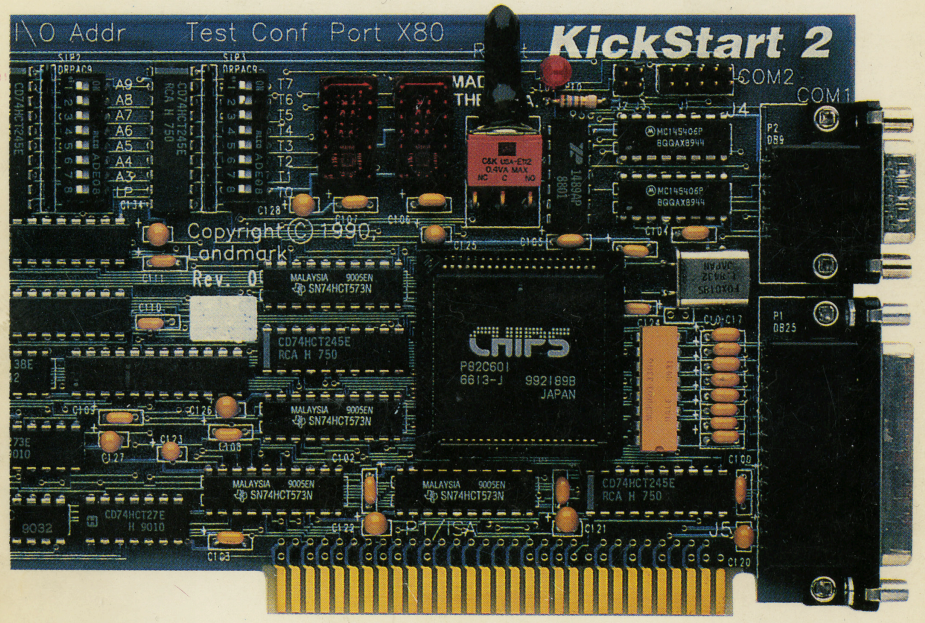
KickStart2™

User's Instruction Manual



Multifunction Diagnostics Card for PC XT, AT, AT/386, AT/486 and Compatibles

LANDMARK™

When You Think of Standards... Think Landmark

KickStart 2™

Multifunction Diagnostic Card

USER'S MANUAL

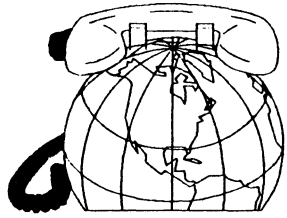
Multifunction Diagnostic Card
for IBM PC, XT, AT, and Compatible Computers

Document # MAN-KS2-110290B
Part Number 01002-02

Landmark Research International Corporation
703 Grand Central Street
Clearwater, FL 34616
Corporate Headquarters Phone (813) 443-1331
Sales / Technical Support Phone (800) 683-6696
FAX (813) 443-6603

THANK YOU FOR PURCHASING THIS PRODUCT

WE WANT TO HEAR FROM YOU



We at Landmark have worked to make this the finest product of its kind available, and to describe it fully and clearly in this manual. We welcome your comments and suggestions for improvements in the manual or product. Please feel free to send your recommendations to our marketing department at the address given on the title page of this manual. And be sure to mail us your Owner Registration Card. We want your feedback.

PLEASE READ THIS NOTICE CAREFULLY:

Do not open the software diskette package (if any) or use this Product until you have read and agreed to the End-User Customer License Agreement on the next page. If you open the package or use the materials, Landmark will assume that you have agreed to the terms of the License Agreement. If you do not accept its terms, you must return the package unused and unopened to the party from whom you received it.

IMPORTANT NOTE

We assume that you intend to read this manual to learn about the product and how to use it. To avoid confusion and make the learning process more pleasant and effective, please be sure to look up the definitions of any words you do not fully understand. Use the glossary in the back of the manual and any good dictionary of the American language.

Record your NAME here: _____

Record your Serial Number: _____

Record your EPROM Release: _____

END-USER CUSTOMER LICENSE AGREEMENT

This Agreement describes Landmark's terms and conditions under which you are allowed to use the product. Please complete, sign, and return the Owner Registration card to acknowledge that you have read and agree to the terms of this Agreement.

Grant of Single-Computer License. Landmark grants to you and you accept a License to use on one computer at a time the programs and related materials ("Product") delivered with this Agreement. This License does NOT authorize you to use the Product on more than one computer at a time, nor on a computer network or electronic bulletin board in which more than one computer can use the product at the same time. This License may not be transferred nor sublicensed to another party.

Term. This Agreement takes effect when you receive the Product, and ends when Landmark has received the Product and all copies you have made back from you. Landmark shall have the right to terminate this Agreement if you violate any of its provisions. Landmark or its licensor owns all right, title, and interest, including all worldwide copyrights, in the Product and all copies of it.

Limited Warranty - Landmark offers no warranty of any kind on the software, disk files, or documentation; you bear the entire risk of the performance and quality of the software. Landmark reserves the right to improve and otherwise modify the Product at any time without notice.

If you are the registered owner or can show proof of purchase, Landmark warrants to you that the Product shall be free of manufacturing defects, provided you have not abused or misused it, for the following time period after you acquired the Product: 90 days for diskettes or mechanical devices; or 1 year for electronic circuit boards. Landmark's sole duty under this warranty shall be to repair or replace defective components that you pay charges for and ship to Landmark during the warranty period, with proof of your date of acquisition.

This warranty gives you specific legal rights, and you may have other rights which may vary from state to state. Landmark makes no other express or implied warranty, unless unlawful or unenforceable under applicable law. Landmark disclaims all implied warranties of merchantability and fitness for a particular purpose, and the liability of Landmark, if any, for damages relating to any allegedly defective product shall under any tort, contract, or other legal theory, be limited to the suggested retail or actual price paid, whichever is lower, for the Product, and shall not include incidental, special, consequential, or indirect damages of any kind, even if Landmark is aware of the possibility of such damages. Some states do not allow limitations on how long an implied warranty lasts or the exclusion or limitation of incidental or consequential damages, so the above limitations or exclusions may not apply to you.

Your Agreement. You agree to all of the following, and acknowledge that violation is a serious crime that is punishable under law, and can subject you

to paying civil and criminal litigation fees as well as damages:

To purchase an additional License for each computer on which you wish to use the software portion of this Product at the same time, or to request from Landmark a site or multi-use License that authorizes you to use the Product software on a computer network or more than one computer at a time.

Not to disassemble, decompile, reverse engineer, discover trade secrets of, transmit, or copy the Product in whole or in part, except for making a single backup floppy diskette copy or copying it to a hard drive to facilitate use of the Product, without Landmark's prior written consent; to label any backup floppy diskette with the program name, copyright, and trademark designation in the same form as the original diskette.

Not to transfer the Product in any form to any party without Landmark's prior written consent; to use your best efforts and take all reasonable steps to protect the Product from unauthorized reproduction, publication, disclosure, use, or distribution.

Software Updates. *In order to be eligible to receive any Product software update from Landmark, you must be a registered owner. That means Landmark must have on file a completely filled-in Owner Registration Card that you have signed.* All Product updates and corrections you receive shall become part of the Product and be governed by the terms of this agreement.

Registered Owners Only: Landmark will do its best to notify you of software updates or major corrections released to the public and the price you must pay for them. If at the time you purchased this Product it is not the latest retail version available, Landmark will, upon receiving it in good condition from you within 30 days after you acquired it, exchange it with the latest version for shipping charges and any difference in retail price between the two versions.

RMA Required. You must call and receive a Landmark RMA (Return Material Authorization number), and write it the outside of the package before returning any product to Landmark. Landmark will refuse any product returned without an RMA number, and you will be liable for any consequent shipping and handling charges.

Entire Agreement. This is the entire agreement between you and Landmark relating to this Product. It cannot be modified by purchase orders, advertising, or representations of anyone, unless a written amendment has been signed by one of the officers of Landmark. This Agreement shall be governed by Florida law, and is deemed entered into at Clearwater, Pinellas County, Florida, by both parties.

For Landmark Research International Corporation:

Warren R. White, President and CEO

TABLE OF CONTENTS

List of Figures and Illustrations

List of Tables

INTRODUCTION

This section of the manual lists and/or describes errors that have been found in the manual since it was originally written. It also documents discrepancies between what the manual says and what the product actually does. This section may change as the product goes through manufacturing revisions to add features or correct problems for your benefit, even though the rest of the manual stays the same. Therefore, this section supersedes all other information in the manual. Last-minute changes may be documented in the README.COM file on a floppy diskette if one comes with the product, and in that case, information in README.COM supersedes the entire manual. Enter the command README to read it.

RECORD OF CHANGES

Table 1. Record of Changes

Document Number	Part #	Rev	Nature of change
MAN-KS2-00001-00	01002-01		Original manual. Rev 1.0 firmware
MAN-KS2-110290B	01002-02	A	General improvement. Rev 1.1 firmware

ERRATA

COMMENTS/SUGGESTIONS

Your considerations about this manual and the product are important to us. Please photocopy this page, answer the questions on the copy, and mail it to us at the address on the title page. We will give your comments our immediate attention, and will use them to improve our products.

Product Name Serial # Date

Your Name Title

Company Phone

Address

City State Zip

Rate the following:

Product	Good	Okay	Poor	Manual	Good	Okay	Poor
Functionality				Organization			
Reliability				Accuracy			
Suitability				Completeness			
Completeness				Writing Style			
Attractiveness				Tables/Figures			
Packaging				Glossary/Index			

What you liked best:

Suggestions for improvement:

INTRODUCTION

This section of the manual lists and/or describes errors that have been found in the manual since it was originally written. It also documents discrepancies between what the manual says and what the product actually does. This section may change as the product goes through manufacturing revisions to add features or correct problems for your benefit, even though the rest of of the manual stays the same. Therefore, *this section supersedes all other information in the manual.*

ERRATA

PAGE	ITEM	ERROR/CORRECTION
xii	Table 27a	Add Table 27a. Microid Mr. BIOS 1.0A POST Codes...93a
5	Table 2	Delete items 3 and 9
9	Readme	No README.COM and no floppy are provided with this release.
17, 27	Figures	Reverse the definitions of switches SW2-3 and SW2-5. Change SW2-3 to Loop, and SW2-5 to Stop on Error.
17, 27, 31 37, 38	Tst/Err#	Change to Err/Tst# (the correct name of switch SW2-1)
29-31	Anomaly in LEDs and Switches	LEDs and switches do not all perform in accordance with the tables. The Extended Test LED comes on whenever the Running LED is on. The Looping LED usually does too, but behaves inconsistently. Setting the StopErr switch on causes the system to hang up when a failure occurs (it does stop on an error) unless used with the LoopErr switch also on.
30, 46	Results Log Anomaly	Results logging to a serial port does not use a hardware or software handshake. This can cause the receiving device to display spurious, skewed information. To prevent this, use a slower baud rate or a faster serial device. The 8250 IRQ4 test displays a spurious "Z" at the beginning of result.
37	Set Up, Item 2	Replace "the test results to go to" with "to run tests from"; replace "want them to go to" with "to run them from".
	Item 5	Change "checking" to "check".
	Item 8	Third line: change "because" to "via"; delete rest of paragraph after "Com1".
38	Start, or Run	Second line: delete "in a loop" from the end of the sentence.
	Display Test or	Delete "(Extended Test LED off)" and "(Extended Test LED on)". Delete "and the Extended Test LED" from the last sentence.
39	end of page	Add explanation: "To enter menu mode, set all Test # switches to off, then cycle Pause on and off."
41	Remote	Delete "(including any modem initialization string)," from the 8th & 9th lines.
47	Remote	Change "whichever" to "a", and delete "is assigned to COM1". Delete "to be sent before switching". Add to the end of the paragraph: "Type in up to 30 characters. Press \ and Enter to enter a carriage return character. Press space to move cursor right, and

PAGE	ITEM	ERROR/CORRECTION
47	Remote (con't)	backspace to delete to the left. Press Enter to send the string. This is the only way KickStart 2 sends an initialization string to the modem." Add new top line to menu: "COM 1", allowing user to select a COM port, and remove COM1 from the second line.
	Character-istics of Remote	First paragraph: Delete "require you to enter the supervisor pass word"; First paragraph: Change "entering remote mode." to "exit-ing the Remote Configuration Menu."; Delete second paragraph.
49	Who is a	First paragraph: Delete "Invoke remote operation."
49, 50	Password	Change default supervisor password from LANDMARK to blank.
50	Security Violations	Change paragraph to: "KS2 will beep on the first two attempts to enter the correct password. Failure on the third attempt will display a large violation message, and your system will lock up until rebooted."
	Security For	Delete First and second paragraphs.
52	Test Numbers	Add sentence "The hex display shows the number of each test as it executes".
53	Table 17	Test 08: add comment "Serial Loopback required"
54	Table 17	Delete test # 91(National...); change test # 93 to 91 (3-COM).
61	Floppy	Add to end of second paragraph: The test aborts on the first failure. If no drive is connected, the test will fail."
63	Hard Drive	Add to end of topic, just before Format Random heading: "If no drive is connected, the test will fail."
68	Custom Batch	First paragraph: change 20 to 18.
	Menu	Replace with: "Add test to batch table, Delete test from batch table, Clear batch table,Execute batch table, Exit add/delete mode."
	2nd paragraph	Last sentence: Change to read "You must select Exit add/delete mode in order to leave custom batch handling and return to normal test menu capability."
	3rd para.	Delete everything from "Please note" to the end of the paragraph.
	4th paragraph	Replace paragraph with the following: "When you have fully selected the parameters for the test, the display will put it in the next available empty position."
	5th para.	4th line: Replace "batch setup" with "Add/delete mode".
69	3rd line	Replace everything following the word "batch" with "a single pass only."
108	Table 34	Change Data Terminal Ready DB25M signal from pin 22 to pin 20.

CONGRATULATIONS

Thank you for your purchase of Landmark's KickStart 2™ Multifunction Diagnostic card for your computer. KickStart 2 is a diagnostic test tool that will help you determine the cause of a failure of your PC to run properly when you switch on power. It is made of top-quality components, and is intended to give you years of trouble-free service. We congratulate you on your purchase of KickStart 2, and we thank you for being our customer.

This manual will fully describe KickStart 2 and how to use it. We believe KickStart 2 is the finest product of its type, and that it is the best overall value for your investment. We are thankful to have you as our customer and we congratulate you on your purchase of KickStart 2.

ABOUT THE PRODUCT

Figure 1. KickStart 2 Multifunction Diagnostic Card

KickStart 2, designed and built in the USA by Landmark, is an add-in card that plugs into any expansion slot of an IBM PC, XT, AT, or compatible

personal computer. We developed it expressly for you after years of PC maintenance and marketing experience taught us what you need.

We named it KickStart 2 because it is a sequel to Landmark's KickStart 1 Power-On Self-Test diagnostic card, and it helps you get troublesome computers back into operation fast. It provides built-in local/remote diagnostic tests, Power-On Self-Test failure indication, system password protection, and complete serial and parallel I/O. Its abundant features make it useful to systems builders and manufacturers as well as technicians.

MAJOR FEATURES AND FUNCTIONS

KickStart 2 has the following major features:

- Full-Featured Power-On Self-Test card
  - Runs on PC, XT, AT, 386, 486
  - Does not require DOS or other operating system
  - Digital display shows failing power-on test
- Easy-to-use menu system makes testing automatic
  - Pull-down menus activated with single keystroke
  - Displays color, mono Hercules, MDA, CGA, EGA, VGA
  - Can be run from remote PC to save service calls
- Built-in ROM diagnostics
  - Diagnostics can loop, log to printer
  - Tests check out all parts of the system
  - Tests run before Operating System boots
- Password protection gives system security
  - Prevents novices from running destructive tests
  - Prevents unauthorized users from booting system
  - Safeguards against virus infection, data theft
- Built-in controller handles standard system I/O
  - Dual serial ports for remote control, data logging
  - Bi-directional parallel port for control, printing
  - Battery-backed real time clock gives accurate time
  - On-board CMOS RAM holds configuration information

Intended Applications

KickStart 2 is intended for use in three major types of applications:

1. **Service** - factory, field, corporate, and repair center technicians will use KickStart 2 to help isolate the cause of system failures on both local and remote systems. Switch selection of a single test or batch of tests allows fast troubleshooting without traversing the menu system. Switches are also provided for looping, results logging, and error handling.

2. **PC manufacturing** - factory test technicians will use KickStart 2 to burn in and check out systems or motherboards prior to shipment; unlike normal diagnostics, no video or keyboard is required to run tests. KickStart 2 is also ideal for final system configuration. It provides low-level formatting for MFM and RLL hard drives. It also provides a printed report of the test results to give customers peace of mind that they have made a good purchase.

3. **Systems integration** - systems builders and value-added resellers will integrate KickStart 2 into systems because it provides standard I/O with built-in pre-boot diagnostics, remote operation, and password protection for security.

Why KickStart 2 Is Ideal for System Test

KickStart 2 is the ideal companion for higher-level system diagnostic test programs. When the system boots but still fails to run properly, your diagnostic test software will help you to find the cause by displaying test results on the computer screen. But when the computer fails to boot, you will often be unable to see anything on the screen.

This is when you need KickStart 2. By plugging it into the computer and switching power on, you can tell if power is available to the slot and within tolerance, and you can observe the POST codes on the digital hexadecimal display until the computer fails. If a failure occurs, the hex display will glow steadily to indicate which circuit caused the failure.

KickStart 2 contains additional, comprehensive tests above and beyond any BIOS POST code. The tests give you a pass/fail indication, error messages, and complete test looping, error handling, and results logging. KickStart 2 tests, in concert with JumpStart BIOS, can function without a keyboard, video, large system RAM, or a speaker, while a normal system BIOS would require they be attached and functioning.

Because KickStart 2 diagnostics run before the operating system boots, it can find problems that prevent the operating system from booting. As a result, it is more effective and reliable than disk-based diagnostics that require floppy drives, keyboard, video, memory, and an operating system.

SYSTEM REQUIREMENTS

To install and operate KickStart 2, you must have an IBM PC, XT, AT, 386 or 486 AT, or compatible personal computer with 64K or more of RAM. Any software provided on floppy diskette requires MS-DOS or PC-DOS version 2.0 or later, and requires a 3.5-inch or 5.25-inch floppy drive, as appropriate to the type of diskettes included with KickStart 2.

ABOUT LANDMARK

Landmark is a software and hardware development and manufacturing company based in the United States of America.

Landmark is the world's leading retail supplier of personal computer diagnostic and test tools for technicians and engineers. Landmark products include *PC Probe*™ advanced system testing software, *Landmark System Speed Test*™ performance tests, *AlignIt*™ floppy disk test and alignment software, *JumpStart BIOS*™, the *KickStart*™ family of power-on diagnostic cards, *Memory Boss*™ family of EMS 4.0 Expanded Memory Managers, hard disk maintenance and diagnostic test software, system level drivers and utilities, and other add-in products for PCs.

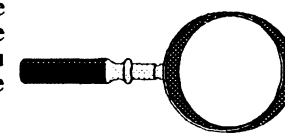
Please feel free to call Landmark headquarters sales office to inquire about products and services available. The address and phone number are on the title page of this manual.

FIRST THINGS YOU SHOULD DO

Inspect The Package

Before using KickStart 2, inspect the packaging for evidence of damage during transit from Landmark or your dealer. Landmark does not warrant the product against damage in transit. If it is damaged from rough handling, you must file a claim with your carrier or shipping company. After observing the special handling procedures outlined in the next topic, also inspect the card itself for evidence of damage and for completeness. If the card was already installed when you received your computer system, you do not need to inspect it.

You should save any original packaging in case you need to ship or transport KickStart 2 in the future. If you are a technician planning to use KickStart 2 to test a variety of computers, you will certainly need to keep both the protective anti-static bag and the padded box.



Handle the Card Carefully

KickStart 2 is ruggedly constructed of reliable components. However, special handling is required if you expect to get the best performance and life from the product. Please heed the advice in the following paragraphs before removing it from its protective packaging or handling it in any other way.

KickStart 2 contains delicate electronic circuits that can be damaged or weakened by static electricity discharges. If you walk across a carpet or slide across the seat of your chair, your body can build up a huge static electricity charge. If you then touch KickStart 2, the resulting static electricity discharge is certain to weaken or destroy the circuits. If the circuits are weakened, the card may work for a period of time, but its life span will be shortened and it may fail prematurely.

Therefore, before removing KickStart 2 from its protective packaging or handling it, please be careful to touch a ground or grounded object with your finger. For example, touch the bare metal surface on the chassis of your computer while it is plugged into a grounded electrical outlet. This will safely discharge any static electricity built up in your body, and it will avoid damaging KickStart 2. Do not allow anyone to walk across a carpet or linoleum floor with the bare card in hand.

Finally, if you are a technician, you will be inserting and removing KickStart 2 from many systems. Its edge connector is more heavily plated than most cards and can withstand hundreds or thousands of insertion/removal cycles. However, the card cannot tolerate such abuse as dropping or tossing it carelessly onto a workbench. You should handle

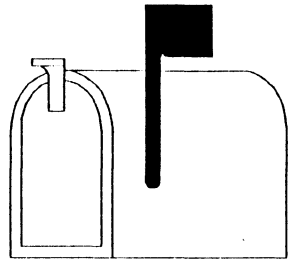
KickStart 2 as you would any delicate instrument. A severe shock can damage the serial port clock crystal or other components, so handle it gently.

Inspect Package Contents

Please inspect the package for completeness and notify the technical support department of the company from which you purchased the product if any of the items in Table 2 are missing:

Table 2. Contents of KickStart 2 Package	
1	KickStart 2 Multifunction Diagnostic Card
2	User's manual
3	One or more program diskettes may be included (not required for normal operation)
4	One 25-pin parallel port loopback test plug
5	One 9-pin serial port loopback test plug
6	One 25-pin serial port loopback test plug
7	One 9-pin serial port jack with ribbon cable and 10-pin Berg plug
8	One twisted pair Reset wire set with 2-pin Berg plug on each end
9	One Reset wire pair with 2-pin Berg plug and 2 ball-clips
10	One polyethylene bag containing above plugs and wires
11	One set (HI and LO) of JumpStart BIOS ROMs for the AT
12	Software license agreement (may be inside front of manual)
13	Your Owner Registration Card

Send in the Owner Registration Card



Please fill in the requested information on the owner registration card and mail it to Landmark. Your warranty is still valid without the card. However, it will validate the warranty period in case you have no sales slip. The card comes with a survey that helps Landmark to make product improvements and add new products to the product line, all in the interest of better serving your needs. Furthermore, with your name on file we will be able to send you valuable information on product updates, new products, and special discount offers. So be sure to send your registration card to us. We look forward to receiving it.

Record Your Serial Number

Your KickStart 2 is labelled with a serial number to help us in keeping track of your particular product. If you call for technical support, you will be asked for the serial number. Therefore, take the time now to write your name, the product serial number, and any release number that may be printed on your KickStart 2 EPROM label in the front of the manual, on the next page after the title page. You should also record the date and place of purchase to help if any questions about warranty period arise.

LANDMARK DISKETTES

Observe Diskette Handling Precautions

Landmark diskettes, if included, are of the highest quality. However, as with all diskettes, special handling is required if you expect to get the best performance and life from them. Please heed the following advice before removing them from their protective packaging or handling them in any other way:

Allow diskettes to acclimatize before use;
Keep diskettes clean and dry;
Keep them out of direct sunlight;
Store them at room temperature;
Protect them from temperature extremes;
Store them in their jackets;
Do not lay anything on top of them, especially tools;
Keep them away from magnets and strong electromagnetic fields;
Handle them only by the jacket edges;
Do not attach paper clips or rubber bands to them;
Never force a diskette into a drive;
Close the drive door carefully to avoid damaging the center hole;
Do not transport a diskette inside a drive.

Diskettes Do Wear Out

Landmark diskettes are similar to other diskettes in that they can eventually wear out. If you are a professional user such as a repair technician, they will wear out very quickly as you make service calls. Floppy wear is caused by both the clamping ring in the drive as it presses against the diskette's center hole, and by pressure of the drive's read/write heads against the recording surface of the diskette.

Backup Each Program Diskette

For this reason, we recommend that you make a backup copy of each program diskette included with the product, stow the original in a safe place, and use only the backup copy. A program diskette is licensed for use on only one computer at a time. Therefore, you are authorized to make a single backup floppy or to copy it to and run it from a hard disk. We recommend using the hard disk where possible because the program loads faster.

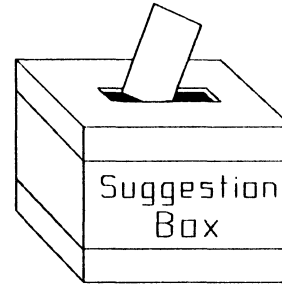
HOW TO GET HELP ON PRODUCT PROBLEMS

If KickStart 2 or any of its components or accessories should be defective or fail to operate properly, you may need to return KickStart 2 for repair or replacement. Do not mail or send it back to your supplier without first receiving a Return Material Authorization (RMA) number from the supplier.

Get an RMA Number

Call the supplier's technical support department, explain the problem, and get an RMA number if you must return the product. Write the RMA number on the outside of the package before returning it. Landmark will reject and send back any returned products that are incomplete, that arrive C.O.D., or that do not bear a valid RMA number on the package.

If you did not purchase KickStart 2 from Landmark, do not send it back to Landmark for service. Rather, send it back to the company from which you purchased it. Your supplier should be equipped to handle your technical support needs.



You May Call or Write Landmark

You should feel free to call or write Landmark technical support department under of the following circumstances: 1) you did purchase the product from Landmark; 2) your supplier cannot help you with your problems; 3) you want to report a product deficiency such as an error in the manual; 4) you want to make a good suggestion; or 5) you want to compliment us on something you liked. Our toll-free technical support phone number is printed on the title page of this manual. We prefer written comments to phone calls because we can schedule our handling of them more easily. If it is not an urgent matter, please write. Send a FAX for faster service.

REFERENCES

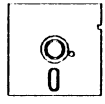
If you are a technician, we recommend ordering the computer technical reference and service manual from your computer manufacturer. Although most IBM-compatible computers have similar components, the placement and specific types of components differ between systems. In particular, memory size and location are seldom the same between computer manufacturers. Other texts are available to assist in troubleshooting IBM-compatible computers. Table 3 supplies some recommended titles.

Table 3. References for Additional Study			
Publication	**Author**	**Publisher**	**Date**
Computer Troubleshooting and Maintenance	Walter J. McBride	San Diego, CA: Harcourt Brace Jovanovich	1988
Basic PC Maintenance (Video Tape)	Touch-Stone	Huntington Beach, CA: TouchStone Software Corp.	1990
Inside the IBM PC	Peter Norton	New York, NY: Simon and Schuster	1987
Installing a Personal Computer System	William E. Perry	Wellesley, MA: QED Information Sciences	1989
Starting Out Right (Video Tape)	Colin Mick	Stanford, CA: Understanding Personal Computers	1983
The Brady Guide to Microcomputer Troubleshooting and Maintenance	Henry F. Beechold	New York, NY: Prentice Hall Press	1986
The Complete Computer Maintenance Handbook	David Bellin	New York, NY: Harper & Row	1986
The Complete IBM Personal Computer	Novogrod-sky, Seth, et alia	New York, NY: Simon and Schuster	1986
The PC Configuration Handbook	John Woram	New York, NY: Bantam Books	1987
Towards a New Concept of Computer Hardware Maintenance	Louis Grail	Paris, France: Organization for Economic Co-operation and Development	1982
Webster's New World Dictionary of Computer Terms	Webster's	New York, NY: Prentice Hall	1988
The Computer Glossary	Alan Freedman	AMACOM; available in book and diskette form from Landmark	1990

INTRODUCTION

This chapter describes the major features of KickStart 2 in summary form as a preface to installation and operation, and it lists KickStart 2 specifications. The reason for having a separate chapter for this information is to help you sharpen your focus on the particular way you intend to use KickStart 2, thus making installation and operation easier.

Run README.COM or Read Updates



If you received a floppy diskette with KickStart 2, you should run its README.COM program on a normal computer to read the latest product update information produced since the printing of this manual. Since some of the information will be important to your understanding and use of the product, we strongly advise you to read it. To do that, insert the program diskette into drive A: and enter the following command (type the command and press the enter key):

```
README
```

The screen will display instructions for reading and scrolling through the document. If no floppy is included, updates will be in printed form.

OVERVIEW OF OPERATION

KickStart 2 allows you to test and perform special functions on your system in accordance with the following capabilities.

Hardware for Professionals

KickStart 2 is ruggedly constructed and contains the features you expect in a professional tool. Serial and parallel I/O give on-board capability for remote control and logging test results without relying on other elements that may not be in the system. They are software configurable to co-reside with other serial and parallel ports in the system, or to be invisible to the system.

Configurable Card

On-board switches allow you to configure the card firmware and EPROM address and size, and select batch tests, test looping capability, remote operation, and voltage measurement thresholds for the system power supply. Hexadecimal LED displays show the POST codes sent to port 80 and 280. EPROM space is configurable to any 32, 64, 128, or 256K block in segment C, D, E, or F. You may also configure KickStart 2 to bypass its menu and operate as a normal I/O card.

Battery and Loopbacks

The on-board battery keeps your personal configuration and password information intact as you move the card from system to system for secure testing and system setup. Loopback plugs are provided for complete serial and parallel port testing.

Informative LEDs
KickStart 2 contains several LEDs to show the status of the tests and the system. Power LEDs are color-coded to be the same as standard power supply wires to facilitate troubleshooting. To save technician time in setting up a meter, on-board comparators detect whether the four voltages are within 2.5% or 5% of rated +/- 5 and 12 Volt values. The corresponding LED will be off if its voltage is out of limits.

Firmware for Professionals

KickStart 2 contains a paged EPROM with up to 512 Kilobytes of advanced software designed for professional applications. It occupies 16K, 32K, 54K, or 128K of ROM space in segment C, D, or E of the host computer, and OEMs can configure it anywhere in that range. The firmware is modular so that it can be enhanced and upgraded for OEM and custom versions; the firmware switches EPROM pages as needed to accomodate its functions. The following paragraphs describe major firmware components.

JumpStart BIOS

Automatic Jump to KickStart 2 Firmware
These are additional ROMs for plugging into AT motherboards for testing purposes; they come with KickStart 2. If JumpStart BIOS fails its normal POST, it does not stop or hang up the way a normal BIOS does. Rather, it searches for KickStart 2 EPROM in the system's adapter ROM address space, and jumps to it when found. KickStart 2's firmware takes over from there.

Like Normal System BIOS
JumpStart BIOS is a normal AT-compatible BIOS and can be used to run most systems; you do not need to install it unless the system hangs up during boot, you cannot figure out what its POST codes mean, or the system issues no POST codes. Some systems require a specially modified BIOS for initialization and normal operation, so we warrant JumpStart BIOS only for testing purposes. OEM versions, including source code, are available at substantially lower prices than competitive offerings.

Failing POST Invokes Diagnostics
When KickStart 2 takes over from a failing POST, it can run low level diagnostics that a technician has selected with on-board switches, and it can loop on a failure to allow motherboard troubleshooting. On-board LEDs and hexadecimal displays show test results and failing test numbers.

ROM Scan Operation
If the system successfully passes POST, its BIOS performs a ROM scan to allow adapter cards (such as VGA, disk, and networks) to initialize themselves. KickStart 2 is such an adapter. When its turn comes, it does not initialize and return control to BIOS the way most adapters do. Rather, it takes complete control of the system and presents a menu to the user. The menu allows you to do the following:

1. Configure KickStart 2 software,
2. Run comprehensive, professional-level diagnostic tests,

3. Enter passwords to allow specific operations, and
4. Resume booting to load and run the operating system.

Software Configuration
KickStart 2 provides a menu system that allows you to set up the following: I/O addresses for the on-board serial and parallel ports, communication with or control by a remote terminal; error logging to printer or terminal; time and date into the on-board real-time clock (RTC); and other default parameters required for operation. Configuration items are stored in the 8K on-board battery-backed CMOS RAM, and are retained when you switch power off. This allows you to set up KickStart 2 in a known-good computer, then remove it and plug it into a computer to be tested without having to reconfigure it.

