



*Personal Computer
Training Reference
Library*

PC^{jr}
Service
Training

LIMITED WARRANTY

The International Business Machines Corporation warrants this IBM Personal Computer Product to be in good working order for a period of one year from the date of purchase from IBM or an authorized IBM Personal Computer dealer. Should this Product fail to be in good working order at any time during this one-year warranty period, IBM will, at its option, repair or replace this Product at no additional charge except as set forth below. Repair parts and replacement Products will be furnished on an exchange basis and will be either reconditioned or new. All replaced parts and Products will become the property of IBM. This limited warranty does not include service to repair damage to the Product resulting from accident, disaster, misuse, abuse, or non-IBM modification of the Product.

Limited Warranty service may be obtained by delivering the Product during the one-year warranty period to an authorized IBM Personal Computer dealer or IBM Service Center and providing proof of purchase date. If this Product is delivered by mail, you agree to insure the Product or assume the risk of loss or damage in transit, to prepay shipping charges to the warranty service location and to use the original shipping container or equivalent. Contact an authorized IBM Personal Computer dealer or write to IBM Personal Computer, Sales and Service Training, P.O. Box 1328, Boca Raton, Florida 33432, for further information.

ALL EXPRESSED AND IMPLIED WARRANTIES FOR THIS PRODUCT INCLUDING THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED IN DURATION TO A PERIOD OF ONE-YEAR FROM THE DATE OF PURCHASE, AND NO WARRANTIES, WHETHER EXPRESSED OR IMPLIED, WILL APPLY AFTER THIS PERIOD. SOME STATES DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS, SO THE ABOVE LIMITATIONS MAY NOT APPLY TO YOU.

IF THIS PRODUCT IS NOT IN GOOD WORKING ORDER AS WARRANTED ABOVE, YOUR SOLE REMEDY SHALL BE REPAIR OR REPLACEMENT AS PROVIDED ABOVE. IN NO EVENT WILL IBM BE LIABLE TO YOU FOR ANY DAMAGES, INCLUDING LOST PROFITS, LOST SAVINGS OR OTHER INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OF OR INABILITY TO USE SUCH PRODUCT, EVEN IF IBM OR AN AUTHORIZED IBM PERSONAL COMPUTER DEALER HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES, OR FOR ANY CLAIM BY ANY OTHER PARTY.

SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES FOR CONSUMER PRODUCTS, SO THE ABOVE LIMITATIONS OR EXCLUSIONS MAY NOT APPLY TO YOU.

THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH MAY VARY FROM STATE TO STATE.



*Personal Computer
Training Reference
Library*

A Guide to PCjr Service Training

**FEDERAL COMMUNICATIONS COMMISSION
RADIO FREQUENCY INTERFERENCE STATEMENT**

Warning: This equipment has been certified to comply with the limits for a Class B computing device, pursuant to Subpart J of Part 15 of FCC rules. Only peripherals (computer input/output devices, terminals, printers, etc.) certified to comply with Class B limits may be attached to this computer. Operation with non-certified peripherals is likely to result in interference to radio and TV reception.

Notice: As sold by the manufacturer, the Prototype card does not require certification under the FCC's rules for Class B devices. The user is responsible for any interference to radio or TV reception which may be caused by a user-modified prototype card.

First Edition (October 1983)

Changes may be made periodically to the information herein.

References in this publication to IBM products, programs, or services do not imply that IBM intends to make these available in all countries in which IBM operates. Any reference to an IBM program product in this publication is not intended to state or imply that only IBM's program product may be used. Any functionally equivalent program may be used instead.

Immediate concerns should be communicated through the Dealer Support Center.

Requests for IBM products should be made through your dealership, your IBM representative, your Program Manager, or the IBM branch office serving your locality.

Forms for students' comments are provided at the back of this publication. IBM may use or distribute any of the information you supply in any way it believes appropriate without incurring any obligation to you.

Introduction

Welcome to IBM PCjr Service Training! This guide is designed to train you, the service technician, to isolate and repair the IBM PCjr to the Field Replaceable Unit (FRU) level.

This guide is intended for use within your service location only. Distribution of this guide to any person other than authorized personnel violates IBM copyrights.

This guide is divided into five sections. Topics included are:

- An overview of the IBM PCjr
- How to use the customer and service documentation
- How to locate and identify all Customer Replaceable Units (CRUs) and Field Replaceable Units (FRUs) in the IBM PCjr
- An overview of the IBM PCjr diagnostics
- How to run and interpret Customer-Level and Service-Level Diagnostics
- How to help customers interpret Customer-Level Diagnostics
- How to diagnose IBM PCjr to the failing FRU level

Prior to reading this guide, you may wish to review other components of the "PCjr Sales/Service Training" package, particularly the Sales Training Videotape and the Sales Training Diskette to get acquainted with the IBM PCjr, its options, and related product information.

Materials Needed:

- An IBM PCjr Enhanced System
- *Guide to Operations* manual
- *Hardware Maintenance and Service* manual
- A screwdriver
- Service plug, POST-loop plug, serial wrap plug, and parallel wrap plug

Contents

Overview of the IBM PCjr	1
IBM PCjr Hardware	1
IBM PCjr Options	5
Hookup Checklist: A Quiz	8
Locating the IBM PCjr Field Replaceable Units	9
Locations for Measuring Voltages	12
Continuity Testing	15
Overview of IBM PCjr Diagnostics	17
Customer-Level Diagnostics	19
Customer Diagnostics	20
Overview	20
Keyboard Problem	22
64KB Memory and Display Expansion Problem	23
Service-Level Diagnostics	25
Resolution to the Keyboard Problem	26
Resolution to the 64KB Memory and Display Expansion Problem	28
Appendix: Answers to Hookup Checklist Quiz	31

Overview of the IBM PCjr

IBM PCjr Hardware

The IBM PCjr is an addition to the IBM Personal Computer Family. It is designed to be a versatile, user friendly, convenient, and affordable entry system. Two models of the IBM PCjr are available: the Entry System and the Enhanced System.

The IBM PCjr Entry System hardware includes the system unit, the cordless keyboard, and a small, desk-top transformer (see Figure 1). The keyboard is powered either by internal batteries in the cordless mode or by the system unit through an optional cord. The transformer simply plugs into a rear-mounted jack on the system unit.

