PRODUCT DESCRIPTION

Micropolis 1370 Series
5 1/4-Inch Rigid Disk Drive

MICROPOLIS

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5 1/4-Inch Rigid Disk Drive

DOCUMENT No. 101689 REV D

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SECTION 1. DESCRIPTION

Micropolis 1370 Series high-performance, 5 1/4-inch Winchester Disk Drives provide OEMs with high-speed, high-capacity, random-access storage with a built-in intelligent controller. The drives are fully compatible with the industry standard Small Computer System Interface (SCSI) and are designed to meet the needs of diverse applications environments. The Series is available in the following configurations:

Model Number	Disks per Drive	Data Surfaces per Drive	Capacity (Unformatted)	Capacity (typical 1024-byte format)
1375	5	8	170.6 Mbytes	150.1 Mbytes
1374A	4	7	149.3 Mbytes	131.3 Mbytes
1374	4	6	128.0 Mbytes	112.5 Mbytes
1373A	3	5	106.7 Mbytes	93.8 Mbytes
1373	3	4	85.3 Mbytes	75.0 Mbytes

1.1 FEATURES OF THE 1370 SERIES

- Industry-standard SCSI intelligent interface supports Common Command Set.
- MTBF 30,000 hours.
- Data transfer rate of up to 1.6 Mbytes/sec on the SCSI bus.
- 16-kilobyte dual-ported data buffer with parity.
- Supports disconnect/arbitrate/reconnect operation.
- Supports reserve/release functions.
- Automatic error recovery.
- In-line defect management (sector slipping).
- High-performance positioner delivers 23-millisecond average seek time.
- Industry-standard 5 1/4-inch mounting provisions and form-factor.
- Rugged dual-chassis construction and balanced rotary positioner provide exceptional shock and vibration protection.
- The positioner automatically retracts and locks, in a data-free landing zone, on spin-down.
- Board-swap design results in MTTR of less than 15 minutes.
- No adjustments or periodic maintenance are required.

1.2 CHARACTERISTICS

General Performance Specifications

Seek Time (including settling time)	
Track-to-Track	5 msec
Average	23 msec
One-Third Stroke (maximum)	25 msec
Maximum	50 msec
Rotational Latency	
Average	8.33 msec
Nominal Maximum	16.67 msec
Start Time (to Drive Ready)	12 seconds typical
	20 seconds maximum
Stop Time	20 seconds maximum
Internal Data Rate	10 MHz
Data Transfers at interface	1.6 Mbytes/sec

General Functional Specifications

Cylinders	1024
Spindle speed (rpm)	3600
Speed variation (%)	± 0.5

General Physical Specifications

Drive:	Height	3.25 in	(82.6 mm)
	Width	5.75 in	(146 mm)
	Depth	8.00 in	(203 mm)
Bezel:	Height	3.38 in	(85.7 mm)
	Width	5.88 in	(149 mm)
	Depth	0.185 in	(4.7 mm)
Drive Weight (1375, typical):		6.0 lbs	(2.7 kg)

1.2 CHARACTERISTICS (continued)

Capacity

Unformatted

	Model Number				
	1373	1373A	1374	1374A	1375
Mbytes/Unit	85.3	106.7	128.0	149.3	170.6
Data Heads	4	5	6	7	8
Cylinders	1024				
Bytes/Track	20,832				
Mbytes/Surface	21.33				

Formatted *

1024-Byte Format:

	Model Number				
	1373	1373A	1374	1374A	1375
Mbytes/Unit	75.0	93.8	112.5	131.3	150.1
Data Heads	4	5	6	7	8
Cylinders	1018				
Physical Sectors/Track	19				
Logical Blocks/Track	18				

512-Byte Format:

	Model Number				
	1373	1373A	1374	1374A	1375
Mbytes/Unit	72.9	91.2	109.4	127.6	145.9
Data Heads	4	5	6	7	8
Cylinders	1018				
Physical Sectors/Track	36				
Logical Blocks/Track	35				

* See Appendix A for a detailed explanation of the capacity calculation.

Vibration

Operating (the drive can be operated and subjected to vibration up to the following levels, and will meet error specifications shown on page 1-5)

5 - 40 Hz	0.006 inches, peak-peak
40-300 Hz	0.5 G peak

Non-Operating (the drive will sustain no damage if subjected to vibration up to the following levels)

Packaged (in original Micropolis shipping container)

5 - 10 Hz	0.2 inches, peak-peak
10 - 44 Hz	1 G peak
44 - 98 Hz	0.01 inches, peak-peak
98-300 Hz	5 G peak

Unpackaged

5 - 31 Hz	0.02 inches, peak-peak
31 - 69 Hz	1 G peak
69 - 98 Hz	0.004 inches, peak-peak
98-300 Hz	2 G peak

Shock

Operating (the drive can be operated and subjected to shock up to the following levels, and will meet error specifications shown on page 1-5)

1/2 Sinusoidal	5 msec, 3 G peak
	11 msec, 2 G peak
	20 msec, 1 G peak

Non-Operating (the drive will sustain no damage if subjected to shock up to the following levels)

Packaged (in original Micropolis shipping container)

Free-fall drop	36 inches
1/2 Sinusoidal	20 msec, 50 G max

Unpackaged

Free-fall drop	0.75 inches
Topple test	1.5 inches
1/2 Sinusoidal	5 msec, 40 G max
	11 msec, 20 G max
	20 msec, 15 G max
	50 msec, 15 G max
	100 msec, 20 G max

1.2 CHARACTERISTICS (continued)

Environmental Limits

	Operating	Storage
Ambient Temperature	10°C to 50°C (50°F to 122°F)	-40°C to 65°C (-40°F to 149°F)
Temperature Gradient, max	2.0°C/5 Minutes (3.6°F/5 Minutes)	24.0°C/Hour * (43.2°F/Hour)

* This gradient should not be exceeded when moving a drive from storage to operation.

Relative Humidity	10% to 90% non-condensing	10% to 90% non-condensing
	26.7°C (80°F) maximum wet bulb non-condensing	26.7°C (80°F) maximum wet bulb non-condensing
Altitude	-200 ft to 10,000 ft	-1,000 ft to 50,000 ft

Power Dissipation (typical drive, nominal voltage)

Stand-by	31.5 Watts;	107.5 Btu/hr
Positioning (average) **	37.5 Watts;	128.0 Btu/hr

** This value is for 1/3-stroke seeks with an 8-millisecond idle period between seeks to simulate a typical system environment.

Acoustic Noise

Less than 51 dBA (sound pressure)

Reliability

Errors (these figures reflect basic HDA error rates)

Soft Read	$\leq$ 10 in 10^{11} bits read
Hard Read	$\leq$ 10 in 10^{13} bits read
Seek	$\leq$ 10 in 10^{7} seeks

Unit MTBF 30,000 Power-On Hours

Maintainability (HDA not included)

MTTR Less than 15 minutes

1.3 MAJOR COMPONENTS

The disk drive consists of a mechanical assembly and an electronics package. For a detailed functional theory of operation, see the 1370 Series Technical Manual, Micropolis No. 101787.

1.3.1 Mechanical Assembly

The mechanical assembly consists of the outer Frame, the sealed Head/Disk Assembly, and the Brake/Solenoid Assembly.

a. Head/Disk Assembly (HDA)

The die-cast HDA is suspended within a die-cast outer Frame. This chassis-within-a-chassis design isolates the HDA from mechanical shock during shipping or operation and protects it from mounting stress which may occur when the drive is installed in the system envelope.

