



GSI Model 4C
Intelligent IDEa™

Four-Channel
Eight-IDE Accelerator

Supports:
Eight IDE Devices

Installation Instructions

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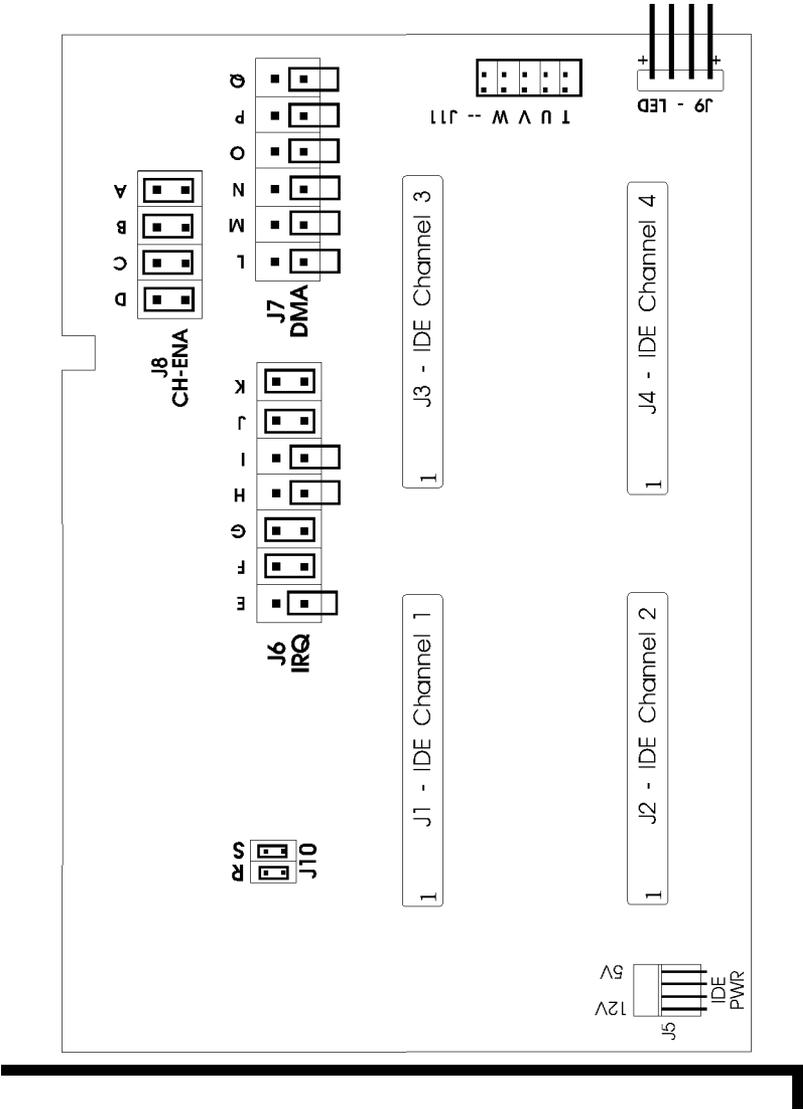
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This manual applies to the Model 4C controller, Part # 1533-4C-01-0, and GSI BIOS version 1.01.

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Board layout- GSI Model 4C
(Jumpers shown are factory default.)

GSI Model 4C User Manual

1.0 PRODUCT OVERVIEW

The GSI Model 4C *Intelligent* IDEa™ **4-Channel** IDE Accelerator Board controls a maximum of **eight** IDE-interface drives — hard drives, tape drives, CD ROM drives, etc. — handling **two** drives on each of its **four** IDE channels. The Model 4C is compatible with all popular PC operating systems, including DOS, Windows, and Novell. It is usable in almost any AT-compatible PC, whether clone or proprietary-brand, as long as the PC has an available **16-bit** ISA AT-bus slot.

The Model 4C employs a state-of-the-art *Flash* BIOS, which **auto-installs** IDE Hard Drives. It will even offer to **auto-prepare** (FDISK & FORMAT) new drives for DOS. The Model 4C **accelerates** IDE hard drive data transfer rates, on most drives, by making best use of drive performance features. The GSI Model 4C is an IDE-**only** controller and does **not** include any floppy drive support.

Two Model 4C boards may be used together — with each channel enabled on only one of the two boards — for example, to provide the controller redundancy needed to support Novell **duplexing**.

Model 4C Product Features

- Supports **eight** IDE drives — two per channel, on **four** IDE channels
- 20-80% throughput acceleration for most hard drives, vs. common passive IDE adapters
- DOS/Windows compatible, without the mess and complication of user-installed drivers
- Novell NetWare compatible; ideal for hi-reliability Novell Server **Mirroring** or **Duplexing**
- **Auto-Install**: Select Type 1 in system CMOS and the Model 4C automatically detects, analyzes, and sets up support for any *existing* hard drive (HD) *partitions*.
- Optional **Auto-Prep**: offers *automatic* FDISK & FORMAT of HDs not yet prepared for DOS.
- Automatically makes available 100% of any IDE HD's capacity, up to **7.9GBs** in *one* HD, when you (re-)partition your drive on the Model 4C (shattering the DOS 504MB barrier).
- Provides *exchangeable-cartridge* support for SyQuest IDE Hard Drives.
- Supports an IDE-interface QIC-80/40 Tape Drive (Note: Backup SW must support IDE.)

Four-Channel Eight-Drive IDE Capability

The GSI Model 4C provides four separate IDE channels. Each channel can control two IDE drives, with a maximum number of eight IDE drives on a system. Each of the four IDE channels may be independently enabled or disabled. User-selectable alternate interrupts (IRQs) and DMA channels are provided. The Model 4C may **co-exist** with another IDE controller, as long as the IDE channel used by the other controller (usually IDE Channel 1) is *deactivated* on the Model 4C.

The primary mission of the Model 4C is to operate in Novell NetWare file servers. The four channel capability allows system builders to configure a system with files spread over multiple drives. By spreading the files over multiple drives, NetWare can optimize the systems resources, increasing the level of concurrency.

The most important parameter of performance for a heavily loaded file server is **throughput in transactions per second**. Throughput can be expressed as: **T = C / E**

where T = Throughput (transactions per second),
 C = Concurrency (number of concurrent events or transactions)
 E = Existence time in seconds

By reducing "E" or increasing "C" the throughput can be increased. "E" is a function of processor and disk speed. "C" is a function of the number of channels used. The Model 4C allows "C" to be increased substantially.

Although the GSI Model 4C was designed for the Novell server market, it works perfectly under DOS and Windows 3.1.

