

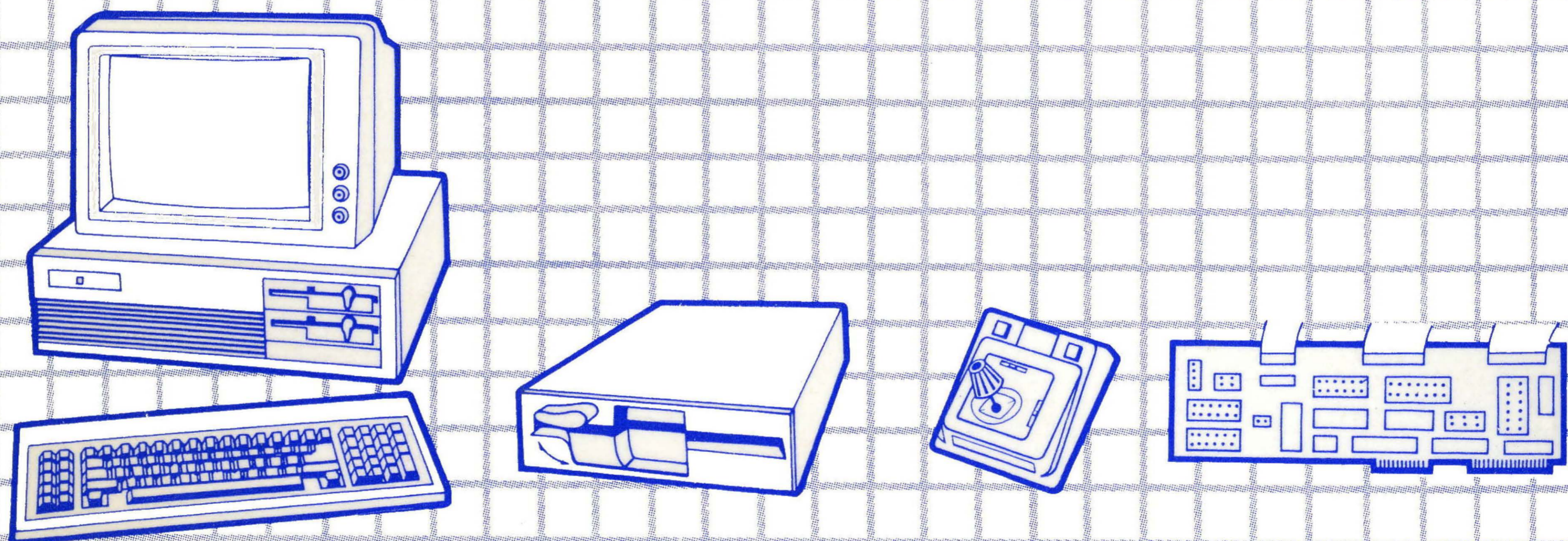


Personal Computer Enhancement Products

JE1043

**Floppy Disk Drive Controller Card
User's Manual**

121.DOC Revision 5.153 January 23, 1989



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Table of Contents

Introduction	1
Description	1
Features	1
Checklist	1
Glossary	1
Precautions	2
Configuration	3
Diagram	4
JP1 BIOS Address	5
JP2, JP3 I/O Address	5
JP4 BIOS Enable	5
JP5 Delay	6
JP6,7,8,9 Drive Type	6
Installation	8
Case Removal	8
IBM PC	8
IBM PC/XT JE1000 JE1001 JE1002	8
80286 80386	9
Other Computers	9
Card Insertion	9
Floppy Disk Drive Settings	11
Case Assembly	13
Operation	14
Power Up	14
286/386 SETUP	14
DOS	16
Capacities	16
Signal Description	18
Obtaining Assistance	19
Glossary	21

Table of Figures

JE1043 Revision E Diagram	4
JE1043 Revision D Diagram	4
Floppy Disk Drive Cable Diagram	12
Drive Cable Connection Diagram	12

Table of Tables

JP1 BIOS Address Jumper Settings	5
JP2/JP3 I/O Address Jumper Settings	5
JP4 BIOS Enable Jumper Settings	6
JP5 Delay Jumper Settings	6
JP6/7/8/9 Drive Type Jumper Settings	7
IBM PC DIP Switch Settings	8
IBM PC/XT DIP Switch Settings	9

Introduction

Congratulations on the purchase of your Jameco Electronics equipment. We realize that you will be anxious to get to work on your new equipment but we ask that you please read the manual. Keep an eye open for any additional information that may have come in an addendum.

This is only one of many innovative new products available from Jameco Electronics, pioneers in the mail-order electronics industry since 1974. Look for a growing line of quality products in your latest Jameco Electronics annual catalog and seasonal flyers.

Description The JE1043 is a floppy disk drive controller card designed to control two floppy disk drives. Any combination of two 360K, 720K, 1.2M or 1.44M floppy disk drives may be connected. The JE1043 has been tested at expansion bus speeds of up to 12MHz. The bus speed is often independent of processor speed; consult your computer owner's manual for information on bus speed.

Features

- Operational at expansion bus speeds up to 12MHz
- Fully compatible with AMI and most other BIOS
- Compatible with 8088/8086, 80286 and 80386 systems

Checklist

- JE1043 card
- Cable for connecting two floppy drives

Glossary Throughout this manual, a variety of common computer terms and abbreviations will be used. For your convenience, a glossary of standard computer terms has been included at the end of this manual.

