SA455/465 Double-sided Minifloppy™ Diskette Storage Drive

P/N 39238-1

OEM Manual
May 1983

Shugart

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ABBREVIATIONS/MNEMONICS

AM	Address Mark	**MFM**	Modified FM (Double Density)
bpi	Bits per Inch	**MTBF**	Mean Time Between Failure
CRC	Cyclic Redundancy Check	**MTTR**	Mean Time to Repair
fci	Flux Changes per Inch	**PM**	Preventive Maintenance
FM	Frequency Modulation (Single Density)	**tpi**	Tracks per Inch
ID	Identification	**WG OFF**	Write Gate Off

NOTICE TO USERS

This manual (P/N 39230-2) supersedes P/N 39230-0 and P/N 39230-1. Changes between this manual and P/N 39230-1 are indicated by either a change bar in the margin or a black hand in some figures.

While every effort has been made to ensure that the information provided herein is correct, please feel free to notify us in the event of an error or inconsistency. Write any comments on the form in the back of this manual and send to:

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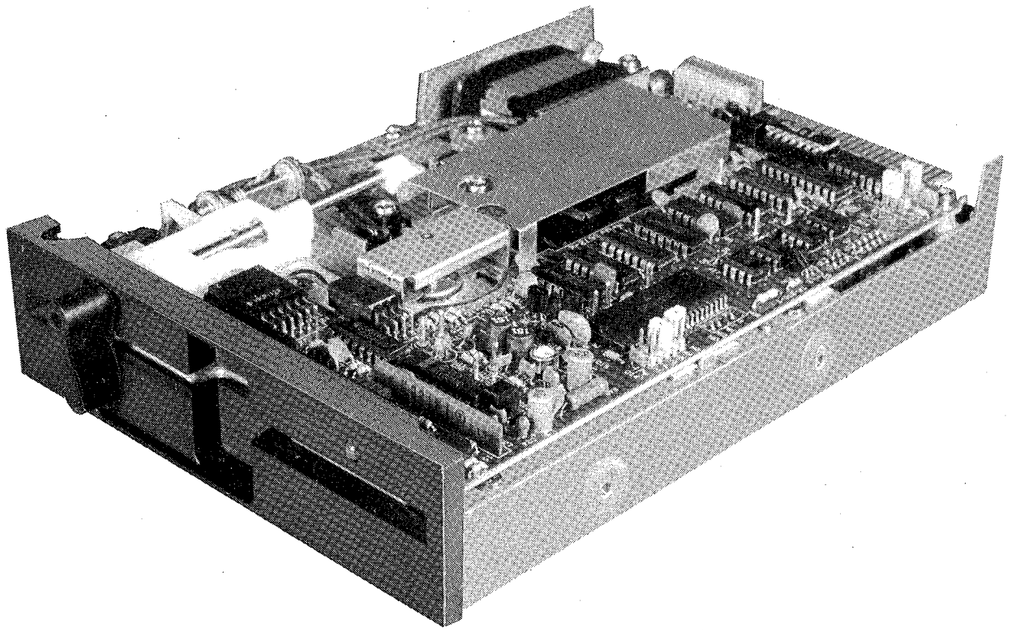

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FIGURE 1-1. SA455/465 DOUBLE SIDED MINIFLOPPY

SECTION I
INTRODUCTION

1.1 GENERAL DESCRIPTION

The SA455/465 Minifloppy Disk Drives are enhanced double-headed, half-height versions of the Shugart SA400 minifloppy drives. The SA455/465 provides up to four times the on-line storage capacity, faster access time, and improved reliability and maintainability.

SA455/465 drives read and write in single and double density on standard 5.25 inch diskettes on both sides of the diskettes. The new drives are half the height of the Shugart SA400 and are plug compatible.

The compact SA455/465 offers a reliable, low cost, high performance alternative to OEM data storage applications where tape cassette units would have been previously considered.

SA455/465 drives have these standard features: compact size - 1.62 inches high × 5.88 inches wide × 8.15 inches deep including the faceplate, and a weight of 3.3 pounds; low heat dissipation; dc drive motor with precision speed control and integral tachometer; band positioner; same proprietary; internal write protect circuitry; activity light, and solid die cast chassis.

Typical applications for the SA455/465 are word processing systems, entry level micro-processor systems, intelligent calculators, program storage, hobby computer systems, and other applications where low cost random access data storage is a requirement.

Key Features

a. 0.5 Mbytes (SA455) or 1.0 Mbyte (SA465) storage capacity (unformatted)
b. Low power (7.5 watts, typical)
c. 125/250 kbits/second transfer rate
d. DC drive motor (eliminates ac requirements)

1.2 SPECIFICATION SUMMARY

1.2.1 Performance Specifications

	SA455 (40 Track/Side)		SA465 (80 Track/Side)	
Capacity (in bytes) Unformatted	Single Density (FM)	Double Density (MFM)	Single Denstiy (FM)	Double Density (MFM)
Per Disk	250,000	500,000	500,000	1,000,000
Per Surface	125,000	250,000	250,000	500,000
Per Track	3,125	6,250	3,125	6,250

	SA455 (40 Track/Side)		SA465 (80 Track/Side)	
	Single Density	Double Density	Single Density	Double Density
Formatted (16 Records/Track)				
Per Disk	163,840	327,680	327,680	655,360
Per Track	2,048	4,096	2,048	4,096
Per Sector	128	256	128	256
Formatted (10 Records/Track)				
Per Disk	204,806	409,612	409,612	819,224
Per Track	2560	5120	2560	5120
Per Sector	256	512	256	512
Transfer Rate	125 kbits/sec	250 kbits/sec	125 kbits/sec	250 kbits/sec
Latency (avg.)	100 ms	100 ms	100 ms	100 ms

	SA455 (40 Track)		SA465 (80 Track)	
	Single Density	Double Density	Single Density	Double Density
Access Time				
Track to Track	6 ms	6 ms	3 ms	3 ms
Average	93 ms	93 ms	94 ms	94 ms
Settling Time	15 ms	15 ms	15 ms	15 ms

1.2.2 Functional Specifications

Motor Start Time	500 ms	500 ms	500 ms	500 ms
Rotational Speed	300 rpm	300 rpm	300 rpm	300 rpm
Recording Density	2938 bpi	5876 bpi	2961 bpi	5922 bpi
Flux Density	5876 fci	5876 fci	5922 fci	5922 fci
Track Density	48 tpi	48 tpi	96 tpi	96 tpi
Media Requirements				
(Soft sectored)	SA154	SA154	SA164	SA164
(16 sectors hard sectored)	SA155	SA155	SA165	SA165
(10 sectors hard sectored)	SA157	SA157	SA167	SA167

Industry standard flexible diskette
Oxide on 0.003 in. (0.08 mm) Mylar
5.25 in. (133.4 mm) square jacket

1.2.3 Physical Specifications

Environmental Limits	Operating	Shipping	Storage
Ambient Temperature	50° to 115°F (10.0° to 46.1°C)	-40° to 144°F (-40° to 62.2°C)	-8° to 117°F (-22.2° to 47.2°C)
Relative Humidity	20 to 80%	1 to 95%	1 to 95%
Maximum Wet Bulb	78°F (25.6°C)	No Condensation	No Condensation
Shock (SA455/465)	0.5G/0.5G 10 ms	15G/TBD 10 ms	35G/35G 10 ms
Vibration	0.5G 5-55 Hz	3G 5-55 Hz	3G 5-55 Hz

DC Voltage Requirements
+12 V ± 10% @ 1.2 A (max), 0.6 A (typ), 100 mV ripple
+ 5 V ± 5% @ 0.9 A (max), 0.6 A (typ), 50 mV ripple

Mechanical Dimensions (exclusive of front panel)
Width = 5.75 inches (146.1 mm)
Height = 1.62 inches (41.1 mm)
Depth = 7.96 inches (202 mm)
Weight = 3.5 lbs (1.5 kg)
Power Dissipation = 9.6 Watts (34 BTU/hr) continuous typical
3.6 Watts (13.5 BTU/hr) standby

NOTE

Standby: Drive motor off, drive select off, and stepper at reduced current.

1.2.4 Reliability Specifications

MTBF: 10,000 POH under typical usage.
PM: Not required
MTTR: 30 minutes

Error Rates:
Soft Read Errors: 1 per 10^9 bits read.
Hard Read Errors: 1 per 10^{12} bits read.
Seek Errors: 1 per 10^6 seeks.

Media Life:
Passes per Track: 3.0×10^6
Insertions: 30,000+

1.3 FUNCTIONAL CHARACTERISTICS

The SA455/465 consists of read/write and control electronics, drive mechanism, read/write head, and precision track positioning mechanism. These components perform the following functions:

a. Interpret and generate control signals.
b. Move read/write heads to the desired track.
c. Read and write data.

The interface signals and their relationship to the internal functions are shown in figure 1-2.

1.3.1 Read/Write and Control Electronics

The electronics package contains:

a. Index detector circuits
b. Head position actuator driver
c. Read/write amplifier and transition detector
d. Write protect detector
e. Drive select circuit
f. Drive motor control

1.3.2 Drive Mechanism

The dc drive motor under servo speed control (using an integral tachometer) rotates the spindle at 300 rpm through a direct drive system. An expandable collet/spindle assembly provides precision media positioning to ensure data interchange.

1.3.3 Positioning Mechanics

The read/write head assembly is accurately positioned through the use of a band positioner which is attached to the head carriage assembly. Precise track location is accomplished as this positioner is rotated in discrete increments by a stepping motor.

