SCSI CONTROLLER

Product P/N 202776

Manual P/N 300935 REV C
Includes:
Installation Specification
Diagnostic Support Package
Programming Specification
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1.1 Warning

This equipment generates, uses and can radiate radio frequency energy and if not installed and used in accordance with this instruction manual, may cause interference to radio and television reception. This equipment has been tested and found to comply with the limits for a Class A computing device in accordance with the specifications in Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
1. Reorient the receiving antenna.
2. Relocate the computer with respect to the receiver.
3. Move the computer away from the receiver.
4. Plug the computer into a different outlet so that the computer and receiver are on different branch circuits.
5. Ensure that the mounting screws, attachment connector screws and ground wires are tightly secured.
6. Ensure that good quality, shielded and grounded cables are used for data communications.

If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions. The user may find the booklet How to Identify and Resolve Radio-TV Interference Problems prepared by the Federal Communications Commission helpful. This booklet is available from the U.S. Government Printing Office, Washington, DC 20402, Stock No. 004-000-0345-4.

1.2 Introduction

Macrolink's SCSI Disk System gives Concurrent Computer 3200 super-minicomputer users easy access to ST-506, ESDI & SCSI disk drives. Ideal for small to mid-size systems, or where space is limited. Replace older high-maintenance disks with new low cost peripherals to lower your operating costs.

The SCSI Controller replaces the fullboard SCSI Disk Controller, Part Number 202775.

Complete Disk System

We have a package solution for your disk requirements. Our SCSI disk system includes: Macrolink SCSI Controller, 5.25" disk drive, formatter module and rack mount chassis with power supply. We supply ST-506 or ESDI drives and the required formatter module, or SCSI disk drives depending on your capacity requirements. We also include an OS/32 driver, on 1600 BPI tape, and diagnostic software. Because we format and test every drive, your installation time is kept to a minimum; just mount the rack-mount chassis, slip the Macrolink SCSI controller under a SELCH and SYSGEN in our driver.

High-capacity Cartridge Tape

The new generation of high-capacity cartridge tape drives, like the Patriot 240 1/2 inch drive from Laser Magnetic Storage (CDC) and the EXB-8200 8mm from Exabyte can be installed with a disk drive or used alone. The Patriot offers 240 MBytes of storage; the EXB-8200 offers 2.3 GBytes. Both drives can be used with standard OS/32 utilities like Backup and Fastback.

Macrolink offers an optional software enhancement for Backup, called BackupPlus, for use with cache-equipped streaming tape drives that insures correct operation with multi-volume tapes.
LD1200 Laser Disk Support

The Macrolink SCSI Controller can be optionally equipped to support the LD1200 optical disk system. Each LD1200 drive can access 1 GByte of on-line data; each cartridge holds 2 GBytes of data. OS/32 support is offered via SVC direct-access disk calls.

Full Compatibility

We include an optimized OS/32 driver and diagnostic software. Our driver emulates standard MSM/IDC disks, so it's compatible with utilities like BACKUP and FASTCHECK, plus all other OS/32 functions. No application software changes are required to utilize the full performance and capacity of your new disks.

Up to 7 ST-506, ESDI or SCSI disks drives or tape drives of any size can be mixed in any combination. Each ST-506 or ESDI formatter module can support 2 drives; additional drives require additional formatter modules. SCSI drives connect directly to the Macrolink SCSI Controller.

Easy Upgrades

Our on-board formatting software makes it easy to add drives to your system. Just boot-load our software right from the SCSI Controller and follow the user friendly menus to format and install the drive. We eliminated option switches by storing the disk configuration on a reserved sector of each drive. Controller functions are retained in non-volatile memory.

High Performance

The Macrolink SCSI Controller takes full advantage of ST-506 and 1.25 MB/second ESDI drives. We don’t require interleaving, so data transfers as fast as possible to your CPU.
2.1 Introduction

The Macrolink SCSI Controller gives Concurrent Computer/Perkin-Elmer access to low-cost disk and tape systems. The SCSI Controller connects up to 7 SCSI devices that can include SCSI/ESDI and SCSI/ST-506 controllers in any combination with up to 7 drives.

The SCSI Controller will work with virtually any ST-506 & ESDI disk drive and most SCSI disks available today without PROM changes or switch options. The configuration of each drive is stored on a reserved sector; the controller configuration is stored in non-volatile memory and read upon power-up initialization.

The SCSI Controller includes an on-board Loader Storage Unit (at address X'05') that contains a system IPL boot-loader, the disk formatter & diagnostic software. The SCSI Controller requires the supplied OS/32 DCB & driver to be installed prior to use. The SCSI Controller is not software compatible with the OS/32 & XEOS drivers for the Concurrent Computer SCSI subsystem, and will not work with the standard CCUR IPL.

2.2 Unpacking Instructions

The SCSI Controller is supplied with a 50 conductor interface cable. The board is packed in an anti-static plastic bag, and foam sponge to cushion the parts during shipment. This packing material should be retained so the board may be properly transported if it should need to be returned to the factory for repair.

Inspect the SCSI Controller immediately upon receipt. If any damage is visible from shipment, you should request the carrier’s agent to inspect the damage, and file a claim with the carrier. Claims must be filed within 7 days after the shipment arrives.

Notify Macrolink of any discrepancies between the invoice and received material, or of any damage found during inspection.

2.3 Return Material Authorization

To return a product for repair, you must obtain a Return Material Authorization (RMA) number from Macrolink. This number should be written on the shipping container. When requesting an RMA number, the following information should be available:

1. Product name or part number
2. Serial Number
3. Failure description

Shipping expenses to Macrolink must be paid by the customer. Macrolink will pay for standard shipment back to the customer for products under warranty. Products returned with an inadequate failure description may be subject to an additional inspection charge.

2.4 Installing the SCSI Controller

The SCSI interface is installed into the host 3200 series CPU in the same fashion as a standard disk controller. The Operating System must be SYSGEN'd with our driver to accept the interface, and the board must be properly configured.

Install the half-board SCSI controller under the left side of a Selector Channel (SELCH) in the processor. If your system uses Sub-Channel Controllers (SCC), the SCSI controller must be installed under SCC 0 to run the on-board LSU software. The SCSI Controller may be installed under any SCC
after configuration if the on-board system IPL is not required. The standard 3200 system IPL cannot be used to boot from the SCSI Disk.

To enable the on-board Loader Storage Unit (LSU), the LSU/RUN/FORMAT CNFG switch should be placed in the LSU position (left). Disable the IPL switch on the 3200 consolete.

Alternatively, the system LSU can be removed, or set to an unused address, and a wire from the LSU slot pin 124 (XOFF) can be connected to the SCSI Controller slot, pin 125-1. This wire will give the 3200 consolete ENABLE/DISABLE switch control of the on-board LSU when its mode switch is set to LSU.

**RACK0/TACK0 Jumper**

You must remove the RACK0/TACK0 wire-wrap jumper between pins 122-1 and 222-1 on the slot selected for the SCSI Controller.

**Device Address**

The SCSI controller and file address are set with the diagnostic software, not switches. If the address of the module is not known, follow the directions in Chapter 3 to load and run the diagnostics. The address is displayed in the main menu.

The following rules must be observed:

1. Controller address must be even.
2. If the Controller address ends in 0 or 8, up to 7 SCSI devices may be configured.
3. If the Controller address ends in 4 or C, up to 3 SCSI devices may be configured.
4. If the Controller address ends in 2, 6, A or E, only one SCSI device may be configured.

Each SCSI device attached to the Controller must have a unique SCSI address (from 0 to 7). Each SCSI address then assigned to an unique system address. The Controller is also assigned an unique address; selecting an address that ends in '0' or '8' will result in a more straight forward installation. SCSI devices that support two drives should have an address reserved for each drive whether or not it is connected. The first drive (0) must be set for an even system address. The second drive (1) must be set for an odd system address.

Additional SCSI devices use the next consecutive addresses as follows:

- 1 drive: Controller address + 1 file address (2 total)
- 2 to 3 drives: Controller address + 3 file addresses (4 total)
- 4 to 7 drives: Controller address + 7 file addresses (8 total)

For example, consider a SCSI system with the controller configured for address X'F8', with an Adaptec ST506 disk controller and Exabyte tape system. First, set the SCSI address for the ST506 controller to 0 (any unique address will work). Set the address of the first ST506 drive to 0; the second drive to 1 (even if it is not installed). The system address must be even for drive 0, odd for drive 1. In this example, use X'FA' & X'FB'. Set the tape drive to SCSI address 1 with a system address X'F9'.

**SCSI Bus Parity**

All SCSI devices connected to the Macrolink SCSI Controller must have their SCSI bus parity disabled.

**Alternate Protocol**

The SCSI Controller supports Standard Protocol, Alternate Protocol and AP/Bus Switch protocol. The 6-pin jumper block at the rear of the board must be correctly strapped for one of the modes. Install the jumper in one of the following positions at the rear of the module:

- E1 – E2 Standard Protocol
- E3 – E4 Alternate Protocol
- E5 – E6 Bus Switch mode

**Interface Cabling**

Each SCSI device is daisy-chain connected to the Controller. Up to 7 individual devices may be connected. Each device must have a unique SCSI bus address, and the last device connected must be terminated. The total cable length from the SCSI Controller to the last device must not exceed 20 feet.
OS/32 Installation

If you purchased a complete SCSI disk system from
Macrolink it has been formatted and tested. Please proceed to
Chapter 4 OS/32 INSTALLATION to install
the required driver and SYSGEN your sys-

If you are integrating a new drive with
the SCSI controller follow the instruc-
tions in Chapter 3 DIAGNOSTICS to format
and test the drive prior to OS/32 instal-

ation.

Alternate Protocol Jumpers

SCSI INTERFACE CABLING

SCSI CONTROLLER

SCSI DEVICE: DISK

SCSI DEVICE: TAPE

SCSI DEVICE: ST-505/ESDI
ADAPTER

Total interface cable length must not exceed 20
feet (6.0m). Last SCSI device must be terminated.
3.1 Introduction

The Macrolink SCSI controller has an integrated software package that can be automatically loaded into the CPU upon system initialization. This software has formatting and diagnostic capabilities and is used to configure the SCSI controller. Additionally, a system loader is available to boot-load OS/32 from an attached disk or tape.

3.2 Minimum Hardware Requirements

The following is a list of the minimum hardware required to run this program:

- Series 3200 processor, 7/32 or 8/32.
- 1MB of memory for all functions (limited operation with less memory).
- Video Display unit (VDU) as a console at X'10'.
- VDU or line printer as a list device.

The following programs should be run prior to using the SCSI Controller diagnostic:

- Series 3200 memory test.
- Series 3200 processor test.
- Console device test.

3.3 Loading Procedure

If your system has Sub-Channel Controllers (SCC), you must install the SCSI Controller under SCC 0 in order to use the on-board software. After configuration, the SCSI Controller can be installed under any SCC.

The diagnostic software package is contained in an EPROM located on the SCSI Controller. The software is automatically loaded into the processor, except 3280s, upon system initialization with the following steps:

1. DISABLE the IPL switch on the processor's console.
2. Set the SCSI Controller switch to "CONFIG".
3. Initialize the processor, or execute the 3280 LSU emulator.

No other device in the system can be set to address X'05' for the on-board loader to operate correctly.

3280 Installation

The 3280 does not support the LSU load of the SCSI Controller, so an emulator program must be manually loaded. Make sure that the LSU function of the MPC installed in your system has been disabled on the board.
### 3280 LSU EMULATOR

<table>
<thead>
<tr>
<th>LOC</th>
<th>OP</th>
<th>INST</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>0000</td>
<td>DCZ 0</td>
<td>LOAD ILLEGAL INSTRUCTION</td>
</tr>
<tr>
<td>32</td>
<td>0000</td>
<td>DCZ 0</td>
<td>LOAD ILLEGAL INSTRUCTION</td>
</tr>
<tr>
<td>34</td>
<td>0000</td>
<td>DCZ 0</td>
<td>LOAD ILLEGAL INSTRUCTION</td>
</tr>
<tr>
<td>36</td>
<td>0070</td>
<td>DCZ 0</td>
<td>X'70' NEW ORG</td>
</tr>
<tr>
<td>70</td>
<td>C820</td>
<td>LHI R2,X'005'</td>
<td>10-BIT LSU ADDRESS</td>
</tr>
<tr>
<td>74</td>
<td>9B20</td>
<td>RDR R2,R0</td>
<td>DUMMY READ</td>
</tr>
<tr>
<td>76</td>
<td>9D20</td>
<td>SSR R2,R0</td>
<td>READ STATUS</td>
</tr>
<tr>
<td>78</td>
<td>0200</td>
<td>NOP</td>
<td>NO OP</td>
</tr>
<tr>
<td>7A</td>
<td>2451</td>
<td>LIS  R5,1</td>
<td>BXLE INCREMENT VALUE</td>
</tr>
<tr>
<td>7C</td>
<td>9920</td>
<td>RHR R2,R0</td>
<td>XFER PSW</td>
</tr>
<tr>
<td>7E</td>
<td>9921</td>
<td>RHR R2,R1</td>
<td>XFER LOCATION</td>
</tr>
<tr>
<td>80</td>
<td>9924</td>
<td>RHR R2,R4</td>
<td>MEMORY START LOCATION</td>
</tr>
<tr>
<td>82</td>
<td>9926</td>
<td>RHR R2,R6</td>
<td>MEMORY END LOCATION</td>
</tr>
<tr>
<td>84</td>
<td>DB24</td>
<td>L1 RD R2,0(R4)</td>
<td>READ A BYTE</td>
</tr>
<tr>
<td>88</td>
<td>C140</td>
<td>BXLE R4,L1</td>
<td>LOOP BACK TO READ</td>
</tr>
<tr>
<td>8C</td>
<td>2612</td>
<td>AIS R1,2</td>
<td>BUMP START ADDRESS</td>
</tr>
<tr>
<td>8E</td>
<td>0301</td>
<td>BR   R1</td>
<td>XFER TO LOADED PROGRAM</td>
</tr>
</tbody>
</table>

Load the above program into your 3280 using the following steps:

- `<CTRL> V <CTRL> V`  
  Use Control V, or your modified escape sequence.