2.0 QUICK INSTALLATION REFERENCE

This section of the manual should allow you to quickly install the Model 4C in your computer. Each step has, if needed, a bracketed [] reference to other sections in this manual that discuss that step in more detail. Should you have problems, or questions regarding a QUICK INSTALL step, please read carefully the reference sections. Below, HD=hard drive and TD=tape drive.

PHYSICAL INSTALLATION

(1) With the system power OFF, open the computer case.

CAUTION! Let disk drives stop before working on the computer. All electronic equipment is sensitive to **static electricity** at levels far below those that humans notice. To protect your system, take care to **touch the metal case** parts **before** touching the electronics.

(2) Check the jumpers on the IDE Hard Drives or Tape Drives [A.1.1, D.1.4]

Each IDE HD's (or TD's) Master/Slave jumpers should be kept at the factory-default *Single* (sometimes *Standalone* or *Single/Master*) setting if the HD will be the **only** drive on its *Model 4C IDE channel*. If there are two IDE devices connected to a Model 4C channel, you must jumper one as the Master and the other as the Slave. For four drives or less, it is recommended that each drive is on a different cable. (Drives can be at *either* cable position.)

(3) Attach the IDE ribbon cables [A.1.2, D.1.2]

Connect the ribbon cables to the IDE drives and to the Model 4C Connectors **J1/J2/J3/J4**. Note that the **colored** band on each ribbon cable edge indicates the **Pin 1** side.

(4) Attach power cables to the IDE drive(s) [A.2.3]

CAUTION! - If using the Model 4C's **J5** connector as a power source, **first** read A.2.2.

(5) Install the drives into the computer case

(6) Check the Model 4C's BIOS Address Jumpers — J10-R/S [A.2.1]

In most cases skip this step, because the factory BIOS address setting should work fine.

(7) Check the Channel-Enable, IRQ, & DMA Jumpers, J8/J6/J7 [F.3]

On the Model 4C, **DISABLE** the IRQs and the I/O address for every unused IDE channel!

SYSTEM CMOS SETUP & GSI FLASH BIOS AUTO-INSTALL

(1) System CMOS Setup — Select *NONE* or *NOT INSTALLED* [B.1]

Do not select a CMOS drive type for drives attached to the Model 4C. Select '*None*'.

(2) Advanced CMOS Setup — Turn OFF BIOS shadowing [B.1.2, B.3]

Many 386 or 486 System Setups offer shadowing of an adapter's BIOS, like the Model 4C's. A shadowed BIOS is executed from a hi-speed RAM copy and may enhance performance. Shadowing of the GSI BIOS should be **ON** for normal operation, but **OFF** when first installing the GSI board or whenever reconfiguring hard drive setup.

(3) Complete the boot-up sequence — watch for GSI Banner [B.2.1]

The GSI Model 4C's BIOS will **Auto-Install** the IDE hard drives, reading their parameters and saving them in the controller's configuration memory.

(4) For new IDE hard drives — Select Auto-Prep feature [B.2.2]

The Model 4C will offer to **Auto-Prep** (FDISK and/or FORMAT) each **new** IDE HD for you. This is a very quick and very easy way to install **new** hard drives!

CAUTION! - Please see important note on **Auto-Prep** in section B.2.3

(5) Install DOS, if needed, using DOS' *SETUP* installation procedure

(6) Test each IDE hard drive and/or tape drive for proper operation

Your Model 4C controller should now be up and running. The following appendices provide more detailed information and there is a Basic Troubleshooting Section [Appendix G] should you encounter installation difficulties.

APPENDIX A — PHYSICAL INSTALLATION

General Precautions: Turn your PC OFF and let disk drives stop before working on the computer. Remove the case cover to gain access to the connectors (slots) on the computer's main board (motherboard). All electronic equipment is sensitive to **static electricity** at levels below those that humans notice. Take care to **touch the metal case** parts **before** touching the electronics.

A.1 INSTALLING IDE HARD DRIVES AND TAPE DRIVES

A.1.1 Setting the IDE Drive's Mode Jumpers for *Standalone, Master or Slave*

IDE (AT-bus) HDs and TDs usually have one or two jumpers (shunts) to set the drive to operate as either *Standalone* (the only IDE drive), *Master* (of a Master/Slave pair) or *Slave* (of a Master/Slave pair). Set these jumpers per this manual's Section D.1.4 and the drive manufacturers' instructions. It is generally recommended that you use separate channels for your IDE drives when possible.

If you must mix drives from two *different* manufacturers as Master and Slave on the same channel, you run a greater risk that the drives will not work together satisfactorily. This aspect of compatibility is **not** under the control of GSI and does not arise from any design detail of the GSI Model 4C. Therefore, for Master/Slave problems, contact the drive manufacturers' Technical Support Departments for help.

A.1.2 Hard-Drive Cable Attachment

For each of the IDE Channels of the Model 4C, use a standard straight 40-pin cable to connect one or two IDE drives. Observe Pin-1 markings on each IDE cable (**colored** band at edge = **Pin 1**) and on the four channel Connectors J1/J2/J3/J4 (Pin 1 is *toward the metal bracket*). Model 4C boards shipped in GSI VAR Packs (Part #1533-4C-Vx-x) include **four** ribbon cables (Part #1548-02-01-9), each one suitable for connecting one or two IDE hard/tape drives on one Model 4C channel.

A.2 INSTALLING THE GSI MODEL 4C BOARD

A.2.1 Setting the Model 4C's GSI BIOS Start Address and SEC/PRI-Mode Jumpers

Jumper block J10 lets you vary the Start Address of the Model 4C's 8kB Flash BIOS, as shown in the following table.

BIOS ADDRESS CC00-CDFE (Default)	BIOS ADDRESS D400-D5FF	BIOS ADDRESS DC00-DDFF	BIOS ADDRESS E000-E1FF
R ON	R ON	R OFF	R OFF
S ON	S OFF	S ON	S OFF

You should confirm the **actual** current GSI BIOS address (**hhhh**) by reading it from the GSI BIOS Banner, on-screen at boot time. (*GSI Banner* = 'GSI Model 4C IDE BIOS vN.NN at **hhhh**. . .')

Changing the GSI BIOS address will usually have no effect **unless** another controller board (e.g., SCSI or CD ROM controller or sound card) is using the same memory address and conflicting with the Model 4C's BIOS. A very few VGA cards cause memory-access conflicts— evidenced by either: 1) lack of a boot-time GSI Banner or 2) on-screen requests to turn OFF shadowing of the GSI BIOS, when it is not being shadowed.

