

***FFD 2.5" and 3.5" Ultra-Narrow SCSI
Flash Disk
User Manual***

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1. GENERAL

This manual provides you with the information you need to properly install your new FFD 2.5” or 3.5” Ultra-Narrow SCSI flash drive. M-Systems recommends that only properly qualified and trained personnel install the drive.

Note: Throughout the remainder of this document the FFD 2.5” or 3.5” Ultra-Narrow SCSI will be referred to as FFD.

The following sections contain information about handling, mounting considerations, address and configuration setups, cabling and connectors, and how to obtain technical assistance and service. In addition, Section 10 provides answers to common questions regarding SCSI devices.

Note: Remember to always back up your data before adding disk drives to your system!

2. KIT CONTENTS

Ensure that your kit contains the following items:

- FFD 3.5” Ultra-Narrow SCSI: Four mounting screws, M-Systems part no. 01-SC-034-00
- FFD 2.5” Ultra-Narrow SCSI:
 - o Four mounting screws, M-Systems part no. 01-SC-059-00
 - o Four jumpers, M-Systems part no. 01-CN-092-00

If any items are missing, please contact your dealer.

3. VISUAL INSPECTION

Before unpacking or handling a drive, take all proper electrostatic discharge (ESD) precautions, including personnel and equipment grounding. Before you begin installing the FFD into your system, verify the following:

- If the shipping container appears to be damaged or water-stained, notify your dealer.
- Remove the disk from its shipping enclosure and inspect it for any damage that may have occurred during shipment. If any damage is observed, notify your dealer.
- Record the disk serial number and shipment date.
- Retain the original shipping enclosure and all packing material for reshipment.

4. HANDLING INSTRUCTIONS

You can prolong the life of your FFD, increase its reliability and prevent unnecessary damage by following the instructions listed below. Failure to follow any of these instructions may void your warranty.

- Always take all proper ESD precautions, including personnel and equipment grounding.
- Always operate the FFD within the environmental specifications.
- Always use a grounded wrist strap when handling the FFD. Drives that are not installed in the system are sensitive to ESD damage.
- Always handle the FFD carefully.
- Never apply DC power to the drive by plugging an electrically live source cable into the drive's power connector.

5. INSTALLATION

5.1 System Requirements

In order to install the FFD 3.5" Ultra-Narrow SCSI in your system, ensure that you have the following items:

- System-mounting hardware
- 4-pin power cable
- 50-pin ribbon SCSI cable
- SCSI host adapter
- Appropriate device driver for your operating system and SCSI host adapter

In order to install the FFD 2.5" Ultra-Narrow SCSI in your system, ensure that you have the following items:

- System-mounting hardware
- Appropriate device driver for your operating system and SCSI host adapter

5.2 FFD Drive Configuration

Before mounting the drive in the drive bay, you must configure the FFD by setting the DIP switches/jumpers on the disk panel to meet your system requirements. Any changes to the DIP switch/jumper settings must be made while the FFD is powered OFF, otherwise the FFD may be damaged or the new settings may not be recognized.

Figure 1 illustrates the orientation of the DIP switches for the FFD 3.5" disk casing.

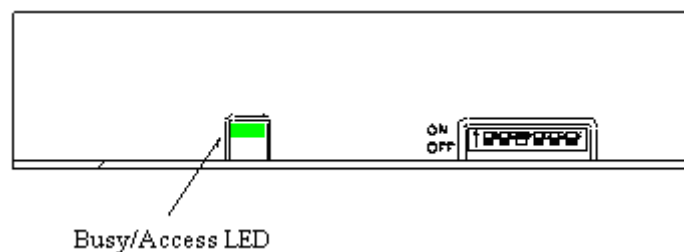


Figure 1: DIP Switches and Busy/Access LED for 3.5" Ultra Narrow SCSI

Figure 2 illustrates the jumper setting for the FFD 2.5" disk casing.

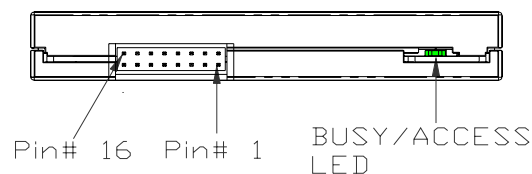


Figure 2: Jumpers and Busy/Access LED for 2.5" Ultra Narrow SCSI

5.3 LED Display

Table 1 describes the color code and status definitions of the FFD LED display located on the front panel.