- *CDS > INIT*  
  Wait for the 3280 IPL menu (may take several minutes).

- `<CTRL> V <CTRL> V`  
  Use Control V, or your modified escape sequence.

- *CDS > HALT*  
  Response from CDS.

- *CDS > MOD 30,0,0,0,0,70*  
  Enter opcodes starting at location 30.

- *CDS > MOD 70,C820,0005,...,0301*  
  Enter opcodes starting at location 70.

- *CDS > RUN 30*  
  Start at location 30.

  The Macrolink menu should appear.

### 6/16, 8/16 & 1600 SERIES LSU EMULATOR

<table>
<thead>
<tr>
<th>LOC</th>
<th>OP</th>
<th>INST</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>0050</td>
<td>2425</td>
<td>LIS  R2,5</td>
<td>SCSI CONTROLLER LSU ADDRESS</td>
</tr>
<tr>
<td>0052</td>
<td>9D20</td>
<td>SSR  R2,R0</td>
<td>READ STATUS</td>
</tr>
<tr>
<td>0054</td>
<td>2451</td>
<td>LIS  R5,1</td>
<td>BXLE INCREMENT VALUE</td>
</tr>
<tr>
<td>0056</td>
<td>9920</td>
<td>RHR  R2,R0</td>
<td>XFER PSW</td>
</tr>
<tr>
<td>0058</td>
<td>9921</td>
<td>RHR  R2,R1</td>
<td>XFER LOCATION</td>
</tr>
<tr>
<td>005A</td>
<td>9924</td>
<td>RHR  R2,R4</td>
<td>MEMORY START LOCATION</td>
</tr>
<tr>
<td>005C</td>
<td>9926</td>
<td>RHR  R2,R6</td>
<td>MEMORY END LOCATION</td>
</tr>
<tr>
<td>005E</td>
<td>DB24</td>
<td>L1 RD R2,0(R4)</td>
<td>READ A BYTE</td>
</tr>
<tr>
<td>0062</td>
<td>C140</td>
<td>BXLE R4,L1</td>
<td>LOOP BACK TO READ</td>
</tr>
<tr>
<td>0066</td>
<td>0301</td>
<td>BR   R1</td>
<td>XFER TO LOADED PROGRAM</td>
</tr>
</tbody>
</table>

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3.4 SCSI Controller Diagnostics Menu

Your console (at address X'10') should display the SCSI Controller configuration menu after INIT, or in 3280 systems after the LSU emulator is executed. All options are preset to run from drive 0 of the SCSI Controller. The only option that you MUST verify is SELCH. SELCH is preset to X'F0'.

SCSI DIAGNOSTIC MAIN MENU
MACROLINK SCSI PLUS DIAGNOSTIC R00-00
COPYRIGHT 1987 MACROLINK, INC. ALL RIGHTS RESERVED.
AVAILABLE MEMORY
000000-3FFFFF
DICon 0E8
DRive 0
SELch 0F0
ILEvel 00
LOW 000000
HIGH 000000
MAX FFFFFF
BYTES 008000
IMAGE A5A5
BUFF4 48F0
INbuf 020000
OUTbuf 010000
PATtern 3
SCOPE 0
ITeration 001500
LOOp 0
PROCeed 1
REPeat 000001
SKIPprint 0001
CONTInuous 0
Blas 000000
TEST 0

Configuring the SCSI Controller

After each new drive is installed, the SCSI controller must be correctly configured before the drive can be formatted, and then used by the operating system. Each SCSI device must have an unique SCSI bus address, and a unique device address. Configuration parameters are stored on the controller.

From the Main Menu, enter CONFIGure:

*CONF
Device Address               SCSI Address     Type
EB                            00              SCSI DISK
E9
EA
ED
EE
EF
Autoboot Name = NONE

Enter Device Address to update, AUTOBOOT to update boot information, CONFIGURE to store updates, or <ESC> to exit.

*CONF
In this example, the Controller address is set to X’E8’. The Controller Device Address may be any even address. If an address with a final digit of 0 or 8 is selected, up to 7 Drives may be configured at any of the consecutive following addresses. If an address with a final digit of 4 or C is selected, up to 3 Drives may be configured at any of the consecutive following addresses. With final digits of 2, 6, A or E, one Drive may be configured at the following address. SCSI address space is automatically adjusted to 1, 3 or 7 addresses depending on the address of the Drive with the highest address. For example, if the Controller address is X’E8’ and one drive is configured at X’E9’, 2 address spaces are reserved; however, if the Drive was configured at X’ED’ then 8 addresses would be reserved.

The Diagnostic only lists the correct possible Drive address selections when the Controller address is selected. CAN may then be used to check the reserved address space. At location X’EA’, a SCSI disk drive has been installed with SCSI address X’00’. Each SCSI device installed must have an unique address.

To change the adapter type for an Exabyte 8200 Tape Drive, for example, enter its address, EA:

EA

Device type:
1 = N/A
2 = ADAPTEC ACB-4520 ESDI
3 = SCSI DISK
4 = ADAPTEC ACB-4000A ST506
5 = CDC PATRIOT TAPE
6 = N/A
7 = EXABYTE 8200 TAPE This list may be different for your revision software.

Device Address | SCSI Address | Type
--- | --- | ---
E8 | | EXABYTE 8200 TAPE
E9 | | EXABYTE 8200 TAPE
EA | 00 | EXABYTE 8200 TAPE
EB | | EXABYTE 8200 TAPE
EC | | EXABYTE 8200 TAPE
ED | | EXABYTE 8200 TAPE
EE | | EXABYTE 8200 TAPE
EF | | EXABYTE 8200 TAPE

Enter Device Address to update, CONFIGURE to store updates, <ESC> to exit.

Similarly, to add a device enter its address, E9:

E9

Device type:
1 = N/A
2 = ADAPTEC ACB-4520 ESDI
3 = SCSI DISK
4 = ADAPTEC ACB-4000A ST506
5 = CDC PATRIOT TAPE
6 = N/A
7 = EXABYTE 8200 TAPE This list may be different for your revision software.

Device Address | SCSI Address | Type
--- | --- | ---
E8 | | EXABYTE 8200 TAPE
E9 | 01 | EXABYTE 8200 TAPE
EA | 00 | EXABYTE 8200 TAPE
EB | | EXABYTE 8200 TAPE
EC | | EXABYTE 8200 TAPE
ED | | EXABYTE 8200 TAPE
EE | | EXABYTE 8200 TAPE
EF
Enter Device Address to update, CONFIGURE to store updates, <ESC> to exit

A SCSI Disk has been added at address X‘E9’ with SCSI ID 01. Now let’s add one more for this example:

   EB
Enter SCSI address for device address EA (0-7; CR for no device)? 2
Device type: 1 = N/A
           2 = ADAPTEC ACB-4520 ESDI
           3 = SCSI DISK
           4 = ADAPTEC ACB-4000A ST506
           5 = CDC PATRIOT TAPE
           6 = N/A
           7 = EXABYTE 8200 TAPE This list may be different for your revision software.

? 7
Device Address  SCSI Address    Type
E8             Controller Address
E9             01                SCSI DISK
EA             00                EXABYTE 8200 TAPE
EB             02                SCSI DISK
EC             ED                EE                EF

Enter Device Address to update, CONFIGURE to store updates, <ESC> to exit? CONF

Another SCSI Disk has been added at address X‘EB’ with SCSI ID 02. The SCSI Disk Drives must be formatted prior to use.

AUTOBOOT Operation

The SCSI controller can be configured to automatically boot-load an Operating System upon initialization. Both SCSI disk and tape drives can be used as a boot source. Options include skip filemarks (for tape) SELCH address (default is X‘F0’), and controller address (used to boot from a second controller). From the configuration menu, enter AUTOboot to select the boot configuration.

*CONF
Device Address  SCSI Address    Type
E8             Controller Address
E9             01                EXABYTE 8200 TAPE
EA             00                ADAPTEC ACB-4520 ESDI
EB             EC                ED                EE                EF
Autoboot Name = NONE

Enter Device Address to update, AUTOBOOT to update boot information, CONFIGURE to store updates, or <ESC> to exit
AUTO Enter AUTO for the AUTOBOOT configuration menu.

Enter: NAME [op1,op2,op3,...]
Valid Names:
   NONE  SCD0  SCD1  SCD2  SCD3  SCD4  SCD5  SCD6
Valid Keyword Options (Addresses in Hex):

- **S** = SELCH address
- **F** = file marks
- **C** = controller address
- **N** = ? SCD1
- **FILE** = SCS10.OS
- **Device Address** = SCSI Address
- **Type**
  - E8 = Controller Address
  - EA = 00 = EXABYTE 8200 TAPE
  - E9 = 01 = ADAPEC ACB- 4000A ST506
  - EB
  - EC
  - ED
  - EE
  - EF

*Your selection will be echoed:*

- Autoboot Name = SCD1
- FILE = SCS10.OS/00000

Enter Device Address to update, AUTOBOOT to update boot information, CONFIGURE to store updates, or <ESC> to exit

Enter CONF to save your choices, or AUTO to make corrections.

*CONF

Autoboot can be terminated by entering ^A (control A) during the LSU memory test.

**SCSI Drive Formatting**

SCSI Drive Formatting supports four drives onboard: Maxtor, Seagate ST225N, Seagate ST4051, and CDC Wren. Support for other drives and additional support these drives may be obtained from Macrolink on Magnetic Tape. Commands and parameters may also be keyed in by the user and saved on tape, making it possible to use virtually any SCSI Drive with the Macrolink SCSI Controller. When attempting to use an unsupported drive, however, it is important to be aware not all SCSI Disk Drives support 256 byte sectors and Concurrent Operating Systems require that the drive is formatted with 256 byte sectors.

The normal procedure to format a SCSI Disk Drive which is currently supported is a multi-step process. First, select the Script file for the drive you wish to format. The DIR command will display the script files in your library. Use the GET command to select the file for the drive you wish to format.

The next step is to execute the SCSI Mode Select Command. This command sets the sector size and other important parameters for the drive to properly function in the Concurrent environment. Use the EXEC SELECT command to do this.

If you are formatting a Seagate drive, it is best to enter flaw map data. The Maxtor and Wren drive do a good job of finding their own flaws and this step is not generally necessary for those drives. Use the INFLOW command to enter the flaw map. INFLOW defaults to the Bytes From Index format, which is the format usually supplied by the manufacturer. If the flaw information is another format, then select the proper format for entry. See the Options Table 3.5 for detailed use of the INFLOW command.

After entering your flaw data, use the FORMAT1 command to format the drive. If you did not enter flaw data and did not use the INFLOW command then use the FORMAT command to format the drive.

Example of steps using INFLOW:

```plaintext
GET ST225N
EXEC SELECT INFLOW
#3265
#3F8E
#4021
<ESC>
FORMAT1
```
The drive will now format and SCSI status will be displayed at the end of the process. Example of steps when not entering flaw data:

GET MAXTOR
EXEC SELECT
EXEC FORMAT

The drive will now format and map its own flaws. SCSI status will be displayed at the end of the process.

If you are not using a drive which is supported by a MacroLink Script file, the following is offered as an aid to formatting your chosen drive. Keep in mind that you may be breaking new ground in doing this and you should have a good knowledge of SCSI equipment in general and your chosen drive in particular. You must read the User’s Manual for your drive and understand the specific requirements for formatting your drive before attempting to proceed with the formatting process.

**IMPORTANT**

*When keying in data be aware that you are accessing main memory in the host computer and careless entries can cause the operating system to fail. Be sure that you access only the data buffers used by the MacroLink SCSI Plus Diagnostic.*

Following are examples using the Option commands to format a SCSI Drive. See Options Table 3.5 for detailed definitions of the Options.

Check the directory of supported Disk Drives

The DIR command will display the script files in your library.

*DIR
**MAXTOR
**ST225N
**ST4051
**WREN

Choosing Seagate ST225N for example

GET and LIST the Script to see the OPT commands necessary to format the ST225N.

*GET ST225N
*LIST
0010 *SELECT
0020 BI 10000
0030 CLEAR 51
0040 MOD 0,1500,0,C00
0050 MOD 10,0,8,0,0,0,100
0060 SELWR 10,12
0070 CMD 0,6
0080 STATUS
0090 EXIT
0100 *FORMAT Without Defective Sectors
0110 BI 10000
0120 CLEAR 512
0130 MOD 0,400,0,200
0140 SELWR 10,0
0150 CMD 0,6
0160 STATUS
0170 EXIT
0180 *FORMAT1  With Defective Sectors, Use Inflaw Block Only
0190 BI 10000
0200 CLEAR 512
0210 MOD 0,410,0,200
DEPRESS < CR >
0220 MOD 10,0,0
0230 INSTALL 10
0240 MOD 0,410
0250 SELWR 10
0260 CMD 0,6
0270 STATUS
0280 EXIT

The *SELECT Script shows the OPT instructions necessary to send the Drive a SCSI Mode Select command. Line 20 set the bias value, pointing to the Write Buffer and Line 30 clears the buffer. Line 40 loads the buffer with the 6 byte SCSI command for Mode Select (X'15'). The X'0C' in byte 5 indicates that there are 12 bytes of data to be sent during the data phase of the command. Line 50 loads the buffer with the 12 bytes of data. The data indicates that the drive will be formatted with 256 byte sectors. Line 60 set up the SELCH to write the 12 data bytes. Line 70 sends the command to the Drive and line 80 requests status from the drive.

Just the Format Scripts may be listed

*LIST FORMAT
0100 *FORMAT
0110 BI 10000
0120 CLEAR 512
0130 MOD 0,400,0,200
0140 SELWR 10,0
0150 CMD 0,6
0160 STATUS
0170 EXIT
*LIST FORMAT1
0180 *FORMAT1  With Defective Sectors, Use Inflaw Block Only.
0190 BI 10000
0200 CLEAR 512
0210 MOD 0,410,0,200
0220 MOD 10,0,0
0230 INSTALL 10
0240 MOD 0,410
0250 SELWR 10
0260 CMD 0,6
0270 STATUS
0280 EXIT

The *FORMAT Script lists the OPT command used when you wish to let the Drive find and map its own flaws. This Script is may be used for the original formatting of the drive when a flaw map is not available.