An aluminum cover seals the HDA to create a contaminant-free clean area containing the servo and data heads, recording media, spindle, voice-coil positioner, and air-filtration system. No electronic components are contained within the clean area. Electrical connection between the HDA and the electronic components is provided by flexible circuits.

b. Air-Filtration System

Air is circulated throughout the clean area by disk rotation-induced flow. A ducted air-filtration system draws the air through a filter. The sealed area breathes to the outside via another filter for pressure equalization.

c. Drive Motor

Spindle rotation is provided by a quiet, brushless, direct-coupled DC motor. Switching information for the electronic commutator is supplied by three Hall-effect sensors mounted within the drive-motor assembly.

d. Positioner System

The 1370-series positioner consists of a balanced, rotary voice-coil/swing-arm assembly. Position reference is obtained from data recorded on a dedicated servo surface. In conjunction with the closed-loop positioner-servo electronics, this system provides superior positioning speed and accuracy and continuous on-track monitoring for greater data protection. Susceptibility to external shock and vibration is minimized, and the drive may be mounted in any orientation.

The positioner system provides positive media protection upon spin-down by retracting and locking the positioner in a data-free landing zone while applying the spindle-motor brake, shortening deceleration time.

1.3.2 Electronic Components

A LED and three printed-circuit boards packaged within the drive envelope comprise the electronic components. The LED is located on the bezel and lights whenever the drive is executing a command.

a. Device Electronics Board

The Device Electronics board provides overall control functions for the drive. Its microprocessor-based logic provides controls for power-up and power-down sequencing and velocity-profile generation.

The positioner-servo electronics controls positioner accuracy and speed, while driver and receiver circuits provide for transmission and reception of control, data, and status signals across the interface.

The Device Electronics board also includes the SCSI interface and intelligent controller. This includes a separate microprocessor, 16k RAM data buffer, and VLSI controller circuits.

b. Motor Control Board

The Motor Control board accepts control signals from the Device Electronics board to drive the spindle motor and operate the Brake/Solenoid Assembly. The Motor Control board also provides power amplification for the voice-coil positioner motor.

c. Preamplifier Board

The Preamplifier board controls the transfer of read/write data and provides for the termination of the read/write head flexible circuits as they exit the HDA clean area.

The Preamplifier board also provides head selection, read preamplification, servo preamplification, write-current drivers, and read/write fault-detection circuitry.

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SECTION 2. INTERFACE

2.1 INTERFACE AND POWER CONNECTOR PIN ASSIGNMENTS

The 1370-series drives are fully compatible with the Small Computer System Interface (SCSI) proposed by the American National Standards Committee. For full command protocol, see Micropolis Document 110011.

Electrical interface between the drive and the host system is accomplished via five connectors: Signal Connector J1 (Table 2-1), Multi-Function Connector/Jumper Block J2, and Power Connector J3 (Table 2-2); and Ground Connectors J4 and J5 on the Head/Disk Assembly (HDA) and outer Frame respectively. See Figure 3-1 for the connector locations.

TABLE 2-1. SINGLE-ENDED CABLE PIN ASSIGNMENTS

J1 CONNECTOR PIN Signal	Ground[1]	SIGNAL NAME[2]	DESCRIPTION	SOURCE[3]
2	1	-DB(0)	Data Bus 0	I/T
4	3	-DB(1)	Data Bus 1	I/T
6	5	-DB(2)	Data Bus 2	I/T
8	7	-DB(3)	Data Bus 3	I/T
10	9	-DB(4)	Data Bus 4	I/T
12	11	-DB(5)	Data Bus 5	I/T
14	13	-DB(6)	Data Bus 6	I/T
16	15	-DB(7)	Data Bus 7	I/T
18	17	-DB(P)	Data Bus Parity	I/T
20	19	GROUND	-	-
22	21	GROUND	-	-
24	23	GROUND	-	-
26[4]	-	TERMPWR	Terminator Power	I
28	27	GROUND	-	-
30	29	GROUND	-	-
32	31	-ATN	Attention	I
34	33	GROUND	-	-
36	35	-BSY	Busy	I/T
38	37	-ACK	Acknowledge	I
40	39	-RST	Reset	I
42	41	-MSG	Message	T
44	43	-SEL	Select	I/T
46	45	-C/D	Control/Data	T
48	47	-REQ	Request	T
50	49	-I/O	Input/Output	T

NOTE: [1] All odd pins, except for pin 25, should be connected to ground. Pin 25 should be left open.

[2] The "-" sign next to a signal name means active low.

[3] I = Initiator, T = Target.

[4] Pin 26 provides optional power for the drive's terminator packs; see Section 3.3.2.

Power is supplied to the drive via AMP MATE-N-LOK Connector J3; refer to Section 4 for power requirements. Suggested wire size is 18 AWG (minimum) for all pins. Recommended mating connector is AMP 1-480424-0; recommended pins are AMP 350078-4.

TABLE 2-2. DC POWER CONNECTOR J3 PIN ASSIGNMENTS

Pin	Voltage *	Pin	Voltage *
1	+12 V	3	+5 Return
2	+12 Return	4	+5 V

* Voltages are ±5%, measured at the drive's power connector.

2.2 INTERFACE ELECTRICAL CHARACTERISTICS

Interface control and status signals are digital (open collector TTL) utilizing industry-standard transmitters and receivers which provide a terminated, single-ended system.

Figure 2-1 summarizes the electrical characteristics of the single-ended signals at Connector J1.

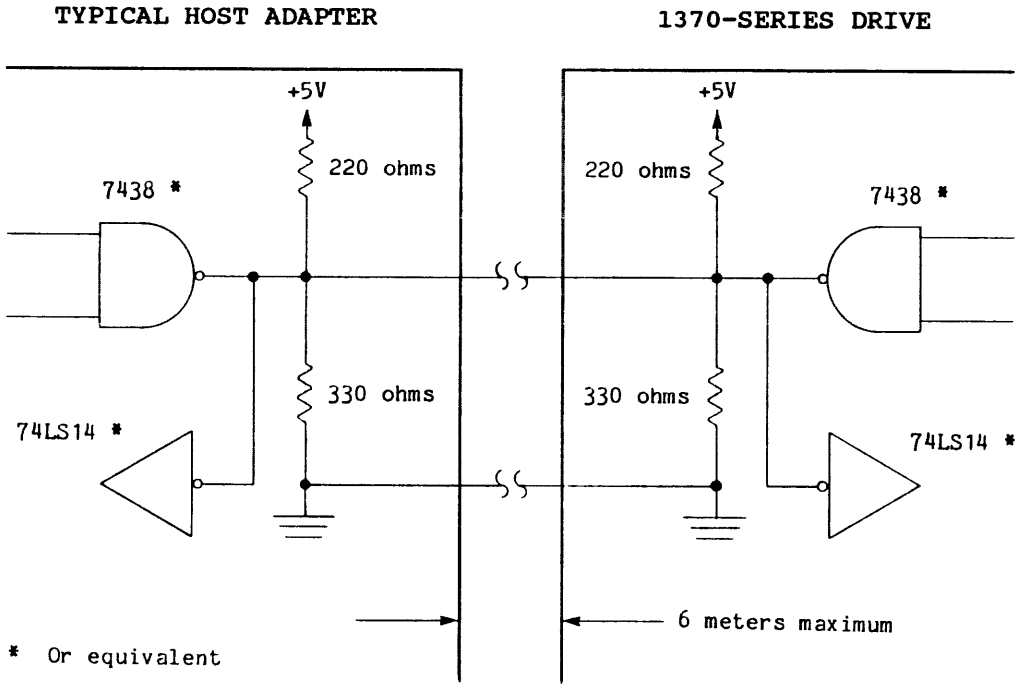


Figure 2-1. Single-Ended Driver/Receiver Combination

2.2 INTERFACE ELECTRICAL CHARACTERISTICS (continued)

The assigned signals are terminated with 220 ohms to +5V (nominal) and 330 ohms to ground at each end of the cable. All signals use open-collector or three-state drivers.