Table 1: LED Status Description

Status	LED Color Indicator	Description
BUSY/Access	Green	Indicates that the FFD is being accessed. The LED illuminates when the disk is accessed (read/write/format) and remains lit until the access is completed.

5.4 SCSI ID

To select the required ID for the FFD 3.5" Ultra-Narrow SCSI, set the DIP switches as described in Table 2.

Table 2: SCSI ID DIP Switch Settings

SCSI ID	Switch 3	Switch 2	Switch 1
0 ¹	OFF	OFF	OFF
1	OFF	OFF	ON
2	OFF	ON	OFF
3	OFF	ON	ON
4	ON	OFF	OFF
5	ON	OFF	ON
6	ON	ON	OFF
7	ON	ON	ON

1 default factory setting

To select the required ID for the FFD 2.5" Ultra-Narrow SCSI, set the jumpers as described in Table 3.

Table 3: SCSI ID Jumper Settings

SCSI ID	Jumpers 5-6	Jumpers 3-4	Jumpers 1-2
0 ¹	OFF	OFF	OFF
1	OFF	OFF	ON
2	OFF	ON	OFF
3	OFF	ON	ON
4	ON	OFF	OFF
5	ON	OFF	ON
6	ON	ON	OFF
7	ON	ON	ON

1. default factory setting

5.5 Termination

The FFD provides the option of using an internal active termination. When selecting this option, ensure that the SCSI bus is terminated at the two physical ends of the cable.

To select the termination condition for the FFD 3.5" Ultra-Narrow SCSI, set the DIP switches as described in Table 4.

Table 4: Termination DIP Switch Settings

Termination	Switch 4
Enabled ¹	ON
Disabled	OFF

1. default factory setting

To select the termination condition for the FFD 2.5" Ultra-Narrow SCSI, set the jumpers as described in Table 5.

Table 5: Termination Jumper Settings

Termination	Jumpers 7-8
Enabled ¹	ON
Disabled	OFF

5.6 Termination Power (TRMPWR)

The FFD has an internal active TRMPWR (termination power) option. To enable TRMPWR for the FFD 3.5" Ultra-Narrow SCSI, set the DIP switches as described in Table 6.

Table 6: TRMPWR DIP Switch Settings

TRMPWR	Switch 5
Enabled	ON
Disabled ¹	OFF

1. default factory setting

To enable TRMPWR for the FFD 2.5" Ultra-Narrow SCSI, set the jumpers as described in Table 7.

Table 7: TRMPWR Jumper Settings

TRMPWR	Jumpers 9-10
Enabled	ON
Disabled ¹	OFF

1. Default factory setting

5.7 Forced Single-Ended Interface (FFD 3.5" Ultra-Narrow SCSI Only)

When set to the ON position, the FFD forces a Single-Ended (SE) electrical interface. When set to the OFF position, the FFD monitors the variation in the SCSI bus signal for operation in either SE or Low Voltage Differential (LVD) mode.

Table 8: Dip Switch Settings for SE Interface

Forced SE Electrical Interface	Switch 6
Enabled	ON
Disabled ¹	OFF

1. Default factory setting.

5.8 Security Erase Option Jumper Setting

By default, the FFD is shipped with the Security Erase jumpers disabled to prevent data being erased by accident. The Security Erase option can then be enabled by connecting the jumpers as described in Table 9.

Customers can make a direct request to have their orders shipped with the Security Option jumpers set to enabled state.

Table 9: Jumper Settings for SE Interface

Security Erase Option	Jumper 11.12
Enabled	ON
Disabled ¹	OFF

5.9 FFD Installation

The FFD can be installed in any mounting position in the system. Unlike rotating disks that have an axis of rotation, the FFD is not susceptible to damage due to orientation.

Note: It is not necessary to perform a low-level format on the FFD. The drive is shipped low-level formatted and ready for use.

5.9.1 Installing the FFD 3.5" Ultra-Narrow SCSI in a PC

If your SCSI host adapter is not installed in the system, follow the installation instructions supplied with the adapter before proceeding with the FFD installation, detailed below. Most SCSI adapters include a BIOS expansion that allows the system to boot from the FFD after it is properly configured and high-level formatted. In addition, the BIOS expansion automatically installs support for the FFD and assigns it a drive letter for use under DOS or other operating systems.

