

ST21M, ST21R

ST22M, ST22R

ST412 Interface Controller

Installation Guide

Introduction

The ST21 and ST22 are 16-bit ST412 interface controllers designed for use in AT-type systems.

- The ST21M and ST22M are designed for use with drives employing MFM data encoding and a 5.0 Mbit/sec. I/O data transfer rate. Seagate Technology, Inc. assumes no liability for installation of an MFM controller with an RLL-certified drive.
- The ST21R and ST22R are designed for drives using RLL (2,7) data encoding and a 7.5 Mbit/sec. I/O data transfer rate. Seagate RLL drives are easily recognized by an *R* after the model number, e.g., ST157R. Seagate Technology, Inc. assumes no liability for installation of an RLL controller with an MFM-certified drive.
- The ST22M and ST22R have an onboard floppy diskette controller which supports two diskette drives in the following formats:
 - 3.5-inch, 720K Byte/1.44M Byte
 - 5.25-inch, 360K Byte/1.2M Byte
- The ST21 and ST22 have a unique recording format and therefore require all attached drives to be installed by one of the processes described in this guide before operation.

This publication may be used with Seagate Paired Program drives or as a controller-only installation guide.

Paired Program drives are shipped with a Seagate controller. They are recognized by a *PR* label on the drive top cover. Paired drives are shipped formatted with a small DOS partition containing the installation program, INSTALLR, which will low-level format and partition your drive. You must supply the DOS program. The ST21/ST22 can recognize whether a drive has the Paired Program software loaded, or has been previously installed.

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Paired Program drives with formatted capacities greater than 32 MBytes have DISK MANAGER (customized by ONTRACK for Seagate) partitioning software loaded. Instructions on installing Paired Program drives begin in Section 3.0.

Before You Begin...

Inspect the controller, drive, cables, mounting hardware/accessories, documentation and packaging. If any item is incorrect, missing or appears damaged, contact your Distributor or Dealer immediately.

Handling: Improper handling during transit/shipping accounts for many "installation" problems. Prior to installation, handle your drive/controller carefully.

Observe Static-Discharge Precautions: Keep the drive/controller in their static-shielded bags until you are ready to complete the installation. Use a grounded wrist-strap at your workstation; if unavailable, ground yourself frequently by touching the metal chassis of the system before handling any components. Avoid static-inducing carpeted areas.

Shipping: When transporting or shipping a drive or controller, a Seagate-approved container must be used. Keep your original box. They are easily identified by a red label identifying them as a *Seagate Approved Package*.

Shipping a drive in a non-approved container will void the drive warranty.

Repair centers may refuse receipt of components improperly packaged or obviously damaged in transit. Contact your Distributor to purchase additional boxes. Seagate recommends shipping by an air-ride carrier experienced in handling computer equipment.

Maintenance: Seagate disc drives do not require any preventative maintenance. The head/disc assembly is sealed and does not contain any user-serviceable components. Tampering with the factory-seal will void the warranty.

Warranty: Contact your Seagate Authorized Distributor or supplier for warranty information.

1.0 ST21, ST22 Setup and Installation

Caution: Do not handle a drive/controller without observing static-discharge precautions. A grounded wrist-strap is preferred; if unavailable, ground yourself frequently by touching the metal chassis of the system before handling any components. Do not unpack the drive/controller until you are ready to complete the installation.

During the formatting process, you will be asked to enter some simple drive specifications. Refer to Figures 1-2 for basic specifications. For non-Seagate drives, refer to the manufacturer's instructions.

Important Note: A Drive Type must be set in the AT system CMOS if the controller BIOS is disabled. See Section 2.6.