In such cases, trying the **E000** GSI BIOS address *may* allow you to resolve such a conflict. Unfortunately, most **non-AMI** System BIOSs do not search for a controller BIOS at E000. If you try the E000 address and no longer see any boot-time GSI Banner on-screen, most likely your System BIOS cannot activate a GSI BIOS at E000. With such a System BIOS you will not have the luxury of trying address E000 to escape C/D-page interference.

A.2.2 Connecting the HD-Active LED — Either One LED or One-LED-Per-Channel

A.2.2.1 Using Just One HD-Active LED — Wired to Connector J9

Connector **J9** provides an output to light an *HD-Active* LED whenever *any* HD connected to the Model 4C is currently *active* (being accessed). If your PC case has just one *HD-Active* LED for your system HDs, attach the LED connector to **J9**, with its **colored** wire going to *either positive* (+) end pin.

A.2.2.2 Using Four HD-Active LEDs — One Per Channel — Wired to Connector J11

If your PC chassis provides multiple HD-Active LEDs, you may set up *independent* HD-Active LEDs for each of the Model 4C's four IDE channels. In this case, use Connector **J11**, as follows:

Channel 1	J11-T	Channel 3	J11-V
Channel 2	J11-U	Channel 4	J11-W

Note: Attach each channel's HD-Active LED cable with its **colored** wire going to the **positive** pin at the edge of the Model 4C circuit board. If you get these connections reversed, it is usually not damaging, but your HD-Active LEDs will never light.

A.2.3 Providing Power for Up to Eight Hard Drives

Model 4Cs shipped in GSI VAR Packs (Part #1533-4C-Vx-x) include **two** Molex-connector power cables, Part #1553-02-40-1. **Each** cable can power up to **four** IDE Hard Drives (or 5.25" Floppy Drives) — from **one** power supply drive-power cable, thus accommodating a total of **eight** HDs.

Alternatively, Connector **J5** is a 4-pin power connector like the one found on most 3.5" floppy drives. You can use it to supply 12V and 5V power to one of your hard or floppy drives (handy, because most chassis makers cannot be expected to provide power for as many as **eight** hard drives).

However, if your power supply has any unused power-supply connectors, it is safer to connect your drives to them. This way you will avoid the risk of accidentally supplying 12V on the wrong HD connector.

Caution! Supplying 12V, even momentarily, on the HD's 5V input line will fry the electronics of most hard drives!) Note also that a *few* hard drives, mostly the older 1.625"-high drives, exceed the 12V/5V power feed limit of the motherboard and/or the GSI Model 4C board.

Caution! The 12V and 5V loads attached to the Model 4C **J5** power connector **must not exceed:**

5V LIMIT — 2.0 Amps maximum (= 10 Watts)
12V LIMIT — 1.5 Amps maximum (= 18 Watts)

Exceeding *either* maximum, *even for a moment*, may seriously damage motherboard or Model 4C.

A.2.4 Inserting the Model 4C Board into a System Motherboard Slot

Choose an open add-on card slot in the computer's motherboard and remove the rear-panel blanking plate in line with the slot, saving the screw to anchor the card in place. Gently but firmly press the GSI Model 4C into the slot, securing it in place with the retaining screw. Be careful to confirm that the Model 4C is **fully** inserted into its slot.

APPENDIX B — SYSTEM SETUP PROCEDURE

B.1 SYSTEM CMOS SETUP — DRIVE-CONFIGURATION DATA

B.1.1 System CMOS Setup — Hard Drives (HDs) and Tape Drives (TDs)

IDE **Tape** Drives should **never** be declared in your System CMOS Setup. IDE **Hard** Drives, when attached to the Model 4C, should also **not** be declared in CMOS. (A possible exception exists. In **rare** cases with proprietary PCs, you *may* find that you are forced to declare the Channel #1 boot drive in CMOS.)

B.1.2 Advanced System CMOS Setup — Shadowing the GSI BIOS

Selecting BIOS *shadowing* causes the BIOS programming to be copied to RAM memory and executed from the high-speed RAM copy. Shadowing of the GSI BIOS should be **OFF** during *GSI Auto-Install*, but should be **ON** for normal operation. See Section B.3 for more information.

B.2 GSI MODEL 4C AUTO-INSTALL & AUTO-PREP — FOR IDE HARD DRIVES ONLY

B.2.1 *Auto-Install: Automatic HD Configuration Setup*

The Model 4C remembers the *system* HD configuration in *Flash* memory. If you install a brand new card, change HDs, or move a card to a different type of PC, the Model 4C will automatically detect the change and revise its setup (that is, perform *Auto-Install*) to accommodate the new HD and/or motherboard. In addition, the Model 4C extracts the necessary HD parameters (#Cylinders, #Heads, & #Sectors) from either:

- 1) an existing partition — for a HD already prepared for use
- 2) the HD's response to the IDE Identify Drive interrogation — for an unprepared HD. (See D.1.4)

B.2.2 *Auto-Prep: An Automatic HD Partition & Format Service for New Hard Drives*

When the Model 4C encounters a HD which has not yet been **both partitioned and DOS-Formatted**, it announces its partition and DOS-Format finding to the user on-screen.

The Model 4C BIOS then *offers to*:

- 1) create a single **primary** partition, making use of the HDs full capacity & DOS-FORMAT it — if no partition exists yet. This partition will be marked *Active* only if the HD is C:. To make the HD bootable, run DOS' SYS command.
- 2) DOS-FORMAT an existing, but not yet formatted, partition — if that is what is found on the hard drive.

Note: In Case #2, **only the first logical** HD associated with each physical hard drive will be auto-formatted. Fortunately, for DOS 5.0/6.x users, there is almost always only one partition per HD. During this **Auto-Prep** sequence, you will be asked whether you are using either:

- 1) DOS 6.0 or DOS 5.0, or
- 2) some *older* pre-5.0 DOS, most often MS/PCDOS 3.30 (If you answer '2', a *32MB-only* single primary partition — the pre-5.0 DOS maximum — will be created on your Hard Drive.)

B.2.3 *When to Refuse GSI Auto-Prep & Use DOS' FDISK Instead*

For cases where you want an **Extended** Partition, not a Primary, **refuse** the Model 4C's offer to prepare the HD, and use DOS' **FDISK** utility instead. You might want an Extended Partition, for example, if you have *logical* Drive Letters C:, D:, and E: all assigned to a first *physical* hard drive. If your new HD, supported by the Model 4C, were to get a *Primary* Partition, DOS would treat the new HD#2 as *Drive D:* — with the old *D:* and *E:* Extended-Partition references *slipping* to *E:* and *F:*. If, instead, HD#2 were to get an *Extended* Partition, DOS would make HD#2 *Drive F:*.