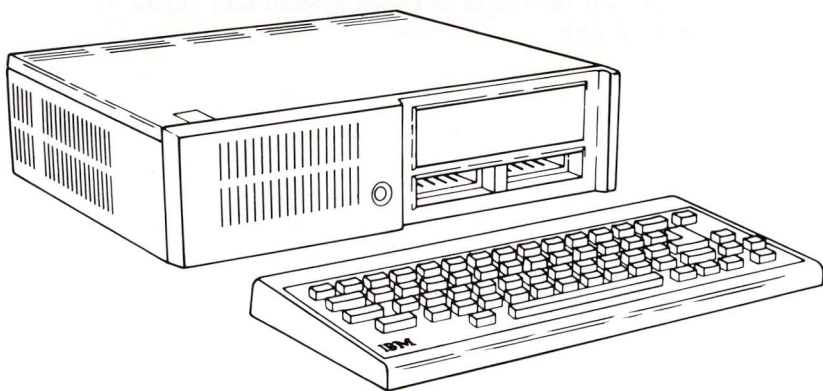


Figure 1. BASE SYSTEM.

The IBM PCjr uses the Intel 8088 microprocessor. This allows customers to handle applications quickly and easily. The IBM PCjr has 64KB of Read Only Memory (ROM). This includes the Power-On Self-Test (POST), the cassette BASIC interpreter, the cassette operating system, user-selectable diagnostic routines as well as the keyboard learning program called "Keyboard Adventure."

The IBM PCjr also has 64KB of Random Access Memory (RAM), an audio alarm, and an audio sound generator. The audio sound generator requires an external amplifier and speaker. This gives the IBM PCjr music capability.

Two cartridge slots allow the use of cartridge-based applications, as well as Cartridge BASIC. Memory expansion and internal modem options are also available, and can be added at any time to the system board.

The IBM PCjr features a low-profile, 62-key detachable keyboard with all the functions offered by the 83-key model (see Figure 2). In the cordless mode, the 62-key keyboard interfaces with the system unit via an infra-red optical link.

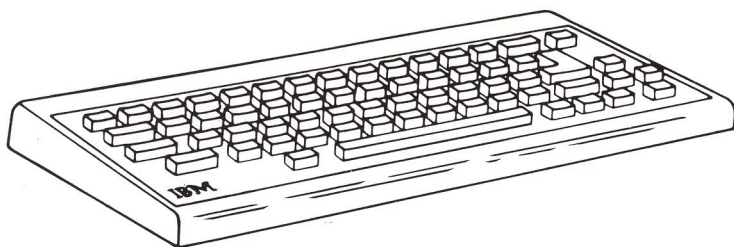


Figure 2. CORDLESS KEYBOARD.

The customer has full, cordless control over the system unit as long as the keyboard is within 20 feet of and in front of the IBM PCjr system unit. The optional cable is 6 feet long and it eliminates any interference that may be experienced when multiple systems are being operated in the vicinity. Figure 3 shows the IBM PCjr Entry System model with the optional cable.

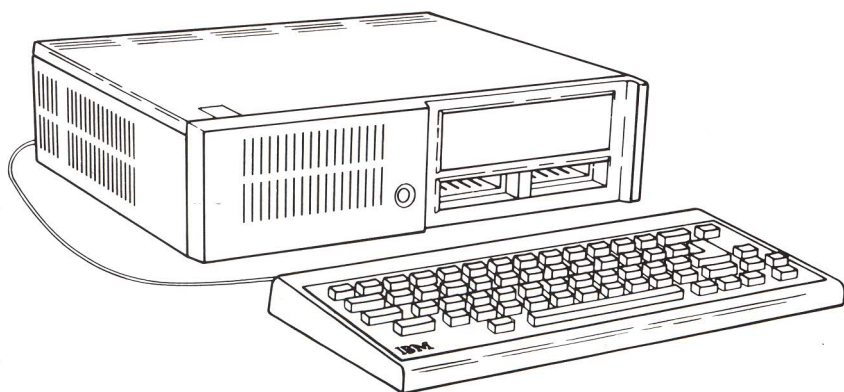


Figure 3. BASE SYSTEM WITH OPTIONAL CORD.

The IBM PCjr Enhanced System (see Figure 4) consists of the Entry System with two additional options. These two options are the diskette drive and the 64KB memory and display expansion. The system unit may be purchased with these options already installed. If these options are added anytime after the initial purchase,* they are user-installed.

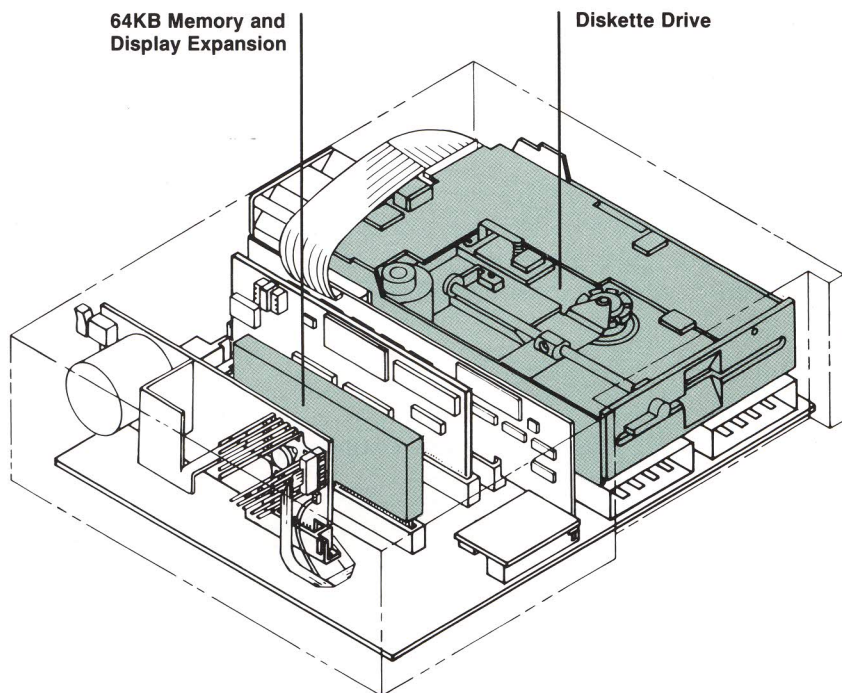


Figure 4. ENHANCED SYSTEM.

IBM PCjr Options

In addition to the diskette drive and the 64KB memory and display expansion, there are several other options that can be added to the IBM PCjr.

The attachable joysticks provide enjoyment for the IBM PCjr game player. A switch on the joystick enables the user to alternate between two modes of operation—"Spring Return" and "Free Float."