1.3.4 Read/Write Heads

The proprietary heads are a single element ceramic read/write head with tunnel erase elements to provide erased areas between data tracks. Thus normal interchange tolerances between media and drives will not degrade the signal-to-noise ratio and ensures diskette interchangeability.

The read/write heads are mounted on a carriage which is located on precision carriage ways. The diskette is held in a plane perpendicular to the read/write heads by a platen located on the base casting. This precise registration assures perfect compliance with the read/write heads. The read/write heads are in direct contact with the diskette. The head surface has been designed to obtain maximum signal transfer to and from the magnetic surface of the diskette with minimum head/diskette wear.

1.3.5 Recording Formats

The formats of the data recorded on the diskette are totally a function of the host system. These formats can be designed around the user's application to take maximum advantage of the total available bits that can be written on any one track.

For a detailed discussion of the various recording formats, refer to section VI.

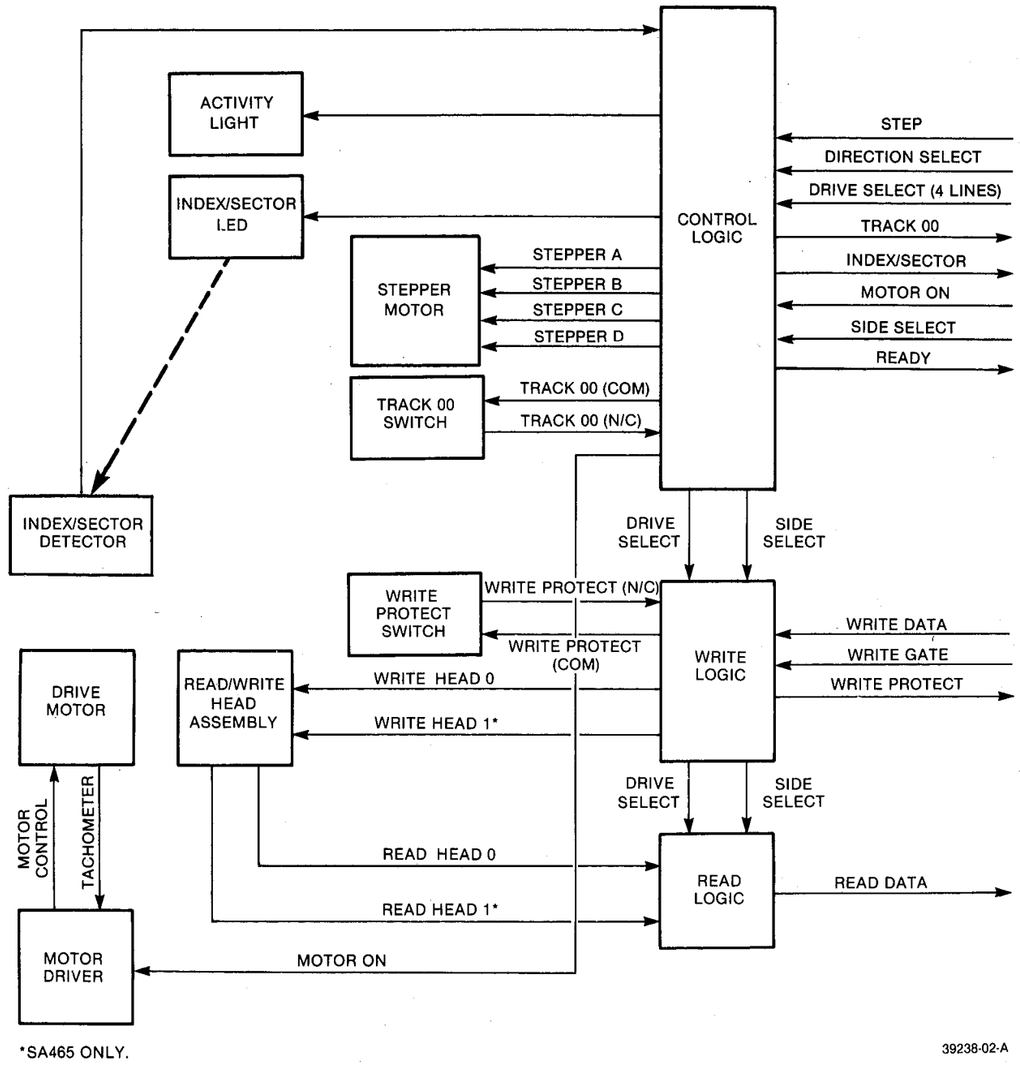


FIGURE 1-2. SA455/465 FUNCTIONAL DIAGRAM

1.4 FUNCTIONAL OPERATIONS

1.4.1 Power Sequencing

Applying dc power to the SA455/465 can be done in any sequence. However, during power up, the Write Gate line must be held inactive or at a high level. This will prevent possible "glitching" of the media. After application of dc power, a 100 ms delay should be introduced before any operation is performed. After powering on, initial position of the read/write heads with respect to the data tracks on the media is indeterminant. In order to assure proper positioning of the read/write heads after power on, a Step Out operation should be performed until the Track 00 line becomes active (Recalibrate).

1.4.2 Drive Selection

Drive selection occurs when the proper Drive Select line is activated. Only the drive with this line jumpered will respond to input lines or gate output lines.

1.4.3 Motor On

In order for the host system to read or write data the dc drive motor must be turned on. This is accomplished by activating the line -MOTOR ON. A 500 ms delay must be introduced after activating this line to allow the motor to come up to speed before reading or writing can be accomplished.

The motor must be turned off by the host system by deactivating the Motor On line. The control electronics keep the motor active for 3 seconds, after Motor On is deactivated. This allows reselecting during copy operations and will ensure maximum motor and media life.

1.4.4 Track Accessing

Seeking the read/write heads from one track to another is accomplished by:

a. Activating the Drive Select line.

b. Selecting desired direction using Direction Select line.

c. Write Gate being inactive.

d. Pulsing the Step line.

Multiple track accessing is accomplished by repeated pulsing of the Step line (with direction valid) until the desired track has been reached. Each pulse on the Step line will cause the read/write heads to move one track either in or out depending on the Direction Select line. Head movement is initiated on the trailing edge of the STEP pulse.

1.4.5 Step Out

With the Direction Select line at a plus logic level (2.4 to 5.25 V), a pulse on the Step line will cause the read/write heads to move one track away from the center of the disk. The pulse(s) applied to the Step line must have the timing characteristics shown in figures 1-3 and 1-4.

1.4.6 Step In

With the Direction Select line at minus logic level (0 to 0.4 V), a pulse on the Step line will cause the read/write heads to move one track closer to the center of the disk. The pulse(s) applied to the Step line must have the timing characteristics shown in figures 1-3 and 1-4.

1.4.7 Side Selection

Head selection is controlled via the I/O signal line designated Side Select. A plus logic level on the Side Select line selects the read/write head on the side 0 surface of the diskette. A minus logic level selects the side 1 read/write head. When switching from one side to the other, a 100 μs delay is required after SIDE SELECT changes state before a read or write operation can be initiated. Figure 1-5 shows the use of SIDE SELECT prior to a read operation.

