# SoundExpression

user guide

Before You Begin your Installation

The product you have purchased is designed to be easily installed into most IBM PC or compatible systems. Many products have large, easy-to-read legends to allow for the easy configuring of the product. This installation manual contains detailed instructions. Most included software has automatic installation programs to pla the software correctly onto your computer. However, as all computers are configured differently, you may be required to perform some basic DOS or Windows tasks. If you are not familiar with basic DOS commands such as DIR, CD, or EDIT, you should check your DOS manual, or seek assistance from you local computer dealer to install the product.

How to get Technical Assistance
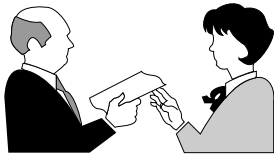
The dealer that you purchased this product or your computer from is the first place you should go for technical assistance. The dealer is usually the most qualified source of help, and is most familiar with your system and how this product should be installed. Many dealers have customer service and technical support programs, with varying levels of support offered, depending on your needs and computer knowledge. ***Please contact the dealer first whenever a problem occurs.***

If your Dealer Can't Assist you
If you can't get assistance from your dealer, the manufacturer provides varying levels of technical assistance as summarized on the following page.

Technical Support
407-241-8088

Technical Support Fax
407-997-0918

Boca BBS
407-241-1601

Automated *Fax Retrieval System*
407-995-9456

Priority Service
900-555-4900
($2 per minute)

On-Line Support!
CompuServe: **GO BOCA**
Internet:
   email: **support@boca.org**
   on the World-wide WEB:
   http://www.boca.org

The Standard Free Technical Support number is for quick answers to specific inquiries on product features and technical questions (call **407-241-8088**; M-F, 8 am to 6:30 pm EST). Direct access to technical support representatives is provided on a limited basis.

If you require immediate attention or in-depth help with the installation of the product, please call our 900-priority support number for service. This number gives you immediate access to senior-level technicians. The number is **900-555-4900**. You will be charged $2.00 per minute. The charges will appear on your next phone bill.

Damaged or Missing Items

We use many world-class quality assurance programs to ensure the product you purchased is of the highest caliber. Sometimes, however, a component may be missing from the box, or is damaged or corrupt in some way. If this happens, immediately return the entire package to your place of purchase so you may exchange it for a new one. Your dealer should be able to provide you with an exchange far more quickly than by contacting us directly. If for some reason you are unable to return the product directly to its place of purchase, refer to the "Servicing Your Product" and "Warranty" sections in this manual for instructions.

Contents

Using The SoundExpression Installation and User Guide

This manual provides installation and operating instructions for this product. The manual assumes you have basic computer skills and are familiar with personal computers. Its primary purpose is to provide physical installation instructions, instructions for configuring the board, and basic troubleshooting.

Our customer support experience has shown that many costly and time-consuming calls to technical support staff can be avoided with closer attention to the information provided here. **In addition to following the instructions provided in this manual, you will also need to consult the documentation supplied with your communications software to make use of the card's modem functions. For Windows sound applications, refer to the documentation for your sound applications.**

How This Manual is Organized

Section One: Introduction. An overview of the features of the SoundExpression, along with system requirements.

Section Two: Installing Your New SoundExpression. This section provides a diagram of the SoundExpression board, instructions on how to insert the board into your system, as well as how to make all connections to other devices.

Section Three: Modem Functions and Features. Describes modem features and provides procedures for testing the modem's connection.

Section Four: Troubleshooting. Provides solutions to common problems for both sound and modem functions.

Appendices. These include technical specifications, configuration settings, microphone and speaker requirements, as well as instructions for installing a wave table card. Notes on the MIDI interface, digital sound, and Windows Sound System are also included. A modem AT command reference, modem and audio glossaries, FCC and DOC (Canada) compliance information, and service and warranty policies complete this section.

Section One: Introduction

The SoundExpression provides a Plug and Play digital sound controller and IDE CD-ROM interface for multimedia PC applications. It also provides speaker phone capability, integrated with a modem for high-speed data and fax communications and voicemail. This unique design offers multiple functionality all in a single-board solution.

This manual covers three separate models of the SoundExpression product. Installation of all three products is similar; only features differ as highlighted in the chart below.

A Word about SRS® Retrieval System...

The SoundExpression also supports **SRS**(●) Sound Retrieval System. SRS is rapidly becoming the standard for 3D audio technology. It creates a three-dimensional sound image from any audio source with only two conventional stereo speakers.

Feature		SE14SRS	SE34SRS	SE34SVD
Plug and Play		●	●	●
Max. Modem Speed:	28.8Kbps		●	●
	14.4Kbps	●		
SRS compatible		●	●	●
DSVD				●

A Word about Digital Simultaneous Voice and Data (DSVD)...

Digital Simultaneous Voice and Data (DSVD) is a standard allowing the simultaneous sharing of voice and data over a single telephone line. With the SE34SVD, you will be able to make ordinary phone calls to other PC users while sharing modem applications over a standard telephone line. When a phone call is in Digital SVD mode, any data (e.g., images, 3D-graphics, shared applications, interactive games) can be shared with a normal phone conversation over the same analog line.

1.1 Summary of Features

■ Integrated sound controller compatible with Sound Blaster Pro, Ad Lib, and Microsoft Windows Sound System.

■ Plug and Play compatible

■ 16- or 8-bit stereo and mono sound

■ Sample rates up to 44.1KHz

■ Built-in sound blaster-compatible digital audio processor.

■ Sound controller (software-configurable only).

■ Full-duplex speakerphone

■ Software-enabled IDE CD-ROM interface

■ Software enable/disable of game (joystick) port.

■ Unique 2-in-1 combination of data communications and audio applications.

■ 28.8Kbps (SE34SRS/SE34SVD) 14.4Kbps (SE14SRS) fax/data/voice modem with speaker phone and 16C550 UART.

■ Class 1 & 2/Group 3 14.4Kbps send/ receive fax

■ V.42 and MNP2-4 error control

■ V.42bis and MNP5 data compression.

1.2 System Requirements

■ IBM-compatible computer models 486 or Pentium (for SE34SRS and SE34SVD); (minimum386/DX for SE14SRS).

■ 4MB RAM minimum.

■ VGA or SVGA display.

■ 25MB of free hard disk space for installing all software.

■ Windows 3.1 enhanced mode (if you intend to run games and applications in Windows).

■ DOS 5.0 or later.

Section Two: Installing Your SoundExpression

This section explains how to install the SoundExpression in your computer.

Non-Windows 95 Users

Windows 95 users may continue with the next page.

2.1 Replacing an Existing Sound Card

1. Turn on your computer and start Windows, go to the Main group, select Control Panel and select Drivers. Here you will see a list of device drivers present in your computer.

2. Remove the sound card drivers from the drivers list. Highlight the sound drivers and click on "remove." **If you are not sure which drivers are for your sound card, refer to the documentation that came with your sound card or your computer system.**

3. Turn off your computer and remove the sound card from the system.

2.2 Replacing an Existing Modem

If your computer came with an internal modem, you must physically remove it or disable it through your computer's BIOS setup. Consult your computer manual's documentation for specific instructions. Now, you are ready to install the SoundExpression.

NOTE for DOS Users... You may need to remove certain drivers from your CONFIG.SYS file when removing existing devices.

2.3 Reviewing Board Connectors

Connection to Internal Devices

CD-ROM AUDIO
INPUT CONNECTORS

WAVE TABLE
CONNECTOR

IDE CD-ROM
INTERFACE
CONNECTOR
(white block
and "#1" show
pin 1)

Mitsumi

Panasonic

Sony/IDE
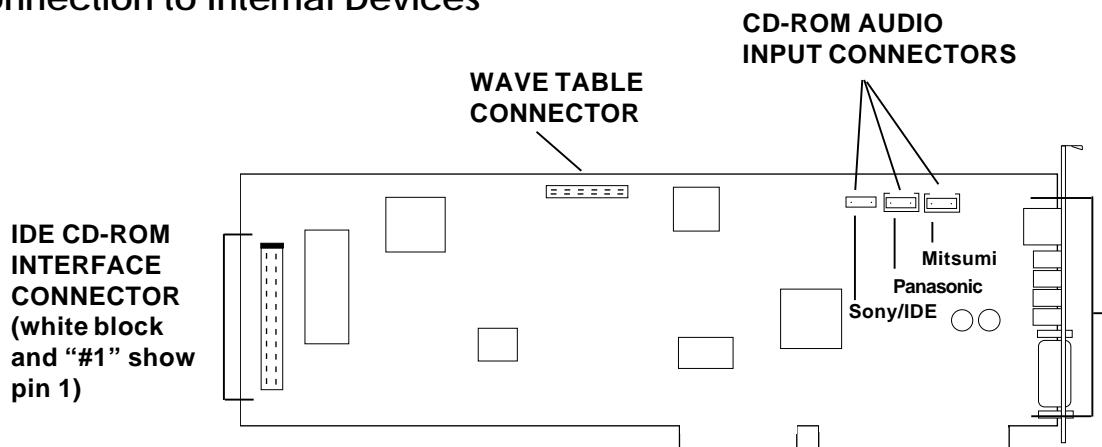
Connection to External Devices

RJ-11 TELEPHONE JACK

MIC (microphone)

L-IN (LINE-IN)

L-OUT (LINE OUT)

SPK (speaker)

JOYSTICK/MIDI CONNECTOR
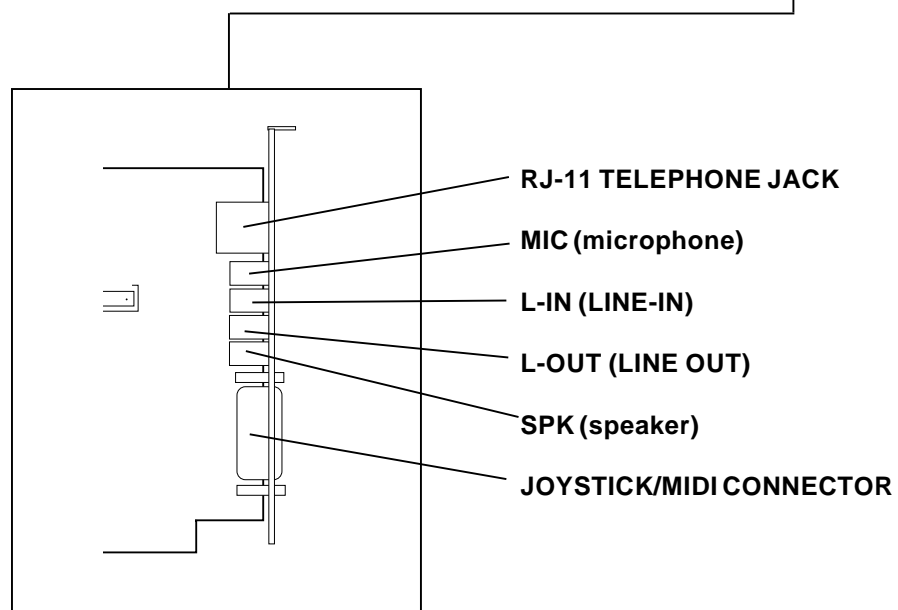
2.4 Connecting to an IDE CD-ROM Drive

1. Remove the SoundExpression from its anti-static bag, handling it by its edges and retaining bracket. Be careful not to touch the edge connector or any components on the card.

2. With your computer **off**, disconnect any attached devices and power cords. Remove the system cover and install the CD-ROM drive (if you are using one) into your computer. Refer to the documentation which came with your CD-ROM drive. Otherwise, skip to 2.5 Inserting the Board.

3. When connecting your CD-ROM drive (must be IDE type) to the SoundExpression, connect the ribbon interface cable from the CD-ROM drive to the interface connector on the SoundExpression before inserting the board into your computer.

4. If an audio cable is included with your CD-ROM drive, connect it from the CD-ROM drive to the respective CD-ROM sound input connector for Sony, Panasonic, and Mitsumi IDE CD-ROM drives. Look for the connectors labeled J11, J10, and J9 in the upper right corner of the board. See illustration on next page.
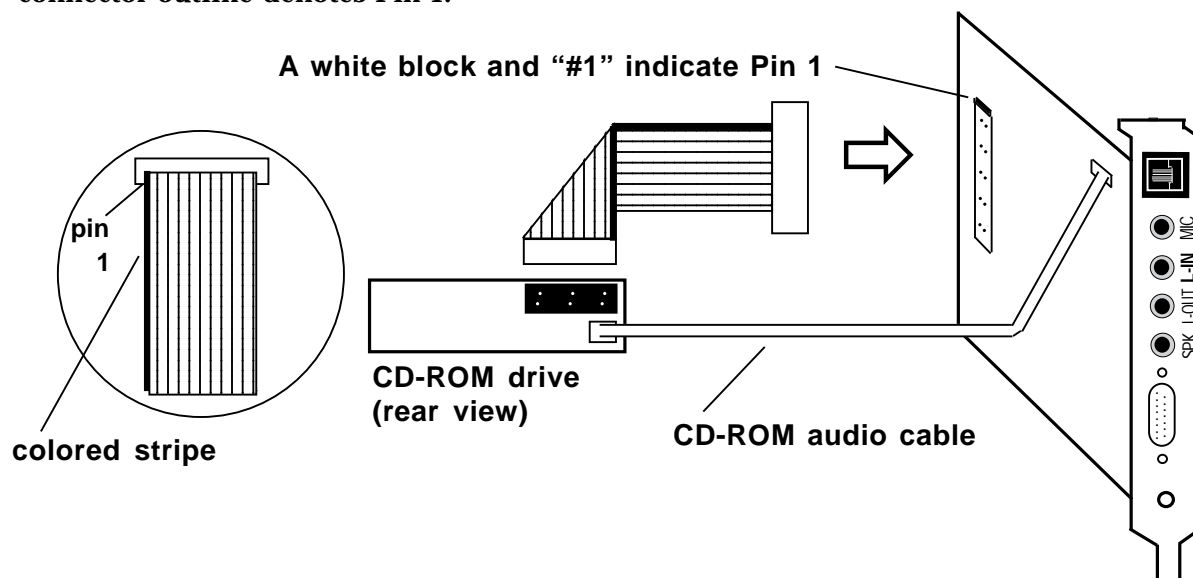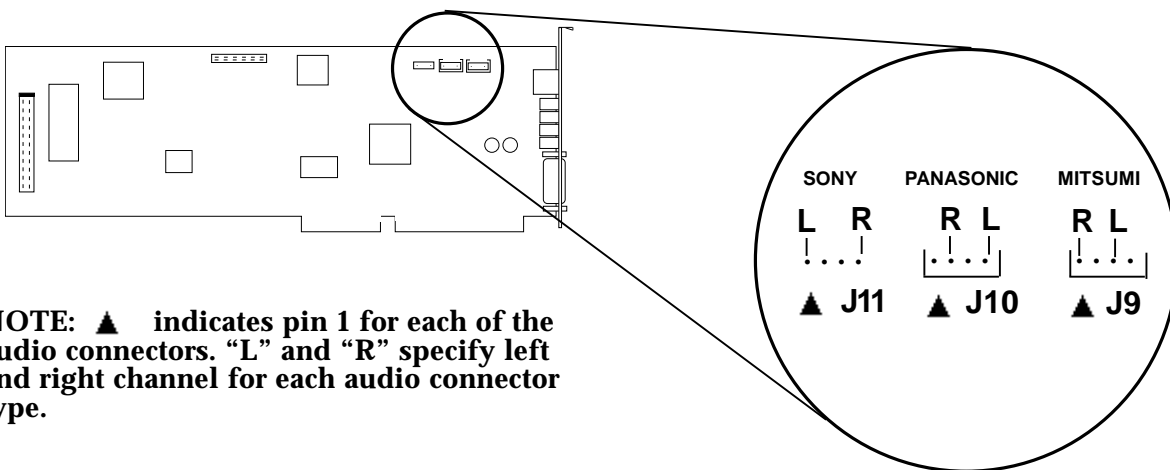
CAUTION: When connecting cables, be sure that Pin 1 on the cable, usually marked with a colored stripe (often red), matches up with pin 1 on the board connector. A band on the connector outline denotes Pin 1.

