INDUSTRIAL COMPUTER SOURCE®

Model EXM-HD Series
Product Manual

MANUAL NUMBER :   41417-009-1B

FORWARD

This product manual provides information to install, operate and or program the referenced product(s) manufactured or distributed by Industrial Computer Source. The following pages contain information regarding the warranty and repair policies.

Technical assistance is available at: **1-800-480-0044**.

Manual Errors, Omissions and Bugs: A "Bug Sheet" is included as the last page of this manual. Please use the "Bug Sheet" if you experience any problems with the manual that requires correction.

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One year limited warranty on all products sold with the exception of the "Performance Series" I/O products, which are warranted to the original purchaser, for as long as they own the product, subject to all other conditions below, including those regarding neglect, misuse and acts of God. Within one year of purchase, Industrial Computer Source will repair or replace, at our option, any defective product. At any time after one year, we will repair or replace, at our option, any defective "Performance Series" I/O product sold. This does not include products damaged in shipment, or damaged through customer neglect or misuse. Industrial Computer Source will service the warranty for all standard catalog products for the first year from the date of shipment. After the first year, for products not manufactured by Industrial Computer Source, the remainder of the manufacturer's warranty, if any, will be serviced by the manufacturer directly.

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For any Limited Warranty or Guarantee return, please contact Industrial Computer Source's Customer Service at **1-800-480-0044** and obtain a Return Material Authorization (RMA) Number. All product(s) returned to Industrial Computer Source for service or credit **must** be accompanied by a Return Material Authorization (RMA) Number. Freight on all returned items **must** be prepaid by the customer who is responsible for any loss or damage caused by common carrier in transit. Returns for Warranty **must** include a Failure Report for each unit, by serial number(s), as well as a copy of the original invoice showing date of purchase.

> To reduce risk of damage, returns of product must be in an Industrial Computer Source shipping container. If the original container has been lost or damaged, new shipping containers may be obtained from Industrial Computer Source Customer Service at a nominal cost.

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In no event shall Industrial Computer Source be liable for any defect in hardware or software or loss or inadequacy of data of any kind, or for any direct, indirect, incidental, or consequential damages in connection with or arising out of the performance or use of any product furnished hereunder. Industrial Computer Source liability shall in no event exceed the purchase price of the product purchased hereunder. The foregoing limitation of liability shall be equally applicable to any service provided by Industrial Computer Source or its authorized agent.

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1. Product Description

The EXM-HD is an EXM expansion module containing an IDE (integrated drive electronics) hard disk. It provides a fully functional hard disk in a single EXM slot form factor.

The EXM-HD expansion module is compatible with all PC operating systems because the IDE hard disk is fully PC-compatible at the hardware level.

The construction and definition of the EXM-HD **prohibits** its use in several logical and mechanical configurations. The contexts in which an EXM-HD may **not** be used are the following:

- In the same system with an EXM-9 disk controller unless the EXM-HD and EXM-9 are not enabled at the same time
- In the same system with another EXM-HD or EXM-MX, unless at most one hard disk is enabled at the same time
- In the same system with an EXP-MX mass storage module

Specifications

Environmental		
Temperature (Ambient)	operating	5 to 50°C 10°C per hour max excursion gradient
	storage	-40 to 65°C 20°C per hour max excursion gradiet
Humidity	operating	10-90% non condensing 26°C max wet bulb
	storage	10-90% non condensing 46%C max wet bulb
Altitude	operating	-60m to 3000m
	storage	-60m to 12,000m
Vibration (as measured on the hard drive)	operating	1.0g acceleration over 5-300Hz sine wave (peak to peak), 1 oct/min sine sweep
	storage	2.0g acceleration over 5-300Hz sine wave (peak to peak), 1 oct/min sine sweep
Shock (as measured on the hard drive)	operating	10g, 10ms duration, half-sine shock pulse
	storage	50g, 11ms duration, half-sine shock pulse
Electrical		
Current	Maximum	5V @ 1.2A
	typical	5V @ 0.6A
Other		
Weight		11 oz (310g)
EXM interface	IDE address	3F6 & 3F7
	Interrupt	IRQ 14

Table 1. EXM-HD Environmental and Electrical Specifications.

2. Installation

Before installing your EXM-HD, you should unpack and inspect it for shipping damage.

- **DO NOT REMOVE THE MODULE FROM ITS ANTI-STATIC BAG UNLESS YOU ARE IN A STATIC-FREE ENVIRONMENT. THE EXM-HD, LIKE MOST OTHER ELECTRONIC DEVICES, IS SUSCEPTIBLE TO ESD DAMAGE. ESD DAMAGE IS NOT ALWAYS IMMEDIATELY OBVIOUS, IN THAT IT CAN CAUSE A PARTIAL BREAKDOWN IN SEMICONDUCTOR DEVICES THAT MIGHT NOT IMMEDIATELY RESULT IN A FAILURE.**

- **ENSURE THAT THE INSTALLATION PROCESS AS DESCRIBED HEREIN IS ALSO PERFORMED IN A STATIC-FREE ENVIRONMENT.**

Before Installation

Before inserting the EXM-HD into the system, check the drive *type* label on the side of the unit. Write down the appropriate drive *type* to use for this module. You will need this information later.

