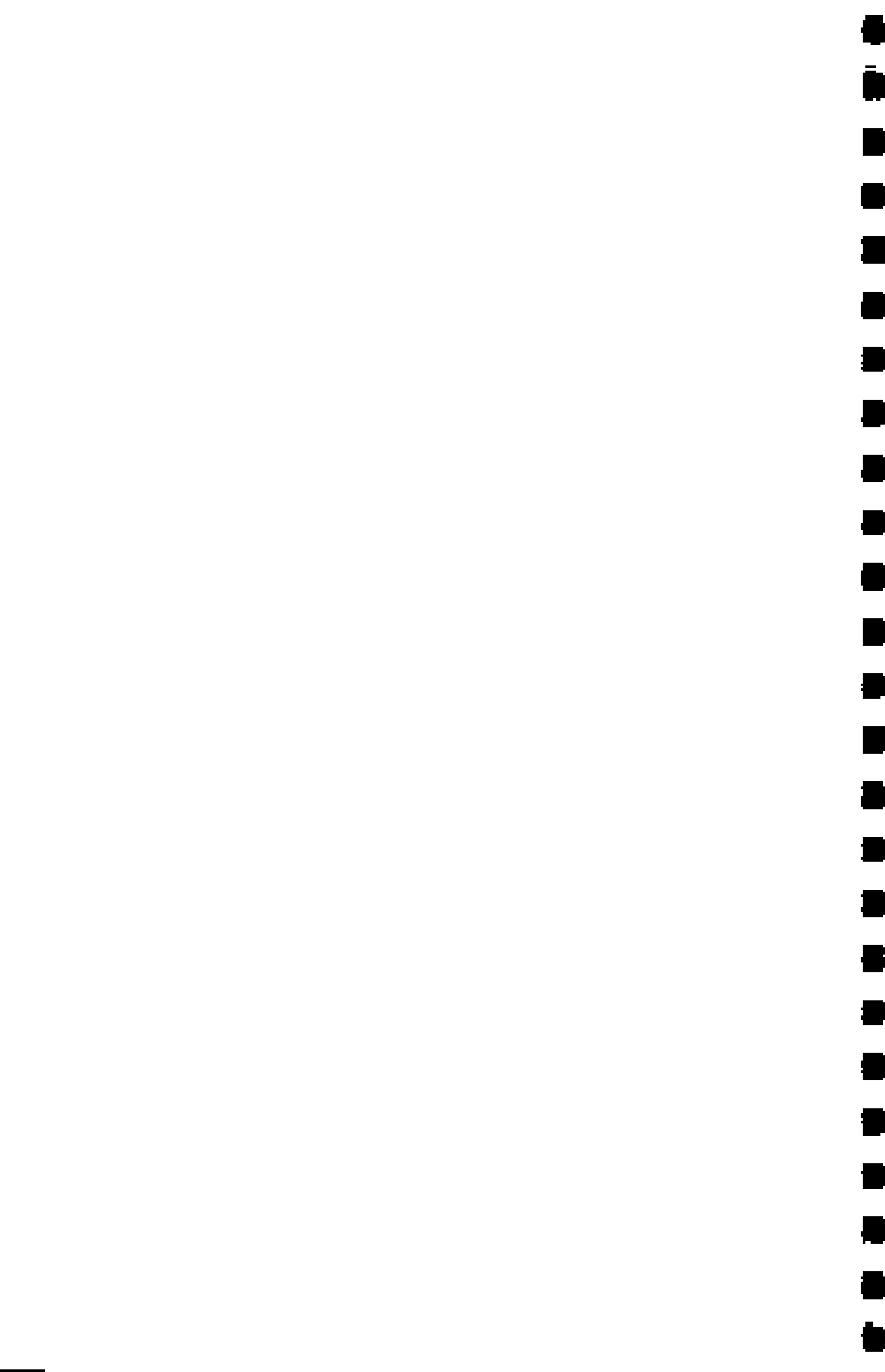


Cat. No. 25-3510

**1200 bps Modem
For Tandy 1400 LT**
User's Manual





**1200 bps Modem
for Tandy® 1400 LT
User's Manual**

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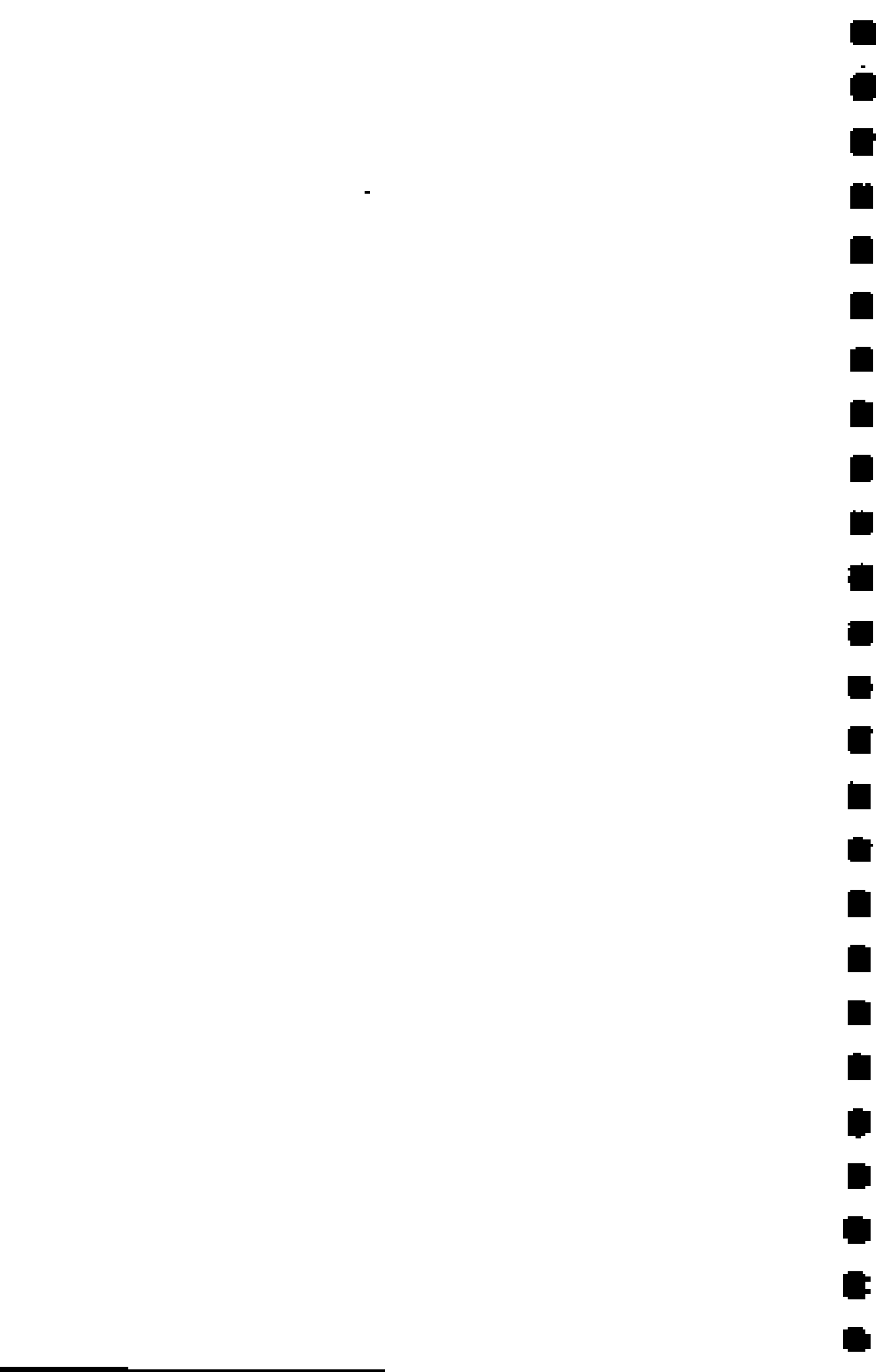


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Chapter 1

INTRODUCTION

1.0 Introduction

Welcome to the world of personal computer communications. You have purchased Tandy's 1200 bps internal modem for the Tandy 1400 LT. With this system and your personal computer, you can call information sources, such as Dow Jones News Retrieval, exchange information with mainframes, minis, or personal computers, and transfer files.