NOTE: Some CD-ROM drives have jumpers for a "MASTER/SLAVE" configuration. Make sure your CD-ROM drive is set for "MASTER".

A white block and "#1" indicate Pin 1

pin 1

colored stripe

CD-ROM drive (rear view)

CD-ROM audio cable

SPK L-OUT L-IN MIC

SONY   **PANASONIC**   **MITSUMI**

L   R   R L   R L

▲ J11   ▲ J10   ▲ J9

NOTE: ▲ **indicates pin 1 for each of the audio connectors. "L" and "R" specify left and right channel for each audio connector type.**

2.5 Inserting the Board

1. Locate an available 16-bit expansion slot. Remove that expansion slot cover and save the screw.

2. Carefully insert the SoundExpression into the expansion slot you selected, applying pressure to the upper board edge until it snaps into place, being careful not to disconnect any CD-ROM or audio cables you may have attached.

3. Secure the board into place by aligning its metal retaining bracket with the hole in the top edge of the system's rear panel. Fasten the modem's metal bracket with the screw removed in step 1.
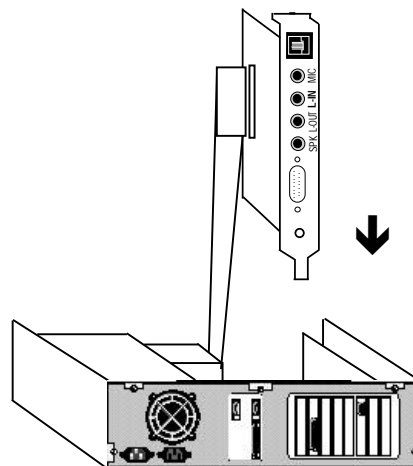
Sample system

2.6 Connecting for Modem Use

Disconnect your present phone cord
from the wall jack. Plug the end of the
splitter/phone cord that came with the
SoundExpression into the wall jack, and
the other end into the phone jack on the
back of the SoundExpression. Plug the
phone into the open jack on the splitter/
phone cable. **A telephone is not
necessary for the proper operation of
this product.**
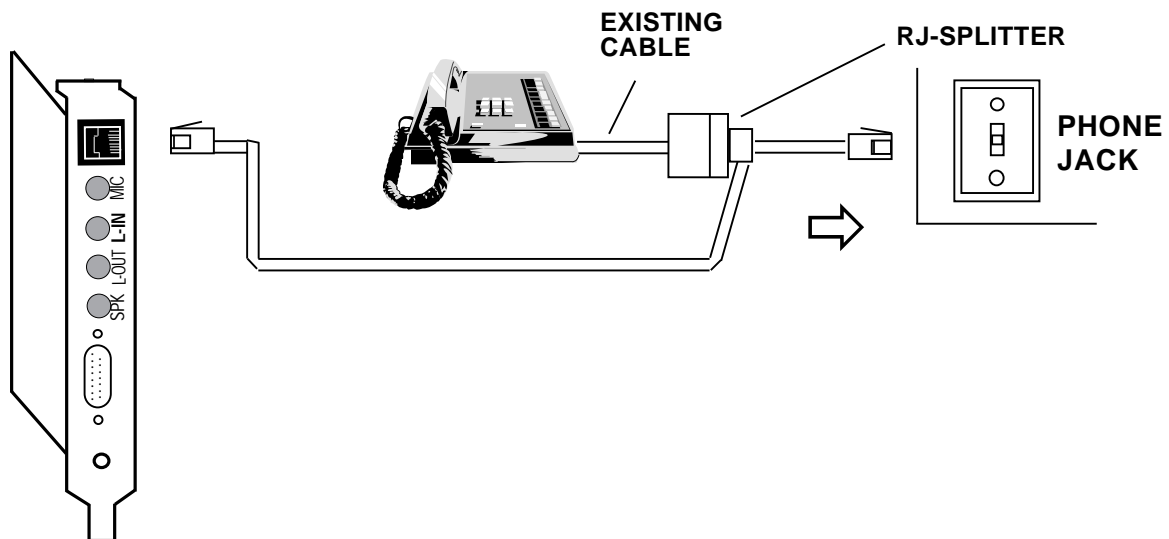
2.7 Attaching External Audio/ Game Devices

You can attach optional devices to the remaining connectors as described below. Note also the diagrams that follow.

2.7.1 Attaching External Audio-in Devices

1. If you are using a microphone, plug it into the **MIC** connector. Use a dynamic microphone with a resistance not exceeding 600 ohms, or an Electret (condenser) microphone. See Appendix C for more information.

2. If you are using a CD-player, hi-fi set, radio set, synthesizer, or walkman, plug it into the **L-IN** (LINE IN) connector.

MICROPHONE INPUT (OPTIONAL)

INPUT DEVICE (A CD-PLAYER FOR EXAMPLE) (OPTIONAL)
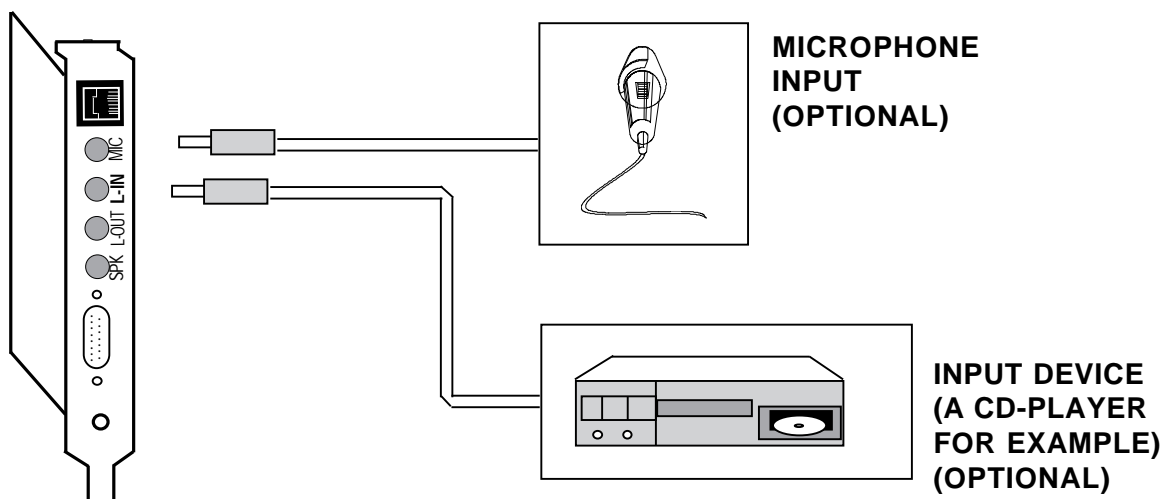
2.7.2 Attaching External Audio-out Devices

1. If you are using an **amplified** device such as stereo amplifiers, tape cassette recorders, headphones, or amplified speakers, plug it into the **L-OUT** (LINE OUT) connector (**8** ohms or greater impedance; see Appendix C for more information).

2. If you are using an **unamplified** device such as speakers, plug it into the **SPK** (SPEAKER OUTPUT) connector (**8** ohms or greater impedance; see Appendix C for more information).

IMPORTANT: To avoid temporary or permanent hearing loss or impairment due to unexpected noise or static, always hold your headphone away from your ears and test the sound before putting them on.

OUTPUT DEVICE (*AMPLIFIED*) SUCH AS STEREO SPEAKERS OR STEREO TAPE RECORDER, FOR EXAMPLE (OPTIONAL)

OR

or

OUTPUT DEVICE (*UNAMPLIFIED) SUCH AS* STEREO SPEAKERS OR HEADPHONES, FOR EXAMPLE (OPTIONAL)
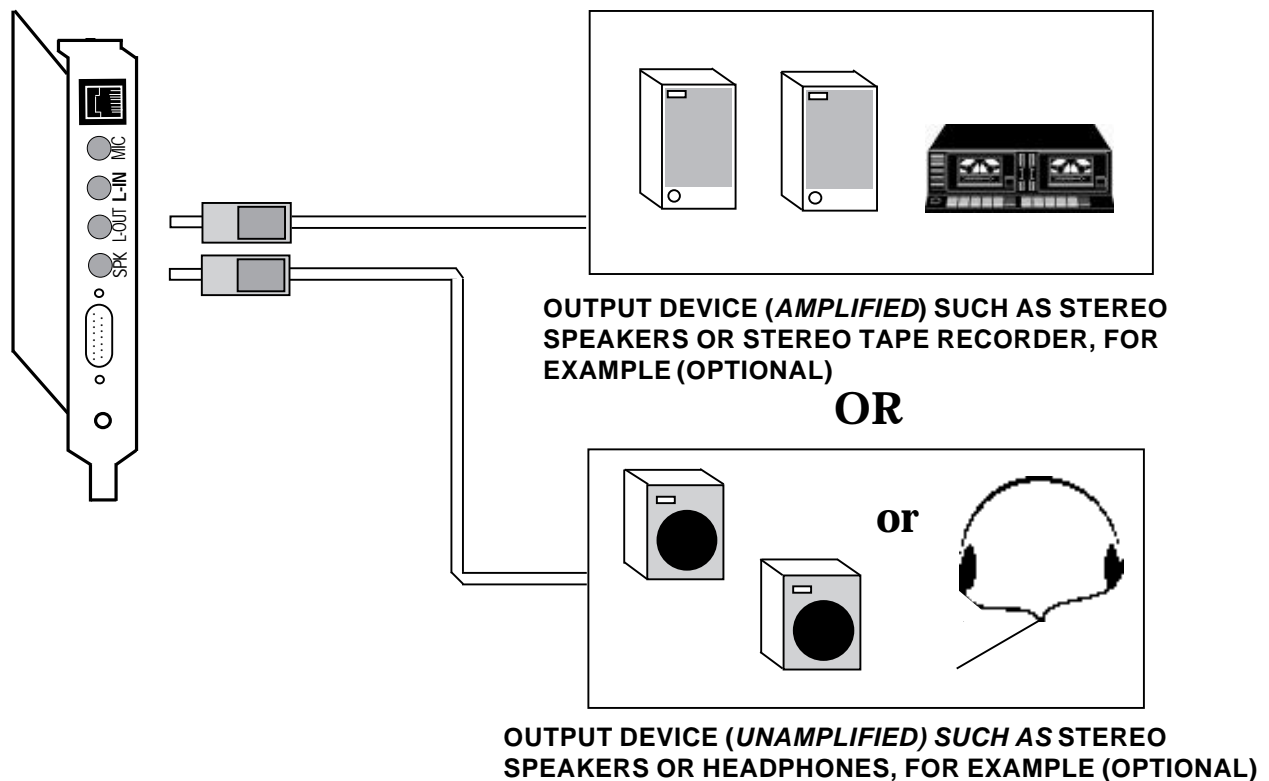
2.7.3 Attaching a Joystick/MIDI Device

1. If you are connecting a joystick only, use a 15-pin cable with D-sub connector. **NOTE: You may also attach two joysticks providing you have a 15-pin "Y" cable.**

2. If you are connecting a MIDI-compatible keyboard synthesizer as well, use a MIDI cable to make connections as shown below. Connecting external audio/game devices is complete.

JOYSTICK WITH IBM PC COMPATIBLE 15-PIN D-SUB CONNECTOR (OPTIONAL)

IN

OUT

KEYBOARD SYNTHESIZER (OPTIONAL)

MIDI CABLE

JOYSTICK WITH IBM PC COMPATIBLE 15-PIN D-SUB CONNECTOR (OPTIONAL)
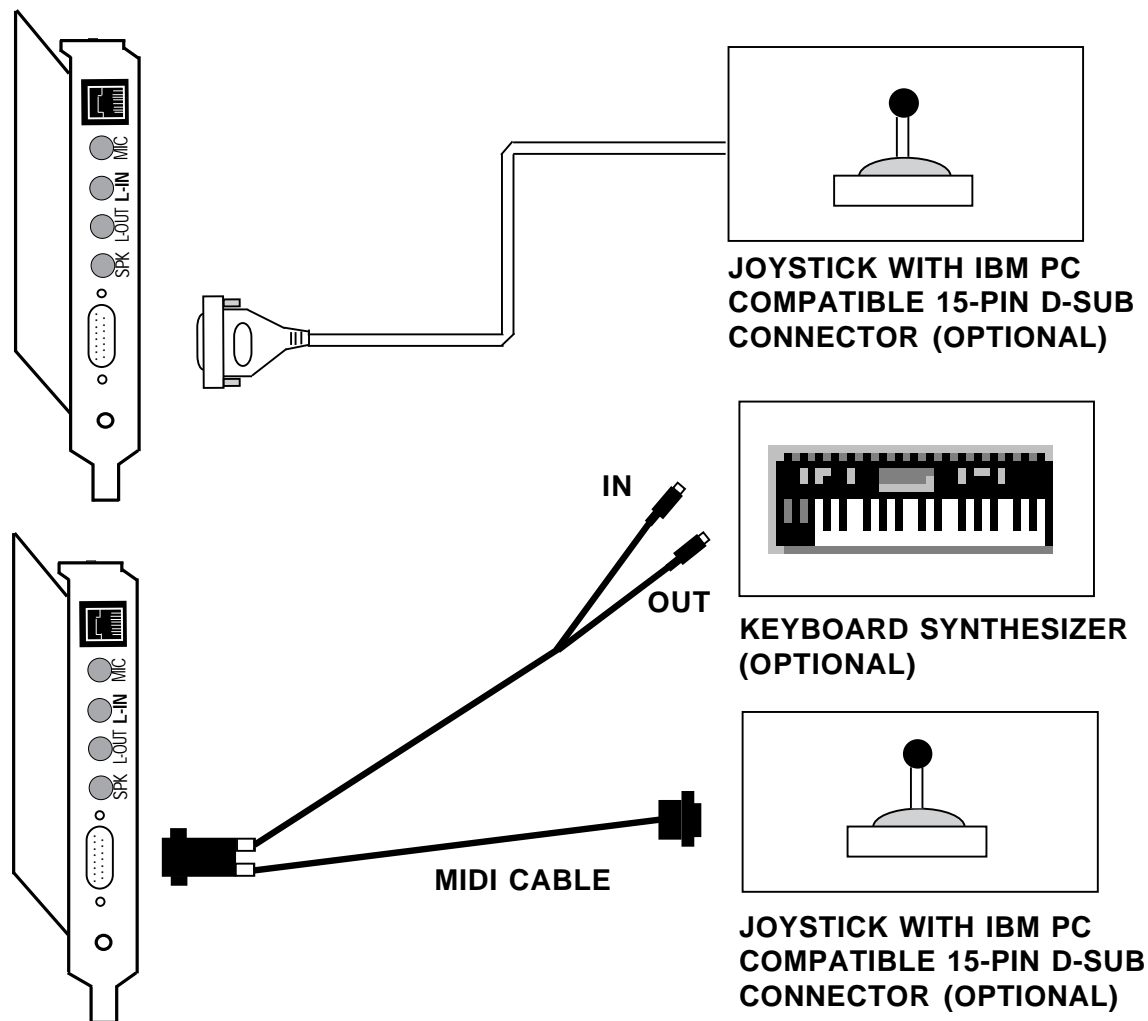
Installation of internal and external components is complete. Windows 3.1 and DOS users should turn to section 2.8 for Driver Installation. Windows 95 users should turn to section 2.9.