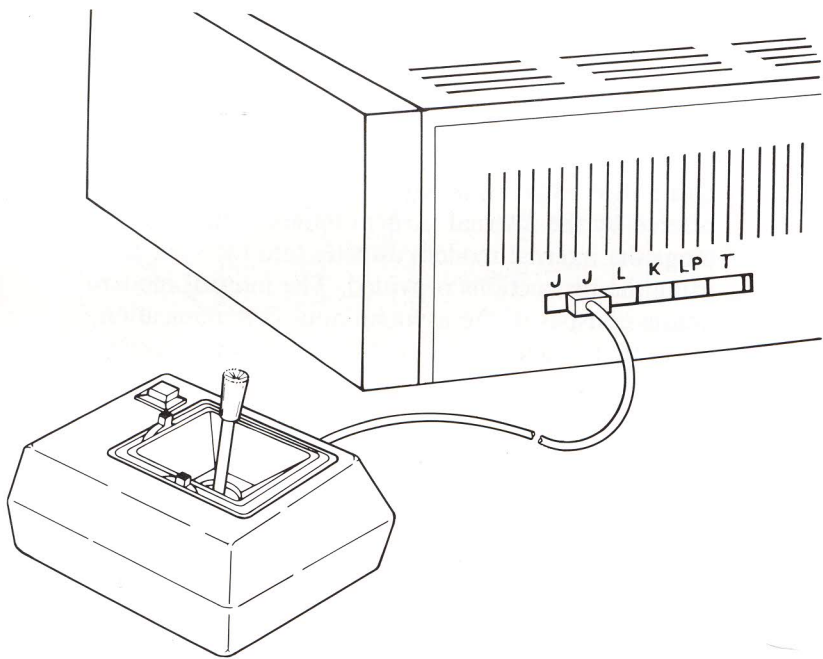


Figure 5. ATTACHABLE JOYSTICK.

A printer is another likely option for the IBM PCjr user. Once the parallel printer attachment card is added to the side of the system unit, the IBM graphics printer or other parallel printers can be directly attached.

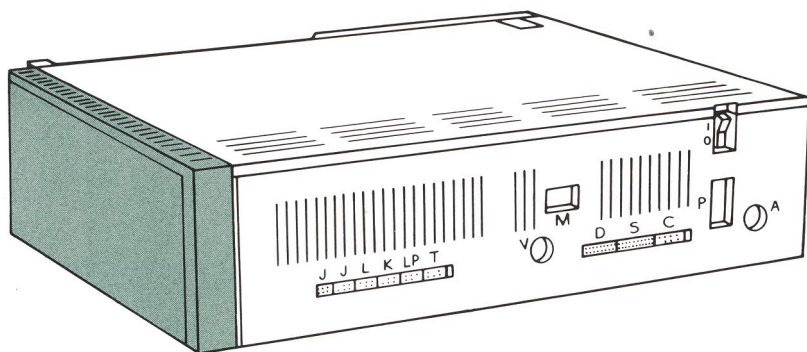


Figure 6. PARALLEL PRINTER ATTACHMENT.

Some IBM PCjr users will want the added capability offered by the internal modem option. The customer plugs the internal modem directly into the system board, using the instructions provided. The internal modem option consists of the asynchronous communication element. It features auto dial, auto or manual answer, and auto or manual originate. It is programmable via ASCII characters, and it offers a 300-bits-per-second data rate. Error detection and diagnostics are also included.

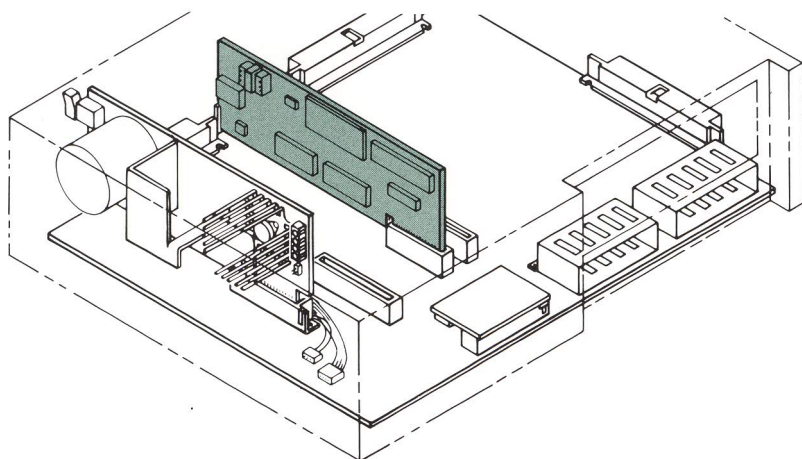


Figure 7. SYSTEM UNIT WITH INTERNAL MODEM CARD INSTALLED.

Connections for each of the available IBM PCjr options are located on the back of the system unit (see Figure 8). These options simply plug in, and reconfiguring the system is not necessary. Some options include cabling; others require a cable or adapter. More will be said about the options later in this guide.

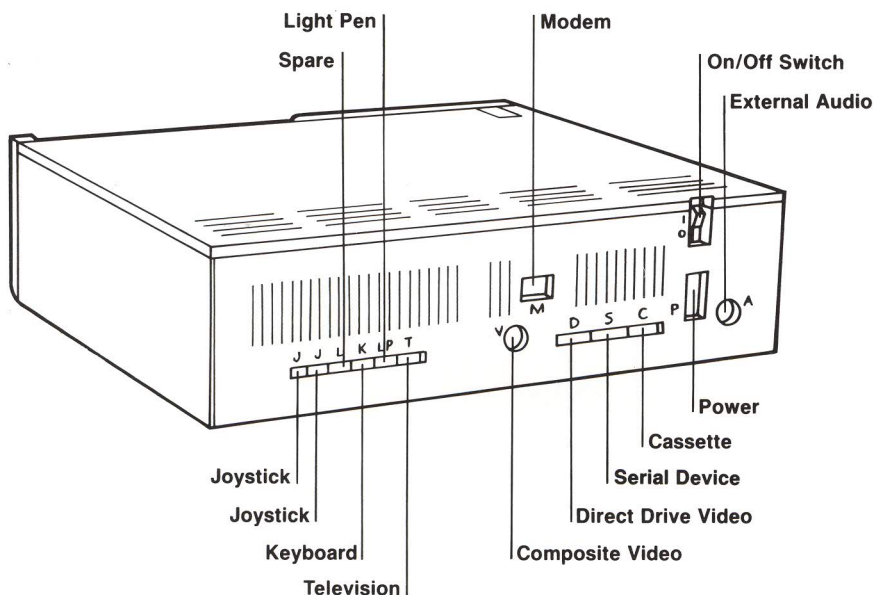
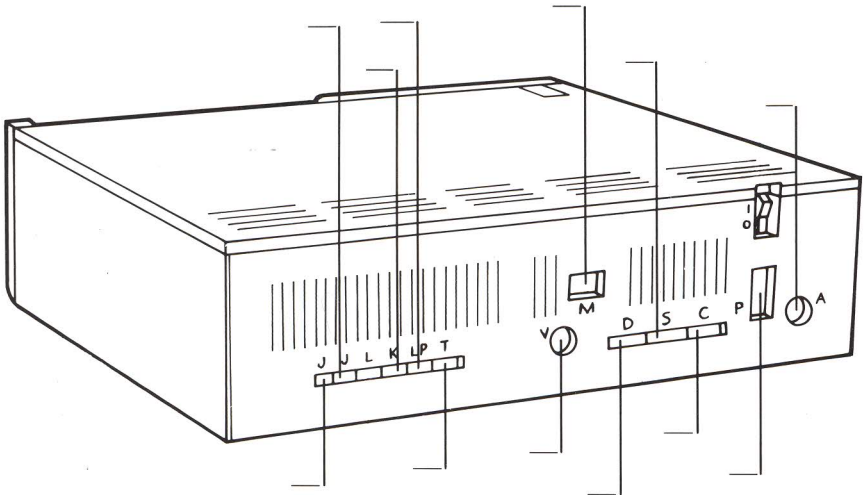