Note: DOS' FDISK is always available to you for partition creation and deletion. If, for example, you allow the Model 4C BIOS to create a *primary* partition for you — and you later realize that you prefer an *extended* partition (see discussion above), you can use FDISK to customize your partitions.

B.2.4 DOS Drive Letter Assignments for FDs, HDs, & Other Drives — An Overview

DOS itself assigns drive letters (A:, B:, etc.) in the following sequence:

- 1) Floppy Drives A: & B: — if at least one floppy drive exists
- 2) All Hard Drive partitions known to DOS before boot-time CONFIG.SYS file processing
 - a) First, all Hard Drive **primary** partitions (C:, D:, etc., one letter per primary partition)
 - b) Then, all *logical drives* (one letter to each) defined within HD **extended** partitions
- 3) Floppy Drives 3: & 4:, if known to DOS *before* boot-time CONFIG.SYS file processing (that is, if supported by BIOS rather than by device driver via Config.Sys)
- 4) Any drives (hard, floppy or other types — e.g., RAM drives or CD-ROMs) made known to DOS by processing of the Config.Sys file — in the *order of appearance* in Config.Sys

Example —

Note that *any* drive which is initialized (made known to DOS) via CONFIG.SYS will be assigned a drive letter *later* than those of all drives known before CONFIG.SYS processing. Thus a PC with DOS 5.0/6.0, four Floppies, two IDE HDs, and a SCSI HD and CD-ROM *might* boot with:

- A: & B: = Floppy Drives #1 & #2 (selected via Drive Select #0 & Drive Select #1)
- C: & D: = IDE Hard Drives #1 & #2
- E: = CD-ROM Drive supported via a BIOS on the SCSI controller
- F: & G: = Floppy Drives #3 & #4 (selected via Drive Select #2 & Drive Select #3)
- H: = SCSI Hard Drive supported via a driver invoked in CONFIG.SYS

Note: The possibility that HD letters *may not be contiguous* (other drive types may be in between). See also Section E.1 regarding environments with multiple fixed drives.

Review of Drives, Logical Drives, & Partitions— Relative to DOS Drive Letter Assignments

- Each HD may have a Primary Partition, an Extended Partition, or both. An extended partition may contain either one logical drive or *multiple* logical drives (drive letters). Logical drives exist **only** within extended partitions.
- Within any drive group above, DOS assigns letters to drives according to the order in which the drives are initialized at boot time.
- For logical drives, DOS assigns letters to **all** logical drives in the **first** extended partition found, then to **all** logical drives in the **next** extended partition found, and so on.

B.3 SHADOWING OF GSI BIOS: ON FOR NORMAL OPERATION, OFF DURING GSI SETUP

Most 386 or 486 System Setups offers *shadowing* of controller card BIOSs like GSI's. A shadowed BIOS is executed from *ah-speed* RAM copy. Shadowing of the GSI BIOS should be **ON** for normal operation, but **OFF** while changing system hard/floppy drive configuration — to allow GSI's **Auto-Install** process to operate.

Note: If the Model 4C detects a write-to-BIOS problem during **Auto-Install**, it will stop the system at the GSI Bootup Banner with an error message, requesting that you run your System CMOS Setup to turn OFF (*disable*) shadowing in the memory region occupied by the GSI BIOS. After you allow your system to reboot once, turn GSI BIOS shadowing back ON — for HD *speed*.

System BIOSs for most 486 and some 386 systems allow you to turn ON **shadowing** (in the C, D, and E pages of memory) in 16kB, 32kB, or 64kB address blocks. *Any* of these block-sizes will *totally contain* the Model 4C's **8kB**-size BIOS. Note your GSI BIOS Start Address, shown in your GSI Bootup Banner, and enable shadowing, in your System CMOS Setup, as follows:

GSI-BIOS Address (HEX)	In System Setup Shadowing, Enable Address Range:		
	If 16kB Block	If 32kB Block	If 64kB Block
CC00-C9FF	CC00-CDFF	C800-CFFF	C000-CFFF
D400-D5FF	D400-D7FF	D000-D7FF	D000-DFFF
DC00-DDFF	DC00-DFFF	D800-DFFF	D000-DFFF
E000-E1FF	E000-E3FF	E000-E7FF	E000-EFFF

See Section A.2.1 for details of the Model 4C's J4 jumper block settings vs. GSI BIOS address.

Note: In a rare case, you may experience PC system errors which occur when the GSI BIOS is shadowed, but not when the GSI BIOS is not shadowed. If so, and if you are using a memory manager (see C.1), try expanding the exclude region described above — so that it includes the entire shadowing address range, as shown in your System CMOS Setup screens. If problems persist, please report your findings (with as much detail as possible) to GSI via your vendor's Technical Support Dept.

APPENDIX C — SYSTEM AND SOFTWARE USAGE GUIDELINES

C.1 USING MEMORY MANAGER SOFTWARE

If you use memory manager software, such as QEMM, 386MAX, or Netroom, you may experience abnormal HD operation. Try **excluding** the memory region of the **GSI BIOS** from the memory manager's optimization process, according to the following table.

GSI BIOS Address (HEX)	In your <i>Device=QEMM.SYS...</i> statement in your CONFIG.SYS File, add the phrase:
CC00-CDFF	exclude=CC00-CDFF
D400-D5FF	exclude=D400-D5FF
DC00-DDFF	exclude=DC00-DDFF
E000-E1FF	exclude=E000-E1FF

E.g., if using QEMM (or 386MAX or Netroom), in your CONFIG.SYS file add the **exclude** option: "Device=C:\QEMM\QEMM.SYS **exclude=DC00-DDFF**" (For 386MAX/Netroom, do similarly) if your Model 4C BIOS is at **DC00**. (Confirm your GSI BIOS address from the GSI Bootup Banner.)

Note: Memory managers cause 386, 486, & 586 (aka *Pentium*) PCs to run in **Virtual Mode**. This mode of operation can dramatically **s-l-o-w** your PC's HD/FD I/O processes.

C.2 DOS, DRDOS, AND DOS-BASED APPLICATIONS SOFTWARE

Normal DOS software usage rules apply to systems using the GSI Model 4C card. Considerable effort has been made to ensure compatibility with the most commonly used DOSs: MSDOS/PCDOS 6.0/5.0/3.30/4.01 and DRDOS 6.0. (See Sections B.2.2 and C.1 if using a DOS versions other than DOS 6.0/5.0.) Common DOS commands like CHKDSK, COPY, XCOPY, DISKCOPY and FORMAT should work straightforwardly. Properly programmed DOS applications should be expected to run normally with the Model 4C.

