clearances.

The shipping container and packing assembly were specially designed to enable the properly packaged *ProDrive* 40AT/80AT to withstand specific levels of shock and vibration.

NOTE: When unpacking your drive, be sure to save the packing materials and shipping container for possible future use.

3.1   MECHANICAL DIMENSIONS AND MOUNTING

Mechanical dimensions of the *ProDrive* 40AT/80AT, exclusive of the faceplate, are shown below:

Height	=	1.625	inches	(41.3 mm)
Width	=	4.0	inches	(101.6 mm)
Depth	=	5.75	inches	(144.8 mm)
Weight	=	1.9	pounds	(0.88 kg)

The mounting dimensions are shown in Figure 5.

The *ProDrive* 40AT/80AT is shipped with a faceplate installed and shock mounts directly mounted to the base casting. The drive may be mounted in any orientation and includes a mounting bracket with integral shock mounts for this purpose. Two mounting holes are located on each side of the bracket.   UNC 6-32 screws are recommended for this purpose.

Clearance from the drive (except shock mount brackets or faceplate) to any other surface must be a minimum of 0.10 inch.   See Figure 6.

5 1/4-inch Configuration Kit

A 5 1/4-inch configuration kit, P/N 900-00-9001, is available for the *ProDrive* 40AT/80AT to facilitate mounting in a system designed for a 5 1/4-inch drive. This kit includes 5 1/4-inch mounting rails, a 5 1/4-inch faceplate, mounting screws, and instructions; it may be ordered through your distributor.
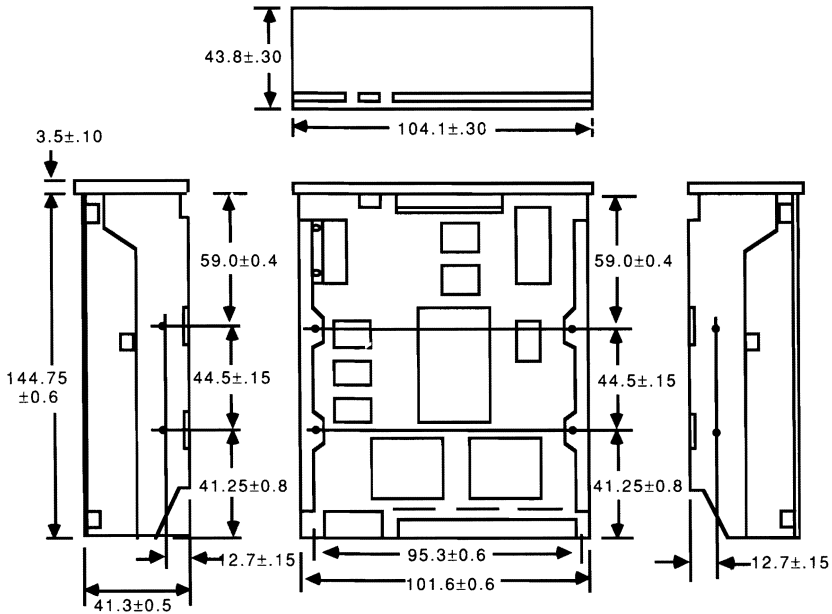
Figure 4   ProDrive 40AT/80AT Mounting Dimensions

CAUTION:

The base casting is very close to the drive mounting bracket. Mounting screw lengths must be chosen so that no more than the specified length of the screw thread protrudes through the mounting bracket holes. This length will allow full use of the mounting hole threads and avoid damaging or placing unwanted stress on the base casting. To avoid stripping the mounting hole threads, the maximum torque applied to the mounting screws must not exceed 8 inch-pounds.
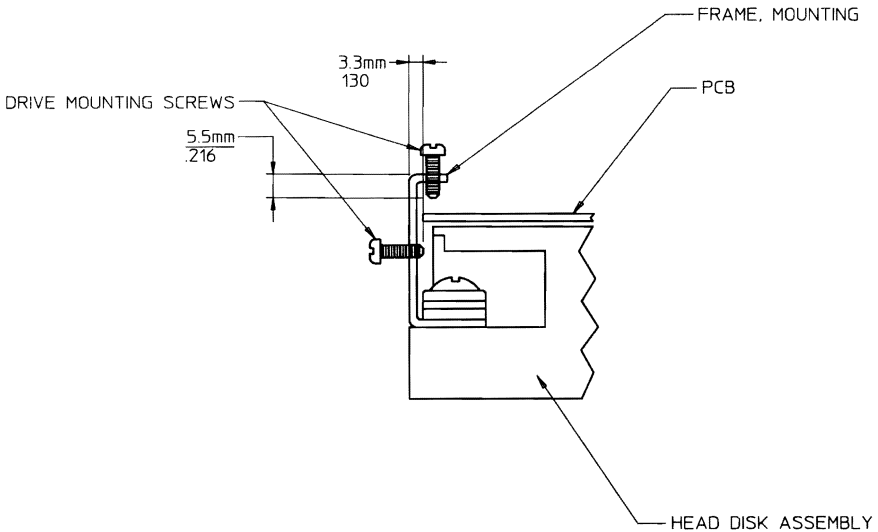
Figure 5   *ProDrive 40AT/80AT Mounting Screw Clearance*