Figure 8. REAR OF SYSTEM UNIT WITH CABLE CONNECTIONS.

Hookup Checklist: A Quiz

Study Figure 8 on the preceding page until you are quite familiar with the locations of all the IBM PCjr hookups. Now, without referring back to the figure, test your memory to see how many cables you can install correctly. All you have to do is insert the number corresponding to each cable in its proper space on the figure below. Check your answers in the Appendix.



1. joystick
2. light pen
3. keyboard
4. connector for TV
5. internal modem
6. system power unit
7. external audio
8. direct drive (graphics) display
9. composite display
10. cassette recorder
11. joystick
12. serial device

Locating the IBM PCjr Field Replaceable Units

In this section you will be directed to step through the *IBM PCjr Hardware Maintenance and Service* (HMS) manual in a particular sequence to become familiar with Field Replaceable Unit (FRU) locations and removal procedures.

Surprisingly, an entry-level IBM PCjr contains only *three* FRUs. What's more, you don't need tools to get to most of them, although you should use a screwdriver to remove the cover of the system unit.

Please note that whenever you are required to remove the IBM PCjr's top cover, your first step is to "Set the system unit's power switch to Off."

We cannot overemphasize the importance of this step. It reduces your chances of receiving an electrical shock.

Notice we said "reduces" your chances. You can reduce the risk of electrical shock even further if you remove your rings, watches, bracelets, and other jewelry before starting to work around the IBM PCjr with the power on.

In the HMS, the Table of Contents shows that Locations are covered in Section 5. Turn to Section 5 and find "System Unit, Internal."

Once you are familiar with the locations, you are ready to take a look at the removal procedures.

Removal procedures are found in Section 4 of the HMS. Find the procedure titled "System Board Removal 120." (The 120 is simply a procedure designator to make referencing easier.)

At this time you need an IBM PCjr system unit so you can follow the procedures as shown in the HMS. Follow along in the HMS as directed to determine the location of all the FRUs. It is not necessary at this time to remove all the units, but you should become familiar with their locations and what is required to remove them.

Because the IBM PCjr has so few parts, the entire set of procedures takes very little time.

You see that the first step is "Set the system unit's power switch to Off." Follow the instructions down to step 4.

Step 4 tells you to remove the parallel printer attachment, if present. Next the number 900, designating procedure 900, can be found in Section 4. Put a bookmark in procedure 120 and turn to procedure 900. (A convenient way to mark your spot is to open the rings of the binder and remove the page from two of the three rings. The now off-set page clearly marks your place.)

You've already performed step 1 of procedure 900 for removing the parallel printer attachment. (You probably have done step 2, also.) The two locating/holding plastic studs hold the cover firmly in place. You may want to pry the cover off. To do so, just insert a screwdriver near the studs. Finish the removal procedure and then return to procedure 120, step 5.

The next procedure is "System Unit Top Cover Removal 100." Step 1 is done; go ahead and perform steps 2 through 4. When finished, go back to procedure 120, step 6.

(By now you have noticed the first digit of the procedure number corresponds to the first digit of the three-digit part of the page number. Another item worth noting is that each of the procedures is written as a stand-alone set of instructions.)

From here you are directed to procedure 200, "64KB Memory and Display Expansion Removal." Procedure 200 already has steps 1 and 2 done, so all you have to do is remove the 64KB memory and display expansion. Let's go to procedure 120, step 7. This is procedure 830, "Internal Modem Removal." Steps 1 and 2 are completed, so do steps 3 and 4 and then return to procedure 120, step 8. It's not necessary to do procedure 660 if you have an Enhanced IBM PCjr. Continue with procedure 120, step 9, which directs you to procedure 600, "Diskette-Drive Adapter Removal."

Steps 1 and 2 have already been done. Follow the instructions for steps 3 and 4 and return to procedure 120, step 10.

Procedure 120, step 10 directs you to "Diskette Drive Removal," procedure 610. Steps 1 through 5 are already completed, so do steps 6 and 7. If you're concerned about lifting the diskette drive out, an easy way is to turn the unit over and push the studs from the bottom (step 8). Complete steps 9 through 11 and return to procedure 120, step 11.

Procedure 120, step 11 sends you to procedure 020 "Power." You have already done steps 1 through 4. Step 5 is important because the power board could be *very warm* to touch. Let's finish procedure 020 and return to procedure 120, step 12. Step 12 sends you to procedure 300, "Infra-Red Receiver Removal."

Steps 1 and 2 are done, and the infra-red receiver doesn't have any cables to unplug. So just perform step 3 and return to procedure 120, step 13.

This is the first time a tool is called for. You will need a small screwdriver to get the screws out. Note that the screw to be removed in step 14 is smaller than the other four. Step 15 completes the procedure.

The system board is now removed. The "System Board Replacement" procedure is procedure 125.

Locations for Measuring Voltages

We turn next to the Problem Isolation Charts (PICs) and look at the locations you will need to know for measuring voltages.

Remove the top cover from the IBM PCjr.

The power board supplies power to the diskette drive from two plugs. One of the plugs supplies power to the diskette drive, and the other supplies power to the cooling fan attached to the diskette drive.

Figure 9, from HMS Section 3, "Power," shows the location of the diskette-drive power plug as well as the pin designations and their proper voltages.