Single-ended drivers and receivers allow a maximum cable length of 6.0 meters (primarily for connection within a cabinet). A stub length of no more than 0.1 meters is allowed off the mainline interconnection within any connected equipment.

Signal transmission requires a single 50-conductor cable. A characteristic impedance of 100 ($\pm$10%) ohms is recommended for unshielded flat or twisted pair ribbon cable.

a. Input Characteristics

Each received signal has the following characteristics when measured at the interface connector.

1) Signal true = 0.0 VDC to 0.8 VDC
2) Maximum total input load = -0.4 milliamps at 0.4 VDC
3) Signal false = 2.0 VDC to 5.25 VDC
4) Minimum input hysteresis = 0.2 VDC

b. Output Characteristics

Each signal driven by an SCSI device has the following characteristics when measured at the interface connector.

1) Signal assertion = 0.0 VDC to 0.4 VDC.
2) Minimum driver output capability = 48 milliamps (sinking) at 0.5 VDC
3) Signal negation = 2.5 VDC to 5.25 VDC

c. Terminator Power (TERMPWR at Pin 26)

Terminator Power has the following requirements:

V_{Term} = 4.0 VDC to 5.25 VDC

800 milliamps minimum source drive capability.

1.0-milliamp maximum sink capability (except for the purposes of providing power to an internal terminator) with 1.0 amp recommended current limiting (e.g., a fuse).

The 1370 Series provides keyed connectors to prevent accidental grounding or misconnection of terminator power.

2.3 SCSI BUS SIGNALS

There are a total of eighteen SCSI bus signals. Nine of the bus signals are used for control, and nine are used for data. (Note that the data signals include the parity signal option.)

2.3.1 Signal Descriptions

ACK: The ACKNOWLEDGE signal is driven by an Initiator to show acknowledgment of a REQ/ACK data-transfer handshake.

ATN: The ATTENTION signal is driven by an Initiator that indicates the ATTENTION condition.

BSY: BUSY is an "OR-tied" signal that shows the bus is in use.

C/D: The CONTROL/DATA signal is driven by a Target to indicate whether CONTROL or DATA information is on the DATA BUS. True = CONTROL.

DB: Eight DATA-BIT signals, DB(0) through DB(7), plus a parity-bit signal, DB(P), form the DATA BUS. DB(7) is the most significant bit and has the highest priority during the ARBITRATION phase. Bit number, significance, and priority decrease to DB(0). A data bit is defined as 1 when the signal value is true and is defined as Ø when the signal value is false. Data parity DB(P) is odd. The use of parity is a system option (i.e., a system is configured so that all the SCSI devices on a bus generate parity and have parity detection enabled, or all the SCSI devices have parity detection disabled or not implemented). Parity is not valid during the ARBITRATION phase.

I/O: The INPUT/OUTPUT signal is driven by a Target that controls the direction of data movement on the DATA BUS with respect to an Initiator. True indicates input to the Initiator. This signal is also used to distinguish between SELECTION and RESELECTION phases.

MSG: The MESSAGE signal is driven by a Target during the MESSAGE phase.

REQ: The REQUEST signal is driven by a Target to indicate a request for a REQ/ACK data transfer handshake.

RST: RESET is an "OR-tied" signal that indicates the RESET condition.

SEL: The SELECT signal is used by:

- An Initiator to select a Target.
- A Target to reselect an Initiator.

2.3.2 Signal Values

Signals may assume true or false values. There are two methods of driving these signals. In both cases, the signal is actively driven true.

- In the case of OR-tied drivers, the driver does not drive the signal to the false state, rather the bias circuitry of the bus terminators pulls the signal false whenever it is released by the drivers at every SCSI device. If any driver is asserted, then the signal is true.

- In the case of non-OR-tied drivers, the signal may be actively driven false, or negated.

In this product description, wherever the term negated is used, it means that the signal may be actively driven false, or it may be simply released (in which case the bias circuitry pulls it false), at the option of the implementor. The advantage to actively drive signals false is that the true-to-false transition occurs more quickly, and noise margins may be somewhat improved.

2.3.3 OR-Tied Signals

The BSY signal and the RST signal are OR-tied only. In the normal operation of the bus, these signals are simultaneously driven true by several drivers. No signals other than BSY, RST, and DB(P) are driven at the same time by two or more drivers, and any signal other than BSY and RST may employ OR-tied or non-OR-tied drivers. DB(P) is not driven false during the ARBITRATION phase.

Note that there is no operational problem in mixing OR-tied and non-OR-tied drivers on signals other than BSY and RST.

2.3.4 Signal Sources

Table 2-3 shows which type of SCSI device is allowed to originate each signal. No attempt is made to show if the source is driving asserted, driving negated, or is passive. All SCSI device drivers which are not active sources are in the passive state.

Note that the RST signal may be originated by any SCSI device at any time.

For further information on the operation of the SCSI interface, refer to Micropolis SCSI Implementation document 110011, the ANSI SCSI Standard, and the Common Command Set.

TABLE 2-3. SIGNAL SOURCES

Bus Phase	Signals				
	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	Target	Target	Initiator	Target
COMMAND	Target	None	Target	Initiator	Initiator
DATA IN	Target	None	Target	Initiator	Target
DATA OUT	Target	None	Target	Initiator	Initiator
STATUS	Target	None	Target	Initiator	Target
MESSAGE IN	Target	None	Target	Initiator	Target
MESSAGE OUT	Target	None	Target	Initiator	Initiator

All: The BSY signal is driven by all SCSI devices that are actively arbitrating.

SCSI ID: A unique data bit (the SCSI ID) is driven by each SCSI device that is actively arbitrating; the other seven data bits are released (i.e., not driven) by this SCSI device. Parity bit DB(P) may be undriven or driven to the true state, but is never driven to the false state during this phase.

I&T The BSY signal is driven by the Initiator, the Target, or both, as specified in the SELECTION phase and the RESELECTION phase.

Initiator: If the signal is driven, it is driven by the active Initiator only.

None: The signal is released; that is, not driven by any SCSI device. The bias circuitry of the bus terminators pulls the signal to the false state.

Winner: The SEL signal is driven by the one SCSI device that wins arbitration.

Target: If the signal is driven, it is driven only by the active Target.

2.4 COMMAND SET

Table 2-4 lists the Command Set for for the 1370 Series. For further information on the operation of the SCSI interface, refer to Micropolis SCSI Implementation document 110011, the ANSI SCSI Standard, and the Common Command Set.