Precautions When working with any circuit board or IC, some precautions need to be observed for the safest installation. Many parts are static sensitive and may be easily damaged by static electricity that may have built up in your body. The best way to assure that no damage comes to your new equipment is to observe a few precautions:

1. Whenever you move your body, you can easily build up enough static electricity to damage a circuit board. When handling a board or ICs, ground yourself often. The best way to do this is with a grounding wrist strap that is properly connected to a ground. These may be purchased through Jameco Electronics; order part WS. Another way to ground yourself would be to plug the computer's power supply into a grounded outlet (but leave it turned off), then touch the frame of the power supply often to dissipate any static charge that you may have built up.
2. Make sure that the power supply is turned OFF before installing or removing anything.
3. Hold all circuit boards and ICs by the edges.

Configuration

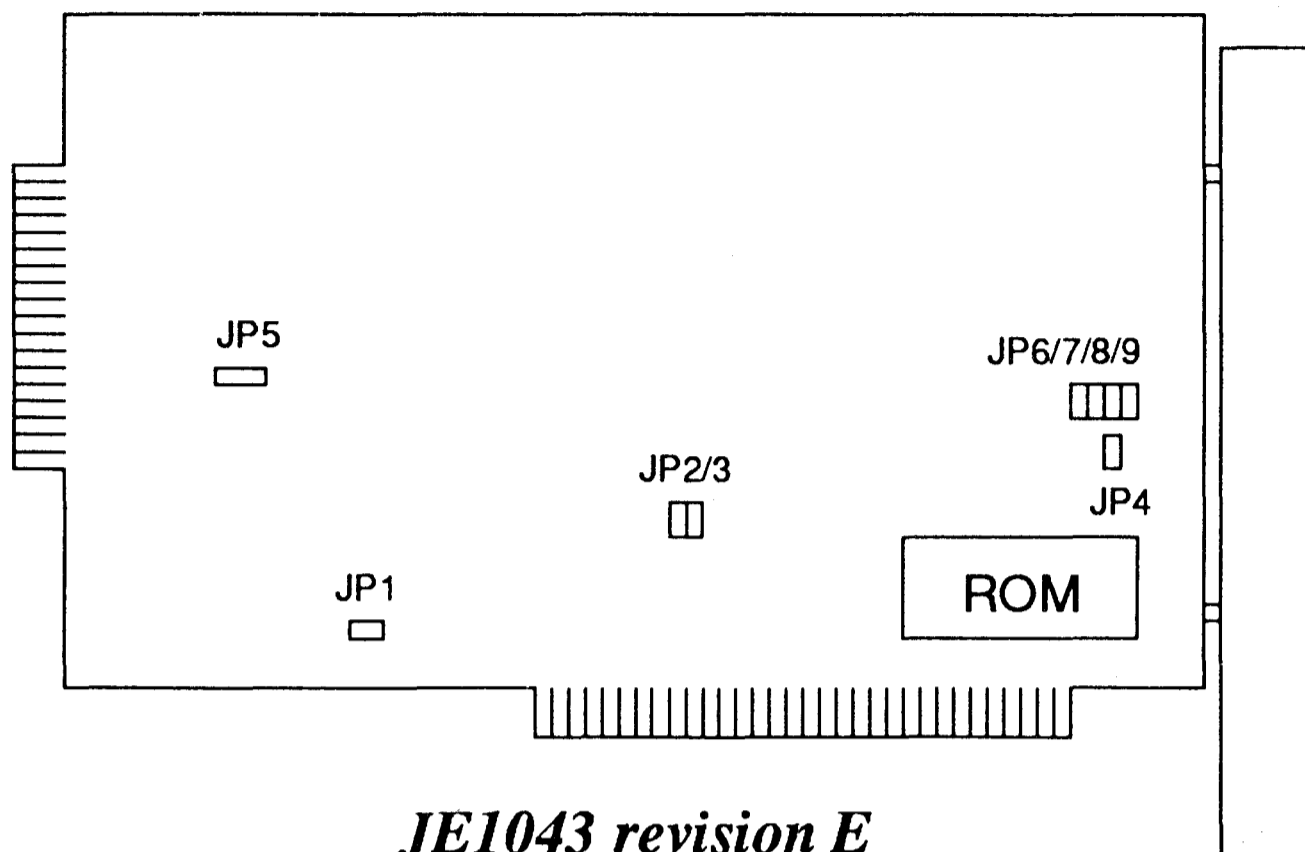
This section will cover the necessary hardware configurations of the JE1043 and your computer. Whenever possible, diagrams and tables have been provided to clarify proper configuration. Default or recommended settings will appear in *italic* type.

Since a computer system must never have two floppy controller cards installed at the same time, you must make sure that you remove (or disable) any existing floppy controller card.

If you have only one floppy disk drive installed in your computer, DOS will consider it to be both logical drive A: and logical drive B:. if you have two floppy disk drives installed in your computer, DOS will consider the first to be logical drive A: and the second to be logical drive B:. Refer to the glossary for a description of a logical drive and a physical drive.