3.2	AT ADAPTER KIT

The AT adapter board, 40-pin ribbon cable, and installation instructions are part of the AT Adapter Kit, P/N 900-00-9002, which may be ordered through your distributor.

The adapter board is a half-size board with an IBM PC AT® bus-compatible interface, and can be installed in any available 16-bit slot inside an IBM PC AT or compatible. The I/O extended bus connector is required for data bus D8 - D15, IRQ14 and IO CS16. The adapter board buffers data and control signals between the drive and the host system, and performs address decoding of the Host Address Bus. The Task File Registers, which accept commands from the host system BIOS, are located on the drive itself.

The adapter board connects to the drive via the ribbon cable supplied as part of the kit. Jumper options are provided on the board in addition to those on the drive PCB.

NOTE: Some host systems will not read the STATUS register after the drive issues an interrupt. In such cases, the interrupt may not be acknowledged. A jumper option is provided on the adapter board to overcome this problem. This jumper allows interrupts to be controlled by the drive's interrupt logic. See jumper option J2 in the following section.

Adapter Board Jumper Options

Four sets of jumper pins, labeled J2 - J5, are provided on the adapter board. See Figure 4 for the locations of the jumper pins on the adapter board. The options are described below.

J2 Allows the drive's BUSY STATUS to control the deassertion of IRQ14. This option is provided for compatibility with systems whose BIOS does not read the STATUS register when the drive issues an interrupt; in such cases, a drive might never drop the interrupt to the system.

- A jumper from the center pin of J2 to E3 allows the interrupt to drop every time the drive goes busy.
- A jumper from the center pin of J2 to E4 gates the interrupt directly from the drive. This is the factory default setting.

J3 Always open. Option for grounding pin #34 of the drive interface.

J4 This jumper should only be installed in systems designed with Chips & Technologies chip sets which run the I/O bus faster than the standard 12 Mhz, 1 wait state. These pins should be left open when other chip sets are used.

J5 Always open. No jumper should be installed on these pins.
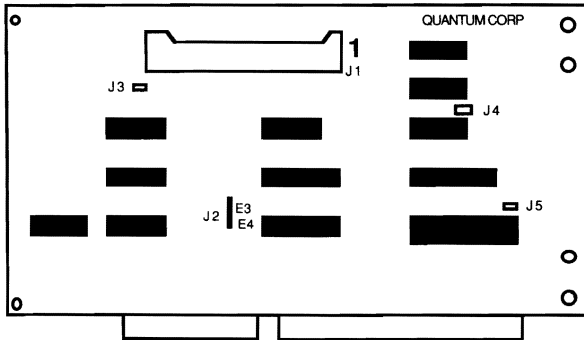

FIGURE 6 Jumper Pin Locations on the Adapter Board

Before installing the adapter board, you must first make sure that no other hard disk controller resides at a primary hard disk address (1F0 - 1F7). In addition, the hard disk controller functions on the resident floppy/hard disk controller must be disabled. Follow the instructions below to set up other resident hard disk controllers, then install the adapter board in the selected 16-bit slot.

- On a Western Digital WD1002-WA2 or WD1003-WA2 floppy/hard disk controller card, jumper pins E5 and E6 should not be jumpered, and jumper pins E4 and E5 should be jumpered; this ensures that the hard disk controller is at a secondary (170 - 177) rather than a primary (1F0 - 1F7) address. Also, move the card from a 16-bit I/O slot to an 8-bit slot; this disconnects the IRQ14 output driver.

- For a DTC (Data Technology Corporation) floppy/hard disk controller card, install a jumper on jumper pins W3, and move the card from a 16-bit I/O slot to an 8-bit slot to disconnect the IRQ14 output driver.

Refer to manual that came with your hard disk controller for further details.