TABLE 2-4. COMMAND SET

Command Name	Operation Code (Hex)
FORMAT TRACK	E4
FORMAT UNIT *	04
INQUIRY	12
MODE SELECT	15
MODE SENSE	1A
READ	08
READ BUFFER	3C
READ CAPACITY	25
READ DEFECT DATA	37
READ EXTENDED	28
READ LONG	E8/3E **
REASSIGN BLOCK	07
RECEIVE DIAGNOSTIC RESULTS	1C
RELEASE UNIT	17
REQUEST SENSE	03
RESERVE UNIT	16
REZERO UNIT	01
SEEK	0B
SEEK EXTENDED	2B
SEND DIAGNOSTIC	1D
START UNIT	1B
TEST UNIT READY	00
VERIFY	2F
WRITE	0A
WRITE AND VERIFY	2E
WRITE BUFFER	3B
WRITE EXTENDED	2A
WRITE LONG	EA/3F **

* Before storing data on a new 1370, set the appropriate parameters for your requirements by using the MODE SELECT command; then execute the FORMAT UNIT command.

** The drive will respond to either operation code.

2.4.1 Definitions

In a typical system, the computer's host adapter acts as the Initiator and the peripheral device's controller acts as the Target.

This section does not attempt to distinguish between a computer and its host adapter. These functions may be separate or merged; the term "Initiator" encompasses both. Similarly, the term "Target" does not distinguish between the peripheral device and its controller, which may be separate or merged (like the 1370).

2.4.2 Command Summary

The following alphabetical listing gives a brief description of each command that is supported by the 1370 Series:

FORMAT TRACK (E4h) causes the drive to format one physical track according to the parameters set with the MODE SELECT command.

FORMAT UNIT (04h) causes the drive to format (or reformat) the media so that all data blocks can be accessed.

INQUIRY (12h) causes the drive to transfer parameter information to the Initiator.

MODE SELECT (15h) enables the Initiator to specify or change drive parameters. MODE SELECT is a complementary command to the MODE SENSE command.

MODE SENSE (1Ah) causes the drive to send media parameters to the Initiator. MODE SENSE is a complementary command to the MODE SELECT command.

READ (08h) causes the drive to send data to the Initiator.

READ BUFFER (3Ch) is used in conjunction with the WRITE BUFFER command as a diagnostic function for testing the drive's buffer memory and SCSI bus integrity. There is no medium access with this command.

READ CAPACITY (25h) causes the drive to send information with respect to its capacity to the Initiator.

READ DEFECT DATA (37h) causes the drive to send defect lists, maintained by the drive, to the Initiator.

2.4.2 Command Summary (continued)

READ EXTENDED (28h) causes the drive to send information to the Initiator.

Note that the READ EXTENDED command can specify a higher Logical Block Address and longer Transfer Length than the READ command.

READ LONG (E8h) causes the drive to send one data block and its associated Error Check Character (ECC) bytes to the Initiator.

REASSIGN BLOCK (07h) causes the drive to reassign defective logical block(s) to an area on disk reserved for this purpose.

RECEIVE DIAGNOSTIC RESULTS (1Ch) causes the drive to execute the diagnostic tests which were requested/defined by the SEND DIAGNOSTIC command.

Note that the drive sends analysis data to the Initiator after completion of the diagnostic tests.

RELEASE UNIT (17h) lets the Initiator release a reserved drive.

REQUEST SENSE (03h) causes the drive to send Sense Data to the Initiator.

RESERVE UNIT (16h) allows the Initiator to reserve a drive for its exclusive use.

REZERO UNIT (01h) causes the drive to position the data heads at physical track zero.

SEEK (0Bh) causes the drive to move the data heads to a specified Logical Block Address.

SEEK EXTENDED (2Bh) causes the drive to move the data heads to a specified Logical Block Address.

Note that the SEEK EXTENDED command can specify a higher Logical Block Address than the SEEK command.

SEND DIAGNOSTIC (1Dh) causes the drive to perform a self test.

2.4.2 Command Summary (continued)

START UNIT (1Bh) allows the Initiator to enable the drive's spindle motor for normal operations.

Note that a jumper-selectable option is available which automatically enables the drive's spindle motor at power-on; refer to Section 3.3.3.

TEST UNIT READY (00h) provides a way for the Initiator to check the ready status of the drive.

VERIFY (2Fh) causes the drive to verify data written on disk.

WRITE (0Ah) causes the drive to write data (from the Initiator) to disk.

WRITE AND VERIFY (2Eh) causes the drive to write data (from the Initiator) to disk and then verify that the data is correctly written.

WRITE BUFFER (3Bh) is used in conjunction with the READ BUFFER command as a diagnostic function for testing the drive's buffer memory and SCSI bus integrity. There is no medium access with this command.

WRITE EXTENDED (2Ah) causes the drive to write data (from the Initiator) to disk.

Note that WRITE EXTENDED can specify a higher Logical Block Address and longer Transfer Length than the WRITE command.

WRITE LONG (EAh) causes the drive to write one data block and its associated ECC bytes to disk.

SECTION 3. INSTALLATION

3.1 PHYSICAL INTERFACE

The electrical interface between the 1370-series drive and the host system is accomplished via five connectors: J1, J2, J3, J4, and J5. These connectors and their recommended mating connectors are described below.

3.2 POWER AND INTERFACE CABLES AND CONNECTORS

Figure 3-1 shows the locations of the connectors.

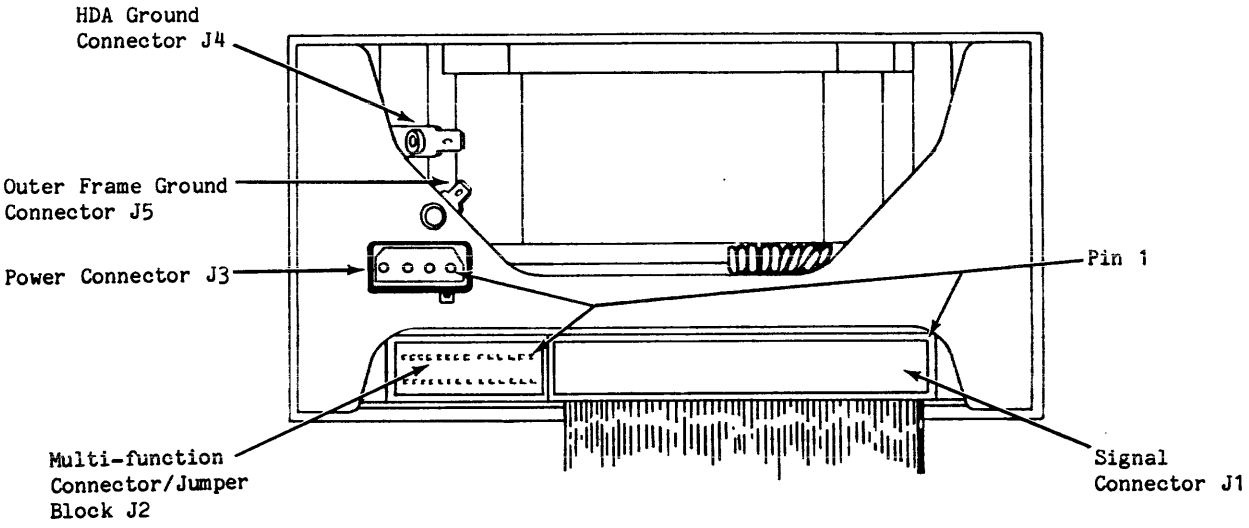


Figure 3-1. Power and Interface Connections

Signal Connector J1

J1 is a 50-pin connector. Signal interface connection is made via this connector. The signals on J1 include the 8-bit SCSI bus and various control and handshaking lines.