To install the FFD 3.5" Ultra-Narrow SCSI:

1. Power down the PC and remove the cover.
2. Check the adapter's memory, I/O, and IRQ settings and verify that they do not conflict with any other devices installed in the system.
3. Configure the FFD's DIP switch/jumper settings according to the information provided in Section 5.2-5.8.
4. Verify that the SCSI bus is properly terminated. Refer to Section 5.5 for termination configuration options.
5. Connect a 50-pin ribbon cable between the FFD and the adapter. Make sure to orient the cable so that pin 1 of the FFD is connected to pin 1 of the host adapter. Neither the host adapter nor the FFD must be at the physical end of the cable, unless they are the only two devices connected to the bus. If additional drives are present in the system, make sure that the cable runs from device to device in a continuous manner, without branches.
6. Connect a power cable from the PC's power supply to the FFD.
7. Mount the FFD in a free drive bay.
8. Close the cover and power on the PC. The host adapter's BIOS sign-on message appears, displaying a list of the installed devices (see Figure 4 for an example of an Adaptec host adapter).

You are now ready to use the FFD. IF you encounter any problems, refer to Section 8 for troubleshooting information.

5.9.2 Installing the FFD 2.5" Ultra-Narrow SCSI in a PC

If your SCSI host adapter is not installed in the system, follow the installation instructions supplied with the adapter before proceeding with the FFD installation, detailed below. Most SCSI adapters include a BIOS expansion that allows the system to boot from the FFD after it is properly configured and high-level formatted. In addition, the BIOS expansion automatically installs support for the FFD and assigns it a drive letter for use under DOS or other operating systems.

To install the FFD 2.5" Ultra-Narrow SCSI:

1. Power down the PC and remove the cover.
2. Check the adapter's memory, I/O, and IRQ settings and verify that they do not conflict with any other devices installed in the system.
3. Configure the FFD's DIP switch settings according to the information provided in Section 5.2.
4. Verify that the SCSI bus is properly terminated. Refer to Section 5.5 for termination configuration options.
5. Connect a 50-pin ribbon cable between the FFD and the adapter. Make sure to orient the cable so that pin 1 of the FFD is connected to pin 1 of the host adapter. Neither the host

adapter nor the FFD must be at the physical end of the cable, unless they are the only two devices connected to the bus. If additional drives are present in the system, make sure that the cable runs from device to device in a continuous manner, without branches.

6. Connect a power cable from the PC's power supply to the FFD.
7. Mount the FFD in a free drive bay.
8. Close the cover and power on the PC. The host adapter's BIOS sign-on message appears, displaying a list of the installed devices (see Figure 4 for an example of an Adaptec host adapter).

You are now ready to use the FFD. IF you encounter any problems, refer to Section 8 for troubleshooting information.