Figure 1: Seagate MFM Drive Setup — ST21M/ST22M

Model	Formatted MBytes	R/W Heads	Data Cyls.	Sectors per Track	R/W Head Auto-Park	Write Precomp.
ST124	21.4	4	615	17	No	None
ST125	21.4	4	615	17	Yes	None
ST138	32.1	6	615	17	Yes	None
ST151	42.5	5	977	17	Yes	None
ST225	21.4	4	615	17	No	Cylinder 300
ST252	42.8	6	820	17	Yes	None
ST251	42.8	6	820	17	Yes	None
ST4053	44.5	5	1,024	17	Yes	None
ST4096	80.2	9	1,024	17	Yes	None
ST1100	83.9	9	1,072*	17	Yes	None

Figure 2: Seagate RLL Drive Setup — ST21R/ST22R

Model	Formatted MBytes	R/W Heads	Data Cyl.	Sectors per Track	R/W Head Auto-Park	Write Precomp.
ST138R	32.7	4	615	26	Yes	None
ST157R	49.1	6	615	26	Yes	None
ST225R	21.17	2	667	31	No	None
ST238R	32.7	4	615	26	No	None
ST250R	42.9	4	667	31	No	None
ST278R	65.5	6	820	26	Yes	None
ST277R	65.5	6	820	26	Yes	None
ST4144R	122.7	9	1,024	26	Yes	None
ST1150R	128.4	9	1,072*	26	Yes	None

Data Cylinders: User cylinders are calculated from logical zero, i.e., 0 to 614 equals 615 cylinders.

* **Note:** The ST21/ST22 can address a maximum of 16 R/W heads and 1,024 cylinders.

Interleave: Use 1:1 interleave as indicated in installation routine.

Read/Write Head Parking: A PARK program is preloaded on all Paired Program drives, PARK.EXE or PARK.COM, which the INSTALLR software will copy to a diskette during installation. The following drives require parking before the drive/system is transported: **ST124, ST225, ST225R, ST238R, ST250R.** Refer to Section 2.7.

1.1 Controller Setup

1.1.1 Set Controller BIOS and Drive Address: JP1-JP2

Controllers and add-in boards are installed in the bus slots on the computer's motherboard. These slots are recognized by the computer BIOS address number. Each board installed must be jumpered for a specific address.

C8000_H-CBFFF_H is the default BIOS address for the ST21/ST22. If this address is already occupied by another board, use the jumpers provided to change the Seagate controller to another address. Refer to Figures 4-5.

When installing the ST21/ST22 in a system already containing a hard disc controller, the Seagate controller must be jumpered at a higher BIOS address than the resident controller. See Figures 4-5.

Figure 3: Controller BIOS and Port Addresses

I/O Port Address	JP1	JP2	BIOS Address	Hard Drive I/O Ports	Diskette Drive I/O Ports
Primary	Open	Open	C8000 _H to CBFFF _H	1F0-1F7 3F6-3F7	3F0-3F5 3F7
	Open	Shorted	CC000 _H to CFFFF _H	1F0-1F7 3F6-3F7	3F0-3F5 3F7
Secondary	Shorted	Open	D8000 _H to DBFFF _H	170-177 376-377	370-375 377
	Shorted	Shorted	DC000 _H to DFFFF _H	170-177 376-377	370-375 377

1.1.2 Floppy Diskette Enable/Disable: JP4 (ST22 Only)

The ST22 features an onboard floppy diskette controller. It is shipped with the controller enabled, to disable remove the jumper at JP4.

Note: Most systems will not support the secondary floppy diskette I/O addresses.

1.1.3 BIOS Enable/Disable Jumper: JP3

The ST21 and ST22 are shipped with the BIOS enabled, JP3 open. To disable the BIOS, attach jumper at JP3. Refer to Figures 4-5.

1.1.4 Remote LED Connector: J6

The ST21 and ST22 provide for connection to the drive activity LED found on most AT-type systems. Connect the remote LED cable to J6.