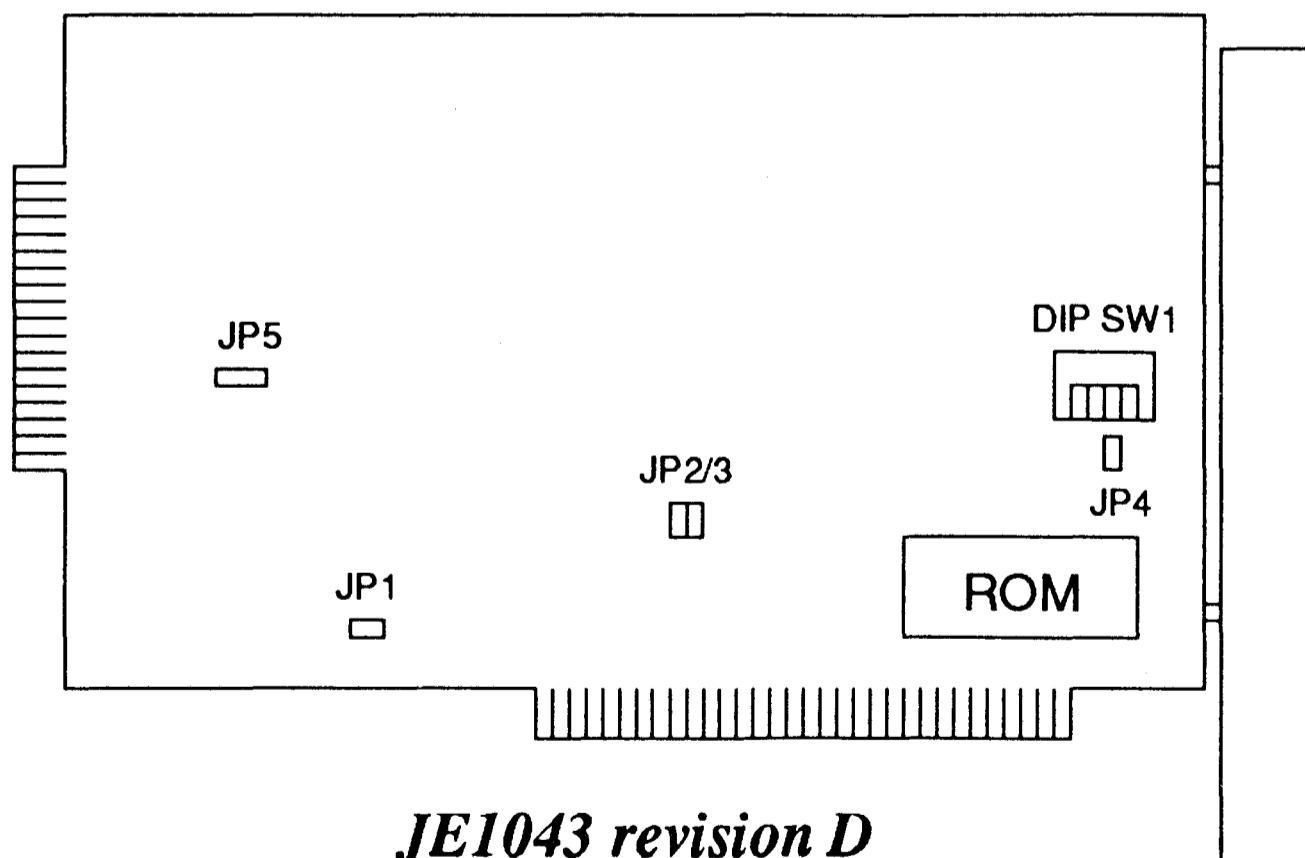
All references to locations on the JE1043 will be made as if you were holding it in front of you, with the expansion card edge to the bottom, and the mounting bracket to the right. All pertinent jumpers and connectors are labeled on the board. Please refer to the following diagram.

Diagram



JE1043 revision E

NOTE: Some versions of the JE1043 do not have JP6 through JP9 labeled on the board. Instead they are labeled "DIP SW1". If you have received this version, refer to the following figure. There are no functional differences between the two versions.



JE1043 revision D

**JP1
BIOS
Address**

Jumper block JP1 allows you to select the address of the ROM BIOS that is on the JE1043. This jumper block is located at the lower left corner of the board. On most computers, the factory default setting will not cause conflicts. However, as more and more expansion options are developed, the possibility for two devices to be addressed at the same location increases. To accommodate this, the JE1043 can be addressed at either of two memory addresses, in case conflicts arise. If you experience a conflict with another expansion board, such as a hard disk controller card, try addressing the JE1043 at the alternate location. Set the address according to the following table; defaults are in *italics*.

JP1	Address
<i>Open</i>	<i>CC00h to CDFFh</i>
Closed	CA00h to CBFFh

**JP2, JP3
I/O Address**

Jumper blocks JP2 and JP3 allow you to select the hardware I/O port address. Only one address may be selected at a time.

JP2	JP3	I/O Address
<i>Closed</i>	<i>Open</i>	<i>3F0h to 3F7h</i>
Open	Closed	370h to 377h

NOTE: *Never jumper both JP2 and JP3 at the same time.*

**JP4
BIOS
Enable**

This jumper block allows you to enable or disable the BIOS on the JE1043. The BIOS provides the routines necessary to run the four floppy disk drive types supported by the JE1043, without relying on whether or not the motherboard is capable of supporting them.