The Tandy system you have purchased contains several elements:

- 1) The modem card.
- 2) A modular telephone cable.
- 3) This manual, which provides complete installation and operating instructions.

1.1 What is a Modem?

A modem allows your computer or terminal to communicate with another terminal or computer over the phone lines. The word "modem" is an acronym for MODulator/DEModulator. A modem converts digital data, generated by the computer, into analog, or

audio tones, suitable for transmission over regular telephone lines. When you send data to another computer, your modem translates the computer data into audio tones. At the other end, the modem attached to the remote computer “demodulates” the audio data back into the digital language of the computer.

1.2 Make a Call or Answer

Your modem is able to dial automatically, either pulse or touch-tone, and communicate with time-sharing services or other computers as well as answer incoming calls. When your modem is in the Originate, or Call Mode, it means that your modem is set up to make a call. Your modem is expecting another modem at the other end to answer the call. Conversely, you can set your modem to the Answer Mode, meaning that any time a call comes in, your modem will answer. (If you expect to be receiving many data calls, it's a good idea to install an extra phone line. When you're set to auto-answer, the modem will answer the phone regardless of whether there is a modem or a human at the other end!)

1.3 Use your Modem with a Database

Once the computer is connected to telephone lines it can communicate with other computers. For example, you can use your PC and modem to call an information utility such as Dow Jones News Retrieval or The Source. Dow Jones and The Source are large computer databases, whose information is rented to the public.

Once you are connected to one of them, you can, for example, read the latest stock quotes or the morning's Wall Street Journal.

1.4 Easy-to-Use

Your Tandy 1200 bps internal modem is made to be easy to use. More and more applications for the PC and your modem are becoming available. Now, for example, you can plan your travel by linking with the latest airline schedules or check your bank balance from the comfort of your living room. In the future, the uses for your modem will continue to grow.

1.5 Introduction to Modem Features

Your modem has many advanced features, such as:

- 1) Auto-dial and auto-answer: no telephone is required.
- 2) Powerful automatic dialer commands compatible with virtually all of the communications software available.
- 3) Can be used with an acoustic coupler.

1.6 How to Use This Manual

This manual should be used in conjunction with your software manual. Chapter 2 includes complete installation instructions.

Chapter 1

Chapter 3 covers testing the modem. More technical information about the modems internal command set is included in Chapters 4 through 6.

Chapter 2

INSTALLATION

2.0 Getting Ready

This chapter will explain installation of the Tandy 1200 bps internal modem.

2.1 Connecting Your Tandy Modem to the Telephone Line

In order to operate, your modem must be connected to a telephone line. Your modem is FCC registered for direct connection to the telephone line. Before proceeding, you should call your local telephone company and inform them that you are going to connect registered equipment. Follow these steps:

Inform the local telephone company that you are connecting registered equipment. Give them the following information:

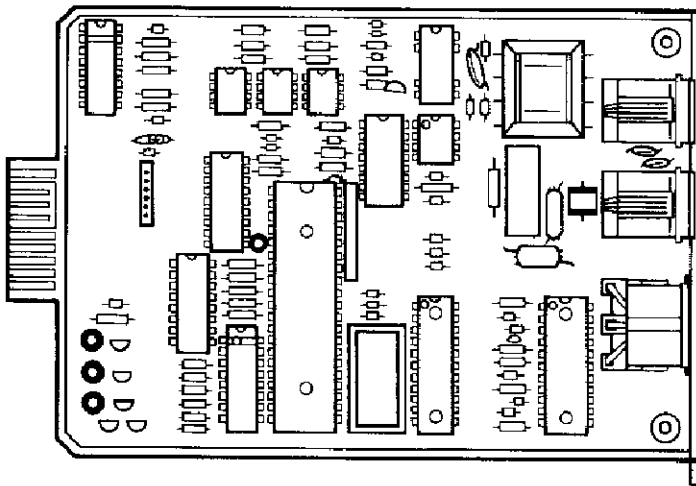
Manufacturer:	Tandy Corp. Fort Worth, TX
Model:	1200 bps Internal Modem
Registration:	AU692V25-3510
Ringer Equivalence:	0.4B

Your modem has been registered with the Federal Communications Commission and is approved for connection to any standard telephone line in the United States.

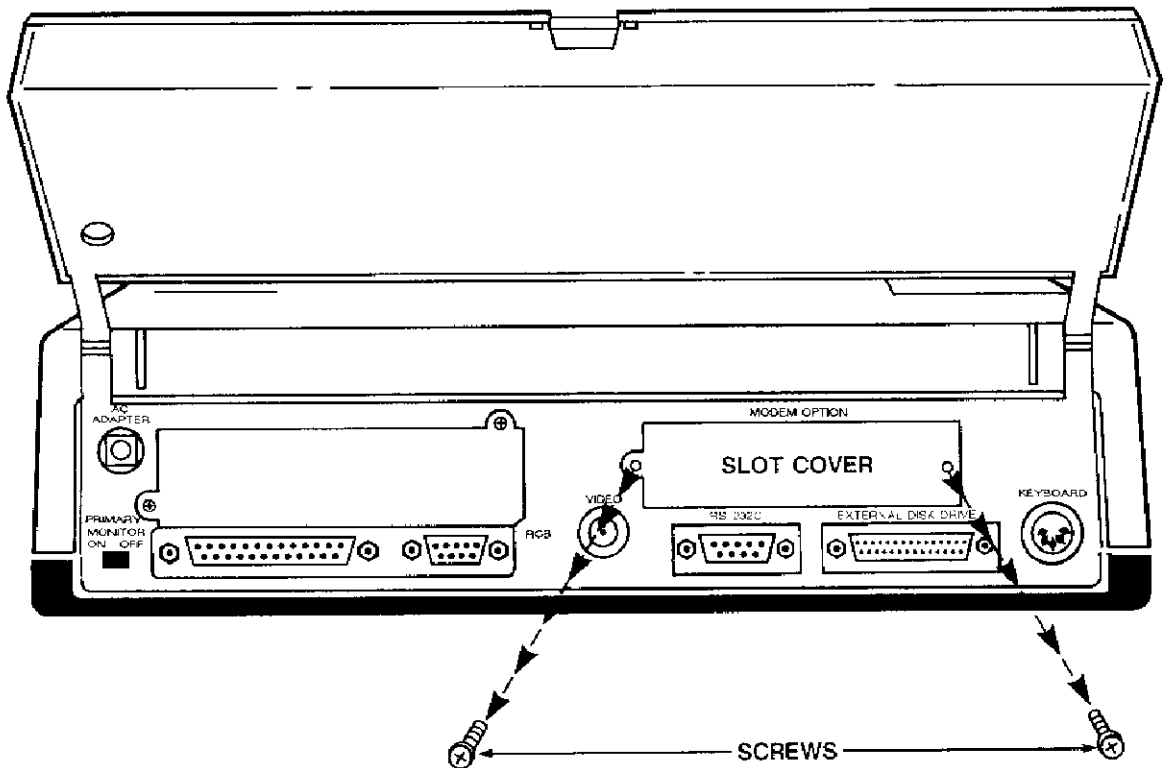
2.2 Connecting Your Modem to Your Computer