2.8 Driver Installation for Windows 3.1/DOS Users

1. If you are in Windows, exit to DOS.

2. Insert the driver diskette into your A: or B: floppy drive and type
   A:\INSTALL (or B:\INSTALL).

The following introductory screen is displayed:
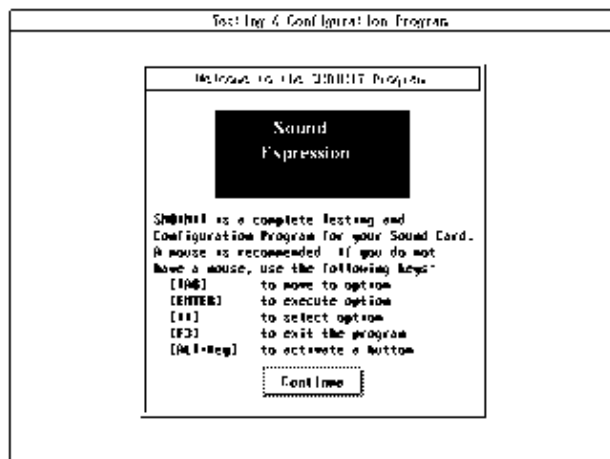
If You Do Not Have a Mouse...

Use the following keys as described below:

[TAB]	**Moves to Option.**
[ENTER]	**Accepts Button. Opens Combo Box for selecting options. Accepts options from combo Box.**
[↓↑]	**Selects Options within Combo box.**
[F3]	**Exits to DOS; all changes are discarded.**
[ALT + KEY]	**Activates a button on the Configuration and Sound-Test screen.**

3. To continue select one of the following options:

   **START INSTALLATION
   VIEW README.TXT
   EXIT**

4. When you "Start Installation", select a destination directory (default is C:\SOUNDEXP). Select OK.

5. If you have Windows, you will be asked for your Windows directory. If you do not have Windows installed on your system, select "NONE".

6. After confirming your selections, files are copied to your hard disk. Then you will be asked for a CD-ROM type. Select "NONE" if you do not have a CD-ROM.
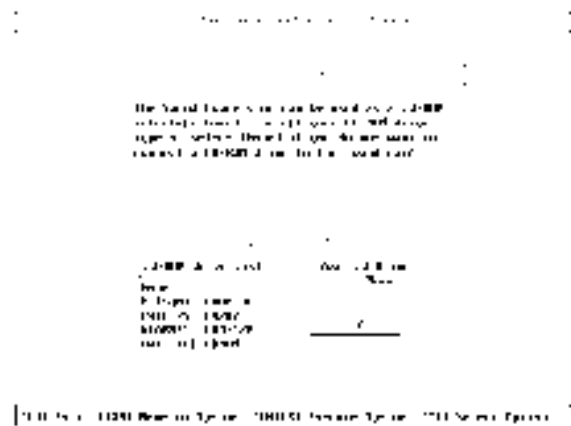
7. Next you are presented with a Configuration and Sound Test screen (for details on options and functions, see the instructions at the end of this section if you need to change default settings). When you are done, select "ACCEPT".
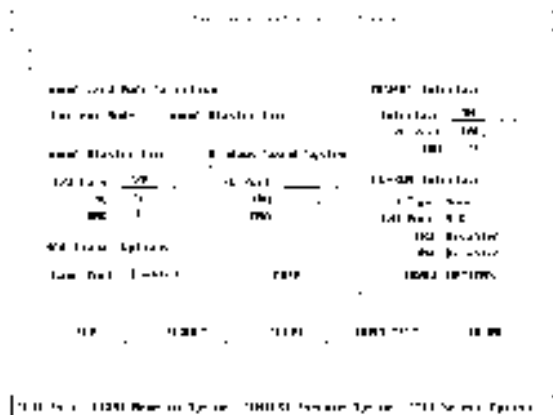
8. You are then asked if you want to update your CONFIG.SYS file. Select "OK".

9. Lastly, you will need to power down your system, then restart. Driver installation is complete for Windows 3.1/DOS users. If you need to reconfigure the board, type **SNDINIT** at the \SOUNDEXP directory to run configuration. See the next section.

Running the Configuration and Sound-Test Utility (SNDINIT) (Windows 3.1/DOS Users only)

NOTE: If you have a Plug and Play computer, use its Plug and Play Configuration utility to change settings. You will not be able to change resource assignments using SNDINIT.

Button Function Descriptions

A button can be activated by either a mouse, keyboard [ENTER] or ALT + button's hotkey. The following are the BUTTON names and their function descriptions:

HELP. Brings up a help page.

DEFAULT. Resets the current mode to Sound Blaster Pro.

ACCEPT. Accepts the current chosen options and exits. The program checks for hardware conflicts. If a conflict exists, a warning window is displayed. The program updates the sound configuration and system   files: SOUND16.CFG, CDROM.CFG, CONFIG.SYS, AUTOEXEC.BAT, SYSTEM.INI, before exiting to DOS.

SOUND TEST. Brings up the Sound Test Window. The Sound Test Window performs the following with the chosen hardware settings:

• 8-Bit Sound Test (Test SB Pro settings)
• 16-Bit Sound Test (Test WSS settings)
• FM Music Test

VOLUME.   Brings up the Volume Control Window. The Volume Control Window allows you to adjust the following volume settings:

•Master Volume
•Voice Volume
• FM Music Volume
• CD Audio Volume

CHANGE OPTIONS. Brings up the CD-ROM Configuration Window. The CD-ROM Configuration Window allows you to configure your CD-ROM drive for the following:

• CD-ROM Drive Type
• MSCDEX selection
• I/O Address
• Interrupt
• DMA Channel

Combo Box Functions and Hardware Configuration Descriptions

You can activate a combo box by mouse, or keyboard [ENTER]. When activated, a list box with options is opened for selections.

Sound Card Mode Selection

Current Mode. Your sound card can operate in one of the following two modes:

> [Sound Blaster Pro] or
> [Windows Sound System] Mode
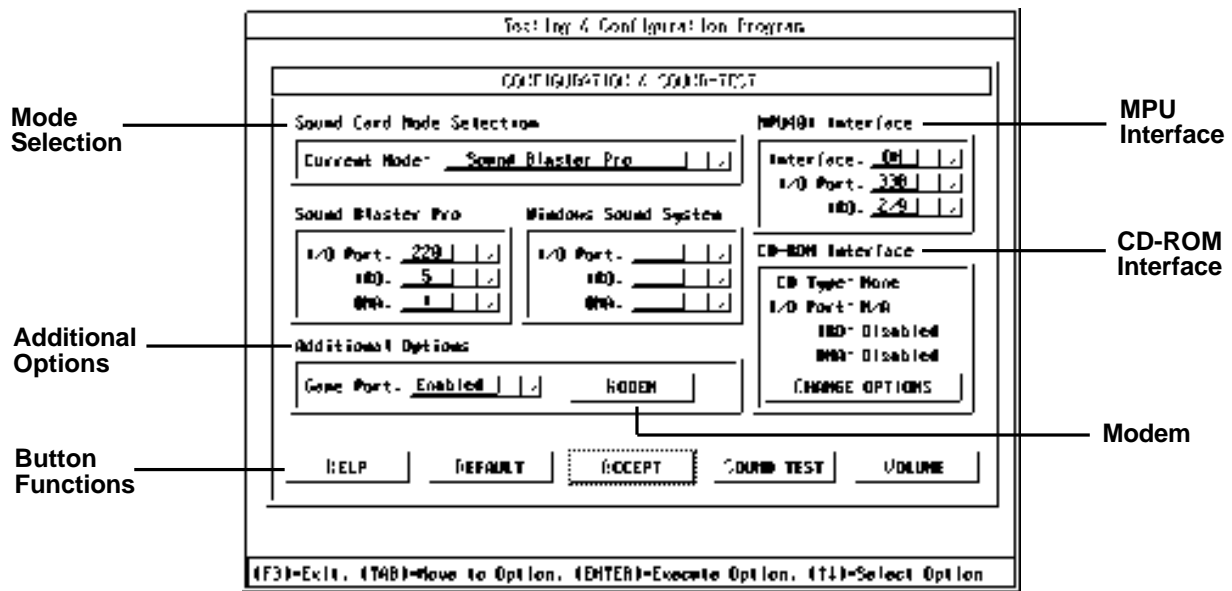
The following describes each sound card's hardware section and available options as highlighted above:

Select [Sound Blaster Pro] mode to enable your sound card to play Sound Blaster compatible DOS games. **(Default)**

Selecting [Windows Sound System] mode will switch your sound card into the mode to play those DOS games or utilities written for Microsoft WSS compatible sound cards. The selected mode becomes the current mode upon exiting.

Sound Blaster Pro (for SB Pro Mode Only; *=default)

I/O Port.   SB Pro I/O Port selections: *__220__, 240
IRQ   SB Pro Interrupt Address selections: *__5__, 7, 10
DMA   SB Pro DMA Channel selections: *__1__, 0, 3

Note: 8-bit Sound Test in the Sound Test Window can be used to test Sound Blaster Pro Mode regardless of the Current Mode setting.

Windows Sound System (for WSS Mode Only; *=default)

I/O Port   WSS I/O Port selections: *__530__, E80, F40, 604
IRQ   WSS Interrupt Address selections: *__11__, 7, 9, 10, 5
DMA   WSS DMA Channel selections: *__0__, 1, 3, 0/1, 1/0, 3/0

There are two modes for DMA selections:

[Single DMA]: Uses a single DMA channel for DMA playback and capture.

[Dual DMA]:   Allows to playback and record at the same time. 0/1, 1/0, 3/0 are the Dual DMA selections. The first one is for Playback. The second is for recording.

Note: 16-bit Sound Test in the Sound Test Window can be used to test Windows Sound System Mode regardless of the Current Mode setting.

MPU401 Interface

MPU401 is the industrial standard interface for MIDI (Music) devices such as keyboards and some Wave Table Synthesizer devices. (*=default)

Interface. External MIDI enable or disable selections: *__ON__, OFF.

I/O. Port. External MIDI I/O Port selections: *__330__, 300, 320.

IRQ. External MIDI Interrupt Address selections: *__9__, 5, 7.

CD-ROM Interface

Your sound card also could be used as a CD-ROM interface card to connect to an IDE-compatible CD-ROM drive.

CD Type.   CD-ROM selected drive type. *__NONE__ or CD-ROM drive types...
I/O Port.   CD-ROM selected I/O port.
IRQ.   CD-ROM selected Interrupt Address.

DMA.   CD-ROM selected DMA Channel.

CHANGE OPTIONS. Brings up CD-ROM configuration menu.

Additional Options

Game Port. Game Port enable and disable selections: ***Enable**, Disabled

MODEM

Change the following settings for the modem or accept the defaults:

Interface: ***ON**, OFF
I/O Address: ***2E8**, 3E8, 2F8, 3F8
Interrupt: ***3**, 4, 5, 7, 9, 10, 11

Configuration is complete.

Completing the Installation for Windows 3.1 Users

After re-booting, ignore any error messages that may be a result of an unconfigured CD-ROM drive. Refer to the information you noted at the CD-ROM screen if you need to re-configure your CD-ROM drive.

At this time you will need to install the MCI CD Audio driver in order to play musical CDs through Windows. Select Control Panel, then Drivers, then Add....

Highlight the "**[MCI] CD Audio Driver**" and select OK. You may be asked for your original Windows diskettes in order to copy the driver.
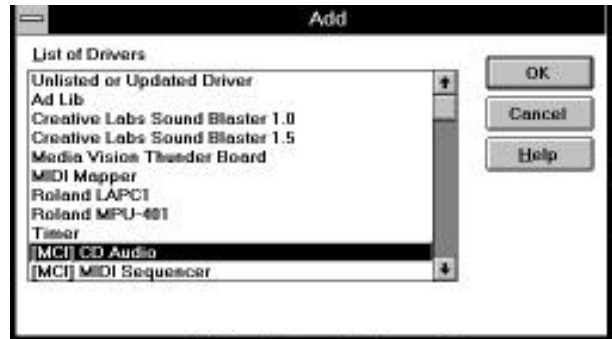
NOTE: When you restart Windows, you will be asked if you want to create a Program Group for the Audio Applications. Choose "Yes".

Congratulations! Installation of the SoundExpression is complete. Now you may install your fax and audio applications. Refer to Section Four for troubleshooting information if you require further assistance.

2.9 Driver Installation for Windows 95 Users

1. When the SoundExpression board is physically installed, start Windows 95 as you normally would.

2. When Windows 95 detects new hardware, it displays the **"New Hardware Found"** dialog box. Here, you are asked what (if any) driver files are associated with the new hardware.

3. From the choices given, select **"Driver from disk provided by hardware manufacturer"**.

4. Windows 95 then displays the **"Install from Disk"** dialog box. Here, you are asked for the location of the driver files. Insert the SoundExpression driver diskette in your floppy drive. Type A: (or B:) and select OK. Windows 95 will now copy files from the installation diskette.