If your motherboard BIOS ROM is able to provide support for all floppy disk drive types that you are using, you do not need to enable the JE1043 BIOS ROM. It is only when

your motherboard BIOS ROMs do not support all floppy disk drive types that you should enable the JE1043 BIOS ROM. If you do not know, we recommend that you enable the JE1043 BIOS.

JP4	JE1043 BIOS
<i>Closed</i>	<i>Enable</i>
<i>Open</i>	<i>Disable</i>

**JP5
Delay**

This is the "Delay Select" jumper block. Put the jumper on pins 2 and 3 if your expansion bus speed is running from 10MHz to 12MHz. Put the jumper on pins 1 and 2 if your bus speed is below 10MHz.

JP5	Delay	Bus Speeds
<i>Pins 1 and 2 Closed</i>	<i>Disable</i>	<i>Lower than 10MHz</i>
<i>Pins 2 and 3 Closed</i>	<i>Enable</i>	<i>10MHz to 12MHz</i>

**JP6,7,8,9
Drive Type**

Jumper blocks JP6, JP7, JP8 and JP9 allow you to select the type of floppy disk drives that will be connected to the JE1043. These are located at the right side of the board. Refer to the previous figure of the JE1043. Configure the JE1043 for the type of floppy disk drives installed based on the following diagram:

OPEN CLOSED
CLOSED OPEN

JP6	JP7	JP8	JP9	Drive A	Drive B
Closed	Closed	—	—	360K	—
Closed	Open	—	—	720K	—
Open	Closed	—	—	1.2M	—
Open	Open	—	—	1.44M	—
—	—	Closed	Closed	—	360K
—	—	Closed	Open	—	720K
—	—	Open	Closed	—	1.2M
—	—	Open	Open	—	1.44M

OPEN CLOSED
CLOSED OPEN

Installation

This section will assist you in mounting your JE1043 and preparing it for operation. Information is provided for IBM and Jameco computers. If you have another type of computer, read this section and apply the information contained here to your application.

Case Removal

Open up your computer so you can access the motherboard. Please refer to the documentation that came with your computer for information on how to remove the cover to access the motherboard.

On some computers there is a set of DIP switches or jumpers that configure the motherboard for the number and type of floppy disk drives installed in the system.

IBM PC

The IBM PC has two switch blocks on the motherboard labeled SW1 (near the center) and SW2 (near the power supply). Each switch block has 8 DIP switches. Set the switches 1, 7 and 8 of SW1 as follows:

Number of Drives Installed	SW1-S1	SW1-S7	SW1-S8
1	Off	On	On
2	Off	Off	On

IBM PC/XT JE1000 JE1001 JE1002

The IBM PC/XT and compatibles, have only one switch block on the motherboard that has eight DIP switches. It is located near the power supply connectors. Set switches 7 and 8 of SW1 according to the following table:

Number of Drives Installed	SW1-S7	SW1-S8
1	On	On
2	Off	On

**80286
80386**

The IBM PC/AT (80286) and most AT compatible computers, including the Jameco Electronics JE1003, JE1007, JE3005, JE3010, JE3020, JE3025 and JE3030 motherboards, do not require any DIP switch or jumper changes that concern floppy disk drives configuration. These computers have a SETUP program that tells the CMOS parameters to recognize the types of floppy disk drives connected. The CMOS parameters are usually battery backed-up so that the parameters are kept while the computer power is off.

**Other
Computers**

There may be some AT compatible computers that have a DIP switch bank that needs to be configured when installing the JE1043. Please consult the owner's manual that came with your computer or contact your dealer for information regarding setting the motherboard for proper floppy disk drive types.

**Card
Insertion**

At this point your JE1043 should now have all jumpers set properly and your motherboard should have its switches set, if any.

If you have an existing floppy controller card in your system, you must remove (or disable) it. The computer can only accept one floppy controller card. Remove the existing cable that had connected the original controller card to your floppy disk drives, if applicable.

If the above step had not left an empty hole for the mounting bracket on the JE1043, you should select a slot

that is convenient for routing cables to the floppy disk drives and remove its empty bracket. Save the screw to use later to secure the JE1043 in place.

Again make certain that the computer's power is **OFF**. Slide the JE1043 into the selected slot. **DO NOT ROCK IT FROM LEFT TO RIGHT OR DAMAGE TO YOUR SLOT MAY RESULT.** As you slide it in, make certain that the gold-plated connector fingers are correctly started in the motherboard connector, then slowly and firmly press the card into place. Check to see that the controller card is fully and properly seated in the connector.

Some motherboards may be mounted too low in the case, causing the metal bracket on the JE1043 to prevent you from plugging it into the slot completely. This may be corrected in one of the following ways:

1. If the motherboard is mounted with all metal standoffs, it may be possible to put insulated washers under each one to raise the motherboard slightly.
2. Some cases allow for up and down adjustments of the rear panel; simply loosen the its screws and adjust the panel to a lower position. Tighten the screws only after all expansion cards have been installed and attached to the rear panel.
3. The last possible method would be to bend or remove the metal bracket of the JE1043.