C.3 THE MODEL 4C WITH WINDOWS 3.1 AND WINDOWS APPLICATIONS SOFTWARE

The Model 4C is compatible with Windows 3.1. Properly programmed Windows applications should be expected to work normally with all fixed and removable-media IDE drives when they are controlled by the Model 4C. However, normal caution is advised when installing and making first use of any application which writes to disk.

C.4 THE MODEL 4C WITH OS/2 2.1 & 2.0 AND UNIX

The GSI Model 4C is compatible with OS/2 Versions 2.1 and 2.0 and UNIX operating systems. For UNIX — that is, your particular version of UNIX — you *may* need to invoke a UNIX-supplied device driver if you want to use the Model 4C as a **Secondary-Address IDE Host Adapter**.

C.5 THE MODEL 4C WITH A NOVELL NETWORK

C.5.1 **Model 4C Channel #1**

When using the Model 4C's Channel #1 with Novell, either:

- 1) declare the hard drive as CMOS Type 1 and use Novell's built-in AT Driver or
- 2) use the Novell IDE driver with setup parameters, IRQ & I/O address, as shown in Section E.3.

C.5.2 **Model 4C Channels #2, 3, and 4**

When using the Model 4C's Channels #2, 3, and/or 4, do the following:

- 1) Novell 4.0 — Use the Novell IDE Driver which you received with the Novell 4.0 kit.
- 2) Novell 3.11 — Get the IDE Driver from Novell's BBS and use it as with Novell 4.0
- 3) Novell 3.0 — Contact Novell about their network operating system upgrade options.

C.5.3 **Running Novell's Compsurf Installation Utility Program**

Caution! When running Novell's Compsurf software, **donot** accept the Format Hard Drive option!

APPENDIX D — IDE HARD & TAPE DRIVES: SETUP & OPERATION

D.1 IDE HD SETUP: CABLES, MASTER/SLAVE DRIVE JUMPERS, SYSTEM CMOS

D.1 IDE Hard Drives — Historical Background

IDE hard drives (HDs) are an evolutionary outgrowth of the older ST506-class MFM and RLL HDs. Most of the electronic functions of the MFM & RLL controllers have been miniaturized and incorporated into the HD's own circuit board. Today's IDE Adapter circuits simply perform the necessary signal buffering to extend motherboard AT-bus signals onto a flexible cable and then on to the HD.

D.1.1 Compatibility of the Model 4C Coard with MFM/RLL Hard Drives

A **primary-address** IDE adapter (which is what most common IDE paddle cards are) **plus** an IDE HD are an **alternative** to the older MFM or RLL controller plus HD. The two **cannot be used together** in the same system. Channel #1 of the Model 4C is a primary-address adapter and therefore must be disabled if used in conjunction with MFM or RLL HD hardware.

An *alternate*-channel IDE adapter uses alternative I/O address, IRQ, and DMA channel and **can** co-exist with MFM/RLL hardware — or with a common primary-address IDE paddle card. Channels #2, 3, and 4 of the Model 4C) are all alternate-channel IDE adapters and **can** therefore be used to add up to six IDE drives, with Channel #1 disabled.

Note: If the Model 4C is added to a system which contains an IDE paddle card (with the 4C's Channel #1 disabled), the 4C's BIOS will take over the control of the paddle card's Channel 1 hardware — giving you all of the same features (e.g., HD Auto-Install and Auto-Prep) on Channel #1 as on Channels #2, 3, and 4!

D.1.2 IDE Drive Ribbon Cables

Model 4Cs shipped in GSI VAR Packs (Part #1533-4C-Vx-x) include **four** identical 40-conductor PC-standard IDE ribbon cables, Part #1548-02-01-9. Each cable can connect two IDE hard drives (or IDE hard drive plus tape drive), one at the End Position and one at the Center. Note that the IDE (CAM-ATA) Interface Specification recommends a **maximum** cable length of **18"**.

D.1.3 IDE Drive Power Cables

See Section A.2.3.

D.1.4 IDE Master/Slave/Standalone Jumpers on Hard Drives & Tape Drives

IDE hard drives *and* *tape drives* usually have jumpers (shunts) to allow operation in the following modes:

- 1) Standalone — the only IDE drive on its IDE adapter card (factory default setting for HDs)
- 2) Master — with another IDE drive (*the slave*) attached to the same IDE adapter card
- 3) Slave — with another IDE drive (*the master*) attached to the same IDE adapter card (factory default setting for IDE *tape* drives)

Some IDE drives *may* not work as master (or slave) with drives from other makers — sometimes even with other drive models from the *same* maker! Consult drive makers about such problems.

Note: In setting the Standalone/Master/Slave jumpers for IDE hard drives (and IDE tape drives), **ignore** all other drives that are attached to any **other controller** (even IDE) in the system.

D.1.5 System CMOS Setting for IDE Hard Drives and Tape Drives

See Section B.1.

D.1.6 Achieving Proper Use of Your *Entire* IDE Hard Drive

For any IDE HD which you are installing on a Model 4C, two cases should be distinguished:

- 1) Partition exists (maybe more than one)
- 2) No partition exists

Partition Exists

If your HD has a **valid partition** (has already been prepared for use), the Model 4C will **analyze** this existing partition — and **will support it**, by setting up proper Heads, Cylinders, and Sectors-per-Track description parameters for the drive.

No Partition Exists

If your hard drive is **not yet prepared** with a partition, the Model 4C will use the HD's IDE Identify Drive response information to set up the HD's #Cylinders, #Heads, and #Sectors parameters. In so doing, the Model 4C should be:

- 1) making use of 100% of the HD's capacity (up to 8.4 Gigabytes!) and
- 2) operating in the Translation Mode (HDs/CYLs/SECs) recommended by the HD maker **as long as** the HD's on-board firmware issues a *correct* Identify Drive report (a few old HDs do not).

Note 1: If you want to **abandon** existing partitions on your HD, use DOS' **FDISK** to delete them.

D.2 IDE HARD-DRIVE OPERATING MODES — SOME BACKGROUND INFORMATION

D.2.1 Native Mode

The recommended mode for operating your HD(s) with the Model 4C is the drive manufacturer's *Native Mode* (or default Translation Mode) because it usually gives optimum performance and maximum storage capacity. The ANSI Standard for IDE HDs provides an optional-to-manufacturer (and usually implemented) Identify Drive Command, which allows GSI Intelligent controllers to interrogate the drive as to the Heads, Cylinders, and Sectors counts (as well as other technical parameters). The Model 4C uses this feature to provide Native Mode operation for a new hard drive which has *not yet been prepared* for use.