Remote Operation
You may run KickStart 2's menu from a terminal attached to its serial port, even from a remote location via modem. All terminal communication functions are built-in. This allows you to perform testing and password protection activities at a customer site from your home office.

Comprehensive Diagnostics
KickStart 2 can run all the diagnostics you would expect of a professional tool for the XT and AT architecture: CPU, math chip, interrupts, DMA, clock and timer, CMOS RAM and RTC (real time clock), extended memory, and base memory with exhaustive pattern and address testing. Diagnostics also test: MFM/RLL hard disk and floppy drive seek, format, write, and read (write and read also work on ESDI and SCSI drives); serial and parallel ports with external loopback plugs; Ethernet; 84 and 101-key keyboards; and display memory. The CMOS RAM is used for memory address testing, so only minimal RAM is required on the motherboard. The RTC allows accurate logging of time and date, even if the system battery is disconnected or no RTC is installed in the system.

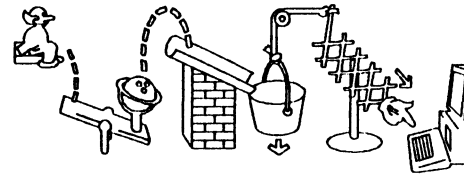
Diagnostic Control
You can run the diagnostics in time-based, pass count-based, or continuous loops to allow troubleshooting. Errors will be logged to a printer or terminal as well as the system display and KickStart 2 display, so no video adapter is needed for operation. The nature of test control and comprehensiveness of tests makes KickStart 2 ideal for running burn-in tests on "bare-bones" or complete systems in a manufacturing environment.

Passwords
KickStart 2 offers both supervisor and user levels of password protection as well as a password encryption routine that can be called by application programs. A user must enter the correct password in order to perform destructive system tests, setup system CMOS RAM, boot the system, or operate major peripherals. Landmark can provide password customization for OEMs.

System Boot
Upon selection of the proper menu item, the firmware will allow the system to boot and run normally. KickStart 2 is the ideal card to be integrated permanently into important computer systems. Fully PS/2-compatible serial and parallel I/O, built-in diagnostics, and password protection make it a tremendous value in a single-slot solution.

CUSTOM VERSIONS

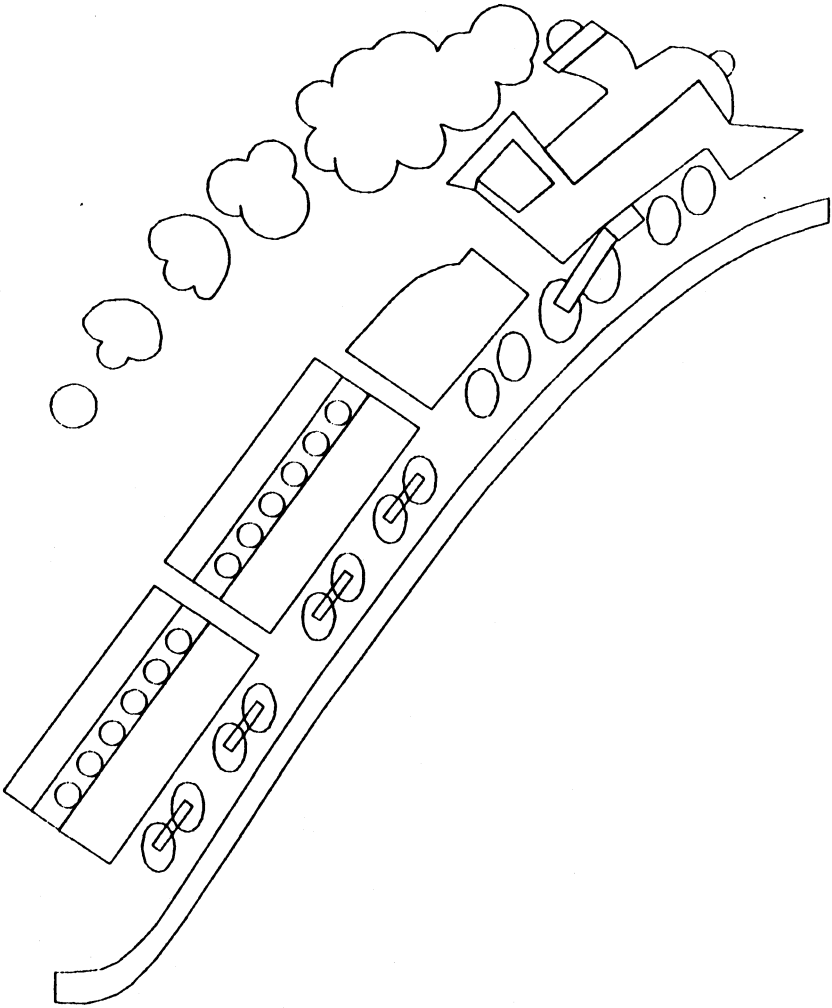
OEMs may license the KickStart 2 source code or contract with Landmark to produce customized versions of KickStart 2 firmware. Contact Landmark sales department for full information and a discussion of your needs.



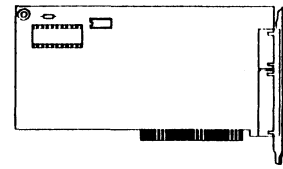
SPECIFICATIONS

Table 4 lists specifications that are characteristic of KickStart 2.

Table 4. KickStart 2 Specifications	
Size	4.125 x 9.5 inches (105 x 242 mm)
Bus	8-bit, IBM XT, AT, PS/2 Model 25, 30 compatible
Test LEDs	2 - seven-segment displays for port 80/280 POST code
	4 - test status (Testing, Looping, Fail, Extended)
	4 - power (+5, -5, +12, -12V) within 2.5% or 5%
Reset	1 - system reset pushbutton with LED
8-Segment DIP Switches	6 - EPROM address; 2 - EPROM window size; 1 - menu bypass; 1 - power limit 2.5% or 5%
	8 - Test control (Loop, logging, error handling, remote)
	8 - Technician's test number
Headers	1 - 10-pin for serial port 2
	1 - 4-pin jumper to motherboard, front panel reset
	4 - 3-pin for EPROM (32K, 64K, 128K, 256K, 512K)
Connectors	1 DB9 serial port (back edge)
	1 DB25 parallel printer port (back edge)
	1 DB9 serial port with ribbon cable for header
EPROM	Paged, 128K standard; other sizes optional
	16K, 32K, 64K, or 128K window mapped at C0000 to F8000
CMOS RAM	8K Static RAM, mapped at top 8K of EPROM window
RTC	Real time clock accurate within 1 minute per day
Battery	3-Volt lithium, 170 mAhr, 3/4-inch diameter button
	10-year life, backs up RTC and CMOS RAM
I/O Control	Fully programmable C&T 82C601
	2 - RS-232C serial, baud rate 110 to 38.5K
	1 - Centronics, PS/2 parallel, bi-directional
Firmware	Menu-driven local/remote technician's diagnostics with password protection and remote operation functions
BIOS	2 - 32K EPROMs with Landmark AT JumpStart BIOS
Power Usage	5 Watts, typical
Loopback Plugs	1 each - DB9 and DB25 serial plug
	1 - DB25 parallel plug



INTRODUCTION



This chapter explains how to install KickStart 2 in your computer. To have the smoothest installation, please read the chapter completely before beginning installation. All switches, jumpers, and connectors are described here. Operational details are described in subsequent chapters.

Types of Installation

There are two types of installation you will be likely to perform: permanent and temporary. Either will require you to set switches and jumpers on KickStart 2, then to remove the cover of the computer and insert KickStart 2 into an available expansion slot.

Then when you boot the system, but before the operating system loads, KickStart 2 will display a menu that will allow you to set parameters into its battery-backed CMOS memory. Once you have set the parameters, KickStart 2 will operate as you have commanded it until you use the menu to change the parameters, or you remove its battery.

You may set a KickStart 2 switch to bypass the menu system and all password protection functions. This chapter describes the method for doing that and the reasons for it. Subsequent chapters describe how to use the menu system to configure the I/O ports and passwords, and to select and run tests.

Temporary Installation

You will perform temporary installation if you intend to use KickStart 2 to test and troubleshoot a defective computer, or to burn in and initialize a new computer or motherboard in a manufacturing environment.

If you are troubleshooting, you will use the menu system to select and run tests. If the computer doesn't work well enough to do that, you will be able to select a pre-defined batch of tests using on-board switches, or install JumpStart BIOS in place of normal motherboard BIOS and use its POST to indicate the nature of the failure on KickStart 2's digital display. After the repair is finished, you will use KickStart 2 again to check out the validity of the repair.

If you are burning in or initializing a system, you will use KickStart 2 to run a batch of burn-in tests, and possibly low-level format the hard drive. You may use any pre-defined batch test to avoid having to set up the tests via the menu each time.

In any case, after testing is complete, you will remove KickStart 2 from the system, and stow it in its protective packaging.

Permanent Installation
You will perform permanent installation if you intend to leave KickStart 2 in the computer. This will make sense if you want it to perform serial and parallel I/O for the system, to make pre-boot diagnostics available to a local or remote user, or to provide password protection to the system so that it cannot be used by an unauthorized person. If you want to put both serial ports in use, you will need to install the second port's ribbon cable.

If your main interest is password protection, please note that a person with strong intent can defeat the protection mechanism by removing KickStart 2 from the computer. If you want to prevent this or minimize its risk, you must secure the system case with a physical lock or location that makes access to KickStart 2 impossible.

Permanent installation will require you to put the cover back on the computer once you have fastened KickStart 2 in place.

TOOLS REQUIRED

Before you get started you will need a few tools to install KickStart 2 and repair your computer, as listed in Table 5.

Table 5. Installation / Repair Tools	Usage
A Medium Phillips screwdriver	Installation
A Medium flat blade screwdriver	Installation
A pen knife or needle-nose pliers for jumpers	Installation
An IC extraction tool	Repair
A continuity checker or digital multimeter	Repair
A pre-formatted floppy diskette	Repair
An Ethernet loopback plug (may not be required; see text)	Testing
Soldering tools (not described in this manual)	Repair

CONFIGURE SWITCHES/JUMPERS

Your KickStart 2, shown in Figure 3, may require physical setup before you can install and run it in your computer. The following topics describe how to do that.

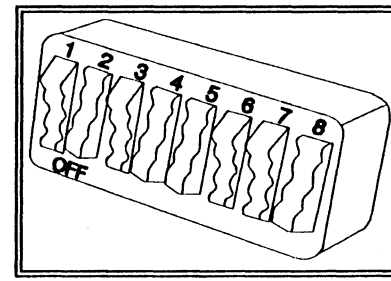


Figure 2. DIP Switch Assembly

As shown in Figure 2, the switches are mounted in plastic DIP packages. A DIP is a dual in-line package, where two parallel rows of pins on the bottom of the switch assembly are soldered to the card. Each package contains 8 slide or rocker switches that you can actuate with your fingernail, a ballpoint pen, or other suitable device. To set the switch off, slide or press the rocker down toward the word "OFF" embossed on the plastic housing. Some switches have the word "ON" embossed on them, so press the switch in the opposite direction to set it off. In the figure, switches 1, 3, 7, and 7 are set OFF.

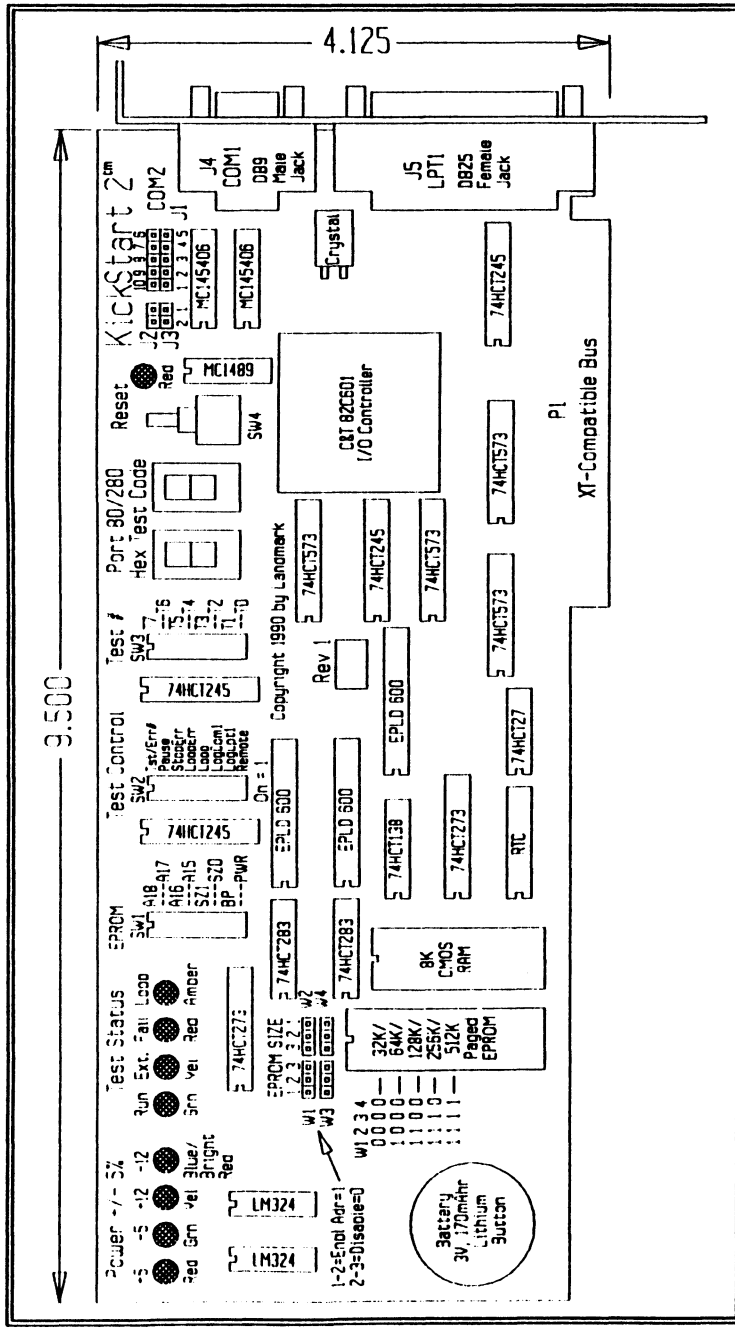


Figure 3. KickStart 2 Card Layout

When a switch is off, it is an open circuit that provides no connection to the corresponding signal. Because of the nature of typical electronic circuits used, this usually forces the signal to a logic 1 (+5V). When the switch is on, it usually connects logic 0 (ground) to the signal.

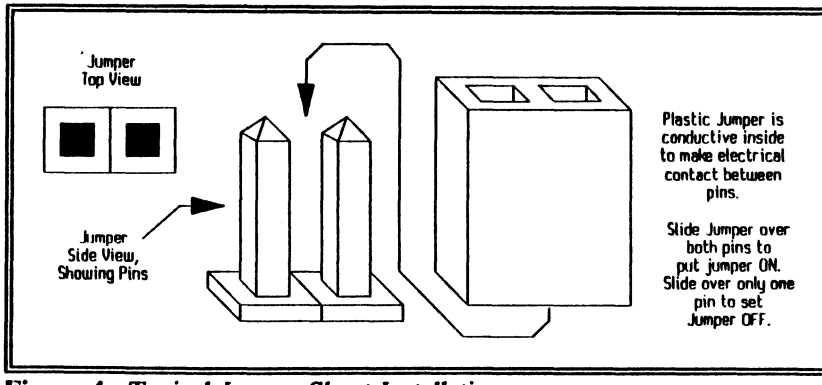


Figure 4. Typical Jumper Shunt Installation

As shown in Figure 4, a jumper is a plastic-covered metal shunt that slips down over two pins in order to connect (or jumper) them together. In order to change the jumper configuration, use needle-nose pliers or a penknife to pry up and pull the shunt off the pins, then use the pliers or your fingers to install the shunt on the pins of your choice.

EPROM Size Jumpers W1-4

EPROM size jumpers W1 through W4 are factory-set for the size of EPROM in your KickStart 2. You must not change their settings or KickStart 2 firmware will not run properly. However, you may need to change them if Landmark issues a firmware update in a new, higher-capacity EPROM, or if you create a custom EPROM of lower or higher capacity.

Table 6. EPROM Size Jumper Settings

Chip Type	Kbytes	W1	W2	W3	W4
27C256	32K	+5 •[••]•	+5 [••]•	+5 •[••]	+5 [••]•
27C512	64K	PA1 [••]•	+5 [••]•	+5 •[••]	+5 [••]•
27C010 (default)	128K	PA1 [••]•	PA2 •[••]	+5 •[••]	+5 [••]•
27C020	256K	PA1 [••]•	PA2 •[••]	PA3 [••]•	+5 [••]•
27C040	512K	PA1 [••]•	PA2 •[••]	PA3 [••]•	PA4 •[••]

The jumpers are located just above the EPROM, at the left side of KickStart 2. Table 6 gives the jumper selection for each type of EPROM. Plus 5 Volts (+5) is the connection to the inside of the jumper blocks, while the page address bit connections (PA#) are on the outside. The center pin routes the jumpered signal (either +5 or PA#) to the address decode circuitry.

SW1 - EPROM Location and Window Size Definition

SW1, shown in Figure 5, allows you to set two parameters that tell KickStart 2 where it's EPROM is located in the PC's address space , and how much of it is available at any one time. SW1-1 through SW1-4, labelled A18 through A15, select the address lines that enable the EPROM, thus defining its starting address at one of 16 locations ranging from C0000 to F8000. SW1-5 and SW1-6, labelled SZ1 and SZ0, select the EPROM window size parameters, thus defining one of 4 amounts of KickStart 2 memory that the host CPU can access at one time, ranging from 32K to 128K. The settings are hardwired to the address decode and enable logic and take immediate effect any time you change them.

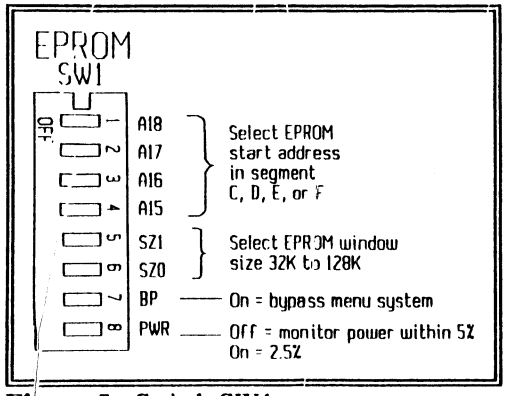


Figure 5. Switch SW1

PC Address Space

Note that the address values are in hexadecimal notation, as is common when discussing PC memory. In case you are not familiar with this, the area from C0000 to C8000 is 32K, and the area from C8000 to D0000 is 32K, so the entire range in Cxxxx is 64K; that 64K chunk of memory space is often referred to as segment C. The lower 1M of PC address space consists of 16 segments, 0 through 9 (640K base RAM for operating system and applications), and A through F (system and adapter BIOS, and special RAM). The address range available to KickStart 2 is below the 1M starting address of extended memory, but it is above both the normal 640K used by DOS and the 128K available to video adapters. Table 7 shows typical usage of the PC address space below 1M.

Table 7. XT / AT Memory Map

Standard Use of Address Space		Typical Uses of Optional Address Space:	
Address	**Purpose**	**Address**	**Purpose**
00000-9FFFF	640K Base RAM	C0000-C7FFF	32K EGA/VGA BIOS
A0000-AFFFF	64K EGA/VGA Graphics	C8000-CBFFF	16K Disk Controller BIOS
B0000-B7FFF	32K MDA Text Memory	CC000-CFFFF	16K Network BIOS
B8000-BFFFF	32K CGA Text Memory	*D0000-D7FFF*	*32K KickStart Firmware*
C0000-DFFFF	128K Adaptor Memory	E0000-EFFFF	64K EMS Memory
E0000-EFFFF	64K System Board ROM		
F0000-FFFFF	64K System Board BIOS		

Factory Default

The factory default SW1-1 through SW1-6 settings are for a starting address of D0000, and a window size of 32K. The window must be that size to accommodate KickStart 2 firmware. The default starting address is least likely to interfere with other add-in cards. For example, disk controller BIOS often takes 16K starting at C8000, and EMS memory takes 64K starting at E0000. If some controller or memory card must use any portion of KickStart 2 window area, then you must change KickStart 2's default setting of SW1-1 through SW1-4 to some other, unused memory area, or you must remove the conflicting card or set it for some non-conflicting memory area. Table 8 shows possible switch settings.

Conflict with Expanded Memory

There is an exception to this. The diagnostics in KickStart 2 cannot test expanded (EMS) memory, and EMS memory is normally off until an EMS driver is loaded by DOS. Furthermore, you can configure KickStart 2 (via its menu) to switch its EPROM and RAM completely off when it has finished testing and enables the operating system to load. In this case, KickStart 2 cannot interfere with EMS memory, and you can set both KickStart 2 and the expanded memory card to use the same address range.

Table 8. SW1 - EPROM Address and Window Size

SW1 Switch Setting				Meaning
SW1-1	**SW1-2**	**SW1-3**	**SW1-4**	**EPROM Start Address**
Off	Off	Off	Off	F8000
Off	Off	Off	On	F0000
Off	Off	On	Off	E8000
Off	Off	On	On	E0000
Off	On	Off	Off	D8000
Off	*On*	*Off*	*On*	*D0000 (default)*
Off	On	On	Off	C8000
Off	On	On	On	C0000
SW1-5	**SW1-6**			**Window Size**
Off	Off			256K
Off	On			128K
On	Off			64K (default)
On	*On*			*32K (default)*

Don't Change SW1-5,6

Physically, KickStart 2's 8K CMOS RAM always occupies the top 8K of the selected EPROM window size, and the firmware is written to assume that memory organization. Since the EPROM is a page-switchable type, the firmware can command KickStart 2 to switch a different chunk of EPROM into view at the lower address range inside its window. The firmware is written specifically for the default window size, and won't work if you select a different window size. Therefore, you must never change the settings of SW1-5 and SW1-6 unless you have programmed your own custom firmware in a paged EPROMs.

SW1-7 - Hardware Bypass

You can disable KickStart 2 EPROM firmware from executing by setting SW1-7 to ON. This will cause the PC to bypass the EPROM during its pre-boot ROM scan, and the KickStart 2 menu system will not come up. Instead, the system will boot as if KickStart 2 were not installed. This is a hardware setting that you cannot alter via a change in the menu configuration. It physically disables the EPROM and RAM. The setting of the hardware bypass switch takes immediate effect when you change it.

The purpose for this is to let you install and use KickStart 2 as an I/O controller only. All functions built into the firmware, such as serial/parallel port initialization, diagnostics, and password protection, will be disabled. Any attempt by a program to read the contents of the KickStart 2 EPROM or RAM will fail, as if the program were reading empty address space.

In hardware bypass mode, all other KickStart 2 I/O control functions are enabled, but a special program is required to initialize the on-board serial and parallel ports. Contact Landmark for more information on the program.

SW1-8 - Set Power Detection Threshold

KickStart 2 contains voltage detection circuitry that lights its power LEDs when the corresponding voltage from the system power supply is within a specific range. Set SW1-8 to OFF to light LEDs when the voltages are within 5% of their rated levels, and ON to tighten the range to 2.5%. The factory default setting is OFF. The setting of the switch is hardwired and takes immediate effect when you change it. Table 14 shows voltage thresholds. Use of the switch is described in the chapter on low-level operation.

SW2 and SW3 - Test Controls

These switches are strictly software-readable switches. KickStart 2 uses them to determine whether to operate in remote or local mode, whether to run a test or to display the menu system immediately after KickStart 2 initializes, and (if a test number is selected) what test to run, and how to run it.

Since all of these switches relate only to testing *after* you have set up KickStart 2 for installation in the computer, they are described and discussed in the chapter on low-level operations.

I/O ADDRESS RANGE

KickStart 2 is designed to use 1 I/O address at port 80 for BIOS to write POST codes, and a block of 8 I/O addresses starting at 280 for KickStart 2 firmware to control its own circuitry such as reading switches, turning on LEDs, and driving the hexadecimal display. Therefore, you must ensure that no other I/O devices in the system use these addresses. Table 9 shows the standard I/O address usage map for the XT and AT.

Table 9. Standard XT / AT I/O Addresses			
I/O Adrs	Purpose	I/O Adrs	Purpose
000-01Fh	DMA Controller 1	278-27Fh	Secondary Parallel Port: LPT2
020-03Fh	Interrupt Controller 1, Master	*280-287h*	*KickStart 2 Display, Control*
040-05Fh	Timer 1	2B0-2Dfh	Alternate EGA
060-07Fh	CMOS RTC, NMI control	2F8-2FFh	Serial Port 2
080h	*KickStart 2 Hex Display*	300-31fh	Prototype Card
080-09Fh	DMA Page Register, MFG Port	360-363h	PC Network Low
0A0-0BFh	Interrupt Controller 2, Slave	364-367h	Reserved
0C0-0DFh	DMA Controller 2	368-36Bh	PC Network High
0F0h	Clear Math Coprocessor Busy	378-37Fh	Primary Parallel Port: LPT1
0F1h	Reset Math Coprocessor	3B0-3BFh	MDA Adaptor
0F8-0FFh	Math Coprocessor	3C0-3CFh	Enhanced Graphics Adaptor
1F0-1F8h	Primary Fixed Disk	3D0-3DFh	CGA Adaptor
200-207h	Game I/O	3F0-3F7h	Diskette Controller
20C-20Dh	Reserved	3F8-3FFh	Primary Serial Port: COM1
21Fh	Reserved		

HOW TO INSTALL CONNECTORS

KickStart 2 provides 5 connectors that you may configure before or after installing the card in the computer. They are described in this topic. The technical information chapter describes connector pinouts. The next major topic describes how to install KickStart 2 in your computer.

J5 - Parallel Port Connector

The DB25 parallel port connector is mounted at the bottom of the mounting bracket and faces outward toward the rear of the computer. It contains 25 sockets and is intended to mate to an IBM-standard Centronics printer cable, or a similar cable. For guaranteed proper operation, the cable should be no longer than 2 meters, although a longer cable may work well. To attach the cable, mate its plug firmly onto connector J5 after installing KickStart 2 in the computer. For permanent installation, fasten the retaining screws. Be careful not to over-tighten them, or you may twist them off and ruin them.

The parallel port circuit is more versatile than the original IBM XT/AT circuit because it has bi-directional capability, as the PS/2 parallel port does. The technical information chapter contains more data on the functionality of that circuit. The operation chapter describes how to set up KickStart 2 for operation as LPT1, 2, or 3 with a printer attached to J5.

J4 - Serial Port Connector

This DB9 IBM AT-compatible serial port connector is mounted at the top of the mounting bracket and faces outward toward the rear of the computer. It contains 9 pins and is intended to mate to an IBM-standard RS-232C serial cable. For operation and control of a modem, you may mate a 9-to-25-pin adapter to J4 if the modem requires it; such adapters are available in almost any computer store.

For guaranteed proper operation, the cable should be no longer than 50 meters, although a longer cable may work well. To attach the cable, mate its plug firmly onto connector J4 after installing KickStart 2 in the computer. For permanent installation, fasten the retaining screws. Be careful not to over-tighten them, or you may twist them off and ruin them.

The serial port circuit is functionally identical to the 16450 serial port controller in the original IBM AT. The technical information chapter contains more data on the functionality of that circuit. The operation chapter describes how to set up KickStart 2 for operation as COM1, 2, 3, or 4 with a device attached to J4.

J1 - Serial Port Connector

This 10-pin header is mounted at the top of the KickStart 2 card near the mounting bracket and faces toward the inside of the computer. It is intended to mate to the ribbon cable assembly supplied with KickStart 2, with the cable stripe (pin 1) on the left-most side of the header (pin 1 is bottom left). The other end of the ribbon cable is affixed to a DB9 9-pin connector that is identical in function to J4.

The J1-to-ribbon-cable assembly thus functions as an IBM AT-standard RS-232C serial port connection. Most modern computer cases have a mounting hole on the back of the chassis near the power supply for the DB9 connector, and include mounting screws. We recommend mounting the connector there. If there is no such hole, contact Landmark technical support or your dealer for assistance. You should install KickStart 2 in the computer after hooking up the ribbon cable. All further information regarding this circuit is identical to that for J4.

J2 and J3 Reset Headers

As shown in Figure 6 and Figure 7, these two-pin headers are intended to provide a connection to both the reset switch on the front panel of the computer (if one is there), and to the motherboard (if the reset header is present there). Figure 6 shows the reset circuit for the original Rev 1 KickStart 2, and Figure 7 shows the revised circuit for Rev 1A KickStart 2.

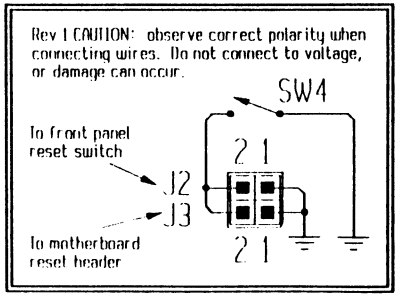


Figure 6. J2, J3 Headers, Rev 1

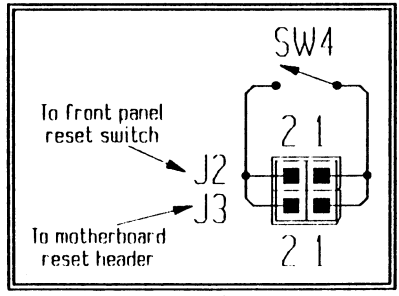


Figure 7. J2, J3 Headers, Rev 1A

Then, when you press the Reset pushbutton switch on either the front panel or KickStart 2, the switch will connect the horizontally opposing pins of J2

and J3 together, and ground the motherboard reset pins to reset the computer. The computer will thus stay reset as long as you hold down the button. This will be handy to you during test and troubleshooting activities.

If your system has a reset switch on the front panel, and it is connected to the motherboard, disconnect the wire from the motherboard and attach it to J2 (the two top pins). Then attach the reset wire-pair provided with KickStart 2 between the motherboard reset header and J3 (the bottom two pins) on KickStart 2. If your motherboard has a reset header, but the front panel does not, then this provision will give you a reset function via KickStart 2.

You should attach the reset wires to the motherboard and front panel before installing KickStart 2, and attach the other ends to KickStart 2 after installation. If there is no reset header on the motherboard, you can connect a wire from one side of J2 or J3 to logic ground, and the other side to the CPU reset pin on the motherboard.

HOW TO INSTALL THE CARD

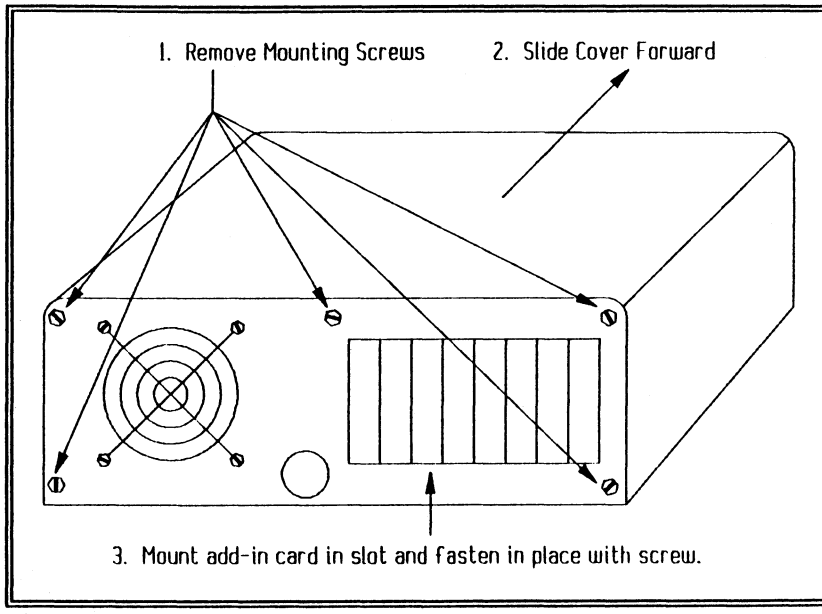


Figure 8. Remove the Computer Cover

Now that you have configured switches and jumpers, you must install KickStart 2 in your computer before using it. To do so, switch power off to the computer and remove the cover of your computer case in accordance with manufacturer's instructions. Normally, you will have to remove 5 screws from the rear, as shown in Figure 8, and slide the cover toward the front before lifting it off. Next, locate an empty expansion slot, and slide

KickStart 2 into the slot connector till it is firmly seated, as shown in Figure 9.