*FORMAT1 is the Script used when a flaw map is available. The INFLAW option is used to enter the flaw map. This must be done before executing *FORMAT1.

1 To enter flaw list

The following is an example interchange in which two flaws are entered and then one is deleted.
*INFLAW
Enter: CYL,HD,BYTES to add, if already in map it will be deleted,
LIST to list, or <ESC> to exit

INFLAW BLOCK
Enter: LBA to add, if already in map it will be deleted,
LIST to list, or <ESC> to exit
#3265
#4021
#LIST
00003265
00004021
DEPRESS <CR>
#4021
Deleted...
#4022
#LIST
00003265
00004022
DEPRESS <CR>
#

Execute the Mode Select Command

Simply type EXEC SELECT and the Mode Select Script is executed. The SCSI Status, indicating a Key Code of 0 and an Error Code of 0 tells us that it executed properly. The most common error at this point would be a Key Code of 5 indicating an error in the information sent to the drive. Consult the user's manual for your drive for an explanation of Key Codes and Error Codes. Since these vary somewhat from manufacturer to manufacturer, a more detailed discussion is beyond the scope of this manual.

*EXEC SELECT
*BI 10000
*CLEAR 512
*MOD 0,1500,0,C00
*MOD 10,0,8,0,0,0,100
*SELWR 10,12
*CMD 0,6
*STATUS
SCSI St 70000000 0000000E 00000000 00000000 00000000 00000000 00000000 00000000
*EXIT

Execute the Format Command

This example executes the SCSI Format Command including the flaw list that was built using INFLAW.

*EXEC FORMAT1
*BI 10000
*CLEAR 512
*MOD 0,410,0,200
*MOD 10,0,0
*INSTALL 10
*MOD 0,410
*SELWR 10
*CMD 0,6
*STATUS
*INQUIRY
BI 10000
CLEAR 512
MOD 0,1200,0,2400
SELRD 10,36
CMD 0,6
EXA 10,18
EXIT

*SENSE
BI 10000
CLEAR 512
MOD 0,1A00,3F00,4C00
SELRD 10,76
CMD 0,6
STATUS
EXIT

*REASSIGN  Use INFLAW Block Only
BI 10000
CLEAR 512
MOD 0,700,0,0
MOD 10,0,0
INSTALL 10
SELRWR 10
CMD 0,6
STATUS
EXIT

**ST225
*SELECT
BI 10000
CLEAR 512
MOD 0,1500,0,C00
MOD 10,0,8,0,0,0,100
SELRWR 10,12
CMD 0,6
STATUS
EXIT

*FORMAT  Without Defective Sectors
BI 10000
CLEAR 512
MOD 0,400,0,200
SELRWR 10,0
CMD 0,6
STATUS
EXIT

*FORMAT1 With Defective Sectors, Use Inflaw Block Only.
BI 10000
CLEAR 512
MOD 0,410,0,200
MOD 10,0,0
INSTALL 10
MOD 0,410
SELWR 10
CMD 0,6
STATUS
EXIT
*INQUIRY
BI 10000
CLEAR 512
MOD 0,1200,0,3A00
SELRD 10,58
CMD 0,6
EXA 10,29
EXIT
*SENSE
BI 10000
CLEAR 512
MOD 0,1A00,3F00,FF00
SELRD 10,76
CMD 0,6
EXA 10,38
EXIT
*REASSIGN  Use Inflaw Block Only
BI 10000
CLEAR 512
MOD 0,700,0,0
MOD 10,0,0
INSTALL 10
SELR 10
CMD 0,6
STATUS
EXIT
**ST405
*SELECT
BI 10000
CLEAR 512
MOD 0,1500,0,1600
MOD 10,0,8,0,0,0,100,103,D105,0,0,2
SELR 10,22
CMD 0,6
STATUS
EXIT
*FORMAT  Without Defective Sectors
BI 10000
CLEAR 512
MOD 0,400,100,100
SELR 10,0
CMD 0,6
STATUS
EXIT
*FORMAT1  With Defective Sectors, Use Inflaw Index Only
BI 10000
CLEAR 512
MOD 0,41C,100,100
MOD 10,0,0
INSTALL 10
SELWR 10
CMD 0,6
STATUS
EXIT
*SENSE
BI 10000
CLEAR 512
MOD 0,1A00,0,1600
SELRD 10,22
CMD 0,6
EXA 10,11
EXIT
**WREN
*SELECT
BI 10000
CLEAR 512
MOD 0,1500,0,2400
MOD 10,0,8,0,0,0,100,316,1,1,0,4,0,100,0,0,1
SELWR 10,36
CMD 0,6
STATUS
EXIT
*FORMAT
BI 10000
CLEAR 512
MOD 10,0,0
INSTALL 10
SELWR 10
CMD 0,6
STATUS
EXIT
*INQUIRY
BI 10000
CLEAR 512
MOD 0,1200,0,2400
SELRD 10,36
CMD 0,6
EXA 10,18
EXIT
*SENSE
BI 10000
CLEAR 512
MOD 0,1A00,3F00,5C00
SELRD 10,92
CMD 0,6
EXA 10,46
EXIT
*REASSIGN Use Inlaw Block Only
### Options Table

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BI 10000</td>
<td></td>
</tr>
<tr>
<td>CLEAR 512</td>
<td></td>
</tr>
<tr>
<td>MOD 0,700,0,0</td>
<td></td>
</tr>
<tr>
<td>MOD 10,0,0</td>
<td></td>
</tr>
<tr>
<td>INSTALL 10</td>
<td></td>
</tr>
<tr>
<td>SELWR 10</td>
<td></td>
</tr>
<tr>
<td>CMD 0,6</td>
<td></td>
</tr>
<tr>
<td>STATUS</td>
<td></td>
</tr>
<tr>
<td>EXIT</td>
<td></td>
</tr>
</tbody>
</table>

** EOF ENCOUNTERED - 204 RECORD(S) COPIED.**
** COPY COMPLETE - 1 FILE(S) COPIED**
END

P  **END OF TASK CODE = 0**  PROCESSOR = 0.648  TSK-ELAPSED = 20

### 3.5 Options Table

Examine each option in the following table and read each description. If a default value is specified and it is the desired value, no action is necessary. If a default value is not specified, or is not the desired value, then the option must be entered.
<table>
<thead>
<tr>
<th>OPTION</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>@</td>
<td>Returns control to the system console by executing a Break-Point instruction.</td>
</tr>
<tr>
<td>ADD</td>
<td>The ADD command can be used as a prefix to the TEST command option to add one or more tests to the current selection. For example: &quot;ADD TEST 1&quot;.</td>
</tr>
<tr>
<td>Bias</td>
<td>The BIAS option is used to specify the bias value for subsequent EXAMINE and MODIFY commands. The default value is &quot;0&quot;.</td>
</tr>
<tr>
<td>BUFFIl</td>
<td>The BUFFIL option specifies the background data pattern to be copied into the input data buffer prior to a read operation. The default setting is: X'48F0'.</td>
</tr>
<tr>
<td>BYTE</td>
<td>The BYTE option specifies the number of bytes to be transferred. X'100' = 1 sector, X'200' = 2 sectors, X'4000' = 64 sectors. When the last transfer is made, the start LBA is adjusted so that the last sector transferred ends on high LBA. When the difference between LOW and HIGH is less than the the number of sectors specified by byte then only data is transferred between LOW and HIGH.</td>
</tr>
<tr>
<td>CLEAR</td>
<td>The CLEAR command initializes an area at the bias address to zero. The number of bytes is specified in decimal. &quot;CLEAR 512&quot; clears 512 bytes beginning at the bias. An error will occur if the bias is less than X'10000'.</td>
</tr>
</tbody>
</table>
| CMD    | The CMD command is used to initiate a SCSI command. The syntax is: CMD adr, len Where: 
  - adr     the address of the SCSI command descriptor block relative to the bias.
  - len     the number of decimal bytes in the command descriptor block. 
If a SELCH transfer is not required then "SELWR 10,0" should be used. A STATUS command issued after the CMD command will wait for the execution to finish and display the SCSI status. |
<p>| CONFIG   | The CONFIGURATION command is used to change the controller address and the drive assignments. The new controller address is asked for first. Enter a new address or a &lt;CR&gt; to default to the old address. A new drive configuration is asked for the next 7 consecutive drive addresses. Enter &lt;CR&gt; if no drive is to be configured or the SCSI unit number. If a SCSI unit number is entered the user will be asked for the type of drive it is. The user is asked if the data input is correct and if it is to be stored in the non-volatile RAM. |
| CONTinuous | The CONTINUOUS option controls the execution of the selected test. When it is set to the default &quot;0&quot; testing stops when repeat limit is reached. When continuous is set to &quot;1&quot; or the CRT is off-line testing continues until the break key is depressed or the CRT is placed on-line. |
| DIRectory | The DIRectory command is used to list the library of drive types supported internally or on a tape. The syntax is: |</p>
<table>
<thead>
<tr>
<th>Options Table</th>
<th>SCSI Controller</th>
<th>DIAGNOSTICS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DIScon</strong></td>
<td>The DIScon option specifies the disk controller address. The default setting is 'E8'.</td>
<td></td>
</tr>
<tr>
<td><strong>DRive</strong></td>
<td>The DRIVE option specifies the drive number to be tested. The drive number can range from 0 to 6. The default is 0.</td>
<td></td>
</tr>
<tr>
<td><strong>EXAmine</strong></td>
<td>The EXAmine command is used to display the contents of memory. The syntax is: EXAMINE aaaaa[,nnnn[,d]] Where aaaaaa the memory address relative to the bias nnnn the decimal number of halfwords to be displayed d is the index of the output device, 1 = console, 3 = printer.</td>
<td></td>
</tr>
<tr>
<td><strong>EXECute</strong></td>
<td>The EXECute command is used to cause commands to be read from the script. The syntax is: EXECute nnnn or EXECute name Where nnnn the script line number at which execution is to start. If not specified, execution starts at the first line. name the script label line, &quot;*name&quot;, after which execution is to start.</td>
<td></td>
</tr>
<tr>
<td><strong>EXIT</strong></td>
<td>The EXIT command is used to return a script fragment to the read command from console mode.</td>
<td></td>
</tr>
<tr>
<td><strong>GET</strong></td>
<td>The GET command is used to read into the script the necessary commands to format a SCSI disk drive. The commands are read from an internal Macrolink provided script or from a library maintained on tape. The syntax is: GET name[,type[,S=ss][,C=cc]] Where name type of disk drive to be formatted. type SCD0-SCD6,MG85, or MG62 specifies the library is on a SCSI tape, standard 800/1600, or Concurrent 6250 tape. If omitted then the internal Macrolink provided library is used. ss SELCH address. Defaults to 'X'F0'. cc controller address. Defaults to current SCSI address for SCSI tape, or 'X'85' for others. The library is scanned until &quot;<strong>name&quot; is found. The current script is deleted. Commands are copied into the script until another &quot;</strong>*&quot; is found.</td>
<td></td>
</tr>
</tbody>
</table>
When reading from tape the entire library is read into an internal format starting at X'10000'.

### HELP

The HELP command is provided to assist the user. Messages can be summoned to explain program options, commands, errors, and test execution. The sequence "HELP *" lists the possible option and command mnemonics. Abbreviated inputs are allowed for most mnemonics. Characters shown in parenthesis in the "HELP *" need not be entered. In general any option may be set to its default value by entering the option followed by a carriage return. Otherwise the option must be followed by a space and then the option value. To recall the function of any command or option enter: HELP MNEMONIC.

### High

The HIGH option specifies the ending LBA for disk read/write tests. For tape operations, HIGH specifies the number of files transferred.

### ILEVel

The ILEVel option sets the the interrupt level for the SELCH disk controller, and file address. The default is 0. The maximum ILEVEL can be is 3.

### IMAGE

The IMAGE option specifies the data pattern transferred when the pattern option is 0 or 2. The default is: X'5A5A'.

### INbuf

The INBUF option specifies the starting address of the input (read) data buffer. The default setting is: X'20000'.

### INLAW

The INLAW command is used to enter or update the flaw map. The flaw map information can be enter in three ways, block format, bytes from index format, or physical sector format.

The syntax is

```
INLAW [typ][,rep][,NEW]
```

Where

- **typ**: BLOCK, INDEX, or SECTOR.
- **rep**: DECIMAL, or HEXADECIMAL

**NEW**  Specifies that the current flaw map is deleted.

The user is prompted to input flaw information, LIST to list the flaw map, or escape to exit. To delete an entry, enter the flaw information again. A message will be printed denoting that the entry is deleted. The default is INDEX,HEXADECIMAL.

### INSTALL

The INSTALL command is used to copy the flaw map to the defect list. The syntax is:

```
INSTALL adr
```

Where

- **adr**: the address of the defect list header (4 bytes).

If the format command descriptor block is to 0 relative to the bias, then the last three bits of byte one are set to 0,4, or 5 depending on the infaw type Block, Index, or Sector respectively. The flaw information is copied after the defect list header. The end of the defect list is denoted by eight bytes of X'FF'. The SELWR command uses this to determine the length.

### Iteration

The ITERATION option specifies the number of times a scope function is performed. The default is: 1500.