You may be asked for your original Windows diskettes.
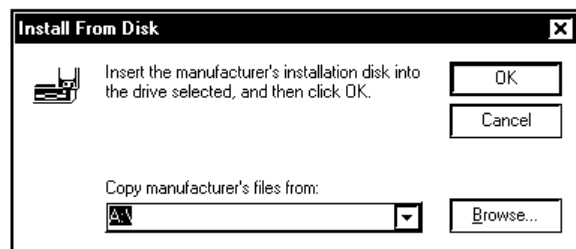
NOTE: Windows 95 will detect a number of devices on the SoundExpression board. After each device is installed, you may be prompted to restart Windows 95. It is not necessary to restart Windows 95 until all devices are detected and set up.

5. Windows 95 will detect the following devices on the board. For each of these devices as listed, select **"Windows Default Driver"**.

   - **Game Port Joystick**
   - **Standard IDE/ESDI Hard Disk Controller**

6. Windows 95 may prompt you to restart your computer to finish setting up the devices on the board. Select **"NO"** so Windows 95 will continue installing the devices present on the board. Some steps may be repeated. Follow all on-screen instructions.

7. Windows 95 then displays the **"Install from Disk"** dialog box (as shown in step 4). Here, you are asked for the location of the driver files. Insert the appropriate driver diskette in your floppy drive. Type A: (or B:) and select OK. Windows 95 will now copy files from the diskette.

8. When all the new devices are installed, Windows will finish loading. When Windows 95 displays the **"Start Menu"**, select **"Start"**, then **"Shut Down"**, then **"Restart the Computer"**. This will restart Windows 95 with the newly installed drivers.
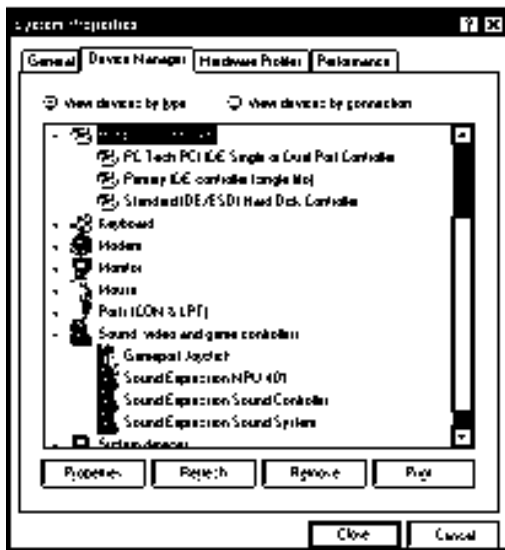
If you need to re-configure the board, click on "Control Panel", then "System", then "Device Manager". The drivers are under the section, "Sound, Video, and Game Controllers". See your Windows 95 documentation on changing properties of devices using the Device Manager. Congratulations! Driver installation is complete for Windows 95 users.

Now you may install your fax and audio applications. Refer to Section Four for troubleshooting information if you require further assistance.

Section Three: Modem Functions and Features

3.1 Introduction

The SoundExpression offers the latest in modem technology, featuring voice, fax, and data communications. This versatile modem allows you to establish a structured set of messages, mailboxes, and faxes. Now, you have an all-in-one communications product that serves as a modem, voicemail system, and fax machine.

The SoundExpression also supports business audio applications such as digital answering machine, voice annotation, and audio file play and record.

Features:

Voice Capabilities

The SoundExpression features speaker phone capability, auto-dial, auto-answer, and an embedded voice modem 'AT' command set. The modem supports basic answering machine functions through the included voice and fax communications software as well as full-duplex speakerphone. You can also set up multiple mailboxes.

The automated attendant feature allows dial-in users to access various mailbox features. When dialing in, you can check, answer, and leave messages. You can also retrieve faxes; enable/disable toll saver; change personal mailbox greetings; enable/disable pager notification; and change fax forwarding and pager notification numbers.

Fax Capabilities

The SoundExpression offers a wide range of fax services It supports Group 3, class 1 and 2 fax send and receive operations. It complies with ITU-T (formerly CCITT) V.17 (14.4Kbps), V.29 (9600bps), V.27ter (4800bps), and V.21 (300bps) channel 2 international fax standards.

Data Capabilities

The SoundExpression offers the widest possible range of internationally accepted standard modulation methods and protocols. The modem is capable of up to 115,200Kbps (SE34SRS and SE34SVD) or 57.6Kbps (SE14SRS) data throughput with data compression. It complies with ITU-TSS standards V.34, V.FC (28.8Kbps), V.32bis (14.4Kbps), V.32 (9600 bps), V.22bis/V.22 (2400 bps), and V.21 (1200bps), as well as Bell 212A and 103. The modem implements V.42 error correction with LAP-M and MNP 2-4, as well as data compression with V.42bis and MNP-5.

Ideal for Travelers

Voice features allow for remote call-in with full services to answer, route, delete, or forward messages. For example, while you are traveling, faxes are stored on your hard drive. When you call in to review a voice message, a fax forwarding function allows received faxes to be forwarded to another fax number at any location.

3.2 Testing the Connection

1. Check that you have made all connections as instructed in section 2.6 (Connecting for Modem Use). Power on the computer.

2. Check for a dial tone on a phone set if one is connected. If a dial tone is heard, continue. If you do not hear a dial tone, check the connections you made in the previous subsection, or refer to *Troubleshooting (Section Four)*.

3. Install and configure your communications software (see companion software manual) and place it in command mode. Refer to the communication software manual for additional information.

4. Start your communications software and enter terminal mode. If you are not in terminal mode, AT commands typed in at the DOS prompt will result in a "Bad Command or File Name" message.

5. Type in **ATZ** followed by ENTER and the modem will respond with OK after a few seconds. If the modem does not respond OK, refer to *Troubleshooting (Section Four)*.

6. Type **ATH1** followed by ENTER and you should hear a dial tone from the external speakers attached to the SoundExpression. To adjust speaker volume, refer to your communications software, or use the **ATL3** command.

7. Type **ATH** followed by ENTER to put the modem "on-hook". This confirms that the modem has been successfully installed into the computer.

8. Your modem is now ready for use. Proceed now to your communications software and documentation.

Section Four: Troubleshooting

Commonly Encountered Problems and Solutions

SYMPTOM

Your computer does not boot up after installing the board.

POSSIBLE REMEDY

The sound board may not have been inserted completely into the 16-bit slot. Refer to Section Two: Installing Your SoundExpression to install the sound board properly.

SYMPTOM

The computer hangs, reboots itself, or issues a parity error after the board is installed.

POSSIBLE REMEDY

There is a hardware conflict between the sound card and other interface cards in your system. Power down and remove all other cards except the SoundExpression, your video card, and the hard drive controller. Reboot again.

SYMPTOM

A device in your computer does not work or does not work properly after the board is installed.

POSSIBLE REMEDY

There might be a hardware conflict between the sound card and the other device. Run **SNDINIT (page 19-22)** to find out which hardware setting is conflicting

SYMPTOM

Your system hangs when you enter or exit Windows.

POSSIBLE REMEDY

a) If you installed another sound card in your system before, make sure you have removed all its drivers in Windows including any virtual device driver.

b) There might be conflicts with another device in your system. Run **SNDINIT (page 19-22)**.

SYMPTOM

There is no sound output in games.

POSSIBLE REMEDY

a) Check that the speakers are connected properly to the L-OUT (**amplified** speakers) connector or SPK (**unamplified** speakers) on the sound card. If your speakers use batteries, make sure that they have the batteries they need.

b) Refer to the documentation for the application or operating system you are

using to determine how to adjust the volume.

c) Make sure that the sound board is inserted properly into the computer.

d) If your games are Sound Blaster compatible, make sure the card is in Sound Blaster mode. You can find out what mode the sound card is in by running **SNDINIT (page 19-22)**.

e) There might be a DMA conflict between the sound card and other interface cards in your computer. Make sure the DMA channel your sound card is using is not being used by another device in your system.

f) Some games need EMM to play digitized voice. Please refer to the documentation that comes with your game.

g) Check the address, DMA, and IRQ settings required by the game.

SYMPTOM
The sound is distorted during sound test or during normal usage.

POSSIBLE REMEDY
a) Your speakers might be defective or the quality of the speakers is poor. Make sure you have a good pair of speakers.

b) Make sure amplified speakers are attached to L-OUT (LINE OUT) jack;

make sure non-amplified speakers are attached to SPK (SPEAKER) jack.

c) Interference from another interface card in your computer. Try to install the sound card into a different slot.

SYMPTOM
There is no music or digitized voice or there is only music in some applications.

POSSIBLE REMEDY
a) Some applications need extended or expanded memory to run properly. Use a memory manager to set up the required memory in your system. Refer to the application's user guide on what is required.

b) You do not have enough memory to run the game. Remove non-essential device drivers.

c) Make sure you have a set blaster= line in your autoexec.bat file (example: set blaster=a220 i5 d1.

SYMPTOM
Your CD-ROM drive doesn't play music CDs or you receive the message:

"CD-ROM Driver Not Detected"

POSSIBLE REMEDY

a) Make sure the CD-ROM audio cable is connected to the CD audio-in connector on the Sound card.

b) Install the MCI CD Audio driver in Windows. Some applications need this driver to play music CDs. The driver is provided by Windows. Simply select Control Panel in the Windows Program Manager. Then select Drivers and Add a Driver. Select "MCI CD Audio Driver". This will require your Windows diskettes.

c) Check the speakers connection. If your speakers use batteries, make sure they have the power they need.

d) Check the documentation that comes with your CD-ROM drive on setting up your CD-ROM for playing Audio CDs. Make sure the volume control is turned up in the software.

SYMPTOM

Your joystick does not work after installing the board.

POSSIBLE REMEDY

a) The joystick port on the SoundExpression may be disabled. Run the SNDINIT utility (pages 19-22) to enable the game port.

b) There is a conflict between the game port on the sound card and the game port in your system. Remove the additional joystick from your system.

SYMPTOM

The joystick is not working properly in some programs.

POSSIBLE REMEDY

The CPU speed of your computer might be too fast. You might want to reduce the speed. Refer to your computer's manual for instructions on setting up your computer's operating speed.

SYMPTOM

You cannot record any sound using a microphone.

POSSIBLE REMEDY

a) If your microphone has an On/Off switch, make sure the switch is turned on.

b) Make sure you plug the microphone into the mic-in connector.

c) The microphone must be a mono Electret (condenser), or dynamic type, with a resistance of no greater than 600 ohms.

SYMPTOM

There is no sound or the sound is distorted when you are running Windows Sound System applications.

POSSIBLE REMEDY

You need the Microsoft Audio Compression Manager to play compressed files in Windows Sound System applications. Make sure you have the following line in the [drivers] section of your system.ini file: wavemapper=msacm.drv

SYMPTOM

Your speaker phone does not work

POSSIBLE REMEDY

Refer to the documentation for your communications software.

Modem Problems

This section lists common problems that may be encountered with modem usage and their possible solutions.

SYMPTOM
No dial tone.

POSSIBLE REMEDY
• Verify that you have cables plugged in correctly as instructed in 2.6 and.

• Connect a telephone set directly to the wall jack and check for a dial tone. If no dial tone is heard, the telephone line is not working. Contact the telephone company.

SYMPTOM
Modem will not connect to another modem.

POSSIBLE REMEDY
• Check the connections between the modem and the computer, and the modem and the telephone line.

• Make sure the telephone jack is operational as described above.

• The telephone line may be in use at a different extension.

• Make sure your communications application is set up for the SoundExpression, or a generic 14.4Kbps modem with AT&F as its init string.

SYMPTOM
No response when you type in AT commands

POSSIBLE REMEDY
• There may be a conflicting port address. Re-configure the modem's COM port address

• Verify that the communication software is set to the same communications port that your modem is set to (e.g., COM1, COM2). Check IRQ settings in your software and on the modem.

• Try typing AT&F to reset the modem to its factory defaults.

• Check the modem settings by running SNDINIT (pages 19-22). Make sure the modem interface is set to ON.

SYMPTOM
AT commands not visible.

POSSIBLE REMEDY
• Make sure the echo command is set to ON. Change to echo with the ATE command.

SYMPTOM
After data connection is established, data is displayed as garbled characters.

POSSIBLE REMEDY
• Make sure the local (yours) and remote modem configurations are compatible.

• Verify that both modems are operating with the same settings, speed, data, parity, and stop bits.

• The software may not be set for correct terminal emulation. Configure software to correct type. ANSI terminal emulation is most commonly used.

• Power down your system and re-run your communications software. Check software settings.

• Exit the communications program and restart it.

SYMPTOM
The modem does not answer an incoming call.

POSSIBLE REMEDY
• You may not have enabled auto-answer. Use your software to enable this function. Type ATS0=1 at the command mode screen of your data communications application.

• If you have an answering machine, it may be answering before the modem can. Turn the answering machine off, or, use the software to set auto-answer to respond in fewer rings than the answering machine.

SYMPTOM
Modem disconnects while on-line.

POSSIBLE REMEDY
• Check for any loose connections.

• Re-try the connection by dialing the number several times. You may be experiencing line interference.

• An incoming call may have broken the connection if a call-waiting feature was enabled. Disable call-waiting and try again.

SYMPTOM
Speaker fails to work.

POSSIBLE REMEDY
• Make sure attached speaker is working and conforms to necessary specifications. See Appendix C.

Appendix A: Technical Specifications

The SoundExpression is an integrated sound controller compatible with Sound Blaster, Ad Lib, and Microsoft Windows Sound System. It is also a 28.8Kbps (SE34SRS, SE34SVD) and 14.4Kbps (SE14SRS) fax/data/voice modem.

- Plug and Play.

- 8 or 16-bit sound data: Sound Blaster and Windows 8/16-bit audio up to 44.1Khz stereo

- SRS® Sound-compatible.

- DSVD-compatible.

- DigiTalk® Standard

- Sample rates up to 48KHz stereo

- Integrated MIDI UART with 64-byte FIFO

- Built-in Sound Blaster-compatible digital audio processor

- Interface for Wave Table Synthesis

- Software Programmable AT interface for I/O address, IRQ, and DMA Channel

- Software programmable CD ROM interface for SONY, Mitsumi, and Panasonic IDE CD ROM

- Software enable/disable of the game port

- Supports 7 DMA and 6 IRQs

- 24mA drivers for direct AT-bus interface

- 16mA drivers for direct CD-ROM interface

- Full-Duplex Speaker phone

- Fax/data/voice modem with 16C550 UART

Modem Data Rate: 28.8K (SE34SRS and SE34DVD only), 14.4K, 12K, 9600, 7200, 4800, 2400, 1200, or 300bps

Fax Data Rate: 14.4K, 12K, 9600, 7200, 4800, 2400bps

Audio Data Rate: 4800 samples/sec.