Figure 4: ST21M/ST21R — No Floppy Diskette Controller

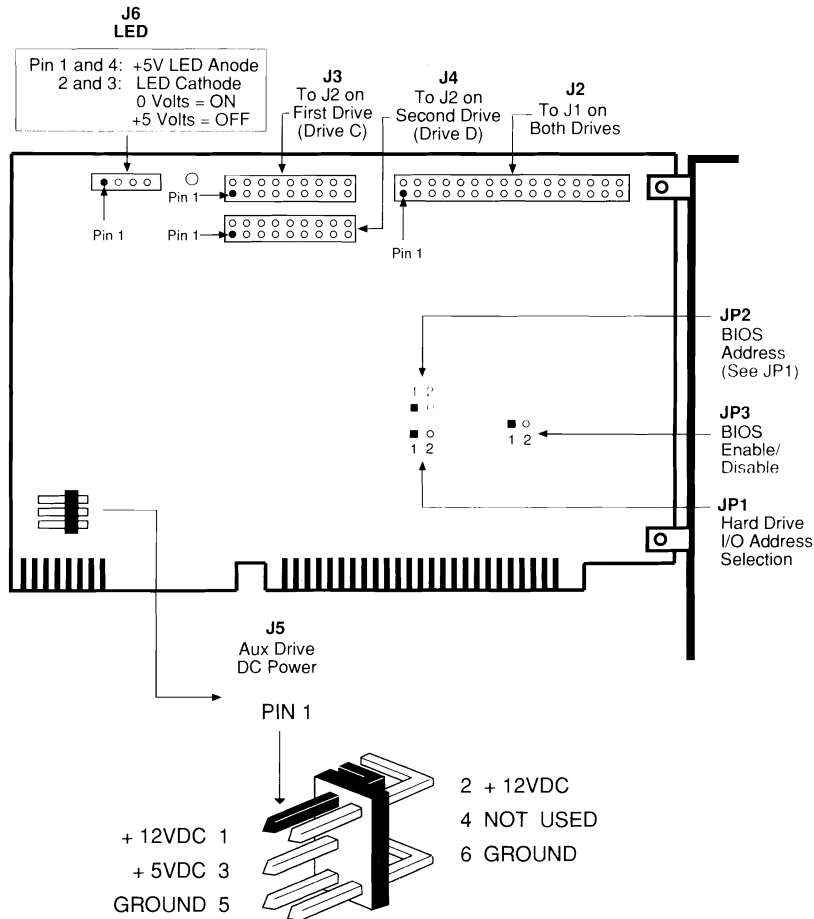
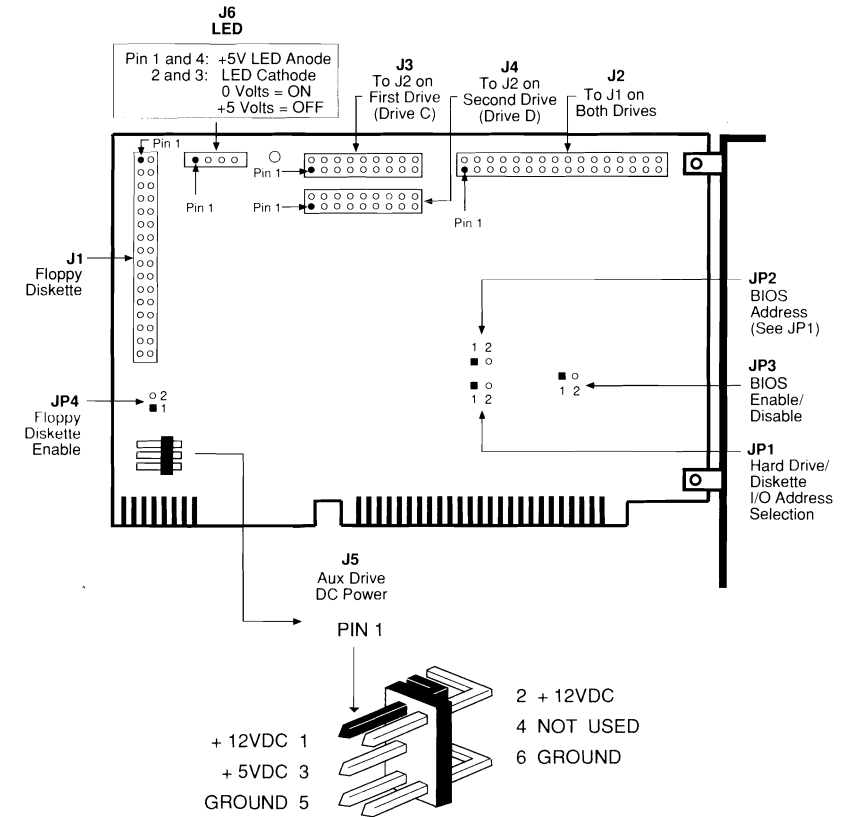


Figure 5: ST22M/ST22R — With Diskette Controller



1.3 Controller Installation

CAUTION: VERIFY THAT THE POWER IS OFF.