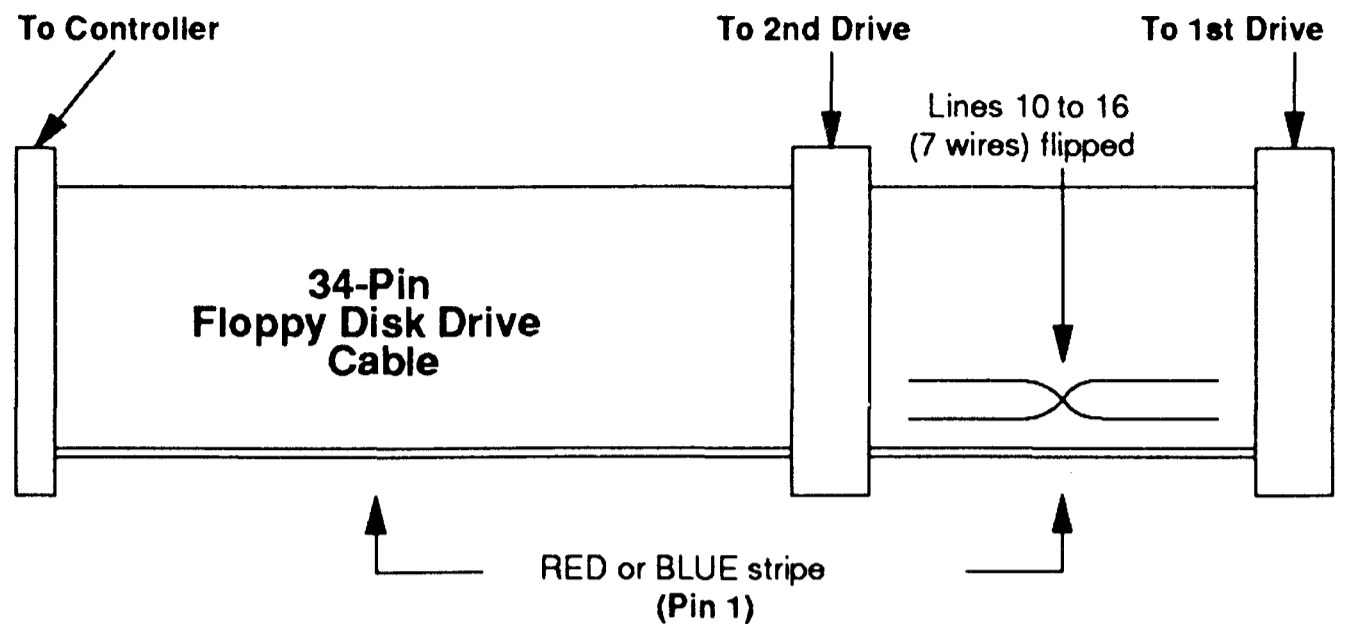
Secure the JE1043 in place with the screw previously used to hold the empty bracket or old controller card. When screwed in place, it should remain fully seated in the motherboard connector.

**Floppy Disk
Drive
Settings**

Find the "drive select" jumper block or shunt located on the floppy disk drive(s) you plan to use. Depending on the manufacturer of your floppy disk drive, the drive select jumper blocks may be labeled many different ways (e.g. 0 through 3, 1 through 4, A through D, DS0 through DS3, D1 through D4, and so on). Make sure each floppy disk drive connected to the JE1043 is set to the second "drive select". For example, if you have an FD55GFV drive which has four "drive select" jumper blocks labeled DS0 through DS3, you would want to put a jumper across DS1.

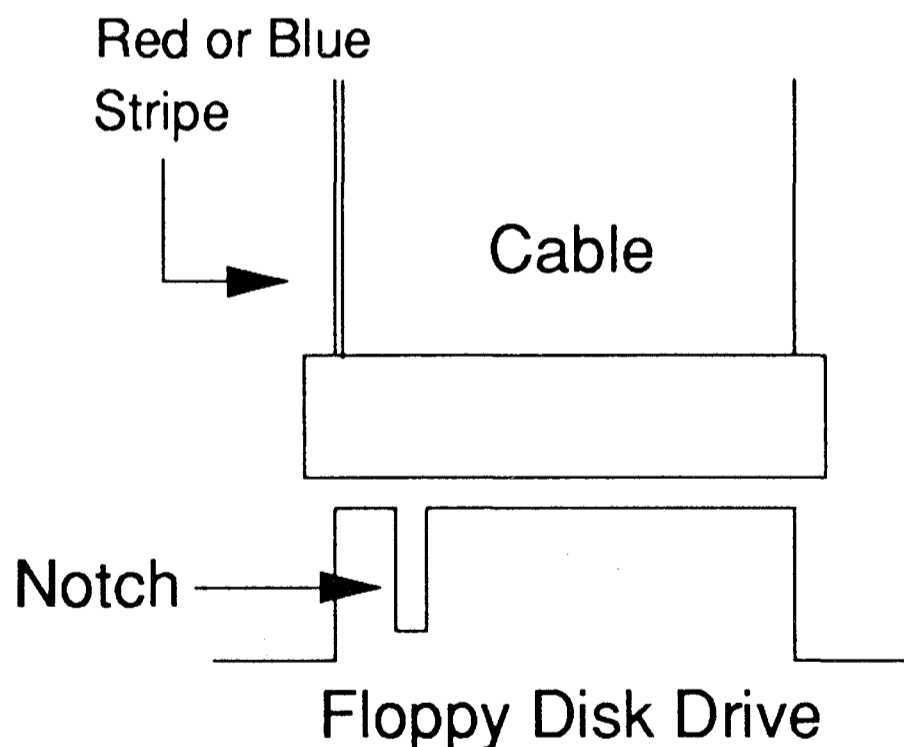
Install the floppy disk drive(s) you plan to use into the computer if they are not installed already. Be aware that most floppy disk drives will not work if they are mounted incorrectly. For example, the TEAC drives will not work if they are mounted upside-down. If you are not sure how this is accomplished, refer to your floppy disk drive manufacturer's manual for recommended mounting conditions. If this information is not included in your manuals, consult your dealer.