The following steps will explain installation of your 1200 bps internal modem in your computer. PLEASE FOLLOW THESE INSTRUCTIONS CAREFULLY.

- **NOTE:** Whenever you are installing or removing boards in your computer, make sure that the POWER IS SWITCHED OFF. NEVER INSERT OR REMOVE THE MODEM WHEN THE POWER IS ON.

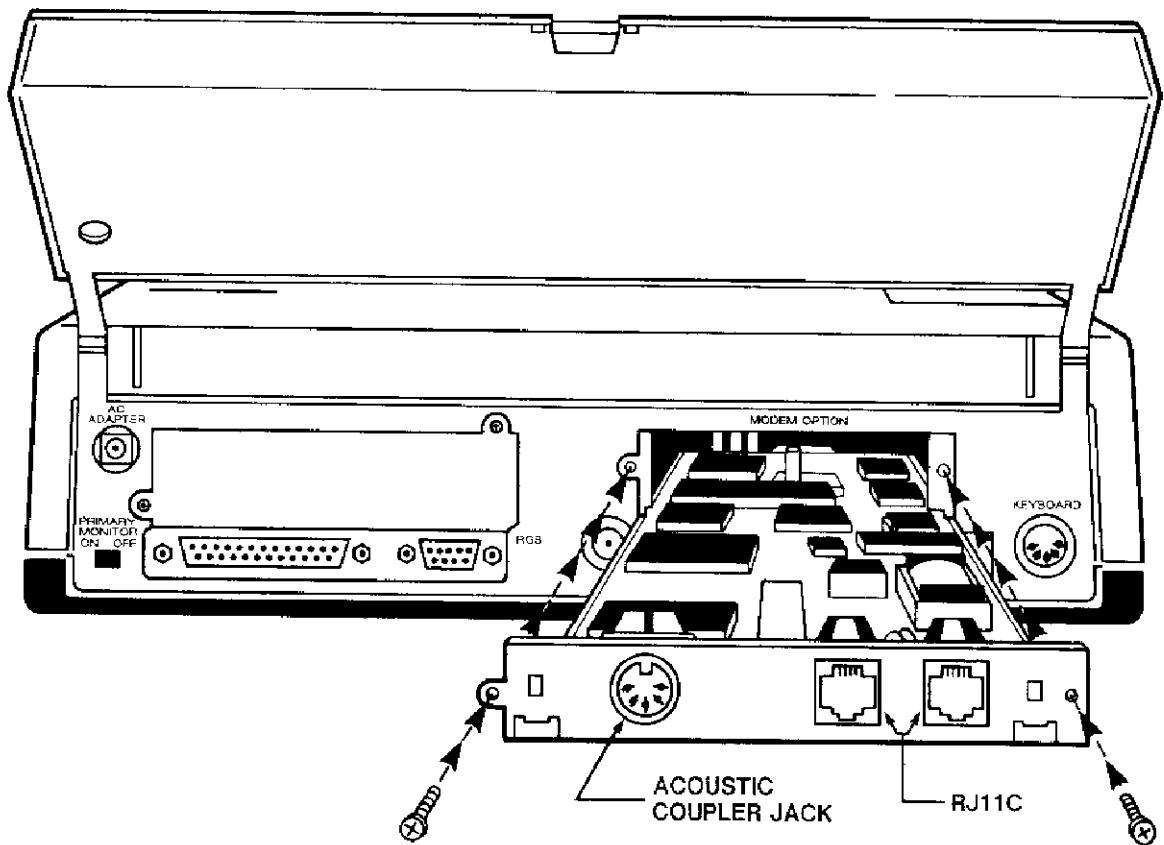


2.3 Installation



To Install:

- 1) Remove the slot cover over the "Modem Option" slot on the back of the computer. It is held in place by two small screws.
- 2) Gently slide in the modem as illustrated. Press in to ensure that it is seated securely in the connector. Use the screws that held the cover to secure the modem into the computer.

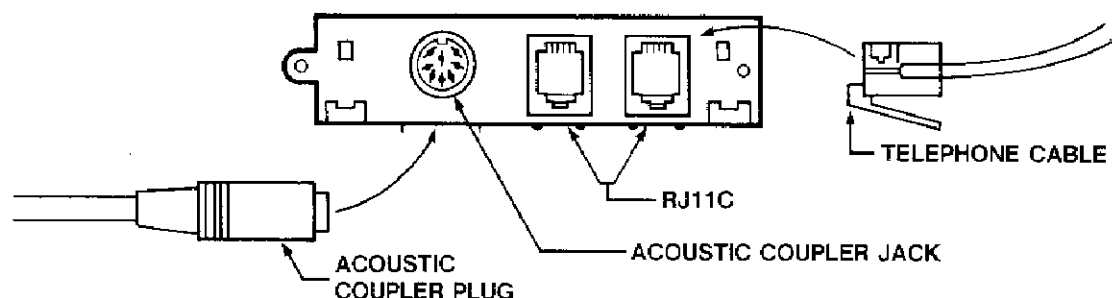


- 3) There are two modular phone connectors on the rear panel of the Tandy 1200 bps internal modem. Connect one end of the modular phone cable supplied with the modem into either of these two jacks. These jacks are identical; it does not matter which one you use. Connect the other end of this modular cable into your wall jack.

► **NOTE:** The second jack on the back of the modem can be used to connect your standard telephone. This is provided for your convenience. You may plug your telephone into this jack and continue to use it normally. The modem can be left

connected even when your computer is turned off. It will not affect the normal use of your telephone.

- 4) If you will be using the Tandy Acoustic Coupler, insert the connector into the holes marked Acoustic Coupler. There is only one way to insert the connector.



- 5) You are now ready to initialize the modem. Begin from the DOS prompt "A:." While holding down the **Ctrl** and **Alt** keys, press the **Ins** key. This will bring up the **Tandy 1400 LT Set Up Menu**.
- 6) Press the **F4** key to highlight the **RS232C / Internal Modem** option. Press the right arrow key to highlight **MODEM**. Press **ENTER**.
- 7) Press the **F5** key to highlight the **Direct Modem / Acoustic Coupler** option. Press the arrow keys to highlight **DIRECT** if you will be connecting the modem directly to the phone line or to **ACOUST** if you will be using the Acoustic Coupler. Press **ENTER** and then escape to return to DOS.
- 8) You are now ready to use the modem. Note that you do not need to reinitialize each time you use the modem. However,

each time you switch between direct use and the acoustic coupler, you will need to reinitialize, following steps 5–7.