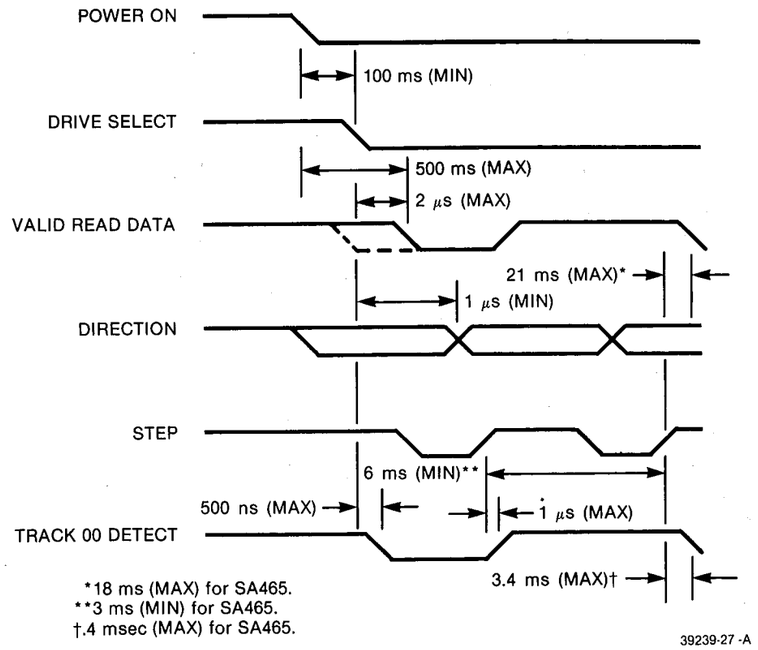


FIGURE 1-3. STEP TO READ

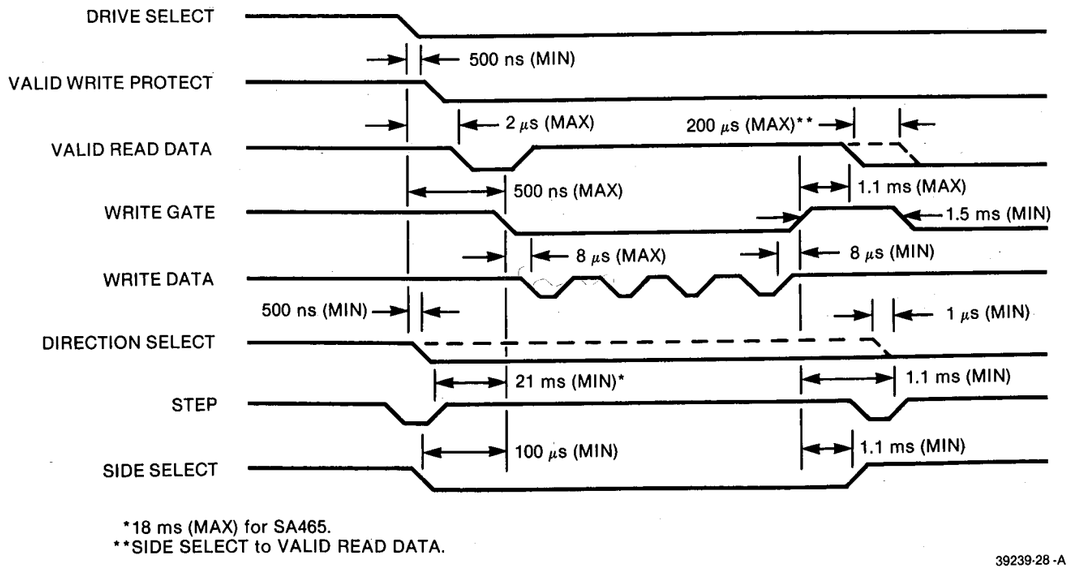


FIGURE 1-4. WRITE TO STEP

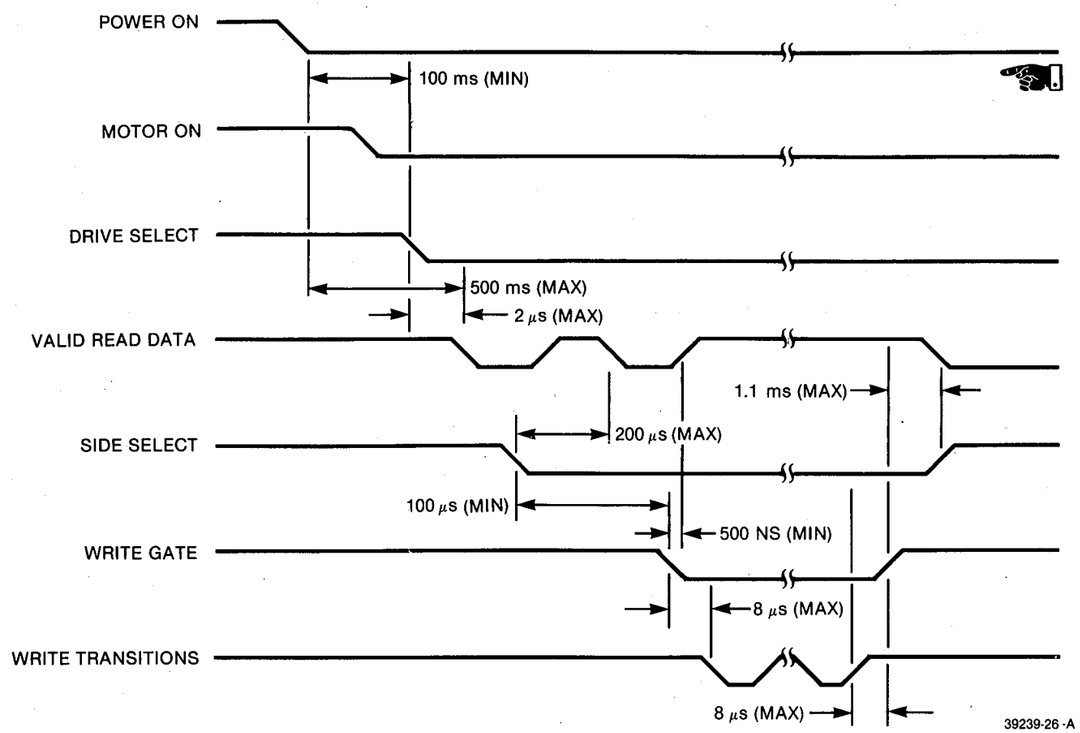


FIGURE 1-5. READ TO WRITE (FM)

1.4.8 Read Operation

Reading data from the SA455/465 is accomplished by:

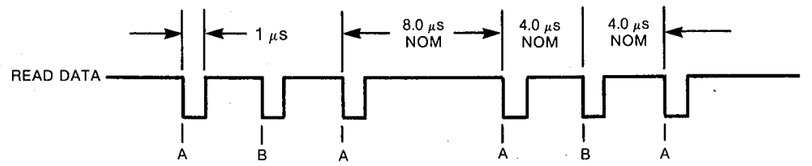
a. Activating Drive Select line.

b. Selecting head.

c. Write Gate being inactive.

The timing relationships required to initiate a read sequence are shown in figure 1-5. These timing specifications are required in order to guarantee that the position of the read/write heads has stabilized prior to reading.

The timing of Read Data (FM) is shown in figure 1-6.



A = LEADING EDGE OF BIT MAY BE ± 800 ns FROM ITS NOMINAL POSITION
B = LEADING EDGE OF BIT MAY BE ± 400 ns FROM ITS NOMINAL POSITION

FIGURE 1-6. READ DATA TIMING (FM)

The encoding scheme of the recorded data can be either FM or MFM. FM encoding rules specify a clock bit at the start of every bit cell and a data bit at the center of the bit cell if this cell contains a one data bit, (see figure 1-7). MFM encoding rules allow clock bits to be omitted from some bit cells with the following prerequisites:

a. The clock bit is omitted from the current bit cell if either the preceding bit cell or the current bit cell contains a one data bit. See figure 1-7.

b. In the above mentioned encoding schemes, clock bits are written at the start of their respective bits cells and data bits at the centers of their bit cells.

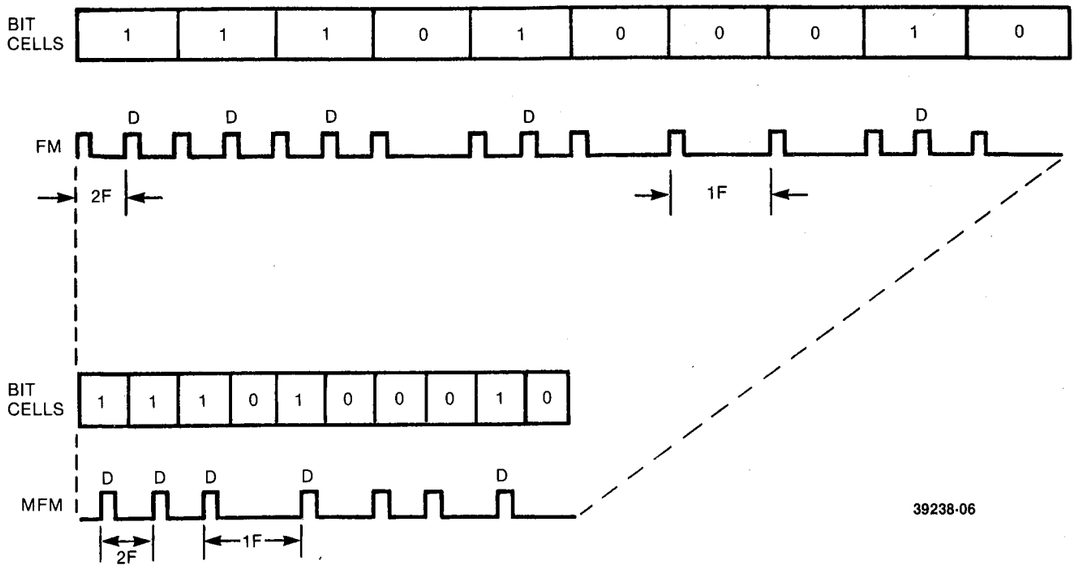


FIGURE 1-7. FM AND MFM CODE COMPARISONS

1.4.9 Write Operation

Writing data to the SA455/465 is accomplished by:

a. Activating the Drive Select line.

b. Selecting head.

c. Activating the Write Gate line.

d. Pulsing the Write Data line with the data to be written.

The timing relationships required to initiate a Write Data sequence are shown in figure 1-5. These timing specifications are required in order to guarantee that the position of the read/write heads has stabilized prior to writing.

The timing specifications for the Write Data pulses are shown in figure 1-8. Write data encoding can be FM or MFM. The write data should be precompensated 250 ns starting at track 22 (SA455) or track 44 (SA465) to counter the effects of bit shift. The direction of compensation required for any given bit in the data stream depends on the pattern it forms with nearby bits.

1.4.10 Sequence of Events

The timing diagrams shown in figures 1-3, 1-4, 1-5, and 1-9 show the necessary sequence of events with associated timing restrictions for proper operation.