Look at the cable that came with the JE1043 and refer to the figure below. You will notice a red or blue stripe on one side of the cable. This stripe signifies line one (1). You will also notice that between two of the connectors, the cable has been split and "flipped." The connector opposite this "flip" connects to the JE1043. If the cable had come connected to the JE1043 already, take a moment to ensure that it is connected properly. If it is not connected to the JE1043, connect it now.



Attach the end of the cable to the first floppy disk drive (drive A:). Make sure the it attaches to the connector on the end of the cable and that the red or blue stripe on the cable faces the correct direction.

NOTE: The red or blue stripe on one edge of the cable refers to line one (1). The notch in the card edge of the floppy disk drive is nearest to line one. Make sure that line 1 on both cable connectors connects to line 1 on the rear of the floppy disk drive(s).



WARNING! Connecting this cable backwards may cause irreversible damage!

If you plan to use a second floppy disk drive (drive B:), attach it to the connector that is in the middle of the cable. Follow the same precautions as you did for connecting the first floppy disk drive.

**Case
Assembly**

Carefully examine your work. Make certain again that all floppy disk drives are securely installed, and that the cables are routed neatly where they will not be abraded by the case cover. Gently tilt the entire computer case from side to side to ensure that there are no loose screws or other bits of hardware in the case. Inspect the top side of the motherboard for other loose hardware you may have accidentally dropped. When you are completely satisfied with the installation, close the computer lid or replace its cover. Reconnect all peripherals.

Place your monitor and keyboard in a comfortable position in front of the you.

Operation

For the safest operation, you should always turn on your computer's peripheral devices (printer, modem, monitor, etc.) first and then turn the computer itself on. This is to protect the delicate computer circuitry from any transients caused by switching the other devices on. If your monitor is plugged into the rear of the computer and comes on when you turn the computer on, that is okay.

Power Up Turn on the computer's monitor and any other peripherals.

Turn on the computer itself.

Adjust front and rear controls of the monitor as necessary.

**286/386
SETUP** 286 (AT) and 386 computers require that you run a setup program to set up the CMOS parameters. These parameters tell the BIOS the time and date, as well as hardware options that are installed. The CMOS parameters must be told what kind of floppy disk drives are installed.

IBM PC/AT The original AT and some other compatible computers have the SETUP program on disk. This program may be found on the diagnostics diskette that came with your guide to operations manual. This involves booting the computer before the SETUP procedure can be started. The original IBM AT CMOS parameters could recognize only 360K, 1.2M and 720K floppy disk drives. However, using the JE1043 (with its BIOS enabled) it is possible to use a 1.44M floppy disk drive. If you have a 1.44M floppy disk drive, you can trick the AT CMOS parameters by telling it you have a 720K floppy.

JE1003
JE1007
JE3005
JE3010
JE3020
JE3025
JE3030

With these computers the SETUP program resides in the BIOS ROM. This enables you to setup the CMOS parameters to recognize the type of floppy disk drive connected before bootup takes place. These motherboards can recognize all four floppy disk drives types as well. All of the JE1003s and most of the JE1007s came with an Award BIOS. Some of the later JE1007s and all of the JE30xx series motherboards came with AMI BIOS.

Award BIOS To invoke the setup program from an Award BIOS computer, perform the following:

1. Turn the computer on. It will start to go through a power on self-test (POST).
2. As soon as it appears to have finished the POST and before the computer accesses the floppy disk drives, hit **Ctrl** **Alt** **Esc**. Release all three.

NOTE: In the Award setup program, the 360K floppy disk drives may be referred to as double sided drives and the 1.2M floppy disk drive may be referred to as high density or high capacity drives.

AMI BIOS To invoke the setup program from an AMI BIOS computer, perform the following:

1. Turn the computer on. It will go through a power on self test (POST).
2. When it prompts to enter system setup, hit **Del**.
3. When it prompts to run SETUP, hit **Y**.
4. When it prompts to run SETUP/other (1/2), hit **1**.

The AMI BIOS automatically recognizes floppy disk drive types, but requires that setup be run anyway.

Once you are in the setup program, simply follow the directions on the screen. Select the type of floppy disk drive(s) you have installed, then save the results. The computer should then reboot.

DOS

In order to use your JE1043 you will need DOS (Disk Operating System). This is software that you can buy from most software mail order houses and software stores. The two most common types are MS-DOS and PC-DOS. Both should work fine with the JE1043.

PC-DOS is the operating system that is available for the PC, XT and AT computers made by IBM and is sold under the IBM name. MS-DOS is written for the compatibles on the market like Compaq, Leading Edge, etc. All Jameco Electronics' motherboards are fully IBM compatible so they will function with either PC-DOS or MS-DOS.