Insertion in an EXM Carrier

Insertion of the EXM-HD into an EXM carrier is straightforward. Remove any blank EXM panel from the carrier (by unscrewing the thumbscrews) and insert the EXM-HD into the cardguides. Firmly press the EXM-HD front panel to ensure that it has mated with the rear connector, and secure it with the thumbscrews.

- Make sure that power to your system is off. the exm is not designed to be inserted or removed from a live system.
- When inserting the EXM-HD, avoid touching the circuit board, and make sure the environment is static-free.

Configuration

To use the EXM-HD, you will need to perform several steps to configure it logically into your system and prepare the hard disk for use:

- Enable it as an EXM module
- Specify the hard disk type in the CMOS setup
- Partition and format the hard disk for your operating system

The EPC BIOS

The BIOS in the EPC to which the EXM-HD is connected needs to be configured to enable the hard disk and specify the hard disk *type*. For the hard disk, the *type* identifies the basic hard disk parameters: the number of cylinders, heads, and sectors in the hard disk assembly. Follow the instructions in the EPC reference manual for your specific EPC model to invoke the BIOS setup function. This is typically done by pressing the CTRL-ALT-ESC keys simultaneously. EPC system configuration procedures differ slightly depending on BIOS versions.

Configuration Using BIOS Setup Screen

Establish the EXM-HD's configuration using the BIOS setup screen. To invoke the setup program, press CTRL+ALT+ESC at the operating-system prompt, or reboot your EPC, wait for the self-tests to complete, and press CTRL+ALT+ESC.

Once in the setup program, a menu displays specifying which function keys are available for further configuration. Press the F2 function key to invoke the EXM menu. The screen display resembles Figure 1 below.

	ID	OB1	OB2
Slot 0	FF	00	00
1	DB	C1	00
2	7D	05	00
3	DE	01	00
4	ED	01	00
5	DC	F5	91

Figure 1. EXM Setup Screen.

The setup screen displays the EXM configuration data (in hexadecimal) stored in nonvolatile memory which the EPC uses at power-up to recognize and configure each installed EXM. The displayed data shows SLOT, ID, OB1 and OB2 for each installed EXM.

Note that all slots are listed on the screen even if the actual system configuration does not have all the possible EXM slots. All slots **not** occupied by an EXM module should show an ID of FF and OB1/OB2 of 00 00 indicating that no EXM is present. A typical value for the EXM-HD is shown in bold letters in slot 2.

Slot, OB1 and OB2 are defined as follows:

SLOT   indicates the slot in which the EXM is installed. See the diagram below to determine which EXM slot the EXM-HD occupies. Note that dashed lines indicate EXM slots that may not be available on all systems.
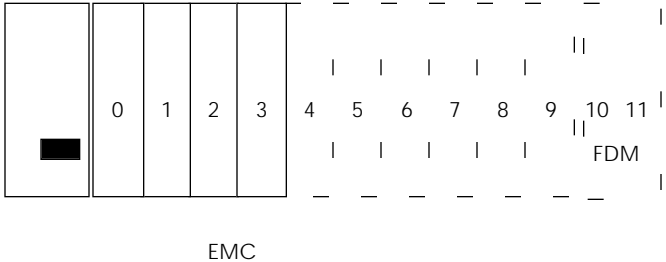
EXM Slots

Figure 2. EXM Slot Numbering.

ID   is a hard-wired ID value. Each EXM has a unique ID value.

OB1/OB2   are two bytes of option information.

To add or change an EXM configuration, use the cursor keys (arrows) to move between the fields on the screen. Move the cursor to the appropriate slot entry and type in the correct value.

The **ID** for the EXM-HD is **7D**h. OB1 and OB2 are two bytes of option information.

OB1 is a hexadecimal value derived by combining the following:

Value	Configuration
0	EXM-HD disabled
5	EXM-HD IDE interface enabled

Table 2. OB1 Configuration Bit Definition.

For example, a typical setting for OB1 would be **05**h, indicating that the IDE interface is enabled.

OB2 is not used and should be set to **00**.

Specify the Hard Disk Type

A separate screen exists for specifying the fixed (hard) disk *type*. Check the function key menu to determine the appropriate function key to bring up the Fixed disk menu. The screen is similar to the one below.

> Fixed Disk Menu
> Fixed Disk Drive C: None
> Fixed Disk Drive D: None

First toggle to the AT option for drive C. Selection of this option causes a *type* line to appear. The *type* line allows you to select among a large variety of predefined drive *types*, or to specify the detailed parameters of a drive not defined by a predefined *type*. Toggle to the *type* number that matches the *type* number on the sticker on the side of your drive.

Fixed disk Drive D: typically should be set to NONE After selecting the appropriate values, press F10 to save this data and return to the main Setup screen.