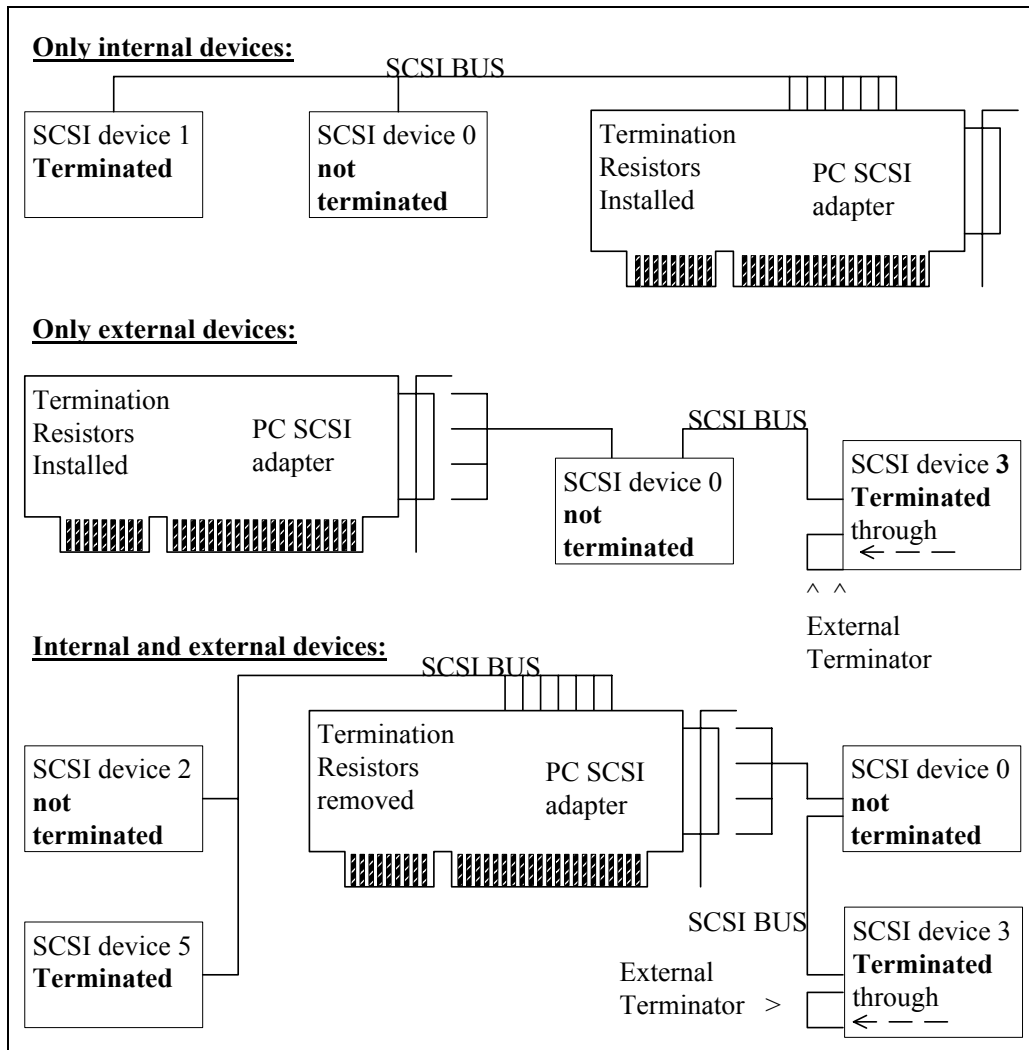


Figure 3: SCSI Cable Connection and Termination Configuration

```
Adaptec AHA-2940 Ultra/Ultra W BIOS v1.23
(c) 1996 Adaptec, Inc. All Rights Reserved
<<< Press <Ctrl> <A> for SCSI Select (TM) Utility >>>

SCSI ID: LUN NUMBER #:# 0:0 – M-Systems FFD 350/FMAX 5D – Drive D:
(81h)
```

Figure 4: BIOS Sign-On Message

5.9.3 Using the FFD on a DOS-Based Platform

After physically installing the FFD, it must be installed as a disk drive under DOS. Run the DOS commands listed below and follow the instructions displayed for each command. For more information regarding the DOS commands, refer to your DOS manual.

To install the FFD as a disk drive under DOS:

1. Run the DOS FDISK program to partition the FFD. If you want the FFD to be a bootable drive, run “Set Active Partition” using the FDISK utility.
2. Run the DOS FORMAT command to high-level format the FFD.
3. If you want the FFD to be a bootable drive, run the DOS SYS command.

Note: Some SCSI host adapters require the installation of a device driver to access SCSI disk drives. In this case, follow the instructions included with your adapter to configure the system and install the FFD as another drive under DOS.

5.9.4 Using the FFD in a UNIX-Based Platform

Most UNIX systems come pre-configured with a SCSI host adapter and a hard disk already installed on the SCSI bus. Follow the instructions below to install the FFD in your system. If a platform does not have room for additional drives, an external unit is required to mount the FFD. External units typically include a 3.5” drive bay, power supply and cables.

WARNING! Installing any disk drive on a UNIX system is a very complex procedure. If you are not an expert, consult your system administrator for help. Failure to do so can lead to loss of data on existing drives in the system.

Refer to your UNIX documentation for more details regarding the installation procedure for SCSI disks under UNIX.

To install the FFD in a UNIX-based platform:

1. Power down the system.
2. Configure the FFD's DIP switch/jumpers settings according to the information provided in Sections 5.2 - 5.8.
3. Verify that the SCSI bus is properly terminated. Refer to Section 5.5 for termination configuration options.
4. Connect a 50-pin ribbon cable between the FFD and the adapter. Make sure to orient the cable so that pin 1 of the FFD is connected to pin 1 of the host adapter. Neither the host adapter nor the FFD must be at the physical end of the cable unless they are the only two devices connected on the bus. If additional drives are present in the system, make sure that the cable runs from device to device in a continuous manner, without branches. Note that some systems require a cable with two different types of connectors, one for the FFD and one to interface with the system's host adapter.
5. Connect a power cable from the system's power supply to the FFD.
6. Mount the FFD into a free drive bay.
7. Close the cover and turn the power on.