2.4 Auto Answer

Your modem is set up to automatically answer incoming calls. The auto answer function is controlled by the S0 register. If you wish to disable auto answer, access the modem command set with your communications software and enter the command `ATS0=0<CR>`. See section 4.7 for additional information.

2.5 Testing Your Modem

So that you can make sure that your equipment is correctly installed and working, your modem can perform several self tests. Consult Chapter 3 for instructions.

Chapter 3

TESTING YOUR MODEM

3.0 Testing the Tandy Internal Modem

So that you can make sure that your equipment is correctly installed and working, your 1200 bps internal modem can perform several tests to check the modem's local and on line modes.

3.1 Performing the Local Analog Loopback Test

These tests check the modem's Originate and Answer modes. Before you perform these tests, disconnect the phone cable from the wall jack to the modem. If this cable is not disconnected, the test results may not be valid. After performing the tests, be sure to plug this cable back in.

To perform the tests:

- 1) Turn your computer on.
- 2) Use your communications software to access the modem's local command set.
- 3) To test the Originate Mode, type in the command:
`AT S16=1 C1 D<CR>`

Chapter 3

If the modem is correctly installed, it should respond:

CONNECT

At this point every character entered from the keyboard goes to the modem's transmitter section and, instead of going out over the phone line, is rerouted to the modem's receiver section. From here, the characters are displayed on the screen. The key you press should match the character displayed on the screen.

- 4) To exit the test, enter:

+++

Do not enter <CR> after +++.

The modem responds:

OK

- 5) If you do not wish to test the answer mode, proceed to step 7.

Now, if you wish to test the Answer Mode, type in the command:

AT S16=1 A<CR>

The modem should respond:

CONNECT

As with the Originate test, every character entered from the keyboard should match the character displayed on the screen.

- 6) To exit the test, enter:

+++

Do not enter <CR> after +++.

The modem responds:

OK

- 7) Enter:

AT S16=0H<CR>

The modem responds:

OK

This resets register S16 and frees the modem for normal operations.

- 8) Remember to plug the phone cable back in before making a call.

If there is a problem:

- 1) Is the modem firmly seated in the expansion slot?
- 2) Double check that you have disconnected the phone line.

3.2 Remote Digital Loopback

RDL is an advanced test feature which allows one modem to request the remote modem to "loopback" data sent to it. The RDL feature allows you to make a complete unattended test of the remote modem. Your local modem sends the data over the phone lines to the remote modem. The remote modem will then loopback whatever is sent, and you should see your test message appear on your screen exactly as you sent it.

This test must be performed when the modems are on line. To begin the test, you must enter the command mode, using the +++ escape code. Once on line and in command mode, you can tell the modem to begin the test.

- 1) In command mode, enter:
ATO2<CR>

The test is now underway.

The message **CONNECT** followed by **OK** will be displayed.

Note that a result code of **ERROR** indicates that the remote modem is not capable of responding to RDL or has not been conditioned to do so.

- 2) Enter a test message:

How now brown cow.

- 3) Check to see whether your test message is appearing on the screen exactly as you entered it.

- 4) To end the test, enter:

+++

- 5) Modem should respond:

OK

You are now in command mode.

- 6) Enter:

ATO1<CR>

- 7) Modem responds:

CONNECT

The test is ended

Notes:

- 1) RDL is automatically terminated when the connection is discontinued.
- 2) If the line is disconnected during RDL (the phone line is pulled out of the wall, etc.), the requesting modem will reset. This prevents an unexpected request for RDL during the next call.
- 3) Your modem will always respond to RDL when on-line. The modem will respond to and initiate RDL; it does not matter which modem placed the original call.

- 4) Note that the O0 command returns you to your previous state. So if you enter **ATO0<CR>** once you have initiated RDL, the command will NOT exit the RDL mode when returning on line. To exit RDL and return on line, you MUST enter **ATO1<CR>**.

If your modem has echoed back the test message exactly as you sent it, your modem, the remote modem, the local data terminal equipment and the phone lines all check out.

If there is a problem:

If the test message does not echo back correctly, either your modem, the remote modem, the data equipment or the phone lines are at fault. If you have already successfully performed the local analog loopback test, you know that your modem and computer are communicating properly. If there is a remote operator, he or she may wish to perform a local analog loopback test as well to verify that the remote modem and computer are communicating.

Assuming that both the local and remote modems have successfully performed local analog loopback test:

- 1) Can you hear your modem dialing?
- 2) If the modems are connecting but the test message is not coming through, you may have a problem with the phone lines. Disconnect and try again.



Chapter 4

INTRODUCTION TO MODEM OPERATION

4.0 Direct Entry into the 1200 BPS Internal Modem Command Mode

This chapter describes the functional states of the 1200 bps internal modem and the guidelines to follow when sending commands to it. The responses which the modem sends to your commands are also described.

For those who want to use the modem's commands directly, access the modem through your communications software. Then enter the command `AT Z<CR>`, which will set the modem options to their default values.

4.1 Functional States

The modem will always be in one of two states: local command state or on-line state. In the local command state, the user is making commands to the modem via keyboard or program control. No data is being sent or received. The local command state is provided so that the modem can be commanded to perform various functions, such as changing configurations and dialing. In the on-line state, the data is sent and received over the phone lines.

When on-line, the modem will be in the originate mode (when the modem is making a call) or the answer mode (when accepting

an incoming call). Occasionally, you may make use of a special form of answer mode, called "reverse mode," which is used to initiate a call to an originate-only modem (a 300 baud acoustic coupler, for example). Changing between originate and answer modes is not something you need to worry about, because the modem makes the switch automatically.

In normal operation, the change from the local command state to the on-line state is automatic. For instance, once the command to dial is given, the transition to the on-line state is performed automatically when the connection to another modem is made. The on-line state is also achieved when the modem answers a call. When the carrier is lost, for whatever reason, the modem automatically returns to the local command state.

The modem will not respond to local commands when on-line. If you wish to enter a command, you must first return the modem to the local state. This is accomplished by entering the **Escape Code**.

4.2 Changing of States

Escape Code

The escape code is a message to the modem which tells it to return to the local state, allowing you to enter commands. The format consists of an escape guard time and an escape character. The escape code does not drop the connection with the other modem; it merely suspends the transmission and reception of data over the line temporarily. The command to hang-up, **ATH<CR>**, must be entered to drop the phone line.

The default escape code is entered as followed:

Wait at least one second after the last character entered.

Enter: +++

Wait at least one second for the result code.

The modem will return to local state and respond with the result code **OK**.

► **NOTE:** The result code will be returned only if the options Q0 and V1 are set.

The purpose of the guard time (the one second delay around the **+++**) is to prevent the modem from accidentally escaping into command mode during normal operation. The one-second guard time surrounding the escape code tells the modem that **+++** is a command to the modem, not just a stream of data.

The default values of the escape code and the guard time may be changed (Registers S2 and S12). The escape code must be a single character entered three times and surrounded by a designated period of time. If you are in auto-answer mode, it is advisable to disable the escape code or set it to a different value from that of the originating modem (See Register S2 for instructions). That way, your modem will not be accidentally put into local command state by the distant modem.