### List

The List command is used to list the current script. The syntax is:
<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIST</td>
<td>List name. The script label line &quot;name&quot;. Enter &quot;HELP SCRIPT&quot; for more information.</td>
</tr>
<tr>
<td>LOG</td>
<td>The LOG command is used to select the console or printer as the log device. Valid commands are: LOG CON:, LOG PR:.</td>
</tr>
</tbody>
</table>
| LOOP | The LOOP option selects the diagnostic response to errors. The default value is "0." Possible entries are: 
 0: No loop on error. 
 1: Loop on error. Overrides proceed 1 or 2. 
 2: Same as 1 except there is no message output. |
| LOW | The LOW option specifies the starting LBA for disk read, write, and read-check tests and scope loops. For tape operations, LOW specifies the number of records per file transferred. |
| MAX | The MAX option specifies the last LBA on the disk. If set to X'TTTTTTTTT', the last LBA value is read from the disk & displayed after any test is executed. |
| MODIFY | The MODIFY command is used to change the contents of memory. The syntax is: MODIFY aaaaaa,xxxx[,xxxx[,xxxx...]] Where 
  aaaaaa is the memory address relative to the bias 
  xxxx is the new contents of the memory location and subsequent locations. |
| NEW | The NEW command causes the script to be deleted. |
| NEXT | The NEXT command is used to select the next subtest to be executed. The form "NEXT n", where n is the decimal test number to be executed. |
| OPTION | The OPTION command is used to list the program options. The "OPTION 3" command causes the options to be listed to the printer. |
| OUTbuf | The OUTBUF option specifies the starting address of the output (write) data buffer. The default setting is: 10000 |
| PATTERN | The PATTERN option specifies the data pattern to be output to the device. Possible values are: 
 0: Use the image option. 
 1: Use an incrementing pattern 0000,0101,0202,...,FEFE,FFFF,0000. 
 2: Use the image option and its complement. 
 3: Use the LBA address (Default). |
| PROCEED | The PROCEED option selects the action taken after an error. The default value is "1." Possible entries are: 
 0: Halt on error. Overrides loop. |
<table>
<thead>
<tr>
<th></th>
<th>Proceed on error as far as possible. The proceed limit is a function of the specific error.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Execute entire test no matter how many errors.</td>
</tr>
</tbody>
</table>

**REMove**

The REMOVE command can be used as a prefix to the TEST command to remove one or more tests from the current selection. For example: "REMOVE TEST 1".

**RENUMber**

The RENUMBER command causes the script line numbers to be assigned new values starting with "0010" and incrementing by "0010".

**REPeat**

The REPEAT option specifies the number of times the entire test sequence is to be repeated. The REPEAT option is specified in decimal and values up to 99999999 are accepted. A REPEAT value of zero is interpreted as the default "1".

**RESET**

The RESET command causes all program options to be reset to their default values.

**RUN**

The RUN command is used to start the test sequence from the first selected test.

**SAVE and SAVENR**

The SAVENR and SAVE commands are used to create or update a tape library of scripts respectively.

The syntax is:

```
SAVENR name,type[,S=ss][,C=cc]
```

or

```
SAVE name,type[,S=ss][,C=cc]
```

Where

- **name** type of disk drive to be formatted.
- **type** SCD0-SCD6, MG85, or MG62 specifies the library is on a SCSI tape, standard 800/1600, or Concurrent 6250.
- **ss** SELCH address. Defaults to X'F0'.
- **cc** controller address. Defaults to current SCSI address for SCSI tape, or X'85' for others.

The SAVE command rewinds the tape. Reads the current library into memory starting at X'10000' skipping "***name". Rewinds the tape. Writes the library starting at X'10000'. If there is a script, writes a header "***name" then writes the script. Finally writes the trailer "***" and two file marks. The SAVENR command is the same as the SAVE command except it does not read the tape first. This allows a tape to be written if an error occurs during a SAVE or create a new tape if the contents of X'10000' is not a "***".

The SAVENR and SAVE commands are used to create or update a tape library of scripts respectively.

The syntax is:

```
SAVENR name,type[,S=ss][,C=cc]
```

or

```
SAVE name,type[,S=ss][,C=cc]
```

Where

- **name** type of disk drive to be formatted.
- **type** SCD0-SCD6, MG85, or MG62 specifies the library is on a SCSI tape, standard 800/1600, or Concurrent 6250.
- **ss** SELCH address. Defaults to X'F0'.
<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>cc</strong></td>
<td>controller address. Defaults to current SCSI address for SCSI tape, or X'85' for others. The SAVE command rewinds the tape. Reads the current library into memory starting at X'10000' skipping &quot;<strong>name</strong>&quot;. Rewinds the tape. Writes the library starting at X'10000'. If there is a script, writes a header &quot;<strong>name</strong>&quot; then writes the script. Finally writes the trailer &quot;<strong>&quot; and two file marks. The SAVENV command is the same as the SAVE command except it does not read the tape first. This allows a tape to be written if an error occurs during a SAVE or create a new tape if the contents of X'10000' is not a &quot;</strong>&quot;.</td>
</tr>
<tr>
<td><strong>SCANdev</strong></td>
<td>The SCANDEV command is used to display the status of all devices on the system.</td>
</tr>
<tr>
<td><strong>SCOPE</strong></td>
<td>The SCOPE option is used for the scope loop tests. The value has the following meanings: 0 Write/read (Default) 1 Read only 2 Write only 3 Write/read/test</td>
</tr>
<tr>
<td><strong>SELch</strong></td>
<td>The SELch option is used to specify the device address of selector channel. The default setting is 0F0.</td>
</tr>
</tbody>
</table>
| **SELRD** | The SELRD command is used to set up a transfer from the SCSI device during the CMD command. The syntax is: SELRD adr,len Where  
  
  adr the address of the receiving buffer relative to the BIAS.  
  len the length in decimal bytes. |
| **SELWR** | The SELWR command is used to set up a transfer to the SCSI device during the CMD command. The syntax is: SELWR adr,[len] Where  
  
  adr the address of the data to be transferred relative to the BIAS.  
  len the length in decimal bytes. If len=0 then no transfer takes place. If omitted then a default list is assumed and the length is calculated. |
| **SKIPprint** | The SKIPPRINT option controls the updating of messages on the CRT. The default value of "1" causes all messages to be printed. A value of "0" causes all messages not to be printed. Any other value causes n messages to be skipped before the message is updated. |
| **STATUS** | The STATUS command causes 16 bytes of SCSI status to be read from the selected Drive and displayed on the console. |
| **TEST** | The TEST option is used to select the test or tests to be executed. To select the default tests enter TEST followed by a carriage return. To select a single test enter TEST followed by a space and the decimal test number. To select multiple tests, enter TEST followed by a space and the decimal test numbers separated by commas. To specify a range of tests, enter the |
decimal first test number, a dash, and the decimal last test number in the range. To recall the purpose of any test enter HELP TEST n where n is the decimal test number. To recall the purpose of all tests enter HELP TEST *.
The default selection is: 0-4. The valid tests are: 0-13

<table>
<thead>
<tr>
<th>^X</th>
<th>Entering control X (^X) terminates the Format or Scan and return control to the diagnostics.</th>
</tr>
</thead>
</table>
The SCRIPT provides a means for the user to enter a sequence of commands and options and execute them with a single command. Commands are prefixed with a decimal line number similar to basic. Lines can be deleted by entering a line number with no command. Lines can be replaced by entering the line number and the new command. LIST causes the lines to be listed. NEW causes all lines to be deleted. RENUMBER causes all lines to be renumbered. If an error occurs execution is stopped and input is directed from the console.

3.6 Test Descriptions

| TEST 00 | Status check. Checks the initial status of the drive and controller. |
| TEST 01 | Restore & read-check. Performs a test of the restore and read-check logic. LBA is set to MAXLBA. A sequence of restore, read-check 0, read-check LBA, LBA = LBA/2 until LBA = 1 is performed. Then a restore and a read-check to MAXLBA + X'10' is done to insure a seek incomplete status is returned. |
| TEST 02 | Oscillating read-check. The disk is partitioned into 400 parts. Read-checks are done from 0, last, 0+1, last-1, 0+2, . . . last-399, 0+399 in an oscillating motion. |
| TEST 03 | Random read-check. 500 Random LBAs are read-checked. |
| TEST 04 | Interrupt read-check. An interrupt read-check of valid and illegal LBAs are made. |
| TEST 05 | Interrupt data transfer (read only). An interrupt read is made to the low LBA. |
| TEST 06 | Read only. A read is performed on all LBAs from low to high. |
| TEST 07 | Write/read using pattern. A sequence of write/read/verify is performed from low to high using the data pattern selected by PATTERN. |
| TEST 08 | Write/read image. A sequence of write/read/verify using the image data from low to high. |
| TEST 09 | Write/read incrementing. A sequence of write/read/verify using a incrementing pattern from low to high. |
| TEST 10 | Write/read image-complement. A sequence of write/read/verify using the image & image complement from low to high. |
| TEST 11 | Read/write scope loop. The test provides a scope loop capability. The scope and byte options select the type of operation performed on the low LBA. |
| TEST 12 | Readcheck scope loop. This test performs a read check on the low LBA. |
| TEST 13 | Tape write/read. LOW=# records, HIGH=# files. |
| TEST 14 | Tape motion commands (REW,BR,FR,WFM,FF,BF). |
| TEST 15 | Tape write/read variable length records. |
| TEST 16 | Tape write-long/read-short, write-short/read-long. |
| TEST 17 | Tape Interrupt Write/Read. |
| TEST 18 | Tape Write/Read Scope Loop. |
| TEST 19 | Tape Erase, Write files, Write Directory, Read. |

3.7 Error Definitions

| Error 001 | Machine Malfunction Interrupt. |
| Error 002 | Supervisor Call Interrupt. |
| Error 003 | Arithmetic Fault Interrupt. |
| Error 004 | System Queue Service Interrupt. |
| Error 005 | Relocation/Protection Interrupt. |
| Error 006 | Illegal External Interrupt. |
| Error 007 | Interrupt Level Error. |
| Error 008 | Illegal Instruction Interrupt. |
| Error 009 | Data Format Fault Interrupt. |
| Error 010 | Inbuf and Outbuf overlap. |
| Error 011 | Inbuf or Outbuf not in valid memory. |
Error 012  False sync from controller.
Error 013  False sync from SELCH.
Error 014  Controller not idle after reset.
Error 015  Controller status error during initial testing.
Error 016  Drive status error during initial testing.
Error 017  Invalid LOW LBA LOWMAX.
Error 018  Invalid HIGH LBA HIGINMAX.
Error 019  Invalid HIGH LBA LOWHIGH.
Error 020  Selch final address error after read.
Error 021  Selch final address error after write.
Error 022  Selch final address error after readcheck.
Error 023  SCSI residual length error after read.
Error 024  Selch final address error after interrupt read.
Error 026  Selch final address error after interrupt readcheck.
Error 028  Selch final address error after illegal LBA readcheck.
Error 029  Selch final address error after interrupt illegal LBA readcheck.
Error 030  Selch status error after read.
Error 031  Selch status error after write.
Error 032  Selch status error after readcheck.
Error 033  Selch busy after stop command.
Error 034  Selch status error after interrupt read.
Error 036  Selch status error after interrupt readcheck.
Error 038  Selch status error after illegal LBA readcheck.
Error 039  Selch status error after interrupt illegal LBA readcheck.
Error 040  Background test failed during fullword store & load.
Error 041  Background test failed during halfword store & load.
Error 042  Background test failed during byte store & load.
Error 043  Background test failed during floating add & subtract.
Error 044  Background test failed during fix to float & float to fix.
Error 045  Background test failed during floating multiply & divide.
Error 046  Background test failed during store multiple.
Error 047  Data compare error after read.
Error 048  Outbuf modified after write.
Error 049  Controller time out after reset.
Error 050  Controller time out after read.
Error 051  Controller time out after write.
Error 052  Controller time out after readcheck.
Error 053  Controller time out after restore.
Error 054  Controller time out after interrupt read.
Error 055  Controller time out after interrupt write.
Error 056  Controller time out after interrupt readcheck.
Error 057  Controller time out after interrupt restore.
Error 058  Controller time out after illegal LBA readcheck.
Error 059  Controller time out after interrupt illegal LBA readcheck.
Error 060  Drive not ready time out after read.
Error 061  Drive not ready time out after write.
Error 062  Drive not ready time out after readcheck.
Error 063  Drive not ready time out after restore.
Error 064  Drive not ready time out after interrupt read.
<table>
<thead>
<tr>
<th>Error Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>065</td>
<td>Drive not ready time out after interrupt write.</td>
</tr>
<tr>
<td>066</td>
<td>Drive not ready time out after interrupt readcheck.</td>
</tr>
<tr>
<td>067</td>
<td>Drive not ready time out after interrupt restore.</td>
</tr>
<tr>
<td>068</td>
<td>Drive not ready time out after illegal LBA readcheck.</td>
</tr>
<tr>
<td>069</td>
<td>Drive not ready time out after interrupt illegal LBA readcheck.</td>
</tr>
<tr>
<td>070</td>
<td>Selch time out after read.</td>
</tr>
<tr>
<td>071</td>
<td>Selch time out after write.</td>
</tr>
<tr>
<td>072</td>
<td>Selch time out after readcheck.</td>
</tr>
<tr>
<td>074</td>
<td>Selch time out after interrupt read.</td>
</tr>
<tr>
<td>075</td>
<td>Selch time out after interrupt write.</td>
</tr>
<tr>
<td>076</td>
<td>Selch time out after interrupt readcheck.</td>
</tr>
<tr>
<td>078</td>
<td>Selch time out after illegal LBA readcheck.</td>
</tr>
<tr>
<td>079</td>
<td>Selch time out after interrupt illegal LBA readcheck.</td>
</tr>
<tr>
<td>080</td>
<td>Controller status error after read.</td>
</tr>
<tr>
<td>081</td>
<td>Controller status error after write.</td>
</tr>
<tr>
<td>082</td>
<td>Controller status error after readcheck.</td>
</tr>
<tr>
<td>083</td>
<td>Controller status error after restore.</td>
</tr>
<tr>
<td>084</td>
<td>Controller status error after interrupt read.</td>
</tr>
<tr>
<td>085</td>
<td>Controller status error after interrupt write.</td>
</tr>
<tr>
<td>086</td>
<td>Controller status error after interrupt readcheck.</td>
</tr>
<tr>
<td>087</td>
<td>Controller status error after interrupt restore.</td>
</tr>
<tr>
<td>088</td>
<td>Controller status error after illegal LBA readcheck.</td>
</tr>
<tr>
<td>089</td>
<td>Controller status error after interrupt illegal LBA readcheck.</td>
</tr>
<tr>
<td>090</td>
<td>Drive status error after read.</td>
</tr>
<tr>
<td>091</td>
<td>Drive status error after write.</td>
</tr>
<tr>
<td>092</td>
<td>Drive status error after readcheck.</td>
</tr>
<tr>
<td>093</td>
<td>Drive status error after restore.</td>
</tr>
<tr>
<td>094</td>
<td>Drive status error after interrupt read error.</td>
</tr>
<tr>
<td>095</td>
<td>Drive status error after interrupt write.</td>
</tr>
<tr>
<td>096</td>
<td>Drive status error after interrupt readcheck.</td>
</tr>
<tr>
<td>097</td>
<td>Drive status error after interrupt restore.</td>
</tr>
<tr>
<td>098</td>
<td>Drive status error after illegal LBA readcheck.</td>
</tr>
<tr>
<td>099</td>
<td>Drive status error after interrupt illegal LBA readcheck.</td>
</tr>
<tr>
<td>151</td>
<td>Controller time out after rewind.</td>
</tr>
<tr>
<td>152</td>
<td>Controller time out after back record.</td>
</tr>
<tr>
<td>153</td>
<td>Controller time out after forward record.</td>
</tr>
<tr>
<td>154</td>
<td>Controller time out after write file mark.</td>
</tr>
<tr>
<td>155</td>
<td>Controller time out after forward file.</td>
</tr>
<tr>
<td>156</td>
<td>Controller time out after back file.</td>
</tr>
<tr>
<td>161</td>
<td>Drive not ready time out after rewind.</td>
</tr>
<tr>
<td>162</td>
<td>Drive not ready time out after back record.</td>
</tr>
<tr>
<td>163</td>
<td>Drive not ready time out after forward record.</td>
</tr>
<tr>
<td>164</td>
<td>Drive not ready time out after write file mark.</td>
</tr>
<tr>
<td>165</td>
<td>Drive not ready time out after forward file.</td>
</tr>
<tr>
<td>166</td>
<td>Drive not ready time out after back file.</td>
</tr>
<tr>
<td>181</td>
<td>Controller status error after rewind.</td>
</tr>
<tr>
<td>182</td>
<td>Controller status error after back record.</td>
</tr>
<tr>
<td>183</td>
<td>Controller status error after forward record.</td>
</tr>
<tr>
<td>184</td>
<td>Controller status error after write file mark.</td>
</tr>
</tbody>
</table>
Error 185  Controller status error after forward file.
Error 186  Controller status error after back file.
Error 191  Drive status error after rewind.
Error 192  Drive status error after back record.
Error 193  Drive status error after forward record.
Error 194  Drive status error after write file mark.
Error 195  Drive status error after forward file.
Error 196  Drive status error after back file.
4.1 Introduction