You are now ready to install the drive under UNIX. If you encounter any problems, refer to Section 8 for troubleshooting information.

In order to proceed with the installation, you must have Supervisor privileges on your UNIX system. If you do not have these privileges, contact your system administrator.

To install the FFD as a drive under UNIX:

1. Run the UNIX *format* utility and follow the displayed instructions.
2. Select the FFD from the list of drives.
3. Define a new drive and manually enter the drive parameters using the *type* option. Refer to Table 10 for a list of the appropriate drive parameters.
4. Define the partitions according to your system requirements.
5. Run the *format* and *analyze* commands.
6. Use the *label* command to partition and initialize the drive.
7. Exit the *format* routine.
8. Build the file system on the FFD, using the UNIX *makefs* utility.
9. Mount the drive and place the appropriate link commands in your startup script.

6. DRIVE PARAMETERS

Most SCSI device drivers can automatically detect the total number of sectors on the FFD, using the READ CAPACITY command, and configure them accordingly. However, some older device drivers must obtain the drive geometry parameters manually. The physical drive parameters are only a convention, and have no effect on how data is stored on the FFD.

Table 10: FFD 3.5" Ultra-Narrow SCSI Available Capacities

Unformatted Disk Capacity (MB) ¹	Formatted Disk Capacity (No. of Blocks) ²	No. of Logical Blocks (Sectors)	Cylinders	Heads	Sectors/Cylinder	Bytes/Sector
512	0EEC00	977,920	3BB	0010	0040	512
1024	1DF600	1,963,520	77D	0010	0040	512
1536	2D0000	2,949,120	B40	0010	0040	512
2048	3C0A00	3,934,720	F02	0010	0040	512
2560	4B1400	4,920,320	12C5	0010	0040	512
3072	5A1E00	5,905,920	1687	0010	0040	512
4096	783200	7877120	1E0C	0010	0040	512
5120	964800	9,848,832	2592	0010	0040	512
6144	B45C00	11,820,032	2D17	0010	0040	512
7168	D27000	13,791,232	349C	0010	0040	512
8192	F08400	15,762,432	3C21	0010	0040	512
9216	10EB000	17,739,776	43AC	0010	0040	512
10240	12CAE00	19,705,344	4B2B	0010	0040	512
12288	0168D600	23,647,744	5A35	0010	0040	512
14336	1A50000	27,590,656	6940	0010	0040	512
16384	1E12800	31,533,056	784A	0010	0040	512
18432	21D5200	35,475,968	8754	0010	0040	512
20480	2597A00	39,418,368	965E	0010	0040	512
22528	295A400	43,361,280	A569	0010	0040	512
24576	2D1CC00	47,303,680	B473	0010	0040	512
26624	30DF600	51,246,592	C37D	0010	0040	512
28672	34A1E00	55,188,992	D287	0010	0040	512
30720	3864800	59,131,904	E192	0010	0040	512
32768	3C27000	63,074,304	F09C	0010	0040	512
34816	3FE9A00	67,017,216	FFA6	0010	0040	512

Table 11: FFD 2.5" Ultra-Narrow SCSI Available Capacities

Unformatted Disk Capacity (MB)¹	Formatted Disk Capacity (No. of Blocks)²	No. of Logical Blocks (Sectors)	Cylinders	Heads	Sectors/Cylinder	Bytes/Sector
512	0EFB00	981,760	3BE	0010	0040	512
1024	1E0500	1,967,360	781	0010	0040	512
1536	2D0F00	2,952,960	B43	0010	0040	512
2048	3C1900	3,938,560	F06	0010	0040	512
3072	5A2E00	5,910,016	168B	0010	0040	512
4096	784200	7,881,216	1E10	0010	0040	512
5120	965700	9,852,672	2595	0010	0040	512
6144	B46B00	11,823,872	2D1A	0010	0040	512
7168	D28000	13,795,328	34A0	0010	0040	512
8192	F09400	15,766,528	3C25	0010	0040	512
9216	10EBF00	17,743,616	43AF	0010	0040	512
10240	12CBD00	19,709,184	4B2F	0010	0040	512
11264	14AD200	21,680,640	52B4	0010	0040	512
12288	168E600	23,651,840	5A39	0010	0040	512
13312	186FB00	25,623,296	61BE	0010	0040	512
14336	1A50F00	27,594,496	6943	0010	0040	512
15360	1C32400	29,565,952	70C9	0010	0040	512

- Notes: 1. Memory capacity is specified when placing device orders.
2. The number of logical blocks as reported by the read capacity command (in Hex Decimal format), which yields one block less than the number of logical blocks (in Decimal format).