Recommended Cable: 3M Scotchflex 3365/50 or equivalent

Mating Connector: 3M P/N 3425-3000 or equivalent

Multi-Function Connector/Jumper Block J2

J2 is a 28-pin multi-function connector/jumper block used for connecting the drive to a user-supplied Operator Panel (Section 3.3.5). J2 is also available for future drive options.

DC Power Connector J3

J3 is a 4-pin, keyed, AMP MATE-N-LOCK connector on the Motor Control board. Both +5V and +12V is supplied to the drive via this connector.

Mating Connector: AMP 1-480424-0 or equivalent
Pins: AMP 350078-4

Suggested Wire Size: 18 AWG

Ground Connectors J4 and J5

3/16-inch spade lugs J4 and J5 are provided for grounding; J4 is located on the HDA, and J5 is located on the frame. System characteristics determine proper ground connection; refer to Figure 3-1 for the exact location of the connectors.

Mating Connector: AMP 60972-2 or equivalent

3.3 DRIVE OPTION SELECTION

Figure 3-2 shows the locations of the connectors, SCSI ID jumpers, option jumpers, and interface terminator packs on the Device Electronics board.

3.3.1 Device Addressing and Interface Termination

Up to eight devices (any combination of hosts and targets) can be attached to an SCSI bus. The 1370 Series has three ID jumpers - IDØ, ID1, and ID2. These three jumpers are used to assign one of the eight SCSI ID bits (0 through 7) to the drive.

SCSI ID	JUMPERS		
	ID2	ID1	IDØ
Ø	out	out	out
1	out	out	in
2	out	in	out
3	out	in	in
4	in	out	out
5	in	out	in
6	in	in	out
7	in	in	in

In multiple-device systems, each drive must have its own unique ID bit. Drives are configured as SCSI ID Ø at the factory.

Interface Terminator packs RN1, RN7, and RN8 provide proper termination for the interface lines. For a multiple-drive system, the terminators are installed in the last drive on the cable; see Section 3.4.

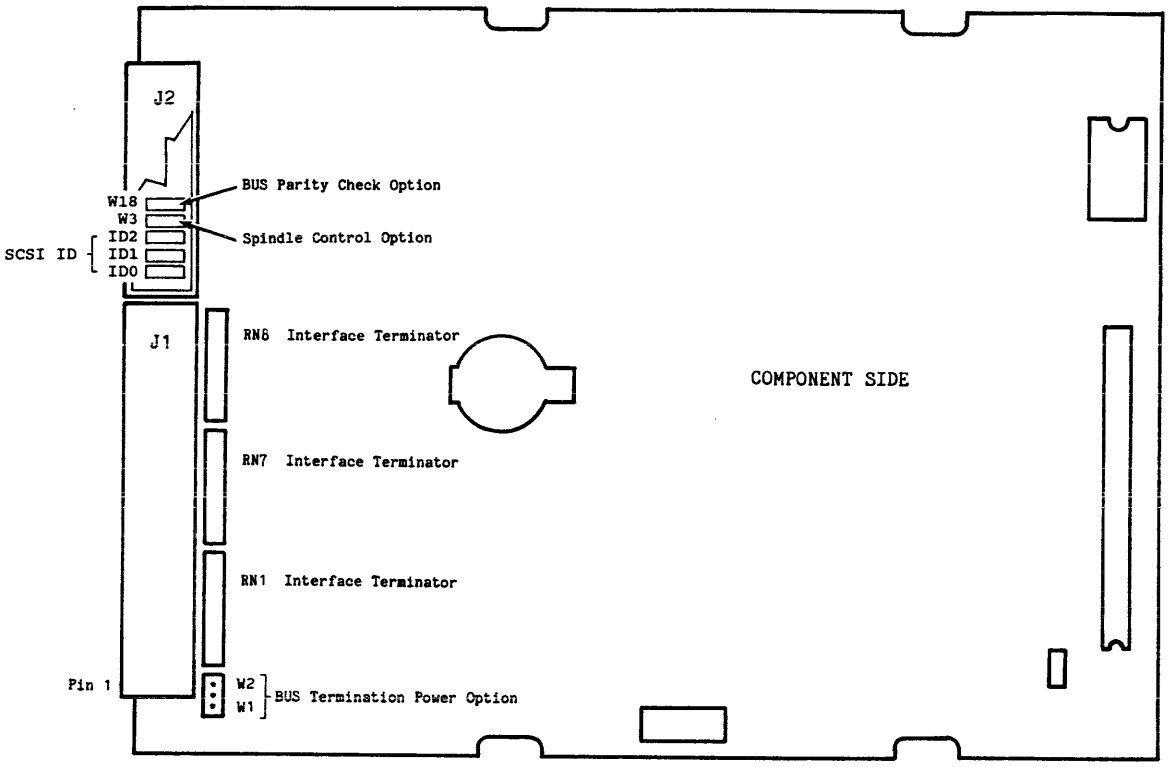


Figure 3-2. Address Jumpers and Interface Terminator

3.3.2 BUS Termination Power Option

A jumper is installed at W1 or W2 to select the source of terminator power (+5V) for the terminator packs on the Device Electronics board.

- When a jumper is installed at W1 (the factory default configuration), the drive provides terminator power.
- When a jumper is installed at W2, terminator power is provided by the host system via interface cable J1, pin 26 (TERMPWR); see Section 2.2 for the TERMPWR requirements.

3.3.3 Spindle Control Option

W3 is used to select the spindle control option.

- When a jumper is installed at W3, the drive must wait for a START UNIT command to start the spindle motor.
- When a jumper is not installed at W3 (the factory default configuration), the drive automatically starts the spindle motor at power-on.

3.3.4 BUS Parity Check Option

W18 is used to select the parity check option.

- When a jumper is installed at W18, the drive neither generates nor detects parity.
- When a jumper is not installed at W18 (the factory default configuration), the drive generates parity and enables parity detection.

3.3.5 Operator Panel Option

Multi-Function Connector/Jumper Block J2 can be used to connect the drive to a user-supplied operator panel. Figure 3-3 shows the wiring diagram of a typical operator panel and the associated J2 pin connections.

J2, PIN	FUNCTION
23	**Logic Ground.**
24	**Not Used.**
25	**Write Protect** input. Logic ground disables writing and lights the Write Protect LED.
26	**Ready** output. Logic ground indicates the drive is Ready and lights the Ready LED.
27	**+5V** source for the LEDs.