4.3 Command Syntax

Attention

All commands must begin with the letters **AT**. **AT** is short for “Attention” and is used by the modem to automatically set the baud rate and parity. **AT** must be entered in upper case; all other commands may be in either upper or lower case. This command is the signal to the modem that what follows is a command.

Line Length Limits

AT may be followed by one or more commands. The commands will be performed in the order given. The number of commands given at once is limited by the line length, which cannot exceed 40 characters following **AT**. Control characters and spaces are not counted, but punctuation marks such as dashes or commas are. For example, the syntax of a command to the modem is as follows:

AT <command> <CR>

Command Terminator

Note that **<CR>** denotes carriage return. This is the command terminator; the command is not processed until a **<CR>** is entered.

Example:

AT M2 DT (408) 767-8900<CR>

In this example there are two commands: the **M** (monitor speaker) and **D** (dial). Notice that a space has been put between the line elements. This is optional; the commands can be entered one right after the other.

There are two parameters shown in this example. The first (M2) indicates that the speaker will be on at all times. The second command (DT) tells the modem to dial, using touch tone, the following number. (*See the D and M commands*).

Regarding the PHONE NUMBER: The numbers in this string can be added together without the parentheses and dash. However, if it is more readable to use these delimiters, the modem will accept them.

Line Editing

When entering commands to the modem, editing can be done by using the backspace key, which deletes the last character entered. The backspace key does not delete the attention code, "AT." Note that when backspacing over a "space," the space is ignored and the next character is erased regardless of whether or not it appears properly on the screen.

Null Parameters

Commands to the modem consist of a letter, such as D for DIAL, followed by a number, or parameter, generally 0, 1, or 2. If a command parameter is inadvertently or intentionally left out the modem assumes a value of 0. For instance, if a command were entered "AT M DT (555) 555-1111<CR>," it would be equivalent to "AT M0 DT (555) 555-1111<CR>". The parameter associated with the M command would be 0 instead of 2 as in the previous example. The result of this change would be to turn the speaker off.

4.4 Command Results

After the CARRIAGE RETURN ("**<CR>**" above) has been entered, the modem returns a RESULT CODE after every operation.

This code may be expressed as a number or an English word. The following table lists the ten possible results and their meanings.

Number (V0)	Word (V1)	Description
0	OK	The command line was successfully processed.
1	CONNECT	The Carrier signal has been detected.
2	RING	The phone is ringing. RING only indicates that the phone is ringing. The modem does not answer it unless commanded to or unless auto-answer is enabled.
3	NO CARRIER	Carrier was not detected or was lost. NO CARRIER is displayed if the carrier signal from the other modem is not detected for a sufficient length of time. NO CARRIER means that a data call was not successfully completed.
4	ERROR	There was an error in the command line.
5	CONNECT 1200	Carrier has been detected at 1200 bps.
6	NO DIALTONE	No dial tone has been detected by the modem dur-

		ing the dial sequence. This result code will only appear if X2, X4 or the W command have been selected.
7	BUSY	The modem has detected a busy signal. This result code will only appear if the X3, X4, or @ commands have been selected.
8	NO ANSWER	The number dialed was not answered. This result code will only appear if the @ command has been used in dialing.

Result Code Notes

- * The NO ANSWER result code appears only when the modem is dialed using the @ command. *See Section 4.7.*
- * V0 and V1 are the modem commands that determine whether the modem is to render numeric or verbal result codes, respectively.
- * The Q command determines whether or not results are sent. In the default state, the modem returns only Codes 0-4.
- * RING only indicates that the phone is ringing. The modem does not answer it unless commanded to or unless auto-answer is enabled.
- * NO CARRIER is displayed if the carrier signal from the other modem is not detected for a sufficient length of time. NO CARRIER means that a data call was not successfully completed.

- * CONNECT 1200, NO DIAL TONE, and BUSY codes are displayed only when the extended result code set is enabled.

4.5 Speed of Transmission

When the 1200 bps internal modem calls another system it automatically detects and adjusts to the transmission speed (baud rate) at which your personal computer is operating. The transmission speed is thus governed by the device you have connected to the modem. You must set the speed of your computer either by setting a switch in the hardware or by a software command. A command to the modem will not change the speed of the equipment.

If the 1200 bps internal modem is in answer mode, it adjusts to the speed of the calling modem. You can use the X command to tell the modem to inform you of the speed of the call it is answering. For example, after connection, the result codes would read:

CONNECT (for a 110 or 300 baud connection)

or

CONNECT 1200 (for a 1200 baud connection)

Note that the 1200 bps internal modem will accept a call from a 1200 baud or a 300 baud modem. Your computer must be set to the correct baud rate for the call.

When the modems begin to "talk" to each other, your 1200 bps internal modem will detect the speed of the calling modem and adjust its speed to match. The modem will then send a message to

the screen telling you at what speed the connection has been made. You must then make sure that your computer is also set to the correct baud rate (1200, 300) for the call or the data you receive will be garbled. Most frequently, you will switch speeds with a command to your communications software, which will tell the modem at what speed to operate.

If you have chosen X1, X2, X3, or X4, you will be informed of the final connect speed by the result code which appears on your screen (e.g., CONNECT 1200 for a 1200 baud call). In the default setting of X0, the modem will return only the message CONNECT.

4.6 Dialing with Examples

Since dialing and answering are the main functions of the modem, the following is a summary of the instructions for these operations with examples.

Dialing

When a dial command is given, the modem is immediately put into originate mode. You are then able to call any distant computer or timesharing system connected to a modem.

The Dial Command is **D**. This command may be followed by a number of commands associated with the dial command, but in its simplest form **D** may be followed with only the number to be dialed.

Example:

AT D 767-8900<CR>

After entry of this command, the modem will dial the number. You will hear the phone dialing. The 1200 bps internal modem will then wait for 30 seconds (default time) for a response from the distant modem. If another modem answers, your modem sends the code **CONNECT**, **CONNECT 1200**, or **1**, or **5**, depending on what parameters have been set (*See V command, X command*). The modem then goes on-line, permitting you to communicate. If no carrier is detected, the modem will hang up and send a **NO CARRIER**, **BUSY**, **3**, or **7** result code, depending again on what parameters have been set. In its factory default setting, **X0**, the modem would respond **CONNECT** when the modem connects, no matter at what speed, and **NO CARRIER** if the phone was not answered.

Note that the modem will ignore the spaces and the dash in the previous example. You could also enter:

ATD5551111<CR>

The other commands associated with the Dial Commands are summarized in the following table:

Command	Description
D	Dial. The modem goes to originate mode and will dial the number following.

The following is a list of subcommands of the **D** command and can only be used in conjunction with this command.

, (Comma)

Pause. The modem will pause for two seconds (default time). It allows the modem to wait for a second dial tone, as, for example, when waiting for an "outside line" on a PBX board.

Example:

```
AT D9,767-8900 <CR>
```

Meaning: Dial 9, 2 second pause, dial second number.

Note: Multiple commas may be used to increase pause time.

W

Wait for dial tone before dialing.

Example:

```
AT DTW767-8900 <CR>
```

Meaning: Wait for a dial tone, then dial the number using tones. Note that the W command MUST be preceded by the D command.