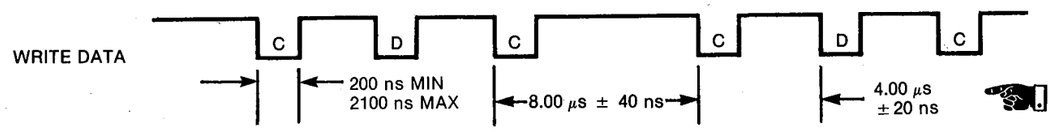


FIGURE 1-8. WRITE DATA TIMING (FM)

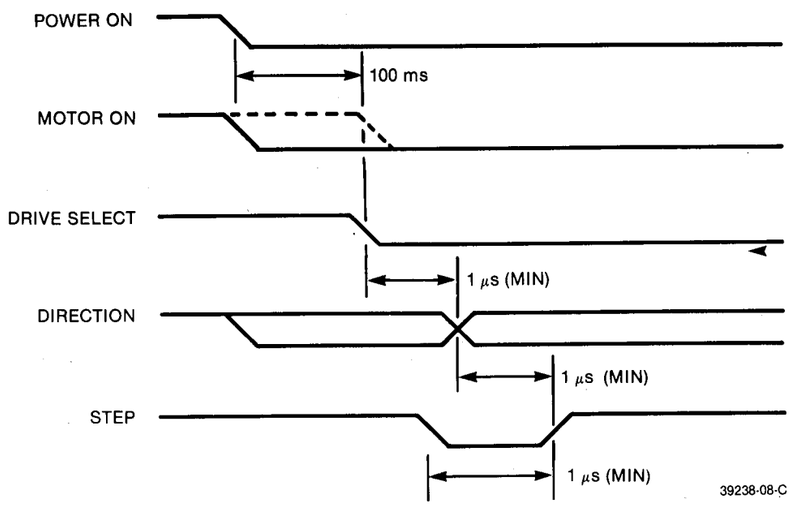


FIGURE 1-9. POWER ON TO STEP

SECTION II
ELECTRICAL INTERFACE

2.1 INTRODUCTION

The interface of the SA455/465 can be divided into two categories:

a. Signal
b. Power

The following sections provide the electrical definition for each line. See figure 2-1 for all interface connections.

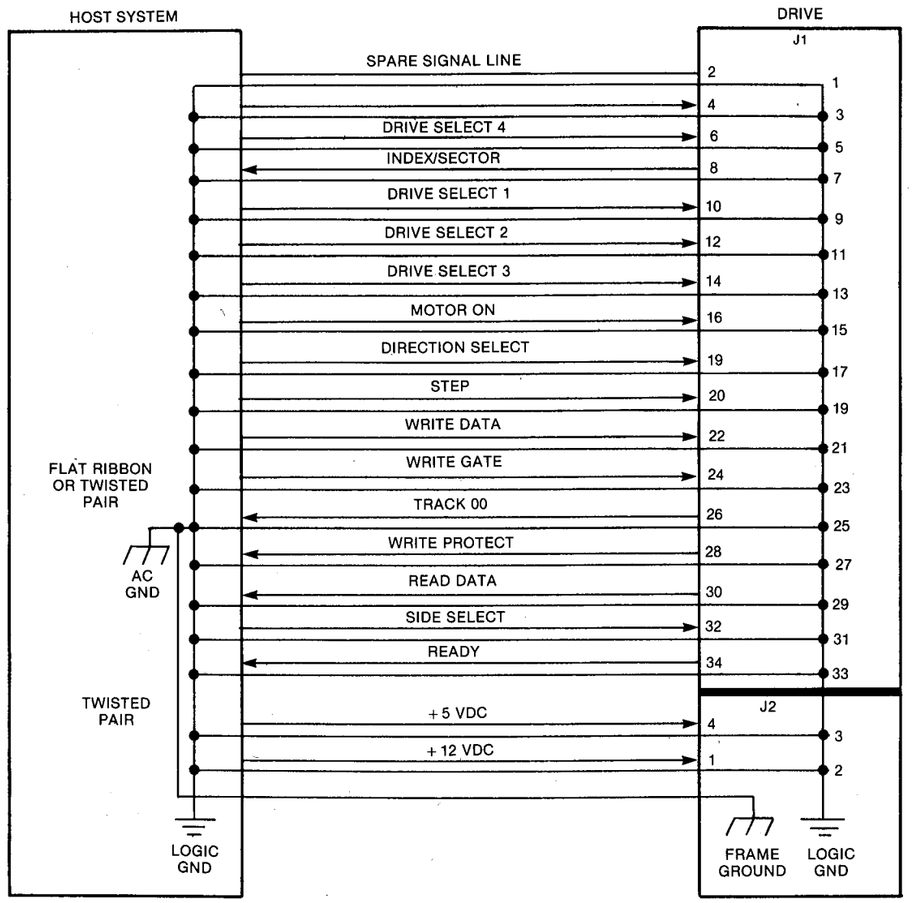


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FIGURE 2-1. INTERFACE CONNECTIONS

2.2 SIGNAL INTERFACE

The signal interface consists of two categories:

a. Control Lines
b. Data Transfer Lines

All lines in the signal interface are digital in nature and either provide signals to the drive (input), or provide signals to the host (output), via interface connector P1/J1.

2.2.1 Input Lines

The input signals are of three types: those intended to be multiplexed in a multiple drive system, those which will perform the multiplexing, and those signals which are not multiplexed and affect all the drives in a daisy chain system.

The input signals to be multiplexed are:

a. DIRECTION SELECT
b. STEP
c. WRITE DATA
d. WRITE GATE
e. SIDE SELECT

The input signals which are intended to do the multiplexing are:

a. DRIVE SELECT 1
b. DRIVE SELECT 2
c. DRIVE SELECT 3
d. DRIVE SELECT 4

The signals which are not multiplexed are:

a. IN USE
b. MOTOR ON

The input lines have the following electrical specifications. See figure 2-2 for the recommended circuit.

True = Logical zero = Vin ±0.0 to +4 V @ Iin = 40 mA (max)

False = Logical one = Vin +2.5 to +5.25 V @ Iin = 250 μA (open)

Input impedance = 150 ohms

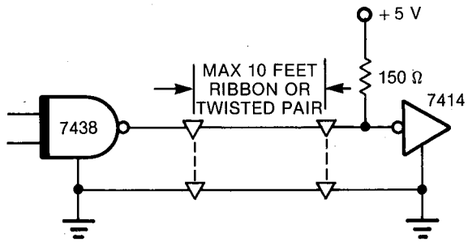

FIGURE 2-2. INTERFACE SIGNAL DRIVER/RECEIVER

2.2.2 Input Line Terminations

The SA455/465 has been provided with the capability of terminating all the ten input lines listed below.

1. Drive Select 1
2. Drive Select 2
3. Drive Select 3
4. Drive Select 4
5. Motor On
6. Direction Select
7. Step
8. Write Data
9. Write Gate
10. Side Select

These lines are terminated through a 150 ohm resistor pack. In a single drive system, this resistor pack should be kept in place to provide the proper terminations.

In a multiple drive system, only the last drive on the interface is to be terminated. All other drives on the interface must have the resistor pack removed. External terminations may also be used. However, the user must provide the terminations beyond the last drive and each of the ten lines must be terminated to +5 Vdc through a 150 ohm, 1/4-watt resistor.

2.2.3 Drive Select 1–4

The SA455/465, as shipped from the factory, is configured to operate as the first drive in the system. The SA455/465 can be easily modified by the user to operate as either drive 2, 3, or 4 in a multiple drive system.

In a multiple drive system the four input lines (Drive Select 1 through Drive Select 4) are provided so that the using system may select which drive on the interface is to be used. In this mode of operation, only the drive with its Drive Select line active will respond to the input lines and gate the output lines. However, in a single drive system, the MX jumper will allow any DRIVE SELECT line to activate the drive. Therefore, the MX jumper must be in the DS position whenever there are more than one drive.

2.2.4 Motor On

This input, when activated to a logical zero level, will turn on the drive motor allowing reading or writing on the drive. A 500 ms delay after activating this line must be allowed before reading or writing. This line should be deactivated, for maximum motor life, if no commands have been issued to the drives within 2 seconds (10 revolutions of the media) after completion of a previous command. Motor on may also be activated by Drive Select. This is achieved by moving the MM jumper to MS position.

2.2.5 Direction Select

This interface line defines the direction of motion the read/write heads will take when the Step line is pulsed. An open circuit or logical one defines the direction as out. If a pulse is applied to the Step line, the read/write heads will move away from the center of the disk. Conversely, if this input is shorted to ground or a logical zero level, the direction of motion is defined as in. If a pulse is applied to the Step line, the read/write heads will move towards the center of the disk.

2.2.6 Step

This interface line is a control signal which causes the read/write heads to move with the direction of motion as defined by the Direction Select line. This signal must be a logical low going pulse with a minimum pulse width of 1 μs and then logically high for 5 ms minimum between adjacent pulses. Each subsequent pulse must be delayed by 6 ms (SA455) minimum or 3 ms (SA465) minimum from the preceding pulse.

The access motion is initiated on each logical zero to logical one transition, or at the trailing edge of the signal pulse. Any change in the Direction Select line must be made at least 1 μs before the trailing edge of the STEP pulse. The Direction Select logic level must be maintained 1 μs after the trailing edge of STEP pulse. See figure 2-3 for these timings.

2.2.7 Write Gate

The active state of this signal, or logical zero, enables Write Data to be written on the diskette. The inactive state or logical one, enables the read data logic and stepper logic. See figure 2-4 for timings.