1. **Remove the System Cover (Refer to your computer system manual).**

Access to the screws is usually at the back of the system. Save the screws. Systems vary, but most require you to slide the cover forward for removal.

2. **Verify Correct Controller Jumper Option Selections**

Refer to Section 1.1

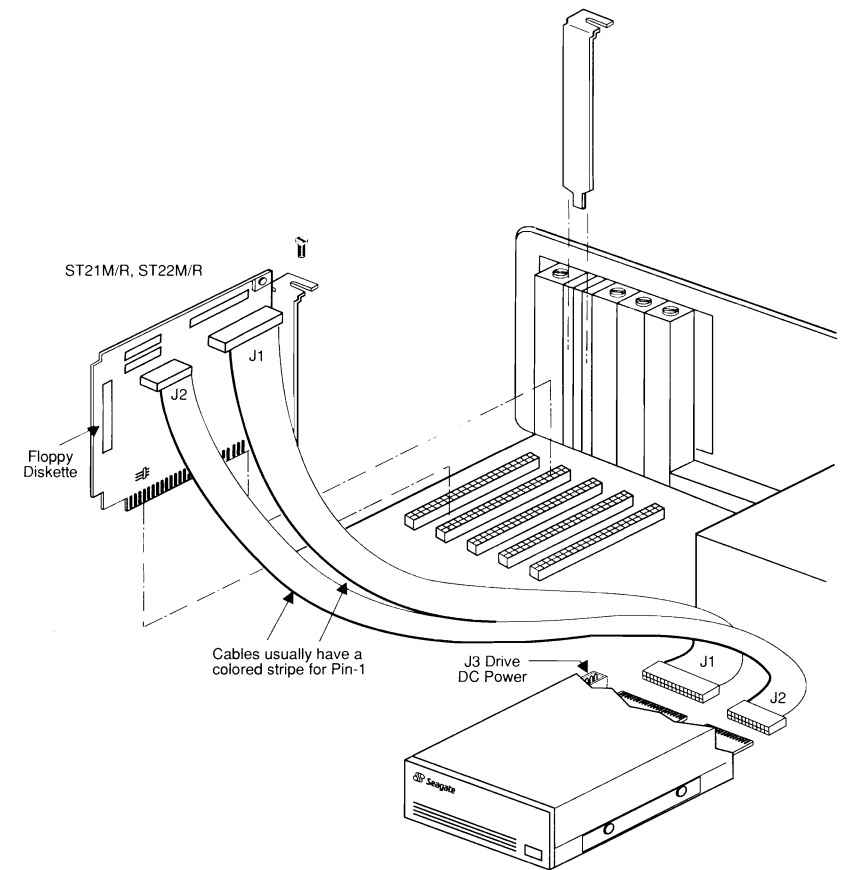
Note: Normally, drive power is supplied via a power harness from the system power supply directly to the drive's J3 DC power connector. The J5 connector on the ST21/ST22 can be used to provide disc drive power in systems lacking an extra power harness or for *Drive-on-a-Card* applications. Refer to Figures 4-6.

A cable splitter, often called a Y-cable, may be used to tap off the diskette drive power cable. They are available from most Distributors/Dealers.

3. **Install the Controller as Illustrated in Figure 6.**

Verify correct cable attachment and replace the system cover.

Figure 6: Controller Installation



2.0 Preparing to Format Your Drive

Please read this section before proceeding to the formatting instructions. Be sure to back up any drive containing data. Formatting at any level may result in partial or complete loss of data. Seagate Technology, Inc. assumes no liability for lost data.

- Always use the same version of DOS throughout the entire process. On two-drive systems: Always use the same version of DOS on both drives.
- For optimum performance, format the drive installed in your system in the same orientation in which it will be used.
- The ST21 and ST22 have the ability to flash controller error conditions via the drive front-panel LED. Refer to Section 5.0

2.1 Paired Program Drive Formatting

Paired Program drives are shipped with a small DOS partition containing Installation software and a README file which has the latest information for the drive being installed. See Section 3.0.