Each of these types of DOS, PC-DOS and MS-DOS, have come in numerous versions: 2.1, 3.0, 3.3, etc. If you plan to use a 720K 3.5 inch floppy disk drive you will need DOS version 3.2 or higher. If you plan to use a 1.44M 3.5 inch floppy disk drive you will need DOS version 3.3 or higher. We recommend that you use PC-DOS 3.3.

Insert a DOS boot diskette into the first floppy disk drive (drive A:) and close the door lever.

Try to format a blank diskette in the first floppy disk drive (drive A:).

If you have a second floppy disk drive (drive B:), try to format a blank diskette in it as well.

Refer to your DOS manual for information on DOS operations.

Capacities

When formatting and using diskettes, you must be aware of the different types of diskettes on the market and what floppy disk drive types they work in.

**180K
Diskettes**

This is the diskette capacity that was used in the earlier systems that used single sided floppy disk drives. These diskettes are labeled, "Single Sided/Double Density".

360K
Diskettes

This is the type you will find most systems using. 5.25" 360K floppy diskettes are usually labeled, "Double Sided, Double Density", "DSDD" or even "2S2D". There are 360K floppy disk drives designed to use only 360K diskettes. You can only format 360K (double sided/double density) diskettes, and the older 180K (single sided/double density) diskettes with 360K floppy disk drives. It is not recommended that you format single sided diskettes in 360K drives (unless you use the "/1" DOS format parameter) because these diskettes are not designed to hold data on the reverse side. Jameco Electronics offers 360K floppy disk drives: JE1020, JE1021, FD55B and TM100-2.

1.2M
Diskettes

This type became popular when the IBM AT came out. 5.25" 1.2M floppy diskettes are usually labeled, "Double Side, High Density". The 1.2M floppy disk drives designed for 1.2M diskettes will also read 360K diskettes. When using 360K diskettes in a 1.2M floppy disk drive, it is recommended that you only perform read and write operations on previously formatted diskettes. Formatting 360K diskettes in 1.2M floppy disk drives will not be reliable. Jameco Electronics offers 1.2M floppy disk drives: JE1022 and FD55GFV.

720K
Diskettes

The later IBM ATs had the option of installing a 720K floppy disk drive. 720K diskettes are 3.5" double sided, double density normal capacity diskettes. The diskettes are usually not labeled, but can be distinguished by a single notch. These diskettes come with a small write protect notch on one corner. When open, the diskette is write-protected. When the notch is closed, the diskette can be written to. You may format and use only 720K diskettes in 720K floppy disk drives. Jameco Electronics offers a 720K floppy disk drive: MF353B.

1.44M
Diskettes

This is the high density version of the 3.5" size floppy disk drives. These diskettes are sometimes labeled, "HD", but can easily be distinguished by two notches. These diskettes come with a write-protect notch (just as 720K

types), and a density notch. The density notch allows the 1.44M floppy disk drives to determine which floppy diskette type is installed. Since 720K diskettes lack the second notch, 1.44M floppy disk drives can detect when a 720K diskette is installed and when a 1.44M diskette is installed. 1.44M floppy disk drives can write and read reliably to both 720K and 1.44M diskettes. Jameco Electronics offers a 1.44M floppy disk drive: MF355B.

NOTE: You may come across older (first release) 1.44M diskettes that did not have the density notch. These had only the single write-protect notch and may look like 720K diskettes to most 1.44M floppy disk drives. In this case, you may have to disable the density select circuitry of your 1.44M floppy disk drive (via jumpers) forcing the drive to see 1.44M capacity only. Refer to the drive documentation or the manufacturer on how to accomplish this.

Signal Description	34-pin Edge Connector	Signal Name
	2	Unused
	4	Unused
	6	Unused
	8	Index
	10	Motor Enable A
	12	Drive Select B
	14	Drive Select A
	16	Motor Enable B
	18	Direction
	20	Step Pulse
	22	Write Data
	24	Write Enable
	26	Track 0
	28	Write Protect
	30	Read Data
	32	Select Head 1
	34	Disk Change
	All odd 1-33	Ground

Obtaining Assistance

Jameco Electronics carefully selects and tests all of our products. However, even the best tested and documented products can still cause you an occasional problem. If you experience difficulty in either assembly or operation of your equipment, recheck cable connections and configuration settings against this document and any other addenda that may have been included. If you have exhausted all other options and are still encountering difficulty, refer to the appropriate section below for assistance.

Technical Support

If you have exhausted all other options and are still encountering difficulty, our Technical Support Staff are available between 7am and 5pm, Pacific Time, Monday through Friday. When you call, please have the equipment in question handy, along with the necessary customer and order numbers. If appropriate, please write down DIP switch settings or other configuration data. The technicians may need all of this information to fully assist you. The phone number is (415) 592-9990.

Customer Service

Discrepancies in shipment, returns, exchanges and refunds are handled by our Customer Service Department. They are also available between 7am and 5pm, Pacific Time, Monday through Friday. Their number is (415) 592-8121.

Foreign Customers

If you are located outside the United States, you may find it more convenient to contact us by either FAX or Telex, both available 24 hours a day. Inquiries should be marked to the attention of either Customer Service or Technical Support. Our FAX numbers are (415) 592-2503 and (415) 595-2664. Our Telex number is 176043, answerback: JAMECO BLMT.