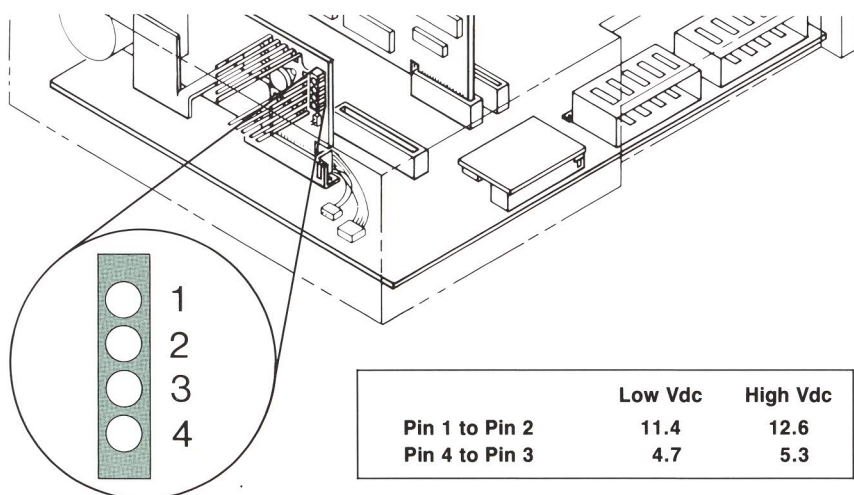


Figure 9. POWER PLUG FOR DISKETTE DRIVE.

Figure 10, from HMS Section 3, "Power," shows the location of the plug that supplies power to the diskette-drive cooling fan. Both plugs are rather close to the side wall of the base of the system unit, so you should exercise caution when measuring voltages on those plugs. You should remove your rings, watches, bracelets, and other jewelry when working around the IBM PCjr with power on.

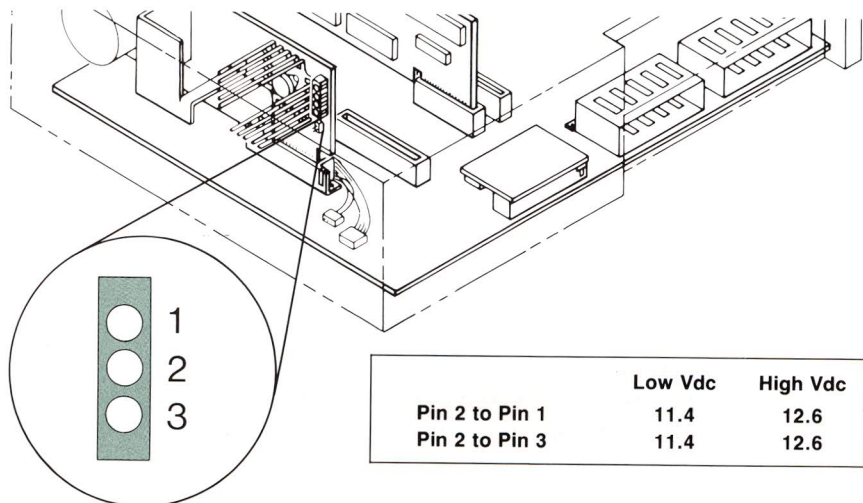


Figure 10. DISKETTE DRIVE FAN POWER PLUG.

This is a good time to point out where power is supplied to the power board. In Figure 11, from HMS Section 3, "Power," you can see the pin designations for the transformer power cable.

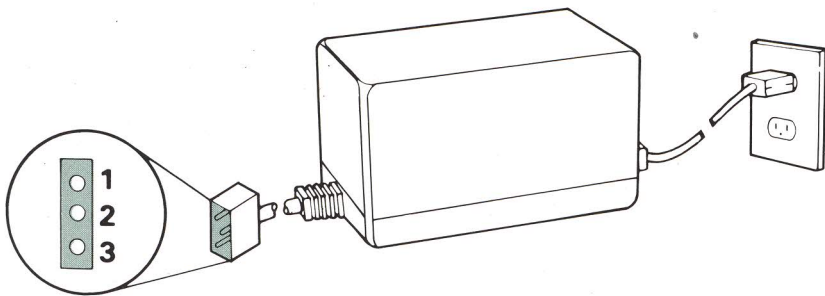


Figure 11. POWER TRANSFORMER CABLE PLUG.

Figure 12, from HMS Section 3, "Display," shows the general layout of the receptacles on the back of the system unit. *All the receptacles follow the same format as the one shown in the figure.* Row A will always be on the top and row B will always be on the bottom (B for bottom). And the columns will always be in numerical order from left to right.

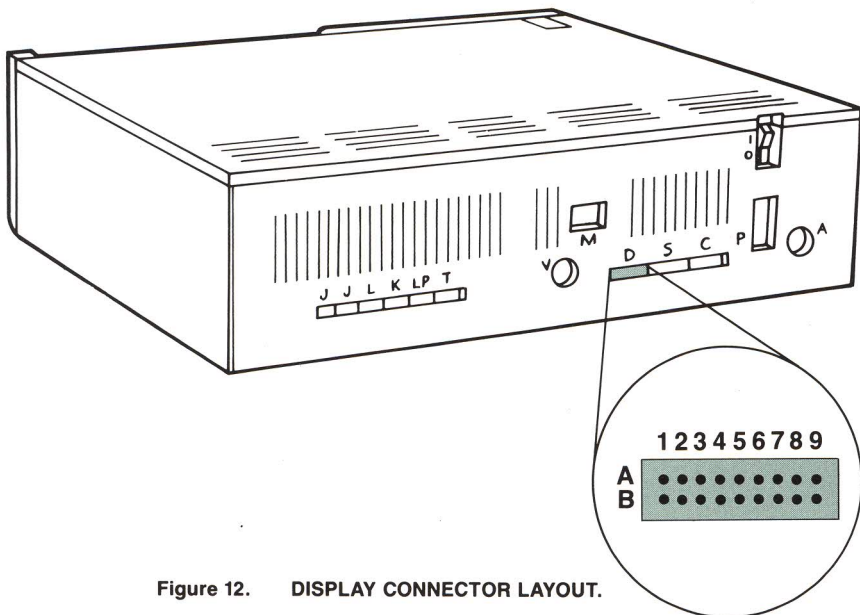


Figure 12. DISPLAY CONNECTOR LAYOUT.

There may be as few as three columns or as many as nine, but the pin numbering always follows the same scheme.

The two phono-style receptacles are designated inside and outside in the HMS. (See HMS Section 3 for an example of how the phono-type plugs are treated.)