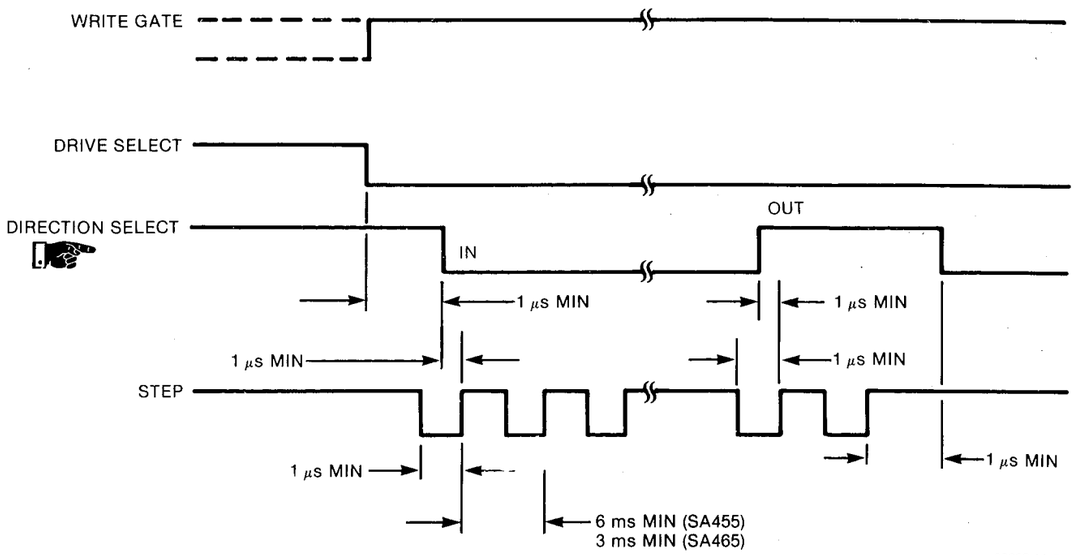

FIGURE 2-3. STEP TIMING

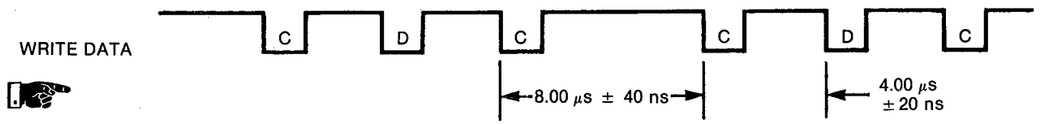

FIGURE 2-4. WRITE DATA TIMING

2.2.8 Write Data

This interface line provides the data to be written on the diskette. Each transition from a logical one to a logical zero level, will cause the current through the read/write heads to be reversed thereby writing a data bit. This line is enabled by WRITE GATE being active. WRITE DATA must be inactive during a read operation. A WRITE DATA clamp is provided on the PCB at the interface which holds the WRITE DATA line at a logical zero whenever WRITE GATE is inactive. See figure 2-4 for timings.

2.2.9 Side Select

This signal defines which side of a two-sided diskette is to be written on or read from. A logical one selects the side 0 head. When switching from one side to the other, a 100 µs delay is required before a read or write operation can be initiated.

2.2.10 Output Lines

The output control lines have the following electrical specifications:

True = Logical zero = +0.0 to +0.4 V @ Iout = 40 mA (max)

False = Logical one = +5 to +2.5 V (open collector) @ Iout = 250 µA (max)

2.2.11 Track 00

The active or logical zero state of this interface signal indicates when the read/write heads are positioned at track zero (the outermost track) and the access circuitry is driving current through phase A of the stepper motor. This signal is at a logical one level, or inactive state, when the read/write heads are not at track zero. When the read/write heads are at track zero and an additional step out pulse is issued to the drive, a mechanical stop will keep the read/write heads at track zero. However, the TRACK 00 signal will go inactive. This is because the stepper motor will go to phase C, and not phase A. One more step out pulse will put the stepper motor back into phase A and the TRACK 00 signal will go active again.

2.2.12 Index/Sector

This interface signal is provided by the drive each time an index or sector hole is sensed at the Index/Sector photo detector. Normally, this signal is at a logical one level and makes the transition to the logical zero level each time a hole is sensed.

When using SA154/164 media (soft sectored), there will be one pulse on this interface signal per revolution of the diskette (200 ms). This pulse indicates the physical beginning of a track. See figure 2-5 for the timing.

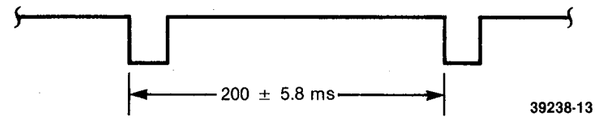

FIGURE 2-5. INDEX TIMING (SA154/164 MEDIA)

When using SA155/165 or SA157/167 media (hard sectored), there will be 17 or 11 pulses on this interface line per revolution (200 ms). To indicate the beginning of a track, once per revolution there is one index transition between 16 or 10 equally spaced sector transitions. The timing for these signals is shown in figures 2-6 and 2-7.

When using the Index/Sector signal, look for an edge or transition rather than a level for determining the status. With no diskette inserted, this signal remains active or at a logical zero level which is an erroneous status.

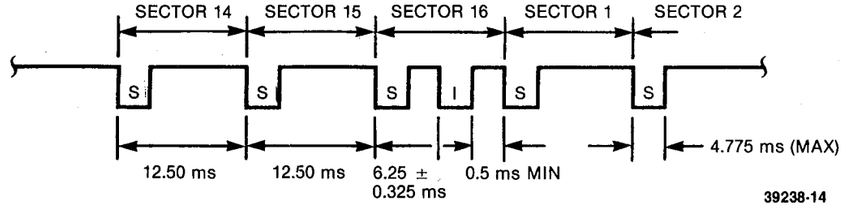

FIGURE 2-6. INDEX/SECTOR TIMING (SA155/165 MEDIA)

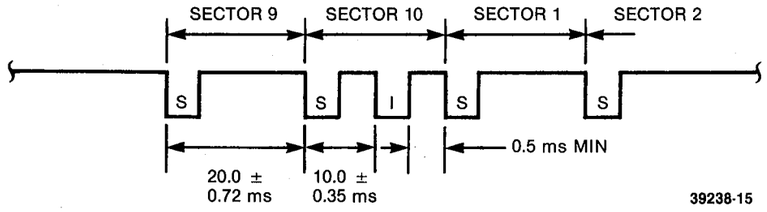

FIGURE 2-7. INDEX/SECTOR TIMING (SA157/167 MEDIA)

2.2.13 Read Data

This interface line provides the raw data (clock and data together) as detected by the drive electronics. Normally, this signal is a logical one level and becomes a logical zero level for the active state. See figure 1-5 for the timing and bit shift tolerance within normal media variations.

2.2.14 Write Protect

This interface signal is provided by the drive to give the user an indication when a Write Protected diskette is installed. The signal is logical zero level when it is protected. Under normal operation, the drive will inhibit writing with a protected diskette installed in addition to notifying the interface.

2.2.15 Ready

READY informs the controller that a diskette is properly inserted and that the drive motor is up to speed. 500 ms is required for starting the motor and an additional 200 ms is required for one revolution at the rated speed. Thus, READY is available 700 ms after power is applied to the motor. The SA455/465 generates READY by sensing index pulses and measuring their frequency of occurence. When the index pulses are 200 ms apart, READY becomes active.

2.3 POWER INTERFACE

The SA455/465 requires only dc power for operation. DC power to the drive is provided via P2/J2. The two dc voltages, their specifications, and their P2/J2 pin designators are outlined in table 2-1. The specifications outlined on current requirements are for one drive. For multiple drive systems, the current requirements are a multiple of the maximum current times the number of drives in the system.

TABLE 2-1. DC POWER REQUIREMENTS

P2 PIN	DC VOLTAGE	TOLERANCE	CURRENT	MAX RIPPLE (p to p)
1	+12 VDC	±1.2 VDC	1.2 A MAX 0.6 A TYP	100 mV MAX ALLOWABLE
2	+12 RETURN			
3	+5 RETURN			
4	+5 VDC	±0.25 VDC	0.9 A MAX 0.6 A TYP	50 mV MAX ALLOWABLE

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2.4 FRAME GROUNDING

CAUTION

It is important that the drive be frame grounded to the host system ac ground or frame ground. Failure to do so may result in drive noise susceptibility.

SECTION III
PHYSICAL INTERFACE

3.1 INTRODUCTION

The electrical interface between the SA455/465 and the host system is via two connectors. The first connector, J1, provides the signal interface. The second connector, J2, provides the dc power.

This section describes the physical connectors used on the drive and recommended connectors to be used with them. See figure 3-1 for connector locations.

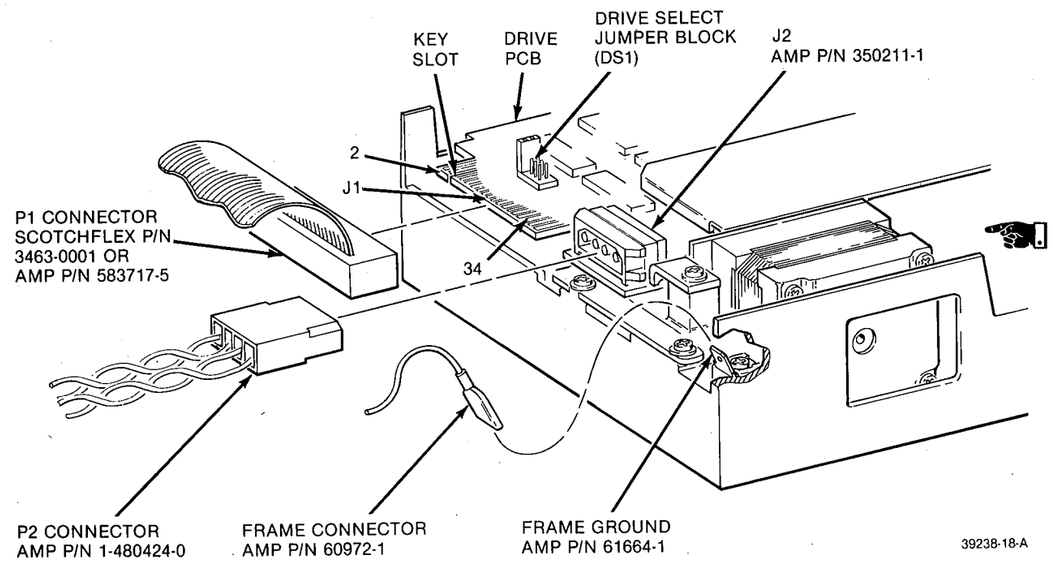


FIGURE 3-1. INTERFACE CONNECTORS PHYSICAL LOCATIONS

3.1.1 J1/P1 Connector

Connection to J1 is through a 34 pin PCB edge connector. The dimensions for this connector are shown in figure 3-2. The pins are numbered 1 through 34 with the even numbered pins on the component side of the PCB. The odd numbered pins are on the non-component side. Pin 2 is located on the end of the PCB connector closest to the corner and is labeled 2. A key slot is provided between pins 4 and 6 for optional connector keying.