7. LED INDICATORS

Table 12: LED Status Description

Status	LED Color Indicator	Description
BUSY	Green	Indicates that the FFD is being accessed. The LED is lit when the disk is accessed (read/write/format) and remains lit until the access is completed.

During the Sanitize process, an LED indicates process status and completion, as follows:

- The Busy LED is lit while erasing.
- The Busy LED blinks four times when the erase process is complete.
- The Busy LED blinks while the media is being filled.
- The Busy LED is lit when remounting the media.
- The Busy LED turns off at the end of the complete Sanitize process.

8. TROUBLESHOOTING

8.1 Built-In Self Test

The FFD performs a self-test during power up. If the test fails, the green LED flashes at a rate of 1 Hz. If you encounter this problem, please contact your dealer or technical support.

8.2 Common Problems

The following sections describe common problems and their causes.

8.2.1 Installing Your SCSI Host Adapter

A SCSI host adapter is basically a standard PC board, regardless of the bus system used. The following procedure details a sample installation process.

To install a standard Adaptec 1542CF:

1. Check the default values of the board and verify that they do not conflict with other devices in the PC.
2. Check the I/O-address range, the IRQ(s), DMA channel, and the BIOS address for conflicts. When using a memory manager, exclude the selected BIOS address space from its memory pool. When selecting all resources, enter them in your list of resources.
3. Install the host adapter in the PC and power it ON. If you did not un-install the BIOS, a BIOS boot message similar to the following is displayed:

```
Adaptec AHA-2940 Ultra/Ultra W BIOS v1.23
(c) 1996 Adaptec, Inc. All Rights Reserved
<<< Press <Ctrl> <A> for SCSI Select (TM) Utility >>>

SCSI ID: LUN NUMBER #:# 0:0 - DEC DSP3085S-B SD16 - Drive C: (80h)
SCSI ID: LUN NUMBER #:# 1:0 - M-Systems FFD 350/FMAX 5D - Drive D: (81h)
```

The boot-up message lists all devices on the SCSI bus that are powered ON. Additionally, it indicates if any of the devices are disks that are supported by the BIOS.

4. Power off the PC and install the SCSI device(s). If you have more than one internal device:
 - o Set up a unique SCSI ID (not 7) on each of the devices.
 - o Select one of these devices to be at the end of the cable.
5. Make sure that the selected device has its termination enabled, and disable termination on all other devices. Termination is either enabled via the jumpers, or by installing/removing several resistor packs on the device PCB.
6. Attach the SCSI cable to the host adapter and to the last device. Do not forget the device power connector.

7. Power on the PC and verify that the host adapter recognizes the SCSI device.
8. If the SCSI device is recognized, power off the PC and install the next device. Verify recognition for the next device and then install. From this point on, the system should be up and running.
9. If you performed a BIOS uninstall procedure, or if the host adapter has no BIOS, the system will not recognize the devices until the drivers are installed.

8.2.2 Termination Configuration

When configuring termination, the basic rule to remember is that termination is required at both ends of the SCSI chain.

- To install a new device as the last device on one of the sides of the complete cable, you must enable termination on the device.
- When replacing another device that was previously at the end of the cable and is now installed on another connector on the bus, you must disable termination on the device.
- When installing an external SCSI device in a system that has only internal devices, you must disable the host adapter's termination using one of the following methods:
 - o Using software (as with the newer Adaptec).
 - o By removing the terminator packs (typically three) near the host adapter's SCSI connector.
 - o By setting a jumper on the host adapter.

The situation is the same if you previously had only external devices.

8.2.3 SCSI ID Configuration

When configuring the SCSI ID, first locate a free SCSI ID. The most effective method is to look at the host adapter boot-up message and check for free IDs.

```
Adaptec AHA-1540CF/1542CF BIOS 2.01s
(c) 1993 Adaptec, Inc. All Rights reserved
Press <Ctrl><A> for SCSISelect(TM) Utility!
Target #0 - DEC          DSP3085S-B SD16      - Drive C: (80h)
Target #1 - QUANTUM     LP425S   606_      - Drive D: (81h)
Target #3 - TOSHIBA     CD-ROM XM-3301T
Target #4 - SDI         LASERSTOR E5
```

In this example, ID **2**, **5** and **6** are free for new devices. ID **7** cannot be used, as this is the host adapter. The FFD uses DIP switches to set the ID in a 4-2-1 configuration. The sum of the switch values determines the ID. For example, if you want a hard disk with ID **0**, set all three switches to OFF.