Whenever you find it necessary to measure voltages on pins in the receptacles, the HMS clearly specifies the pin designation. The pictures of the receptacles are repeated as often as necessary to help you make accurate measurements.

Continuity Testing

Now that you are familiar with the pin designations, let us continue with continuity testing. You will need to test cable continuity to find out whether a cable is open, and therefore, can be eliminated as the source of a problem.

The specifics on how to perform continuity testing for cables are in the HMS, Section 3.

Notes:

Overview of IBM PCjr Diagnostics

Diagnostics for the IBM PCjr are divided into two categories:

Customer-Level Diagnostics, which customers use to locate malfunctioning Customer Replaceable Units (CRUs), such as System Unit and Keyboard.

Service-Level Diagnostics, which you will use to isolate malfunctions to Field Replacement Units (FRUs), such as Diskette Drive and Internal Modem.

Both types of diagnostics are referred to as Power-On Self-Tests, or POST, for short. Later, you will be given an opportunity to practice using both types.

Briefly, here is how the two types are used: When a customer suspects a problem, he or she performs a "Problem Determination" test. This means that the customer recognizes a problem may exist and determines whether it is a hardware or software problem. Following the Customer-Level Diagnostic procedures, the customer then performs a "Problem Source Identification" test, which identifies the failing Customer Replaceable Unit. The customer then brings the failing CRU to your company for service.

At this point you would perform the Service-Level Diagnostics, starting with the "Problem Isolation" test on the customer-supplied Customer Replaceable Unit. When properly performed, and the results carefully interpreted, this test will enable you to identify the failing Field Replaceable Unit.

Notes:

Customer-Level Diagnostics

Customer-Level Diagnostics are contained in ROM for use by the customer. As such, they are easily performed and interpreted.

Customer-Level Diagnostics are fully described in Section 6, "Testing," of the *Guide to Operations* (GTO). The customer is directed to this section whenever trouble is suspected on the IBM PCjr system.

Customer-Level Diagnostics utilize a letter code that designates what operation is in error, which Customer Replaceable Unit may need service, and what the customer should do to obtain service.

In servicing the IBM PCjr your customers will bring you the suspect Customer Replaceable Units. If they used and interpreted the diagnostics correctly, they performed a "Problem Source Identification" test and identified the failing Customer Replaceable Unit.

To effectively and efficiently service the IBM PCjr you should be prepared to run Customer-Level Diagnostics and interpret the results. It will be helpful if you familiarize yourself with Customer-Level Diagnostics to provide assistance to a customer experiencing difficulty with Problem Source Identification. Remember, many of your customers may never have used a product sophisticated enough to diagnose its own problems.

Customer Diagnostics

The best way to understand customer diagnostics is to look at a problem from the customer's point of view.

To help you do this, the material is presented in three sections:

- Overview
- Keyboard Problem
- 64KB Memory and Display Expansion Problem

The overview reviews the sequence of tests the customer can perform before calling for service. The keyboard and 64KB memory and display expansion problems provide practice in using the GTO to interpret test results.

Remember, you, the service technician, may be called upon to assist a customer in diagnosing a problem, so you will need to become familiar enough with Customer-Level Diagnostics to provide instruction to your customers.

Overview

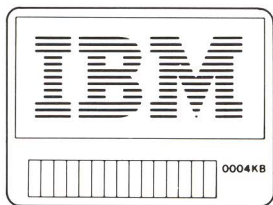
Recall from our earlier discussion that diagnostics are in ROM, and they are called Power-On Self-Tests, or POST. This means that the diagnostics are invoked automatically upon Power On. Of course, the customers can invoke the diagnostics whenever they want. They may even ignore certain failures at will. For instance, if the modem diagnostics fail, they can ignore the failure if they do not plan to use the modem.

Customer-Level Diagnostics can be invoked at any time by pressing Control, Alternate, and Insert simultaneously.

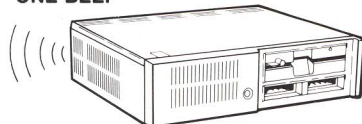
“Keyboard Adventure” is the diagnostic program for the keyboard. It is invoked by using the Esc key when the IBM Personal Computer BASIC Message Screen first appears following the IBM Color Bar Screen.

Failures detected by POST are indicated in any of three ways. The IBM Color Bar Screen will not appear or more than or fewer than the appropriate one beep will be heard from the internal beeper; or the IBM Color Bar Screen will display a single alphabet character in the lower right corner. Below is a graphic illustration of these conditions.

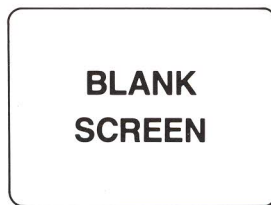
WORKING



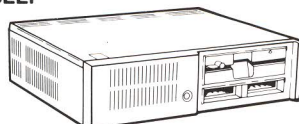
ONE BEEP



PROBLEM



NO BEEP



How should you, as a customer, handle a problem? Let's look into the GTO to find out. A logical place to begin is with Section 6, "Testing." In the introduction we find the directions to start: "First Things First." So read through these pages to see how you, as a customer, can set up your IBM PCjr to run diagnostics.

First the GTO shows you what you should see if your system is operating properly, and then, in step 12, you begin diagnosing the trouble. From there, you, as a customer, are led step by step through a "Yes/No" maintenance analysis procedure, which will lead either to further diagnosis or to a message stating the proper procedure for servicing the IBM PCjr.

To get started, install the first "bug" on the keyboard.

Keyboard Problem

Configure the system either with or without the keyboard cable.

Now place something on the keyboard so that *any* key is being pressed down (your HMS will work just fine. We want to simulate a situation in which a customer has placed something on the keyboard when power is applied to the system). Power the system up with any keyboard key pressed.

Your symptoms will be both audible and visual. The visual symptom will look like this

ERROR
B

with the error indication in the lower right corner of the screen. The audible symptom will be a series of beeps. (This is the same signal that other PCs give off when a key is pressed before the system is ready to accept it.)

Where do you go from here?

Let's suppose there really is a keyboard problem and that you are at step 12 in the GTO when the symptoms appear. Since the expected results do not happen, you are sent to step 21.

Then, via step 22, you are asked to go to step 23, which shows the alphabetic error messages. These would be good pages to mark for future reference, providing the GTO you're reading belongs to you. Then, if a customer should call and ask what a "B" means, you'll be able to quickly identify a keyboard failure and point out the possible causes suggested in the text explaining Error Message B.