Note: This command tells the modem to wait for 3 seconds of continuous dial tone before beginning to dial. The W command will return a result code of NO DIALTONE if no dial tone is found. The amount of time the modem waits is governed by the S7 register. If the X2 or X4 commands are used in conjunction with the W command, the modem will only wait 5 seconds for dial tone instead of S7 time. The factory default setting of S7 is 30 seconds.

Note also that the default setting of the X command does NOT tell the modem to wait for dial tone. *See the X command, Section 5.18.*

@ Wait for quiet answer before dialing.

Example:

```
ATDT 5555555 @ 12345 <CR>
```

Meaning: Dial the number, and, after the phone rings at least once, wait for 5 seconds of silence. When 5 seconds of silence are detected, dial the rest of the number. If the 1200 bps internal modem does not detect 5 seconds of silence, the modem will return a result of **NO ANSWER** and hang up. If it detects a busy signal the modem will return the **BUSY** result code.

Note: This command tells the modem to wait for one or more rings followed by 5 seconds of silence before continuing the command string. The length of time the modem waits is specified in register S7. The factory default time of S7 is 30 seconds. The **BUSY** result code will be displayed after 5 seconds if a busy signal is detected. This command is used to access a system that does not have a dial tone.

! Hook Flash

Example:

```
AT D767-8900! <CR>
```

Meaning: Dial a number, hang up for half a second.

Note: The hookflash tells the modem to hang up for a half a second. It is like holding the button on your phone down for a moment. This command may be used to transfer a call, for example.

T Touch-Tone Dialing

P Pulse Dialing

Example:

```
AT DP9,T 767-8900 <CR>
```

Meaning: Dial 9 using pulse (rotary) dialing, pause for two seconds, dial the rest of the number using touch-tone.

Note: When the modem is turned on, it defaults to **Pulse** dialing. The **P** and **T** commands specify which type of dialing to use. The modem will then always default to the last method used. If you were to enter **AT D767-8900<CR>** immediately after the previous example, the modem would automatically dial using touch tone, which was the last method used.

; (Semicolon) Returns modem to command mode after dialing.

Note: This command is used to return the modem to the command state at the end of dialing a number. It basically serves the same function as an escape code (+++) but can be used automatically at the end of a command. This feature may come in handy when you wish to call a timesharing service which will require you to dial additional digits once you connect. You will continue to hear the call being made as in normal operation.

Example:

```
AT D 767-8900;<CR>
```

Meaning: Dial the phone number and return for command.

R Reverse Mode. Used to call an "originate only" modem such as an acoustic coupler.

Example:

```
AT DP9,T767-8900R<CR>
```

Meaning: Go into originate mode, dial the first number using pulse dialing, pause, dial the second number using touch tone, reverse into answer mode so that the modem will "answer" the originate only modem.

Note: The R command is always placed at the end of a string of commands.

Auto-Dialing for Voice Calls

The modem may be used to automatically dial a number for you with the D command. You would enter a number, listen for the ring, pick up the phone, press any key, which tells the modem to hang up. You can then talk to the person on the other end.

Example:

```
AT D 767-8900<CR>
```

If the phone line is busy, you would then only have to enter A/ to redial if you hear a busy signal.

Timing Parameters

The times assigned to the dialing sequences are controlled by registers S6 through S11. *See Chapter 6* for a complete listing of all of the registers, functions and values.

4.7 Auto Answer Mode

The modem is set to automatically answer calls. This is a useful feature when you wish to access your computer from a distant location, for example. The auto answer function is controlled by the S0 register. To disable the auto answer function, enter the direct command `AT S0=0<CR>`.

The S0 register determines the number of rings the modem will wait before answering a call. The register may have values from 0-255. Setting the register at 0 tells the modem not to answer the call at all.

Examples:

ATS0=0<CR> Modem will not answer.

ATS0=1<CR> Modem will answer after one ring.

ATS0=5<CR> Modem will answer after five rings.

The new value will be in effect until a **Z** (re-set) command is given or until the modem is turned off. At that time, the **S0** register will return to the default value.

The modem will wait until the ring number in register **S0** is reached and then answer the phone and send a signal to the other modem. The 1200 bps internal modem then waits until a carrier signal is received. If it is, you will see a **CONNECT** result code on your screen in the default setting of the **X** command, **X0**.

If no carrier is detected within 30 seconds (default time), the modem will return a **NO CARRIER** result code (again, in the default value of the **X** command), hang up, and return to the command state.

If another modem calls your system, when auto-answer is disabled, you will receive a **RING** result code on your screen. The modem will not answer. If you are not set up to auto-answer, and the phone is ringing, you can type **AT A <CR>**, and the modem will answer. (*See Section 5.1*)

Timing Parameters

As with the dialing commands, the timing parameters associated with answering are controlled in the **S** registers. Registers **S0**, **S7**, and **S9** control the functions. *See Section 6.1* for a complete listing of the registers, functions and values.

Chapter 5

COMMAND SUMMARY

The following is a summary of all of the modem commands in alphabetical order with examples. For each command a parameter table is provided stating the default values (those established when the modem is turned on or reset). Recall that a value of 0 is assumed when no parameter is entered. Command examples follow the description.

5.1 A – Answer Immediately

Command	Default Value	Parameter Range	Parameter Description
A	--	--	--

Sending an A command to the modem tells it to answer immediately without waiting for a ring. It then will wait for a Carrier Signal. It could also be used, for instance, if the RING result code appears on the screen when the modem is not set for auto answer. Once the A command is executed, no other commands can be entered.

Example:
AT A<CR>

There are no parameters associated with this command. When it is entered, the modem immediately goes off-hook (without waiting

for a ring) and "listens" for the Carrier signal. The default time is 30 seconds (use the S7= command to change this value).

5.2 A/ - Repeat Last Command

Command	Default Value	Parameter Range	Parameter Description
A/	A/	--	--

This command will repeat the last command line. It is most useful when used to re-dial the last number dialed.

Example:

A/

This command differs from all the others in two ways:

- * It is not preceded by AT.
- * No CARRIAGE RETURN is entered.

5.3 C – Carrier Signal Control

Command	Default Value	Parameter Range	Parameter Description
C	C1	0-1	0=transmitter off 1=transmitter on

The C command allows manual control of the modem's carrier signal. The carrier is the high pitched whistle you hear when calling a modem. In the C1 state (the default) the carrier signal set by the modem automatically goes on and off as required. That is, Carrier is on:

- * after dialing a number results in a connection.
- * after an A command detects a Carrier from the other end.

At all other times, the Carrier signal is not output. If C0 is entered, the Carrier signal is never output. This is handy when using the modem to dial voice calls.

Example:
AT C0<CR>

This command prevents the modem from outputting the carrier signal. To change this condition, the C1 or Z command must be entered. Be very careful in using the C0 command. If entered while communicating with Telenet, Tymnet, or some other network, the network will disconnect you.

5.4 D – Dialing Command

Command	Default Value	Parameter Range	Parameter Description
D	--	--	Sn=dialing sub-commands Nn=telephone numbers

The D command allows the user not only to dial a number but adjust dialing to the local telephone conditions as well. The set of sub-commands include:

- , Pause for dial tone
- T Touch tone dialing
- P Pulse (rotary) dialing
- R Reverse mode
- ; Return to Command Line after Carrier detected
- ! Hookflash
- W Wait for dial tone
- @ Wait for 5 second quiet answer

Examples of the use of the Dialing command and subcommands are provided in *Section 4.7*.