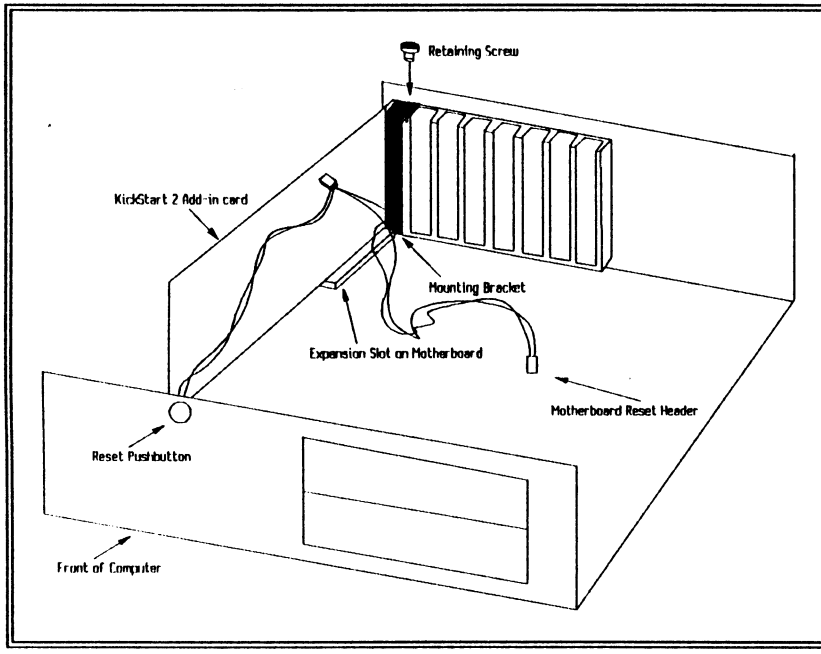


Figure 9. Fasten Card in Place With Mounting Bracket Screw

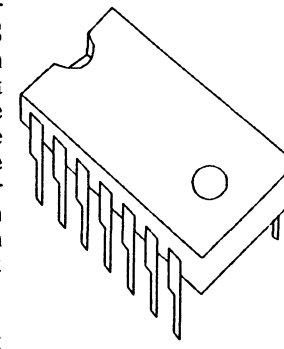
Caution: LOOSE BOARD. *You must fasten KickStart 2 in place via the mounting bracket screw, BEFORE putting the cover on the computer. If you do not, the board may come loose as a result of jostling, and this may cause component damage on the board or elsewhere in the computer.*

HOW TO INSTALL JUMPSTART BIOS ROMS

KickStart 2 comes with JumpStart BIOS ROMs to help with testing and troubleshooting of AT-compatible computers. These ROMs contain standard IBM-compatible BIOS. They issue POST codes to output port 80h, but they detect and jump to KickStart 2's firmware EPROM upon detecting a POST error. They will not, however, initialize any special circuitry such as Chips and Technologies motherboard chipset. If the motherboard hardware is IBM compatible and requires no other internal setup, JumpStart BIOS ROMs can be installed and left in the computer for reliable operation.

The purpose of these ROMs is to allow you to force the system to issue known POST codes during power-on testing. The technical information chapter contains a full list of codes for these ROMs. You should use them when you don't know the meanings of codes issued by your BIOS, when your BIOS does not issue codes, or when your motherboard does not allow BIOS POST codes to go to the expansion slot containing KickStart 2. Otherwise, don't bother using them.

To install JumpStart ROMs, first locate the corresponding BIOS ROM chip on your motherboard. It is almost always plugged into a socket. However, some are soldered in, in which case you are out of luck, and you must somehow troubleshoot around them or unsolder them and put a socket in their place. Once you have located the BIOS ROM, mark it with a label to identify what it is, where it came from, and how it was oriented. Be careful not to mistake the AT 8042 or 8742 keyboard controller chip for a BIOS ROM. That chip sometimes looks similar to a BIOS ROM, but it is longer, and usually clearly marked.



Using your IC extractor, pen knife, or a tweaker screwdriver, gently pry up each end of the BIOS ROM until it comes loose from the socket, then remove it and set it aside in the JumpStart protective packaging. Position the corresponding JumpStart BIOS ROM on the socket, ensuring all pins are aligned. Make sure that the end of the ROM with indentation or small dot is at the end of the ROM socket with the indentation or dot. If you put the chip in backward, you could damage it, and it will not boot.

If the ROM is new and the pins are sprung outward, bend them inward so they are perpendicular with the top of the ROM. This will allow them to glide more easily into the socket. Position the ROM over the socket and press it gently, but firmly, downward to force the pins down into the holes. If you bend a pin, remove the ROM, straighten the pin with needle-nose pliers, and try installing it again.

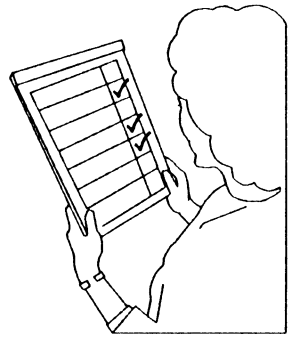
The AT ROMs are marked HIGH and LOW. Be sure not to put the HIGH ROM in the LOW ROM's socket. If you do, the system will not boot. When you are finished running tests, remove the ROM(s) and reinstall the original(s).

HOW TO INSTALL LOOPBACK PLUGS

KickStart 2 comes with serial and parallel port loopback plugs, and the Ethernet tests may require a loopback plug, to allow thorough testing of all signal lines entering and leaving those ports. There is nothing special about installing the plugs because they are identical in type to the standard serial, parallel, and Ethernet cable connectors. Just remove the cable connector from the port you are going to test, and attach the loopback plug in its place. When testing is complete, reverse the steps to reconnect the original cables.

INTRODUCTION

This chapter presents information you need to operate your KickStart 2 and use it in all its low-level modes. It includes a description of switches and LEDs. The menu system and its functions, as well as troubleshooting suggestions, are described in subsequent chapters.



VITAL FUNCTIONS

KickStart 2 does three things to help you diagnose failures:

1. It shows the status of DC power on the system bus,

2. It shows error codes issued by BIOS during Power-On Self-Test,

3. It runs its firmware before the operating system boots. The firmware immediately runs a pre-configured test, or it displays a menu that allows you to select and run diagnostic tests of your choice. If KickStart 2 is in remote mode, the menu will be displayed on a terminal attached to the serial port.

Once the menu is displayed, you may execute diagnostics, set up password and security functions, configure the on-board serial, parallel, clock, and control circuitry, or boot the operating system.

SWITCHES AND LEDS

Knowledge of KickStart 2's switches and LEDs is vital to proper use of KickStart 2 for testing and troubleshooting. The LEDs tell you whether a normal test is running, an extended test is running, the test has failed, the test is executing in a loop, the system is reset, or power is within limits. Table 13 and Table 12 list the LEDs and switches and describes how to use them.

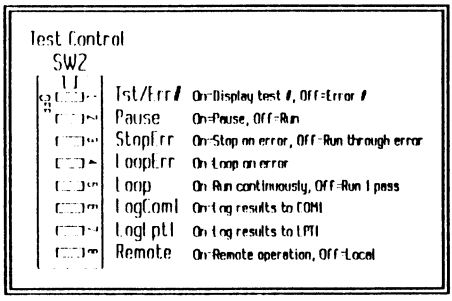


Figure 10. Switch SW2

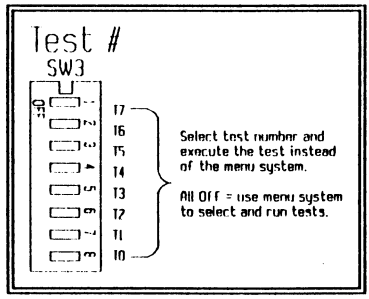


Figure 11. Switch SW3

SW1 - EPROM Address, Window Size

SW1, described in the installation chapter, allows you to set up KickStart 2 EPROM and I/O addresses, bypass the testing and menu system altogether, and change tolerances for the power LEDs. Use of the power switch is described in a subsequent topic.

SW2 - Test Control

These switches function as described in Table 12. Their purpose is to allow you to control how a test runs without using the KickStart 2 menu system.

SW3 - Test Number

These switches select the test number of a KickStart 2 diagnostic test as described in Table 12. The test will run immediately, without first invoking the KickStart 2 menu.

When you set a non-0 test number on the switches and then switch power on or reset the system, KickStart 2 will start running the test when it comes up, and it will not display the menu system. A test number value of 0 (all switches OFF) will cause KickStart 2 to display its menu rather than to run a test immediately after it initializes. Table 17 in the diagnostics menu chapter shows the available test numbers.

The 8 switches offer you a maximum of 255 test numbers from which to select the desired test. Use the example in Table 11 as a guide to setting a test number on SW3. Table 10 shows how to set binary values on the switches to correspond to the hexadecimal test number.

Table 10. Decimal - Hexadecimal - Binary Conversion

Dec	Hex	Bin	Dec	Hex	Bin	Dec	Hex	Bin	Dec	Hex	Bin
0	0	0000	4	4	0100	8	8	1000	12	C	1100
1	1	0001	5	5	0101	9	9	1001	13	D	1101
2	2	0010	6	6	0110	10	A	1010	14	E	1110
3	3	0011	7	7	0111	11	B	1011	15	F	1111

Note: When setting a switch or lighting an LED, **ON = 1 and OFF = 0**

Table 11. How to Set SW3 to a Test Number

Switch SW3-x	1	2	3	4	5	6	7	8
Test Number Bit	T7	T6	T5	T4	T3	T2	T1	T0
Test Number Bit Value	128	64	32	16	8	4	2	1
Example: set switches →	ON	OFF	ON	OFF	OFF	ON	ON	OFF
Get this binary value →	1	0	1	0	0	1	1	0
Same as this hex value →	A				6			

Table 12. Meaning and Use of Switches		
Switch	**Name**	**Meaning/Use**
SW1-1..4	EPROM A18..15	KickStart 2 EPROM start address - see installation chapter.
SW1-5,6	EPROM SZ1,0	KickStart 2 EPROM window size - see installation chapter. Do not change from default setting.
SW1-7	Bypass	Off = run menu system and enable password protection. On = bypass and disable KickStart 2 firmware and all but I/O addresses to/from the card. KickStart 2 still functions as a POST card. Usage: after switching on, boot the operating system and run a special program to configure on-board serial and parallel ports for normal operation.
SW1-8	Power	Off = light Power LEDs if power supply output is within 5% of rated voltage levels. On = light Power LEDs if power is within 2.5% level. Usage: cycle this switch and watch Power LEDs during heavy disk activity. Replace supply if LED flickers or goes out.
SW2-1	Err/Tst#: Hex Display Mode	Off = Hex display shows most recent test error code (Extended Test LED will be off) On = Hex display shows KickStart 2 individual test number currently being run, either single test as set on SW3, or single test within a test batch, or single test selected via menu system. Does not show a test batch number. Extended Test LED will be on when test number is displayed. Usage: hex display always shows POST code during boot. When you see a failure during KickStart 2 test, toggle the switch to change the hex display between test number and error code. Leave it on to see the test numbers cycling during a test batch.
SW2-2	Pause	On - do not run any test. If running, stop at the end of the current test. Turn off Test Running LED. Off - start running the test on the test number switches. Turn on Test Running LED If a single or batch test was in progress, but paused, rerun the test just completed and continue with the next test or iteration. Usage: set it on before changing test number switches, or to force rerunning a test that failed because you neglected to set it up properly (such as with a loopback plug). Set it off to start or continue running.
SW2-3	Loop: Loop on Test (LOT)	Off = run the selected test or batch once to completion and stop. Allow detailed test results to go to log devices if enabled. On = repeatedly run the selected test or batch, including any nested time-based or count-based menu test. Allow failures and pass/fail summary results to go to log device if enabled. Usage: Leave it off to run a test or batch for quick checkout. Set it on to burn-in a circuit or system with a batch of tests, or to check a specific circuit for intermittent failures by watching the Fail LED for flickering. Error handling is dependent on the SOE (Stop on Error) and LOE (Loop on Error) switches, and LOT is subordinate to them.

Table 12. Meaning and Use of Switches		
Switch	**Name**	**Meaning/Use**
SW2-4	LoopErr: Loop on Error (LOE)	Off = when a test error occurs, either log it and continue, or stop, as determined by the SOE switch. If a test is looping on error, stop looping and continue to the next test. On = when an error occurs, repeatedly run the individual test that caused it. If SOE is off, continue to the next test the first time the test being looped on passes. If SOE is on, loop continuously on the test, and do not continue to the next test until LOE is switched off. Usage: set LOE on before starting a test or batch of tests to make it catch and loop on the first failure that occurs and log results unattended. If SOE was on and a failure caused a test batch to stop, switch LOE on to loop on that test repeatedly and watch the Fail LED for flicker to see if it the failure is intermittent. When ready to continue to the next test in a batch, switch LOE back off; immediately switch it back on to make it automatically loop on the next failing test.
SW2-5	StopErr: Stop on Error (SOE)	Off = If LOE is off, run a test through to completion. If LOE is on, loop on the first error that occurs until the test passes, then continue testing to completion. On = run the test or batch of tests to completion unless an error occurs. If an error occurs and LOE is on, repeatedly execute the individual test that failed, even if it is intermittent and sometimes passes. If LOE is off when the error occurs, halt the test immediately upon detecting the failure. Usage: Set SOE and LOE off to run a test or batch once (LOT off) or repeatedly for burn-in (LOT on), regardless of errors. Set SOE on to force a test or batch to stop (LOE off) or loop (LOE on) at the point of failure, and to proceed no further in the test, possibly to avoid causing problems by continuing to test with a faulty circuit in the system.
SW2-6	LogCOM1	Off = disable test results logging to serial port COM1. On = log detailed test results to serial port COM1 if not in remote mode; default setup is 9600 baud, no parity, 8 data, 1 stop bit. Usage: use this setting to send results data via serial port to a remote terminal or printer, or to a computer set up to store results on disk for later analysis and printing.
SW2-7	LogLPT1	Off = disable test results logging to parallel port LPT1. On = enable detailed test results logging to parallel port LPT1, or only errors if LogCOM1 is also on. Usage: use this setting to send results data via parallel port to a standard line/character printer. Switch on LogCOM1 to print only error results for long unattended test loops.
SW2-8	Remote	Off = run KickStart 2 under control of the local console and show the menu and results on the computer display. On = run KickStart 2 under remote control of the terminal or computer attached to serial port COM1. Default setup is 9600 baud, 8 data, 1 stop, no parity, or the most recent setup made via the menu system. While in remote, no menu or results appear on the local display, and local keyboard input is ignored. Use the menu system to change default setups. Assumes ANSI or VT100 terminal.

Table 12. Meaning and Use of Switches		
Switch	**Name**	**Meaning/Use**
SW3-1..8	T7..0	All off = run the KickStart 2 menu system. Other = if a valid test number (see tables in this and diagnostics chapter), run the test after POST and KickStart 2 initialization. If not a valid test number, then run the menu system normally. Usage: Run tests on a system that has no console or terminal attached. Set SW2 to control the test and watch hex displays and LEDs for test results. Use for system burn-in or for troubleshooting a single failing circuit or peripheral.
SW4	Reset	Push this button to short the pins of J2 together (J3 also). If the pins of J2 or J3 are connected to motherboard reset and logic ground as described in the installation chapter, this will reset the system, causing the Reset LED to come on as long as you hold the switch down. Use the reset switch during troubleshooting to repeatedly restart POST or a KickStart 2 test number set on SW3.

Table 13. Meaning and Use of LEDs		
LED	**Color**	**Meaning/Use**
Power: +5V -5V +12V -12V	Red Green Yellow Blue or bright red	On if power supply output is within 5% or 2.5% (see description for power level switch SW1-8). Watch LEDs after switching power on, and during heavy disk and memory usage. If any LED goes out or flickers, the supply is bad and should be replaced to avoid data loss.
Hex Display	2 Red digits	These show the POST or KickStart 2 test currently being or just executed. If no status LEDs (below) are on, it is a POST test. If the Extended Test LED is on, the hex display shows a KickStart 2 test number; otherwise it shows an error number. See the Tst/Err# switch for more information.
Test Running	Green	On if KickStart 2 is running a test and the test is active. Turned on at start of test; turned off when test and all loop passes have finished and test has stopped. If Looping LED is on and Running is off, the test is looping repeatedly on the failing test because StopErr (stop on error) and LoopErr (loop on error) are both on, and the Fail LED will also be on.
Extended Test	Yellow	On if the KickStart 2 hex display is showing a KickStart 2 test number. Off if it is showing a POST code or an KickStart 2 test error code.
Test Fail	Red	On if a KickStart 2 test just failed; off it just passed. The Fail LED stays on or off throughout the duration of the next test. When it is on, the error code is available to the hex display, provided the Tst/Err# switch is on.
Looping	Amber	KickStart 2 is running a test or batch of tests repeatedly in a loop. If the Fail LED is on and LoopErr switch is on, the test is looping on the failing individual test, but not an entire batch of tests.
Reset	Red	Normally Off. On if the reset signal on the system bus is active. This will happen if the processor issues reset, or if you press the front panel reset button (if one is there and wired to the motherboard), or if you press KickStart 2 reset button (and J2/J3 is wired to motherboard reset as described in the installation chapter). Power supply can activate reset (via POWERGOOD signal) if it detects its own voltages to be out of tolerance.

POWER SUPPLY VOLTAGE DETECTION

The 4 power LEDs show the presence and accuracy of +5, -5, +12, and -12 Volts DC. If the power is missing or too low or high in voltage, the corresponding light will not be on. The standard AT power supply is required by IBM specification to regulate its +5, and +12 voltages to within 5%, and -5 and -12 voltages to within 10%. KickStart 2 detects whether they are within 2.5% or 5%, as shown in Table 14.

The power LEDs are color-coded to match the standard power supply wiring. The only exception is the -12V LED which is supposed to be blue, but may be another color (such as bright red) because blue LEDs are unduly expensive.

The amount of voltage required to light the power LEDs is precisely determined by voltage comparators on KickStart 2, and the setting of KickStart 2 SW1-8. Table 14 shows levels within which the voltages must be to light the LEDs. If the switch is off, the voltage must be within 5% of the rated voltage to turn on the LED; if the switch is on, the voltage must be within 2.5%. For example, if the switch is off, the +5V signal must be between 4.75V and 5.25V; otherwise the +5V LED will be off.

The benefit of this capability is that you do not need a voltmeter to determine whether the power is within IBM's power supply voltage level specification. There are other specifications as well, such as AC ripple, noise immunity, power surge absorption, and so on, but these are beyond the testing scope of KickStart 2 and require a line voltage monitor and oscilloscope to measure.

If any of the LEDs are not lighted, then the power is not being applied to the card (or the LED is bad). If power is bad, the computer will not work properly. You should get the power supply fixed or replaced if necessary, but first check to be sure it is properly connected to the motherboard. There is no POST code to indicate bad power.

Typically, +5V affects all logic circuits in the computer, +12 affects the disk drives and serial ports, and -12 affects the serial ports. Therefore, in an emergency, you may be able to operate your computer if -12V is low or missing, although doing so can possibly damage the serial port driver circuitry.

If the Power supply itself thinks its output voltages are incorrect, it will deactivate the POWERGOOD signal going to the motherboard. This will in turn hold the RESET signal active. This will light the Reset LED at the top edge of KickStart 2, next to the Reset switch. Your computer will not run while RESET is active.

You can use the power LEDs to ascertain the adequacy of your power supply. Poor or weak supplies will lower their voltage output when a heavy load is placed on them. Therefore, watch the LEDs during the entire boot process, especially during heavy disk accesses, and memory testing. If any of the power LEDs blink, go out, or don't come on at all, the power supply should be replaced.

Table 14. Power LED Threshold Levels					
SW1-8 →		*OFF*	*OFF*	ON	ON
Voltage	**LED**	*-5%*	*+5%*	-2.5%	%2.5%
+ 5 VDC	Red	*+4.75*	*+5.25*	+4.875	+5.125
-5 VDC	Green	*-5.25*	*-4.75*	-5.125	-4.875
+12 VDC	Yellow	*+11.4*	*+12.6*	+11.7	+12.3
-12 VDC	Blue*	*-12.6*	*-11.4*	-12.3	-11.7
* Because of availability, blue LED may be replaced by clear, blue-green, or bright red.					

Try this test with SW1-8 in both the ON (2.5%) and the OFF (5%) positions. Most supplies should regulate to these levels, especially when new. It is a useful check to leave the tighter thresholds on during testing. When you see that the LEDs stay steadily on, you can be confident that your supply is putting out sufficient power.

HEXADECIMAL POST CODE DISPLAY

KickStart 2's two hexadecimal digital display modules show the most recent value, normally a Power-On Self-Test (POST) code, that the CPU has sent to output port 80h or 280h. The BIOS on most motherboards sends a POST error code in hexadecimal form to output port 80 just prior to executing each major step of the Power-On Self-Test; the POST code is the actual test number.

During POST

During normal boot, you will see test codes flickering on the hex display. During a long memory test, the hex display may stay constant until the test is complete. Often, when POST is complete, the display will show a specific POST code steadily, but there will be nothing wrong. In such a case, the computer will continue with the boot process and load the operating system.

POST Error or Hang

If the computer halts or hangs up during POST, the hex display on KickStart 2 will glow steadily, showing the most recent POST code received, and thus the failing test number. By referring to the BIOS manufacturer's table of POST codes in the troubleshooting aids chapter of this manual, you can find out which circuit caused the POST failure, and use your standard procedures to troubleshoot the failing circuit (or call your dealer or repair center).

During Initialization

During KickStart 2 initialization, the hex display shows numbers in sequence to verify to you that the display modules are functioning properly. Afterward, during KickStart 2 testing, the hex display shows either a test number or an error number. You may set the position of SW2-1 to select either test number display or error number display, as described in Table 13.

If No POST Codes Appear

Motherboards from some manufacturers are designed to prevent any data to I/O addresses below 100h from being sent to the expansion slots. Since KickStart 2 is in an expansion slot, it will not display port 80 POST codes in such a motherboard, whether or not BIOS issues them. That is the reason that we designed KickStart 2 to contain its own diagnostics, and to write its post codes to 280h.

If KickStart 2 does not show any POST codes during boot, you can determine whether it is working by sending data to ports 80 and 280. To do this, use the DOS DEBUG program (refer to DOS technical reference manual for information on how to use it). Alternately output 55h and AAh to port 280h then 80h and note that alternate hex display segments light up.

If the test proves KickStart 2 can show codes sent to port 280, your only hope is that the motherboard works well enough to run a test or display the KickStart 2 menu. If test fails to display the correct value on the hex display, either the motherboard or your KickStart 2 is defective. If hex displays work on 280, but not 80, then the motherboard does not send port 80 data to the expansion slots.

If your motherboard contains its own LEDs to show port 80 POST codes in binary form (for example, because it does not send port 80 data to the expansion slots), you may translate them to hexadecimal using Table 10.

WHY YOU NEED JUMPSTART BIOS

If your system BIOS does not issue POST codes, or they don't appear on the KickStart 2 digital display, you may install JumpStart BIOS ROMs as described in the installation chapter. JumpStart BIOS issues POST codes to port 80 and works like a normal system BIOS, except for the following:

When a POST error occurs, a normal BIOS stops or hangs up, but JumpStart BIOS does not. Instead, it waits a short amount of time to allow the POST code to appear on the digital display. Then, it searches for and finds KickStart 2 firmware (unless the KickStart 2 bypass switch is on), and jumps to it, executing the KickStart 2 self-test. If KickStart 2 is not installed, a POST error will stop the system the way a normal BIOS does.

If no POST error occurs, JumpStart finishes POST and initialization and looks for KickStart 2 in the normal ROM scan.

INITIALIZATION AND SELF-TEST

Upon being invoked by BIOS ROM scan, KickStart 2 firmware begins a test of its own circuitry, and an initialization sequence, as shown in Table 15. During the tests, the hexadecimal displays and LEDs stay on long enough for you to determine that they are working properly. After finishing with the self-test, KickStart 2 checks its switches for pause, remote, and test number. Based on the settings, it will either run a test or request a password and bring up its menu system or boot the operating system.

Self-Test and Failure Codes

During self-test, KickStart 2 displays a self-test code (also shown in Table 15) to let you know what it is doing. If KickStart 2 fails its self-test, its hexadecimal display will show one of the following failure codes, and the Fail LED will be on. To avoid confusing error symptoms, install KickStart 2 in a known-good system and verify its proper operation before using it to test and troubleshoot a failing system.

Table 15. KickStart 2 Initialization Sequence

Code	Initialization Action
	Display self-test message with code (see left column) to show progress.
4	Verify the 82C601 I/O controller chip is functional.
	Verify the 82C601 does not conflict with another in the system.
	Initialize the 82C601 I/O controller chip.
3	Enable RAM.
	Verify EPROM and RAM exist at their proper location.
	Verify correct EPROM window size (32K).
	Read/write-test complete 8K CMOS RAM.
	Calculate firmware checksum.
2	Verify the hexadecimal display segments show data sent to port 280 (display 00, 01, 02, 04, 08, 10, 20, 40, 80).
	Turn on, off the 4 LEDs: Running, Extended Test, Looping, Test Fail.
	Verify the real time clock functions properly.
1	Save the program stack.
-	Check Pause switch and do not continue until it is off.
-	Check Remote switch and enable remote console via COM1 if on, or local console if off.
-	Check Test # switches, and run the selected test if any are on, logging results to the console. Proceed with next step only when all Pause and all Test # switches are off.
-	Request user to enter user password if not blank in CMOS RAM, and do not allow boot or menu system to come up if password is incorrect (see security chapter for more information).
-	Check CMOS RAM for Bypass mode previously setup via the menu system, and if not, bring up the menu system. Perform configuration and test operations as commanded by user. Proceed to next step when user selects Boot, or if Bypass was previously enabled.
-	Hard boot the operating system, reinitializing registers and memory.

Error 00 - Hardware conflict.

This code means KickStart 2 cannot execute its own Hardware Test. This is an indication of memory and/or I/O address space conflict in the computer under test. It is possible that the computer contains an 82C601 I/O controller chip like the one in KickStart 2. If this is the case, KickStart 2 may not be able to initialize its own chip because of I/O address conflicts with the other one. Recheck switches SW1 and SW2, and/or remove other expansion cards from the computer under test.

Error 01 - Hardware Test Error
This error code means some component in KickStart 2 is broken and it cannot continue. It is possible that this is an I/O space conflict, but unlikely. If KickStart 2 fails in a known-good computer, return the card to your supplier for repair or replacement.

Video Initialization Problems

If the video adapter has been initialized at the time BIOS invokes KickStart 2 firmware, then in local mode operation, KickStart 2 will show the menu system on the computer display. However, if it has not been initialized, the display may be blank.

MDA and CGA (monochrome and color graphics adapter) support is built into the normal system BIOS and is usually initialized when KickStart 2 is started. However, EGA and VGA (enhanced graphics adapter, or video graphics array) are not initialized until their adapter ROM BIOS is found after POST during ROM scan. Unless they default to CGA mode at power-on, if they have not been initialized, the screen may be blank.

The only solution for this problem is to run in remote mode or to rely on KickStart 2 display of POST codes.

HOW TO RUN TESTS

There are two ways by which you may select and run tests:

1. Use KickStart 2 switches and LEDs alone, or
2. Use the KickStart 2 menu system.

You would use the first method if KickStart 2 cannot display a menu or because in your situation the menu is too unwieldy. For example, you may be trying to test a computer that has a defective display adapter or none installed, in which case the menu won't be displayed anyway. Or, you may be troubleshooting a system and you feel more comfortable controlling its testing via switches.

You would use the menu method for overall testing of a system in which the local or remote display works. Even when using the menu method, the switches and LEDs can be used in concert with keyboard selections. For example, the hex displays, the individual LEDs operate the same in menu mode as they do in non-menu mode.

The menu system, configure menu, and diagnostics menus chapters describe how to set up and run tests from the menu. The troubleshooting aids chapter describes basic troubleshooting procedures and gives information that can help you isolate problems. The following topics, in conjunction with the preceding tables in this chapter, describe how to use the LEDs and switches for running tests and troubleshooting system problems.

HOW TO TEST WITH SWITCHES AND LEDS

As mentioned in the beginning of this chapter, there are two methods by which you may select and run tests: via switches, or via the menu system. The diagnostic menu chapter describes all of the tests and explains how to select and run them via the menu system.

You may invoke a test from KickStart 2 by setting its test number on SW3, as shown earlier in this chapter (see Table 12). KickStart 2 will run it after initialization, in lieu of displaying a menu system.

This allows you to make tests run immediately without the menu system. Or you may use the menu system to select and run tests under your direct control. Either way, you may use the loop switch and test LEDs as described in Table 12 and Table 13. Chapters that follow describe the menu system and give troubleshooting aids. To perform a test using the switches, use the following procedure:

Set Up the Test

1. Set Pause = on to stop the current activity.

2. Set Remote = on if you want the test results to go to the remote terminal attached to COM1, of off if you want them to go to the local console.

3. Set SW3 = the desired test number, taken from Table 17 in the diagnostics menu chapter.

4. Set Tst/Err# = off if you want the hex display to show you the current test number. This makes sense for batch tests, because the hex display will show the number of each individual test as it starts running. Set Tst/Err# = on if you want the hex display to show the number of any error that occurs.

5. Set Loop = on if you want to loop repeatedly on the test for burn-in or to checking for intermittent failures.

6. Set StopErr = on if you want the test to stop if it detects an error. This will cause an individual or batch test to stop after finishing the individual test that detected the error, not in the middle of execution, and not at the end of the batch. Set StopErr off if you want the test to run through to completion.

7. Set LoopErr = on if you want the test to repeatedly execute the test that causes an error if one occurs. If StopErr is not on, the test will stop looping on the error as soon as the error goes away, and it will continue to the next test in the batch, or the next iteration of the test if Loop is on.

8. Set LogCom1 and/or LogLpt1 = on if you want to log errors to a printer or terminal attached to one of those ports. LogCom1 will not work if you are in remote mode because COM1 is used for the menu system. However, test results will always be logged to the local or remote console if attached. If both switches are on, all test results will be logged to the serial port (unless in remote mode), but only errors will be logged to the printer.

Start, or Run the Test

Set Pause = off to start running the test. The Running LED will come on. The Looping LED will be on while the test is running in a loop. If Loop switch is off and no error occurs, the test will run through to completion and stop, turning off the Running LED. If the Loop switch is on, the test will run repeatedly.

How and Why to Stop a Test

If you are running an individual or batch test in a loop, you can stop the process after the currently executing test by switching Pause = on. You may want to do this to keep a test from failing because you didn't set it up correctly, such as installing a loopback plug on a serial port to be tested. You may also want to do this because you want to change test numbers. If you change the test number when Pause is on, then when you switch it back off, KickStart 2 will abort the old test and start running the new one. If you did not change the Test# switch setting since the last time you set Pause = off, then when you set it off again, KickStart 2 will continue running tests where it left off.