Some older IDE drives (particularly 20MB and 40MB drives) **do not** conform to this standard. For these drives to operate on a Model 4C, you **must** declare, in the System CMOS Setup, a Drive Type that corresponds to the drive's parameters (see manufacturer's documentation).

D.2.2 Partition Emulation Mode

The Model 4C uses existing partition information on a formatted drive to establish the drive's operational parameters. If a user is connecting the Model 4C to a drive which has been used in CMOS Emulation Mode (see above), it is recommended that he back up the drive data to other media (e.g., tape or floppies) and re-format the drive to run in its Native Mode. However, the user may have a drive which contains valuable data and therefore may wish to use the drive in its present configuration. In the majority of the cases, the Model 4C will use the partition information placed on the drive by the old controller. Data saving **cannot be guaranteed** but the user may well want to take advantage of this capability.

D.3 LARGE IDE HARD DRIVES WITH MORE THAN 1024 CYLINDERS

Some IDE HDs report to the controller that they are using more than 1024 cylinders. Historically, drives reporting more than 1024 cylinders have caused integration headaches because system BIOS calls do not provide for cylinder counts greater than 1024. When the GSI Model 4C is connected to such a drive, it *automatically* uses a special setup strategy to handle this problem.

D.4 VERYLARGE IDE HARD DRIVES — FROM 504MB TO 8.4-GIGABYTE CAPACITY

Some IDE HDs have *very* large capacities, exceeding the **DOS limit** of **504MB**. The GSI Model 4C provides BIOS-level support for IDE HDs up to **8.4 GB's** in capacity! The very large HD is treated as one drive volume and will be assigned *one drive letter* by DOS. No device drivers are needed! It is transparent to the user that there is anything unusual about his large hard drive.

Note: You should be extremely cautious about using HD-modifying utility software, such as a HD **defragmenter** program, on a HD >504MB. You might end up with an **unrecoverable** HD, because of unwarranted assumptions made by the utility software programming team. Consult with the software company's Tech Support Dept. before using such products.

D.5 INTEGRATING IDE TAPE DRIVES

An IDE Tape Drive can be operated on the Model 4C in either:

- 1) Slave Mode, where there is also a HD in *Master Mode* on the Model 4C, or
- 2) Standalone Mode, where there is no other IDE drive on the Model 4C

In either case, the Tape Drive should **not** be declared in the System CMOS Setup procedure. Both the Mountain and the Summit IDE Tape Drives are shipped set up for Slave Mode but they also provide jumpers which allow setup for Standalone Mode. Follow the drive manufacturer's installation and user manual information.

D.6 SYQUEST EXCHANGEABLE-CARTRIDGE IDE HARD DRIVES

GSI Model 4C BIOS has special exchangeable-cartridge support for the SyQuest 3.5" exchangeable-cartridge IDE drives. This support cooperates with the SyQuest-supplied driver SQATDRVR.SYS. The SyQuest exchangeable-media drive should be connected to the Model 4C just the same as any other IDE hard drive would.

To allow DOS to cope with cartridge exchanging, include the following line in your Config.Sys file:

```
device = path\SQATDRVR.SYS /i
```

where *path* reflects where you stored SQATDRVR.SYS — for example, C:\SYQUEST.

APPENDIX E — OTHER SYSTEM INTEGRATION TOPICS

E.1 WHERE THE MODEL 4C CO-EXISTS WITH A SCSI OR ESDI CONTROLLER

The Model 4C has been designed to be able to co-exist with **SCSI** or **ESDI** controllers. Unfortunately, many SCSI and ESDI controller BIOSs are *ill behaved*. They have been written on the assumption that there would **never** be any **other drive controller** with a **BIOS** co-residing in the system with them. If you do **not** see a GSI Banner at boot time, and if you have situated the GSI BIOS at a *lower address* than the SCSI/ESDI BIOS, try putting the **GSI BIOS** at a **higher address** — or vice versa. (See Section A.3.1)

Note: Some SCSI controllers expect the user to have set up an installable device driver (via a 'device=...' statement in CONFIG.SYS) whenever they see that *at least two* other hard drives are already known to the system. *Removable SCSI Hard Drives*, like the QUANTUM PASSPORT XL, can co-exist with a Model 4C — but you *may* not have flexibility as to which drive is the system's Boot Drive, C:.

E.1.1 Special Case: SCSI Removable-HD Controllers that offer a Bootability Option

Some SCSI Removable-HD/controller combinations have been engineered to include a Boot Drive Switch option on each removable SCSI HD-pack. The user can employ this feature to allow his system to boot to either:

- 1) The first IDE Hard Drive (when the SCSI HD-pack's Boot Switch is OFF) or
- 2) The removable SCSI HD-pack (when its Boot Switch is ON)

A case in point is the Quantum Passport XL SCSI **removable-HD** kit. The GSI Model 4C has been engineered to be compatible with both the Standard (**Non-Boot**) Mode and also the SCSI-Boot Mode of such controllers. Whether or not you can use such SCSI products in their Boot Mode (along with any other GSI or non-GSI HD controller), depends essentially on non-standard implementation techniques used in these products. For this reason, GSI cannot guarantee compatibility with all variants of these products. For help with IDE/SCSI integration problems, please contact the SCSI controller manufacturer's Technical Support Department.

E.2 WITH MULTIPLE HARD DRIVES, WHICH WILL BE THE BOOTABLE HARD DRIVE?

E.2.1 CASE 1: All of the Hard Drives in the System are Connected to the Model 4C

If **all** of the Hard Drives in the PC system are connected to the GSI Model 4C board, then the **Master** (or **Standalone**) Drive on the **lowest**-numbered IDE **Channel** will be designated by DOS as **C:**, the Boot Hard Drive. Note that it is **not** an absolute rule that Channel 1 be enabled if any other IDE channels are enabled. You *may* find, however, on the occasional name-brand, proprietary system that Channel 1 *must* be used. This will *not* generally be the case with the better-known clone System BIOSs.