8.2.4 Solving Installation Problems

The problems that arise in most installations are described below.

Unstable Termination

This occurs when there is a passive termination with Fast-SCSI devices on the bus.

Incorrect Termination

This occurs when there are too many devices terminated, or when the SCSI bus cable ends are not terminated.

Cables

Avoid using homemade, short, flat ribbon cables with bad contacts or cheap cables. Do not mix round cables with flat cables.

Cable Length

Ensure that the cable length is within the limit specified in the standard, and avoid using cables that are too long to support the transfer rate.

Device ID Conflict

This occurs when a new device is added with a SCSI ID identical to an existing device on the bus.

Missing TRMPWR

This occurs when the host adapter or at least one of the devices on the SCSI bus does not supply termination power.

Missing Software Device Driver

Some host adapters do not install support for SCSI drives as an expansion BIOS. In this case, load an additional driver for your operating system after the system boots. Note that this configuration cannot boot from the SCSI drive.

9. GETTING HELP

For technical assistance with the installation and configuration of your FFD, contact one of the sources listed in this manual. Please have the following information available to aid the customer support representative in providing you with the best possible assistance:

- Product and serial number of your FFD
- Description of your computer hardware (manufacturer, model, attached devices, etc.)
- Description of your SCSI host adapter and associated drivers
- Description of your software (operating system, version, application software, etc.)
- A complete description of the problem
- The exact wording of any error messages

Before contacting M-Systems directly, first contact your dealer. If your dealer cannot provide the help you need, you can obtain technical support from M-Systems directly at one of the numbers listed at the end of this manual.

10. FREQUENTLY ASKED QUESTIONS (FAQS) ABOUT SCSI

Q: What is SCSI?

A: SCSI (Small Computer System Interface) is a general-purpose, parallel bus system. It originated with Shugart's 1979 SASI (Shugart Associates System Interface), and Shugart and NCR presented it to the ANSI in 1981. It became official in 1986, when the ANSI-committee X3T9.2 defined the SCSI-1 spec as Document X3.131-1986.

SCSI is now an acknowledged and very well standardized multipurpose interface in all its flavors. SCSI supports a wide variety of devices, including hard disks, removable disks, magneto-optical devices, tape drives, printers, processors, WORMs, CD-ROMs, scanners, medium-changers (jukeboxes), and communications devices.

Q: What is SCSI-1?

A: SCSI-1 defined a universal 8-bit I/O bus that allows connection of up to 8 devices, including the host adapter. Every device must have a unique ID in the range of 0-7. SCSI-1 was a high-speed bus system compared to the era's existing peripheral devices.

Q: What is SCSI-2?

A: Although SCSI-1 was the first approved standard, it lacked various parameters and definitions. This led to the development and approval of SCSI-2 before SCSI-1 was even officially approved. In 1986, when SCSI-1 was officially approved, SCSI-2 already was far along in the development process. The official SCSI-2 designation is X3.131-1994.

SCSI-2 provided a better formal definition, removed some oddities and obsolete items, added some extensions, and most importantly, added the ability to double and even quadruple data transfer speed on the SCSI bus with its Fast SCSI and Wide SCSI options.

Q: What is Fast SCSI?

A: Fast SCSI was defined as an option with SCSI-2. Despite the tendency of the market to define Fast-SCSI as "different but faster SCSI", Fast SCSI is simply an additional synchronous data transfer mode with tighter timing to achieve the 10 MB/sec maximum data rate. As with any other synchronous transfer mode, only data transfers are synchronous, while commands are transferred asynchronously.

Q: What is Wide SCSI?

A: Wide SCSI is another SCSI-2 option. There are two defined types, 16-bit and 32-bit. Wide SCSI can be combined with Fast SCSI to provide up to a 40 MB/sec data rate.

The X3T9.2 committee defined a 68-pin SCSI cable for the 16-bit type, and a combination of a standard 8-bit 'A' and a 68-pin 'B' cable for 16-bit and 32-bit Wide SCSI. Wide SCSI host adapters can address standard SCSI devices if the correct adapter cable is used.

Q: What is Plug-and-play (P&P) SCSI?

A: Plug-and-play SCSI is an extension of the generic plug-and-play specification. P&P is an approach for defining an auto-configuring environment for ISA boards. One of the key features of P&P-SCSI is SCAM.