This section contains information on installing the supplied Macrolink disk driver into your OS/32 system. The SCSI controller is not driver compatible with existing Concurrent Computer SCSI or MSM/IDC drivers or the system LSU. This driver works with all disk types under the SCSI Controller: SCSI, ESDI, ST-506 & LD1200. In addition the driver supports the Patriot and Exabyte cartridge tape systems.

Our driver communicates to disks, via the SCSI Controller, on a logical basis, using the LBA values from the SVC. The SCSI controller converts these logical values into the physical values required by the device. To be compatible with other OS/32 constraints, physical head, sector & cylinder values must be entered to equal the logical storage content of the drive.

4.2 Distribution Tape

The Macrolink SCSI distribution tape contains programs necessary to install, SYSGEN and use the SCSI devices. The distribution tape is in BACKUP format and should be restored to the system account where tasks are loaded and SYSGENs performed. To restore, enter the following:

LOAD BACKUP
TASK BACKUP
START, IN = tape:, OUT = disk:, L = list:, DELE/NO, VER

Where

"tape:" is the input tape device
"disk:" is the output disk device
"list:" is the list device.

A listing of the driver revisions can be produced by executing the CSS: SCSIREV.CSS

OS/32 Software Installation

This section contains information on installing the supplied Macrolink SCSI drivers into your OS/32 system. The SCSI Controller is not driver compatible with existing Concurrent Computer SCSI & MSM/IDC drivers or the system LSU. The disk driver works with all disk types under the SCSI Controller: SCSI, ESDI, ST-506 and LD1200. The tape driver works with the Patriot 240 and EXABYTE EXB-8200.

DCB Installation

The distribution tape includes INSTLDCB.CSS to create or update the USERDLIB.MLB file. To use the installation CSS, enter the following:

INSTLDCB XX

Where XX is the revision of your OS (62, 72, 81 or 82).

When the MLU32 task is finished updating, a directory of the library will be printed. Verify that DCB63 and DCB248 appear at the end of the list.

Driver Installation

An INSTLDVR CSS is provided to create or update the USERDLIB.LIB file. To use the installation CSS enter:
INSTLDRVR XX

Where XX is the revision of your OS (62, 72, 81 or 82).

When the LIBLDR is finished updating a list of programs and the library is printed, verify that INITSCD, INITST, and INITSCO appear at the beginning of the list. These represent the Disk, Tape and Optical disk drivers. If the INSTLDRVR is updating to an existing USERDLIB.LIB, the original file is saved as USERLIB.SAV.

If the file USERLIB.SAV exits from a previous INSTLDRVR, the current USERDLIB.LIB is deleted and the new SCSI drivers are added to USERDLIB.SAV to create USERDLIB.LIB. If other drivers are added to USERDLIB.LIB after the INSTLDRVR CSS is executed, it is suggested that the file USERLIB.SAV be deleted before executing INSTLDRVR again. The drivers will appear in the library more than once but only the first and most current entry is used by SYSGEN.

BKPLUS Installation

BKPLUS & BKPLEXA are created to allow fully compatible use of the PATRIOT 240 and EXABYTE EXB-8200 drives with BACKUP. To give easy access, a routine is added to BACKUP to start the appropriate monitor task. BKPLUS & BKPLEXA are explained in section 4.4. To install the BKPLUS software enter:

INSTLBKP

This CSS links routines with BACKUP.OBJ to create BKPLUS.TSK and BKPLEXA.TSK. The use of these programs requires SVC intercept support by the OS. If you do not have an INTERCEPT statement in your configuration file, add it and re-SYSGEN.

4.3 OS/32 SYSGEN Specifications

The MacroLink DCB63 is a general purpose disk driver DCB that will allow the user to define any drive configuration. If your system was previously using a disk with a device of 63, the new DCB63 will generate correct structures as before, without modifications to your SYSGEN statements. This DCB may also be used with the MacroLink MACRO 3+ disk controller and the MacroLink Solid State Disk system. You may now specify the following additional features:

- CYL: total Cylinders (default 823)
- HOFF: head offset drives (default 0)
- SEC: logical Sector count (default 64)
- TOC: slow drive Time Out Constant (default 4)
- TRKS: available Tracks (default 40)
- TYPE: LARK, MMD, SSD or SCD (SCSI) drives (default MMD)

Use the following form for one or more of these options:

USER = (option = parameter)

OS/32 Revision 8.1

Example for a ST4026 under 8.1:

XDD:EA,63,SELCH = F0,CONTROLLER = E8,USER = (TYPE = SCD),USER = (SEL = 64),
USER = (TRKS = 5),USER = (CYL = 244)

OS/32 Revision 8.2

Example for a ST4026 under 8.2:

XDD:EA,63,SELCH = F0,CONTROLLER = E8,DISK = (64,5,246,2),USER = (TYPE = SCD)

Computing the Cylinder Value

The cylinder value can be found in APPENDIX III. If your drive is not listed, the procedure is simple. Just load the SCSI diagnostic, and run Test 0. Next, enter “OPTIONS”, and note the value of MAX, the
maximum available LBAs (sectors). Divide this value by 320 (5 Tracks * 64 Sectors) to round down to
the next integer value to find the total cylinders: MAX/320 = Cylinders.

The driver converts the physical track & cylinder requests to a logical address, and the SCSI Controller
translates the logical request to the specific configuration required by the drive. Any combination
of tracks & cylinders can be used that yield the correct product. Because fractional cylinders are lost,
small drives should use the 320 value. Larger drives (over 500 MBytes), can use 1216 (19 Tracks * 64
Sectors).

OS/32 Optical Disk SYSGEN specifications

The Optical disk driver, TYPE=SCO, is an updated disk driver that uses the same access to the SCSI
status as first disc drivers before REV C. Refer to the section on READ SCSI status. To access this driver
use TYPE=SCO instead of TYPE=SCD.

OS/32 SCSI Tape SYSGEN Specifications

The Macrolink DCB 248 is used to access the SCSI TAPE driver. This DCB allows use of OS/32 utili-
ties by returning a device code of 64 when accessed by an SVC 7 fetch attributes call.

Use the following format for each drive SYSGEN statement: dev name, dev address, 248, selch address,
controller address. Example:

XMT:,E9,248,SELCH=F0,CONTROLLER=E8

To use the BACKUP Plus software also include the INTERCEPT statement.

4.4 Backup Plus

This section describes performance limitations of the Patriot 240 and Exabyte EXB-8200. These
drives are mainly used to provide a security backup of the user disk systems. FASTBACK and BACKUP
are the main programs that provide this function. The tape drives are limited in two ways:

1. EOM status is only provided during a write operation on both the Patriot 240 and Exabyte EXB-
8200.

2. The write filemark (WFM) operation requires a extraordinary amount of time on the Exabyte
EXB-8200 because of tape repositioning.

These limitations do not affect operation under FASTBACK. FASTBACK should be used as first
choice for security backup.

Optimum performance is provided because the tape drives go into streaming mode. FASTBACK also
recognizes its own EOV record and does not require an EOM status when reading at the end of tape.

The standard distribution OS/32 BACKUP can be used as long as the data will fit on one tape. Be-
cause BACKUP does not recognize its own EOV record without an EOM status, multi-volume backup
with cache-equipped tape drives may result in lost data at EOT. If the data spills over onto another
tape BKPLUS can be used to verify or restore the data without re-writing the data with BKPLUS.

BKPLUS is the OS/32 BACKUP program modified to include a routine that loads and starts a moni-
tor program. This monitor program, SBACKUP.TSK, uses SVC intercepts to control all I/O from the
backup program to the tape. Once the monitor program is started control is returned to BACKUP.
BKPLUS is loaded and started just like BACKUP. Example:

LOAD BKPLUS
TASK BKPLUS
START,IN=DSKO;,OUT=XMT;,L=CON;,VERIFY

During the write phase of BKPLUS all operations are issued to the tape as if BACKUP were in use.
During the read phase BKPLUS reads ahead and buffers records. When the look ahead has deter-
mined that the EOV record is read then BKPLUS returns the EOM status in the proper record so that
BACKUP renews the tape and asks user to mount the next tape. This is the preferred usage of
BACKUP to multi-volume tapes on the Patriot 240.

BKPLEXA is used to create the fastest BACKUP type tape on the EXBYTE EXB-8200. Backup writes
a filemark between each file on the tape. Because the Exabyte drive has to reposition on each file-
mrk, a Backup that includes many files will take a long time. BKPLEXA is used to overcome this limita-
tion. BKPPLEXA is loaded and started just like BKPLPLUS. When BKPPLEXA is started SB-uppercase.TSK is used to monitor tape I/O from Backup. During the write phase, data is written to the tape like Backup except a write filemark (WFM) is changed into a write with a 4 byte data pattern of C'SEOF'. This allows the drive to continue writing without the time-consuming tape repositioning. When the write operation is finished and a rewind is performed to verify, a real double filemark is written so that data can be appended to the tape. If a rewind is not performed by BKPPLEXA, the user should append filemarks using the WF command before rewinding. During the read phase, BKPPLEXA does a read ahead like BKPLPLUS. The difference is that all C'SEOF' records are returned as EOF status. Also, since there are no filemarks, an FF operation is changed into a read until C'SEOF'.

Both the Patriot and Exabyte drives have a maximum block transfer size of 32 KBytes. If the application program should attempt a write over this limit, an error status will be returned. For both BACKUP and Fastback, use the default block size when creating tapes.

4.5 SCSI LSU

To enable the SCSI Controller LSU, turn off the IPL (or LSU) switch on your computer and turn the toggle switch located at the front of the SCSI controller to "LSU". Press the INIT switch on the CPU, or execute the 3280 LSU Emulator in Chapter 3. The following message should appear on the system console:

SCSI + LSU BOOT PROGRAM
COPYRIGHT 1986 MACROLINK, INC. ALL RIGHTS RESERVED
Enter: NAME [op1,op2,op3,...]
Valid Names:
SCD0 SCD1 SCD2 SCD3 SCD4 SCD5 SCD6 MG85 MG62
Valid Keyword Options (Addresses in Hex):
S = select address C = controller address
D = file address F = filemarks
Name ? Enter the desired SCSI device name, or MG85/MG62 for standard 9-track tape.

The SCSI names (SCD0-SCD6) correspond to the unique SCSI address of each device (disk or tape) attached to the Macrolink SCSI Controller. Once a disk device is selected, the loader will respond with the volume name, and prompt you for the filename:

VOL = DSK1 FILE = Enter your filename, or <CR> for Display Files.

Display Files

This command operates like the DF command in OS/32. Both the "-" and "*" are supported for each field. The "-" requests all files starting with the characters preceding it displayed. The "*" requests all files with matching characters in the same position(s) to be displayed. Example:

.OS/3-
OS32-.OS/0000
Display Files - .OS
OS3205T .OS /0000 OS3205.OS /0000 OS3230.OS /0000 OS3220T .OS /0000
OS3220T .OS /0000
Display all of the .OS files in any account.
Display files only in account 0.
Strike any key to stop the display.
Enter your selected OS filename & account information.