When you are sure that the CMOS Setup data is correct, press F10 to save this data. Then press F5 to confirm the data and reboot.

Low-level Formatting

CAUTION!

If you are using a drive type that is larger than the actual drive capacity, do not attempt to low-level format the drive. You may permanently damage the drive.

No function is provided for low-level formatting IDE drives.

All disk drives used by Industrial Computer Source are pre-formatted by the manufacturer. Modern disks, with automatic bad-block mapping, don't need low-level formatting.

Previous generations of hard disks sometimes needed to be formatted at a low level to set the interleave, map out bad sectors, or to clear the disk of all data. Disks were typically delivered by the manufacturer in an unformatted state, so several commercial programs are available that perform a low-level format. We do not supply nor recommend any particular program for this purpose.

Disk Partitioning and Formatting

The EXM-HD is shipped from the factory with no partition or high-level formatting. The hard disk must be partitioned and formatted for your operating system before you can load any software.

Partitioning is the process of building the primary data structures on the hard disk that define the physical characteristics of the drive and divide the disk into one or more sections. Formatting (also called high-level formatting) is the process of actually building a file system on a disk drive partition - basically setting up each partition so that it "looks like" a file system.

Partitioning and Formatting for DOS

The following procedure requires a floppy drive be installed. The process for MS-DOS 5.0 is described here. Other operating systems have similar procedures, with different details.

   1) Boot the system using the operating system SETUP diskette.

   2) You are asked several questions. Follow the instructions on the screen until you see the following prompt:

> Allocate all free hard disk space for MS-DOS
>
> Allocate some free hard disk space for MS-DOS
>
> Do not allocate free hard disk space for MS-DOS

The first option will be highlighted. You can allocate ALL the hard disk space by pressing EN-TER. The SETUP program will partition the disk and reboot the system. The SETUP program will be re-invoked and automatically start formatting the disk.

Note that you may choose to "Allocate some free hard disk space for MS-DOS" to allow multiple partitions on the disk.   If you do, the process is slightly different.

   3) The remainder of the installation process is automatic. Follow the instructions on the screen.

Troubleshooting

Symptom	Possible Cause	Solution
Cannot access hard drive.	Bios has not enabled the EXM-HD.	Check the entry in the BIOS setup screen EXM menu.
	The fixed-disk type assumed by the BIOS is incorrect.	Check the drive type in the BIOS setup Fixed disk menu.
	There is another disk controller in the system interfering with the EXM-HD.	Reread the configuration rules in Chapter 1.
Cannot boot from hard disk.	The hard drive may not have been formatted as a system disk.	See your operating system manual for details on making a system disk.
	Wrong drive type in the BIOS Setup.	Check the BIOS setup screen against the drive type sticker to verify the correct drive type entry.
	The partion may not be set Active.	Use the partitioning function for your operating system to activate the partition.

Table 3. Troubleshooting Suggestions.

3. Programming Interface

This chapter contains information needed to write custom software drivers for the EXM-HD. Anyone using the EXM-HD as a standard PC/AT compatible hard disk and floppy disk controller can ignore this chapter. The EXM-HD defines the following registers in the I/O space.

	Bit 7	Bit 6	Bit 5	Bit 4	Bit3	Bit 2	Bit 1	Bit 0	I/Oport
Device ID Register	0	1	1	1	1	1	0	1	100
Config Option Byte 1 Reg						IDEN	O	CDEN	102
Data Register									1F0
Error/Writ Precomp Reg									1F1
Sector Number Register									1F2
Cylinder Low Register									1F3
Cylinder High Register									1F4
SDH Register									1F5
Status/Co Register									1F6
Alt Status/Dig Out Reg									3F6
IDE interface									3F7

Z = not driven onto EXM expansion interface on a read.

The first two are standard EXM registers for device identification and configuration. The EXM-HD responds to accesses to these ports only if EXM interface line -EXMID is asserted. An 8-bit read from I/O address 100h returns the value 7D, the device ID of the EXM-HD. A read/write configuration register appears at I/O address 102h. The defined bits are

IDEN specifies whether the IDE interface and hard drive is enabled (1) or disabled (0). If IDEN and CDEN are set, the I/O addresses 1F0-1F7 and 3F6-3F7 are active.

CDEN specifies whether the EXM-HD is enabled (1) or disabled (0). If disabled, the EXM-HD will not respond to the 1F0-1F7 and 3F2-3F7 I/O addresses; it will only respond to reads from I/O port 100h and reads and writes from I/O port 102h, and then only if EXM interface line -EXMID is asserted.

The IDE interface defines bits 0-6 of address 3F7. Bit 7 is reserved..

For an explanation of the IDE registers, refer to documentation on any standard PC/AT fixed-disk and floppy drive interface.

BUG REPORT

While we have tried to assure this manual is error free, it is a fact of life that works of man have errors. We request you to detail any errors you find on this BUG REPORT and return it to us. We will correct the errors/problems and send you a new manual as soon as available. Please return to:

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Please list the page numbers and errors found. Thank you!