2.2 Non-Paired Drive formatting

Seagate non-paired drives do not have installation software or recognizable format. These drives may be installed by following the procedures in Section 4.0.

2.3 Paired Drives: Less than 32 Formatted MBytes

You will need one DOS-bootable diskette that has the boot files from the version of DOS that you plan to use on your Seagate drive. This diskette should also contain the FORMAT program provided with DOS, and sufficient space (approximately 50K Bytes) to save the installation programs from the hard drive. The diskette must not be write-protected.

2.4 Paired Drives: Greater than 32 Formatted MBytes

You will need two diskettes; one DOS-bootable with the version of DOS you plan to use. The second diskette must have at least 360K Bytes available to save the installation and DISK MANAGER programs. The diskettes must not be write-protected.

2.5 CMOS Configuration

If you are installing your drive in a PC/AT and a hard drive is not presently attached or operational, the hard drive count in CMOS will already be set to zero.

If a standard hard drive is already attached and operating, it will be the first drive and the Seagate Paired Program drive will be Drive 2. It is not necessary to change the CMOS hard drive count when installing with ST21/ST22 controllers.

2.6 BIOS Enable/Disable

The ST21 and ST22 are shipped with the BIOS enabled, JP3 open. To disable the BIOS, attach jumper at JP3. Refer to Figures 4-5.

2.6.1 BIOS Enabled

Drive	Controller BIOS Address	CMOS Setting
C	C8000 or CC000 (Primary I/O)	Set to 0 or a type which matches the R/W head and cylinder specifications
D	C8000 or CC000 (Primary I/O)	Do not set drive in CMOS
C or D	D8000 or DC000 (Secondary I/O)	Do not set drive in CMOS

2.6.2 BIOS Disabled

Set all hard drives attached to the ST21/ST22 in system CMOS to a type that matches the R/W head and cylinder specifications.

Remove jumpers JP2 and JP3.

Important Note: The ST21/ST22 must be the primary controller (i.e., DRIVE C:) when running with the BIOS disabled.

2.7 Read/Write Head Parking

A read/write head parking program, PARK.EXE or PARK.COM, is preloaded on all Paired Program drives.

The following drives require running this program before the drive/system is transported: **ST124, ST225, ST225R, ST238R, ST250R.**

If your drive is not Paired, see your Distributor/Dealer for a read/write head parking program.

2.8 AT Systems with 40-Pin Hard Drive Interface (IDE)

Some newer AT systems have a 40-pin hard drive AT interface connector on their motherboard. On most systems, the AT interface connector must be disabled before the ST21/ST22 can be installed. Refer to the hardware installation manual supplied with your system to determine the interface enable/disable requirements.

The ST21/ST22 can operate concurrently with an installed 40-pin drive, however the ST21/ST22 BIOS must be enabled and JP1-JP2 jumpered to operate at the secondary address. Refer to Section 2.6.

3.0 Paired Program Installations

Read Sections 1-2 before beginning any formatting. The entire software installation routine is menu-driven and takes from ten to thirty minutes, depending on drive size. For specific DOS questions, refer to the DOS manual supplied with your system. After the format is completed, the read/write heads will be parked. At the next power-up, the system will boot from the hard disc.

3.1 Paired Program Formatting

Place a DOS-bootable diskette (to boot simply means to start the system) in Drive A and switch the power on and follow the instructions displayed on the screen. Type:

C:INSTALLR C

If you are installing a second drive, type:

D:INSTALLR D

If you are installing a drive with DISK MANAGER software, and you already have a hard disc in your system, you must copy the DMDRVR.BIN and CONFIG.SYS files from the DISK MANAGER diskette to the root directory of the existing (first, or boot) drive.

If you already have a CONFIG.SYS file on the boot drive, update the file to include the following line: **DEVICE=DMDRVR.BIN**

Refer to your DOS manual for instructions on editing the CONFIG.SYS file. DISK MANGER also provides help files which you may print using the standard DOS print commands.