3.1.2 J2/P2 Connector

The dc power connector, J2, is a 4 pin AMP Mate-N-Lok connector (P/N 350211-1). The recommended mating connector, P2, is AMP P/N 1-480424-0 using AMP pins P/N 61473-1. J2, pin 1, is labeled on the component side of the PCB. Wire used should be #18 AWG. Figure 3-3 illustrates J2 connector as seen on the drive PCB from the non-component side.

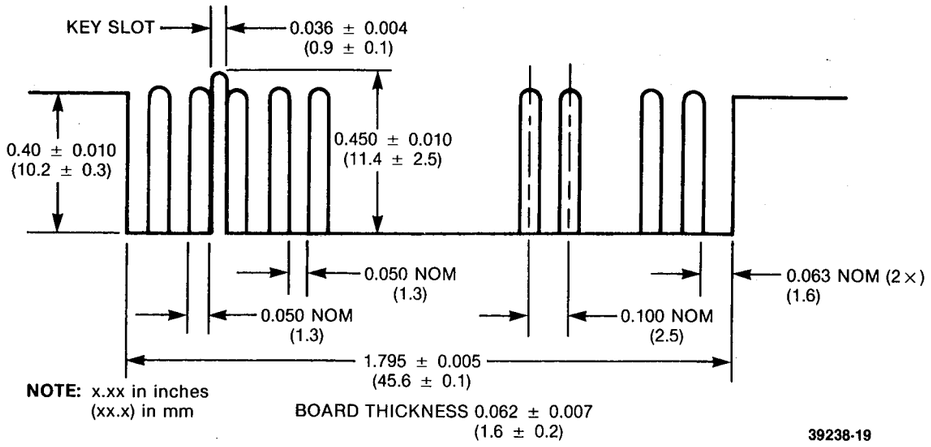


FIGURE 3-2. J1 CONNECTOR DIMENSIONS

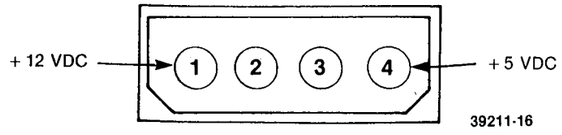


FIGURE 3-3. J2 CONNECTOR

3.2 FRAME GROUNDING

CAUTION

The SA455/465 must be frame grounded to the host system to ensure proper operation. If the frame of the drive is not fastened directly to the frame of the host system with a good ac ground, a wire from the system ac frame ground must be connected to the SA455/465. For this purpose, a faston tab is provided on the drive near the motor control PCB where a faston connector can be attached or soldered. The tab is AMP P/N 61664-1 and its mating connector is AMP P/N 60972-1.

SECTION IV
DRIVE PHYSICAL SPECIFICATIONS

4.1 GENERAL

These paragraphs contain the mechanical dimensions and mounting recommendations for the SA455/465.

4.2 MECHANICAL DIMENSIONS

See figure 4-1 for dimensions of the SA455/465.

4.3 MOUNTING

CAUTION

Do not mount horizontal with the PCB down. Failure to do so may damage the drive.

The SA455/465 is capable of being mounted in one of the following positions:

1. Top Loading — mounted upright.
2. Front Loading — mounted vertical with door opening left or right.
   — mounted horizontal with PCB up.
3. Mounting hardware for bottom and side holes is number 3 metric.

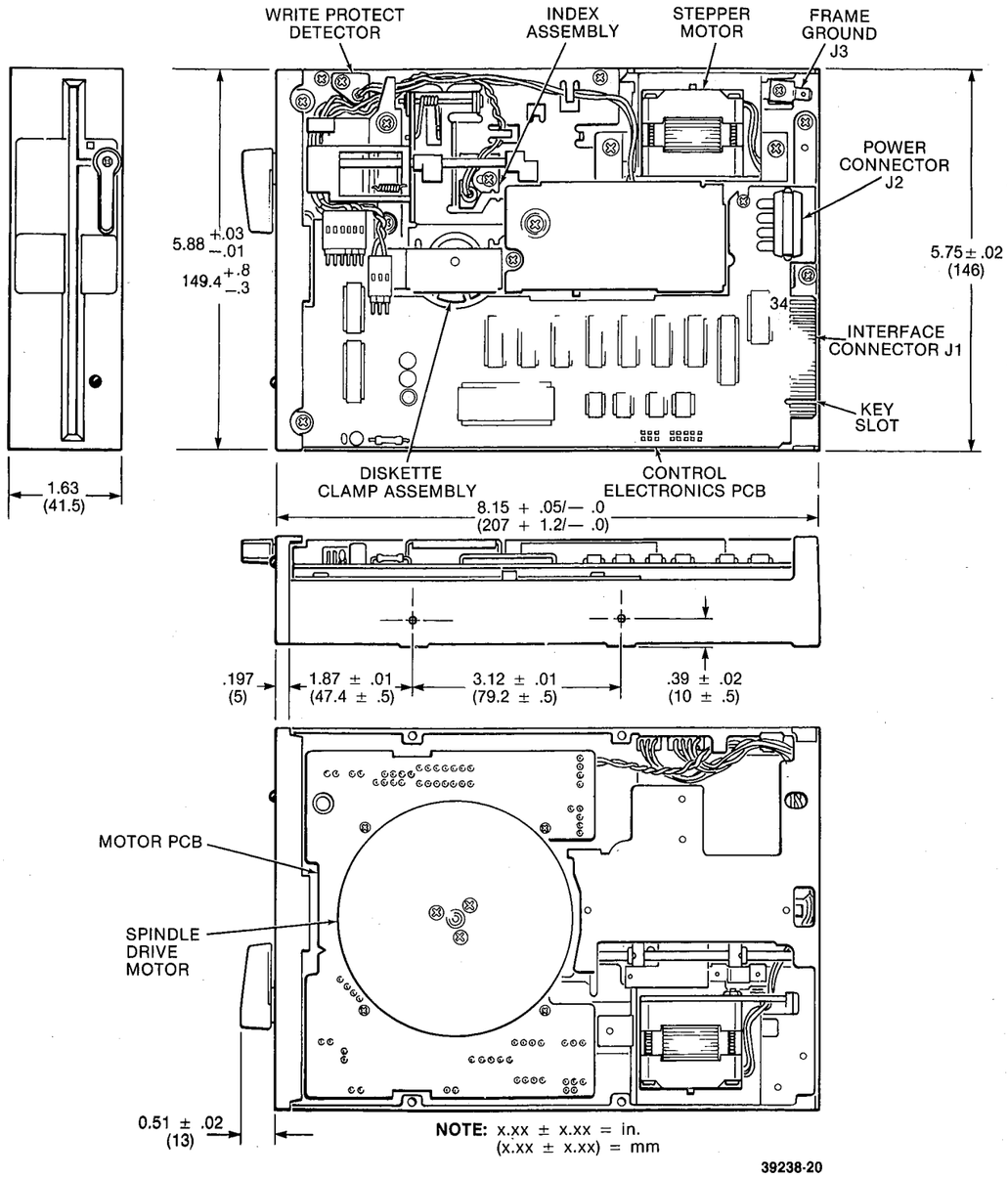


FIGURE 4-1. SA455/465 PHYSICAL DIMENSIONS

SECTION V
ERROR RECOVERY

(To be furnished at a later date.)

SECTION VI
RECORDING FORMAT

6.1 GENERAL

The format of the data recorded on the diskette is totally a function of the host system. As discussed in paragraph 1.4.8, data can be recorded on the diskette using FM or MFM encoding. In these encoding techniques, clock bits are written at the start of their respective bit cells and bits at the centers of their bit cells.

6.2 BYTE

A byte, when referring to serial data (being written onto or read from the disk drive), is defined as eight consecutive bit cells. The most significant bit cell is defined as bit cell 0. The least significant bit cell is defined as bit cell 7. When reference is made to a specific data bit (i.e., data bit 3), it is with respect to the corresponding bit cell (bit cell 3).

During a write operation, bit cell 0 of each byte is transferred to the disk drive first with bit cell 7 being transferred last. Correspondingly, the most significant byte of data is transferred to the disk first and the least significant byte is transferred last.

When data is being read back from the drive, bit cell 0 of each byte will be transferred first with bit cell 7 last. As with reading, the most significant byte will be transferred first from the drive to the user.

Figure 6-1 illustrates the relationship of the bits within a byte. Figure 6-2 illustrates the relationship of the bytes for read and write data.