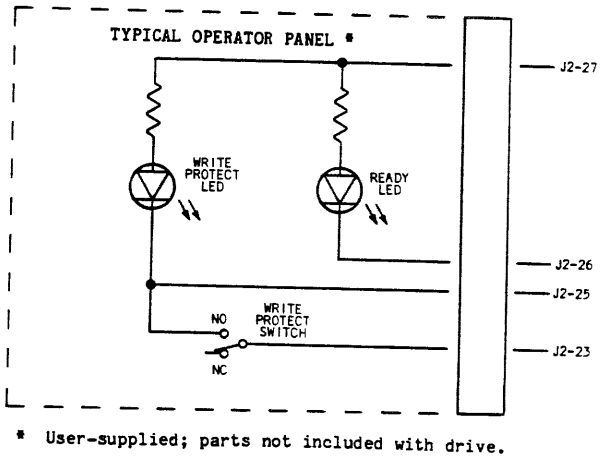
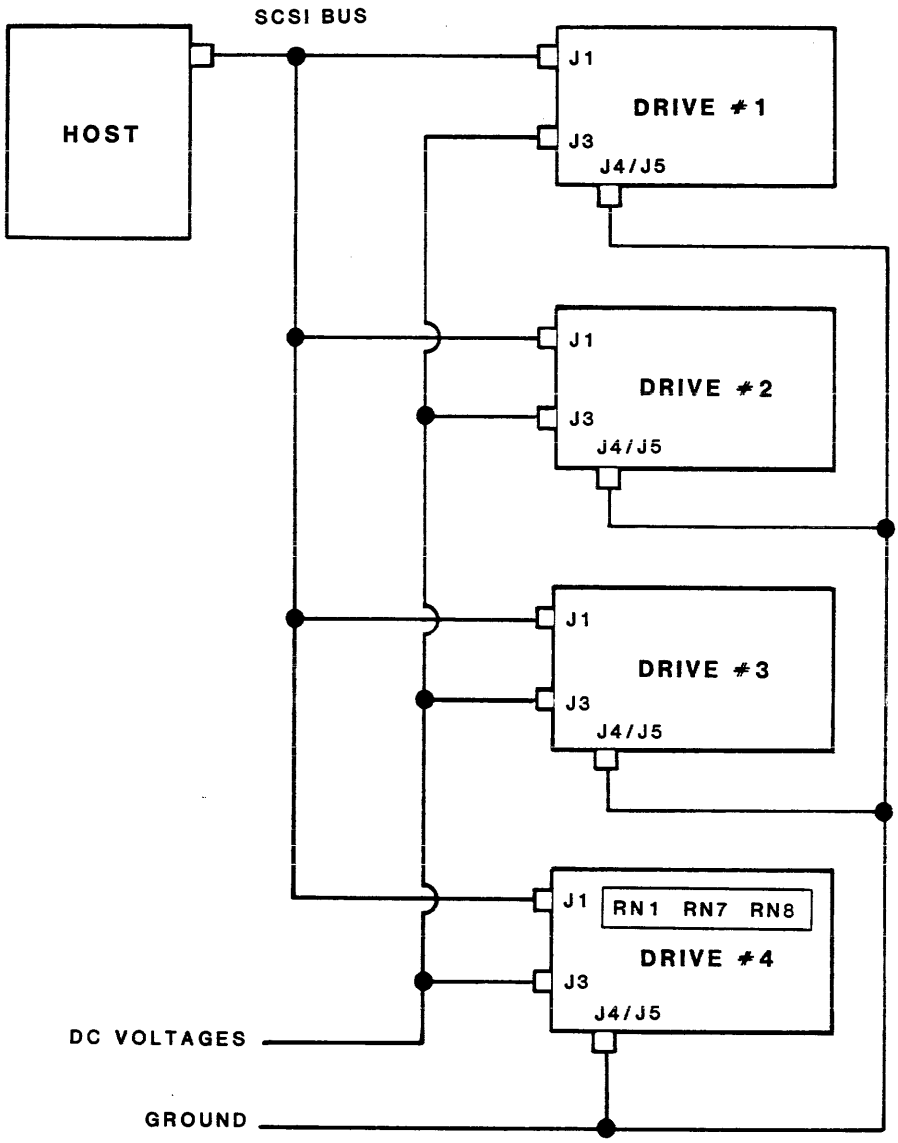


Figure 3-3. Operator Panel Interface

3.4 MULTIPLE-DRIVE SYSTEMS

Up to seven 1370-series drives can be connected to a single host, see Figure 3-4. The figure shows the connections for a system configuration using four drives.



NOTE: 1) Interface Terminators RN1, RN7, and RN8 are installed only in the last physical drive in the control chain.

2) Connectors J4 and J5 are provided for grounding; system characteristics determine the proper ground connection.

Figure 3-4. Multiple Drive Configuration

3.5 DIMENSIONS AND MOUNTING

The 1370 Series uses industry-standard mounting techniques for 5 1/4-inch Winchester disk drives (the same as for 5 1/4-inch flexible disk drives). Figure 3-5 shows mounting hole locations.

CAUTION: Screws must be selected so that they do not penetrate the mounting holes more than .25 inches. Maximum torque applied to the screws must not exceed 10 in-lbs.

Recommended orientation is vertical on either side, or horizontal with the Device Electronics board down; other mounting orientations may be used provided the ambient air temperature around the drive is kept at or below 50°C (122°F). Inasmuch as the drive frame acts as a heat sink to dissipate heat from the unit, the enclosure and mounting structure should be designed to allow natural convection of heat around the HDA and frame. If the enclosure is small or natural convection is limited, a fan may be required.