5.5 E – Echo Back Control

Command	Default Value	Parameter Range	Parameter Description
E	E1	0-1	0=do not echo in command mode 1=echo characters in command mode

Whether or not keystrokes are echoed back to the screen when the modem is in the Command State is determined by the E command. The default setting (E1) displays all characters on the screen. The E0 command should be used when the modem is connected to a terminal in half-duplex. The reason for this is that if the terminal is in half-duplex, both it and the modem will echo the character on the screen resulting in double printing. To prevent this, turn the modem's echo off (AT E0<CR>). The echo feature is only activated in the Command State, that is, when you are entering commands to the modem. It is not activated when data is transmitted to a remote system. Some communications software also requires that character echoing be suppressed.

5.6 F – Set Communications Mode

Command	Default Value	Parameter Range	Parameter Description
F	F1	0-1	0=half-duplex 1=full-duplex

The communication mode is normally set to full duplex, which is the default setting of your modem. This command is available pri-

marily for compatibility with some software, which may not provide an echo. You should not have to change this setting.

Both your computer and modem are set for either full or half duplex. In half-duplex, the modem will echo back characters; in full duplex, it will not. If either the modem or the computer is set for half duplex, the characters you enter will echo on your computer screen. If both are set at half duplex, double characters will appear on your screen since both the modem and the computer are echoing characters. Change the modem to full duplex. If both the computer and the modem are set for full duplex, no characters will appear on the screen. Change the modem to half duplex to see the characters you enter echoed on the screen.

Example:
AT F0<CR>

This command will cause the modem to echo back characters being transmitted onto the screen.

5.7 H – Hook Control

Command	Default Value	Parameter Range	Parameter Description
H	--	0-1	0=On hook (hang up) 1=Off hook

The H command replicates the action of picking up the handset on a telephone. That is, when you remove a telephone's handset

from the cradle, you go off-hook (a dial tone is heard); when you replace it in the cradle, you go on-hook (drop the connection). In normal operation only the H0 command is used to go on hook (terminate the call). Going off hook is automatic when the Dialing command is entered.

Example:
AT H<CR>

This command assumes that the user has temporarily suspended the On-line State to enter the Command State by entering the Escape Code (+++). After the CARRIAGE RETURN <CR> is entered, the Carrier Signal is terminated and the connection put on-hook. Notice that no parameter was entered in this example; hence, a 0 entry is assumed.

5.8 M – Monitor Speaker Control

Command	Default Value	Parameter Range	Parameter Description
M	M1	0-2	0=Speaker off 1=On until carrier. 2=Speaker always on.

The computer's speaker can be used to listen in on a call in process. For instance, the default setting (M1) sends all tones (e.g., dial tone, busy, ringing) up to the point the carrier is received. Once the carrier is received, the speaker is automatically turned off. Alternately, the M0 command can be entered to keep the

speaker off all of the time or the M2 command entered to send all signals, including the Carrier Signal, to the speaker.

Note that the M2 command can be used as a form of trouble-shooting. If unanticipated call terminations occur frequently, enter M2 and listen to the Carrier signal. If it changes tone or stops, the modem will drop the connection. In this case, the phone lines are faulty or the modem at the other end is malfunctioning.

Example:

AT M<CR>

This command is used to turn off the speaker so that no signals are sent to the speaker. Notice that no parameter is entered so that 0 is assumed.

5.9 O – Return to On-line State/Initiate or Exit RDL

Command	Default Value	Parameter Range	Parameter Description
O	O0	0-2	0=Return to on line state. 1=Exit RDL and return on-line. 2=Initiate RDL and return on-line.

This command is generally used to return to the On-Line State after an Escape Code (+++) has been entered to exit to the Command State, as in the following example.

Example:

Enter:	Result:	Note:
+++	OK	Returns modem to local command state.
AT M0 O<CR>	CONNECT	Turns the speaker off and returns on line.

Two specialized versions of the command, O1 and O2, are used to exit and initiate Remote Digital Loopback. These two commands are used ONLY when entering or exiting RDL. Consult Chapter 3 of this manual for information on how to perform these tests.

5.10 P – Pulse Dialing

Command	Default Value	Parameter Range	Parameter Description
P	--	--	--

Before a Dial is attempted, the modem must be told whether pulse (rotary) dialing or touch tone dialing methods should be used. This command sets the modem so that all numbers output by subsequent dialing commands use the pulse dialing method until told otherwise.

Example:

AT DP767-8900<CR>

This is the only form of this command. There are no parameters associated with it.

5.11 Q – Quiet Mode (Result Code) Control

Command	Default Value	Parameter Range	Parameter Description
Q	Q0	0-1	0=Result codes sent 1=Result codes not sent

Whether or not the Result codes are returned is set with this command. For example, the command Q1 would be used when you are using the modem with a receive-only printer. This command would prevent the result codes from being printed out.

5.12 R – Reverse Mode

Command	Default Value	Parameter Range	Parameter Description
R	--	--	--

This command is used at the end of a command to put the 1200 bps internal modem into answer mode when trying to establish contact with an originate-only modem.

Example:
AT D 767-8900R<CR>

The modem is instructed to dial the number and then enter answer mode.

5.13 Sr? – Determine Status of a Register

Command	Default Value	Parameter Range	Parameter Description
Sr?	--	0-16	"r" in this command specifies one of the modem's registers.

This command allows the user to display the contents of the register specified in the command. These registers set certain operational characteristics. All of the characteristics have a default value set when the modem is turned on or reset. However, they can be changed (see the next command) if needed. For a description of the registers and examples of the Sr? command, see the "Set Command" (*Section 6.1*).

5.14 Sr=n – Change Register Value

Command	Default Value	Parameter Range	Parameter Description
Sr=n	--	0-16	for "r" (register number)
		0-255	for "n" (value in register)

As mentioned previously, certain modem operations are controlled by the contents of the registers. When the modem is turned on or

reset, a default value is set for each of these registers. This value can be changed, however, using the `ATSr=n<CR>` command. A description of the registers and examples of the Set Command are provided in the heading "Set Command," *Chapter 6*.

5.15 T – Touch Tone Dialing

Command	Default Value	Parameter Range	Parameter Description
T	--	--	--

Before a Dial is attempted, the modem must be told whether pulse (rotary) dialing or touch tone dialing methods should be used. This command sets the modem so that all numbers output by subsequent dialing commands use the touch tone dialing method until told otherwise.

Example:

```
AT DT767-8900<CR>
```

This is the only form of this command. There are no parameters associated with it.

5.16 V – Result Code Control

Command	Default Value	Parameter Range	Parameter Description
V	V1	0-1	0=Result numbers displayed 1=Result words displayed

In the default mode, all result codes are displayed as English words. Alternatively, the V0 command can be entered to render numbers instead of words. *See Section 4.5* for an explanation of the words and their corresponding numbers along with the meaning of each. Recall that words are recommended when the results are to be interpreted by a user and numbers should be used when the results are interpreted by a program.

Example:
AT V0<CR>

Enter this command from the Command State before turning over control of the modem from the user to a program.