Corrections If you run across any errors or omissions in this manual or the manual does not explain something thoroughly enough, please write to us and let us know. Feedback from our customers provides for consistently high quality now, and in the future. Please reference the document and revision numbers as well as the printing date (located on the cover of all Jameco Electronics documentation) when writing so that corrections can be made as easily as possible. Address correspondence to:

JAMECO ELECTRONICS
1355 Shoreway Road
Belmont, CA 94002
ATTN: Technical Support

Glossary

BIOS	Basic Input/Output System. Normally stored in ROM, BIOS routines provide for the basic "housekeeping" chores for the hardware configuration. The CPU relies on the BIOS to provide information on interfacing to the various types of hardware.
Boot	Originally referred to "pull up by the bootstraps." Causing the CPU to re-initialize itself. See COLD BOOT and WARM BOOT.
Bus	A series of wires that conveys information to a large number of devices. See EXPANSION BUS.
Bus Speed	The frequency of the clock signal supplied to the expansion bus. This is not necessarily the speed at which the processor is running.
CGA	Color Graphics Adapter. Provides RGB video at 320 x 200, 4 colors from a palette of 16.
Clock Speed	The frequency of the clock signal supplied to the processor (i.e. 8MHz).
Cold Boot	Causing the CPU to re-initialize by removing its source of power. This can be accomplished either by turning the power off and on or pressing a RESET SWITCH.
CPU	Central Processing Unit. In PC and PC/XT machines, the CPU is an Intel 8088. In PC/AT machines, the CPU is an Intel 80286. In 386 machines, the CPU is an Intel 80386.

Daisy Chain Describes similar devices connected along a single cable. Often, daisy chain cables contain "flipped" wires that differentiate one device from another on the cable.

DIP Dual Inline Package. Describes integrated circuits, cables, connectors, etc. that utilize a dual row of pins layout.

DIP Switch Usually a set of four or eight small switches that are set either on or off. Normally scanned only at time of BOOT, these often select system options.

DOS Disk Operating System. DOS is responsible for the management of the computer and its software. In addition to standard DOS commands, many other utilities are often included. The two most popular versions of DOS for PCs are PC-DOS by IBM and MS-DOS by Microsoft.

EGA Enhanced Graphics Adapter. Provides RGB video at 640 x 350 or 640 x 480, 16 colors from a palette of 64. Usually capable of emulating CGA and HGA.

Expansion Bus In an IBM-style computer, the expansion bus consists of a number of connectors or slots connected in parallel to the processor. In traditional designs, the expansion bus and processor were driven from the same oscillator clock (i.e. 8MHz). In newer designs, the processor may be clocked at a higher rate for performance while the bus is clocked at a lower rate to accommodate slower expansion cards. For example, the JE3010s processor operates at 16MHz while its bus is clocked at 8MHz.

HGA Hercules Graphics Adapter. Provides TTL video at 750 x 348 in 2 colors (monochrome).

Jumper	A rectangular piece of metal in a plastic casing, usually black, that fits over two pins of a jumper block to make an electrical connection between them. This is also called a "Strap".
Jumper Block	Two or more pins side by side protruding from a circuit board that can be electrically connected with a jumper. These are used to configure the circuit for different conditions.
Logical Drive	DOS assigns one or more logical drives to each physical drive and assigns them a unique alphabetic designator. Drive A: can be a floppy disk drive, drive B: can be a RAM disk, drive C: can be the first half of a hard disk drive, drive D: can be the second half of a hard disk drive, etc.
MDA	Monochrome Display Adapter. Provides TTL output, 80 x 25 text only, 2 colors (monochrome).
Physical Drive	This is the actual drive itself. A floppy disk drive itself would be considered one physical drive.
Processor	See CPU.
RAM	Random Access Memory. This is memory that the computer can change randomly. This is the part of memory that the computer uses for programs and data. Once power is turned off to the computer, the RAM contents are lost.
ROM	Read Only Memory. This is memory that cannot be changed. When power is turned off and back on, the data is not lost. Generally used for BIOS.

SETUP This is a program (which can be stored in the BIOS ROM or on a disk) that is necessary to configure the parameters needed by the motherboard. Usually found only on AT style computers. These parameters tell the motherboard upon boot-up the following information: time, date, drive types, monitor type, memory amount and type.

SIMM Singular Inline Memory Module. A compact expansion board containing RAM. SIMM normally refers to a memory module with a card edge connector.

SIPP Singular Inline Pin Package Memory Module. A compact expansion board containing RAM. SIPP normally refers to a memory module with protruding pins.

Terminator Terminating resistor pack. Used in disk drives to filter out line noise and terminate a data cable. Consists of a row of 220 to 330 ohm resistors molded together. This is usually installed in a socket. It is removed from all drives except the disk drive at the end of a DAISY CHAIN cable.

VGA Video Graphics Array. Provides many RGB or Analog modes up to 800 x 560. Can display 256 colors from a palette of 262,000. Usually can emulate EGA, CGA and HGA.

Warm Boot To reset the computer without removing power. The CPU is told to re-initialize itself. The procedure to invoke this is:

Press and hold the **Ctrl** key down.
Press and hold the **Alt** key down.
Press the **Del** key down.
Release all three.

NOTES

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