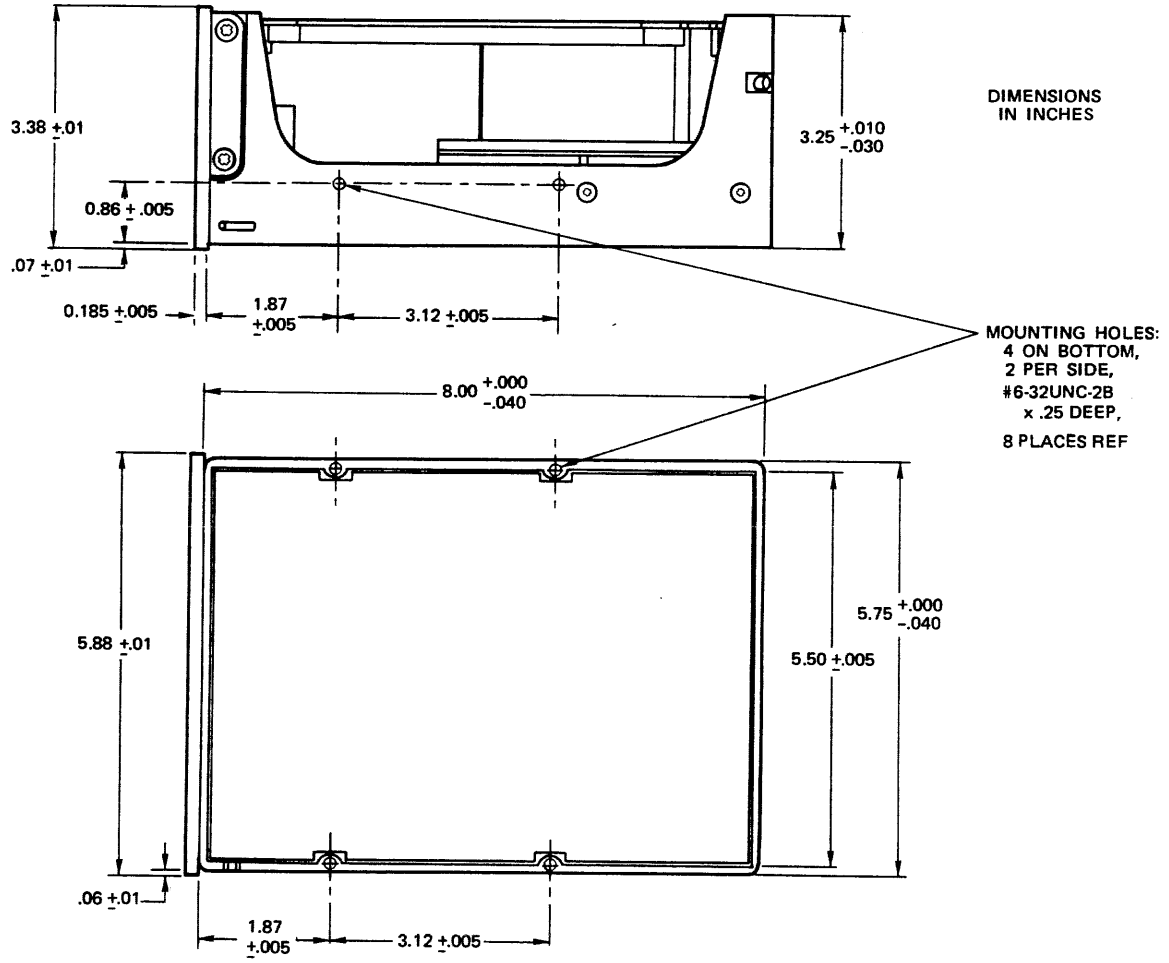


Figure 3-5. Dimensions and Mounting

SECTION 4. POWER REQUIREMENTS

4.1 POWER SUPPLY REQUIREMENTS

DC voltage and current requirements for the 1370 Series are shown below. Voltages may be applied in any sequence during power-up. Voltage verification must be performed at the drive connector. The rise time of the +5V must be less than one second for proper operation of the power-on reset circuits. Figure 4-1 shows the current profile for the +12V.

TABLE 4-1. DC POWER REQUIREMENTS

Voltage	Start-up Avg.	Start-up Peak	Idle Avg.	Idle Peak	Seeking (1) Avg.	Seeking (1) Peak	Ripple (5) (maximum)
+5V ±5% maximum: (2)	2.0A	2.0A	2.0A	2.0A	2.0A	2.0A	2%
+12V ±5% (3) typical: (4)	4.25A	4.25A	1.80A	1.90A	2.25A	3.10A	2%
maximum: (2)	4.35A	4.35A	2.00A	2.10A	2.45A	3.30A	

(1) These values are for 1/3-stroke seeks with an 8-millisecond idle period between seeks to simulate a typical system environment.

(2) Maximum values to be considered for power supply design and system integration.

(3) +5%, -10% tolerance during start-up.

(4) Typically measured values.

(5) Peak-to-peak, includes noise.

DC POWER PIN ASSIGNMENTS (Connector J3)

Pin	Voltage	Pin	Voltage
1	+12 VDC	3	+5 RETURN
2	+12 RETURN	4	+5 VDC

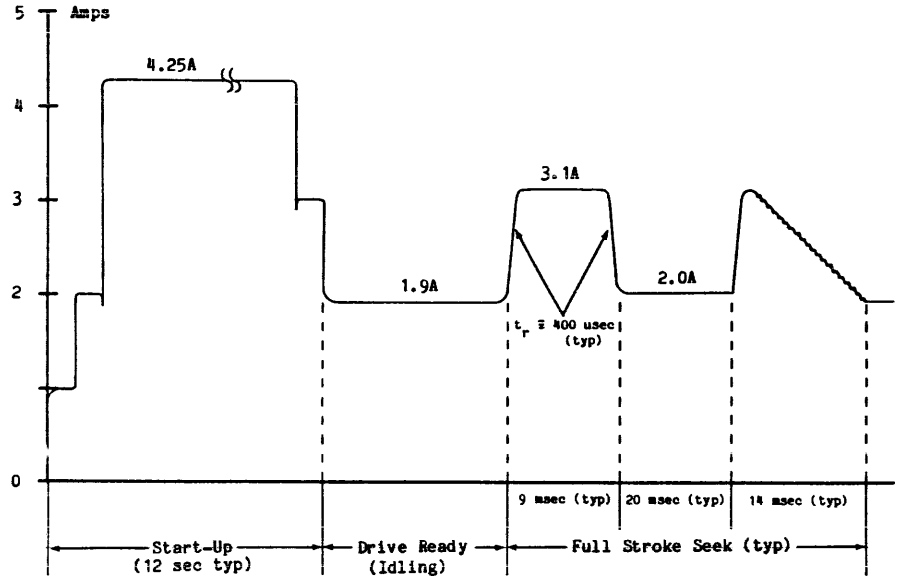


Figure 4-1. 12V Peak Current Profile (typical, 1375)

SECTION 5. SERVICEABILITY AND TECHNICAL SUPPORT

5.1 ADJUSTMENTS AND MAINTENANCE

The 1370 Series requires no adjustments or periodic maintenance; additionally, no mechanical adjustments are required to prepare a system for handling or shipment.

5.2 FIELD-REPLACEABLE COMPONENTS

The concept of repair by replacement of complete functional components is utilized in the 1370 Series, resulting in an MTTR of less than 15 minutes.

5.3 SERVICE DATA

See Micropolis Technical Manual No.101787 for complete maintenance and service data.

5.4 TECHNICAL SUPPORT

For assistance regarding spares, technical training, system integration, applications, etc, contact:

Micropolis Corporation
Product Support
21123 Nordhoff Street
Chatsworth, CA 91311

(818) 709-3300
FAX: (818) 709-3396

- or -

Micropolis Corporation
European Operations
Acre Road, Reading, Berkshire,
RG2 OSU, England

(734) 751315

APPENDIX A. FORMATTED CAPACITY CALCULATION

The formatted capacity of the 1370 Series depends upon a number of user-selectable variables.

The following formula is used to calculate the formatted capacity, C, using track-oriented sparing:

$$C = [(SPT - SPARE\_SPT) \times HDS)] \times (1024 - 3 - SPARE\_CYL) \times (BYTES)$$

where SPT is the number of physical sectors per track.

SPARE SPT is the number of spare sectors per track. This value is user programmable from 0 to 3; a typical value for sparing is 1.

HDS is the number of data heads.

1024 is the number of physical cylinders.

3 cylinders, used by the drive, are not user accessible.

SPARE CYL is the number of spare cylinders. This is user-programmable; a typical value for sparing is 3.

BYTES is the bytes per sector (e.g., 1024, 512, etc).

For example, a 1375 Drive using 19 sectors per track, 1 spare sector per track, 3 spare cylinders, and a 1024-byte format, would have a formatted capacity (C) of:

$$C = [(SPT - SPARE\_SPT) \times HDS)] \times (1024 - 3 - SPARE\_CYL) \times (BYTES)$$

$$= [(19 - 1) \times 8)] \times (1024 - 3 - 3) \times 1024$$

$$= [18 \times 8] \times 1018 \times 1024$$

$$= 144 \times 1,042,432$$

$$= 150,110,208$$

= 150.1 Mbytes, when truncated

The calculated capacity is based on the conservative use of spares (1 spare sector per track and 3 spare cylinders). A higher capacity could have been attained had fewer spares been used.

APPENDIX B. MODE SENSE PARAMETER PAGES - DEFAULT VALUES

MODE SENSE Command

The MODE SENSE command provides a means by which an Initiator may receive parameters from a Target (e.g., a 1370-series drive).

The MODE SENSE Command Descriptor Block is formatted as shown:

MODE SENSE Command Descriptor Block

BYTE	BIT							
	07	06	05	04	03	02	01	00
00	0	0	0	1	1	0	1	0
01	Logical Unit Number			Reserved				
02	PCF		Page Code					
03	Reserved							
04	Allocation Length							
05	Vendor Unique		Reserved				Flag	Link

In response to the MODE SENSE command, the drive sends (to the Initiator) blocks of parameters that are separated into categories called pages. The 1370 Series supports four pages of parameter information:

Page 1 - Error Recovery Parameters (Page Code 01h)

Page 2 - Disconnect/Reconnect Parameters (Page Code 02h)

Page 3 - Direct-Access Device Format Parameters (Page Code 03h)

Page 4 - Disk Drive Geometry Parameters (Page Code 04h)

This appendix shows each 1370-series parameter page and lists the corresponding default parameter values.