If the Test Fails...

If a test fails, the Fail LED will come on and stay on until the end of the next test. Any time the Fail LED is on, the hex display can show either the failure number or the failing test number (if Running LED is off).

Display Test or Error Number

Change the position of the Tst/Err# switch to switch the hex display between the error number (Extended Test LED off) and the test number (Extended Test LED on). Remember that the Fail LED shows the status of the most recent test completed because it is lit at the end of a test, while the test number display shows the number of the test currently being run because it comes on at the beginning of the test. Furthermore, the hex display is not updated during a test, but only at the end or beginning. Therefore, the display and the Extended Test LED may not change when you flip the Tst/Err# switch.

How and Why to Stop on Error

You may elect to stop the test when an error occurs because you don't want to lose the failure indication on the hex display, or because you don't want to continue testing a system beyond an error condition. If you suspect a circuit of failure, but it is intermittent, you can set the Loop and StopErr switches on either before or after an error occurs. Then run the test, and it will loop repeatedly. If an error occurs, the test will stop so you can see the indication.

How and Why to Loop on an Error

Once you have stopped on an error, or verified that a circuit will fail, you may want to determine whether the circuit is failing solidly or intermittently. To do this, set LoopErr = on and run the test. If you are going to run a batch test, also set StopErr = on and Loop = on. The whole batch of tests will run repeatedly (because Loop is on) until an error occurs (because StopErr is on), and then it will loop repeatedly only on the failing test

(because LoopErr is on), and it will not continue to the next test in the batch (because StopErr is on), even though the test may pass sometimes and fail sometimes. Meanwhile, you can watch the Fail LED and the test log to see whether the LED is flashing or the results reported show passes and fails, indicating an intermittent failure. When you then set StopErr = off, the batch will continue to the next test in the batch.

Another Reason to Loop on Error

You may also want to run through a batch of tests and stop to loop on an error only as long as it is failing, then once it passes, continue to the next test. To do this, set StopErr = off and LoopErr = on before running the test, or after it stops on an error. For you can have both on, an error occurs, the test loops continuously on the failure, you see it is intermittent, you want to let the test continue the next time the test passes, so you switch StopErr = off.

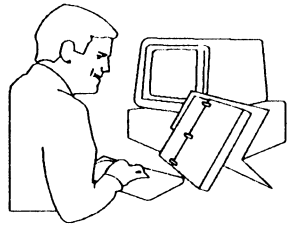
The Simplest Error Loop

Of course, the simplest way to loop on an error, once you know what is failing, is to set the Test# switches for the individual test that causes a failure, and set the Loop switch on, then start the test (switch Pause on and off). Now the individual test will run repeatedly in a loop; the Fail LED will come on when it fails and stay on till it passes, then stay off till it fails again.

Troubleshooting Failures

The troubleshooting aids chapter gives many tips on isolating and repairing problems. However, for the purpose of simplifying troubleshooting, looping can be very helpful. During the loop, you can probe around in the suspected circuit with an oscilloscope or other test instrument to find the cause of failure. If the failure is intermittent, you can heat or cool (using a heat gun like a hair dryer or cooling spray like freon) to temperature-stress the suspected circuit. Then you can observe the Fail LED for it to go out when the test has passed, and on when it has failed. Fast tests will flash the LED.

INTRODUCTION



This chapter explains the basic functions of the menu system and describes how to use it to operate KickStart 2. We recommend that you read this chapter as you experiment with it in order to get a "feel" for it and learn how to use it.

You do not need special knowledge or skill to perform the functions provided by KickStart 2's menu system, including execution of the tests. However, if you are not a qualified technician, you should not attempt to repair your computer, even if you think you know the cause of the problem. You should use KickStart 2 to test, and refer repairs to the technician.

If you attempt to repair the electronics or mechanics inside a computer under warranty, you might void the warranty. If you then have system problems, you may have to pay for out-of-warranty repairs. Therefore, if the system is under warranty, we recommend that you use KickStart 2 to test the system, but NOT to adjust or repair it. Rather, send an in-warranty system back to a factory-authorized repair facility.

REMOTE OPERATION

You may configure KickStart 2 for remote operation by setting SW3-1 on, as described in the operation chapter. In remote mode, KickStart 2 will by default send and receive all console display and keyboard information to and from the terminal or computer attached to KickStart 2 serial port COM1. No information will be exchanged with the local keyboard and display attached to the computer. During remote operation, KickStart 2 will not test that serial port, the keyboard, nor the display. You may change the default serial port to use, as well as its operating parameters (including any modem initialization string), via the menu system. If no terminal or computer is connected to the serial port, then you will not be able to operate KickStart 2 via the menu system at all. You will only be able to use it for POST and running a test that you have selected via on-board switches.

MAIN MENU SCREEN

Once you have switched power on to your computer and the system has passed POST, KickStart 2's firmware will take control of the system before the operating system boots, and it will display the main menu.

HOW TO EXIT

To exit from KickStart 2, press B from the main menu. KickStart 2 will release control of the system back to BIOS to perform a hard boot, initialize its memory, and bootstrap load the operating system from disk or ROM in the normal way.

HOW TO USE THE MENU SYSTEM

The pull-down menu system is similar to IBM's SAA (System Application Architecture) menu system. However, you are not required to press the Alt key to make a main menu selection when no menus but the main menu are on the screen. The display shows menu selections at or near the top, and any available helping information at the bottom of the screen. The main menu is shown across the top of the screen. Subordinate menus are displayed beneath main menu items that you select.

Keyboard Control

KickStart 2's menu system allows you to use the keyboard keys to select and execute items (also known as functions) shown in the submenus. Once you select a function, it becomes activated to allow you to make further selections or data entries, or it starts executing.

All main menu functions will cause submenus to drop down under the selected menu item; some menu selections will cause a dialogue box to appear. You may select functions from the submenu or dialogue box. All menu functions are executed upon selection. Dialogue box functions are executed when you press enter or spacebar while the <OK> or <YES> function is highlighted. You may cancel a dialogue box by pressing Esc or Enter when the <CANCEL> or <NO> function is highlighted (press Tab to move the highlight to the cancel word).

Important Keys - Esc, Enter/Spacebar

Press Enter or Spacebar to execute any highlighted function or menu item. Esc exits from a menu or stops a test, except for Ctrl-Esc which exits from the keyboard test. Table 16 lists the popular keys and their uses.

Table 16. Summary of Menu Keys and Uses

Key	Meaning
Esc	Back up to previous menu till main menu is reached; cancel the current dialogue box; stop running the current test or batch of tests if the current test is interruptable.
Enter or Space	Execute the highlighted function unless on a text entry field; if in a text entry field, insert a space above the cursor.
Insert	For text entry only: toggle between character insert and overtype mode.
Delete	For text entry only: delete the character above the cursor.
Backspace	For text entry only: delete the character to the left of the cursor.
Home, End	For text entry only: move the cursor to the beginning or end of the line, respectively.
Tab, Shift-Tab	For dialogue box only: move the selection highlight to the next or previous field, respectively.
→, ← Cursor Arrows	Move cursor or menu highlight bar to left or right; this will drop down the adjacent menu if at the next level below main menu.
↑, ↓ Cursor Arrows	Move cursor or menu highlight bar up or down.
Ctrl-J, K, H, or L	Move cursor up, down, left, or right, respectively, in remote mode.
Pg Up, Down	Scroll through text or list fields a screen at a time.
Highlighted Character	Press the corresponding key to invoke a menu selection.

Remote Operation

As described in the low-level operation and configure menu chapters, you may operate KickStart 2 in remote mode via a terminal or computer connected to a serial port. Since normal terminals do not have cursor control arrow keys, KickStart 2 accepts control characters instead of arrow keys to move the cursor in remote mode (see Table 16). Alt keys are ignored. All other keys function normally.

Making Menu Selections

There are two ways to use the keyboard for menu selections: cursor control using the highlight bar, or key select using the highlighted character of the menu item.

With the cursor control method, you press cursor control keys to move the menu highlight bar between menu selections. When the desired item is highlighted, press Enter or spacebar to select that item.

With the menu key select method you may press the key for the highlighted letter in the desired menu item for the lowest level of menu on the screen (the menu box in which the highlight bar is displayed). When you press the key, the corresponding item is immediately selected and executed.

Once KickStart 2 has finished executing a function that you have selected, in most cases it returns to the main menu.

Using Dialogue Boxes

A dialogue box allows you to enter information into a text entry field, or to select parameter items from several different fields of information. Parameter items affect the way the dialogue box functions.

The current field will be highlighted. Press the Tab key to highlight the next field in a forward direction, or Shift-Tab to highlight and select the next field in a reverse direction.

List and Text Display Fields

A list field displays a list of items from which you may choose a single item using the cursor and Enter keys. A text display field shows text but does not allow you to select it. The amount of information in the text or list can be so long that the field cannot show all of it at the same time, but you can scroll the list or text up and down in the field and move the highlighted selection bar up and down in the list.

Use the cursor and page keys to scroll the highlight bar up and down in the list, or the text or list up and down in the field of selections.

Alternatively, you may press the key for the first character in a selection name. The cursor will jump immediately in the list to the first or next name that begins with that character. For example, if you press p while the selection bar is on a name starting with m, the selection bar will jump to the first name starting with p. Each time you press p, the bar will go to the next name starting with p, or back to the first if on the last name starting with p.

Text Entry Fields
While entering information in a text entry field, you have normal editing capability. You may press backspace to erase the character to the left of the cursor, Delete to erase the character above the cursor, arrow keys to move the cursor, Insert key to toggle between typeover and character insert mode, and Home and End keys to move the cursor to the beginning and end of the line. Naturally, you will press Enter to accept the entry.

PASSWORD PROTECTION

KickStart 2 allows you to run tests and perform other operations that can disrupt the configuration of your system or destroy data on your disk drives. However, it also offers protection by requiring a supervisor password entry before performing the operation. When requested, you must enter it exactly as it was originally stored. If you forget it, you will not be able to execute those secure functions unless you remove the battery from KickStart 2.

The security menu allows you to change the password from the default to any other password you like. If you don't want an unskilled user to run KickStart 2 and risk damaging data or changing the configuration on your computer, you should change the password. If you are a technician permanently installing KickStart 2 on a user's computer, you may want to change the password so that only you can run the destructive tests. For more information, read the security menu chapter.

MAIN MENU STRUCTURE

KickStart 2 performs the following major functions, and menu items are there to support them:

Boot	Quit the menu and continue the boot process
Configure	Lets you configure and save KickStart 2 setup
Security	Allows you to set up password protection
Diagnostics	Enable test mode, select and run diagnostic tests

The remaining chapters of this manual discuss all the items in the submenus invoked when you select any of the above main menu items. However, they do not describe each and every dialogue box or selection because those are self-evident when you are running the program. The topics will explain the significance of the selections and how they apply to your testing or usage situations.

INTRODUCTION

This chapter describes the Configure menu functions that allow you to change the configuration of KickStart 2. Whenever you change a configuration item, KickStart 2 stores the new configuration in the battery-backed RAM on KickStart 2 itself. As a result, the next time you run KickStart 2 it uses the most recent configuration you set up.

The Configure menu offers you the following selections to set up:

Assign port addresses
Set test results/activity log
Memory size
Set real time clock
Remote configuration
Bypass menu

The supervisor password is required for assigning port addresses and configuration of remote operation.

ASSIGN PORT ADDRESSES

This menu selection allows you to set up the on-board serial and parallel ports for proper operation. The KickStart 2 I/O controller is versatile, and can select any I/O address available to the 8-bit slots of the computer as the assigned control channels for the serial and parallel ports. Possible selections and defaults are as follows:

Serial port 1 address: 3F8 (COM1)
Serial port 2 address: 2F8 (COM2)
Parallel port address: 378 (LPT1)

You may use this menu to assign the serial and parallel devices to any standard port address, or to disable them. Press space to select the next value for a given port, Tab or down arrow to select the next port, and Enter to save the selections shown and exit to the main menu.

Either serial port may be 3F8 (COM1), 2F8 (COM2), 3E8 (COM3), 2E8 (COM4), or disabled. COM1 and COM3 share IRQ4, and COM2 and COM4 share IRQ3. The ports may not share the same address/interrupt assignment.

The parallel port may be 378 (LPT1), 278 (LPT2), 3BC (LPT3), or disabled. If disabled, the port addresses may be used by any other I/O devices in the system. If these are the only serial and parallel ports, and you have disabled them, the tests will not log results to a printer or run in remote mode.

When you have assigned the COM ports, KickStart 2 automatically sets their default operating parameters as follows:

Baud rate: 9600
Data bits: 8
Parity bits: none
Stop bits: 1

The remote operation configuration parameters let you change the defaults for the remote operation port. Defaults are saved in saved into KickStart 2 CMOS RAM and used as initialization defaults.

TEST RESULTS/ACTIVITY LOG

This selection allows you to tell KickStart 2 whether and where to print test results. By default, KickStart 2 sends its results only to the console and its hexadecimal display. Menu choices are:

Log to serial port 1
Log to serial port 2
Log to parallel port
Log to console
Log summary/detailed

When enabled, the detailed log prints the name of every test that is executed (including every pass), its time and date, and its results. By contrast, the summary only prints the test name, time and date of the last pass of a test, the number of times the test ran, its duration, and the number of passes and failures. Both cannot be enabled at the same time. You may enable none, one, or all of the devices. If you log to the serial port used for remote communication, the test results will disrupt the appearance of the menu screen.

MEMORY SIZE

This menu selection allows you to enter the amount of memory installed in the system:

Base Memory _____
Extended Memory _____

Base memory is the amount actually installed in the lower 640K range that DOS and its applications usually run in. Extended memory is the amount actually installed in the range at 1M and above. There is no entry for expanded memory because KickStart 2 cannot test it since drivers are not loaded until after DOS boots. The default values are taken from system CMOS RAM. If those values are incorrect, you must enter the correct values here. Entering them will not affect the CMOS RAM values.

KickStart 2 uses the values you enter here as the total amount of memory to test when running the memory tests. If you enter values less than the amount installed, KickStart 2 will test only the amount entered. If you enter values more than the amount installed, the memory test will fail upon attempting to test the empty area.

REAL-TIME CLOCK

This menu selection displays the current values of the built-in KickStart 2 real-time clock (RTC) and allows you to change them. The clock's time and date are logged as part of the test results when results logging is enabled.

Selections are as follows; use up and down arrow keys to highlight a field, then type its new value and press Enter to save it in KickStart 2's RTC.

Year ____
Month ____
Day ____
Hour ____
Minute ____

REMOTE CONFIGURATION

This menu selection allows you to operate KickStart 2 by remote control via whichever serial port is assigned to COM1. You may switch from local to remote operation during the current session, and you may set up a modem initialization string to be sent before switching.

Menu selections and default values are:

COM1 baud rate 9600
Parity bits none
Stop bits 1
Data length 8
Modem initialization _____

Remote operation

Parameter Entry and Storage

You may use up and down arrow keys to move up and down in the menu. You may change the default COM port values, and key in a modem initialization string if a pair of modems is to be used to interface the computer under test with a remote terminal or computer. Once you have set all parameters, they are saved into KickStart 2 CMOS RAM and used as initialization defaults for remote operation.

Characteristics of Remote Operation

While in local mode KickStart 2 displays everything on the local console and responds to input from the local keyboard, but does not interact with the remote terminal. If you highlight the Remote operation menu item and press Enter, KickStart 2 will require you to enter the supervisor password, prompt you to make sure, display a message identifying its new mode, and switch to remote operation. KickStart 2 will send the initialization string to the serial port upon entering remote mode.

Because of the danger of locking up the system and having to remove the cover if you incorrectly enter remote operation, and because of the risk of data loss in allowing an unauthorized local operator to control the system, KickStart 2 requires the local operator to enter the supervisor password before being able to enter remote operation from the menu.

Once you select remote, you are not then allowed to switch back to local. Only the operator at the remote terminal can switch KickStart 2 back to local operation. While in remote mode, KickStart 2 displays all menus on the remote console, and nothing on the local one. It assumes the terminal

or computer can send and display the standard ASCII character set, and behaves like a standard ANSI or VT100 terminal. For use of the keyboard, see the menu system chapter.

If you enter remote and no terminal is attached, or if you have set up an incorrect modem initialization string or incorrect serial port parameters, then the only way to switch back to local is to turn system power off and back on.

Remote Selection Via Switch

The position of the KickStart 2 switch used for remote (see the chapter on low-level operation) determines the default power-on state of operation, and it overrides the remote mode menu selection. If it is set to remote at power-on initialization, KickStart 2 will assume the terminal or computer is attached, and it will send all menu and display information through the serial port. If nothing is attached, or if port parameters have been set incorrectly, you must set the switch for local operation and reset the system or cycle power. When the remote switch is on, it is not possible to use the menu system to switch to local mode.

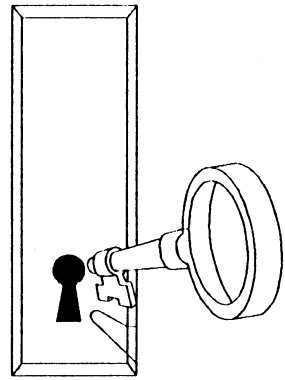
BYPASS DIAGNOSTICS

The Bypass Diagnostics menu selection is a toggle function, so it is enabled or disabled each time you select it; when it is in bypass mode, an X is displayed to the left of the menu item. In bypass mode, KickStart 2 will not start up the menu system the next time you reset or power-on the computer. Rather, it will display a message for a few seconds requesting you to press Escape to enter the menu system. If you do not, it will request you to enter the user password in order to boot the operating system.

This menu-based bypass is different from the hardware-based bypass that you can enable with a KickStart 2 switch setting. See the installation chapter for more information on that switch.

INTRODUCTION

This chapter describes the Security menu selection and explains how to use its functions to set up passwords. It also explains how the password protection mechanism works when fully implemented.



MENU SELECTIONS

This menu allows you to select one of the following types of passwords to change:

User
Supervisor

The default user password is empty (blank); the default supervisor password is LANDMARK

PERMISSIONS

Who is a User?

A user is anyone allowed to boot the system and run diagnostics. A user must enter the correct user password in order to perform those functions. A user may change the user password. If the user password is blank, then KickStart 2 does not request a user password for functions that normally require one. This allows KickStart 2 to be installed in a system and to impose no normal user security functions on it. Again, a user password is required to:

Run diagnostics via KickStart 2's menu system
Boot the operating system.

Who is a Supervisor?

A supervisor has all the permissions of a user, plus more. The supervisor may also use the menus to switch the system into remote mode and run destructive tests. The supervisor may view and change the user password. This will prevent the user from booting the system unless the supervisor tells the user what the password is. Even if the supervisor password is blank, KickStart 2 will request a supervisor password entry for functions that normally require one. If it is blank, then the user need only press Enter to simulate entry of the password. Again, a supervisor password is required to use the menu system to:

Format or run destructive tests on a hard disk
Change serial or parallel port configuration
Invoke remote operation.

NORMAL REQUEST OF PASSWORD

KickStart 2 automatically requests you to enter appropriate password when required for any of its functions. The password is a displayable case-sensitive string of up to 8 characters. Displayable means any character with an ASCII value greater than 32 (space) and less than 127 (DEL). Case-sensitive means upper and lower case characters are seen as different characters (e.g., AA is different from Aa).

When you enter the password, KickStart 2 encrypts it and compares it to the encrypted password stored in KickStart 2 CMOS RAM. If they are the same, you may execute the selected function. If they are not, KickStart 2 will not allow you to execute the function.

If you change the password, you must remember it in order to execute password-protected functions, including entry of a new password. If you forget it, you will not be able to execute those functions, and you must remove KickStart 2 from the system and remove its battery in order to force KickStart 2 to "forget" the password.

How to Change the Password

To change the password, select the appropriate menu item and enter the current password when prompted by the display. As soon as you have completely entered it, KickStart 2 encrypts it and saves it in CMOS RAM.

Default Passwords

The default user password is blank, so you are not required to enter it in order to boot the system or run diagnostics. The default supervisor password is LANDMARK, and you must enter it to perform destructive hard disk tests or I/O setup, or remote tests.

SECURITY VIOLATIONS

KickStart 2 does not tolerate many mistakes when you are entering a password. If you enter it incorrectly once, KickStart 2 will display an alert message and beep. If you enter it incorrectly a second time, the system will beep raucously and flash a large security violation message on the screen. If you enter it incorrectly a third time, KickStart 2 will reset the computer and make you wait 5 minutes before being allowed to reboot it.

SECURITY FOR APPLICATION PROGRAMS

Application programs can call a KickStart 2 firmware routine, pass it a password with security level (e.g., user or supervisor) and security handling parameter, and receive an OK or NOT OKAY response from the routine.

If the response is not okay, the application can take appropriate action, such as by shutting down the program and not allowing the user to operate the program.

The application may also read the settings of the KickStart 2 switches in SW2 and behave according to the settings. For example, a systems integrator or software manufacturer that bundles KickStart 2 with an application or system can set a different serial number on each KickStart 2,

and refuse to operate if the setting is not correct for that specific system or application. In order to do this, the KickStart 2 Remote switch and test number switches must be off.

If you are a potential OEM customer, contact Landmark for more information on these features.

DIAGNOSTICS MENU

INTRODUCTION

This chapter describes all the diagnostic tests that prove your system is working correctly. If a test fails and you are a technician, refer to the troubleshooting aids chapter for remedial suggestions. This chapter assumes you are familiar with use of KickStart 2 switches and setup as described in the low-level operation and configure menu chapters.

Advanced Diagnostics with PC Probe

If you want to run advanced diagnostics and additional utility functions under DOS, we recommend you obtain Landmark's PC Probe software package. It is the perfect complement to KickStart 2, and it is designed to produce results for both the technician, and the less technical end user. Contact Landmark for more information and immediate attention.

Results Log

You may configure KickStart 2 to print summary or detailed test results. See the configure menu chapter for more information.

TEST NUMBERS AND NAMES

Table 17 lists all the tests that KickStart 2 can run. Each test has a number associated with it. When you are using KickStart 2 to select a test to run, the test number in the table is the value to set on the switches. It is also the value that can be shown on the KickStart 2 hexadecimal display while the test is running. Refer to the low-level operation chapter for more information.

Batch Testing

In order to facilitate burn-in testing over a period of time, some tests are pre-organized for your convenience into groups of tests called batches, as shown at the end of Table 17. To run a batch test, select it from the diagnostics menu as you would any other test. You may also set the batch test number on the KickStart 2 switches just as you would any other test number. You may even build a custom batch test and save it in KickStart 2 CMOS RAM to be run automatically after power-on initialization. Any tests requiring loopback plugs or diskettes will fail unless those items are installed properly before starting the test.

TEST CONTROL

KickStart 2 gives you a variety of ways to control test execution, consisting of both Diagnostic menu selections, and on-board switch settings. We recommend you become familiar with switches as described in the low-level operation, and setups in the configure menu chapter, before continuing with this chapter.

Table 17. Diagnostic Test Numbers and Names	
Test #	Test Name
00	No test
	SYSTEM BOARD TESTS
01	80x86/8 Central Processor (CPU)
02	80x87 Math Coprocessor (NPU)
03	CMOS Real Time Clock
04	Speaker
	I/O CONTROL TESTS
06	8259 Interrupt Controller
07	8253/4 IRQ0
08	8250/16450 IRQ4
05	8237 DMA Controller
	MEMORY TESTS
10	Data Line Test
11	Parity Test
12	March Test
13	Galrow 1 Test
14	Galrow 2 Test
15	Galrow 3 Test
16	Galrow 4 Test
17	Galrow 5 Test
18	Refresh Toggle
19	Refresh Bandwidth
1A	Refresh Rate
1B	Extended Memory Test
	VIDEO BOARD/MONITOR TESTS
1F	CRT RAM
24	Video Mode
	KEYBOARD TESTS
20	84-Key
21	101-Key
	FLOPPY DRIVE TESTS (3x=A:, 4x=B:)
30	Format Random
31	Write Random
32	Read Random
33	Seek Random
34	Format Entire
35	Write/Read Random
	HARD DRIVE TESTS (3x=C:, 4x=D:)
39	Format Random
3A	Write Random
3B	Read Random
3C	Write/Read/Compare Entire

Table 17. Diagnostic Test Numbers and Names	
Test #	Test Name
3D	Write/Read/Compare Track 0
3E	Format Entire (Interleave = 2)
3F	Park Heads
	SERIAL PORT TESTS (5x=COM1, 6x=COM2, 7x=COM3, 8x=COM4)
50	Data Line
51	Asynchronous I/O
	PARALLEL PORT TESTS (5x=LPT1, 6x=LPT2, 7x=LPT3)
58	Data Line
59	Command Line
5A	DATA to STATUS
5B	DATA to COMMAND
5C	Toggle line
	8930 ETHERNET TEST
90	Western Digital WD 8003 family
91	National Semiconductor Ethernet
92	Novell NE 1000 family
93	3-COM EtherCard
	BATCH TESTS
E0	All possible tests except custom batch
E1	System board
E2	I/O control
E3	Main and CRT memory, not including Galrow
E4	Main and CRT memory, including all Galrow
E5	All floppy drives
E6	Floppy drive 0 (A:)
E7	Floppy drive 1 (B:)
E8	All hard drives
E9	Hard drive 0 (C:)
EA	Hard drive 1 (D:)
EB	All parallel ports except log port
EC	Parallel port LPT1
ED	Parallel port LPT2
EE	Parallel port LPT3
EF	All serial ports except log / remote port
F0	Serial port COM1
F1	Serial port COM2
F2	Serial port COM3
F3	Serial port COM4
F4	All possible Ethernet
FF	Custom Batch Test

Test Looping and Duration

The test duration dialogue box appears after you select a test to run. For most tests, it allows you to select how much you want to run it:

Continuous
Timed
Passes __1__

Continuous is the default, and it causes any test you select to run continuously. If you select # Passes, you may then enter a pass count, and the test will execute that many times and stop. The default pass count is 1. If you select Timed, you may then enter the amount of minutes to run the test, up to 59,999 minutes (1000 hours, or 41.7 days). The test will run that long and stop.

Running a test in a loop allows you to stress-test the circuit, and it lets you check the Test Fail LED for evidence of intermittent failure. See the configure menu chapter for more information.

Stop on Error

Batch, timed, continuous, and multiple pass tests allow you to select stop on error or not. Unless stop on error is enabled, an individual test that encounters an error will log the result and continue to completion. Under no circumstances will KickStart 2 intentionally stop an individual test until it completes. With stop on error enabled, either via the menu system, or via KickStart 2 switches, a failing set of tests, either batch or multiple passes, will stop immediately after the test has finished running and it has logged the results.

Sometimes, it is important in the testing or troubleshooting process to stop a looping test or batch of tests when an error occurs, rather than to let it run through to completion. For example, there is no point in running a hard disk format test when the controller is failing.

Errors and What to Do about Them

When a test fails, it will display an error code on the KickStart 2 LEDs, display an error message on the console (local or remote, if connected and in operation), light the KickStart 2 Test Fail LED, and run to completion. If you want to run the test repeatedly, you may select either the menu method to run a given number of passes or amount of time, or the switch method of continuous looping on KickStart 2.

The switch method and use of the LEDs are described in the chapter on low-level operation. Refer also to the troubleshooting aids chapter.

How to Halt a Test

To halt a test, press Esc. In general you cannot halt a short test in progress, but Esc will halt a series of tests running in a batch or loop, after the currently executing individual test is finished. Longer tests are always able to halt. Upon being halted, the test returns you to the menu.

Remote Testing

The configure menu chapter describes how to set up remote operation, and the menu system chapter describes remote use of the menus. During remote operation, KickStart 2 will not test the display, keyboard, serial port used for communication, or serial or parallel port used for logging. Any tests requiring loopback plugs or floppy diskettes will fail unless they are already installed.

DIAGNOSTICS MENU

The diagnostics menu provides the following categories of tests to run, and subsequent topics describe them in detail. For assistance in troubleshooting any errors that occur, refer to the chapters on low-level operation and troubleshooting aids.

System board tests
I/O control tests
Memory tests
Video tests
Keyboard tests
Floppy disk tests
Hard disk tests
Serial port tests
Parallel port tests
Ethernet tests
Batch tests

SYSTEM BOARD TESTS

These diagnostics check the circuitry typically found on the system board, sometimes referred to as the motherboard. Test failures are displayed on the screen. If enabled they are sent to the printer or a disk file.

80x86/8 Central Processor (CPU)

This test checks the internal circuitry of the CPU chip, including registers, execution of the instruction set, and some communication with external circuits. It works with 8088, 8086, 80188, 80186, 80286, 80386, 80486, and truly compatible processors.

80x87 Math Coprocessor (NPU)

Tests all of the floating point number translation, arithmetic, and transcendental function instructions, as well as register transfer and data path integrity. Works with 8087, 80287, 80387, and all truly compatible math chips, including the circuitry built into the 80486 processor that contains an integrated math chip.

CMOS Real Time Clock

Tests the ability of the Real Time Clock to hold and increment time and date accurately.

Speaker

Tests the ability of the 8253/4 timer (and in XTs, the 8255 programmable peripheral interface) circuitry controlling the system beeper to function properly and accurately. You will hear a short series of beeps if it is functioning properly. If you do not hear the beeps, the speaker may be disconnected. No error message will be displayed.

I/O CONTROL TESTS

This category of tests checks out circuitry that is normally contained on add-in I/O cards that plug into the computer's expansion card slots. Because of the high level of circuit integration into powerful computer chips, many modern computers have the circuitry included on the motherboard. Where possible, KickStart 2 automatically detects the presence of a controller for an I/O device and will not allow you to run the corresponding test if the controller is not installed.

Interrupts

These tests check the 8259A PIC (programmable interrupt controllers) and associated circuitry. Various circuits send interrupt signals to a controller which prioritizes them and interrupts the CPU with a request to pay attention to an I/O device or other circuit. The XT uses only one 8259A, while the AT uses two.

Controller

This tests the ability of the 8259 programmable interrupt controller to recognize interrupts and prioritize them properly, and the ability of the system to issue and recognize the non-maskable interrupt. A normal XT contains 8 IRQ (interrupt request) signal lines, while an AT contains 16. Most of them are not used.

Aside from the standard IRQs, KickStart 2 has no way of knowing whether special controller cards are installed that can issue IRQ signals, nor how to get them to do it. The other tests in this set do check the standard ones.

IRQ0

This test checks the proper functioning of the XT's 8253 or the AT's 8254 timer, and its ability to issue interrupts properly.

IRQ4

This test checks the ability of 8250 or 16450 serial port COM1 to issue interrupts. You must attach a serial port loopback plug onto the COM1 connector at the rear of the computer before executing the test. See the Accessories chapter for more information on loopback plugs.

8253/4 Counter-Timer

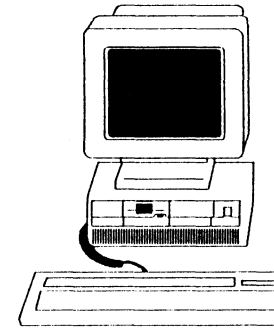
This test verifies the functionality and accuracy of the counter timer chip.

8237 DMA Controller

This test checks the proper functioning of the 8237A Direct Memory Access controller registers and related data path. KickStart 2 cannot test all DMA channel control signals because DMA Request signals can only be issued by special I/O controller cards, and KickStart 2 has no way of knowing whether such cards are in the system nor how to get them to issue the request. The only standard I/O device that uses DMA in an AT-style computer is the floppy controller, which is tested elsewhere. This test does check internal operations of the DMA controller chips. However, because of the difference in system designs, it does not test memory-to-memory DMA transfers.

MEMORY TESTS

The RAM tests check the proper functioning of the memory chips, address circuitry, and the data path into and out of memory.



The Data Line, March, Long/Quick Parity, and Galrow tests are run only on base memory (RAM in the lower 640K). For these tests, KickStart 2 moves data from the area to be tested to a safe place in memory, runs the test, then restores the data to its original location.