Compatibility:
Modem Modulation Protocols

ITU-T: ITU-T V.34 (SE34SRS and SE34SVD only), V.32bis (14.4Kbps), V.32 (9600bps),V.22bis (2400bps), V.22 (1200bps)

Bell: Bell 212A (1200bps), Bell 103 (300bps)

Fax Modulation Protocols

V.17 (14.4Kbps) transmit and receive
V.29 (9600/7200bps) transmit
V.27 ter (4800/2400bps) transmit and receive
V.21 channel 2 (300bps) transmit and receive
EIA-578 Service Class 1 commands

V.42/MNP2-4 and V.42bis/MNP5 support

Diagnostics:
• Local/remote digital and analog loopback.
• Automatic power-on self-test.

Physical and Electrical Characteristics

■ Dimensions: 13.4" x 4.2"
■ Power:
   +5V, 1.2 watts (maximum)
   +/-12V, 0.5 watts (maximum); (from host computer power supply)

■ **Operating Temperature Requirements**

Dry Bulb Temperature:
10-40° C (50-104° F)

Relative Humidity: 8-80%

Storage: 1-60° C (33.8-140° F)

Appendix B: Configuration Settings

Sound Blaster Addresses: 220, 240 IRQ: 5, 7, 10 DMA: 0, 1, 3	**IDE CD (only)** Address: 170 IRQ: 15
Windows Sound System Addresses: 530, E80, F40, 604 IRQ: 7, 9, 10, 11 DMA: 0, 1, 3	**MODEM Addresses** COM1, 2, 3, 4 IRQ3, 4, 5, 7, 9, 10, 11
MPU-401 Interface Addresses: 300, 320, 330 IRQ: 2/9, 5, 7	

Default Configuration

The SoundExpression supports both Sound Blaster as well as Windows Sound System applications. After drivers are installed and configured, the card is in Sound Blaster mode when in DOS. It switches to Windows Sound System mode when you start Windows. The default configuration for the board is as follows:

Mode:	Sound Blaster
Interrupt:	IRQ5
DMA Channel:	DMA1
I/O Port Address:	220h
CD-ROM interface:	None

Mode:	Modem
Interrupt:	IRQ3
DMA Channel:	NA
I/O Port Address:	2F8h (COM2)
CD-ROM interface:	IDE

The IRQ, DMA channel, and I/O port address for the sound portion of the SoundExpression are all software-selectable. The type of CD-ROM and modem interface, I/O port address, IRQ, and DMA channel are software-configurable as well.

IMPORTANT NOTE: The IRQ chosen for the modem must be different than the IRQs used for sound functions and the CD-ROM interface. The Sound Blaster settings for the SoundExpression (DOS-based) may be different from the Windows Sound System settings (Windows-based).

Appendix C: Microphone and Speaker Requirements

The SoundExpression is equipped with microphone (MIC) and speaker jacks (SPK) for use with headset, speakers, and microphone. The microphone can be used to record outbound messages as well as sound files. These messages can also be recorded with a telephone attached to the modem. However, a microphone is recommended for better quality recordings. You may use a combination headphone and microphone or a separate microphone and speaker(s).

Microphone Requirements

The microphone element should be of the electret type also known (incorrectly) as a condenser type. The microphone in most telephone handsets and headsets are of this type. The SoundExpression was designed for a microphone sensitivity of -64 dBspl. Other microphone sensitivities work equally well, with only a subjective difference in loudness. Carbon microphone elements will also work, but don't offer the quality of the electret. Another common microphone element is the dynamic type which will work with the SoundExpression. Its sensitivity is much lower, and its frequency response is not as suitable for this purpose.

Speaker Requirements

You can attach the SoundExpression to a high-quality external speaker or the earpiece of a handset or headset. The external speaker must have an impedance rating of 8 ohms or more.

Appendix D: Wave Table Card Installation

The SoundExpression will support a Wave Blaster™ compatible wave table card. The Wave Table card contains sound samples of actual instruments. When MIDI music is played using the wave table card, the music will sound like real instruments.

Windows 3.1 Users

To set up the Wave Table Card:

1. Start Windows as you normally would.

2. Select the Midimapper icon in the Windows Control Panel.

3. Select MPU-401 in the Midimapper dialog box.

Windows 95 Users

1. Start Windows 95.

2. Select Control Panel, then the MIDI tab.

3. Next, select "MPU-401 Compatible".

NOTE: To use internal FM synthesis, select "...FM Synthesis" at the MIDI tab.
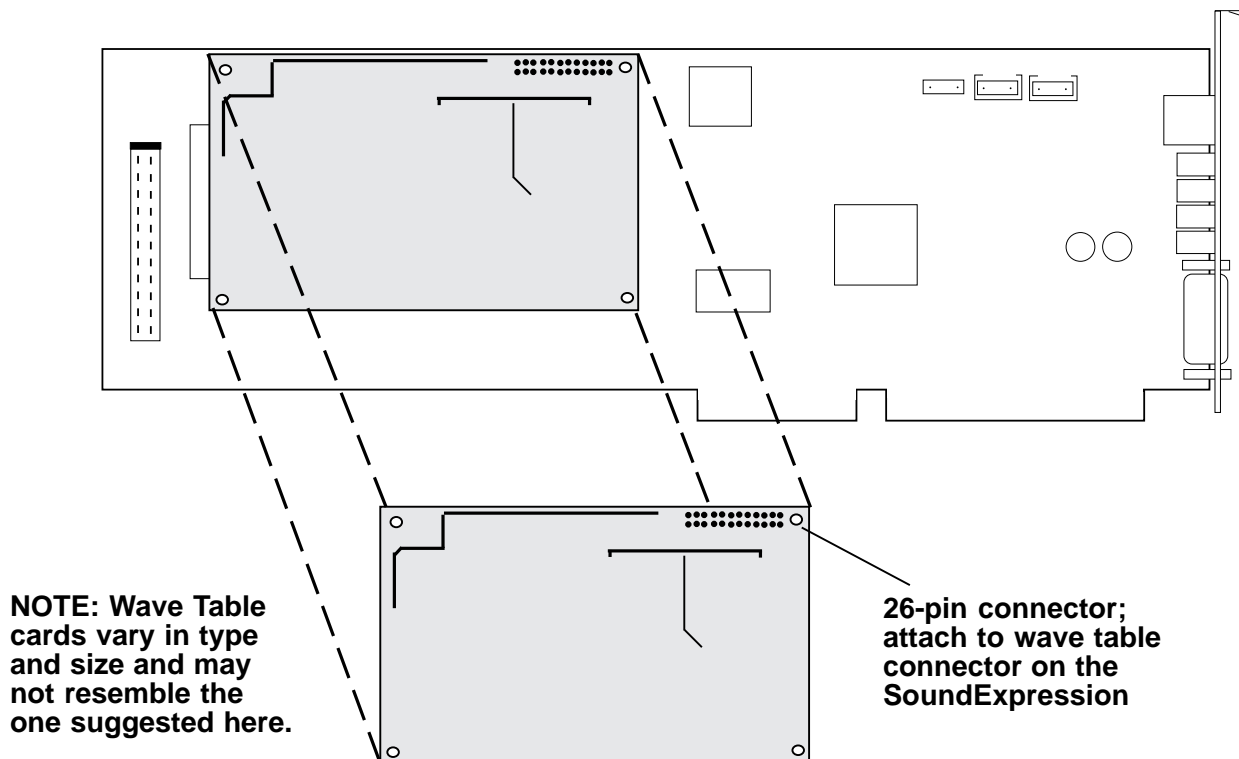
NOTE: Wave Table cards vary in type and size and may not resemble the one suggested here.

26-pin connector; attach to wave table connector on the SoundExpression

Appendix E: A Note on the MIDI Interface

MIDI (Musical Instrument Digital Interface) is a standard for composing and playing music using electronic instruments and computers.

The MIDI interface transmits (MIDI-out) and receives (MIDI-in) MIDI commands serially at 32.5K baud. Multiple instruments can be connected in a daisy-chain fashion to the MIDI interface.

MIDI commands are sent from a MIDI sequencer (i.e., the computer) to the attached instruments. Several instruments can play simultaneously. The result is similar to a complete band playing a song.

MIDI songs consist of commands, not actual digital sounds. Consequently, file size is greatly reduced when compared, for example, to a Windows .WAV file.

The SoundExpression can play MIDI songs in three different ways:

1. Through an instrument attached to the joystick/MIDI port.

2. Through an attached Wave Blaster™ compatible wave table card (see Appendix D).

3. Through the on-board OPL3 FM synthesizer.

When playing MIDI songs through the MIDI port or wave table card, the Windows MIDI mapper must be configured for MPU-401 (1-16).

When playing MIDI songs through the OPL3 FM synthesizer, the Windows MIDI mapper must be configured for:

SoundExpression FM (1-10), or
SoundExpression FM (13-16), or
SoundExpression FM (1-16).

NOTE: Most MIDI files will play correctly using the FM (1-10) setting. This setting uses MIDI channels 1-10. Some MIDI files may use channels 13-16. In this case, the song or tune may not play correctly. If this is the case, select FM (13-16). The FM (1-16) setting allows you to play MIDI files that use either channels 1-10 or 13-16.

NOTE: Some MIDI files contain two images of the song (dual-authored files). In this case, the music on channels 1-10 is duplicated on channels 13-16. This type of MIDI file will not sound correctly. So, you should select FM (1-10) instead.

References

Microsoft Windows Multimedia Authoring and Tools Guide
Microsoft Press
©1991 Microsoft Corporation
ISBN 1-55615-391-0

How MIDI Works
by Dan Walker
©1991 Peter L. Alexander Publishing, Inc.

Appendix F: A Note on Digital Sound

Traditionally, sound has been recorded in analog format. Magnetic tape is an example of the media used by analog recording. Analog audio uses electrical signals to create a single model of a given sound or "waveform" as shown below:

Digital sound applies computer-based technology to the recording, handling, and regeneration of sound. A digital waveform reduces the sound to a sequence of binary numbers. Digital audio systems sample the waveform and extrapolate the complete sound from the sample. When a digital recording is played, the numeric data is transformed back to its original acoustic waveform.

Tradeoffs

While the quality of a digital sound recording is subject to almost no degradation (unlike an analog recording), digital sound storage requirements are quite high in terms of computer hard disk space.

Analog Waveform

Amplitude

Time interval

Digital Waveform

Amplitude

0   1   0   1   0   0   1   1   0

Time interval
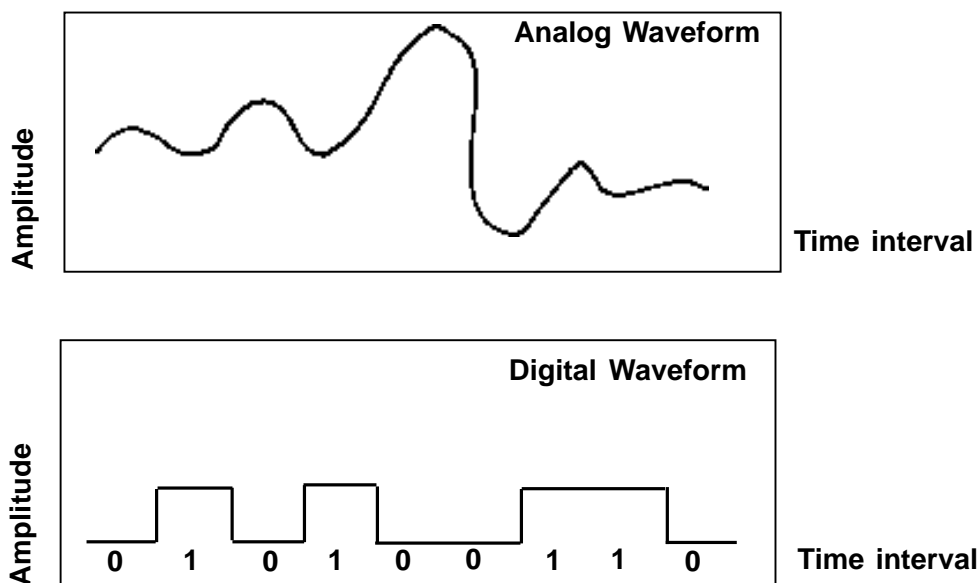
Appendix G: A Note on Windows Sound System

Windows Sound System provides 16-bit 44.1 KHz stereo record and play back with OPL3 FM synthesis for DOS game support in a DOS window. Settings for Windows Sound System may be chosen when selecting Driver Setup in the Windows Control Panel. These settings are as follows:

DUPLEX.

Half-duplex allows for either playing or recording.

Full duplex allows simultaneous playing and recording at the same sample rate.

Enhanced is the same as full duplex, but simultaneous playing and recording may occur at different sampling rates.

The default is full-duplex.

I/O Address. The default is 530h.

DMA Channel. The default is 1 for Play and 0 for Capture. NOTE: you may use the same DMA as your Sound Blaster. DMA Channel is not active in Windows.

IRQ. IRQ10 is the best choice. If you select IRQ9 or IRQ11, DOS-based games will not be supported in a DOS window.

Appendix H: Compliance Information

FCC Statement:

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference.
(2) This device must accept any interference received including interference that may cause undesired operation.

THIS UNIT COMPLIES WITH FCC PART 68 AS OF DATE OF MANUFACTURE. This equipment has been tested and found to comply with the limits for a **Class B** digital device, pursuant to Part 15 of FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

• Re-orient or relocate the receiving antennae.
• Increase the separation between the equipment and the receiver.
• Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
• Consult the dealer or an experienced radio/TV technician for help.

Note: This unit was tested with shielded cables on the peripheral devices. Shielded cables must be used with the unit to insure compliance.

Note: The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications to this equipment. Such modifications could void the user's authority to operate the equipment.

Notification to the Telephone Company

Notification to the telephone company is no longer required prior to connecting the registered equipment but upon request from the telephone company the user shall tell the telephone company which line the equipment is connected to as well as the registration number and the ringer equivalence of the registered protective circuitry. In most, but not all areas, the sum of all RENs should be 5.0 or less. The FCC Registration number and Ringer Equivalence number are printed on the main chip in the center of the internal modem board.

Malfunction of the Equipment

In the event that the modem should fail to operate properly, the customer shall disconnect the equipment from the telephone line to determine if it is the customer's equipment which is not working properly, or if the problem is with the modem, the user shall discontinue use until it is repaired. In the event service is needed the user should contact the vendor from whom you purchased the modem.

Telephone Connection Requirements

Except for telephone company-provided ringers, all connections to the telephone network shall be made through standard plugs and standard telephone company-provided jacks, or equivalent, in such a manner as to allow for easy and immediate disconnection of the terminal equipment. Standard jacks shall also be arranged that, if the plug connected thereto is withdrawn,

no interference to the operation of the equipment at the customer's premises which remains connected to the telephone network, shall occur by reason of such withdrawal.