4.0 Non-Paired Drive Formatting

Use this procedure for non-Paired drives or when reformatting a Paired drive whose installation software files were lost or not copied before formatting.

Be sure to back-up any drive containing data. Formatting at any level may result in partial or complete loss of data. Seagate Technology, Inc. assumes no liability for lost data.

Always use the same version of DOS throughout the entire process. On two-drive systems: Always use the same version of DOS on both drives. When adding a second drive, it is sometimes necessary to reformat the first drive.

4.1 Low-Level Physical Format Using BIOS Facility

When using the system DEBUG to format in a AT system, the CMOS or system setup should be set to 0 (i.e., no hard drive installed).

1. Boot the system from the DOS system diskette
2. At the A: prompt, insert the system DEBUG diskette and type:

DEBUG

<ENTER>

3. To access the controller's format routine; at the "-" prompt, type:

G=XXXX:5 (Where XXXX is the BIOS base address). The most common base address is C8000 (e.g., G=C800:5)

Note: Seagate controllers will step you through the process. Refer to the drive charts, Figures 1-2, for correct drive parameters.

DISK MANAGER is supplied with drives having greater than 32 formatted megabytes. It can be used as an alternative to FDISK and FORMAT to partition and high-level format drives

Use FDISK and FORMAT on your DOS diskette with drives having less than 32 formatted megabytes, or if you do not want to use DISK MANAGER.

Note: Some versions of DOS have other names for FDISK and FORMAT (e.g., HDFORMAT). Refer to *Hard Disc Installation* in your DOS manual

4.2 Low-Level Format With Controller BIOS Disabled

If you are running the ST21/ST22 with its BIOS disabled, use the low-level format utility supplied with your system. A drive interleave of 1:1 should be selected.

5.0 Troubleshooting Your Installation

5.1 Controller Error Codes

The ST21 and ST22 will flash controller error conditions via the drive activity LED. The code will repeat at about 1 second intervals.

Error information is flashed only at power-up or soft boot. The LED will repeat the error flashes until the condition is corrected or the system is powered-down.

Error code numbers 2 through 6 are fatal errors. If you receive any of these messages, contact your Distributor/Dealer.

Controller Error Codes (LED Flashes)	Controller Error Condition
1	Normal completion of controller diagnostics
2	Failure of hard disc drive interface
3	Sector buffer error
4	Controller task file interface failure
5	Microcode ROM checksum error
6	Controller ECC circuits failure

5.2 Common System/Controller Problems

If you have a problem getting the initial screen, or later getting the system to boot:

- Check the cabling between the controller and drive. Pin-1 on the controller always corresponds to Pin-1 at the drive connector. Most cables have a contrasting color on the cable to indicate Pin-1.
- Check the power cable to the drive. Can you hear the drive spin-up?

- Verify correct CMOS settings
- Verify correct controller BIOS Address. If you have more than one board that uses BIOS ROM space, each must be set to a different memory address. Addressing multiple boards at the same address can cause problems of a seemingly indeterminate nature.
- **Low-level formatting takes too long or never completes:** Format again. Make sure correct drive parameters were entered and cable connections are correct.
- **FDISK or Partitioning Error Messages: "Error reading fixed disc", "No fixed disc present":** Check correct drive parameters entered. Refer to pages 3-4. Turn the system off and power-up again.
- **High-Level Format Error Message: "Invalid drive specification":** Check drive parameters and controller jumpers. Run FDISK and low-level format again.
- **Drive fails to recalibrate or test Ready:** Verify correct installation, cables and drive select jumper.
- **After formatting with DISK MANAGER, your system does not recognize the D, E, F... partitions:** First, make sure that you boot from the hard drive. If you still cannot access these partitions, check that the DISK MANAGER device driver, DMDRVR.BIN is in the root directory of the C: (boot) drive. Verify that the CONFIG.SYS file contains the following line:

```
DEVICE=DMDRVR.BIN
```

If you experience problems accessing your DOS partition after installation, refer to the help files provided with DISK MANAGER.

For system or operating system help, contact your computer manufacturer. For additional installation support, contact your authorized Seagate Distributor/Dealer.