For a more detailed explanation of the MODE SENSE command, refer to Micropolis SCSI Implementation document 110011.

MODE SENSE Parameter Pages

a. Error Recovery Parameter Page (Page Code 01h)

Page Format

BYTE	BIT							
	07	06	05	04	03	02	01	00
00	Reserved		Page Code = 01h					
01	Page Length (maximum) = 06h							
02	AWRE	ARRE	TB	RC	EER	PER	DTE	DCR
03	Retry Count							
04	Correction Span							
05	Head Offset Count							
06	Data Strobe Offset Count							
07	Recovery Time Limit							

Default Values

PARAMETER	DEFAULT VALUE	CHANGE-ABLE	LIMITATIONS/ RANGE
AWRE (Automatic Write Reallocation Enabled)	0	N	Not supported
ARRE (Automatic Read Reallocation Enabled)	0	N	Not supported
TB (Transfer Block)	1	Y	0 or 1
RC (Read Continuous)	0	Y	0 or 1
EER (Enable Early Recovery)	0	Y	0 or 1
PER (Post Error)	0	Y	0 or 1
DTE (Disable Transfer on Error)	0	Y	0 or 1
DCR (Disable Correction)	0	Y	0 or 1
Retry Count	10 (dec) 0A (hex)	Y	0 - 255 (dec) 00 - FF (hex)
Correction Span	11 (dec) 0B (hex)	Y	0 - 19 (dec) 00 - 13 (hex)
Head Offset Count	0	N	Not supported
Data Strobe Offset Count	0	N	Not supported
Recovery Time Limit	0	N	Not supported

MODE SENSE Parameter Pages (continued)

b. Disconnect/Reconnect Parameter Page (Page Code 02h)

Page Format

BYTE	BIT							
	07	06	05	04	03	02	01	00
00	Reserved		Page Code = 02h					
01	Page Length (maximum) = 0Ah							
02	Buffer Full Ratio							
03	Buffer Empty Ratio							
04	Bus Inactivity Limit (MSB)							
05	Bus Inactivity Limit (LSB)							
06	Disconnect Time Limit (MSB)							
07	Disconnect Time Limit (LSB)							
08	Connect Time Limit (MSB)							
09	Connect Time Limit (LSB)							
10	Reserved							
11	Reserved							

Default Values

PARAMETER	DEFAULT VALUE	CHANGE-ABLE	LIMITATIONS/ RANGE
Buffer Full Ratio	0	N	Not supported
Buffer Empty Ratio	0	N	Not supported
Bus Inactivity Limit	5	Y	0 - 650 (dec) 0000 - 028A (hex)
Disconnect Time Limit	0	N	Not supported
Connect Time Limit	0	N	Not supported

MODE SENSE Parameter Pages (continued)

c. Direct-Access Device Format Parameter Page (Page Code 03h)

Page Format

BYTE	BIT							
	07	06	05	04	03	02	01	00
00	Reserved		Page Code = 03h					
01	Page Length (maximum) = 16h							
02	Tracks Per Zone (MSB)							
03	Tracks Per Zone (LSB)							
04	Alternate Sectors Per Zone (MSB)							
05	Alternate Sectors Per Zone (LSB)							
06	Alternate Tracks Per Zone (MSB)							
07	Alternate Tracks Per Zone (LSB)							
08	Alternate Tracks Per Volume (MSB)							
09	Alternate Tracks Per Volume (LSB)							
10	Sectors Per Track (MSB)							
11	Sectors Per Track (LSB)							
12	Data Bytes Per Physical Sector (MSB)							
13	Data Bytes Per Physical Sector (LSB)							
14	Interleave Value (MSB)							
15	Interleave Value (LSB)							
16	Track Skew (MSB)							
17	Track Skew (LSB)							
18	Cylinder Skew (MSB)							
19	Cylinder Skew (LSB)							
20	SSEC	HSEC	RMB	SURF	Reserved			
21	Reserved							
22	Reserved							
23	Reserved							

See the default values on the opposite page.

MODE SENSE Format Parameters (continued)

Default Values

PARAMETER	DEFAULT VALUE	CHANGE-ABLE	LIMITATIONS/ RANGE
Tracks Per Zone	1	N	Track-oriented sparing only
Alternate Sectors Per Zone	1	Y	0 - 3 (dec) 0000 - 0003 (hex)
Alternate Tracks Per Zone	0	N	Not supported
Alternate Tracks Per Volume	*	Y	0 - 255 (dec) 0000 - 00FF (hex)
Sectors Per Track	36(dec) 0024(hex)	Y	0 - 255 (dec) 0000 - 00FF (hex)
Data Bytes Per Physical Sector	512(dec) 0200(hex)	Y	128 - 4000 (dec) 0080 - 0FA0 (hex)
Interleave Value	1	N	Default value used in FORMAT UNIT command
Track Skew	0	Y	Must be $\leq$ Sectors Per Track field
Cylinder Skew	12(dec) 000C(hex)	Y	Must be $\leq$ Sectors Per Track field
SSEC (Soft Sector)	0	N	Soft-sector formatting not supported
HSEC (Hard Sector)	1	N	Hard-sector formatting only
RMB (Removable)	0	N	Removable media not supported
SURF (Surface)	0	N	Surface sector allocation not supported.

* The default value equals 3 x (number of data heads).

MODE SENSE Parameter Pages (continued)

d. Disk Drive Geometry Parameter Page (Page Code 04h)

Page Format

BYTE	BIT							
	07	06	05	04	03	02	01	00
00	Reserved		Page Code = 04h					
01	Page Length (maximum) = 12h							
02	Maximum Number of Cylinders (MSB)							
03	Maximum Number of Cylinders							
04	Maximum Number of Cylinders (LSB)							
05	Maximum Number of Heads							
06	Starting Cylinder - Write Precompensation (MSB)							
07	Starting Cylinder - Write Precompensation							
08	Starting Cylinder - Write Precompensation (LSB)							
09	Starting Cylinder - Reduced Write Current (MSB)							
10	Starting Cylinder - Reduced Write Current							
11	Starting Cylinder - Reduced Write Current (LSB)							
12	Drive Step Rate (MSB)							
13	Drive Step Rate (LSB)							
14	Landing Zone Cylinder (MSB)							
15	Landing Zone Cylinder							
16	Landing Zone Cylinder (LSB)							
17	Reserved							
18	Reserved							
19	Reserved							

Default Values

PARAMETER	DEFAULT VALUE	CHANGE-ABLE	LIMITATIONS/ RANGE
Maximum Number of Cylinders	1024(d) 000400(h)	Y*	4 ≤ cyl ≤ 1024
Maximum Number of Heads	Depends on model	Y*	1 ≤ hds ≤ actual count
Starting Cylinder - Write Precompensation	0	N	Not supported
Starting Cylinder - Reduced Write Current	0	N	Not supported
Drive Step Rate	0	N	Not supported
Landing Zone Cylinder	0	N	Not supported

* May be changed, but this value is normally left at the default value to preserve maximum capacity.