Incidence of Harm

Should terminal equipment or protective circuitry cause harm to the telephone network, the telephone company shall, where practical, notify the customer that temporary discontinuance of service may be required; however, where prior notices are not practical, the telephone company may temporarily discontinue service if such action is deemed reasonable in the circumstances. In the case of such temporary discontinuance, the telephone company shall promptly notify customers and will be given the right to bring a complaint to the FCC if they feel the disconnection is not warranted.

Changes in Telephone Company Equipment or Facilities

The telephone company may make changes in its communications facilities, equipment, operations, or procedures, where such action is reasonably required and proper in its business. Should any such changes render the customer's terminal equipment incompatible with the telephone company facilities, the customer shall be given adequate notice to make modifications to maintain uninterrupted service.

General

The FCC prohibits customer-provided terminal equipment be connected to party lines or to be used in conjunction with coin telephone service.

Installation

The modem is equipped with a USOC RJ-11 standard miniature modular jack and is designed to plug directly into a modular jack.

DOC Compliance Statement (Canada)

The Canadian Department of Communications label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective operational and safety requirements. The Department does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunction, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure, for their own protection, that the electrical ground connections of the power utility, telephone lines, and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

CAUTION Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority or electrician, as appropriate.

The Load Number (LN) assigned to each terminal device denotes the percentage of the total load to be connected to a telephone loop which is used by the device to prevent overloading. The termination on a loop may consist of any combination of devices subject only to the requirement that the total of the load numbers of all the devices does not exceed 100. The Load number appears on the bracket of the SoundExpression.

Appendix I: Servicing Your Boca Product

If your Boca product requires service, first contact the authorized dealer from whom you purchased the modem. If the dealer is unable to assist you, and you must contact Boca Research, Inc., please follow the instructions below.

Our electronic BBS is available 24 hours a day at (407) 241-1601 and will support data transmission speeds up to 28.8Kbps with settings of N, 8, 1. Once your modem is functional, the BBS may be helpful (especially during off hours) if you have a question about product settings, or if you wish to download special software or utilities.

If the Troubleshooting section did not resolve your problem, you may call our technical support staff for assistance. If you haven't referred to the Troubleshooting sections, do so now.

> **NOTE: CALLING TECHNICAL SUPPORT WITHOUT COMPLETE AND ACCURATE INFORMATION CONCERNING YOUR PROBLEM MAY BE BOTH TIME-CONSUMING AND FRUSTRATING FOR YOU.**

1. When calling Boca Research Technical Support, have the following information available:

- **Board name and part number**
- **Computer manufacturer**
- **Computer Model**
- **Peripherals in system**
- **Operating system and version**

If you suspect a problem with a specific program or software package, make note of the name, version or release number, and manufacturer of the software.

2. Call our Technical Support Department between the hours of 8:00 a.m. and 6:30 p.m. EST Monday through Friday at (407) 241-8088. A technician will be available to discuss the problem(s) you are experiencing.

   If factory service is required, you will be given a Return Merchandise Authorization (RMA) number. Please place this number on the outside of the package when you return the item(s) for service and reference it on any correspondence included in the package. Boca Research, Inc. will return any product which is not accompanied by an RMA number.

3. Refer to the Warranty Statement if the product is covered under the five-year Boca Research, Inc. Limited Warranty.

4. Certain parts will not be covered under the Boca Research, Inc. Limited Warranty. Dealer installed parts are warranted by the dealer. Parts which you have installed yourself are covered only by the supplier's warranties. In

these cases, Boca Research, Inc. can identify which parts are defective, but will not replace such parts until specific written authorization is received from you. The cost of parts and labor involved in making such repairs will be billed to you C.O.D.

5. When sending the SoundExpression to Boca Research, Inc. for repairs, please be sure to include:

• **the SoundExpression** *(board only)*
• **a copy of the original invoice**
• **your return street address (for UPS purposes)**
• **phone number**
• **the RMA number mentioned above**

Package the product securely in a container equivalent to the original packaging, and insure the package to protect against loss or damage during transit. Shipping charges must be prepaid; C.O.D. shipments will not be accepted. Please use the address below for all correspondence:

<div align="center">

Boca Research, Inc.
RMA Department - RMA #
_____
1601 Clint Moore Road
Boca Raton, FL 33487-2841

</div>

6. If the repairs performed on your modem were covered by the warranty, Boca Research, Inc. will return it prepaid via UPS.

Appendix J: Warranty Information

Limited Warranty

Boca Research, Inc. (BRI) warrants to the original buyer of this BRI product that the hardware is free of defects in materials and workmanship for a period of five (5) years from the date of purchase from BRI or its authorized dealer. Should the product fail to be in good working order at any time during the five-year
period, BRI, will at its option, repair or replace this product as described below. This warranty does not cover defects resulting from misuse, abuse, negligence, accident, repairs, or alterations made by either the customer or another party. Boca Research reserves full rights to determine whether a defective product falls into this category.

The entire risk as to the quality and performance of the product rests with the customer. Any written or oral information or advice given by Boca Research dealers, distributors, agents, or employees will in no way increase the scope of this warranty. This warranty applies only to the product described in this manual and not to any other value-added software which may be included.

All products will be serviced and returned via UPS-ground at no charge to customers DURING the first year of service.

All customers are required to demonstrate proof of purchase when requesting a Return Merchandise Authorization (RMA). The period of service commences on the date of purchase. A copy of the sales slip must be included with the returned merchandise.

Products which require Limited Warranty service during the warranty period should be delivered to BRI at the address in the Appendix (Servicing Your Boca Product) with proof of purchase and the Return Merchandise Authorization (RMA) number provided by BRI Technical Support. Refer to the Appendix in your manual. Replacement parts or complete products will be furnished on an exchange basis only. Replaced parts and/or products become the property of BRI.

If the returned product is sent by mail, the purchaser agrees to prepay shipping charges, insure the product or assume the risk of loss or damage which may occur in transit, and to use a shipping container equivalent to the original packaging. ALL EXPRESS AND IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS OF PURPOSE FOR THE PRODUCT ARE LIMITED IN DURATION TO THE ABOVE FIVE- AND ONE-YEAR PERIODS, RESPECTIVELY.

UNDER NO CIRCUMSTANCES (WHETHER BASED IN CONTRACT OR TORT) SHALL BOCA RESEARCH BE LIABLE FOR INCIDENTAL, CONSEQUENTIAL, INDIRECT, SPECIAL, OR PUNITIVE DAMAGES OF ANY KIND, OR FOR LOSS OF REVENUE, LOSS OF BUSINESS, OR OTHER FINANCIAL LOSS AS A RESULT OF THE SALE, INSTALLATION, MAINTENANCE, USE, PERFORMANCE, FAILURE, OR DISRUPTION OF ITS PRODUCTS.

Boca Research reserves the right to make periodic changes or enhancements to any Boca Research product without prior notification, but has no obligation to modify or update products once sold.

This warranty gives you specific legal rights, and you have other rights which may vary from state to state. This warranty is valid only in the United States.

Appendix K: Modem Command Reference

BASIC AT COMMANDS (default values are highlighted)

Command Description

AT   Attention characters
ATA   Answer command
ATA/   Re-Execute last command

Dial Modifiers

Dial	Options	Description
ATD	none	Dial. (ATD followed by phone number)
ATDL	none	Re-dial.
ATDP	none	Pulse (rotary) dial. 10 pulses per second.
ATDT	none	Touch tone dial (DTMF).
ATDW	1-255sec	Wait for dial-tone. Default is 50 seconds.
ATD,	0-255sec	Pause. Default is 2 seconds.
ATD@	none	Wait for quiet answer.
ATD!	none	Initiate hook flash.
ATD;	none	Return to command state after dialing.
ATD^	none	Disable calling tone.
ATDS=0-3	none	Dial stored number. (See AT&Z).

Command Description

Command Character Echo

ATE0	Disables echoing of the commands to the screen.
ATE1	**Enables echoing of the commands to the screen. (default).**

Disconnect (hang-up)

ATH0	Instructs modem to go on-hook.
ATH1	Instructs modem to go off-hook.

Identification

ATI0	Displays the product identification code.
ATI1	Displays the checksum.
ATI2	Displays ROM checksum as OK or ERROR.
ATI3	Displays the firmware revision level.
ATI4	Reports OEM-defined identifier string.
ATI5	Reports country code.
ATI6	Reports modem data pump model.

Speaker volume

ATL0	Low volume.
ATL1	**Low volume. (default)**
ATL2	Medium volume.
ATL3	High volume.

Command	Description

Speaker control

ATM0	Disables the modem speaker.
ATM1	**Turns speaker on until carrier has been detected. (default)**
ATM2	Speaker is always on.
ATM3	Speaker is off when receiving carrier and during dialing, but off during answering.

Automode enable

ATN0	Requires speed of the connection be that specified by the value of S37.
ATN1	**Permits handshaking at any speed supported by both modems. (default)**

Return to on line state mode

ATO0	Switches the modem from command mode to on-line mode without dialing.
ATO1	Switches from command mode to on-line mode and initiates an equalizer retrain sequence.

Mode responses

ATQ0	**Enables result codes to be issued to the screen. (default)**
ATQ1	Disables result codes to be issued to the screen.

Command	Description

Result code format

ATV0	Numeric format.
ATV1	**Verbal format. (default)**

Error correction message control

ATW0	**Error correction call progress not reported. (default)**
ATW1	Call progress reported.
ATW2	Call progress not reported. Connect xxxx message reports DCE speed (e.g., CONNECT 28800).

Extended result codes

ATX0	Disables monitoring of busy tones unless forced otherwise by country requirements; sends only OK, CONNECT, RING, NO CARRIER, ERROR and NO ANSWER result codes.
ATX1	Disables monitoring of busy tones unless forced otherwise by country requirements; sends only OK, CONNECT, RING, NO CARRIER, ERROR, NO ANSWER and CONNECT XXXX result codes.
ATX2	Disables monitoring of busy tones unless forced otherwise by country requirements; sends only OK, CONNECT, RING, NO CARRIER,

Command	Description
	ERROR, DIAL TONE, NO ANSWER and CONNECT XXXX result codes.
ATX3	Enables monitoring of busy tones; sends only OK, CONNECT, RING, NO CARRIER, ERROR, NO DIALTONE, NO ANSWER and CONNECT XXXX.
ATX4	**Enables monitoring of busy tones and sends all messages. (default)**

Control long space disconnect

ATY0	**Disables long space disconnect. (default)**
ATY1	Enables long space connect.

Soft reset and restore profile

ATZ0	Restores stored profile 0.
ATZ1	Restores stored profile 1.

Escape Characters

+++	The escape characters are known as +++. They will switch from on-line mode to command mode while preserving the connection with the on line modem.

Extended AT Commands

Command	Description

Data carrier detect (DCD) signal

AT&C0	Forces DCD signal to be on at all times.
AT&C1	**DCD on indicates presence of data carrier. (default)**

Data terminal ready (DTR) signal.

Interprets the ON to OFF transition of the DTR signal from the DTE according to the &Q settings.

AT&D0	&Q0,5,6. DTR ignored. &Q1,4. Modem hangs up; auto answer not affected. &Q2,3. Modem hangs up; auto answer inhibited.
AT&D1	&Q0,1,4-6. Asynchronous escape sequence. &Q2,3. Modem hangs up; auto answer inhibited.
AT&D2	**&Q0-6. Modem hangs up; auto answer inhibited. (default)**
AT&D3	&Q0,1,4-6. Modem does a soft reset as if the ATZ command were received; &Q2,3. Modem hangs up; auto answer inhibited.

AT&F	**Recalls factory defaults.**
	Instructs the modem to use the factory set parameters.

Command Description

DTE/Modem flow control

AT&K0	Disable flow control.
AT&K3	**Enable RTS/CTS (default for data modem)**
AT&K4	Enable XON/XOFF.
AT&K5	Enable transport XON/XOFF.
AT&K6	**Enable both RTS/CTS and XON/XOFF (default for FAX modem)**

Note on Flow Control. XON/XOFF is a software-based flow control method, using standard ASCII control characters to pause or resume data transmission. RTS/CTS pacing, a hardware-based method, uses an electrical signal. Signals are exchanged as follows:

RECEIVER		**TRANSMITTER**
CTS ON	➡	START SENDING
CTS ON	⬅	RTS ON (ready to send)
CTS OFF	➡	RTS OFF (stop sending)

Command Description

Select pulse dial make/break ratio

AT&P0	**Selects a make/break ratio of 39/61 at 10pps. US and Canada. (default)**
AT&P1	Selects a make/break ratio of 33/67 at 10pps. UK and Hong Kong.
AT&P2	Same as 0 except at 20pps.
AT&P3	Same as 1 except at 20pps.

Asynchronous mode

AT&Q0	Direct Asynchronous mode.
AT&Q5	**Modem negotiates an error-corrected link. (default)**
AT&Q6	Selects asynchronous operation in normal mode (i.e., speed buffering).

RTS/CTS (Request to Send/Clear to Send)

AT&R0	Not supported.
AT&R1	**CTS will drop if required by flow control (default).**

Data Set Ready (DSR) signal

AT&S0	**Causes DSR signal to be active at all times. (default)**
AT&S1	Causes DSR signal to be active according to the CCITT specification.

Test and diagnostics

AT&T0	Terminates any test in progress.
AT&T1	Executes the local analog loopback test.
AT&T3	Executes the local digital loopback test.
AT&T4	**Enables the modem to accept a request from a remote mode for a digital loopback test. (default)**
AT&T5	Instructs the modem to deny a request from a remote modem for a digital loopback test.

Command Description

Command	Description
AT&T6	Executes the remote digital loopback test.
AT&T7	Executes the remote digital loopback test with a self test.
AT&T8	Executes the remote analog loopback test with a self test.

View Configuration

Command	Description
AT&V	View current configuration and user profile.

Store user profile.

Saves the current configuration into non-volatile RAM as one of two user profiles.

Command	Description
AT&W0	Saves as user profile 0.
AT&W1	Saves as user profile 1.

Designate default user profile

Command	Description
AT&Y0	Selects user profile 0.
AT&Y1	Selects user profile 1.

Stored phone number

Command	Description
AT&Z0=	Stores a 45 digit dial string.
AT&Z1=	Stores a 45 digit dial string.
AT&Z2=	Stores a 45 digit dial string.
AT&Z3=	Stores a 45 digit dial string.

MNP Operation

The V.34 Modem supports all of the preceding classes. The following AT Commands apply to the MNP protocol. Default values are highlighted.

Maximum MNP Block Size

Use this command to transmit smaller blocks of data in a reliable data link connection.

Command Description

Command	Description
AT\A0	set maximum block size to 64 characters.
AT\A1	**set maximum block size to 128 characters. (default)**
AT\A2	set maximum block size to 192 characters.
AT\A3	set maximum block size to 256 characters.

Transmit Break

When this command is entered during a non-MNP connection, a break signal is sent to the remote modem. The length of the break is 100 times the n parameter (1-9) in milliseconds. The default is 3.