Data Line Test

This test checks the integrity of the data path into and out of memory by writing and reading ones, then zeros.

Parity Test

This test checks the ability of the parity generation circuitry to generate a correct parity bit. A parity bit exists for every byte in memory to ensure that an even number of 1's is stored in every address. If one of the data bits is stored incorrectly, then when the value is read, the parity checking circuit will find incorrect parity, and will generate an error.

March Test

This test writes, then reads a pattern of 00000001, with the 1 moving to the left on successive writes, then repeats the process with 11111110, moving the 0 to the left on successive writes. This test checks the ability of memory cells not to affect nor be affected by the status of adjacent cells.

Galrow Tests

The 5 Galrow tests are extremely time-consuming, requiring several hours to run completely. They are exhaustive tests that verify the integrity of the memory read/write and addressing circuitry of the entire system, concentrating on the lower 640K. Based on modern computer science testing algorithms, they perform the most thorough and comprehensive diagnostic checkout of combined memory circuitry available in any popular diagnostic product. Faulty address decode circuitry can cause apparent memory failures that don't exist, but Galrow tests will catch the bad address decoders.

Galrow tests are separated into 5 tests, each of which checks a different 128K block of memory, as follows:

Galrow 1 - 0 to 128K
Galrow 2 - 128K to 256K
Galrow 3 - 256K to 384K
Galrow 4 - 384K to 512K
Galrow 5 - 512K to 640K

Each test writes a unique data pattern to a base address in its 128K block, then reads it to ensure its value has not changed after each write-read-compare of another unique pattern to each other address in the entire range of installed memory, including extended memory. Then, it increments the base address and repeats the operation. While the test is running, it displays a progress indicator so you will know it has not halted.

You especially need to run Galrow tests if you detect failures with the other memory tests, or you want to run exhaustive tests of address decode and memory circuits for burn-in or quality assurance verification. Galrow is an excellent all-around group of memory tests because each test verifies the entire memory while focusing on one 128K block at a time. It is very good for finding intermittent memory problems.

Some users may have a tendency to complain that the Galrow tests take too long to run, but in doing so they can overlook the main reason for Galrow. When you want a thorough burn-in and intermittency check of your memory, run Galrow for some hours or days. If you want a faster but less brutal check of your memory, run one or more of the other tests.

Refresh Toggle

This test verifies that the memory refresh circuitry is generating the signals necessary to prevent the motherboard's dynamic random access memory (DRAM) from losing (or forgetting) its contents. The DRAM is used in the computer's base memory, extended memory, and expanded memory. DRAM will lose their contents if they aren't read every few microseconds. The refresh circuitry performs a simulated read between normal memory reads in order to keep the data alive and "refreshed". If the refresh circuitry fails or operates marginally, data "dropout" (occasional missing bits) or complete memory loss can occur. The refresh toggle test verifies that refresh signals are occurring.

Refresh Bandwidth

This test programs the refresh controller to its 5.3% bandwidth limits according to IBM technical reference manual specifications, and verifies that memory loss does not occur at those limits (between 14.32436974 and 15.92773109 microseconds). This guarantees that incrementing the refresh address every 15 microseconds, and executing 5 clock cycles will refresh the entire memory.

Refresh Rate

This test measures the actual time between leading edges of memory refresh pulses.

Extended Memory Test

Extended memory is the range of linear memory that resides above the first megabyte of address space in the computer. There is no extended memory in a PC or XT because their 20-bit address bus cannot access above 1M (megabyte). An AT or compatible can access up to 16M of total memory via its 24-bit address bus, 15M of which can be extended memory, mounted either on the motherboard or on one or more cards plugged into the computer's expansion slots. 80386 and 80486-based AT compatibles can address up to 4G (gigabytes), but require a specially modified bus with 8 additional address lines.

The extended memory test checks all available (unused as determined via an Interrupt 15 query) extended memory, but is not as exhaustive as the base memory tests. It writes then reads a data pattern to each location in extended memory, then verifies that the data written is the same as the data read. It makes no attempt to save any data already in memory that is unused. The test is well-behaved and does not interfere with 80286 protected mode operation, nor 80386 Virtual 86 mode operation.

Expanded Memory Test

KickStart 2 does not test expanded memory because there is no way to detect its presence until DOS is loaded.

VIDEO BOARD/MONITOR TESTS

These tests allow you to check functionality of both the video adapter and the monitor. They operate with either monochrome or color system using popular monochrome, Hercules, color graphics (CGA), enhanced graphics (EGA), and video graphics array (VGA) adapters, as well as monochrome and color analog, digital, and multiple scan frequency monitors.

CRT RAM

This test writes, then reads at least the 16K display memory area on standard video adapters, and verifies that memory works properly.

Video Mode

This selection allows you to select any video mode that your video system can display, then to test all character generation, character attributes, foreground / background color generation and purity, dot and line matrix drawing isotropy and linearity (equality of spacing, distance, and straightness), and graphics drawing capability.

You can use this test to verify that your monitor is properly adjusted, for image size and position, color purity for the color guns, presence of all pixels, and pincushion (tendency of the picture to bow at the edges). You can also use it to verify that monitors have the ability to display properly in all video modes with a given video adapter. For example, some video

adapters do not properly compensate for monitor characteristics, causing some images to be displayed off center.

Because of KickStart 2's ability to detect all popular super VGA adapters and exercise all of their character and graphics modes, this is one of the most comprehensive video exercise tests available in any test program.

KEYBOARD TESTS

You may select either the original 84-key AT-compatible keyboard, or the 101-key enhanced AT-style keyboard.

These tests display a keyboard map, then allow you to press each key on the keyboard and receive verification on the display that you pressed that key and none other. You must press each key in sequence as the display shows you. The test verifies that the correct key code was generated by the keyboard for each key you pressed.

You may press Ctrl-Esc to abort the test. This test is disabled during remote operation because the remote user cannot press the keys on the local keyboard.

FLOPPY DISK AND DRIVE TESTS

These tests verify that the floppy controller and drive function properly. You are required to put a freshly formatted floppy diskette (a "scratch" diskette that does not contain data you care to retrieve) into the drive. The scratch diskette must be fully formatted so that it will not cause errors from an attempt to read, write, or seek to an unformatted area of the diskette.

If KickStart 2 detects that you are using a low density diskette in a high density drive, it will perform low density operations. If it cannot detect the density of the diskette, and you are testing in a high density drive, it will assume you are working with a high density diskette. If you use a low (double) density 5.25-inch diskette (360K) in a high density drive, you are risking significant errors because such diskettes are not intended for use in those drives.

To avoid confusion, we recommend that you acquire and label both high and low density scratch diskettes for use in testing floppy drives, and keep them with your diagnostic test accessories such as the manual, loopback plugs, and so on.

The tests destroy data on the diskette. You cannot run the destructive tests unless you enter the correct password. Refer to the Configure chapter for more information on passwords.

Head Cleaning and Alignment

It is important to realize that floppy subsystem errors can also be caused by dirty heads and misaligned internal drive mechanisms. KickStart 2 can test the drive for functionality, but not for proper alignment and noise interference. For this reason, we recommend that you purchase Landmark's AlignIt™ floppy drive maintenance kit. AlignIt contains a patented floppy drive alignment test diskette that is highly accurate (to near-laboratory

standards), dry-lubricated head cleaning diskettes, and professional quality test software. AlignIt is a DOS application program.

Format Random

This test formats 8 randomly selected tracks and verifies each track to ensure it was formatted properly.

This is not a DOS format operation because it does not write a file allocation table onto the diskette. Therefore, you cannot format a diskette with this test and then use it to hold DOS files. You must reformat it under DOS in order to store DOS files on it.

Write Random

This test writes a data pattern to 8 randomly selected tracks on the diskette and verifies that it did not cause any write errors.

Read Random

This test reads 8 randomly selected tracks and verifies each track to ensure it was formatted properly. Optionally, you may elect to read the entire diskette. In this case, the test begins at track 0 and proceeds inward to the last track. The tracks must have been previously formatted, either under DOS or using the Format all tracks menu selection. The test does not affect any data on the diskette.

Seek Random

This test commands the heads to seek to 8 randomly selected tracks on the diskette and verifies that it reached the proper track each time.

Format Entire

This test is identical to the format random test, except that it formats the entire floppy, starting at track 0 and going to each track in sequence to the innermost track. After if formats a track, it reads the track and verifies that it was formatted properly.

This is not a DOS format operation because it does not write a file allocation table onto the diskette. Therefore, you cannot format a diskette with this test and then use it to hold DOS files. You must reformat it under DOS in order to store DOS files on it.

Write/Read Random

This test writes and then reads 8 random tracks on the diskette. At each track the test compares the data read with that written, verifying they are the same. The diskette must have been entirely formatted or this test will fail when it attempts to write on an unformatted track.

HARD DRIVE TESTS

Most of the hard drive tests destroy data on the drive; the read and seek tests do not. You cannot run the destructive tests unless you enter the correct password. Refer to the Configure chapter for more information on passwords. Even if you know the password, please heed the following:

DO NOT RUN WRITE OR FORMAT TESTS UNLESS IT IS OKAY TO DESTROY DATA ON THE DRIVE!

The tests are ideal to run on a brand-new MFM (modified frequency modulation) or RLL (run-length limited) hard drive or on one that has given catastrophic data errors, forcing you to reformat it. After running the destructive random format, write, or compare tests, use the Format Entire selection to perform a low-level format of your MFM or RLL hard drive.

If you are using any other kind of hard drive (such as SCSI, or ESDI), contact Landmark sales department for a recommendation of the best kind of low-level format to use.

Format Random

DO NOT EXECUTE THIS FUNCTION UNLESS IT IS OKAY TO DESTROY DATA AND FORMATTING ON THE DRIVE!

This test is only guaranteed to work properly on MFM and RLL hard drives and other drives that can be formatted with normal BIOS Interrupt 13 calls, and contain accurate parameters as pointed by the CMOS RAM into the BIOS disk parameter table. In particular, it will not work if the disk controller BIOS performs sector translation to compensate for the inability of BIOS or DOS to handle large drives or more than 1024 cylinders.

The test performs low-level format using a 2-to-1 sector interleave of 30 randomly selected tracks, destroying any data on the tracks. Meanwhile, it verifies that the controller detects no formatting errors. By running the random format test in timed batch mode for some hours, you can theoretically eventually format all tracks.

Write Random

DO NOT EXECUTE THIS FUNCTION UNLESS IT IS OKAY TO DESTROY DATA ON THE DRIVE!

This test writes a data pattern on 30 randomly selected tracks, destroying any data already on each track. Meanwhile, it verifies that the controller has not detected a write error. The test works on any kind of drive that has been low-level formatted. By running the random test in timed batch mode for some hours, you can theoretically eventually test all tracks.

Read Random

This test reads data from all heads on your choice of 30 randomly selected tracks or all tracks. It does not affect any data already on the tracks. Meanwhile, it verifies that the controller has not detected a read error. The test works on any kind of drive that has been low-level formatted. It is perfectly safe to run on any DOS formatted drive.

You can run this test repeatedly in timed batch mode for some hours to do a thorough test of the data areas on the drive. If the test detects errors and it is an MFM or RLL drive we recommend you perform data revitalization

to refresh the information on the drive and reduce the chance of errors. Data revitalization is available in Landmark's PC Probe test software.

Format Entire

DO NOT EXECUTE THIS FUNCTION UNLESS IT IS OKAY TO DESTROY DATA AND FORMATTING ON THE DRIVE!

This menu selection performs a low-level format (and implicit format test) of the entire hard drive. It is only guaranteed to work properly on MFM, RLL, and other hard drives that can be formatted with normal BIOS Interrupt 13 calls. It assumes that you have set up system CMOS RAM with the correct drive type (see the setup chapter for more information, including parameters for popular drives), and that the BIOS disk parameter table contains accurate parameters for the type of drive in the system.

The test will not work if the disk controller BIOS performs sector translation to compensate for the inability of BIOS or DOS to handle large drives of more than 1024 cylinders.

The test first determines the optimum sector interleave factor to use on the drive by formatting the customer engineering (innermost) cylinder, and measuring the time required to read a track. It does this repeatedly with a different sector interleave each time. It displays the interleave that gave the fastest operation as a recommendation, and allows you to enter the desired interleave factor. If you are attempting to format an IDE drive, that drive will probably ignore the interleave factor and force it to 1-to-1 because IDE controllers usually buffer a track and thus transfer disk data at maximum speed.

The test ignores any bad track or sector data that may be on the drive, including any sectors or tracks marked as bad in their headers. It performs low-level format of all tracks, destroying any data on the tracks. It starts at track 0 and goes to each track in sequence to the innermost track specified in the BIOS disk parameter table. As it formats a track, the controller monitors the format process to ensure that it occurs correctly and there are no errors. The test will log any errors reported by the controller. By running the test for one or more passes, you can verify the integrity of the drive, but the test does not perform a comprehensive media analysis.

You may use the error log as a list of defective tracks or sectors. The test will not mark such tracks or sectors as bad in their headers, nor in any other way. When you run DOS format on the drive, it will test each sector for errors, and it will identify the blocks or clusters they are in as unavailable in a record kept on the disk. If you want to have the actual defective track or sector headers marked as bad, contact Landmark's sales department for a recommended product.

This format test will not write a partition or file allocation table onto the disk. You must perform a high-level format for DOS, UNIX, or some other operating system before you can store files on it.

Write/Read/Compare Entire

DO NOT EXECUTE THIS FUNCTION UNLESS IT IS OKAY TO DESTROY DATA ON THE DRIVE!

This test writes and then reads each track on the diskette, beginning with track 0 and progressing inward to the last track. At each track the test compares the data read with that written, verifying they are the same.

The whole drive test takes much longer than the track 0 test. It is very comprehensive. It verifies that the system can correctly write and read data with each head on the entire track of every track on the drive. You can run the test in batch mode for some hours to exercise the drive thoroughly and test the entire disk surface. The test logs all errors reported by the controller, and all compare errors.

Write/Read/Compare Track 0

DO NOT EXECUTE THIS FUNCTION UNLESS IT IS OKAY TO DESTROY VITAL TRACK 0 DATA ON THE DRIVE!

This test writes data onto track 0, destroying whatever is there, then reads it back and compares it with what was written. If the data are the same, the test passes. This is a quick test to verify functionality of the drive and controller write/read capability. It is an important test because track 0 is where the partition table is stored, and if that goes bad, the drive will be useless for DOS or other operating system operations.

Park Heads in Landing Zone

This selection positions the head assembly for the selected physical drive inward until it rests at the innermost cylinder, the head landing zone. The operation uses the landing zone cylinder reported by BIOS, so if that value is not correct for the drive, the heads will not be parked properly in the landing zone.

You would want to park the heads if you intend to move the computer. The reason is: if you bump or jar the computer, the heads on some hard drives can crash into the surface of the disk and damage it so that it cannot store or read data at that spot.

Hard drive heads are never allowed to contact the disk surface. When the disk is spinning, they are pressed toward the surface of the disk, but they ride on a cushion of air. The landing zone is not used to store data, and so it is safer to the system if the heads accidentally contact the disk there rather than in the data area.

The last thing to do before switching the computer's power off is to park the heads on all drives. Some modern drives have built-in mechanisms to lock the heads off the disk with power off. Park them to be sure.

8250/16450 SERIAL PORT TESTS

These tests check the internal functionality of the 8250 or 16450 serial port controller chips, as well as the integrity of the drivers and connections to external serial devices. Some of the tests will prompt you to connect a loopback plug onto the parallel port connector at the rear of the computer. The plug is included with KickStart 2 (see accessories chapter for more information).

Once you have selected the test to run, the display allows you to pick a communication port such as COM1, 2, 3, or 4, based on what is installed in your computer. The tests are disabled for any COM port used for remote operation or results logging because that COM port must be used to communicate with the remote computer or printer.

Data Line (Internal Loopback) Test

This tests the serial port controller chip circuitry, and interface between it and the CPU.

Asynchronous I/O (External Loopback) Test

This tests integrity of drivers and external connections; it requires the serial port loopback plug.

PARALLEL PORT TESTS

These tests verify the ability of the parallel ports to control a printer properly. The tests send various patterns of signals out the port in order to test it, so you should disconnect the printer cable from the port before running the test. Part of the test requires you to plug a loopback plug onto the parallel port connector at the rear of the computer. The plug is included with KickStart 2 (see accessories chapter for more information).

Once you have selected the test to run, the display allows you to pick a parallel port such as LPT1, LPT2, or LPT3, based on what is installed in your computer. The test is disabled for the parallel port used for results logging.

Data and Command Line (Internal Loopback)

These tests verify that data and command signals sent to the parallel port control circuitry can be read back properly.

DATA to STATUS and COMMAND Line

These tests verify that data and control signals can pass out of the computer, into a loopback plug, and back into the computer properly, thus proving the external interface works.

Toggle line

This test verifies all signals not verified in the above test.

ETHERNET TESTS

There are a variety of Ethernet controller chips on the market, and an even greater variety of cards based on those chips. These tests check the basic functionality of those that use the National Semiconductor Corporation (NSC) 8390 chip, as implemented by both Western Digital and Novell.

The tests check only internal 8390-based Ethernet adapter circuit integrity. If your version also tests external data packet transfer capablility, a display message will request you to install a BNC loopback plug, described in the accessories chapter. A message will also notify you if you have to change the I/O address of the Ethernet card in order for the test to run.

If a loopback plug is required, before running the test you must disconnect the network cable from the back plate of the Ethernet card, and attach the loopback plug in its place. Before disconnecting the network cable, consult with your network supervisor to make sure it will not interfere with network operations. After connecting the loopback plug, run one of the following:

Novell NE 1000 family adapters
National Semiconductor Corp. Ethernet
Western Digital WD 8003 family adapters
3-COM EtherCard

When the test has finished execution, remove the loopback plug, inform the network supervisor, and re-connect the network cable.

BATCH TESTS

This menu selection allows you to run a batch or group of several tests as if the group were an individual test. It also lets you setup and run a custom batch test. It displays another menu with the following choices:

All possible tests except custom batch
System board
I/O control
Main and CRT memory, not including Galrow
Main and CRT memory, including all Galrow
Floppy drives
Hard drives
Parallel ports except log port
Serial ports except log / remote port
All possible Ethernet tests
Create custom batch test
Run custom batch test

Selection of a single batch test displays a pass control menu that allows you to select continuous, timed, or # passes. The only exception is Run custom batch, which does not allow you to select timed mode because timed mode applies only to the tests within a custom batch test.

Furthermore, with one exception, after you select a pass control parameter, the menu system will ask whether you want the test to stop on error. The exception is when you are selecting tests to insert in a custom batch test.

In that case stop on error applies only to the custom batch test as a whole, and not to the tests contained within it.

Any time a batch of tests stops on an error, it will have stopped at the end of the individual test that caused the error before running the next test.

All of the batch tests except custom are pre-defined as suggested by their menu entries. They run all tests in their respective main diagnostic menu except as suggested. You are assumed to have installed all loopback plugs on the serial, parallel, and Ethernet ports to be tested, and you are assumed to have inserted pre-formatted scratch diskettes into all the floppy drives to be tested.

How to Create a Custom Batch Test

To create a custom batch test, select the menu item with that name. The display will show a menu plus window on the right that allows you to place up to 20 test names in any order you like, and shows all the existing entries. The menu offers the following selections:

Clear all entries
Clear one entry
Create entries
Exit batch setup

The top two items allow you to clear one or all entries in the list of tests. When you select Create entries, the display will show a message at the bottom of the screen telling you that the system is in custom batch creation mode. While the system is in this mode, any tests you select from the menu system will go into the custom batch test list, and will not be executed immediately upon selection. You must press Esc from the main menu, or select the Exit batch setup item from the Setup custom batch menu in order to terminate Create entries mode.

While in Create entries mode, select a diagnostic test as you normally would for running a single test, and enter all the parameters required. Please note that the parameters include # of passes or timed mode, but exclude continuous, since it would make no sense to make a test within a batch run continuously.

When you have fully selected the parameters for the test, the display will prompt you to enter a position number, offering as a default the next empty position, or the last position if none are empty. Type in any number from 1 through 20 and press Enter; the test name will appear in the appropriate slot in the custom window, overwriting any name already there. The system will return you to the main menu.

Every entry you make is immediately saved in KickStart 2 CMOS RAM. It is okay to leave some entries blank, as KickStart 2 will simply ignore them when it runs the batch. Once you have made all the entries you desire, press select the Exit batch setup menu item. The system will exit from batch creation mode, and return to normal. You have completed creating your custom batch test.

Now you may run the custom batch test as you would any other test by selecting the run custom batch test menu item. You may run the custom batch in continuous or # passes mode, but not in timed mode. The reason is to avoid conflict with timed modes of tests contained within the custom batch.

INTRODUCTION

This chapter gives information that can help you set up your computer for proper operation after testing, troubleshooting, and repair. It explains the use of CMOS RAM to hold configuration information, and provides a table to guide you in the selection of a hard drive type.

WHAT IS CMOS RAM?

CMOS RAM is a small amount of memory (normally less than 100 bytes) that is imbedded in the real-time clock chip on the motherboard. CMOS is a type of integrated circuit technology that consumes a very small amount of power, so it can be kept alive by a battery that is also built into the chip or attached to the motherboard. The purpose of the battery and CMOS RAM is to save system configuration information when system power is switched off.

Some systems, such as those containing modem controlling chip sets from Chips and Technologies, Opti, Headlands, and Gemini, can store more information in CMOS RAM than the original AT can. This allows manufacturers to set up the systems for optimum use of the chipsets, but the information is normally of no use to the end user. Because of the variety of such offerings in the market, Landmark's Setup program assumes only the standard IBM AT-compatible BIOS is installed in the system.

SETUP PROGRAM

You must run a CMOS RAM setup program in order to change the contents of system CMOS RAM. After initial configuration, you only need to run it to change its parameters. It is most typically used to change date and time because the real time clock in most systems is inaccurate and can gain or lose several minutes per day or hours per month. Landmark provides such a setup program with both Landmark Utilities and PC Probe advanced diagnostics software.

Built-in Setup

Some system BIOS manufacturers (such as Landmark, Quadtel, AMI, Phoenix, and Award) provide a Setup program built into the system BIOS. In such a case, you can invoke the program at boot time, change any parameters, and reboot the system afterward. Some versions offer user-customizable features such as hard drive types not stored in BIOS and optional shadow RAM (use of high-speed RAM on some motherboards to store program code from slow BIOS ROMs).

DRIVE TYPES IN CMOS RAM

Regardless of the type of setup program you use, one of the most troublesome items to be identified and stored is hard drive type.

The typical AT-compatible system BIOS contains a table of up to 4 floppy drive types and 47 hard drive types. The system CMOS RAM contains identifiers to indicate which types of drives are installed in the system (normally up to two hard drives and two floppy drives per system).

If you change the drive type identifiers in CMOS RAM to a type that is not the same as the type of drive installed, then the system will not be able to use that drive properly. In fact, it is possible for you to select floppy and hard drive types that are completely different from those installed. If you do this, you will most likely not be able to boot the computer at all, from either floppy or hard disk. Your only hope will be to have a technician disconnect the CMOS RAM battery and discharge the CMOS RAM. Therefore, we recommend you leave drive types alone unless you are technically qualified and really know what you are doing.

A major exception to incorrect hard drive types is the case in which your system contains a disk controller with its own BIOS. Such a BIOS, as on an ESDI or SCSI controller, replaces the normal system BIOS at boot time. It typically will not use the CMOS RAM hard drive type information and instead will use its own. For example, an Adaptec ESDI controller will allow you to set CMOS RAM to hard drive type 1 for a 380-megabyte ESDI hard drive, even though type 1 is for a much smaller capacity drive.

Hard Drive Types Available

A hard drive type identifies to BIOS how many cylinders, sectors per track, and heads a drive has, as well as the track at which write current must be reduced to prevent interfering with adjacent bits, and the write precompensation track at which data needs to be skewed to prevent it from being spread out too widely on inner tracks.

There are many types of hard drives available. One of the most annoying problems people have with hard drives is trying to figure out the drive type of a given hard drive. Manufacturers almost never label the IBM type on the drive. Actually, they shouldn't be faulted too heavily for this because the drives are used in many non-IBM-compatible systems. Furthermore, some have no corresponding type in the drive table for IBM-standard BIOS, and some BIOSes (such as the original AT BIOS) cannot support drives with more than 1024 cylinders.

If the BIOS doesn't support a given type of drive, then the drive controller, drive manufacturer, or a third party company (such as OnTrack) must provide a special driver that is loaded at boot time to provide the support. Some BIOSes allow you to enter a custom drive type through a built-in setup program, but you must know the drive parameters before you can do it properly.

To help alleviate the mystery of drive types, Table 18 lists a great many of the drive manufacturers along with their drive characteristics. If you are unsure of your drive's type, look it up in the list, find the same characteristics for one of the drive types in the Setup program, then enter the corresponding type for your drive.

If everything for a given Setup type matches your drive except that the drive's number of cylinders is greater than those for the Setup type, you can use that type anyway without fear of losing data when you write it. For example if the drive contains 500 cylinders and otherwise matches the setup

type 46 which shows only 400 cylinders (and no other Setup type matches as well), then you may use type 46 as your drive type.

Table 18. Hard Drive Manufacturers and Parameters

Cap = MB Formatted Capacity; **RW** = Reduced Write Cyl #; **WP** = Write Precomp Cyl #

Manufacturer	Model	Interface	Cap	Hd	Cyl	RW	WP
Ampex	PYXIS13	MFMST506/412	10	4	320	132	0
Ampex	PYXIS20	MFMST506/412	15	6	320	132	0
Ampex	PYXIS27	MFMST506/412	22	8	320	132	0
Atasi	ATASI3033	MFMST506/412	28	5	645	999	320
Atasi	ATASI3046	MFMST506/412	39	7	645	999	323
Atasi	ATASI3051	MFMST506/412	44	7	704	999	352
Cogito	COGITO912	MFMST506/412	10	4	306	128	128
Computer Mem	CMI3426	MFMST506/412	21	4	615	616	919
Computer Mem	CMI5206	MFMST506/412	5	2	306	999	214
Computer Mem	CMI5412	MFMST506/412	10	4	306	999	128
Computer Mem	CMI5616	MFMST506/412	13	6	256	999	214
Computer Mem	CMI5619	MFMST506/412	15	6	306	999	128
Computer Mem	CMI6213	MFMST506/412	10	2	640	999	999
Computer Mem	CMI6426	MFMST506/412	21	4	640	999	999
Computer Mem	CMI6426s	MFMST506/412	21	4	614	999	999
Computer Mem	CMI6640	MFMST506/412	33	6	640	999	999
Connor	CP3100	SCSI	100	8	740	-	-
Connor	CP340	SCSI	40	4	752	-	-
Control Data	WREN1	MFMST506/412	-	-	-	-	-
Control Data	WREN2	MFMST506/412	-	-	-	-	-
Control Data	WREN3	MFMST506/412	-	-	-	-	-
Disctron	DSCTRN519	MFMST506/412	19	6	306	128	128
Disctron	DSCTRN526	MFMST506/412	21	8	306	128	128
Fuji Electric	FK301	MFMST506/412	10	4	306	-	-
Fuji Electric	FK302-13	MFMST506/412	10	2	615	-	-
Fuji Electric	FK302-26	MFMST506/412	21	4	615	-	-
Fujitsu	FUJIT2230	MFMST412/SA4000	5	2	320	128	128
Fujitsu	FUJIT2226	MFMST412/SA4000	30	6	615	-	-
Fujitsu	FUJIT2227	MFMST412/SA4000	40	8	615	-	-
Fujitsu	FUJIT2233	MFMST412/SA4000	10	4	320	128	128
Fujitsu	FUJIT2234	ST412/SA4000	16	6	320	128	128
Fujitsu	FUJIT2235	ST412/SA4000	21	8	320	128	128
Fujitsu	FUJIT2241	ST412/SA4000	26	4	754	999	300
Fujitsu	FUJIT2242	ST412/SA4000	46	7	754	999	300
Fujitsu	FUJIT2243T	ST412/SA4000	68	7	1186	-	-
Fujitsu	FUJIT2243A	ST412/SA4000	72	11	754	999	300
Fujitsu	FUJIT2243R	RLL	111	7	1186	-	-
Fujitsu	H2225DR	MFMST506/412	32	4	615	-	-
Fujitsu	H2226AD	MFMST506/412	32	6	615	-	-
Fujitsu	H2226D	MFMST506/412	32	6	615	-	-
Fujitsu	H2226DR	MFMST506/412	50	6	615	-	-
Fujitsu	H2226SA	SCSI	32	6	615	-	-
Fujitsu	H2227D	MFMST506/412	44	8	615	-	-
Fujitsu	H2227DR	RLLST506/412	67	8	615	-	-
Honeywell/Bull	BULLD530	MFMST506/412	23	3	987	999	400
Honeywell/Bull	BULLD550	MFMST506/412	40	5	987	999	400

Table 18. Hard Drive Manufacturers and Parameters

Cap = MB Formatted Capacity; RW = Reduced Write Cyl #; WP = Write Precomp Cyl #

Manufacturer	Model	Interface	Cap	Hd	Cyl	RW	WP
Honeywell/Bull	BULLD570	MFMST506/412	60	7	987	999	400
Honeywell/Bull	BULLD585	MFMST506/412	77	7	1166	1166	400
IBM	IBM1430	MFMST506/412	31	5	300	-	-
IBM	IBM665-30	MFMST506/412	21	4	615	300	615
IBM	IBM665-38	MFMST506/412	30	5	733	300	732
IBM	IBMWD12	MFMST506/412	10	4	306	296	296
IBM	IBMWD25	MFMST506/412	21	8	306	296	296
Internat'l Mem	INI5006	MFMST506/412	5	2	306	128	128
Internat'l Mem	INI5012	MFMST506/412	10	4	306	128	128
Internat'l Mem	INI5018	MFMST506/412	15	6	306	999	214
Lapine Tech	LT200	MFMST506/412	21	4	612	-	-
Lapine Tech	LT300	MFMST506/412	33	4	616	-	-
Maxtor	MXTR1065	MFMST506/412	56	7	918	999	400
Maxtor	MXTR1085	MFMST506/412	71	8	1024	999	400
Maxtor	MXTR1105	MFMST506/412	88	11	918	999	400
Maxtor	MXTR1140	MFMST506/412	120	15	918	999	999
Maxtor	MXTR1140E	MFMST506/412	150	15	1141	999	999
Maxtor	MXTR2085	MFMST506/412	74	7	1224	1224	1224
Maxtor	MXTR2140	MFMST506/412	120	11	1224	1224	1224
Maxtor	MXTR2190	MFMST506/412	160	15	1224	1224	1224
Maxtor	MXTR4380E	ESDI	318	15	1224	-	-
Maxtor	MXTR4380S	SCSI	338	15	1224	-	-
MicroScience	MCSI612	MFMST506/412	10	4	306	999	128
MicroScience	MCSI725	MFMST506/412	21	4	615	999	300
MicroScience	MCSIIIII1050	MFMST506/412	44	5	1024	-	-
MicroScience	MCSIIIII1060	RLLST506/412	70	5	1024	-	-
MicroScience	MCSIIIII825	MFMST506/412	21	4	612	-	-
Microc. Mem	MMI106	MFMST506/412	5	2	306	-	-
Microc. Mem	MMI112	MFMST506/412	10	4	306	-	-
Microc. Mem	MMI125	MFMST506/412	21	8	306	-	-
Micropolis	MICRP1302	MFMST506/412	22	3	830	999	400
Micropolis	MICRP1303	MFMST506/412	36	5	830	999	400
Micropolis	MICRP1304	MFMST506/412	43	6	830	999	400
Micropolis	MICRP1323	MFMST506/412	35	4	1024	1024	1024
Micropolis	MICRP1323A	MFMST506/412	44	5	1024	1024	1024
Micropolis	MICRP1324	MFMST506/412	53	6	1024	1024	1024
Micropolis	MICRP1324A	MFMST506/412	62	7	1024	1024	1024
Micropolis	MICRP1325	MFMST506/412	71	8	1024	1024	400
Micropolis	MICRP1333A	MFMST506/412	44	5	1024	-	-
Micropolis	MICRP1334	MFMST506/412	53	6	1024	-	-
Micropolis	MICRP1335	MFMST506/412	71	8	1024	-	-
Micropolis	MICRP1353	ESDI	79	4	1024	-	-
Micropolis	MICRP1353A	ESDI	99	5	1024	-	-
Micropolis	MICRP1354	ESDI	119	6	1024	-	-
Micropolis	MICRP1355	ESDI	159	8	1024	-	-
Micropolis	MICRP1354A	ESDI	139	7	1024	-	-
Micropolis	MICRP1373	SCSI	77	4	1024	-	-
Micropolis	MICRP1373A	SCSI	96	5	1024	-	-
Micropolis	MICRP1374	SCSI	115	6	1024	-	-