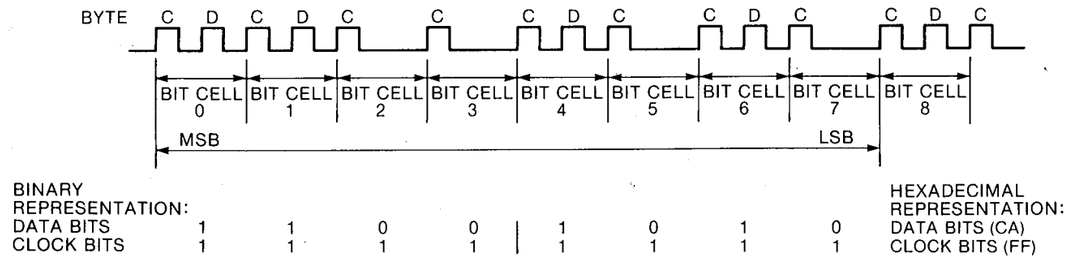


FIGURE 6-1. BYTE (FM ENCODING)

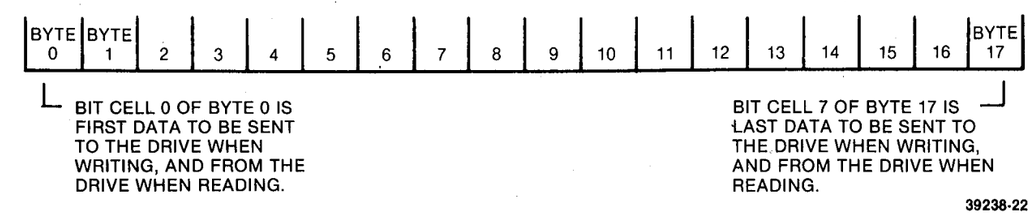


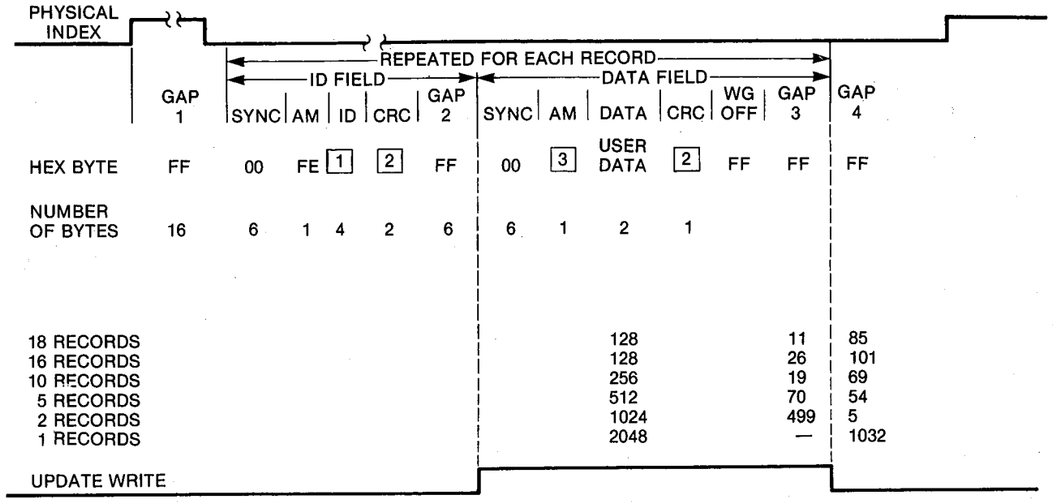
FIGURE 6-2. DATA BYTES

6.3 FORMATS

Tracks may be formatted in numerous ways and are dependent on the using system. The SA455/465 can use either hard or soft sectored formats.

6.3.1 Soft Sectored Recording Format

In this format, the using system may record one long record or several smaller records. Each track is started by a physical index pulse and then each record is preceded by a unique recorded identifier. This type of recording is called soft sectoring. Figure 6-3 illustrates the recommended single density (FM) formats. Figure 6-4 illustrates the recommended double density (MFM) formats.



NOTES: 1. TRACK NUMBER, HEAD NUMBER, SECTOR NUMBER, AND SECTOR LENGTH.
2. IBM OR EQUIVALENT CRC GENERATOR.
3. FB FOR DATA OR F8 FOR DELETED DATA.

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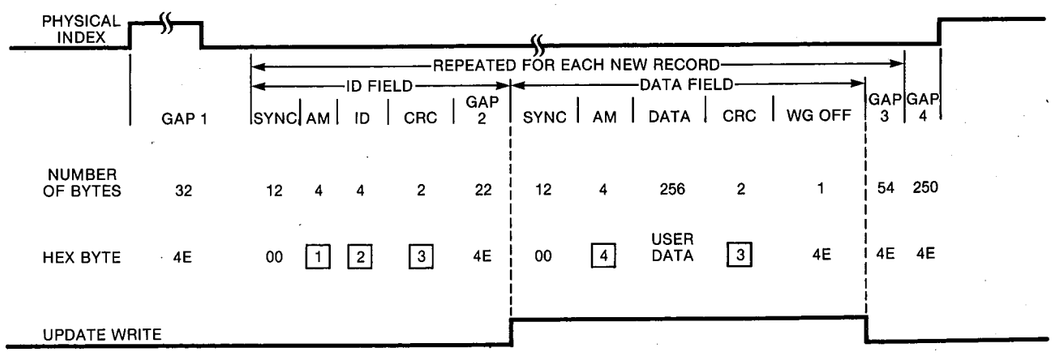
FIGURE 6-3. FM RECOMMENDED SOFT SECTOR SINGLE DENSITY (EVEN BOUNDARIES)



NOTES: 1. FIRST THREE BYTES ARE HEX A1 WITH MISSING CLOCK TRANSITIONS BETWEEN BITS 4 AND 5. LAST BYTE IS HEX FE.
2. TRACK NUMBER, HEAD NUMBER, SECTOR NUMBER, AND SECTOR LENGTH (HEX 01).
3. IBM OR EQUIVALENT CRC GENERATOR.
4. SAME AS NOTE 1, EXCEPT LAST BYTE = HEX FB.

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FIGURE 6-4. MFM RECOMMENDED FORMAT - 256 BYTES/16 RECORDS PER TRACK (IBM TYPE)

6.3.2 Track Layout

Index is the physical detector indicating one revolution of the media. Index is used to initiate format operations, generate the READY signal in the storage device, ensure one complete revolution of the media has been searched, and as a deselect storage device signal, after a certain number of revolutions.

Gap 1 — **Gap 1** is from the physical index mark to the ID field address mark sync. Gap 1 allows for physical index variation, speed variation, and interchange between storage devices.

ID Field — **Sync** is a fixed number of bytes for Separator synchronization prior to AM. Sync includes a minimum of two bytes plus worst case Separator sync up requirements.

ID Pre Address Mark (MFM) is three bytes of A1 with unique clock bits not written per encode rules.

ID Address Mark (FM) is a unique byte to identify the ID field and is not written per encode rules.

ID Address Mark (MFM) is one byte of FE and is written per encode rules.

ID is a four byte address containing track number, head number, record number, and record length.

CRC is two bytes for cyclic redundancy check.

Gap 2 — **Gap 2** is from ID CRC to data AM sync. Gap 2 allows for speed variation, oscillator variation, and erase core clearance of ID CRC bytes prior to Write Gate turn on for an update write.

Data Field — **Sync** is a fixed number of bytes for Separator synchronization prior to the AM. Sync includes a minimum of two bytes plus worst case separator sync up requirements.

Pre Data Address Mark (MFM) is three bytes of A1 with unique clock bits not written per encode rules.

Data Address Mark (FM) is a unique byte to identify the data field and is not written per encode rules.

Data Address Mark (MFM) is one byte of FB or F8 and is written per encode rules.

Data is the area for user data.

CRC is two bytes for cyclic redundancy check.

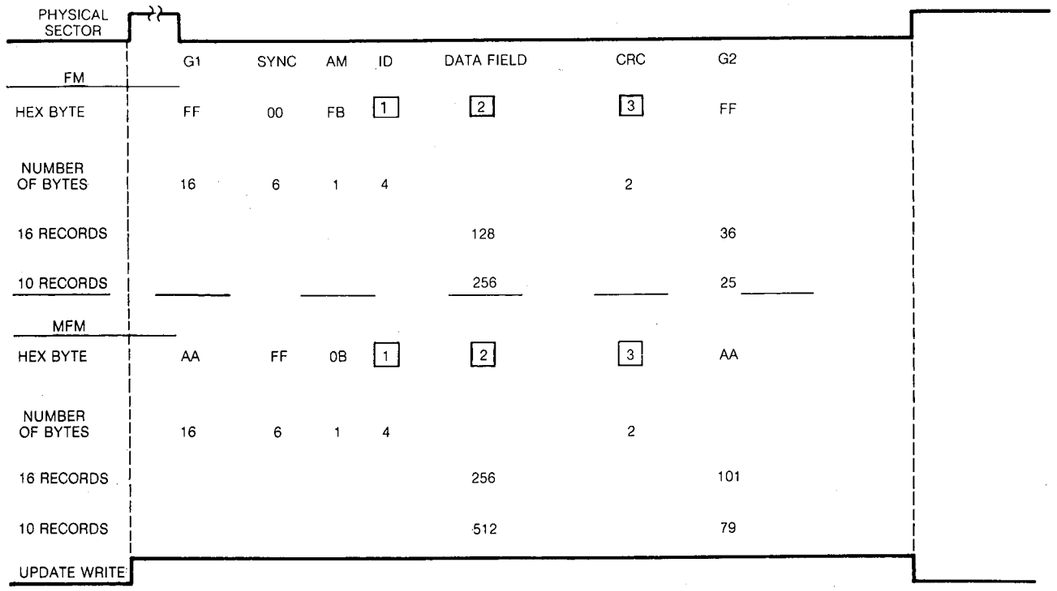
WG OFF (Write Gate Off) is one byte to allow for Write Gate turn off after an update write.