AT\B3   (default)

Command Description

Break Control

Determines the modem response when a BREAK is received from the DTE or the remote modem. The values of the parameters vary based on the three following conditions:

(1) When a break is received from the DTE during NORMAL or MNP mode:

AT\K0, 2, 4: modem enters command mode without sending a break to the remote modem.
AT\K1: modem clears the terminal and modem buffers and sends a break to the remote modem.
AT\K3: modem does not clear the buffers, but sends a break to the remote modem.
AT\K5: modem sends a break to the remote modem in sequence with any transmitted data. (default).

(2) When a break is received from the remote modem during NORMAL mode:

AT\K0, 1: modem clears the terminal and modem buffers and sends a break to the local DTE.
AT\K2, 3: modem does not clear the buffers but sends a break to the local DTE.
AT\K4, 5: modem sends a break in sequence with any data being buffered. (default)

(3) When a break is received from the DTE during DIRECT MODE mode:

AT\K0,1,3: modem sends a break to the remote modem and enters command mode.
AT\K2, 4, 5: modem sends a break to the remote modem. (default)

Error Correction Operating Mode

Selects the operating mode the modem uses while connected.

AT\N0	NORMAL (speed buffering) mode.
AT\N1	DIRECT (pass-through) mode.
AT\N2	RELIABLE LINK mode. Specifies error correction for the modem-to-modem connection
AT\N3	AUTO-RELIABLE LINK mode. Attempts error-correction connection but will fall back to normal mode if unable to establish an MNP link.
AT\N4	LAPM error correction mode.
AT\N5	MNP error correction mode

AT Commands for V.42/V.42bis

The following AT commands apply to the V.42/V.42bis protocol:

Command   Description

Compression Control

Determines whether or not modem will use data compression.

AT%C0	disables data compression
AT%C1	enables MNP5 data compression negotiation
AT%C2	enables V42bis data compression.
AT%C3	**enables both V.42bis and MNP5 data compression (default)**

Auto-retrain

Determines whether or not the modem automatically monitors the line quality and requests a retrain when necessary.

AT%E0	disables line quality monitor auto-retrain
AT%E1	enables line quality monitor auto-retrain
AT%E2	**enables line quality monitor auto retrain and auto fall back/forward. (default)**

Report Received Signal Level

AT%L	009 = -9 dBm, 010 = -10dBm, etc. all the way to 043 (-43 dBm)

Line signal and noise are determined by the unit of measurement dBm (decibel referenced to one milliwatt). To arrive at a signal/noise ratio, the noise level is subtracted from signal level in dBm.

Report Line Signal Quality

AT%Q	009 = -9 dBm, 010 = -10dBm, etc. all the way to 043 (-43 dBm)

Returns a "high-order" byte of the calculated EQM ("eye quality monitor"). This can range from 0 to 255. When the value is 8 or greater, the modem will automatically retrain if enabled by the AT%E1 command. The value for a normal connection ranges from 0 to 2 and approaches 8 for a progressively poorer connection. Returns an OK result code.

000 to 007	no retrain
008 to 255	retrain performed if enabled by %E1.

S-Registers

This section defines the purpose of the modem registers, and sequentially lists the registers and describes their functions. These registers affect various operating characteristics and allow you to obtain information about the modem, as well as test the modem. Each register has a factory-set value, which you can read or change to fit your needs.

Reading a Register Value

To read the current value of a register, type:

AT Sn? [ENTER],

where n is a register number.

AT Sn? Sn? [ENTER] from the command mode.

To read the register values of S0 and S1, type

AT S0? S1? [ENTER].

The modem will display the first register value, a carriage return, the next register value, a carriage return, and OK or 0.

Changing a Register Value

To change a register value, use the Sn command (ATSn=v), where n is a

register number and v is the new value you want to assign to the register. Type:

AT S0=3 [ENTER]

to have the modem automatically answer on the third ring.

The following table on the following page lists the modem's registers and their functions.

Reg.	Range	Units	Default	Definition
S0	0-255	rings	0	Auto-answer
S1	0-255	rings	0	Count incoming rings
S2	0-255	rings	43	Escape character value.
S3	0-127	ASCII	13	Carriage return character.
S4	0-127	ASCII	10	Line feed character.
S5	0-255	ASCII	8	Backspace character.
S6	2-255	seconds	2	Wait time for Blind Dialing.
S7	1-255	seconds	50	Wait for carrier after dial.
S8	0-255	seconds	2	Pause time for dial delay.
S9	1-255	seconds	6 (0.6)	Carrier detect.
S10	1-255	seconds	14 (1.4)	Lost Carrier to Hang Up Delay.
S11	50-255	ms	95 ms	DTMF tone duration (* in one-hundredth second increments)
S12	0-255	seconds	50(1)	Escape code guard time*. (*in one-fiftieth second increments)
S13				Reserved.
S14	Bit Mapped		138(8Ah)	Bit mapped registers.
S15				Reserved
S16	Bit Mapped		0	Modem test options.
S17				Reserved.
S18	0-255	seconds	0	Test timer.
S19				Reserved.
S20				Reserved.
S21	Bit Mapped		4(04h)	Bit mapped registers.
S22	Bit Mapped		117(75h)	Bit mapped registers.
S23	Bit Mapped		54(36h)	Bit mapped registers.
S24	0-255	seconds	0	Sleep Inactivity Timer.
S25	0-255	seconds	5	Asynchronous DTR Delay.
S26	0-255	seconds	1	RTS to CTS Delay Interval.
S27	Bit Mapped		9(09h)	Bit mapped registers.
S28	Bit Mapped		0	Bit mapped registers
S29	0-255	ms	0	Flash Dial Modifier Time.
S30	0-255	tens of seconds	0	Disconnect Inactivity Timer.
S31	Bit Mapped		2	
S32	0-255	ASCII	17(11h)	XON Character.

SoundExpression

Reg.	Range	Units	Default		Definition
S33	0-255	ASCII	19(19h)		XOFF Character.
S34-35					Reserved.
S36			7 (07h)		LAPM Failure Control
S37			0		Line Connection speed

NOTE: Desired sub-V.34 line connection speed. If an invalid number is entered, the number is accepted into the register, but S37 will react as though the default value has been entered. See the +MS command for more modulation selections.

Bits 0-4:

0 =		**Attempt auto mode connection (DEFAULT)**
1-3	=	Attempt to connect at 300bps
4	=	Reserved
5	=	Attempt to connect at V.22 1200bps
6	=	Attempt to connect at V.22bis 2400bps
7	=	Attempt to connect at V.23
8	=	Attempt to connect at V.32/V.32bis 4800bps
9	=	Attempt to connect at V.32/V.32bis 9600bps
10	=	Attempt to connect at V.32bis 12Kbps
11	=	Attempt to connect at V.32bis14.4Kbps
12	=	Attempt to connect at V.32bis 7200bps (ATF7)

Reg.	Range	Units	Default	Definition
S38	0-255	seconds	20	Delay Before Forced Hangup.
S39		Bit Mapped	3	Bit Mapped Registers.
S40		Bit Mapped	105(69h)	Bit Mapped Registers.
S41		Bit Mapped	3	Bit Mapped Registers.
S46		136 or 138	138	Data Compression Control.

NOTE: 136 enables error correction with no compression; 138 enables error correction WITH compression.

Reg.	Range	Units	Default	Definition
S48	0, 7, 128		7	V.42 Negotiation.

NOTE: 0 disables negotiation and proceeds with LAPM; 7 enables negotiation; and 128 disables negotiation and proceeds with fallback action specified in S36. The default for S36 is to attempt an MNP connection.

Reg.	Range	Units	Default	Definition
S82	3, 7, 128		128(40h)	Break Handling Option.
S86	0,4,5,9,12,13,14		NA	Connection Failure Cause Code.

    0   = Normal disconnect; no error occurred.
    4   = Loss of carrier
    5   = V.42 negotiation failed to detect an error-correction remote modem.
    9   = The modems could not find a common protocol.
    12 = Normal disconnect initiated by the remote modem.
    13 = Remote modem does not respond after 10 re-transmissions of the same message.
    14 = Protocol violation.

Reg.	Range	Units	Default	Definition
S91	0 to -15	dBm	10	PSTN Transmit Level.
S92	0 to -15	dBm	10	Fax Transmit Level.
S95	Bit-Mapped		0	Extended Results Codes.

NOTE: Bit values are defined as follows for S95:

    0 = CONNECT CODE indicates DCE speed instead of DTE speed.
    1 = Append ARQ (automatic repeat request) to verbose CONNECT XXXX result code if protocol is other than none.
    2 = Enable CARRIER XXXX result code.
    3 = Enable PROTOCOL XXXX result code.
    5 = Enable COMPRESSION result code.

Bits 4, 6, and 7 are reserved.

AT+MS Command (Modulation Select)

This extended format command selects the modulation, optionally enables or disables automode, and optionally specifies the lowest and highest connection rates using from one to four subparameters. The command format is:

+MS=<mod>[,[<automode>][,[<min_rate>][,[<max_rate>]]]]

The default value as reported by the +MS? command is:

+MS=11,1,300,28800

Note 1: For 14400bps and lower speeds, the Nn command and S37 register can alternatively be used, in which case the +MS subparameters will be modified to reflect the Nn command and S37=x settings. Use of the Nn and S37=x commands is not recommended, but is provided for compatibility with existing communication software. (S37 is not updated by the +MS command).

Note 2: Subparameters not entered (enter a comma only or <CR> to skip the last subparameter) remain at their current values.

Reporting Selected Options

The modem can send a string of information to the DTE consisting of selected options: +**MS?**

The response is:

+MS:<mod>,<automode>,<min_rate>,<max_rate>

Example: +MS: 11, 1, 300, 28800 (shows default values)

Reporting Supported Options

The modem can send a string of information to the DTE consisting of supported options using the following commands.

+**MS=?**

The response is:

+MS: (list of supported <mod> values), (list of supported <automode> values), (list of supported <min_rate> values), list of supported <max> rate values)

Example:

+MS: (0, 1, 2, 3, 9, 10, 11, 64, 69, 74), (0,1) (300-28800), (300-28800)

Subparameter Definitions

1. <**mod**> = a decimal number which specifies the preferred modulation (automode enabled) or the modulation (automode disabled) to use in originating or answering a connection. The options are as shown below:

<mod>	Modulation Selected	Possible rates (bps)
0	V.21	300
1	V.22	1200
2	V.22bis	2400 or 1200
3	V.23	1200*
9	V.32	9600 or 4800
10	V.32bis	14400, 12000, 9600, 7200, or 4800
11	**V.34**	**28800, 26400, 24000, 21600, 19200, 16800, 14400, 12000, 9600, 7200, 4800, or 2400 (default)**
64	Bell 103	300
69	Bell 212	1200
74	V.FC	28800, 26400, 24000, 21600, 19200, 16800, 14400

* For V.23, originating modes transmit at 75bps and receive at 1200bps; answering modes transmit at 1200bps and receive at 75bps. The rate is always specified at 1200bps.

The modem may also automatically switch to another modulation (automode), subject to the following constraints:

• The modem may not be able to automatically switch from the current modulation (specified by <mod>) to some other modulation. For example, there is no standard way to automode from Bell 103 to V.23.

• The DTE may disable automode operation (see <automode>).

• The DTE may constrain the range of modulations available by specifying the lowest and highest rates (see <min_rate> and <max_rate> below).

2. <**automode**>=an optional numeric value which enables or disables automatic modulation negotiation. Options are:

<automode>	Option Selected
0	Automode disabled
1	Automode enabled

The default value is 1, which enables automode. Note, however, there are modulations for which there is no automatic negotiation (e.g., Bell 212 (<mod>=69).

For <automode> = 0 (automode disabled, i.e., fixed modulation):

a. If <max_rate> is within the rates supported by the selected modulation, the selected rate is that specified by <max_rate>.

Example: +MS=9,0,1200,4800 selects V.32 4800bps fixed rate.

b. If <max_rate> is greater than the highest speed supported by the modulation specified by <mod>, the starting rate is the highest rate supported by the selected modulation.

Example: +MS=9,0,2400,14400 selects V.32 9600 or 4800bps.

c. To emulate N0S37=x command sequence to select fixed mode operation, specify the <max_rate> and <min_rate> both to be the same requested speed, and <mod> to be the modulation for that speed.

Example: +MS=11,0,16800,16800 selects V.34 16800bps fixed mode (no comparable S37 command).

+MS=9,0,12000,12000 selects V.32 12000bps fixed mode (same as N0S37=10).

For <automode> = 1 (automode enabled; i.e., automatically selected speed and modulation).

a. If <max_rate> is greater than the highest rate supported by the modulation specified by <mod>, the modem automodes down from the highest rate of selected modulation.

Example: +MS=10,1,1200,24000 selects automoding down from V.32bis 14400bps.

b. To emulate N1S37=x sequence command, specify the modulation and the rate to start automoding down from using <mod> and <max_rate>, respectively. Set <min_rate> to 300 to allow automoding all the way down to V.21 300bps.

Example: +MS=11,1,300,16800 selects automode starting at V.34 16800bps (no comparable S37 command)

+MS=9,1,300,12000 selects automode starting at V.32bis 12000bps (same as N1S37=10).

3. **<min_rate>**= is an optional number which specifies the lowest rate at which the modem may establish a connection. The value is decimal-coded in units of bps, e.g., 2400 specifies the lowest rate to be 2400bps. The default is 300 for 300 bps.

4. **<max_rate>**= is an optional number which specifies the highest rate at which the modem may establish a connection. The value is decimal-coded in units of bps, e.g., 14400 specifies the highest rate to be 14400bps. The default is 28800 for 28800bps.

Result Codes

Result Code	Numeric Value	Description
OK	0	Modem successfully executed a command line.
CONNECT	1	Connection made at 300 bps.
RING	2	Modem detected an incoming call.
NO CARRIER	3	Modem lost or could not detect a remote carrier signal within the Register S7 time.
ERROR	4	Modem found an error in the command line.
CONNECT 1200	5	Modem established a connection at 1200 1200bps.
NO DIALTONE	6	Modem did not detect a dial tone within 5 seconds after going off-hook.
BUSY	7	Modem detected a busy signal.
NO ANSWER	8	Five seconds of silence was not detected when using the @ command in the dial command line.
CONNECT 0600	9	Modem established a connection at 600 bps.
CONNECT 2400	10	Modem established a connection at 2400 bps.
CONNECT 4800	11	Modem established a connection at 4800 bps.
CONNECT 9600	12	Connection made at 9600 bps.
CONNECT 7200	13	Connected as data modem during an answer.
CONNECT 12000	14	Connection made at 12000 bps.
CONNECT 14400	15	Connection made at 14400 bps.
CONNECT 19200	16	Connection made at 19200 bps.
CONNECT 38400	17	Connection made at 38400 bps.
CONNECT 57600	18	Connection made at 57600 bps.
CONNECT 115200	19	Connection made at 115,200 bps.
CONNECT 75TX/1200RX	22	Modem returns this result code when upon establishing a V.23 originate connection when the modem has

Result Code	Numeric Value	Description
		been instructed to report the DTE speed to the DTE upon connecting.
CONNECT 1200RX/75RX	23	Modem returns this result code when upon establishing a V.23 answer connection when the modem has been instructed to report the DTE speed to the DTE upon connecting.
DELAYED	24	For X4; when a call fails to connect and the number dialed is 'delayed' due to country blacklisting requirements.
BLACKLISTED	32	For X4; when a call fails to connect and the number dialed is considered 'blacklisted'.
FAX	33	A fax modem connection is established.
DATA	35	A data modem connection is established.