E.2.2 CASE 2: Only Some of the HDs in the System are Connected to the Model 4C

E.2.2.1 CASE 2.1: Another IDE Adapter Exists in the System

It is possible to use the Model 4C in a system where *another IDE Adapter* exists. For example, you may add the Model 4C to a system which already has an IDE+Floppy Adapter With I/O Ports — and you want to retain that adapter because of its I/O ports. Almost always, that other IDE Adapter will be a *primary*-address adapter, commonly called a *paddle card*. Simply **DISABLE Channel 1** on the Model 4C board. The Model 4C BIOS will then take over control of the paddle card IDE channel — *as if* the paddle-card IDE hardware were an integral part of the Model 4C board! In addition, the Model 4C's easy-initialization and performance-enhancement features will be extended to include the off-board IDE channel on the paddle card! (**Exception:** If your paddle card is an unusual one that contains BIOS support for hard-drive functions (not very likely...), you may not be able to leave it in your system — *unless* you can disable the paddle card's BIOS.)

E.2.2.2 CASE 2.2: A Non-IDE Hard Drive Controller Exists in the System

Where **some non-IDE** Hard Drives exist in the PC system, connected to controllers other than the Model 4C, you should expect, in the general case, that DOS will assign letters to *those drives* after it assigns letters to the Model 4C's drives. Consequently, the Boot Hard Drive will usually have to be one of the IDE Hard Drives connected to the Model 4C (specifically, the Boot Hard Drive will be the Standalone or Master Drive on the *lowest-numbered Model 4C channel in use*.)

It *may be possible* with some system configurations to have the Boot Hard Drive be a drive attached to some other controller than the Model 4C board. In practice, this would ordinarily be a SCSI-interface drive. If you wish to operate in this mode, try setting up your SCSI controller board's jumpers (or switches) to place the SCSI BIOS Start Address at a **lower** address than the GSI Model 4C BIOS.

Experimentation *may* show that reversing the BIOS address order for the SCSI controller and the Model 4C also reverses the HD letters assigned. (See Section A.2 regarding the Model 4C BIOS address options.) Whether or not BIOS-address order affects drive letter assignment depends on subtleties of drive initialization procedures which are beyond the scope of this manual.

E.3 INTEGRATING THE MODEL 4C WITH AN EISA-BUS MOTHERBOARD

EISA-bus motherboards have a built-in system configuration protocol that is intended to provide automatic setup of add-on cards. This automated procedure deals with the add-on cards one at a time, working its way from one side of the computer to the other. The sequence in which two add-on cards get scanned for EISA bus setup *may* affect proper card operation for one or both cards. This consideration is analogous to the order of BIOS addresses for two cards, as discussed in Section E.3. Therefore, try interchanging slot positions of the Model 4C and other cards with BIOS. If you still have a problem, call the EISA motherboard maker's Technical Support Department.

E.4 MODEL 4C I/O-ADDRESS, INTERRUPT, AND DMA USAGE

I/O Port Addresses for the four IDE channels are **fixed**. They are the PC-standard addresses which conform to Novell IDE I/O Address assignments. Interrupts (IRQs) and DMA Channels (DRQs & DACKs) used by the GSI Model 4C are *user selectable* via Jumper Blocks J6 and J7, respectively.

Per-Channel Fixed I/O Address and User-Selectable Options for Interrupt and DMA:

IDE Ch. #	I/O Address Range	Interrupt (IRQ) Options	DMA Options
1	1F0 - 1F7 hex	IRQ 14 / no interrupt	DMA 7 / no DMA
2	170 - 177	IRQ 15 / 10 / no interrupt	DMA 6 / no DMA
3	1E8 - 1EF	IRQ 11 / 12 / no interrupt	DMA 5 / no DMA
4	168 - 16F	IRQ 10 / 9 / no interrupt	no DMA

Items in bold above show GSI-recommended option selections for DOS and Windows usage. For OS/2 and UNIX operating systems, see Section C.4. See Section F.3 for details of Model 4C jumper settings for IRQ (and DMA) options.

Note: For each **disabled** channel, be sure to select “no interrupt” and “no DMA”.

APPENDIX F — MODEL 4C PRODUCT — OVERVIEW INFORMATION

F.1 PRODUCT VERSIONS — BULK & VAR-PACK

The GSI Model 4C Intelligent IDE Host Adapter is distributed in two ways:

- 1) in *bulk* (board and manual only) — GSI Part # 1533-4C-xx-x, where xx-x is the Model 4C revision number, and
- 2) in *VAR packs* (board, manual, & GSI IDE 2-drive cable packaged up in a white GSI box) — GSI Part # 1533-4C-Vx-x

F.2 PRODUCT SPECIFICATIONS

Model 4C Board Dimensions:

4.50" x 5.938" (printed circuit board, not including its metal L-bracket)

Bus Slot Requirements:

16-bit ISA — conforming to IEEE Personal Computer (ISA) Bus Standard P996

Power Consumption:

10 watts max. (Model 4C board itself, without J5 drive-power load included — see Section A.2.2)

IDE Drive Compatibility:

Supports IDE drives conforming to the industry-standard IDE interface specification, *ATA Common Access Method Specification*, ANSI Doc. #X3T9.2/791D.

IDE Ribbon-Cable Connector Type:

Standard 40-pin (2x20) IDE connectors, 3M 3417-7000 or equivalent

For per-channel I/O Address (fixed) and IRQ/DMA recommendations (selectable), see Section E.4.

F.3 MODEL 4C FACTORY DEFAULT JUMPER SETTINGS — SUMMARY

Bold markings below indicate **GSI factory default** jumper settings — for **all channels** enabled.

F.3.1 Jumper Block J8: IDE-Channel Enable (Independent per IDE Channel)

Jumper	IDE Channel	I/O Address	Channel Status
J8-A	1	1F0 hex	ENABLED/DISABLED = ON/OFF
J8-B	2	170 hex	ENABLED/DISABLED = ON/OFF
J8-C	3	1E8 hex	ENABLED/DISABLED = ON/OFF
J8-D	4	168 hex	ENABLED/DISABLED = ON/OFF

Note: For each **disabled** channel, be sure to select “**no interrupt**” and “**no DMA**”.

F.3.2 Jumper Block J6: IRQ Select (Independent per IDE Channel)

Jumper	IDE Channel	I/O Address	IRQ#	Channel Status	Jumper
J6-K	1	1F0 hex	IRQ 14	ENABLED/DISABLED = ON/OFF	
J6-J	2	170 hex	IRQ 15	ENABLED/DISABLED = ON/OFF	
J6-I	2	170 hex	IRQ 10	ENABLED/ DISABLED = ON/OFF	
J6-H	3	1E8 hex	IRQ 12	ENABLED/ DISABLED = ON/OFF	
J6-G	3	1E8 hex	IRQ 11	ENABLED/DISABLED = ON/OFF	
J6-F	4	168 hex	IRQ 10	ENABLED/DISABLED = ON/OFF	
J6-E	4	168 hex	IRQ 9	ENABLED/ DISABLED = ON/OFF	

Note: Use IRQ 12 with caution. You may encounter a conflict with the mouse port.