If the controller has been configured for AUTOBOOT mode, the boot-load can be aborted by entering ^A (control A) on the system console during the memory test.
5.1 Introduction

The MMD Support programs allows the creation and maintenance of standard Concurrent Computer Multi Media Diagnostics and user diagnostics onto the supported SCSI tape drives. Data can be transferred from the system disk, or standard 9-track tape drives onto the SCSI tape. While this utility allows you to copy CCUR MDL tapes, you are responsible for complying with your license and copyright agreements.

Two programs are provided on the SCSI distribution tape:
1. SCSI Controller MMD OS/32 Support.
2. SCSI Controller MMD Boot Loader.

5.2 OS/32 Support program

The support program is used to create or update SCSI tapes. The program assigns or allocates the following disk files for its use:
- LU 2 SCSIEX1.EEE
- LU 4 Temporary file, record length = 256 (about 2.2 MBytes required for full MMD tape).
- LU 5 Command input/output.

To use the program, load and start it on an MTM terminal or system console:

LOAD SCSIMMD
START [.cmd] CMD is an optional command input/output device. The default is the system console (CON).
SCSI MMD SUPPORT R01-00
COPYRIGHT 1988 MACROLINK, INC.
ALL RIGHTS RESERVED.
COMMAND ?
HELP
Valid commands:
ADD  DELeate
List  MOVE
LList  GET
INITialize  SAVE
Pause  HELP
End

For more information, enter: HELP command, e.g. "HELP ADD". The following on-line command descriptions are available:

**ADD**

The ADD command is used to input programs from the MMD tape or diagnostic file. The user is asked for information pertaining to the program type, input filename, name, and selection criteria. Two types of programs are supported: Diagnostic (EEE), and Multi Media Tape (MMD). The user is asked for the name of the input file. For MMD, tape input is required. The program then asks for the 32 character directory name or MMD selection criteria.

**DELETE n[,m]**

The delete command is used to remove a program or a range of programs from the directory.
<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIST</td>
<td>The LIST command lists the directory of programs on the SCSI+ tape in a condensed double column format.</td>
</tr>
<tr>
<td>MOVE n[m]</td>
<td>The move command is used to rearrange the order in which the programs are listed. A program or a range of programs can be moved. The user will be asked if the programs are to be moved to the end or what program they are to be inserted before.</td>
</tr>
<tr>
<td>LLIST</td>
<td>This command gives a long format list each program. Each entry lists the program number, MMD sequence number MMD program number, name, start, and end.</td>
</tr>
<tr>
<td>GET</td>
<td>The GET command is used to read programs previously saved on tape with a SAVE command. When the GET command is executed the directory is cleared of all programs. Programs can be added, deleted, moved after the GET command.</td>
</tr>
<tr>
<td>SAVE</td>
<td>The SAVE command is used to write the programs read using GET and ADD commands to tape. The executive program and directory are written first to allow the LSU boot loaders to load them. Programs can be added by reading the tape with GET command. Adding with the ADD command. And saving with the SAVE command.</td>
</tr>
<tr>
<td>INITIALIZE</td>
<td>This command is used to set the directory and available space pointers to their initial values and copy the executive program to the scratch file on LU 4. This command must be entered before the first ADD command. The INITIALIZE command is not necessary before the GET command.</td>
</tr>
<tr>
<td>PAUSE</td>
<td>This command is used to pause the task. Use the continue command to continue the task.</td>
</tr>
<tr>
<td>END</td>
<td>This command is used to terminate the task.</td>
</tr>
</tbody>
</table>

To create a tape, the general command sequence is as follows:

```
INITIALIZE
ADD :
ADD
DELETE
MOVE
SAVE
END
```

To update a tape the general command sequence is as follows:

```
GET
ADD :
ADD
DELETE
MOVE
SAVE
END
```

The following example shows how to add MMD diagnostics to the SCSI MMD tape.

```
COMMAND ?
INITIALIZE
COMMAND ?
```

reads tape
writes tape
ADD
TYPE (EEE,MMD) ?
MMD
FILENAME ?
MT45:
INPUT MMD SEQ. # (XXX) OR RANGE (XXX,YYY)
001,007
ADDING 001
ADDING 002
ADDING 003
ADDING 004
ADDING 006
ADDING 007
COMMAND ?
ADD
TYPE (EEE,MMD) ?
MMD
FILENAME ?
MT45:
INPUT MMD SEQ. # (XXX) OR RANGE (XXX,YYY)
100,122
ADDING 113
ADDING 114
ADDING 115
ADDING 116
ADDING 118
ADDING 119
ADDING 120
ADDING 121
ADDING 122
COMMAND ?
ADD
TYPE (EEE,MMD) ?
EEE
FILENAME ?
LNK.TXT32,EEE/S
NAME ?
LINK TEST 32
COMMAND ?

<table>
<thead>
<tr>
<th>NUM</th>
<th>NAME.....</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>LOW LOADER/EXECUTIVE 06-270R07</td>
</tr>
<tr>
<td>2</td>
<td>3200 PROCESSOR TEST 1</td>
</tr>
<tr>
<td>3</td>
<td>3200 PROCESSOR TEST 2</td>
</tr>
<tr>
<td>4</td>
<td>HIGH LOADER/EXECUTIVE</td>
</tr>
<tr>
<td>5</td>
<td>XF PROCESSOR TEST PART 1</td>
</tr>
<tr>
<td>6</td>
<td>XF PROCESSOR TEST PART 2</td>
</tr>
<tr>
<td>7</td>
<td>S32 PROCESSOR TEST PART 1</td>
</tr>
<tr>
<td>8</td>
<td>S32 PROC. TEST PART 2 (3706)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NUM</th>
<th>NAME.....</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>S32 PROC. TEST PART 3</td>
</tr>
<tr>
<td>10</td>
<td>S32 PROC. TEST PART 4</td>
</tr>
<tr>
<td>11</td>
<td>3220 CLASS PROC DIAG (6019)</td>
</tr>
<tr>
<td>12</td>
<td>3240 MEMORY SYSTEM DIAGNOSTIC</td>
</tr>
<tr>
<td>13</td>
<td>8/32 WCS TEST</td>
</tr>
<tr>
<td>14</td>
<td>3220 WCS TEST (4456,5328)</td>
</tr>
<tr>
<td>15</td>
<td>3240 WCS TEST</td>
</tr>
<tr>
<td>16</td>
<td>LINK TEST 32</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NUM</th>
<th>MMD#</th>
<th>PROGRAM #</th>
<th>NAME</th>
<th>START</th>
<th>END</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>001</td>
<td>06:145 F01R11 11</td>
<td>LOW LOADER/EXECUTIVE 06-270R07</td>
<td>A00</td>
<td>7FFF</td>
</tr>
<tr>
<td>2</td>
<td>002</td>
<td>06-228 R05 05</td>
<td>3200 PROCESSOR TEST 1</td>
<td>A00</td>
<td>6AFF</td>
</tr>
</tbody>
</table>
3 003 06-229 R05 05 3200 PROCESSOR TEST 2 A00 3FFF
5 006 06-307 R00 00 XF PROCESSOR TEST PART 1 A00 6AFF
6 007 06-308 R00 00 XF PROCESSOR TEST PART 2 A00 40FF
7 113 06-154 R03 04 S32 PROCESSOR TEST PART 1 A00 3FFF
8 114 06-155 R02.1 04 S32 PROC. TEST PART 2 (3706) A00 37FF
9 115 06-178 R01 06 S32 PROC. TEST PART 3 A00 1FFF
10 116 06-195 R00 01 S 32 PROC. TEST PART 4 A00 21FF
11 118 06-226 R00.1 01 3220 CLAS PROC DIAG (5019) A00 A3FF
12 119 06-264 R00 00 3240 MEMORY SYSTEM DIAGNOSTIC A00 68FF
13 120 06-192 R00 02 8/32 WCS TEST A00 1BFF
14 121 06-232 R00.2 02 3220 WCS TEST (4456,5328) A00 2AFF
15 122 06-234 R00 00 3240 WCS TEST A00 30FF
16 LINK TEST 32 A00 2AFF

COMMAND ?
SAVE
FILENAME ?
MT45:
COMMAND ?
END
DEMO -END OF TASK CODE = 0 PROCESSOR = 5.566 TSK-ELAPSED = 42:50

User diagnostics should be created in the following manner:
1. Add to the source code:
   ORG X ‘60’
   B start
   START OF PROGRAM
2. Link using the commands:
   ESTABLISH TASK
   OPTION ABS = O
   INCLUDE fd
   MAP
   BUTLD fd .TEE
   END

5.3 MMD Loader

The Loader is placed at the start of the tape in the format of an OS image, and loaded using the onboard LSU boot program. Once loaded, a directory is listed and the user can select from a menu of diagnostics. Multi Media diagnostics are selected by specifying “Mnnn”, where nnn is the Multi Media sequence number. Other diagnostics are selected by “Proc” where xxx is the program number.

On-Line Help

If the user escapes from the load menu, the following commands can be entered:
COMMANDS: BIAS,EXAMINE,LOAD,DEVICE,SELCH,LIST;L;LIST;HELP;END
COMMAND ?
Entering HELP will list the valid commands:

HELP
Valid commands:
List DEVICE
LList SELch
LOAD Bias

5 - 4
Copyright 1988 Macrolink, Inc. All rights reserved. 300935 REV B
HELP EXAmine
End

For more information, enter: HELP command

COMMAND?

For a description of the LIST command, enter "HELP LIST":

<table>
<thead>
<tr>
<th>LIST</th>
<th>The LIST command lists the directory of programs on the SCSI+ tape in a condensed double column format.</th>
</tr>
</thead>
<tbody>
<tr>
<td>LLIST</td>
<td>This command gives a long format list each program on the SCSI+ tape. Each entry contains the program number, MMD sequence number, MMD program number, name, start, and end.</td>
</tr>
<tr>
<td>LOAD [n]</td>
<td>This command is used to load and execute a program located on the Macroloader. If a program number is not specified then the initial load menu is entered. If a program number is specified then it is loaded and started.</td>
</tr>
<tr>
<td>DEVICE [adr]</td>
<td>The DEVICE command is used to set the address of the input tape. If no address is specified, then the current address is displayed.</td>
</tr>
<tr>
<td>SELCh [adr]</td>
<td>The SELCH command is used to set the address of the selector channel. If no address is specified, then the current address is displayed.</td>
</tr>
<tr>
<td>BIAS addr</td>
<td>This command is used to set a bias for EXAMINE command.</td>
</tr>
<tr>
<td>EXAMINE addr[,count]</td>
<td>This command is used to examine the contents of memory. The BIAS address, if any, is added to the examine address. The count specifies the number of halfwords to be displayed.</td>
</tr>
</tbody>
</table>

Once the program is started, a menu of applications will appear:

*SCSI MMD LOADER R01-00 COPYRIGHT 1988 MACROLINK, INC. ALL RIGHTS RESERVED.
DEVICE = 45 SELCH = F1

**M001**  LOW LOADER/EXECUTIVE 06-270R07  M222  32 BIT MEMORY TEST (PART 2)
M002  3200 PROCESSOR TEST 1 M223  32 BIT MEMORY TEST (PART 3)
M003  3200 PROCESSOR TEST 2 M227  32 MULTI PORT MEM TEST (3771)
M004  HIGH LOADER/EXECUTIVE M228  3200 STM TEST PART 1
M006  XF PROCESSOR TEST PART 1 M229  3200 STM TEST PART 2
M007  XF PROCESSOR TEST PART 2 M230  3203/3205 MEMORY DIAG 1 L
M113  S32 PROCESSOR TEST PART 1 M231  3203/3205 MEMORY DIAG 2 H
M114  S32 PROC. TEST PART 2 (3706) M240  PE 3200 SHARED MEMORY TEST
M115  S32 PROC. TEST PART 3 M250  3200 ERROR LOGGER TEST (5672)
M116  S32 PROC. TEST PART M303  DIOS TEST PROGRAM
M118  3220 CLASS PROC DIAG (5019) M305  32 BIT SELCH TEST L
M119  3240 MEMORY SYSTEM DIAGNOSTIC M306  CHANNEL MANAGER DIAGNOSTIC
M120  8/32 WCS TEST M307  MAC TEST (PART 1) 3389,3743
M121  3220 WCS TEST (4456,5328) M308  MAC TEST (PART 2) X'10010'
M122  3240 WCS TEST M309  32 BIT SYS EXEC. (5161)
M219  S32 S6A MEMORY TEST (PART 1) M310  3220 MAC PT 1 (4314,5483,5571)
M220  S32 S6A MEMORY TEST (PART 2) M311  3220 MAC 2 '10010' (4314,5571)
M221  32 BIT MEMORY TEST (PART 1) M312  MAT/CACHE TEST PT1 (4655)

ENTER XNNN TO LOAD, <ESC> <CR> TO EXIT, <CR> FOR MORE
NUM   NAME.....                NUM   NAME.....
M313  MAT/CACHE TEST PT2 (4655) M329  3200 COMMERCIAL INST. TEST
M320  3200 MAT TEST PART 1L     M330  S32 FLOATING POINT TEST
M321  3200 MAT TEST PART 2 H     P044  LINK TEST 32
M324  32 BIT LSU SUPPORT        P045  CAM TEST 32
M328  3200 FLOATING POINT TEST

ENTER XNNN TO LOAD, <ESC> <CR> TO EXIT, <CR> FOR MORE COMMANDS: BIAS, EXAMINE, LOAD, DEVICE, SELCH, LIST, LI LIST, HELP, END COMMAND ?

Enter the command(s) to load and execute the desired diagnostic.
6.1 Introduction

If your SCSI Controller is equipped for operation with the LMS LD1200 Laserdrive, it will be available as an option in the configuration menu. Additional SCSI magnetic disks, or tape drives may be installed with the LD1200.

While the LD1200 may be used with the supplied driver on OS/32, the optical disk is not compatible with the file management system. Because the optical disk is a write once device, the user must design a directory system that will support his application. The optical disk has no equivalent to Bit and Flaw maps, updatable PACKINFO.DIR files, or other conventional file management tools available on read/write disks. For best results with optical media, the user should address the disk like a magnetic tape drive, and append large contiguous files to the unused media.