CARRIER 300	40	Carrier rate of 300 bps.
CARRIER 1200/75	44	V.23 backward channel has been detected.
CARRIER 75/1200	45	V.23 forward channel has been detected
CARRIER 1200	46	Carrier rate of 1200 bps.
CARRIER 2400	47	Carrier rate of 2400 bps.
CARRIER 4800	48	Carrier rate of 4800 bps.
CARRIER 7200	49	Carrier rate of 7200 bps.
CARRIER 9600	50	Carrier rate of 9600 bps.
CARRIER 12000	51	Carrier rate of 12000 bps.
CARRIER 14000	52	Carrier rate of 14400 bps.
CARRIER 16800	53	Carrier rate of 16800 bps.
CARRIER 19200	54	Carrier rate of 19200 bps.
CARRIER 21600	55	Carrier rate of 21600 bps.

Result Code	Numeric Value	Description
CARRIER 24000	56	Carrier rate of 24000 bps
CARRIER 26400	57	Carrier rate of 26400 bps.
CARRIER 28800	58	Carrier rate of 28800 bps.
CONNECT 16800	59	Connect speed of 16800 bps.
CONNECT 21600	61	Connect speed of 21600 bps.
CONNECT 24000	62	Connect speed of 24000 bps.
CONNECT 26400	63	Connect speed of 26400 bps.
CONNECT 28800	64	Carrier rate of 28800 bps.
COMPRESSION: CLASS 5	66	The modem has connected in MNP class 5 and COMPRESSION message reporting has been enabled.
COMPRESSION: V.42bis	67	The modem has connected in V.42bis and COMPRESSION message reporting has been enabled.
COMPRESSION:	69	The modem has NONE connected without data compression and COMPRESSION messagereporting has been enabled.
PROTOCOL: NONE*	70	Modem has connected without any form of error connection.
PROTOCOL: LAPM*	77	Modem has connected in the V.42 LAPM mode of error correction.
PROTOCOL: ALT*	80	Modem has connected in the MNP mode of error correction.
PROTOCOL: ALT* CELLULAR	81	Modem has connected in the MNP10 mode.

* PROTOCOL message reporting has been enabled.

| +FCERROR | +F4 | Fax carrier error. |

Appendix L: Glossary of Audio Terms

amplitude. The variation in a sound signal producing varying levels of loudness. Measured in decibels (dB).

analog sound. Recorded sound depicted by fluctuations in amplitude.

bits per sample. The number of bits employed to record information from a single sample when recording digital sound. See Sampling.

CD quality. Recording quality similar to that of a compact disc player. This means that 16 bits of information are recorded for every sample taken. See Bits Per Sample and Sampling.

decibel (db). A means of measuring amplitude.

digital sound. Recorded and stored sound as a series of numerical values rather than fluctuations in amplitude.

line-in. A connector on audio equipment to which a device like a CD-player or tape cassette player may be attached. See also Line Out.

line out. A connector on audio equipment to which audio components can be attached such as stereo speakers. See also Line In.

MIDI. Musical Instrument Digital Interface. A standard which allows for the exchange of data between two music synthesizers or a synthesizer and a computer. Sound data may be communicated from the synthesizer to the computer and stored as a MIDI file. Or, a MIDI file can be transmitted to the synthesizer for playback.

MPU-**401.** A UART on the MIDI port which allows MIDI interface to transmit and receive at 32.5K baud (see Appendix E for more information).

pitch. A sound's tone, usually determined by the sound's frequency.

sample. A measurement of sound taken during a certain duration. In digital recording, sampling means recording voltages which make a sound as a sequence of numerical values representing the sound's amplitude.

sound file. Any file which holds sound data. Examples: files with .MID file name extensions are compatible with the MIDI standard (see above); a file with a .WAV file name extension is a standard Microsoft file format for storing waveform audio data. See Waveform and wave file.

timbre. How the ear identifies and classifies sound. Example: the timbre of the same note played by two different instruments (flute and tuba) will not be the same.

voice annotation. Embedding of a voice message into a document for later playback.

wave file. A standard Microsoft file format for storing waveform audio data.

waveform. A graph showing the amplitude of a sound over a particular interval of time. Any portion of that interval is a sample.

Appendix M: Glossary of Modem Communication Terms

A

algorithm. A formula or procedure which employs various methods defining how data is to be used to give a prescribed result.

analog signals. Signals which can vary over a continuous range (e.g., the human voice over conventional telephone lines). Analog circuitry is more subject to distortion and noise, but it is more capable of handling complex signals than are digital signals which can have only discrete values.

ARQ. Automatic ReQuest for retransmission. A type of communications link where the receiver asks the transmitter to re-send a block of data when errors are detected.

ANSI. American National Standards Institute. A non-profit, private industry association which governs most USA-standards setting agencies.

ASCII. Acronym for American Standard Code for Information Interchange. ASCII is an ANSI character set. The standard ASCII character set consists of 128 decimal numbers (0-127) for letters of the alphabet, numerals, punctuation marks, and common special characters. The extended ASCII character set extends to 255 characters and contains special mathematical, graphics, and foreign characters.

asynchronous communications. A method of transmission in which one character is sent one bit at a time; also referred to as serial transmission.

B

Bell standards. Refers to the U. S. modulation protocol standards developed by the former AT&T Bell Systems such as Bell 103 (300bps transmission) and Bell 212A (1200bps transmission).

bit-mapped registers. An S-register which contains multiple bit-oriented values.

blind dialing. An automated process whereby the modem goes off-hook and dials without waiting for a dial tone. This is prohibited in many countries.

block transfer control. Determines whether or not the modem uses block or stream mode during an MNP connection. In stream mode, MNP sends data frames in varying length. Block mode sends fixed data frames of 256 characters.

bps. bits per second.

break handling. Determines how the modem responds when a BREAK signal is received from either the DTE (Data Terminal Equipment or computer/terminal) or the remote modem. This is controlled by the MNP-based AT extended command \K. A break signal is represented on the communications line by a steady space signal for a significant length of time. Break signals may be activated from the keyboard by pressing the BREAK key or the control (CTRL) and C keys.

C

CCITT. Consultative Committee for International Telephone and Telegraph. This advisory organization is part of the ITU (International Telecommunication Union) which is an agency of the United Nations. Organization recently renamed International Telecommunications Union-Telecommunications Standard Sector (ITU-T)

command mode. The modem is in command mode when it is turned on or reset, when it loses its connection to a remote modem, when it is in on-line mode, or when escape characters (+++) are typed. To transmit data, the modem must be in data mode. The modem does not transmit data when in command mode.

communications protocol. A set of procedures which controls how a data communications network operates.

D

DCD. Data Carrier Detect. Indicates to the terminal device that the modem is receiving a valid carrier signal from a remote modem. The carrier is a tone at a specified frequency.

DCE. Data Communications Equipment. The local and/or remote modem. A DCE is usually connected to a DTE.

DTE. Data Terminal Equipment. The computer or terminal, either local (yours), or the remote (the one you're communicating with). A DTE is usually connected to a DCE.

DTR. Data Terminal Ready. The computer issues this signal to the attached modem indicating that it is ready to receive data.

data compression. A technique that examines transmitted data for redundancy and replaces strings (groups) of characters with special codes which the receiving modem interprets and restores to its original form. Transmission of compressed data results in shorter connect times and hence cost savings for connect charges. Data compression is sometimes called "source encoding".

data mode. The modem is in data mode when a connection has been established with a remote modem and sends a CONNECT response confirming the connection. User data may then be transmitted or received.

dial modifier. Dial modifiers are special characters appended to the ATD command which instruct the modem how to place a call.

digital signal. A discrete signal which can only take on one of several (usually only two) discrete levels in contrast to analog signals which can take a continuous range of levels.

E

error detection and correction. The transmitting modem attaches a special pattern (called a frame check sequence) calculated according to a prescribed algorithm from user-defined data to the end of a block of data. The receiving modem performs the same algorithm and compares it to the one with the transmitted data. If these match, then the block of data has been received correctly. If not, the block of data is re-transmitted until no errors are detected.

escape sequence. Also referred to as the escape command. This special command is entered as three plus symbols (+++) and places the modem in command mode and interrupts user data transmission, but does not terminate the data connection. This allows the entering of commands while the connection is maintained.

extended AT-command. Extended commands were developed to provide greater functionality and control over modem operations than is available from the basic AT command set.

F

fax mode. The modem is in fax mode when, through use of fax communications software, it can send and receive faxes, print and display fax files, convert files to fax-files, and set certain fax-related features. Note: the modulation protocol used by the modem in fax mode is also different from the usual data mode modulation.

flow control. Compensates for the difference between the rate at which data reaches a device and the rate at which the device processes and transmits. The two common types of flow control are RTS/CTS signaling (a hardware based method, employing an electrical signal) and XON/XOFF (a software-based method using standard ASCII control characters to pause or resume transmission). The \G command controls XON/XOFF flow control.

full-duplex. Two-way simultaneous transmission between modems, which may occur via a four-wire circuit on a leased line, or with a two-wire connection when the frequency bandwidth is divided into two distinct channels, or when echo cancellation is employed (e.g., Bell 103, 212, and V.22 use frequency division, while V.32 uses echo cancellation).

G

guard tone. Guard tones are used in the United Kingdom and other countries. This requires that the modem transmit an 1800-Hz tone after it sends an answer tone. The guard tone is controlled by the &G command. Guard tones are not used in the U.S.A.

H

half-duplex. Signal flow in both directions, but only one way at a time with each modem alternating between send and receive.

Hayes-compatible. Hayes Microcomputer Products, Inc. developed the AT command set which has become a de facto industry standard. Hayes commands are always initiated with an AT (attention code) prefix.

hook flash. The dial modifier "!" causes the modem to go on-hook (hang-up) for one-half second. Also controlled by the ATH command.

L

LAPM. Link Access Protocol Modem. A V.42 ARQ type of error correction protocol where LAPM may be activated with or without V.42bis data compression.

leased line. Also referred to as a private line. A leased line is obtained from a communications company (carrier) to provide a transmission medium between two points. The line consists of a permanent dedicated circuit between two points, or to set of previously arranged points. The cost of the line is usually based on the distance between locations. This is in contrast to switched or dial-up lines, which can be connected to any point on the network.

line modulation. The means by which a carrier is varied to represent a signal carrying information. In a modem, the user's digital data is used to modulate the modem's transmitter's carrier or carrier to allow the digital signal to be carried over analog facilities.

long space disconnect. Determines whether or not modem disconnects when it receives a continuous break from a remote modem. Controlled by the ATY command.

loopback tests. There are four types of loopback tests which are as follows: (1) the local digital loopback tests the operation of the DTE, including whether or not data is leaving the terminal or computer port; (2) the local analog loopback tests the digital and analog circuits of the modem; (3) the remote digital loopback checks the operating condition of the line and remote modem; (4) the remote analog loopback tests the line to the remote modem.

M

MNP. Microcom Networking Protocol. A series of data communications protocols developed by Microcom for full-duplex, error-free communications.

make/break ratio. The &P command controls the ratio of the off-hook (make) to on-hook (break) interval used by the modem when it pulse dials. &P0 selects a 39%/61% make/break ratio for use in the U.S. &P1 selects a 33%/67% make/break ratio for use in the United Kingdom and Hong Kong. The &P command is NOT allowed in some countries.

modulation handshake. Also referred to as Automode Enable and is controlled by the ATN command. This determines whether or not the modem must connect at a particular speed, or allow connection at any speed supported by both modems.

N

negotiation fallback. Controlled by S-Register 36 as part of the V.42 protocol. Setting this register indicates what action to take when a desired connection cannot be made (e.g., hang-up, direct mode connect, normal mode connect).

non-volatile RAM. Also NVRAM. Random access memory whose data is retained when power is turned off. This is especially useful for modems to store user-defined default configuration settings and frequently used telephone numbers. This information would be loaded into modem RAM at power-up.

O

on-line state. Same as data mode. To transmit or receive data, the modem must be in the on-line state. When placing a call, the modem is put on-line with the dial command.

P

PBX. Private Branch Exchange. A telephone switch at a customer site.

pulse dialing. Also referred to as rotary dialing, i.e., dialing with the older-style rotary dial wheel. The dial modifier ATDP sets the modem to pulse dialing, which is the default method as opposed to tone dialing (push-button touch-tone) which is enabled with ATDT. All telephone exchanges will accept older-style pulse dialing and most exchanges will accept modern tone-dialing. Tone dialing is faster and more reliable since mechanical relays and their inherent failure mechanisms are avoided.

R

result code. A response sent by the modem after executing a command. The response reports the modem's status or the progress of a call and can take the form of either digits (numeric) or words (verbose). Issuing a V1 command enables word responses. A V0 (V-

zero) command enables numeric responses. The Q1 command disables their use entirely. Example: "OK" (word), or 0 (numeric) indicates that the modem successfully executed a command.

retrain. An adjustment process performed when one of the modems detects signal distortion or line noise which threaten data integrity.

RTS/CTS. Request to Send/Clear to Send. RTS and CTS are two control signal lines between the modem (DCE) and terminal (DTE) which allow the terminal to control the flow of information. See also flow control.

S
sleep inactivity timer. Determines the length of time the modem operates in normal mode with no activity before entering low-power "sleep" mode.

split-**speed direction**. Determines which direction (transmit or receive) has the 75bps channel and which has the 1200bps channel.

standard AT-**command**. The basic AT command set, originated by Hayes Microcomputer Products, Inc.

synchronous communications. A method of transmission in which data bits are sent continuously at the same rate under the control of a fixed frequency clock signal.

T
touch-**tone dialing**. Push-button tone dialing as used on contemporary phone sets. The dial modifier ATDT sets the modem to "tone" mode. Tone dialing is faster and more reliable than older-style pulse dialing.

trellis coding. A method of modulation which targets specific modulation points. Signals falling outside of these points are treated as line noise, thus ensuring greater noise immunity over a given line. QAM (Quadrature Amplitude Modulation) functions similarly, but has a broader tolerance and results in lesser noise immunity than trellis coding.

X
XON/XOFF. XON and XOFF are the names of two different flow control characters. See also flow control.

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