Table 18. Hard Drive Manufacturers and Parameters

Cap = MB Formatted Capacity; RW = Reduced Write Cyl #; WP = Write Precomp Cyl #

Manufacturer	Model	Interface	Cap	Hd	Cyl	RW	WP
Micropolis	MICRP1374A	SCSI	134	7	1024	-	-
Micropolis	MICRP1375	SCSI	154	8	1024	-	-
MiniScribe	MINI2012	MFMST506/412	10	4	306	128	128
MiniScribe	MINI3006	MFMST506/412	5	2	306	999	128
MiniScribe	MINI3012	MFMST506/412	10	2	612	256	256
MiniScribe	MINI3053	MFMST506/412	45	5	1024	-	-
MiniScribe	MINI3212	MFMST506/412	10	2	612	256	256
MiniScribe	MINI3412	MFMST506/412	10	4	306	128	128
MiniScribe	MINI3425	MFMST506/412	21	4	615	256	256
MiniScribe	MINI3650	MFMST506/412	43	6	809	-	-
MiniScribe	MINI4020	MFMST506/412	15	4	480	128	128
MiniScribe	MINI6032	MFMST506/412	27	3	1024	1024	500
MiniScribe	MINI6053	MFMST506/412	44	5	1024	1024	500
MiniScribe	MINI6074	MFMST506/412	62	7	1024	1024	500
MiniScribe	MINI6085	MFMST506/412	71	8	1024	1024	500
MiniScribe	MINI8212	MFMST506/412	10	2	615	999	300
MiniScribe	MINI8425	MFMST506/412	21	4	615	999	300
NEC	NEC5126	MFMST506/412	21	4	615	615	128
NEC	NEC5146	MFMST506/412	44	8	615	615	128
Quantum	Q520	MFMST506/412	18	4	512	256	256
Quantum	Q530	MFMST506/412	27	6	512	256	256
Quantum	Q540	MFMST506/412	36	8	512	256	256
Rodime	RO201	MFMST506/412	6	2	320	132	0
Rodime	RO201E	MFMST506/412	11	2	640	132	0
Rodime	RO202	MFMST506/412	11	4	320	132	0
Rodime	RO202E	MFMST506/412	22	4	640	132	0
Rodime	RO203	MFMST506/412	16	6	320	132	0
Rodime	RO203E	MFMST506/412	33	6	640	132	0
Rodime	RO204	MFMST506/412	22	8	320	132	0
Rodime	RO204E	MFMST506/412	44	8	640	132	0
Rodime	RO252	MFMST506/412	10	4	306	80	80
Rodime	RO351	MFMST506/412	5	2	306	80	80
Rodime	RO352	MFMST506/412	10	4	306	80	80
Seagate	ST125	MFMST506/412	21	4	615	-	-
Seagate	ST125N	RLL/SCSI	21	4	407	-	-
Seagate	ST138	MFM/RLL	32	6	615	-	-
Seagate	ST138N	RLL/SCSI	32	4	615	-	-
Seagate	ST138R	RLLST506/412	32	4	615	-	-
Seagate	ST157N	RLL/SCSI	48	6	615	-	-
Seagate	ST157R	RLLST506/412	49	6	615	-	-
Seagate	ST212	MFMST506/412	10	4	306	128	128
Seagate	ST213	MFMST506/412	10	2	615	615	300
Seagate	ST225	MFMST506/412	21	4	615	999	300
Seagate	ST225N	SCSI	21	4	615	-	-
Seagate	ST238	RLLST506/412	32	4	615	-	-
Seagate	ST251	MFMST506/412	44	6	820	-	-
Seagate	ST251-1	MFMST506/412	44	6	820	-	64K
Seagate	ST251N	RLL/SCSI	43	6	820	-	-
Seagate	ST277N	RLL/SCSI	65	6	818	-	-

Table 18. Hard Drive Manufacturers and Parameters

Cap = MB Formatted Capacity; **RW** = Reduced Write Cyl #; **WP** = Write Precomp Cyl #

Manufacturer	Model	Interface	Cap	Hd	Cyl	RW	WP
Seagate	ST277R	RLL/412	65	6	820	-	-
Seagate	ST296N	RLL/SCSI	85	6	818	-	-
Seagate	ST4026	MFMST506/412	21	4	615	999	400
Seagate	ST4038	MFMST506/412	32	5	733	999	400
Seagate	ST4051	MFMST506/412	43	5	978	999	400
Seagate	ST4053	MFMST506/412	44	5	1024	-	-
Seagate	ST406	MFMST506/412	5	2	306	128	128
Seagate	ST4096	MFMST506/412	85	9	1024	-	-
Seagate	ST412	MFMST506/412	10	4	306	128	128
Seagate	ST4144R	RLLST506/412	122	9	1024	-	-
Seagate	ST419	MFMST506/412	15	6	306	128	128
Seagate	ST4192E	RLL/ESDI	169	8	1147	-	-
Seagate	ST4192N	RLL/SCSI	168	8	1147	-	-
Seagate	ST425	MFMST506/412	21	8	306	128	128
Seagate	ST506	MFMST506/412	5	4	153	128	128
Shugart	SA612	MFMST506/412	10	4	310	128	128
Shugart	SA712	MFMST506/412	11	4	320	128	128
Tandon	TM2085	SCSI	71	8	1024	-	-
Tandon	TM2128	SCSI	119	8	1024	-	-
Tandon	TM252	MFMST506/412	10	4	306	128	128
Tandon	TM262	MFMST506/412	21	4	615	999	300
Tandon	TM270	SCSI	159	8	1024	-	-
Tandon	TM3085	MFMST506/412	71	8	1024	-	-
Tandon	TM362	MFMST506/412	21	4	615	999	300
Tandon	TM362R	RLLST506/412	20	2	780	-	-
Tandon	TM364	RLLST506/412	41	4	782	-	-
Tandon	TM501	MFMST506/412	5	2	306	128	128
Tandon	TM502	MFMST506/412	10	4	306	128	128
Tandon	TM503	MFMST506/412	15	6	306	128	128
Tandon	TM702AT	MFMST506/412	-	4	615	615	615
Tandon	TM703	MFMST506/412	30	5	695	999	256
Tandon	TM703AT	MFMST506/412	30	5	733	733	733
Tulin	TL226	MFMST506/412	22	4	640	999	300
Tulin	TL240	MFMST506/412	33	6	640	999	300
Vertex/Priam	V130	MFMST506/412	25	3	897	999	400
Vertex/Priam	V150	MFMST506/412	42	5	987	999	400
Vertex/Priam	V170	MFMST506/412	60	7	987	999	400
Vertex/Priam	V185	MFMST506/412	71	7	1166	1166	400

INTRODUCTION

This chapter is designed to aid you in the analysis, troubleshooting and repair of failures in PC, XT, AT, or compatible motherboards. The KickStart 2 diagnostics assume you are testing a standard IBM computer.

This chapter is intended only for qualified computer technicians and engineers. If you are a typical business user of KickStart 2, we urge you not to attempt any system repair because to do so could void your warranty and cost you heavily in terms of wasted time and accidental damage to your system. Please refer all such activities to your dealer or repair center.

DIAGNOSTIC STRATEGY

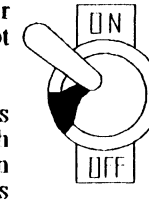
It will be helpful for you to formulate a diagnostic testing strategy before trying to troubleshoot your computer. This topic will make some suggestions that apply generally to PCs. The strategy begins with the fact that you are made aware of a problem with the computer. Table 19 identifies symptoms from the general, catastrophic type to the more specific, intermittent annoyance type.

Table 19. Diagnostic Testing Strategy

Symptom	Problem / Action
Nothing happens at all	Power is off. Plug into wall and switch on power to all system components and look for power light on front of computer; listen for fan running inside computer. Smell and look for signs of burning. If the fan is off, replace power supply, otherwise continue.
	Open the computer and install KickStart 2 in accordance with instructions in the Installation chapter.
Power and fan are on but nothing happens at all	Power supply disconnected from motherboard. Plug power supply connectors in. Be sure the correct plugs are on the correct power jacks; refer to table in Technical Information chapter for reference. If plugged in, check the power LEDs on KickStart 2. Make sure the KickStart 2 Reset LED is off. Listen for the fan changing pitch or power LEDs flashing on and off (anything but steady on is bad).
Fan changing pitch	Incoming power is varying, typical during peak load times. Consider buying an uninterruptable power supply that prevents brown-out or black-out. A cheap supply in your computer can damage components or allow data faults to occur without your knowing it. Some high-quality supplies have a fan that changes speed as temperature increases or decreases, and fan-pitch changes are no concern.
KickStart 2 power LED(s) off or flashing	Power supply is bad or power is bad to the expansion slot containing KickStart 2. Try KickStart 2 in other slots. If LEDs still off/flashing, replace the supply.
Power LEDs on, but: Reset LED on; or KS2 won't run remote tests; or no BIOS beeps, no POST codes, no display	Major motherboard circuits dead. Look at failing POST code on KickStart 2, and troubleshoot corresponding circuit; see POST code tables in this manual, or check with BIOS manufacturer. To be sure, install JumpStart BIOS on motherboard first. You may need to replace data or address bus chip, CPU, or clock chip, in that order. Refer to motherboard chipset type in this chapter.

Table 19. Diagnostic Testing Strategy	
Symptom	**Problem / Action**
POST code shows or BIOS beeps more than once, but no display	Troubleshoot circuit based on BIOS beeps/POST code; refer to BIOS and POST codes topics in this chapter, and check with BIOS manufacturer for meaning of beeps. May need to install or correct the setup and installation of video adapters to correct the beep problem. Check the monitor function and adjustment. Replace failing component as indicated by POST code; use JumpStart BIOS if you are unsure of POST codes.
BIOS beeps more than once, also get display	Troubleshoot circuit based on nature of display. If disk problem, ensure disk drives and controller are installed and connected properly, disk is low-level formatted properly, boot disk is high-level formatted properly for operating system being used, and current/correct operating system is on boot disk. If you are unsure, install JumpStart BIOS and run tests from KickStart 2.
BIOS beeps once, but no display	Monitor is not connected, is off, or needs to be adjusted brighter. Connect it to the video adapter and switch it on, ensure brightness and contrast adjustments are correct.
BIOS beeps once and displays, but something doesn't seem right	Run comprehensive system, hard drive, and floppy drive diagnostic and calibration software as necessary. Contact Landmark for information on products available to help with problems.
Power LEDs are on, but KickStart 2 shows error via screen, LED, or POST codes.	Look up POST code in the POST code table for your BIOS. Contact BIOS manufacturer for more information as needed. Use JumpStart BIOS that comes with KickStart 2 for accurate POST code definition. Replace indicated bad component.
Display ok, no POST code, system boots but doesn't run right	Run KickStart 2 diagnostics from KickStart 2 menu. Refer to KickStart 2 diagnostic test error codes and troubleshooting tips in this chapter, and replace the faulty component.

BIOS ERRORS DURING BOOT



The ROM BIOS built onto the motherboard of the computer runs its built-in POST (Power-On Self Test) when you boot (switch power on to) the computer.

The BIOS from most manufacturers will alert you if it detects a problem during POST. It sounds the system speaker with beeps to signify that it is running properly or has detected an error. See information on BIOS manufacturers later in this manual for phone numbers. The meanings of the beeps are typically as given in Table 20, but you should check with your BIOS documentation to be sure.

BIOS POST CODES

The POST codes are test number (error) codes issued by BIOS firmware built into the motherboard's Read Only Memory (ROM) chips. BIOS issues the codes when it is running Power-On Self-Test just after you switch power on or press the reset button on the front panel or (if wired) on KickStart 2.

There are probably 20 or 30 different BIOS developers in the world, and each developer has created a special set of POST codes, with each being

different from the other. Although IBM set the standard for POST codes, they are not the same among manufacturers.

The best way to determine what the post codes are is to write or call the BIOS manufacturer, or refer to your computer's technical reference manual. It is a good idea to do this immediately so when the opportunity to use KickStart 2 arises, you'll already have the necessary information handy to solve the problem.

Table 20. Meaning of BIOS Beeps during POST Before Boot

POST Beeps	Meaning
One beep	POST ran okay and detected no error. System will now boot.
Two beeps	POST detected a configuration error, or a change since the last time you ran Setup. Configuration information is kept inside a memory circuit (CMOS RAM) on the motherboard. If the battery power to that circuit is lost, so is the configuration information. You must run Setup again.
One long and two short beeps	faulty video configuration error (no video card or a faulty card installed), or a faulty ROM on a peripheral controller card (address range C0000 through FFFF).
One long and a series of short beeps	faulty peripheral controller card such as VGA. Usually, the display will show a message describing the problem. Check the setup of peripheral controllers.
Another series of beeps	Check with the computer or BIOS manufacturer. Some systems give a detailed message via beeps.

Some early BIOSes on the IBM PC and XT/AT clones from DTK (a Taiwan motherboard manufacturer) do not generate POST codes. BIOSes known to generate POST codes are: IBM XT and AT, 80386/486-based AT clones, Compaq, Intel, AT&T, Phoenix, Award, AMI, and Quadtel.

Your BIOS might behave strangely and not give the error alerts or issue POST codes as indicated in this manual. Your computer may use a specially modified version of a standard BIOS, so any POST code or error alert information we provide regarding a generic BIOS may not apply to your system. If the computer manufacturer cannot supply sufficient details on the BIOS to you, particularly a list of the valid POST codes, try contacting the BIOS developer directly at the number Table 21. In the event your BIOS does not issue POST codes, use Landmark's JumpStart BIOS.

Table 21. BIOS Manufacturers

Company	Phone	Company	Phone	Company	Phone
AMI	(404) 263-8181	Landmark	(800) 683-6696	Quadtel	(714) 754-4422
Award	(408) 370-7979	Phoenix	(617) 551-4000		

In spite of the foregoing cautions, the tables on the following pages list POST codes for some of the most common BIOSes. We have provided this information for your convenience. Its accuracy is based on the best information we could obtain from the BIOS makers themselves.

Table 22. IBM AT BIOS POST Codes	
Code	Meaning
01	IBM AT 80286 Processor test (real mode). Verify flags, registers, and conditional jumps.
02	ROM Checksum Test 1 - Test 32k ROM Modules of POST, BASIC, BIOS.
03	CMOS Shutdown Byte Test - Rolling Bit pattern at Shutdown Address
04	8254 Timer 1 All Bits ON - Set timer count, check all bits ON
05	8254 Timer 1 All Bits OFF - Set timer count, check all bits OFF
06	8237 DMA 0 Initialization Channel Register Test - Disable 8237 DMA Controller 0, R/W current all channels
07	8237 DMA 1 Initialization Channel Register Test - Disable 8237 DMA Controller 1, R/W current all channels
08	DMA Page Register Test - Write/Read all Page Registers
09	Storage Refresh Test - Verify Refresh is occurring
	8042 Interface Test
10	Issue Self Test - check 55H is received
0A	Soft Reset
0B	Reset 8042
0C	Test OK
0D	Write Byte 0 of 8042 Memory
	Base 64k Read/Write Memory Test - W/R Data Patterns AA, 55, FF, 01 and 00 to first 64K of memory and verify storage addressability
0E	Fill memory with data
0F	Get I/P Buffer Switch Settings
DD	Roll Error Code to MFG_PORT
11	Initialize Display Row Count
	Verify 286 LGDT/SGDT LIDT/SIDT Instructions
12	Test Protected Mode Registers
13	Initialize 8259 Int. # 2 Controller Chip
14	Setup Int. Vectors to Temp. Interrupt
15	Establish BIOS Interrupt Call Subroutine Vectors
	Verify CMOS Checksum/Battery OK (Configuration OK for Init.?)
16	Set Data Segment
17	Set Defective Battery Flag
18	Ensure CMOS Dividers Set
19	Set Return Address Byte in CMOS
1A	Set Temporary Stack
	Protected Mode Test And Determine Memory Size - Runs in protected mode to address all storage, checks (MSW) for protected mode. Base memory size saved. Memory size determined with Planar & I/O Parity disabled. Soft reset checks for Parity Error.
1B	Segment Address 01-0000 (Second 64k)
1C	Set or Reset 512 t0 640 k installed Fl.
	Protected Mode Test and Memory Size - Determine >640k
1D	Segment Address 10-0000 (>640k)
1E	Set Expanded Memory Size Determined in CMOS
1F	Test Address Lines 19-23

Table 22. IBM AT BIOS POST Codes	
Code	Meaning
20	Cause a Shutdown
21	Return 1 From Shutdown
.	Initialize and Start CRT Cont. (6845) Test Video - W/R Reset Video enable signal, select alpha mode (40x24 B&W) W/R patterns, check addressability. Error: 1 long 2 short beeps (Port 80 Not Used)
	Set Up Video Data on Screen for Video Line Test
22	Enable Video Signal and Set Mode; Display Horizontal Bar on Screen
	CRT Lines Interface Test Sense ON/OFF Transition of Video Enable and Horizontal Sync Lines
23	Check for Advanced Video Card
24	Go do Next Test
	8259 Interrupt Controller Test - R/W Interrupt Mask Register with 1's and 0's Enable Interrupts, Mask Device Interrupts Off Check for Hot Interrupts (Not Expected)
25	Test Interrupt Mask Registers
26	Check for Hot Interrupts
05	Display 101 Error (?)
27	Check the Converting Logic 106 Err.
28	Check Hot NMI Interrupts (Error 107)
29	Test Data Bus to Timer 2 (Error 108)
	8254 Timer Checkout Verify that System Timer (0) counts correctly
2A	Do Test (Error 102)
2B	Too Fast
2C	Too Slow (Error 103)
2D	Check 8042 for Last Command Accepted (Error 105)
	Additional Read/Write Storage Test (Protected Mode) - W/R Data Patterns to Area > 1st 64k. Storage addressability is checked
2F	Go TO Next Test if Warm Start
30	Set Shutdown Return 2
31	Enable Protected Mode
33	Next Block of 64k
34	Back to Real Mode, Test Done
	Additional Protected Mode Test
F0	Set Data Segment
F1	Interrupt Test (Programmed Int. 32)
F2	Exceptional Interrupt (Interrupt 13D)
F3	Verify 286 LDT/SDT, LTR/STR
F4	Verify 286 Bound Instruction
F5	Verify Push All & Pop All Instruction
F6	Verify Access Rights Function
F7	Verify ARPL Functions*
F8	Verify LAR Instruction
F9	Verify LSL Instruction
FA	Low Meg Chip Select Test
35	Test for Error

Table 22. IBM AT BIOS POST Codes	
Code	**Meaning**
34	Restore Checkpoint
	Keyboard Test
35	Keyboard Test (Mfg Burn-in?)
36	Check for 'AA' Scan Code
38	Stuck Key?
39	Error- Check 8042 Working
3A	Initialize 8042
	Optional ROM C000-E000 ?
3B	Check for ROM in 2k Blocks
40	Enable H/W Interrupt if 80287
3F	Initialize Printer
41	System Code at Segment Code E000:0 ?
42	Exit to System Code
43	Go To Boot Loader
	Diskette Attachment Test
3C	Check for Initial Program Load Diskette Drive
3D	Initialize Floppy for Drive Type
3E	Initialize Hard File
	Exception Interrupt Routine
81	Build Descriptor Table
82	Switch to Virtual Mode
90-B6	EXEC_00 to EXEC_31 and SYS_32 to SYS_38 tests
	Memory Test and Boot Strap Test
32	Address Lines 0-15
44	Attempt Boot from Fixed Disk
45	Unable to Boot from Disk Go TO BASIC
	POST & BIOS Utility Routine
	CMOS_READ
	CMOS_WRITE
	Manufacturer Loop Error Mode Flag

Table 23. Phoenix 80286 BIOS POST Codes	
Code	**Meaning**
01	CPU register test in progress
02	CMOS write/read bad
03	ROM BIOS checksum bad
04	Programmable interval timer bad
05	DMA initialization bad
06	DMA page register write/read bad
08	RAM refresh verification bad
09	First 64K RAM test in progress
0A	First 64K RAM chip or data line bad, multi-bit
0B	First 64K RAM odd/even logic bad
0C	Address line bad first 64K RAM
0D	Parity bad first 64K RAM
10	Bit 0 first 64K RAM bad
11	Bit 1 first 64K RAM bad
12	Bit 2 first 64K RAM bad
13	Bit 3 first 64K RAM bad
14	Bit 4 first 64K RAM bad
15	Bit 5 first 64K RAM bad
16	Bit 6 first 64K RAM bad
17	Bit 7 first 64K RAM bad
18	Bit 8 first 64K RAM bad
19	Bit 9 first 64K RAM bad
1A	Bit 10 first 64K RAM bad
1B	Bit 11 first 64K RAM bad
1C	Bit 12 first 64K RAM bad
1D	Bit 13 first 64K RAM bad
1E	Bit 14 first 64K RAM bad
1F	Bit 15 first 64K RAM bad
20	Slave DMA register bad
21	Master DMA register bad
22	Master interrupt mask register bad
23	Slave interrupt mask register bad
25	Interrupt vector loading in progress
27	Keyboard controller test bad
28	CMOS power bad and checksum calculation in progress
29	CMOS configuration validation in progress
2B	Screen initialization bad
2C	Screen retrace test bad
2D	Search for video ROM in progress
2E	Screen running with video ROM
30	Screen operable
30	Screen running with video ROM
31	Monochrome monitor operable

Table 23. Phoenix 80286 BIOS POST Codes	
Code	**Meaning**
32	Color monitor (40 column) operable
33	Color monitor (80 column) operable
34	Timer tick interrupt test in progress or bad
35	Shutdown test in progress or bad
36	Gate A20 bad
37	Unexpected interrupt in protected mode
38	RAM test in progress or address bad > FFFFh
3A	Interval timer channel 2 test or bad
3B	Time-of-Day clock test or bad
3C	Serial port test or bad
3D	Parallel port test or bad
3E	Math coprocessor test or bad
41	System board select bad
42	Extended CMOS RAM bad

Table 24. Quadtel AT BIOS 3.00	
Code	**Meaning**
02	Flag test
04	Register test
06	System hardware initialization
08	Initialize chip set registers
0A	BIOS ROM checksum
0C	DMA page register test
0E	8254 timer test
10	8254 timer initialization
12	8237 DMA controller test
14	8237 DMA initialization
16	Initialize 8259/Reset coprocessor
18	8259 interrupt controller test
1A	Memory refresh test
1C	Base 64KB address test
1E	Base 64KB memory test
20	Base 64KB test (upper 16 bits)
22	8742 Keyboard self test
24	MC146818 CMOS test
26	Start first protected mode test
28	Memory Sizing test
2A	Auto-size memory chips
2C	Chip interleave enable test
2E	First protected mode test exit
30	Unexpected shutdown
32	System board memory size
34	Relocate shadow RAM if configured
36	Configure EMS system
38	Configure wait states
3A	Retest 64K base RAM
3C	CPU speed calculation
3E	Get switches from 8042
40	Configure CPU speed
42	Initialize interrupt vectors
44	Verify video configuration
46	Initialize video system
48	Test unexpected interrupts
4A	Start second protected mode test
4C	Verify LDT instruction
4E	Verify TR instruction
50	Verify LSL instruction
52	Verify LAR instruction
54	Verify VERR instruction
56	Unexpected exception

Table 24. Quadtel AT BIOS 3.00	
Code	**Meaning**
58	Address line 20 test
5A	Keyboard ready test
5C	Determine AT or XT keyboard
5E	Start third protected mode test
60	Base memory test
62	Base memory address test
64	Shadow memory test
66	Extended memory test
68	Extended address test
6A	Determine memory size
6C	Display error messages
6E	Copy BIOS to shadow memory
70	8254 clock test
72	MC146818 real time clock test
74	Keyboard stuck key test
76	Initialize hardware interrupt vectors
78	Math Coprocessor test
7A	Determine COM ports available
7C	Determine LPT ports available
7E	Initialize BIOS data area
80	Determine floppy/fixed controller
82	Floppy disk test
84	Fixed disk test
86	External ROM scan
88	System key lock test
8A	Wait for F1 key pressed
8C	Final system initialization
8E	Interrupt 19 boot loader
B0	Unexpected interrupt

Table 25. Landmark JumpStart BIOS POST Codes	
Code	**Meaning**
03	make one short beep when first come up
04	initialize bell tone
05	enable CMOS RAM
06	reset video controller
07	disable I/O parity
08	start memory refresh
09	clear reset flag in RAM
0A	teste DMA page registers
10	use CMOS to determine if soft reset
11	perform ROM checksum
12	test timer A
13	test DMA channel A
14	test DMA channel B
15	test refresh
16	flush 8042 Input Buffer
17	reset 8042
18	get keyboard switch
19	initialize keyboard
1A	clear any existing parity
1B	enable on-board parity
1C	test base 64K memory
1D	test base 64k parity
1E	initialize POST stack
20	put keyboard # in RAM
65	set video speed
21	test protected mode registers
22	initialize 8259 interrupts
23	zero all 256 interrupts
24	initialize interrupts 0 - 1fh
25	perform DRAM checksum
26	adjust configuration based on hardware found
27	check manufacturing switch (may exit POST)
28	initialize video controller
2A	test video memory
2B	test video sync
2C	look for external video
2D	change video configuration if external video
2E	unused
2F	initialize video controller
30	change video interrupt
31	print any POST messages
32	size memory by testing it
33	adjust memory configuration

Table 25. Landmark JumpStart BIOS POST Codes	
Code	Meaning
33	verify CMOS RAM size
34	enable I/O parity
35	test 8259
36	byte swap test
37	test NMI
38	timer test
39	initialize timer A
3A	protected mode memory test
3B	test keyboard
3C	test keyboard interrupt
3D	enable A20
3E	reset hard disk controller
3F	setup floppy controller
40	test floppies
41	setup keyboard (NUMLOCK)
42	enable timer interrupt
43	check for dual floppy/hard disk controller
44	find floppy drive A type
45	find floppy drive B type
46	reset hard disk
47	enable slave DMA
63	set video interrupt vector
48	call any external ROMs
49	initialize printer
4A	initialize serial
4B	initialize 80287
4C	read CMOS RAM status
4D	check CMOS configuration against hardware found
70	check CMOS configuration against memory found
4E	initialize timer ticks
4F	enable IRQ9
50	enable on-board parity
51	call add-on board ROM
52	enable keyboard interrupt
53	reset printer
60	check for any errors
61	one short beep
62	print sign-on message
64	perform boot

Table 26. AMI BIOS Plus POST Codes	
Code	**Meaning**
01	NMI disabled & 286 reg. test about to start
02	286 register test over
03	ROM checksum OK
04	8259 initialization OK
05	CMOS pending interrupt disabled
06	Video disabled & system timer counting OK
07	CH-2 of 8253 test OK
08	CH-2 of delta count test OK
09	CH-1 delta count test OK
0A	CH-0 delta count test OK
0B	Parity status cleared
0C	Refresh & system timer OK
0D	Refresh link toggling OK
0E	Refresh period ON/OFF 50% OK
10	Confirmed Refresh ON & about to start 64K memory error
11	Address line test OK
12	64K base memory test OK
13	Interrupt vectors initialized
14	8042 keyboard controller test OK
15	CMOS read/write test OK
16	CMOS checksum/battery check OK
17	Monochrome mode set OK
18	Color mode set OK
19	About to look for optional video ROM
1A	Optional video ROM control OK
1B	Display memory R/W test OK
1C	Display memory R/W test for alternative display OK
1D	Video retrace check OK
1E	Global equipment byte set for video OK
1F	Mode set call for Mono/Color OK
20	Video test OK
21	Video display OK
22	Power on message display OK
30	Virtual mode memory test about to begin
31	Virtual mode memory test started
32	Processor in virtual mode
33	Memory address line test in progress
34	Memory address line test in progress
35	Memory below 1MB calculated
36	Memory size computation OK
37	Memory test in progress
38	Memory initialization over below 1MB
39	Memory initialization over above 1MB

Table 26. AMI BIOS Plus POST Codes	
Code	**Meaning**
3A	Display memory size
3B	About to start below 1MB memory test
3C	Memory test below 1MB OK
3D	Memory test above 1MB OK
3E	About to go to real mode (shutdown)
3F	Shutdown successful and entered in real mode
40	About to disable gate A-20 address line
41	Gate A-20 line disabled successfully
42	About to start DMA controller test
4E	Address line test OK
4F	Processor in real mode after shutdown
50	DMA page register test OK
51	DMA unit-1 base register test about to start
52	DMA unit-1 channel OK, about to begin CH-2
53	DMA CH-2 base register test OK
54	About to test f/f latch for unit-1
55	f/f latch test both unit OK
56	DMA unit 1 & 2 programmed OK
57	8259 initialization over
58	8259 mask register check OK
59	Master 8259 mask register OK, about to start slave
5A	About to check timer and keyboard inter. level
5B	Timer interrupt OK
5C	About to test keyboard interrupt
5D	ERROR! timer/keyboard int. not in proper level
5E	8259 interrupt controller error
5F	8259 interrupt controller test OK
70	Start of keyboard test
71	Keyboard BAT test OK
72	Keyboard test OK
73	Keyboard global data initialization OK
74	Floppy setup about to start
75	Floppy setup OK
76	Hard disk setup about to start
77	Hard disk setup OK
79	About to initialize timer data area
7A	Verify CMOS battery power
7B	CMOS battery verification done
7D	Analyze diagnostics test results for memory
7E	CMOS memory size update OK
7F	About to check optional ROM C000:0.
80	Keyboard sensed to enable SETUP
81	Optional ROM control OK

Table 26. AMI BIOS Plus POST Codes	
Code	**Meaning**
82	Printer global data initialization OK
83	RS-232C global data initialization OK
84	80287 check/test OK
85	About to display soft error message
86	About to give control to system ROM E000.0
87	System ROM E000.0 check over
00	Control given to int-19, boot loader.