To the customer, Error Message B means that the IBM PCjr needs servicing. The path to "Service Information" is in the GTO. Review the contents page for Section 6 at this time.

64KB Memory and Display Expansion Problem

In this section, our objective will be to locate failures in the 64KB memory and display expansion card. Specifically, we will see what happens when the customer powers up and gets no display and two beeps. The GTO, in the section "Getting Started," directs the customer to Section 6, "Testing Your IBM PCjr." Turn there now, and then continue.

Assume that the customer has followed the "First Things First" procedure and has progressed from step 12 to step 21 to steps 24 and 25. Step 25 tells him/her that two beeps indicate that the IBM PCjr needs servicing.

At this point, you might find it useful to perform several operations that customers might mistake for “bugs” on the system. Run Customer-Level POST Diagnostics against the following problems:

1. Diskette diagnostics attempted with a write-protected diskette.
2. Diskette diagnostics attempted with the diskette-drive latch unlatched.
3. A loose display plug on the back of the IBM PCjr.
4. The television RF modulator switched from Game to Antenna.

Simulating these problems should help you to better understand the customer's point of view.

Service-Level Diagnostics

Service Level Diagnostics are for you, the IBM PCjr service technician. As explained earlier, your task of performing a “Problem Isolation” test only begins after the customer has performed a “Problem Source Identification” test. Recall that like Customer-Level Diagnostics, Service-Level Diagnostics are located in ROM. Service-Level Diagnostics, however, are only invoked through use of the “service plugs.”

During the remainder of this Service Training for the IBM PCjr, your reference text will be the *Hardware Maintenance and Service (HMS)* manual. You will also need the following:

1. A working Enhanced IBM PCjr system.
2. An advanced POST diagnostics plug, also called a service plug, Part Number 1503441.
3. An advanced POST diagnostics loop plug, also called the POST-loop plug, Part Number 1503442.
4. A serial wrap plug, Part Number 1503443.
5. A parallel printer attachment wrap plug, also called a parallel wrap plug, Part Number 8529228.

If you don't have the plugs labeled, the numbers can help you identify which is which if you forget. The parallel wrap plug can only fit on the parallel printer attachment. The serial wrap plug is the only eight-pin-wide plug, and it clearly belongs in the eight-pin-wide serial connector.

The service plug and the POST-loop plug are not only similar in looks but also in function. They both provide advanced POST testing capability. The major difference is that the POST-loop plug will reinvoked the called diagnostic until a failure is detected. At that point, the system will “hang” until you intervene, allowing you to test for intermittent problems. You can set the unit aside and loop the diagnostics while you go on to other things: the detected failure will still be there when you return.

Service-Level Diagnostics are fully described in the HMS, where they are called advanced POST. Step 7 in HMS Section 2, “Introduction to Diagnostics,” represents the single most significant difference between the Customer-Level POST Diagnostics and the Service-Level Advanced POST Diagnostics. The actual testing is the same, but with the service plug installed, the error messages are more detailed.

Service-Level Diagnostics utilize a four-digit number code that appears whenever an error is detected. The error, and directions for correcting it, are given in a four-part Advanced POST Error Table, which is located in HMS Section 3. From the Advanced POST Error Table, you are directed to the Problem Isolation Charts (PICs), which directly follow the Error Table. The PICs will enable you to isolate the failing FRU.

Resolution to the Keyboard Problem

Remember the keyboard problems left unresolved in the previous section on Customer Diagnostics? Well, here are solutions. For the first problem—the one in which the keyboard has a heavy object on it—simply run the advanced POST diagnostics against it. First run the advanced POST diagnostics against the known-good IBM PCjr. Directions for how to do it are in the HMS, Section 2. If everything is fine, the BASIC screen will be displayed. This will be helpful to prove that there are no other undiscovered problems which might lead to confusion.

Now that we know the IBM PCjr is working, let's begin diagnosing "bugs."

Set the system unit's power switch to Off and press any key on the keyboard. Now power it up while holding the key down. Note the four-digit error on the IBM Color Bar Screen. Before you go further, note the four digits and try another key. This time just tap one (a different one) while the diagnostics are running. Another four-digit error. The first two digits are the same, the last two are different.

Both times, the first two digits are 22 and the last two digits are scan codes for the individual keyboard keys. You can look at other scan codes if you want to take the time. If the BASIC screen appears, it is possible you didn't have the service plug installed. As a matter of fact, you might want to remove the service plug in order to see what the customer saw.

If a problem is detected in advanced POST diagnostics, the IBM PCjr "freezes up" when detecting the error, whether the service plug or the POST-loop plug is installed. Try it.

But what are you going to do with this wealth of symptoms? Turn to HMS Section 3, "Problem Isolation Charts, Start." (Notice, by the way, that even here you are reminded of the proper diagnostic procedure to perform the advanced POST.) "Start" sends you directly to the Advanced POST Error Table. Scan the first column, POST Error, until you find the right error code.

Error 22XX in the Error Table describes our error code. The "Problem Area" column tells us which FRU is suspect. And, the "What to Do" column instructs you on the action to take. Here, the keyboard is clearly the failure, and we do not have to go any further (other than to remove the object from the keyboard, of course).

By the way, you should know that interference problems may occur when more than one IBM PCjr with infra-red keyboards is operating in a room at the same time. If more than one is necessary, then all others should be connected by the optional cable.

Resolution to the 64KB Memory and Display Expansion Problem

The next "bug" was created by floating (putting tape on) *pin A01 of the 64KB memory and display expansion card*. Recall that the second problem left unresolved in the last section was the one where we had no display and two beeps. As always, you will start with HMS Section 2, "How to Perform Advanced POST."

While running advanced POST, your visual symptom is the usual, no display on the screen. But your audio symptom is three beeps. And the Advanced POST Error Table in Section 3 shows that the 64KB memory and display expansion circuit is the only failing FRU to produce a three-beep symptom. Since there was a piece of tape on a pin on the card, the recommended action is to get another card.

A "bug" that is closely related to the one just described was designed by floating pin B01 on the same card. This results in a "bug" that neither beeps nor has anything on the display. Your advanced POST diagnostics will fail with the same symptoms. Find the POST Error "No beep. No image or image on screen wrong" in the Error Table. It shows Power as the problem area. We all know that the bug is on the 64KB memory and display expansion card. As instructed, go to HMS Section 3 procedure 020, "Power," and follow the instructions.

If we follow the Problem Isolation Chart (PIC) labeled "Power," we see that it asks for the missing beep. The PICs tell you to replace the 64KB memory and display expansion card.

Now, let's try another approach. Go back to the Error Table and look at the next symptom, "one beep." The Error Table tells you to go to the Display PIC and gives you the page location.