Connecting the Adapter Board and the Drive

The adapter board connects to the drive via the ribbon cable supplied with the board. (See Figure 7.) The colored wire on one edge of the cable is used to ensure that the cable is plugged into the adapter board and the drive correctly. To connect the drive and the board:

1. Note the large "1" printed on the board next to the connector. Insert the end of the cable with no strain relief into the connector on the adapter board so that the colored wire on the cable is on the same side of the connector as the "1".

2. Insert the other end of the cable (with strain relief) into the connector on the drive. Make sure that the colored wire is on the *inside* edge of the drive connector next to the J1 power connector.
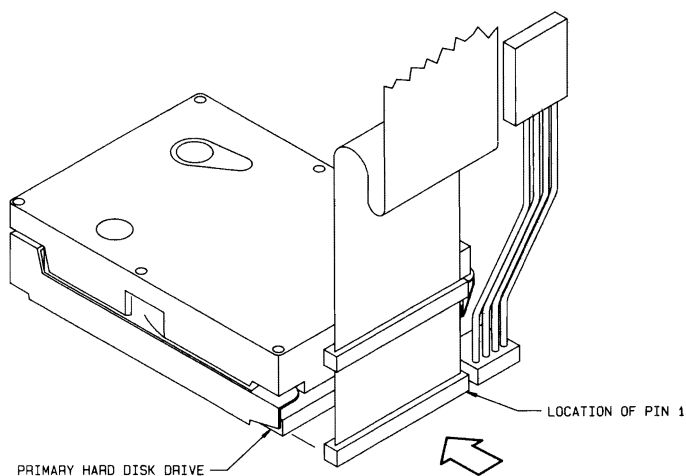

LOCATION OF PIN 1

PRIMARY HARD DISK DRIVE

Figure 7   *Adapter Board Installation*

3.3   SYSTEM SETUP AND OPERATION

Once you have installed the *ProDrive* 40AT/80AT drive and adapter board in
your system, you are ready to partition and format the drive for operation.
Follow the instructions below to set up the drive correctly.

1. Power up the system.

2. Run the **SETUP** program, entering the appropriate parameters.

    The SETUP program is typically located on a Diagnostics or Utilities
    diskette or within the system's BIOS (Basic Input Output System). This
    program enables you to tell the system what type of hardware options you
    have installed such as, the type of hard disk drive(s), the capacity of the
    floppy drive(s), and the type of display adapter. The system's BIOS uses
    this information to initialize the system each time it is booted up. Refer to
    your system manual for details and instructions on the SETUP program.

3. During the SETUP process you will be requested to enter the 'hard disk drive
    type' of your *ProDrive* disk drive. Since the BIOSs used in various
    systems differ, you should consult your system's drive type table to match
    the logical specifications of the *ProDrive* 40AT/80AT to a particular drive
    type. Below are some guidelines for choosing a drive type:

    • The *ProDrive* 40AT/80AT drives have 965 logical cylinders and 17
      sectors/track.

    • The *ProDrive* 40AT has 5 logical heads; the *ProDrive* 80AT has 10
      logical heads.

    • You must choose a drive type that has the same number of logical heads
      as your *ProDrive* disk drive and a capacity less than or equal to the
      capacity of your drive, where:

$$\text{drive capacity in megabytes} = \frac{\text{cylinders x heads x sectors/track x 512 bytes/sector}}{1{,}000{,}000 \text{ bytes/megabyte}}$$

4. Boot up the system with your **DOS** diskette.

5. Run **FDISK** or a third party partitioning program.

NOTE: If you are using DOS versions 3.2 or below, only 32 megabytes of the drive's capacity can be used as the DOS partition. DOS 3.3 will allow the drive to be partitioned in multiples of 32 megabytes. Some third party partitioning programs allow more than 32 megabytes to be used.

6. At the keyboard, enter **FORMAT C:/S**. This command will high level format the *ProDrive* 40AT/80AT. It also transfers the operating system to the drive so you can boot the system from the hard drive.

NOTE: A low level format is not required.

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Section 4 REPAIR PROCEDURES

Should your *ProDrive* 40AT/80AT disk drive fail, contact your distributor immediately. You should be prepared with the following information:

1. Model number
2. Quantum's serial number on the drive
3. Proof of purchase / Sales slip
4. Reason for return (or a brief description of the problem or possible cause of failure)

In return, your distributor will supply you with the following information:

1. A Return Material Authorization (RMA) number
2. Information regarding any applicable charges
3. The address to which the drive should be returned

Drives should be shipped in their original shipping container and packing assembly.

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