Table 27. AMI BIOS 2.2x POST Codes	
Code	Meaning
00	Flag test
03	Register test
06	System hardware initialization
09	BIOS ROM checksum
0C	Page register test
0F	8254 Timer test
12	Memory refresh initialization
15	8237 DMA controller test
18	8237 DMA initialization
1B	8259 interrupt controller initialization
1E	8259 interrupt controller test
21	Memory refresh test
24	Base 64KB address test
27	Base 64KB memory test
2A	8742 Keyboard self test
2D	MC146818 CMOS test
30	Start first protected mode test
33	Memory Sizing test
36	First protected mode test passed
39	First protected mode test failed
3C	CPU speed calculation
3F	Read 8742 hardware switches
42	Initialize interrupt vector area
45	Verify CMOS configuration
48	Test and initialize video system
4B	Unexpected interrupt test
4E	Start second protected mode test
51	Verify LDT instruction
54	Verify TR instruction
57	Verify LSL instruction
5A	Verify LAR instruction
5D	Verify VERR instruction
60	Address line 20 test
63	Unexpected exception test
66	Start third protected mode test
69	Address line test
6C	System memory test
6F	Shadow memory test
72	Extended memory test
75	Verify memory configuration
78	Display configuration error messages
7B	Copy system BIOS to shadow memory
7E	8254 clock test

Table 27. AMI BIOS 2.2x POST Codes	
Code	**Meaning**
81	MC46818 real time clock test
84	Keyboard test
87	Determine keyboard type
8A	Stuck key test
8D	Initialize hardware interrupt vectors
90	Math coprocessor test
93	Determine COM ports available
96	Determine LPT ports available
99	Initialize BIOS data area
9C	Fixed/Floppy controller test
9F	Floppy disk test
A2	Fixed disk test
A5	External ROM scan
A8	System key lock test
AE	F1 error message test
AE	System boot initialization
B1	Interrupt 19 boot loader

Table 28. Award BIOS 3.03 POST Codes	
Code	**Meaning**
01-05	Keyboard controller (8042)
06	On-board LSI
07	CPU
08-0E	CMOS 8254, 8237, 8259 & EPROM
0F	Extended CMOS
10-14	Refresh
15	First 64K of RAM
16	Interrupt vector tables
17	Video initialization
18	Video memory
19/1A	Interrupt line mask
1B	Battery good
1C	CMOS checksum
1D	CMOS chip
1E	Memory size
1F	Memory verifier
20-23	CPU support chips
24	Protected memory size
25	Protected memory test
26	Protected mode
27-28	Shadow RAM, cache controller
29	Reserved
2A	Initialize keyboard
2B	Floppy drive initialization
2C	Serial port initialization
2D	Parallel port initialization
2E	Hard disk initialization
2F	Math coprocessor
30	Reserved
31	Option ROMs
FF	Boot

Table 29. Award BIOS 3.1 POST Codes	
Code	**Meaning**
01	CPU status flags - set/clear carry, zero, sign, overflow flags (fatal)
02	Determine POST type - manufacturing (run POST 01-05 in continuous loop) or normal (boot when POST is finished)
03	8042 Keyboard controller clear - send, verify TEST_KBRD command (AAh)
04	8042 Keyboard controller reset - verify AAh return from test 03
05	Get POST type - reset system if manufacturing status from test 02
06	Initialize on-board chips - disable color & mono video, parity, and 8237 DMA; reset 80x87 math chip, initialize 8255 timer 1, clear DMA, page registers, and CMOS shutdown byte
07	CPU registers - read/write/verify SS, SP, BP with FF and 00 data
08	Initialize CMOS timer - update timer cycle normally CMOS 8254, 8237, 8259 & EPROM
09	Calculate BIOS EPROM and sign-on message checksum; fail if not 0
0A	Initialize video interface - set 6845 controller register to 80 columns, 25 rows, 8/14 scan lines per row, cursor lines at 6/11 (first) & 7/12 (last), offset 0
0B	8254 timer, channel 0
0C	8254 timer, channel 1
0D	8254 timer, channel 2
0E	CMOS shutdown byte - walking 1 to test CMOS interface
0F	Extended CMOS - calculate checksum of motherboard chip setup area
10	DMA channel 1 - test with AA, 55, FF, 00 pattern
11	DMA channel 2 - test with AA, 55, FF, 00 pattern
12	DMA page registers - use I/O ports to test address circuits
13	Keyboard controller interface
14	DRAM refresh circuit
15	First 64K of RAM
16	Set up and load 8259 interrupt vector tables
17	Initialize video - MDA / CGA via internal BIOS; EGA / VGA via adapter
18	MDA / CGA video memory
19	8259 channel 1 interrupt line toggle mask
1A	8259 channel 2 interrupt line toggle mask
1B	CMOS battery level status - error if 0 (bad CMOS or battery)
1C	Calculate CMOS and (if present) extended CMOS RAM checksum and compare with location 2E and 2F
1D	Set system configuration using CMOS RAM values
1E	Determine base memory size - write/read 0 through 640K till empty space is found, and compare size with CMOS RAM. If different, set flag for error message at end of POST.
1F	Test base memory found in test 1E - write/read data FFAA and 5500 to each byte and verify correct
20	8259 interrupt controller - stuck bits
21	8259 interrupt controller - stuck non-maskable interrupt bits (parity check)
22	8259 interrupt controller - general functionality
23	CPU protected mode - verifies virtual, protected, page operations

Table 29. Award BIOS 3.1 POST Codes	
Code	**Meaning**
24	Determine extended memory size - write/read 1M - 16M (on 286 or 386SX) or 1M - 64M (on 386DX or 486) till empty space is found, and compare size with CMOS RAM. If different, set flag for error message at end of POST.
25	Test extended memory found in test 24 - write/read data FFAA and 5500 to each byte and verify correct
26	Protected mode exceptions - execute functions that should cause protected mode violations & verify detected
27	Shadow RAM (2/3/486), cache controller (3/486) functionality
28	Initialize optional 8242/8248 keyboard controller
29	Reserved
2A	Initialize keyboard controller
2B	Initialize floppy controller and drives
2C	Detect and initialize serial port
2D	Detect and initialize parallel port
2E	Initialize hard disk controller and drives
2F	Detect and initialize Math coprocessor
30	Reserved
31	Detect and initialize option (adapter) ROMs from C8000 to EFFFF (also F0000 to F7FFF if FSCAN option is enabled
3B	Detect and initialize Opti chipset secondary cache
CA	Detect and initialize Micronics cache controller
CC	NMI handler shutdown - detect any untrapped non-maskable interrupts during boot
EE	Unexpected process or exception
FF	Attempt to boot (if no error flags such as memory size are set) via INT 19 - normally attempt to load operating system from drive A, then C, or display error message if boot device not found

DIAGNOSTIC TEST ERROR CODES

Each KickStart 2 diagnostic test will either pass, or show an error code on the computer screen and its hex displays to identify the fact that the test failed and the nature of the failure. Table 30 shows the failure codes issued by the tests, as well as a probable cause of failure and likely remedial action. You may use KickStart 2 to test system components in any order. However, the tests are given here in their order of importance to the proper operation of the motherboard and the entire computer.

In general, motherboard tests take less than a minute, the major exception being the Galrow memory tests which are exhaustive and time consuming. If any test appears halted or frozen, the system board data/address bus may be intermittent.

The table refers to components you should replace. These are standard XT or AT circuit parts. A later topic in this chapter cross references them to modern motherboard chip sets. Figure 12 shows a block diagram of the XT and AT to help orient you as to the uses of the major components.

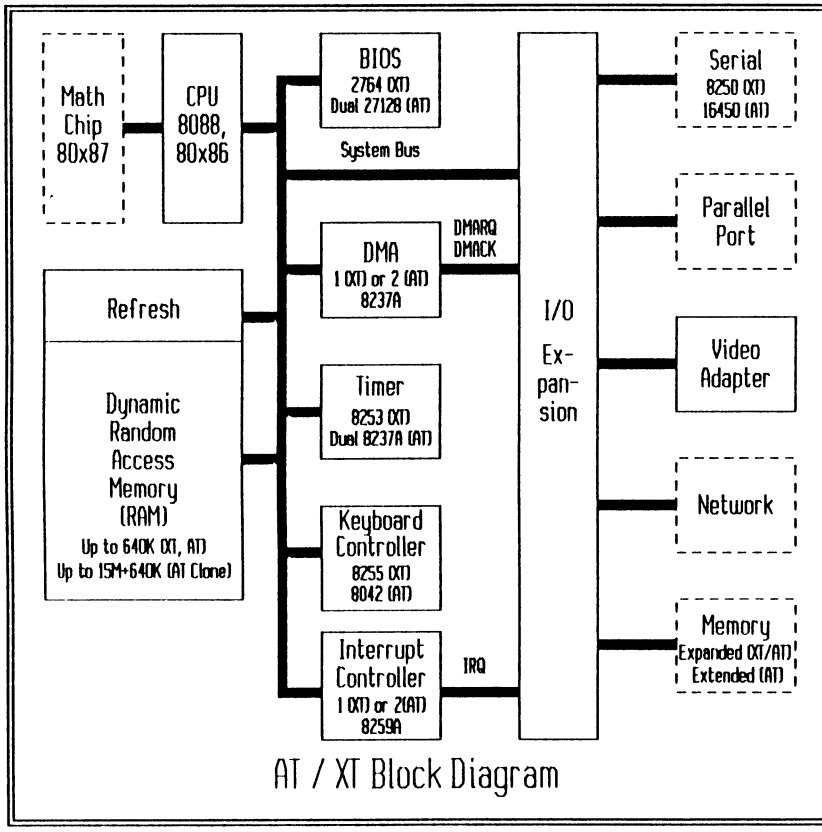


Figure 12. Block Diagram of XT and AT

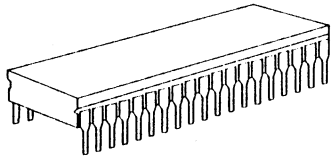
Table 30. Diagnostic Test Error Codes and Meanings		
Code	**Meaning**	**Comment or Corrective Action**
	KickStart 2 Self-Test	
01	KickStart 2 initialization error	KickStart 2 cannot execute its own hardware test, indicating a memory or I/O space conflict in the system. Recheck DIP switches SW1 and SW2, and/or remove other expansion cards from the system.
02	KickStart 2 hardware test error	Some KickStart 2 component is broken. Possible (but unlikely) I/O space conflict. If this error occurs in a known-good computer, contact KickStart 2 technical support.
	CPU Test	
04	CPU register test failed	The 8088 or 80x86 CPU failed its register test. This is extremely unlikely, since the CPU must be running to get this far. It is more likely that the CPU is running at a clock speed faster than it is rated. Replace CPU.
	Math Coprocessor Test	
08	Math coprocessor test failed	The 8087, 80287, or 80387 math chip failed to function properly. This may be due to running at a speed greater than rated, or a bad bus interface/reset circuit. Replace math chip. If problems persist, check its socket.
	Refresh Test	
09	No RAM refresh toggle	The refresh signal is not changing states. This represents a catastrophic failure because DRAM loses its memory without refresh. Repair/replace refresh circuit.
0A	RAM refresh rate out of limits	Refresh is not working within the +/- 5.3% bandwidth specified by IBM for the AT. This can cause memory errors and undetected data loss. Many clones intentionally use a slower refresh rate, and they will therefore fail this test even though there is no danger of data loss.
0B	Real Time Clock error	The RTC is not properly timing an event. Replace the RTC chip.
	RAM Test	
0C	RAM data compare error	The test could not verify data at a given memory address. This is most likely due to the absence of a memory chip, or chips. Re-check DIP/SIMM installation for arrangement, jumpers, orientation. Look at the error message for the failing address/data, and replace chip if necessary.
0D	RAM even parity error	A parity error has occurred at the address in the error message, although the data is correct. This is due to a bad RAM chip, or running the system at too high a clock speed for the parity circuit. Replace the offending DRAM chip if possible, or run the system at a slower speed.
0E	RAM odd parity error	
0F	Address conflict error	Data was written to one address that was intended for another address. The message shows both addresses. Suspect a bad DRAM external RAS/CAS line or internal address line, bad socket, cold solder joint, running the DRAM too fast, or a bad address multiplexer. Swap RAM chips; if symptoms change, suspect bad DRAM chip. If bad addresses are a power of 2 apart (e.g., 32K, 64K, 128K) look for floating address line by comparing levels. If bad addresses are a sum of two multiples of 2 (e.g., 24K, 48K, 96K), look for two shorted lines. Check at the DRAM chip itself, and the address multiplexer.

Table 30. Diagnostic Test Error Codes and Meanings		
Code	**Meaning**	**Comment or Corrective Action**
8253 (XT) or 8254 (AT) Timer Test		
10	8253/4 timer controller failed	The test cannot access the system timer at 40h. Replace it.
Speaker Test		
·	Speaker doesn't beep (no error display given)	The speaker is driven from timer channel 2, but does not respond. Check the timer. Check that the speaker is connected. Check the speaker gate control works by examining circuit in 'Loop on Error' mode.
8237A DMA Controller Test		
18	Controller failed	The test cannot read/write the DMA controller. Replace it.
19	Page register failed	The DMA Page register, which controls Address lines 16-19 during DMA, does not work. Replace it.
1A	8-bit RAM-to-RAM transfer failed	The test cannot move a block of data from one area of memory to another via DMA. Suspect faulty bus transceiver, or strange motherboard design (some properly functioning motherboards cannot pass this test).
1B	8-bit RAM-to-I/O transfer	
Programmable Interrupt Controller (8259A) Tests		
20	Interrupt mask register incorrect	The test cannot read/write the mask register. Replace the 8259A.
21	Unexpected ISR bit set	There is an unexpected Interrupt In Service bit set. Insert JumpStart BIOS, and retry test. If the problem remains, replace the 8259A.
22	Can't clear ISR bit	The test cannot clear an In Service Request. Replace the 8259A.
23	Unknown fatal failure	There is an unexpected failure. Rerun test with JumpStart BIOS installed. If still fails, replace the 8259A.
24	No interrupt occurred	No interrupt occurred from the timer. Check timer, and then replace the 8259A.
28	Can't disable parity circuit	The test cannot disable the parity circuit for testing. Check Parity circuit.
29	NMI not received	The test did not receive a requested NMI. Check NMI circuit.
2A	Unexpected NMI	The test received an unexpected NMI. Check NMI circuit.
2B	Interrupt pending bit not cleared	The Interrupt pending bit was not cleared as the interrupt was removed. Replace 8259A.
2C	Wrong interrupt source	Replace 8259A.
2D	Wrong priority	Replace 8259A.
2E	Interrupt pending bit not set after reset	Replace 8259A.
2F	Can't disable IRQ with I/O Channel printer/serial port data	The test cannot remove an interrupt from the I/O channel. Either a conflict exists on the I/O Channel or the input to the 8259 is faulty. Remove all cards from the system. If problem remains, look for Serial/Parallel on motherboard, then replace 8259.
Keyboard Test		
34	Keyboard Error	A key error occurred. Rerun test, then replace Keyboard.

Table 30. Diagnostic Test Error Codes and Meanings		
Code	**Meaning**	**Comment or Corrective Action**
	Printer Port Test	
x8	Command port error	These errors show expected versus received data. A conflict exists with another adapter or two printer ports/interrupts, or running the port at too high a bus speed. Replace port circuitry or reconfigure the port. Note: These tests require a loopback plug on the port tested (any of three). Errors 3x are for LPT1 (port 378, IRQ7); 4x are for LPT2 (port 278, IRQ5); 5x are for LPT3 (port 3BC, INT7).
x9	Status port error	
xA	Control port error	
xB	Data port error	
xC	Driver toggle error (can't turn on/off port driver)	
	Serial Port Test	
x0	Framing error	A conflict exists with another adapter or two serial ports/interrupts, or running the port at too high a bus speed. Reconfigure the port. If still failing, replace 8250/16450 serial chip, or RS-232C/RS-422 driver/receiver. Note: These tests require a loopback plug on the port tested. Errors 4x are COM1 (3F8, IRQ4), 5x for COM2 (2F8, IRQ3), 6x for COM3 (3E8, IRQ4), 7x for COM4 (2E8, IRQ4).
x1	Overrun error	
x2	Parity error	
x3	Data error	
x4	Transmit timeout error	
x5	Receive timeout error	
	Video Test	
x8	6845 registers failed	These tests check video adapter base registers. Errors 6x are for mono (I/O address 3B0), and 7x are for color (3D0). EGA is tested at 3C0h, in addition to its mono or color mode.
x9	Other latches, registers failed	
xA	Video memory error	
xB	Extended EGA/VGA registers failed	
	Floppy Drive Tests	
80	Read failure	Check cables between drive and controller circuit, and power supply cable going to drive. Possibly drive ID jumpers or cable type are incorrect. Replace the floppy controller card or interface chip. Possible problem with interrupt controller.
81	Write failure	
82	Format failure	
83	Seek failure	
86	RAM request error	
8C	Interrupt timeout	
	Hard Disk Tests	
x1	Read failure	Check cables between drive and controller circuit, and power supply cable going to drive. Possibly drive ID jumpers or cable type are incorrect. Replace the disk controller card or interface chip. Possible problem with interrupt controller. Note: Errors Cx are for drive 0 (C:), and Dx are for drive 1 (D:)
x2	Write failure	
x3	Format failure	
x4	Compare failure	
x5	Drive(s) not present	
x7	Unsuccessful info request	

Table 30. Diagnostic Test Error Codes and Meanings		
Code	**Meaning**	**Comment or Corrective Action**
Ethernet Adapter Test		
E1	Ethernet not present	These tests require the 50-Ohm terminator to be connected to the network controller card. If the test fails, replace the card or controller chip.
E2	I/O port failure	
E3	Data path or memory buffer failure	
E4	Transmit hung	
E5	Receive hung	
E6	CRC mismatch	
E7	CTI failure	
E8	Cable failure	
E9	Hardware failure	
EA	Insufficient DOS memory for packet	
CMOS Real Time Clock Test (AT only)		
F1	System not initialized or checksum error	Check or replace the CMOS RAM/RTC battery or chip.
F2	RTC RAM write/read failure	

MOTHERBOARD CHIP SETS



The preceding troubleshooting information refers to specific integrated circuits such as the DMA or Interrupt Controllers. These were the circuits used on the original XT and AT from IBM. However, many modern systems use large-scale and very large-scale integrated circuits (LSI and VLSI) that combine the functions of IBM's original chips into larger, but fewer chips. This is a boon to computer manufacturers because they can make motherboards with fewer components and cheaper.

It can also make the motherboards easier to troubleshoot, except that now you must know how to cross-reference the original circuits to their modern LSI and VLSI counterparts.

The following topics name various LSI chip sets that are available in the market place and are popularly used to build motherboards. Some may be in sockets, allowing you to replace them. Others may be soldered in place, which will make them harder to replace.

Before you begin to replace a chip set, examine the cost of your time and the parts. It may be cheaper simply to swap the motherboard for a new one.

XT Chip Sets

XT chip sets are generally single-chip; about 1 inch square, with tiny pins. The 1990 cost of an XT motherboard is about $50, without RAM.

Zymos POACH 4/XT88

The POACH 4/XT88 contains most of the required components for an XT compatible. External components include only the processor, coprocessor, and Address Data and Memory Drivers (LS244, LS245, LS373, LS374, LS573, LS574).

Zymos POACH 5/XTB

The POACH 4/XTB contains all the required components for an XT-compatible. External components include only the processor, and coprocessor.

AT/286 Chip Sets

AT/286 chip sets are generally multi-chip. The 1990 cost of an AT/286 motherboard is about $150. If the motherboard is dead, you may have to replace all chips to find the bad one. Look first at the Data and Address bus drivers, since these are the most likely damaged by static from the insertion of expansion cards. The processor (CPU), math coprocessor, BIOS, and Keyboard controller are always external to the chip sets. The Integrated Peripheral Controller, if present in the chip set, contains the DMA, Interrupt, and Timer controllers. The System Controller is the master clock, and bus logic for the processor. The external RTC (real time clock) may be the original Motorola MC146818, or the Dallas Semiconductor DS1287. Also note that some of the following parts may be found in AT/386 designs.

ACC 82010 PC/AT Chip Set

The ACC 82010 PC/AT is a four-chip set containing:

ACC 2000 - Multifunction Peripheral Controller
ACC 2100 - System Controller
ACC 2210 - Data Bus Buffer
ACC 2220 - Address Bus Buffer

ACC 82020 Turbo AT Chip Set

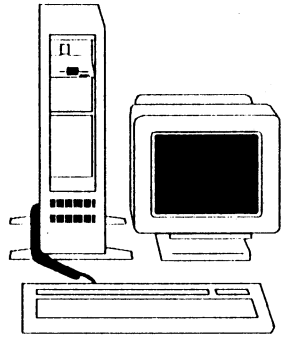
The ACC 82020 Turbo PC/AT is a faster, more featured version of the ACC 82010. The ACC 82020 Turbo PC/AT is a four-chip set containing:

ACC 2000 - Multifunc. Periph. Controller
ACC 2120 - Enhanced System Controller
ACC 2210 - Data Bus Buffer
ACC 2220 - Address Bus Buffer

ACC 2030/2035 AT

The ACC 2030 and 2035 are single-chip AT solutions to 286, and 386SX designs respectively. External components include only the RTC.

C&T CS8220
The Chips & Technologies CS8220 is a five-chip set containing the following: External components include the processor, coprocessor, DMA, PIC (programmable interrupt controller), timer, Real time clock, and keyboard controllers.



82C201 - System Controller & Extended CMOS RAM
82C202 - I/O & MEN Decode Logic
82C203 - High Address Buffer
82C204 - Low Address Buffer
82C205 - Data Bus Buffer and Parity Logic

C&T CS8221 NEAT
The C&T CS8221 is a four-chip set containing the following:

82C211 - System Controller & Extended CMOS RAM
82C212 - I/O & MEN Decode Control and Logic
82C215 - Address & Data Bus Buffer and Parity Logic
82C206 - Integrated Peripherals Controller

C&T CS82C235 NEAT
The C&T CS8221 is a single-chip solution for an AT/286 design, requiring only external Bus drivers, and Memory.

Faraday (WD) FE3600B
The FE3600B is a four-chip AT/286 solution, requiring only an external RTC.

FE3001 - System Controller
FE3010B - Peripheral Controller
FE3021 - Address Bus and Memory Controller
FE3031 - Data Bus and Parity Control

Faraday (WD) FE3600C
The FE3600C chip set is the same as the FE3600B chip set.

Styra ST82C21
The Styra chip set is a pin for pin replacement of the C&T CS8221 NEAT chip set.

Suntac Super 286
The Suntac Super 286 is a five-chip set AT design which requires only the RTC externally. They are flat leaded plastic packaging requiring special tools for removal.

ST62C201 - System Bus Controller
ST62C202 - Memory Controller (DRAM and ROM)
ST62C008 - Integrated Peripherals Controller
ST62C010 - Address Bus Controller

Suntac 62 Chip Set
The Suntac 62 chip set is a six-chip AT/286 design.

ST62BC001B - System Controller
ST62BC002B - Upper Address Buffer
ST62BC003B - Lower Address Buffer
ST62BC004B - Data Buffer
ST62C005B - DMA Page register, Motherboard I/O control
ST62C006 - Integrated Peripheral Controller

WD7500 Chip Set
Western Digital's family of components including:

7XC10 - Single-chip AT/286 Solution
7XC20 - FD, HD, and RTC controller
7XC30 - 2 Serial plus Parallel Adapter

The Western Digital WD75C10 is a single-chip AT/286 solution, requiring only an external RTC, or 76C20.

WD7600 Chip Set
The Western Digital WD76C10 is a high-speed single-chip AT/286 solution, requiring only an external RTC, or 76C20.

WD7600/LP Chip Set
The Western Digital WD76C10LP is a low-power single-chip AT/286 solution, requiring only an external RTC, or 76C20.

VIA FlexSet AT
The VIA family of products include:

SL9011 - System Controller
SL9020 - Data Bus Controller
SL9023 - Address Controller
SL9151 - AT/286 Page Interleave Memory Controller
SL9152 - AT/286 System and Memory Controller
SL9250 - AT/386SX Page Mode Memory Controller
SL9251 - AT/386SX Page Interleave Memory Controller
SL9252 - AT/386SX System and Memory Controller
SL9350 - AT/386 Page Mode Memory Controller
SL9351 - AT/386 Page Interleave Memory Controller
SL9352 - AT/386SX System and Memory Controller
SL9030 - Integrated Peripheral Controller
SL9090 - PC/AT Universal Clock chip
SL9095 - Power Management Unit

Zymos POACH/AT (1&2)
The POACH/AT is a two-chip AT solution which requires only external address and data bus buffers.

POACH 1 - System Clock, bus control, PIC and RTC functions
POACH 2 - DMA, Timer, Refresh, and I/O Control functions

Zymos POACH 3
The Zymos POACH 3 is a dual-mode device that functions as both an Address and Data bus controller. This requires two-chips on the motherboard, both of which look identical.

AT/386SX Chip Sets

These chip sets are similar in function to the AT/286 chip sets, since both are designed around 16-bit buses.

Suntac GS62CS03
The Suntac GS62CS03 is a two-chip solution, requiring an external RTC.

GS62C101 -	System, Data Bus, Timer, and PIC controllers
GS62C102 -	Memory, DMA, and I/O Controller

WD6400SX
The Western Digital WD6400SX is a four-chip AT/386SX solution which contains:

WD6000 -	System, PIC and Timer controllers
WD6010 -	DMA, Reset, and Parity controllers
WD6020 -	Address and Data bus controllers
WD6036 -	Cache/DRAM Memory Controller

WD6400SX/LP
The Western Digital WD6400SX/LP is a four-chip low-power AT/386SX solution which contains:

WD6000 -	System, PIC and Timer controllers
WD6010 -	DMA, Reset, and Parity controllers
WD6020 -	Address and Data bus controllers
WD6036/LP -	Cache/PSRAM Memory Controller

Zilog System 90/SX
The Zilog System 90/SX is a three-chip set which includes:

P90 -	System, PIC, DMA, RTC and refresh controllers
P91 -	Advanced Memory controller
P92 -	Address and Data bus controller

AT/386 Chip Sets

AT/386 chip sets are generally more complex, as they are required to deal with a 32 bit local bus and a 16 expansion bus. These chip sets will also be found on AT/486 designs.

ACC 82300
The ACC 82300 is a three-chip set that requires external Address, and Data bus controllers. The chip set contains:

ACC2000 -	Integrated Peripheral Controller
ACC2300 -	Page Interleaved Memory Controller
ACC2500 -	System Controller

Opti HiD AT/386
The Opti HiD AT/386 chip set is a system and memory controller solution only. It also requires an Integrated Peripheral Controller.

82C381 - System and Cache controller
82C382 - Direct Mapped Page Interleaved Memory Controller

WD6500
The WD6500 chip set is a five device solution which requires an external RTC and contains:

WD6000 - System, PIC, Timer and I/O Controllers
WD6010 - DMA, Reset and Parity control
WD6022 - Address or Data bus controller

This is a dual-mode chip, similar to the Zymos POACH 3, in that it can function as either a Data or Address bus controller. This means that there will be two of these chips present.

WD6030 - Cache/DRAM Controller

Zymos POACH/AT386
The POACH/AT386 (POACH 6) is a high-speed 80386 System controller. It also requires either a POACH/AT or POACH/ATF.

Zymos POACH/ATF (7&8)
The POACH/ATF is a high-speed two-chip AT solution, similar to the POACH AT. The chip set requires only external address and data bus buffers for an AT/286, or external address and data bus buffers, and a POACH/AT386 (POACH 6) for an AT/386 design.

POACH 7 - System Clock, bus control, PIC and RTC functions
POACH 8 - DMA, Timer, Refresh, and I/O Control functions

MOTHERBOARD CONNECTORS

You may find it convenient while troubleshooting to know the pinouts of some of the major connectors on the IBM-standard PC/XT and AT motherboards. The following tables give pinouts for the expansion slots and power supply connectors.

Power Supply Connector

The IBM XT/AT-standard power supply cable follows a color code convention, shown in Table 31, that should help you orient the power supply connectors properly before plugging them onto the motherboard. Not all power supply manufacturers conform to the color coding scheme. Pin 1 is toward the rear of the computer. Not all systems identify the plugs on the power supply cables as P8 and P9. Typically, when plugged onto the motherboard, the connectors are side-by-side, and the sides containing the black wires are adjacent.

Table 31. Power Supply Connector Pinouts			
P8 Pin	Signal Use	P9 Pin	Signal Use
1	POWERGOOD (white, reset system)	7	Ground (black)
2	+5 Volts DC (red)	8	Ground (black)
3	+12 Volts DC (yellow)	9	-5 Volts DC (green)
4	-12 Volts DC (blue)	10	+5 Volts DC (red)
5	Ground (black)	11	+5 Volts DC (red)
6	Ground (black)	12	+5 Volts DC (red)

Expansion Slot Connectors

The 8-bit expansion slots in a PC or XT are shorter than the 16-bit slots in an AT. Table 32 shows the long connector pinout, while Table 33 shows the pinout for the short connectors. In identifying the signals, note that a minus sign preceding the signal name means it is low-true (0 volts when active). Pin numbers are identified as Ax, Bx, Cx, or Dx. Rows A and C are on the left side of the edge connector when you are facing the front of the computer, and rows B and D are nearest to the power supply on a standard XT or AT.

Table 32. Long Connectors (AT and XT)					
Pin	Use	Pin	Use	Pin	Use
A1	I/OCHK	A22	SA9	B43	-SMEMR
A2	SD7	A23	SA8	B44	-IOW
A3	SD6	A24	SA7	B45	-IOR
A4	SD5	A25	SA6	B46	-DACK3
A5	SD4	A26	SA5	B47	DRQ3
A6	SD3	A27	SA4	B48	-DACK1
A7	SD2	A28	SA3	B49	DRQ1
A8	SD1	A29	SA2	B50	-REFRESH
A9	SD0	A30	SA1	B51	ATSYSCLK
A10	-I/OCHRDY	A31	SA0	B52	IRQ7
A11	AEN	B32	Ground	B53	IRQ6
A12	SA19	B33	RESETDRV	B54	IRQ5
A13	SA18	B34	+5V	B55	IRQ4
A14	SA17	B35	IRQ9	B56	IRQ3
A15	SA16	B36	-5V	B57	-DACK2
A16	SA15	B37	DRQ2	B58	T/C
A17	SA14	B38	-12V	B59	BALE
A18	SA13	B39	OWS	B60	+5V
A19	SA12	B40	+12V	B61	OSC
A20	SA11	B41	Ground	B62	Ground
A21	SA10	B42	-SMEMW		

Table 33. Short Connectors (AT Only)					
Pin	Use	Pin	Use	Pin	Use
C1	SBHE	C13	SD10	D25	IRQ14
C2	LA23	C14	SD11	D26	-DACK0
C3	LA22	C15	SD12	D27	DRQ0
C4	LA21	C16	SD13	D28	-DACK5
C5	LA20	C17	SD14	D29	DRQ5
C6	LA19	C18	SD15	D30	-DACK6
C7	LA18	D19	-MEMCS16	D31	DRQ6
C8	LA17	D20	-IOCS16	D32	-DACK7
C9	-MEMR	D21	IRQ10	D33	DRQ7
C10	-MEMW	D22	IRQ11	D34	+5V
C11	SD8	D23	IRQ12	D35	-MASTER
C12	SD9	D24	IRQ13	D36	Ground

SERIAL AND PARALLEL PORT CONNECTORS

KickStart 2's serial and parallel connector pinouts and signal names, including those for the 10-pin header J1, are given in Table 34 and Table 35.

Table 34. Serial Connector J1, J4 Pinouts			
Signal Name	Connector Pin Numbers		
	Header J1	DB9M J4	DB25M Adapter
Carrier Detect	1	1	8
Received Data	3	2	3
Transmitted Data	5	3	2
Data Terminal Ready	7	4	22
Signal Ground	9	5	7
Data Set Ready	2	6	6
Request To Send	4	7	4
Clear To Send	6	8	5
Ring Indicator	8	9	22
No Connection	10	-	-
Earth Ground	-	-	1

AT INTERRUPT AND DMA CONTROLLERS

This topic gives an overview of interrupt and DMA controller signal usage in a typical AT. The associated tables indicate the signals used in the XT by showing that they go to the 8-bit expansion slots.

Interrupt Controllers

AT-compatible computers have two 8259A-type Programmable Interrupt Controllers (PICs), a master and a slave, that handle the hardware interrupts to the 80286/80386/80486 CPU. Table 36 lists the interrupt lines, their priorities, and the associated devices, and the type of expansion slot containing (if any) the signal. An 8-bit slot is a 62-pin, PC-compatible slot. A 16-bit slot is an AT-compatible, 36-pin extension to the PC slot.