The PIC first looks for random symbols and then sends us to a page that asks about the type of display we have. Eventually, the HMS will direct you to the problem by sending you back to the Power PIC.

Next, we turn to some "bugs" that occur in different FRUs. One of these is found on the diskette-drive adapter card, pin B02.

The customer saw Error Message H on the IBM Color Bar Screen. This message instructs the customer to have the IBM PCjr serviced, if he wants to use the diskette drive.

So now you've been handed another servicing job. You run the advanced POST diagnostics with the service plug installed and get Error 2603. That sends you to the Advanced POST Error Table, part 4, where you find that replacing the diskette-drive adapter is the first thing to do to fix the error.

To simulate an actual diskette-drive failure, mentally unplug the write cable on the diskette drive itself. (The write cable is located on top of the drive at the front of the unit.)

This will cause the customer to report that he is unable to write on the diskettes. Customer POST tests run successfully, and he is directed to run the IBM PCjr Test Tag 1. This fails with a "C" code, indicating either that a write-protected diskette has been installed or that the IBM PCjr needs servicing.

Your advanced POST diagnostics do not fail. Since the customer's complaint was registered against the diskette drive, you are directed to go to the PIC for the area you want to test (diskette drive) and run the menu-driven diagnostic. It fails with an 0503 message.

Following the procedure, you find an error table, which directs you to the next page. Notice the strategy now. The procedure has you try another diskette. (That's easiest.) Next, it has you check the continuity of the power cable and the signal cable, then swap the diskette-drive adapter card, and then it has you swap the diskette-drive itself. It makes sense, because all those items have to come out anyway before the diskette-drive can be removed.

Simply replacing the diskette drive solves the problem, because the write cable is part of the diskette drive FRU.

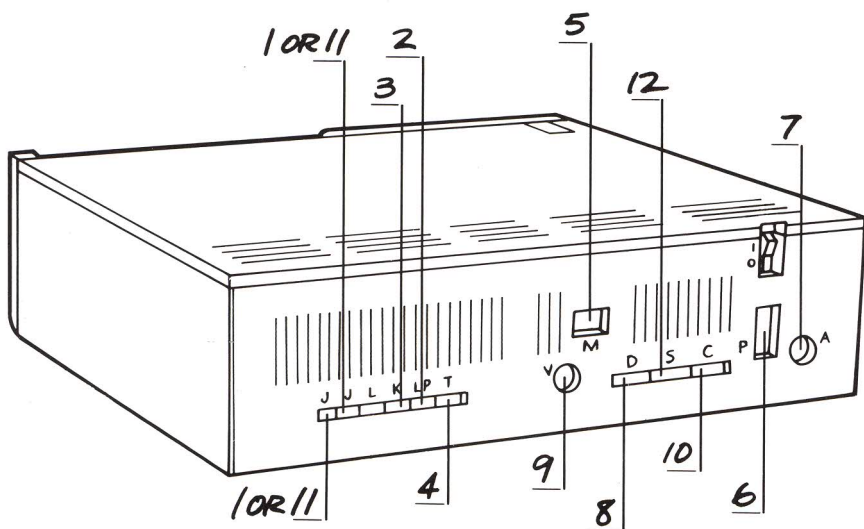
A modem "bug," designed by floating pin A13, caused the customer to get POST Error E, which suggests the modem. When you run advanced POST your error code is 2412. From part 4 of the Advanced POST Error Table you know that the modem is the suspect FRU.

The final "bug," developed for the parallel print adapter, was the toughest to create, because the circuit card had to be removed from the housing. An alligator clip was used to short a couple of data lines together. With that, none of the devices plugged into the parallel port would work.

Of course, you start in HMS Section 3, "Parallel Printer Attachment." The diagnostics produce a failure, but here there is no concern about the failure code. Anything but a successful run will suggest that the parallel print adapter be swapped.

Congratulations. You have now completed the IBM PCjr Service Training Guide.

Appendix: Answers to Hookup Checklist Quiz



Date: _____

1502223

IBM PCjr SALES/SERVICE TRAINING PACKAGE

Your evaluation of this training package by answering this optional questionnaire will help us improve the training you receive in the future—and, in return, help you to increase your sales.

After answering the question, please mail this form back to us at your earliest convenience.
Thank you.

1. Place a check mark next to each Training component you *completed*.

ALL COMPONENTS _____ TRAINING GUIDE _____ SALES CAI _____

VIDEOTAPE _____ SERVICE TRAINING _____ SALES GAME _____

2. How much *time* did you spend on each of the Training components? Please write in the amount of time for each component (in minutes).

ALL COMPONENTS _____ TRAINING GUIDE _____ SALES CAI _____

VIDEOTAPE _____ SERVICE TRAINING _____ SALES GAME _____

3. How do you feel about the amount of *time* needed to do this Training? Check the statement that best expresses your feelings.

_____ Appropriate for the product _____ Too long for the product

_____ Too brief for the product

4. As a salesperson, which of the *sales* components were most helpful to you?
Explain your choices.

5. Evaluate this training package by circling the appropriate "X" for each of the qualities below:

	EXCELLENT	VERY GOOD	GOOD	FAIR	POOR
EDUCATIONAL VALUE	X	X	X	X	X
PRACTICAL USEFULNESS	X	X	X	X	X
EASE OF USE	X	X	X	X	X
CLARITY	X	X	X	X	X

6. Do you have additional *comments or suggestions* about this training?

THANK YOU FOR PARTICIPATING IN THE EVALUATION OF THIS TRAINING. IF YOU
CARE TO, PLEASE INCLUDE THE FOLLOWING INFORMATION.

NAME _____ JOB TITLE _____

STORE NAME _____ STORE ADDRESS _____

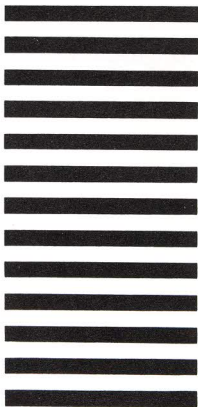
Tape

Please do not staple

Tape

Cut Along Line

Fold here



International Business Machines Corporation
Entry Systems Division, Dept. 8U1
P.O. Box 1328
Boca Raton, Florida 33432

POSTAGE WILL BE PAID BY ADDRESSEE

BUSINESS REPLY MAIL
FIRST CLASS PERMIT NO. 321 BOCA RATON, FL 33432

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES





International Business Machines Corporation

P.O. Box 1328

Boca Raton, Florida 33432

1502223

Printed in United States of America