Gap 3 — **Gap 3** is from WG OFF to the next ID AM sync. Gap 3 allows for erase core to clear the data field CRC bytes, speed and write oscillator variation, read preamplifier recovery time, and system turn-around time to read the following ID field.

Gap 4 — **Gap 4** is the last gap prior to physical index. Gap 4 allows for speed and write oscillator variation during a format write and physical index variation.

6.3.3 Hard Sectored Recording Format

In this format, the using system may record up to 16 or 10 sectors (records) per track. Each track is started by a physical index pulse. Each sector is started by a physical sector pulse. This type of recording is called hard sectoring. Figure 6-5 illustrates the hard sectored formats. The SA155 or SA157 minidiskette is to be used for these formats. All drive tolerances have been taken into account in developing these formats.



NOTES: 1. Track Number, Head Number, Record Number, Record Length.

2. User Data.

3. Generated by CRC Generator (IBM or Equivalent).

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FIGURE 6-5. RECOMMENDED HARD SECTOR FM AND MFM FORMATS

SECTION VII
CUSTOMER INSTALLABLE OPTIONS

7.1 CUT/ADD TRACE OPTIONS

The SA455/465 can be modified by the user to function differently to suit individual needs. These modifications can be implemented by adding or deleting connections. These options can be accomplished by use of a shorting plug or by cutting a trace (refer to table 7-1). This Section discusses examples of modifications and how to implement them.

These examples are:

1. DRIVE SELECT, MOTOR ON.
2. READY

TABLE 7-1. CUSTOMER CUT/ADD TRACE OPTIONS

TRACE DESIGNATOR	DESCRIPTION	SHIPPED FROM FACTORY	
		OPEN	SHORT
DS1	DRIVE SELECT 1 input line		plugged
DS2,3,4	DRIVE SELECT 2,3,4 input lines	X	
MX	DRIVE SELECT Enabled Single Drive System	X	
MS	MOTOR ON From DRIVE SELECT	X	
RY	DOOR DISTURB SWITCH	X	
DR	READY-INDEX + DRIVE SELECT		plugged
RR	READY From DRIVE SELECT Only	X	

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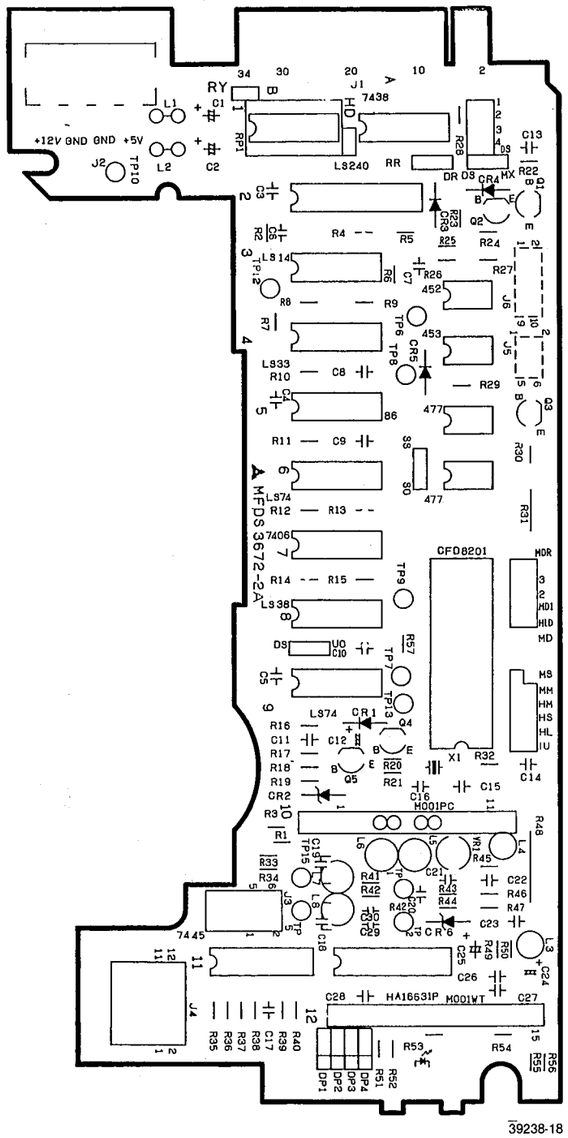
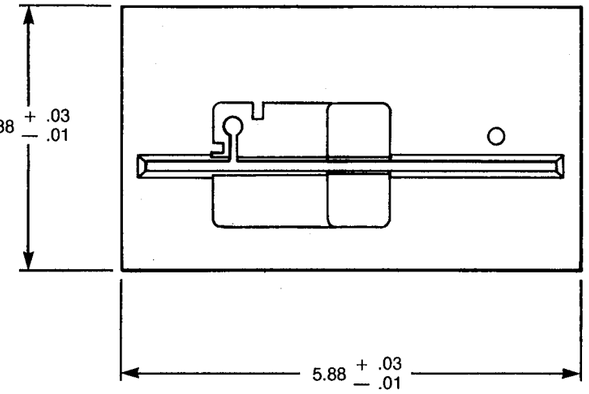


39238-18

FIGURE 7-2 PCB COMPONENT LOCATIONS

7.2 FULL HEIGHT FACE PLATE, 54755

This is another option for those who need full height faceplate.



FULL HEIGHT FACEPLATE, P/N 54755

39238-26

FIGURE 7-2. FULL HEIGHT FACEPLATE

SECTION VIII
OPERATION PROCEDURES

8.1 INTRODUCTION

The SA455/465 was designed for ease of operator use to facilitate a wide range of operator-oriented applications. The following section is a guide for the handling procedures on the minidiskette and minifloppy drive.

8.2 MINIDISKETTE LOADING

To load the diskette, open the door on the front panel, insert the diskette with label towards the door handle and close handle. A mechanical interlock prevents door closure without media insertion. This prevents head damage.

8.3 MINIDISKETTE HANDLING

To protect the diskette, the same care and handling procedures specified for computer magnetic tape apply. These precautionary procedures are as follows:

a. Return diskette to storage envelope whenever it is removed from drive.

b. Do not bend or fold diskette.

c. Store diskettes not for immediate use in their box.

d. Keep diskettes away from magnetic fields and from ferromagnetic materials which might become magnetized. Strong magnetic fields can distort recorded data on disk.

e. Replace storage envelopes when worn, cracked, or distorted. Envelopes are designed to protect disk.

f. Place I.D. labels in correct location, never use in layers.

g. Do not write on plastic jacket with lead pencil or ball point pen. Use felt tip pen.

h. Do not use erasers.

i. Heat and contamination from a carelessly dropped ash can damage disk.

j. Do not expose diskette to heat or sunlight.

SECTION IX
PACKAGING

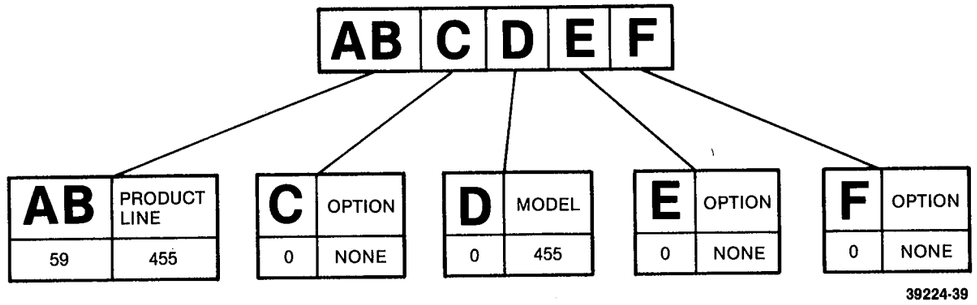
It is suggested that packing material be kept, in case the unit must be returned to Shugart for repair. Regardless, the unit must be individually packaged in comparable packing as shipped to prevent damage in shipping and handling. **Damage to the unit as a result of inadequate packaging will void the warranty on the unit.**

(Further information to be supplied at a later date.)

APPENDIX A
ORDERING INFORMATION

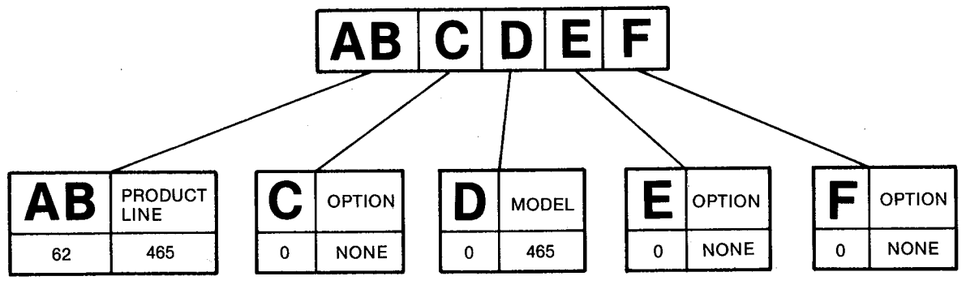
The tables below can be used to construct a part number for a unique drive configuration. These tables are interim and not complete. Further information will be furnished later.

TABLE A-1. SA455 PSI



39224-39

TABLE A-2. SA465 PSI



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