Table 35. DB25F Parallel Connector J5 Pinout

Pin #	Signal	Pin #	Signal
1	-Strobe	14	-Auto Feed
2	Data 0	15	-Error
3	Data 1	16	Initialize
4	Data 2	17	-Select In
5	Data 3	18	Ground
6	Data 4	19	Ground
7	Data 5	20	Ground
8	Data 6	21	Ground
9	Data 7	22	Ground
10	-Acknowledge	23	Ground
11	Busy	24	Ground
12	Paper Out	25	Ground
13	Select	-	-

Table 36. AT-Compatible Interrupts

Priority	Bits	Source	Destination
NMI	-	Parity Error	CPU NMI
0	-	Timer Channel 0	Master, Interrupt 0
1	-	Keyboard Controller	Master, Interrupt 1
2	-	Slave PIC IRQ 8-15	Master, Interrupt 2
3	-	Clock/Calendar	Slave, Interrupt 0
4	8	IRQ 9	Slave, Interrupt 1
5	16	IRQ 10	Slave, Int 2, unused
6	16	IRQ 11	Slave, Int 3, unused
7	16	IRQ 12	Slave, Int 4, unused
8	-	80x87 Busy IRQ 13	Slave, Int 5
9	16	IRQ 14	Slave, Int 6, Hard Drive
10	16	IRQ 15	Slave, Int 7, unused
11	8	IRQ 3	Master, Int 3, Serial Port 2
12	8	IRQ 4	Master, Int 4, Serial Port 1
13	8	IRQ 5	Master, Int 5, Printer Port 2
14	8	IRQ 6	Master, Int 6, Floppy Drive
15	8	IRQ 7	Master, Int 7, Printer Port 1

DMA Controllers

AT-compatible computers contain two 8237A Direct Memory Access controllers for byte and word transfers. Typically, they run at 8 Mhz, but they may run faster. Table 37 lists the DMA channels and the corresponding signals on the PC and AT expansion slots where these channels can be accessed.

Table 37. DMA Channels

SLAVE	MASTER	Bits	DEVICE
0	-	8	DRQ 0, unused
1	-	8	DRQ 1, IBM SDLC
2	-	8	DRQ 2, floppy drive
3	-	8	DRQ 3, unused
-	4		Slave cascade to master
-	5	16	DRQ 5, unused
-	6	16	DRQ 6, unused
-	7	16	DRQ 7, unused

INTRODUCTION

This chapter describes the various options and accessories (such as loopback plugs) that you can receive with KickStart 2. It is possible that your version of KickStart 2 will not contain all those items described here. However, they are still available from Landmark or your Landmark dealer as separately purchased items. If you have doubts or questions about them, contact Landmark directly.

SERIAL/PARALLEL LOOPBACK PLUGS

Serial and parallel port loopback plugs are connectors with internal wiring that connects output pins to input pins, thereby "looping" the outputs back to the inputs. When connected to a serial port, for example, any data sent out is received back in, thus verifying the integrity of the computer's data path, signal driver circuitry, and connectors.

Loopback plugs won't work properly if protection devices are installed on parallel port or serial ports.

Table 38. Loopback Plug Interconnections			
25-Pin Female Serial Port Plug (DB25F or DB25S)			
Signal	**Pin→**	**←Pin**	**Signal Name**
Transmit Data	2	3	Receive Data
Request to Send	4	5	Clear to Send
Data Set Ready	6	8	Carrier Detect
Data Set Ready	6	20	Data Terminal Ready
Carrier Detect	8	22	Ring Indicator
9-Pin Female Serial Port Plug (DB9F or DB9S)			
Signal Name	**Pin→**	**←Pin**	**Signal Name**
Transmit Data	3	2	Receive Data
Request to Send	7	8	Clear to Send
Data Set Ready	6	1	Carrier Detect
Data Set Ready	6	4	Data Terminal Ready
Carrier Detect	1	9	Ring Indicator
25-Pin Male Parallel Port Plug (DB25M or DB25P)			
Signal Name	**Pin→**	**←Pin**	**Signal Name**
-Strobe	1	2	Data Bit 0
Data Bit 1	3	14	-Auto Feed
Data Bit 2	4	15	-Error
Data Bit 3	5	17	-Select Input
Data Bit 4	6	13	Select
Data Bit 5	7	12	Paper End
Data Bit 6	8	10	-Acknowledge
Data Bit 7	9	11	Busy
-Error	15	16	Initialize

Table 38 and Figure 13 show which loopback plug pins are interconnected. We recommend you use only Landmark's top-quality loopback plugs.

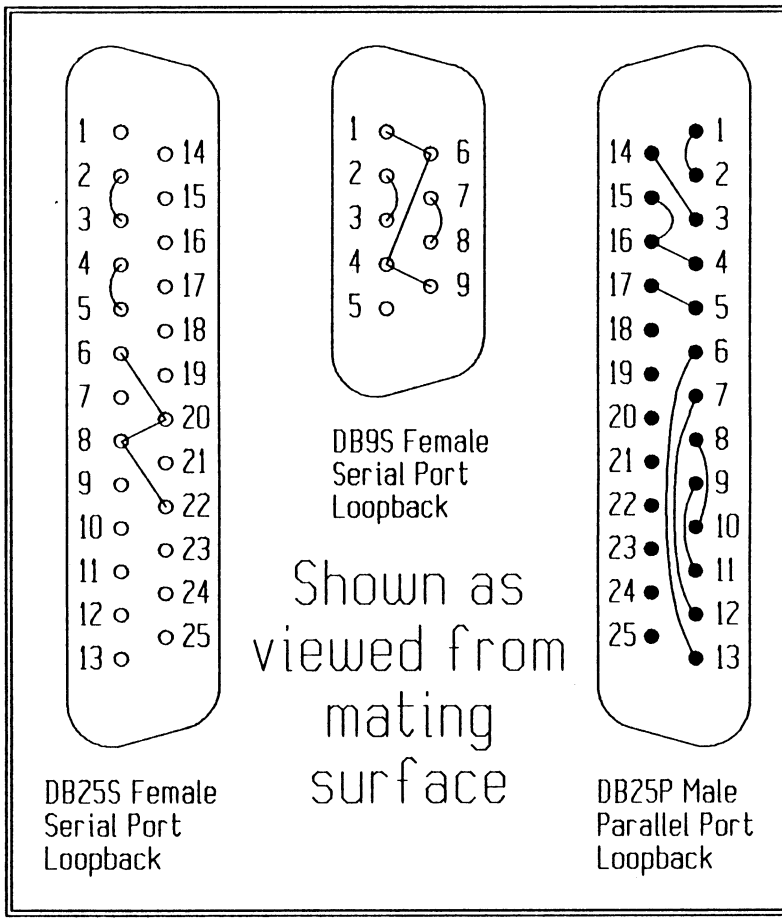


Figure 13. Loopback Plug Wiring

ETHERNET LOOPBACK PLUG

An Ethernet loopback plug is actually a standard Ethernet BNC T-connector with two 50-Ohm BNC terminators attached. Because they are so simple, no wiring table or diagram is needed to describe them. They are available from Landmark. Table 39 gives standard AMP part numbers.

Table 39. Ethernet Loopback Plug Components

Quantity	Item	AMP Part Number
1	BNC T-connector	221543-2
2	50-Ohm BNC terminator	221629-4

access - any disk seek or any disk or memory read or write operation

add-on cards - an electronic circuit board that plugs into an expansion slot of an IBM-compatible computer. The card expands the capabilities of the basic computer, such as by adding memory or capability to communicate with other Input/Output devices.

address - a location in a computer's memory where particular data are stored, or the identity of an Input/Output device or controller card. The specific number that the microprocessor places on the bus to wake up a particular memory or I/O circuitry, and to prepare it to send or receive data. The address is used to identify a specific circuit, and to prevent other circuits from responding.

alignment - the placement of a disk drive's read/write head precisely above the center of the specific track the computer expects it to be above.

analog - continuously variable representation of quantities by numbers; for example, the magnitude of an electrical voltage represents number. Also see digital for contrast.

ANSI - American National Standards Institute, an organization that coordinates the establishment of voluntary national standards, especially for the computer industry. For example, ANSI standards exist for floppy diskettes and the meanings of numeric codes computers use to communicate with remote keyboard-display terminals.

AT - a computer invented by IBM in 1984 based on the Intel 80286 microprocessor and having 8 expansion slots and a 20 Megabyte hard disk.

AT-compatible - being functionally identical to the original IBM AT personal computer. AT-compatible add-on cards must be able to plug into and operate correctly in AT expansion slots. AT-compatible computers must be able to run software that runs on the original AT, and accept AT-compatible add-on cards.

backup copy - a copy that a user makes of an original program diskette from a software manufacturer; the copy is made so that if the original gets overwritten or destroyed somehow, the user still has an authorized copy to use until the original is replaced. Usually, it is illegal to make more than one backup copy, or to use a backup copy on one computer while the original is being used on another.

binary - the designation for a number system that contains only two digits, 1 and 0. Computers operate with binary numbers because transistor circuits that computers depend on can represent a 1 by being turned on and a 0 by being turned off. Also see bit and byte.

BIOS - Basic Input/Output System. This is software that resides in ROM (read-only memory) chips that are plugged into the motherboard or some controller cards. BIOS provides a standard interface between application programs or DOS and specific AT-compatible I/O devices. For example, BIOS contains software that receives a command from DOS to write data

to a disk sector, then gives detailed low-level commands to the disk controller to write the data. Motherboard BIOS must usually be compatible and functionally identical to the original IBM PC, XT, AT, or PS/2 motherboard BIOS. Clone makers sometimes develop their own BIOS, but usually prefer to buy the BIOS from a software company. Major BIOS manufacturers are Phoenix, Award, AMI, and Quadtel. These BIOSes also perform a self-test during system boot. They often come with additional features such as built-in system setup program, low-level hard disk format, and advanced diagnostic tests.

bit - acronym for binary digit, the smallest number a computer can deal with. A bit is either a 1 or a 0, usually represented in computers by +5 Volts DC, or 0 Volts (ground), respectively.

boot failure - the inability of a computer to start running properly because its circuitry is broken, or it cannot find or load the operating system software from the disk drive.

boot - the process of bootstrapping, or self-starting the computer. When you turn on power, the computer performs a self-test (a function of BIOS), then attempts to "boot", or read an operating system from the floppy or hard disk. Also see firmware.

boot - the process of bootstrapping, or self-starting the computer. When you turn on power, the computer performs a self-test (a function of BIOS), then attempts to "boot", or read an operating system from the floppy or hard disk. Also see firmware.

buffer - an amount of memory in either a RAM chip or a register that acts as a temporary holding place for data passing from one place in the computer to another. Buffer memory allows the CPU to deposit the data and return to other tasks rather than waiting for an I/O device to take the data. Another type of buffer is an electronic circuit that amplifies weak digital signals in order to prevent a circuit sending data from being overloaded by several circuits receiving the data.

bus - electrical data and address signal connections that are routed on the motherboard between the microprocessor, the memory, the math coprocessor, and the expansion slots. As with a city bus, the connections have stopping off points that allow any device's data to be sent to or from the microprocessor.

byte - 8 bits. A byte is a the typical size of a personal computer number, especially as used for I/O to displays, disk drives, printers, keyboards, and modems.

card - a printed circuit board containing computer chips and other electrical or electronic components.

cathode ray tube (CRT) - the main screen of a computer display or monitor, a CRT contains a high-energy source of electrons (the cathode) which emits a beam or ray of electrons which other components in the tube accelerate to

a high velocity. Upon striking the phosphor-coated inside surface of the front of the tube (screen), the ray causes the struck area of the phosphor to emit light. By deflecting the beam across the screen very quickly, the tube makes a text or graphic image appear on the screen.

central processing unit (CPU) - see microprocessor

compatible - being functionally identical to the original IBM PC, XT, AT, or PS/2 personal computer. A compatible add-on card must be able to plug into and operate correctly in AT expansion slots. A compatible computer must be able to run software that runs on the original IBM, and accept compatible add-on cards.

computer - a mechanical or electronic machine that performs repetitive or complex calculations and reasoning operations with numbers and text. The term "computer" comes from Latin roots that mean "to think with". Thus, a computer helps people to think by removing the drudgery from repetitive calculation and reasoning activities. Modern electronic computers contain the following major components: Central Processing Unit (CPU), the electronic circuit that performs arithmetic and reasoning calculations; memory, the electronic circuits that store programs and data; and Input/Output (I/O), the electronic circuits and mechanical devices such as printers, keyboards, displays, and disk drives, that allow the computer to communicate with humans or expand its capabilities. The computer runs by virtue of the CPU fetching and executing the instructions of a program that is usually loaded into memory from a disk drive.

controller - a card or circuit that provides an interface between the computer's microprocessor and its actual I/O devices such as a disk drive. The controller performs low-level electronic control of the device (such as a display or disk drive) upon receipt of commands from the microprocessor, and it buffers data flowing between the two.

data - information, in the form of binary numbers (see bit, byte) that is stored on a floppy or hard disk, or in the computer's memory, or is transferred from one place in the computer to another (such as from the disk to the memory), or is transmitted to or from external devices such as printers.

data patterns - the placement of data in memory or on an Input/Output device such as a disk drive in a way that is calculated to cause a read or write error because of unusually sensitive or insensitive circuitry. The memory or device should not cause an error, regardless of the data pattern sent to it, so if it does, it is assumed to be faulty.

diagnostic - a test or process that examines symptoms of a problem, runs tests to exercise suspected bad circuits, and points out remedial action to take.

digital - representing values by a configuration of binary digits (ones and zeros, represented in most computers by +5 Volts and ground, respectively). For contrast, see analog.

DIP - dual in-line package, refers to the integrated circuit (chip) packaging technique whereby opposing parallel rows of pins are on each long side of the chip. These are contrasted with SIP (single in-line package), and ZIP (zig-zag in-line package).

Direct Memory Access (DMA) - the process by which a block of data is sent directly between an I/O controller circuit and the computer's main memory, rather than having to pass through the microprocessor. AT Floppy controllers use DMA. See programmed I/O.

diskette - a round, flat, thin sheet of mylar or similar material enclosed in a protective jacket that can be inserted in a floppy drive. It is coated with a ferrous oxide that is magnetizable, and is used to record computer data when it spins in the drive. It is often referred to as a floppy because the original diskettes were flexible enough to flop around when waved in the air. A cleaning diskette has a similar shape, but is made from a non-recordable material that cleans the read/write (recording) heads in the drive as it spins in contact with the heads.

display - a computer screen that shows text and graphic information to the computer user. Also see cathode ray tube.

DOS format - A special high-level format that MS-DOS or PC-DOS writes on a computer disk. The format puts a file structure on the disk surface, including an area that identifies sectors in use, a directory of the files present, and the files themselves.

DOS - Disk Operating System. MS-DOS (from Microsoft) and PC-DOS (from IBM) are the industry standard operating systems for AT-compatible computers. The main tasks of DOS are to create and manipulate a system of program and data files on the disk, and to provide a console interface to the user.

drive type - a numeric designator that specifies a particular type of disk drive to BIOS in the AT. Standard IBM AT BIOS recognizes up to 47 types of drives, each being identified by a number of tracks and heads, and each assumed to be an MFM type with 17 sectors of 512 bytes each.

drive - an electronic and mechanical computer Input/Output device that contains a fixed (rigid) disk or allows you to insert and remove floppy diskettes. The drive can write data onto and read data from the disk surface in concentric tracks under command of the computer. The drive spins the disk and uses an actuator to position read/write heads above the surface of the disk in order to deposit or extract data.

drive door - a movable front cover or actuating lever on a floppy drive that clamps a diskette in place when closed, but releases and ejects the diskette when opened.

driver - a special software program that is specified in the CONFIG.SYS file and is loaded at boot time. It's purpose is to implement special BIOS functions for a particular I/O device. For example, a driver is required to

operate a disk controller at its secondary I/O addresses because the real motherboard BIOS only uses the primary addresses.

electromagnetic - a type of energy that electronic circuits radiate, creating unwanted interference with the behavior of nearby electronics that are susceptible to the radiation. The radiation is caused by electrons flowing in interconnecting wiring in alternating directions at a very high frequency. The radiation is sometimes intentional, as in the case of radio and television signals coming through the air. However, susceptible circuits can be shielded from the effects of the radiation by moving them to a different location or by putting a metal housing around them. Computer cases must be properly closed to prevent electromagnetic radiation of its circuits from interfering with television and radio reception.

EMS - acronym for Expanded Memory Specification developed by Lotus, Intel, and Microsoft. EMS provides a mechanism for programs that were originally intended to run within the 1M address space of an 8088 microprocessor (as found in the IBM PC and XT computers) to have access to many megabytes of additional memory. The original technique was to provide electronic circuitry with memory add-on cards that allowed the application program to command an EMS driver to switch various 16K chunks of the add-on memory so that the application could read and write the memory through addresses above the normal 640K reserved for DOS and below the area under 1M reserved for BIOS. EMS versions 3.2 and 4.0 are the most popular, with version 4.0 allowing application programs more flexibility in usage of RAM in the lower 640K of address space. Version 3.2 allows 8M of expanded memory, and 4.0 allows 32M. Motherboard chip makers now incorporate EMS control circuitry in their chipsets. Software manufacturers have developed drivers that use disk space and extended memory to emulate expanded memory in systems that have no EMS control circuitry.

expanded memory - see EMS.

expansion slot - a socket on a motherboard into which to plug add-on cards such as memory, disk controller, video adapter, and serial/parallel port controllers.

expansion slot - a socket on a motherboard into you can plug add-on cards such as memory, disk controller, video adapter, and serial/parallel port controllers.

extended memory - The address space between 1M and 16M in an AT-compatible computer. Modern 80386 and 80486-based computers can address extended memory up to 4G (gigabytes, equivalent to 1024 megabytes).

ferrous oxide - a magnetizable chemical compound containing iron that is used to coat the surface of floppy and hard disks. The ferrous oxide can be worn from a floppy diskette surface by the pressure of the read/write head riding directly on the surface as the diskette spins. The oxide can thus build

up on the head, causing the head to become dirty, and inducing read/write errors.

file - a logical grouping of information in the form of pure data or a program on the surface of a disk. The actual file structure of the disk and the creation, deletion, and other handling of files is done by the operating system (see DOS and DOS format).

firmware - software for a microprocessor that is built into ROM. BIOS is a specific firmware for the motherboard's microprocessor.

floppy - see diskette and drive.

format - the organization of data on a floppy or hard disk. Typically, the disk must have two levels of formatting before it is useful. The low level consists of writing onto the disk concentric tracks, each of which is subdivided into a number of sectors, each of which can typically contain 512 bytes of data; the format is written on a hard disk by a special program. The high level consists of writing into the sectors a file structure. This is done by the operating system (see DOS format).

gigabyte - 1024 megabytes. Optical disk 80386/80486 address space capacities are normally rated in megabytes.

ground - the connection of a common return of electrical current to the earth. All AC power systems in most countries require one leg of an electrical circuit to be grounded for safety. One should always ground oneself by touching the computer chassis before handling an electronic circuit card.

hard disk - a magnetic disk that is rigid and not removable from the drive. Also see diskette and drive.

hardware - physical or tangible components of a computer, such as the motherboard, disk drives, display, keyboard, and so on. Also see computer and software.

head - a relatively small device used for writing and reading data on the surface of a magnetic disk inside a disk drive. The device is usually made of plastic, ceramic, or non-ferrous (non-magnetizable) metal, and contains a precisely placed set of tiny coils of wire. Write current passes through the coil, builds up a magnetic field that alternates direction at high speeds as the disk spins under it, and thereby magnetizes (writes to) spots on the disk track. Conversely, when reading, the magnetized spots on the disk track pass under the head, induce alternating voltage in the head's coil of wire; the induced voltage is amplified by the drive electronics and sent to the computer. Thus is the data on the disk read. Also see diskette, drive, guide rods, ferrous oxide, actuator, and alignment.

hexadecimal - often referred to as "hex", a number system with 16 digits, used as a convenience by computer programmers, engineers, and technicians because 2 hexadecimal digits can represent 8 binary digits (it is easier to

deal with 2 digits than 8, especially when operating with large numbers). Hex digits can be 0 through 9 and A through F, where A, B, C, D, E, and F represents decimal values 10, 11, 12, 13, 14, and 15, respectively. A through F are used because there are no single symbols to represent those digits. To distinguish from decimal or random character sequences, a typical hex number is followed by the letter h, or preceded by 0X, as in the following examples: 49FBh, 0X30C1, 5442h.

Decimal - Hexadecimal - Binary Equivalent Values

Dec	Hex	Bin
0	0	0000
1	1	0001
2	2	0010
3	3	0011
4	4	0100
5	5	0101
6	6	0110
7	7	0111
8	8	1000
9	9	1001
10	A	1010
11	B	1011
12	C	1100
13	D	1101
14	E	1110
15	F	1111

high density - a type of diskette that is manufactured to high standards and can accept data packed more closely together than low-density diskettes allow. 5.25-inch high-density disks allow formatting with 96 tracks per inch (1.2M), and 3.25 diskettes allow 135 tracks per inch (720K or 1.44M).

I/O - Input/Output. The process of transferring data into or out of the computer from or to a peripheral device such as the disk drive, display, and so on. Such devices are known as I/O devices.

IBM - International Business Machines, the American computer manufacturer that popularized the term "personal computer", invented the IBM PC, XT, AT, and PS/2 computers, and made them the major *de facto* world standard for desktop and deskside computer systems.

interleave, memory - 2-way page interleave refers to a memory access method whereby odd addresses are located in one bank, and even addresses in another. 4-way interleave schemes are less popular, but still occur. Interleaving like this allows sequential memory accesses to occur fast, even though the system is using slow memory. One bank can be fetching data while the other is pre-charging. The effect is similar to that of a high-RPM multi-cylinder combustion engine compared to the lower-RPM of a single-cylinder engine. Page interleaved architectures sometimes require separation of the two halves of a 16-bit bank of memory, thereby affecting location of a bad RAM chip.

interleave, sector - the sequence in which sectors around the track are numbered and read. Modern fast systems use 1-to-1 interleave in which the sectors are numbered in sequence; this allows the system to read a track in one revolution of the disk. Older, slower systems use 1-to-3 interleave in which every third sector is numbered next in sequence; this allows the system to read a complete track in 3 revolutions. Programs are available that determine the interleave factor of your drive if it is the MFM or RLL type. If your interleave is wrong for your system, it can cause reduced performance. The 1-to-3 and other slow interleave factors are required because the controller cannot store more than one sector (512 bytes) of data, and must pass it to the computer's memory before reading the next sector.

1-to-1 interleave is allowed if the controller can store an entire track of data and time-share the reading of sectors at high speed with writing of stored sectors to the computer's memory.

jacket - the protective plastic covering of a floppy diskette. The jacket of a 5.25-inch diskette is very flexible, while that of a 3.5-inch diskette is rigid.

keyboard - a device shaped like the typing area of a typewriter that allows you to type information or commands for entry into a computer.

kilobyte - 1024 bytes. Floppy and memory storage capacities are normally rated in kilobytes.

LED - light emitting diode. A LED is frequently used in computers in place of incandescent indicator lamps because they are actually transistor-like semiconductors that glow when current is passed through them. They use low voltage levels (+5V), are much more rugged, and last much longer than incandescent lamps.

load - the process by which a computer program or data is brought from the disk into the computer's main memory.

loop - the process by which a computer program executes the same set of instructions repeatedly.

low density - a type of diskette that must accept data packed more loosely than high-density diskettes allow. 5.25-inch low-density disks allow formatting with 48 tracks per inch (360K).

megabyte - 1024 kilobytes. Hard disk and memory storage capacities are often rated in megabytes.

microprocessor - a complex integrated circuit "chip" molded into a square or rectangular flat piece of plastic or ceramic to be mounted (usually) on the motherboard of a computer. The microprocessor is the "brain" of the computer and is sometimes known as the Central Processing Unit (CPU). It contains arithmetic, logical, and reasoning circuits, can fetch and execute instructions from memory that is external to the chip, can read and write data to memory and Input/Output devices. Also see computer.

motherboard - the main card or printed circuit board of the computer. It contains the expansion slot connectors, the microprocessor, and related circuitry.

mouse - an palm-sized input device for the computer. As you move the mouse around on the desktop, it sends relative vertical and horizontal motion information to the computer. Mice have buttons on top that you push with your finger. Popular versions have 2 or 3 buttons. Any program that uses a mouse displays a mouse cursor or arrow shaped pointer on the screen; the pointer moves to mimic the direction and amount you move the mouse. When the pointer is on top of a menu item, you can push the mouse button to tell the program that you are selecting that item. In order to use a mouse

with an application program, you must have a mouse driver software program loaded into the computer. Some programs contain a built-in mouse driver.

nybble - four bits (half of a byte).

optical sensor - an electronic device that detects the presence of another object. It functions by having a light source such as a L.E.D shine into a light-sensitive electronic component, and allowing the other object to interrupt the light beam. An electronic circuit detects that the light beam was interrupted, thus sensing the presence of the other object. Typical use is in the detection of the write protect tab on a 3.5-inch floppy diskette jacket.

oscilloscopes - an instrument for measuring the voltage frequency and amplitude characteristics of electrical and electronic energy signals. It contains a cathode ray tube and actually shows the electrical waveform on the screen. They are usually expensive and used only by skilled technicians and engineers.

overwriting - writing new data on top of old data on a hard or floppy disk.

PC - a computer invented by IBM in 1981 based on the Intel 8088 microprocessor and having 5 expansion slots and a floppy drive, but no hard disk.

PIC - programmable interrupt controller. This refers to the 8259A chip on XT and AT motherboards that recognizes and prioritizes IRQ (interrupt requests) for the CPU

potentiometer - an adjustable electrical component of electronic circuits that allows a technician to change the behavior characteristics of the circuit. Similar to the volume control in a radio.

power supply - a major subassembly of a computer system that supplies electricity to electronic circuits in the computer. It converts the high voltage alternating current (e.g. from a wall outlet) to lower 5 and 12 Volt direct current used by computer circuits. The power supply is in a metal chassis that bolts inside the computer chassis. It contains a fan that pulls air into the supply from inside the computer and exhausts behind the computer.

program - a step-by-step sequence of instructions that a computer can execute. A program is written by a person who understands how the computer functions. It what tells the computer what work it must do and in what order, and guides it through doing the work.

programmed I/O - the type of data transfer between the controller and the computer's main memory that requires data to pass through the microprocessor. Also see DMA.

RAM - acronym for Random Access Memory. A RAM is an integrated circuit that a microprocessor can both read and write with data or

instructions. The processor can access any storage location in the RAM in the same amount of time. Unless backed up by a battery, the RAM loses its memory contents when power to the computer is switched off.

read - the action of taking data from a computer's memory or an I/O device such as a disk drive. Reading is usually non-destructive in that the data is still in the memory or on the disk after the read has taken place. Also see read/write.

read/write - a dual characteristic of computer memories and disk drives that puts data into the device (write) or takes data from the device (read). Also see head, RAM, ROM, and microprocessor.

RMA - Return Material Authorization, usually given by a manufacturer to a customer prior to allowing the customer to return a product for repair. The RMA number must be written on the outside of the returned package. Without it, the manufacturer cannot differentiate customer products that need immediate attention from less important packages.

ROM - acronym for Read-Only Memory. A ROM is an integrated circuit that is preprogrammed at the factory to contain data or instructions that a microprocessor can read. The microprocessor cannot write to it, however. The ROM is special because it retains its contents even after power to the computer is switched off.

RTC - real time clock. This refers to a circuit on the AT motherboard that is backed up by a battery so that it will not stop running when computer power is switched off, and it keeps track of the actual time and date. The chip also contains CMOS RAM. Some versions of the chip contain a 10-year battery as well.

sector - an invisible magnetic portion of a disk track that aligns with sectors on all other tracks in order to take the shape of a wedge of pie. A standard sector on an IBM-compatible drive contains a sector header and 512 bytes of data. The header contains the track, head, and sector numbers. Both header and data areas also contain a numeric code used for error checking. The track is divided into sectors in order to simplify error checking and to reduce the amount of track data that will be lost if a bad or magnetically weak spot on the track causes data to be written or read erroneously. A 5.25-inch floppy diskette usually contains 9 sectors per track. A standard AT-compatible hard disk contains 17 sectors per track, though more modern hard disks can contain 26 to 35. Also see track.

sector not found - an error that occurs when the computer commands the disk controller to read or write data in a specific sector, but upon checking the sector headers around the track, the controller was unable to find a match for the requested sector number. This can happen because the sector header is unreadable as a result of misalignment of the head or some other malfunction in the disk drive.

seek - the action in a disk drive of the head assembly being positioned to a specific track on the disk surface. Seek time is the slowest of all critical high-speed I/O activities in the computer.

Setup - a special program that users must run to configure the CMOS RAM in IBM AT compatible computers in order to identify the memory size and allocation, type and number of floppy and hard drives installed, type of video adapter installed, and current time and date.

signal to noise ratio - the ratio in an electronic circuit of the energy level of valid data information (the signal) to the energy level of unwanted interference (the noise). A low ratio means the electronic circuit cannot reliably distinguish between the data and the noise, and will deliver erroneous data as a result. Also see noise and data.

slot - see expansion slot.

software - intangible components of a computer consisting of the instructions telling the computer what to do and the data that the computer must process. The most common form of software is a computer program. Also see computer and hardware.

static - the build up of electrical charge in one's clothing or body by walking across a carpet, such as on a dry winter day. The discharge of the static electricity can damage delicate electronic circuits.

technician - relating to computers, a person who is trained in the technology of maintaining, troubleshooting, and repairing complex electronic or mechanical devices.

technology - science applied to the practical solution of everyday problems.

throughput - the overall rate at which large volumes of data can pass through the system, from the computer's memory to the hard disk, for example.

actuator - a mechanism inside a disk drive that holds the read/write heads, presses (or loads) them toward the disk surface, and moves them above the surface of the disk toward and away from the drive spindle.

toggle switch - a mechanical devices with two positions that routes electricity to the path determined by the current position.

track - a normally circular path on the surface of a magnetic diskette onto which data is written (recorded), or from which data is read, while the read/write head is positioned on the track. A track is created by the low level disk formatting process in which the format program causes the drive to write a track header and a number of sectors (see sector) onto the surface of the disk as it spins. An index hole that has been punched through a non-data area of the disk identifies the start of the track. The track header contains the track and head number, as well as an error checking code and information to identify whether the track is bad and cannot reliably store data. Depending on the capacity, floppy diskettes have 35, 40, 80, or more

concentric tracks on one surface. Standard diskettes have 48, 96, or 135 tracks per inch. Hard disks can have more than a thousand tracks. Also see spiral track and sector.

track-per-inch - a rating of the density of tracks on a floppy diskette; used to identify the quality and data capacity of the diskette.

troubleshooting - trying to identify the cause of a failure or problem in a computer circuit. This is usually the main job of a technician.

utilities - somewhat small, helpful computer programs such as disk formatters, simple text editors, and so on. These are not major application programs such as data base managers, word processors, and spreadsheets.

write protect - a mechanism on a floppy diskette that prevents you from inadvertently overwriting good data with inappropriate data; used to protect valuable data from being destroyed. A 5.25-inch diskette has a square notch cut in the side to allow writing; you must put a piece of tape over the notch to write-protect the disk. A 3.5-inch diskette has a sliding write-protect tab built into it near one of the corners.

write - to deposit data into memory or onto the surface of a disk

XT - a computer invented in 1982 by IBM based on the Intel 8088 microprocessor and having 7 expansion slots and a 10-Megabyte hard disk.

Document # MAN-KS2-110290B
Part Number 01002-02

Landmark Research International Corporation
703 Grand Central Street
Clearwater, FL 34616
Corporate Headquarters Phone (813) 443-1331
Sales / Technical Support Phone (800) 683-6696
FAX (813) 443-6603

Document # MAN-KICKSTART2-070890A

Landmark Research International Corporation
703 Grand Central Street
Clearwater, Florida 34616
Phone (813) 443-1331
Fax (813) 443-6603