Use the Macrolink SCSI DCB described in Chapter 4. The LD1200 will generally not work with the SCSI diagnostic package. An OS/32 system level demonstration program is provided to verify basic read/write operation.

Data Transfer Operations

The Laserdrive 1200 has a fixed 1024 byte sector size. If less than 1024 bytes are written, the last byte of data will fill the sector.

All data transfers will use bare disk access, and will be made with Supervisor Calls (SVC1).

File Management

The user must develop a file management system that is compatible with each application, and the limitations of the Laserdrive. The most straightforward method is to write concatenated contiguous data files, in the same fashion as a tape drive. However, no “skip filemark” capability exists, and serially searching over 1,000 MB of disk space will take an unacceptable time. A directory containing the file information, starting LBA and size could be kept on another device, but this will be unsuitable for most uses.

The file system that we recommend requires reserving a directory area at the start of the disk, allowing one physical sector of directory for each file. In this 1024 byte “directory sector” the file description, starting LBA, file size, and next valid LBA are contained.

The Laserdrive has a total of 4,095,484 logical sectors. This value is divided by the average file size to give the number of directory sectors that should be reserved. For example with 250KB average file size: 4,095,484 / (262,144/256) + 1 = 3,995 files

This value (3,995) is the starting LBA for the data. The data file must be written prior to writing the directory sector, as the ending LBA (from LBA 0) must be recorded in the directory.

Prior to writing the next file, the directory is read, and its last valid sector will contain the next blank LBA for the file write. The directory can be read one sector at a time, or a large block can be read. Upon completion of each directory read, the “LBA” and “Sense Key” of LBA 0 should be read to verify data validity.

The Laserdrive will automatically alternate a sector that cannot be written. When an SVC1 read is made to a physical sector, the user will receive the correct logical sector.

Write Operations

1. Using SVC1, write the data to the desired starting LBA.
2. Using SVC1, read with image bit set 16 bytes of extended SCSI status. This is the Sense Data transferred by the LD 1200 in response to a Request Sense Command. For a complete explanation of this data refer to the LD 1200 manual paragraph 9.1.3. Request Sense Command.
3. To determine the next writeable LBA, assuming you have a Sense Key (byte 2) of 0 or 1 and the Address Valid bit (byte 0) is set, add the Skip Count (bytes 8 & 9) to the LBA contained in the Information Bytes (bytes 3 through 6) and add 1. Use this LBA for your next write.

Any attempt to write to a previously written sector will produce an error (Sense Key 8).

Read Operations

1. Using SVC1, read the data from the desired starting LBA.
2. Using SVC1, read with image bit set 16 bytes of extended SCSI status. This is the Sense Data transferred by the LD 1200 in response to a Request Sense Command. For a complete explanation of this data refer to the LD 1200 manual paragraph 9.1.3.
3. To determine the next LBA to read, assuming you have a Sense Key (byte 2) of 0 or 1 and the Address Valid bit (byte 0) is set, add 1 to the LBA contained in the Information Bytes (bytes 3 through 6). Use this LBA for your next write.

Any attempt to read from a blank sector will produce an error (Sense Key 8).
CHAPTER 7

OS/16 INSTALLATION

7.1 Introduction

This section contains information on installing and using the Macrolink SCSI disk and tape drivers on your OS/16 R5 system. The SCSI controller is not compatible with existing OS/16 drivers or LSU programs. The SCSI drivers support all disk types — SCSI, ST-506 & ESDI — except optical disks. SCSI tape drives are also supported.

7.2 Distribution Tape

The Macrolink OS/16 SCSI distribution tape contains all programs to install, SYSGEN, and use the SCSI devices. Also included are the source files so modifications can be made if necessary. The distribution tape is in COPY format. Object files are 108 bytes per record. MAC and CAL files are 80 bytes per record. List files are 132 bytes per record. Each file is separated by one file mark. The files are supplied in the following order:

- POSTCUP.OBJ - 23 RECORDS
- SCDDDR.OBJ - 19 RECORDS
- SCDDDR.OBJ - 10 RECORD(S) COPIED
- SCDDDR.OBJ - 20 RECORDS
- SCDDDR.OBJ - 11 RECORDS
- POSTCUP.MAC - 264 RECORDS
- POSTCUP.CAL - 769 RECORDS
- SCDDDR.CAL - 782 RECORDS
- SCDDDR.CAL - 438 RECORDS
- POSTCUP.LST - 529 RECORDS
- SCDDDR.LST - 1771 RECORDS
- SCDDDR.LST - 997 RECORDS
- SCDDDR.LST - 1003 RECORD(S) COPIED

Copy the files onto your SYSGEN disk as required. The files are identified as follows:

POSTCUP

Postcup is a text processor that modifies the output of cup. Postcup recognizes device code 52 as a SCSI disk or tape. Tape devices require a *MT in the comment field. Postcup changes the device busy flag pointer to point to a common busy flag for the controller. The MAC source file is provided if modifications are to be made on a OS/32 system, otherwise the CAL file is used.

SCDDVR, SCDDDR

The disk driver is provided in non-extended and extended memory versions respectively. The disk driver replaces the standard disk driver. The 40 MB disk, device code 52, is not supported. Device code 52 is changed to support SCSI disks. The driver reads the number of sectors from the drive when it is accessed for the first time. It is not necessary to specify the size of the disk at SYSGEN time.

SCTDVR, SCTDvrex

The tape driver is provided in both non-extended and extended memory versions. The SCSI tape driver is separate from the 800/1600 BPI 9 track tape driver.
Installation

The installation of the SCSI software requires updating the SYSGEN CSS as follows:

1) Insert after the START command for CUP/16.
   LDBG POSTCUP
   TASK .BG
   START

2) Insert after the INCLUDE EXEC@1,* command for TET/16.
   EDIT SCDDVR@4.OBJ
   EDIT SCTDVR@4.OBJ

The updated SYSGEN CSS is listed below.

$IFNULL @1
$COPY
***@0: MISSING PARAMETER (OSID)
$N
$CLEAR
$ENDC
TASK .BG
CLOSE ALL;OPTION NOCOMP
LDBG CUP
$IFNULL @2
$IFNX CUPI@1
$COPY
***@0: FILE CUPI@1 NONEXISTENT
$N
$CLEAR
$ENDC
ASSIGN 1,CUPI@1,SRO
$ELSE
$IFNX @2
$COPY
***@0: FILE @2 NONEXISTENT
$N
$CLEAR
$ENDC
ASSIGN 1,@2,SRO
$ENDC
ASSIGN 3,PR:
$IFX CUPO@1
DELETE CUPO@1
$ENDC
ALLOCATE CUPO@1,IN,80
ASSIGN 2,CUPO@1
START
LDBG POSTCUP
TASK .BG
START
LDBG CAL16D
TASK .BG
ASSIGN 1,EXEC16,CAL,SRO
$IFX EXEC@1
DELETE EXEC@1
$ENDC
ALLOCATE EXEC@1,IN
ASSIGN 2,EXEC@1
ASSIGN 7,CUPO@1,SRO
$IFNX CALS6,SCT
ALLOCATE CALS6,SCT,IN,256
$ENDC
ASSIGN 6,CALS6.SCT
$IFNX CALS8.SCT
   ALLOCATE CALS8.SCT,IN,256
$ENDC
ASSIGN 8,CALS8.SCT
$IFNULL @3
   $IFNX CALS5.SCR
   ALLOCATE CALS5.SCR,IN,256/2
$ENDC
ASSIGN 5,CALS5.SCR
$IFNX CALS9.SCR
   ALLOCATE CALS9.SCR,IN,36
$ENDC
ASSIGN 9,CALS9.SCR
START,CROSS,ERLST
$ELSE
START,NLIST
$ENDC
ASSIGN 1,FMR16.CAL,SRO
$IFX FMR@1
   DELETE FMR@1
$ENDC
ALLOCATE FMR@1,IN
ASSIGN 2,FMR@1
$IFNULL @3
START,CROSS,ERLST
$ELSE
START,NLIST
$ENDC
ASSIGN 1,CMDP16.CAL,SRO
$IFX CMDP@1
   DELETE CMDP@1
$ENDC
ALLOCATE CMDP@1,IN
ASSIGN 2,CMDP@1
$IFNULL @3
START,CROSS,ERLST
$ELSE
START,NLIST
$ENDC
TASK,BG
CLOSE 1,2,5,6,8,9
DELETE CALS6.SCT,CALS8.SCT
$IFNULL @3
   DELETE CALS5.SCR,CALS9.SCR
$ENDC
$IFX OS16@1
   DELETE OS16@1
$ENDC
ASSIGN 7,CON:
$BUILD TETN.SGN
REMOTE
ESTABLISH OS
JOB @0
INCLUDE EXEC@1,*
EDIT SCDVPR@4.OBJ
EDIT SCDVR@4.OBJ
EDIT DLVR16@4.OBJ
7.3 OS/16 SYSGEN Specifications

The MacroLink SCSI disk and tape devices are specified as follows:

DEVICE 52,dd,DEVN.;ss,cc [*MT]

Where:
- dd is the drive address
- ss is the selch address
- cc is the controller address

*MT is the optional tape identifier

Example:

DEVICE 52,EA,DSC1.;F0,E8
DEVICE 52,EB,DSC2.;F0,E8
DEVICE 52,9,SCT.;F0,E8 *MT

7.4 16 Bit Diagnostics

The on board diagnostics and LSU boot program are similar to the 32 bit version. The 16 bit version differs in that the HELP command only allows HELP TEST to get a summary of test routines. The diagnostic & boot program is loaded using the LSU feature of the processor. For systems that have an ALO in place of the LSU (6/16 & 8/16), the 50 sequence must be manually loaded.

When booting OS/16, locations X'7A'-X'7B' must be manually entered to enable OS/16 to determine the overlay volume.

50 SEQUENCE

ENTER:

50  D500  AL X'CF'
52  00CF  
54  4300  B X'88'
56  0088  
78  0500  LSU ADR, OUTPUT COMMAND
7A  EA34  DEVICE, DEVICE CODE
OS/16 INSTALLATION

SCSI Controller

16 Bit Diagnostics

7C E8F0 CONTROLLER, SELCH
7E 0000 NOT USED

Place the SCSI switch in the "CONFIG" position. Enter:

DTA 50 ADR
DTA FN SEL
INI
RUN

LOC = 50
PSW = 0
INITIALIZE
8.1 Introduction

The SCSI Controller is divided into two separate hardware functions: the Controller with one address and the Devices with up to seven consecutive following addresses. Each address must be commanded separately and each has separate status bytes.

The controller address may be configured for any address; however, configuring the controller to end on a 0 or 8 address boundary (e.g. \text{x}F0' or \text{x}F8'), will avoid programming confusion. Device address will be the following consecutive devices; e.g. for a controller address of \text{x}F8' Device addresses will be \text{x}F9', \text{x}FA', etc. You may configure address space for one, three or seven Devices in addition to the Controller.

Devices may be configured for any SCSI address (0 through 7) and may be configured for operation at any device address within the SCSI Controller address space. Devices which may control more than one Drive should have address space reserved for as many Drives as the Device is capable of controlling whether Drives are configured or not to avoid bus contention.

For example, consider a SCSI system with the Controller configured at \text{x}F8' which will use an Adaptec 4000 ST506 Winchester controller with one disk Drive and a CDC Patriot Tape Drive. First, set the SCSI address for the Adaptec to 0 (each SCSI device must have an unique address) and the SCSI address for the Patriot to 1. The SCSI address is jumper selectable on each Device. Next, set the Drive address jumper on the disk drive to 0 (this is not arbitrary and must match its intended device address). Using the Configuration Menu (resident in the SCSI Controller), configure the Patriot for SCSI address 1, device address \text{x}F9' and configure the Adaptec for SCSI address 0, device addresses \text{x}FA' and \text{x}FB'. The disk drive will use device address \text{x}FA' since it was set at drive address 0. This is because the least significant device address bit is used to address the drive (a drive set with drive address 1 would occupy device address \text{x}FB'). In this example device address \text{x}FB' is reserved for a Winchester ST506 disk drive and any attempt to configure another device at that address will result in bus contention and unpredictable results.

8.2 Controller Commands

These are commands to be sent to the Controller. Separate commands are required for the Devices. Data transfers between a Device and the Processor will require the following sequence of operations:

Data Transfer Sequence
1. Clear command to Device.
2. Write 3 bytes of LBA to the Device (Disk Drives only; Skip this step for Tape Drives).
3. Write 3 bytes of transfer size to the Device.
4. Data transfer command to Controller.
5. Start SELCH immediately.

Read Command — X'01'

The READ command caused the SCSI Controller to read data from a SCSI device and transfer it to the processor. The Data Transfer Sequence must be used for this command. Upon completion of the command the controller Idle bit will be set.

Errors are reported after retries are exhausted by the SCSI Device and normally retries by the programmer at this point will usually be futile in recovering data. Requesting Extended SCSI Status at this point may give useful information for recovering the data or determining the problem.
8.3 Write Command — X'02'

The WRITE command causes the SCSI Controller to transfer data from the Processor to a SCSI Device. The Data Transfer Sequence must be used for this command. Upon completion of the command the controller Idle bit will be set.

Errors are reported after retries are exhausted by the SCSI Device and normally retries by the programmer at this point will usually be futile in attempting to write data. Requesting Extended SCSI Status at this point may give useful information for determining the problem.

Read Check Command — X'03' (Disk Drives only)

This command does an off-line read of a single LBA. No data is passed to the Processor. Use the Data Transfer Sequence for this command except step 5 starting the SELCH must be omitted.

Execute SCSI Command — X'04' (Disk Drives only)

This command allows the user to create a SCSI Command Descriptor Block and execute it. Use the Data Transfer Sequence for this command except send the SCSI CDB instead of the LBA and transfer size. Use the Selch for the Data In or Data Out Phase if necessary.