F.3.3 Jumper Block J7: DMA Select, Independent per IDE Channel

Jumper	IDE Channel	I/O Address	Channel Status	Jumper
J8-Q	1	1F0 hex DRQ 7	ENABLED/ DISABLED = ON/OFF	
J8-P	1	1F0 hex DACK 7	ENABLED/ DISABLED = ON/OFF	
J8-O	2	170 hex DRQ 6	ENABLED/ DISABLED = ON/OFF	
J8-N	2	170 hex DACK 6	ENABLED/ DISABLED = ON/OFF	
J8-M	3	1E8 hex DRQ 5	ENABLED/ DISABLED = ON/OFF	
J8-L	3	1E8 hex DACK 5	ENABLED/ DISABLED = ON/OFF	

Note: DMA (DRQ & DACK) should be left DISABLED, unless you are using a driver which you know is prepared to use DMA. There is **no** DMA capability provided for Channel 4.

F.3.4 Jumper Block J10: GSI BIOS Address

J10-R/S GSI BIOS Address Range:

J10-	R / S	BIOS Address
	ON / ON	= CC00-CDFF
	ON / OFF	= D400-D5FF
	OFF / ON	= DC00-DDFF
	OFF / OFF	= E000-E1FF ¹

¹For information regarding use of the **E000** address, see Section A.2.1.

APPENDIX G -- BASIC TROUBLESHOOTING -- SYMPTOMS AND CURES

G.1 GSI Banner is Not Seen On-Screen During Bootup:

- Is there a second controller BIOS at the same address as the GSI BIOS?
See Section A.2.1
- The System BIOS, if non-AMI, may not find GSI BIOS if at E000 address. **See Section A.2.1**
- Badly behaved VGA card in 16-bit BIOS mode? (Try it in an 8-bit slot -- or if the VGA board will operate in 8-bit mode, but no 8-bit slots are available, try insulating the short 16-bit connector. One method is to wrap regular or plain paper around its 16-bit connector edge & re-insert in 16-bit slot.) **See Section A.2.1**
- Badly behaved SCSI or ESDI adapter with BIOS at a higher or lower address than GSI BIOS? Re-jumper the Model 4C to put the GSI BIOS at lower or higher address. **See Section E.2 or (-V)**
- Second card with a BIOS in C000-DFFF area, or with the same IRQ, or I/O address. (LAN, multimedia, scanner, etc)? Remove it and run diagnostic software to pinpoint where the conflict is.
See Sections E & A.2
- 'BIOS found -- bad checksum' bootup message. Request a GSI BIOS-Update diskette from vendor's Tech Support Dept.. (It re-writes Model 4C Flash BIOS.)

G.2 Hard Drive(s) Are Not Found by GSI Model 4C

- Is a Ribbon cable or power cable not attached to HD or Model 4C?
See Section 2.1
- Is Ribbon-cable Pin 1 orientation wrong at HD or Model 4C board?
Reverse it. **See Section A.2.2**
- Check hard or tape drive's Standalone/Master/Slave jumpers vs. device-maker's technical info. **See Section D.1**
- Hard drive balking at CYL/HD/SEC values it just reported as default?
See Section D.1.5 or (-G)
- HD may need more time before first command. Enable 'Floppy Seek at Boot' and 'Test Memory beyond 1MB' options, if available, in System CMOS Setup.
- IDE Tape Drive is declared in CMOS & should not be. **See Section B.1**

- Standalone/Master/Slave should be independently set channel by channel. **See Section D.1.2**
- Did you forget to connect power cable or ribbon cable to HD?
See Section 2.1

G.3 Hard Drive Read/Write Operations Appear to be Faulty

- Garbled data in GSI-Banner HD description (rare! -- usually the result of Faulty HD-Read). **(-G)**
- Excessive IDE cable length (>18" IDE-spec. max.)? Try a shorter cable.
See Section D.1.1

G.4 HD Capacity Seems to be Wrong, After Preparation with Model 4C

- Capacity<normal: HD is reporting wrong CYLs/HDs/SECs.
Temporary Fix: Use another controller to prepare proper partition.
Permanent Fix: HD-firmware update. **(-G)**

-V = Check with your vendor that you have the latest GSI BIOS version for your Model 4C card.

-G = Ask vendor's Tech Support Dept. to contact GSI to discuss the problem directly with GSI.

INSTALLATION NOTES

During installation, you should take down the following information. This information will be useful should you need to contact technical support. GSI's Authorized Distributors can provide you technical support, or you can contact:

GSI Technical Support

PHONE: (714) 261-9744

FAX: (714) 757-1778

When calling either Technical support department, *MAKE SURE TO HAVE THE FOLLOWING INFORMATION READILY AVAILABLE:*

SUPPLIER INFORMATION

Date of Purchase: _____ Invoice #: _____

Product Purchased From: _____

Seller's Tech Support Phone #: _____

GSI PRODUCT INFORMATION

GSI Model 4C Serial #: _____

GSI Model 4C BIOS Version : _____

GSI BIOS Address Used: _____

OTHER INFORMATION

System Information: _____

Disk Drive Information: _____

Other Controller Cards: _____

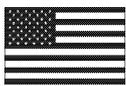
GSI manufactures other disk controller products including:

The **GSI Model 12** -- An 8-bit primary or secondary floppy disk controller board. Supports tape backup speeds of 2Mb/s and supports up to four floppy drives, including 2.88MB

The **GSI Model 18** -- Enhanced IDE for ISA Systems. A 16-bit primary or secondary hard disk accelerator board. **Increases IDE** throughput up to 80%. Supports high-capacity IDE drives and allows IDE hard drives to co-exist with MFM, RLL, SCSI, ESDI and other IDE hard drives. Also supports duplexing and mirroring of IDE hard drives in Novell networks.

The **GSI Model 21** -- Enhanced IDE, Floppy & Tape for ISA Systems. A 16-bit Combo IDE / Floppy & Tape accelerator board. **Increases IDE** throughput up to **80%**. Supports two IDE, four floppy (including 2.88MB) and one floppy-tape drive. **Doubles** the speed of QIC-80 tape backup drives.

The **GSI Model 32** -- Enhanced IDE, Tape & I/O for ISA Systems. This 16-bit high-speed, multi-port disk accelerator board has all of the GSI Model 21 features, plus two 16550 high speed serial ports and one bi-directional parallel port!



All GSI products are designed,
manufactured and tested in the U.S.A.

GSI

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