Q: What is SCSI Configured AutoMagically (SCAM)?

A: SCAM is a protocol for automatic SCSI ID assignment. It is included in the SCSI-3 parallel interface drafts. The SCAM master (typically the host adapter) scans the bus for attached SCSI devices. For compatibility, it also needs to find and identify legacy (standard) SCSI devices. This scan provides the SCAM master with a map of the attached devices, and it then assigns a valid soft ID to each SCAM-compliant SCSI device. The SCAM master keeps this device table in non-volatile memory to provide an identical ID setup for further boot processes.

Q: What is a SCSI ID?

A: Every SCSI device must have a unique ID on the bus. For this reason, most devices have three ID jumpers to set the SCSI ID from 0-7. With the exceptions of ID 0 and 7, there is no particular ID that must be assigned to a particular device type. Additionally, every ID can have up to seven subunits identified by a LUN (Logical Unit Number), enabling addressing multiple devices through a single ID.

Table 13: General Description of SCSI ID

ID Number	Description
ID 7	Reserved for the host adapter.
ID 0	For a boot device, usually a hard drive.
ID 1	Normally used for a second hard drive, although it is not required.
ID 2 and up	Used for other devices, for example, CD-ROM.

Q: What are Termination and TRMPWR?

A: The SCSI bus needs to be terminated. This means that both ends of the bus must have a circuit of some sort to eliminate signal reflections that otherwise would occur from the physical ends of the bus. The termination circuit requires power, generally supplied by a line called TRMPWR or Termination Power on the bus. Typically, the TRMPWR source is the host adapter. However, multiple devices can supply TRMPWR without causing damage.

The old, passive termination (Alternative 1 in the SCSI-2 specification) came with SCSI-1 and consisted of a 220 Ω pull-up and a 330 Ω pull-down resistor on each signal.

Active termination (Alternative 2 in the SCSI-2 specification) consists of a 110 Ω resistor on each signal, pulled up to a 2.85V reference supply.

Q: What types of SCSI connectors are available?

A: There are many different connectors for SCSI. Some of them were defined with SCSI-1 and are now obsolete, such as the DB-50 connector. The most common connectors in use today are the 50-pin Centronics-type SCSI-1 connector, the 50-pin High-Density SCSI-2 connector and the DB-25 connector that Apple introduced for Macintosh computers. Most new host adapters and external devices use the SCSI-2 HD.

Q: What is important to know about cables and cable lengths?

A: Cable lengths in SCSI-1 and SCSI-2 were defined up to 6 m maximum, for a single-ended SCSI bus and up to 5 MHz data rate.

SCSI-2 allows up to a 10 cm cable “stub” length from the device to the main bus cable. Sometimes this length is exceeded, causing higher capacitive loading.

With Fast SCSI-2, the highest possible data rate doubled to 10 MHz in synchronous mode and the maximum cable length was halved to 3 m.

A differential SCSI bus can use the full cable length up to 25 m (approx. 82 ft) while maintaining a maximum data rate of 10 MHz. This is especially important with external devices, as most external single-ended cables prohibit the use of 10 MHz.

Q: What kind of signal levels does SCSI produce?

A: Single-Ended SCSI signal levels vary from 0V to +5.25V. All signals are active low. True is a voltage level between 0 and +0.8 V and false is a voltage between +2 and +5.25V. Differential SCSI signals conform to the EIA RS-485 interface.

Q: What are Single-Ended and Differential SCSI?

A: There are two different electrical SCSI interfaces, Single-Ended and Differential SCSI. Single-Ended and Differential devices are **not** electrically compatible with each other. Mixing them will destroy the Single-Ended devices on the bus and possibly the differential devices.

Single-Ended SCSI has single-ended TTL transceivers that allow up to 5 MHz data transfer rates with up to 6 m cable length, or up to 10 MHz data transfer (Fast SCSI) with up to 3 m cable length.

Differential SCSI has RS-485-style transceivers that allow up to 10 MHz data transfer rate, but with cable lengths up to 25 m and with much better S/N conditions.

Q: What are Synchronous and Asynchronous Transfers?

A: SCSI can use two handshaking modes, Asynchronous and Synchronous. The main difference is as follows:

- Asynchronous is basically a “classic” REQ/ACK handshaking system for each data packet
- Synchronous, multiple REQs can be issued before receiving ACKs, thus increasing the overall transfer rate.

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