8.4 Device Commands

Clear Command — X'00'

This command clears the Controller's internal registers in preparation for writing LBA and transfer size data prior to issuing a data transfer command to the controller. It may also be used as a no operation command for changing interrupt bits. Upon completion, the status bits are reset.

Restore/Rewind Command — X'01'

This command restores disk drives to Cylinder 0 or rewinds tape drives to load point. The Controller is available for other device I/O during rewind.

Backspace Record — X'02' (tape drives only)

This command repositions the tape to the present LBA minus one.

Forward Space Record — X'03' (tape drives only)

This command repositions the tape to the present LBA plus one.

Write File Mark — X'04' (tape drives only)

This command writes a file mark at the present tape position. Prior to issuing this command, a Clear Command (X'00') and a zero byte must be written to the Device.

Skip File Forward — X'05' (tape drives only)

This command repositions the tape at the beginning of the file following the file containing the present LBA.

Skip File Reverse — X'06' (tape drives only)

This command repositions the tape at the beginning of the file preceding the file containing the present LBA.

Read Capacity — X'06' (disk drives only)

Execution of this command will give access to 4 bytes of data containing the last available LBA on the disk Drive. This value varies to reflect the number of alternated sectors. After waiting for Device Busy status to clear, four Data Requests to the Device will read the last LBA, most significant byte first. Requesting more data will produce unpredictable data.
Request SCSI Status — X'07'

The first execution of this command following any other command (Controller command or Device command) will give access to the first 16 bytes of Extended SCSI status as defined in the applicable Device manual. After waiting for device busy status to clear, data requests to the Device will read the status data. If more than 16 bytes are read, the data "wraps around" and repeats; i.e. the 17th byte will be the same as the first.

The second execution of this command will give access to the next sixteen bytes of Extended SCSI status. Consult the applicable Device manual. Many Devices do give status beyond 16 bytes and the status of the ones that do is typically not very interesting. After waiting for device busy status to clear, data requests to the Device will read the status data. If more than sixteen bytes are read, the data "wraps around" and repeats; i.e. the 17th byte will be the same as the first.

Any number of data requests may be made including none and more than sixteen. There is no need to request any more data than is interesting.

Reset Command — X'08'

This is a global reset and it does not matter which Device it was sent to, the result is the same: All activity on all Devices will stop and the Controller will appear to have just powered up. Obviously, this command is to be used sparingly and is recommended only when all else fails but you are not quite ready to resort to a System Clear.

Test Device Ready — X'20'

This command is to be used after power up or after loading removable media to set the status register to a meaningful status. Status is never reported by a SCSI Device unless a command is executed. This command is therefore used to set the status when no other command is appropriate in order to make status available to the programmer.

8.5 Controller Status Byte

<table>
<thead>
<tr>
<th>BIT</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controller Status</td>
<td>Write Protect</td>
<td>Header Failure</td>
<td>Defective Sector</td>
<td>Media Overflow</td>
<td>Busy</td>
<td>Examine</td>
<td>Idle</td>
<td>Data Error</td>
</tr>
</tbody>
</table>

Write Protect (Bit 0)

This bit is set when an attempt is made to access data that is write protected by the Device. Consult the applicable SCSI Device manual for the exact meaning of this status for the specific Device.

Header Failure (Bit 1)

This bit is set when an LBA cannot be located, usually because of a data error in the header. Extended SCSI status should be requested to determine the exact nature of the error for the specific Device. This bit is not valid with tape operations.

Defective Sector (Bit 2)

This bit is set when an unrecoverable data error in the LBA is detected usually because of defective media. Extended SCSI status should be requested to determine the exact nature of the error for the specific Device. This bit is not valid with tape operations.

Media Overflow (Bit 3)

An LBA was requested beyond the capacity of the Device usually during a long data transfer. Seek Incomplete status in the Device status byte will be set instead of this bit if no data has been transferred.

Busy (Bit 4)

This bit is set upon completion of any command.
Error (Bit 0)

A device error has occurred. Execute a Read SCSI Status Command and consult the device programming manual for a definition of the SCSI status.

End of File (Bit 1)

An end of file mark has been read from the tape drive.

End of Tape (Bit 2)

The logical end of tape has been reached.

Beginning of Tape (Bit 3)

The tape is positioned at the logical beginning of tape, or the load point.

Not Ready (Bit 4)

The drive is not ready to accept a command. An interrupt will be generated, if enabled, when this bit is reset.

Examine (Bit 5)

This bit is set when any of bits 0 through 3 are set. This bit is also set in conjunction with the Off-Line bit to indicate that no commands have been issued to the device (after power-up or reset) and valid status in not available. A test device ready Command (X'20') will cause valid status to be available.

8.8 Patriot Erase & Rewind

The Patriot command structure is extended to allow erase and special rewind by writing a modified byte to the device address before the Write File Mark or rewind commands. The modifier byte is output to the device in the same sequence as the Transfer Length is output prior to a read or write.

1. Output a clear command.
2. Write 1 byte modifier (0 or 1).
3. Issue rewind or write file mark.

The modifier byte for the rewind command is:

0: Normal rewind.
1: Special rewind (no End Of Data mark written).

The modifier byte for the Write File Mark is:

0: Normal Write File Mark.
1: Short Erase.

The addition of the erase and special rewind allow a directory space to be reserved at the beginning of tape. To utilize this feature, follow the following steps:

1. Rewind
2. Erase 12 times
3. WFM 2 times
4. Rewind
5. Write a dummy block the size of the desired directory
6. Special rewind
7. Forward file
8. Write data files
9. WFM 2 times
10. Rewind
11. Write directory
12. Special Rewind
Data errors will occur if more than 12 erase commands are issued.
These functions are available on revision L or above microcode. Additionally, revision C Tape Driver is required.

OS/32 SVC1 Access

The erase and special Rewind are accessed through the extended SVC1 function code. This requires a function code of X'81', device dependent function. LU and an extended function code as follows:

7 = Short Erase
10 = Special Rewind

8.9 Read SCSI Status

The Macrolink SCSI drivers provide access to the raw SCSI status from the drive or adapter. After an operation, the user can read up to 32 bytes of information. The SCSI status is accessed by one of two methods depending on the type and revision driver.

1. For all tape drivers and REV C and above disk drivers:
   a. Set up a SVC1 parameter block with a READ + WAIT + IMAGE function code and a buffer of up to 32 bytes.
   b. Set the SVC1 extended option to Y'80000'.
   c. Link the task with the XSVCL option.

2. For disk drivers before REV C and the Optical disc driver (TYPE=SCO):
   a. Set up a SVC1 parameter block with READ + WAIT + IMAGE function code and a buffer of 32 bytes.
   b. Link the task without the XSVCL option.

Disk And Tape Driver Error Status Codes

The following is a list of error status codes for all SCSI tape drivers and REV C and above disk drivers.

- **A000** Service unavailable
- **9000** End of medium
- **8800** End of file
- **84FF** Hardware error
- **8283** Write protect
- **84xx** 1. Maximum retry count reached
   2. Time out or bad status during READ SCSI STATUS xx= device status
- **82xx** 1. Time out waiting for rewind
   2. Time out during TEST UNIT READY.
1.1 Introduction

This section covers the cabling and strap options for the optional disk formatter modules. If you purchased a complete SCSI disk system from Macrolink, the hardware will be correctly configured.

Cabling

ST-506 Installation

Install the 50 conductor flat cable from the connector on the SCSI Controller (P1) to the optional SCSI/ST-506 Formatter (J1). Pin 1 must be properly aligned on all connectors. The Formatter may be mounted directly to the disk drive. Connect the 34 conductor control cable from the Formatter (J2) to the drive(s). If this cable is supplied with three connectors, the middle connector should be used for the second drive. Only the drive at the end of the cable must have its termination resistor installed (see your drive manual).

Connect the first data cable from J3 on the formatter to Drive 0. Connect Formatter J4 to Drive 1, if installed.

ST-506 Formatter Configuration

The OMTI model 5100 Formatter is supplied properly configured. You can verify that the following jumpers are in place:

- W0: pins 0
- W1: 2 to 3
- W3: none

In addition, the 220/330 ohm resistor network must be installed in location 1D.

ST-506 Drive Configuration

The address selection for the first drive should be set to 0. The second drive is set to 1. If your drive has an “always selected” option, it must not be enabled. See your drive manual for information on these options.

ESDI Installation

Install the 50 conductor flat cable from the connector on the SCSI controller (P1) to the optional SCSI/ESDI Formatter (J4). Pin 1 must be properly aligned on all connectors.

The Formatter may be mounted directly to the disk drive. Connect the 34 conductor control cable from the Formatter (J2) to the drive(s). If this cable is supplied with three connectors, the middle connector should be used for the optional second drive. Only the drive at the end of the cable must have its termination resistor installed (see your drive manual).

Connect the data cable from J0 on the Formatter to Drive 0. Connect Formatter J1 to drive 1, if installed.

ESDI Formatter Configuration

The Adaptec model ACB-4520 Formatter is supplied properly configured. No jumpers should be in place for Drive 0 operation. A jumper should be in place from A to B for Drive 1 operation. In addition, the 220/330 ohm resistor network must be installed in location RP1.
ESDI Drive Configuration

The address selection for the first drive should be set to 0. The second drive is set to 1. If your drive has an "always selected" option, it should not be enabled. See your drive manual for information on these options.
<table>
<thead>
<tr>
<th><strong>APPENDIX II</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SPECIFICATIONS</strong></td>
</tr>
<tr>
<td>----------------------------------------</td>
</tr>
<tr>
<td><strong>Disk interface</strong></td>
</tr>
<tr>
<td>Any ST-506 or ESDI disk of any size. Contact Macrolink for specific SCSI disk compatibility.</td>
</tr>
<tr>
<td>----------------------------------------</td>
</tr>
<tr>
<td><strong>Format limits</strong></td>
</tr>
<tr>
<td>Maximum cylinders: 65,536</td>
</tr>
<tr>
<td>Maximum heads: 256</td>
</tr>
<tr>
<td>Maximum Sectors/Track: 256</td>
</tr>
<tr>
<td>Bytes/Sector: 256</td>
</tr>
<tr>
<td>----------------------------------------</td>
</tr>
<tr>
<td><strong>CPU</strong></td>
</tr>
<tr>
<td>Any 3200 series CPU with SELCH.</td>
</tr>
<tr>
<td>----------------------------------------</td>
</tr>
<tr>
<td><strong>Software</strong></td>
</tr>
<tr>
<td>OS/32 driver supplied on 1600 bpi tape. On-board formatter and diagnostic software contained in EPROM.</td>
</tr>
<tr>
<td>----------------------------------------</td>
</tr>
<tr>
<td><strong>Data rate</strong></td>
</tr>
<tr>
<td>1.25 MB/second transfers, byte mode.</td>
</tr>
<tr>
<td>----------------------------------------</td>
</tr>
<tr>
<td><strong>Address</strong></td>
</tr>
<tr>
<td>10-bit address decoding. Each SCSI Controller supports up to 7 drives with consecutive address.</td>
</tr>
<tr>
<td>----------------------------------------</td>
</tr>
<tr>
<td><strong>Protocol</strong></td>
</tr>
<tr>
<td>Jumper select: Standard, Alternate &amp; Alternate Bus Switch.</td>
</tr>
<tr>
<td>----------------------------------------</td>
</tr>
<tr>
<td><strong>Size</strong></td>
</tr>
<tr>
<td>7 x 15 inch half-board.</td>
</tr>
<tr>
<td>----------------------------------------</td>
</tr>
<tr>
<td><strong>Power requirements</strong></td>
</tr>
<tr>
<td>5 volts @ 3 amps.</td>
</tr>
<tr>
<td>----------------------------------------</td>
</tr>
<tr>
<td><strong>Product number</strong></td>
</tr>
<tr>
<td>SCSI system includes:</td>
</tr>
<tr>
<td>SCSI Controller, Half-Board Kit, 10' Direct-connect cable set, RETMA Rackmount 5.25&quot; chassis &amp; slides, power supply (110-220 V, 50-60Hz), ST-506 or ESDI disk &amp; formatter module or SCSI disk, OS/32 driver, Installation and maintenance manual.</td>
</tr>
<tr>
<td>20MB 65ms access P/N 202720</td>
</tr>
<tr>
<td>40MB 40ms access P/N 202721</td>
</tr>
<tr>
<td>80MB 26ms access P/N 202722</td>
</tr>
<tr>
<td>182MB 16.5ms access P/N 202723</td>
</tr>
<tr>
<td>Other sizes available. Contact Macrolink for availability.</td>
</tr>
<tr>
<td>OEM kit P/N 202776 includes:</td>
</tr>
<tr>
<td>SCSI Controller, 10' Direct-connect cable set, OS/32 driver, Installation and maintenance manual. Select optional formatter module below.</td>
</tr>
<tr>
<td>ST-506 Formatter Module P/N 202785</td>
</tr>
<tr>
<td>ESDI Formatter Module P/N 202790</td>
</tr>
</tbody>
</table>
### APPENDIX III

#### DRIVE INFORMATION

<table>
<thead>
<tr>
<th>MAKE</th>
<th>MODEL</th>
<th>AVG SEEK</th>
<th>CYL</th>
<th>HD</th>
<th>FMT MB</th>
<th>LBA LBA</th>
<th>CYL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDC</td>
<td>Wren IV</td>
<td>16.5</td>
<td>1365</td>
<td>9</td>
<td>268</td>
<td>1028FC</td>
<td>3309</td>
</tr>
<tr>
<td>Seagate</td>
<td>ST225</td>
<td>65</td>
<td>615</td>
<td>4</td>
<td>17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seagate</td>
<td>ST4026</td>
<td>40</td>
<td>615</td>
<td>4</td>
<td>17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seagate</td>
<td>ST4051</td>
<td>40</td>
<td>977</td>
<td>5</td>
<td>40</td>
<td>26290</td>
<td>488</td>
</tr>
<tr>
<td>Seagate</td>
<td>ST4096</td>
<td>28</td>
<td>1024</td>
<td>9</td>
<td>75.5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>