5.17 W – Wait for Dial Tone

Command	Default Value	Parameter Range	Parameter Description
W	--	--	--

The W command instructs the modem to wait for a dial tone before dialing. It must be entered AFTER the dial (D) command.

Example:

AT DT W 767-8900<CR>

This command tells the modem to wait for a dial tone before dialing the number, using touch tone. (See Section 4.7 for more information on the W command.)

5.18 X – Extended Result Code Set

Command	Default Value	Parameter Range	Parameter Description
X	X0	0-4	See following table.

The X command allows you to select the set of desired result codes. See Section 4.5 for a further explanation of these codes.

Code	X0	X1	X2	X3	X4
0 OK	*	*	*	*	*
1 CONNECT	*	*	*	*	*
2 RING	*	*	*	*	*
3 NO CARRIER	*	*	*	*	*
4 ERROR	*	*	*	*	*
5 CONNECT 1200	—	*	*	*	*
6 NO DIALTONE	—	—	*	—	*
7 BUSY	—	—	—	*	*
8 NO ANSWER	—	—	—	—	—

Notes:

- 1) Most software written for the "AT" modem command set does not accept the extended result codes (5 through 10), so the default X0 is used.
- 2) The NO ANSWER result code is returned only when the modem is using the @ command. *See Section 4.7.*
- 3) The BUSY and NO DIALTONE result codes will be displayed after 5 seconds instead of after 30 seconds (default of S7).

5.19 Z – Modem Reset

Command	Default Value	Parameter Range	Parameter Description
Z	--	--	--

The Z command resets the modem. There are several results when the modem is reset.

- * any call-in-progress is terminated.
- * all commands are reset to the default values.
- * all commands after the Z command in a command line are NOT executed.

Example:
AT Z<CR>

This is the only form of this command. There are no parameters associated with it.

Chapter 6

MODEM REGISTERS

6.1 The Set Command

There are two Set command forms:

ATSr?<CR>
ATSr=n<CR>

The first reveals the contents of the register indicated by "r." The second changes the contents of "r" to the value specified by "n."

These registers are dedicated memory locations within the 1200 bps internal modem's memory space that control certain operations. Every time the modem is turned on or reset (with the Z command), the default values are set. This means that if changes are required to one or more registers to ensure proper operations, they must be made each time the modem is turned on.

The following table lists the registers and summarizes their effect upon operation.

Register	Range	Unit	Default	Description
S0	0-255	rings	1	Ring to answer on
S1	0-255	rings	0	Number of rings passed
S2	0-127	ASCII	43	Escape code character

S3	0-127	ASCII	13	Command terminator (Carriage return character)
S4	0-127	ASCII	10	Line feed character
S5	0-127	ASCII	8	Back space character
S6	2-255	seconds	2	Wait time for dial tone
S7	0-255	seconds	30	Wait time for Carrier
S8	0-255	seconds	2	Pause time
S9	1-255	1/10 sec.	6	Carrier detector response time
S10	1-255	1/10 sec.	7	Hang up delay after loss of Carrier
S11	50-255	millisec.	70	Touch tone duration, spacing
S12	0-255	1/50 sec.	50	Escape code time
S13	bit mapped			UART status register
S14	bit mapped			Option register
S15	bit mapped			Flag register
S16	0-1			Test Modes
S17	Not used			
S18	Not used			

6.2 Reading and Changing Registers

To find out what the current setting of a register is, you use the Sr? command. The modem will respond with the decimal value of

the current value in the register. Several registers may be checked at one time. For example if you wanted to check what ring the modem is set to answer on (Register S0) and how long the modem will wait for a dial tone (Register S6), you would enter:

AT S0? S6? <CR>

If the registers are set at default values, the response would be:

001 The modem is set to answer after one ring.

002 The modem waits two seconds for a dial tone.

OK End of sequence.

To change the value in these registers, you would use the **Sr=n** command. Using the same registers as the previous example, you would enter:

AT S0=4<CR> (Change the value in Register S0 to 4; modem will answer on ring 4.)

OK (Command acknowledged by modem.)

AT S6=3 <CR> (Change the value in Register S6 to 3; modem will wait three seconds for dial tone.)

OK (Command acknowledged by modem)

The next section describes each register in greater detail.

6.3 Register S0 – Auto Answer

To Display Status, Enter:	Modem Displays:	To Change Status, Enter:
AT S0? <CR>	0 or 1	AT S0=n <CR> n=0-255

Whether or not the modem is set for auto-answer is determined by this register. A value of 0 turns the modem into an originate only device. A value of 1-255 sets the modem to answer a call on the "nth" ring.

6.4 Register S1 – Rings Passed

To Display Status, Enter:	Modem Displays:	To Change Status, Enter:
AT S1? <CR>	0	--

The S1 register counts the number of times the phone rings. This register is cleared after 8 seconds have passed without a ring. Note that there is no need to change the value of this register. (The S1=n command can be used, however.)

6.5 Register S2 – Escape Code ASCII Value

To Display Status, Enter:	Modem Displays:	To Change Status, Enter:
AT S2? <CR>	43 (+)	AT S2=n<CR> (n=0-127)

The default value of this register, 43, sets the Escape Code to be the "+" character, but it can be changed to any ASCII character

of the user's choosing. The value for "n" MUST be a legitimate ASCII character within the range of 0-127. Setting "n" out of this range disables the Escape Code.

Recall the sequence of steps necessary to effect an escape from the On-line State to the Command State:

- 1) Wait 1 second (*see register S12 to change*)
- 2) Enter escape character three times (e.g., +++)
- 3) Wait 1 second (*see register S12 to change*)

Notice that both the Escape Character AND the Guard Time (the time period in steps 1 and 3) can be redefined.

6.6 Register S3 – Command Terminator ASCII Value

To Display Status, Enter:	Modem Displays:	To Change Status, Enter:
AT S3? <CR>	13	AT S3=n <CR> (n=0-127)

The default value of this register is 13, which is the ASCII character for carriage return. There should be no need to change this value unless another special character better suits the user's needs.

6.7 Register S4 – Line Feed ASCII Value

To Display Status, Enter:	Modem Displays:	To Change Status, Enter:
AT S4? <CR>	10	AT S4=n <CR> (n=0-127)

The line feed character is used only in the verbal result mode (V1) after a carriage return. Change this value to a null only if you do not want or need a line feed at this time.

6.8 Register S5 – Back Space ASCII Value

To Display Status, Enter:	Modem Displays:	To Change Status, Enter:
AT S5? <CR>	8	(Do not change) (n=0-127)

The S5 register defines the character that is echoed when the back space key is pressed. This value is not normally changed.

6.9 Register S6 – Wait for Dial Tone Time Period

To Display Status, Enter:	Modem Displays:	To Change Status, Enter:
AT S6? <CR>	2 seconds	AT S6=n <CR> (n=2-255)

The S6 register sets the amount of time the modem waits between going off hook and dialing the number. The modem will accept a minimum of a 2 second delay. (In fact, even if this register is set to 1, the modem still waits for 2 seconds.)

If outward dialing repeatedly fails (result code 3 or NO CARRIER), it may be because a dial tone is not rendered to the modem by the phone company before dialing begins. In this case, increase the value of the S6 register until a satisfactory delay is established. Note that "n" is a value expressed in seconds.

6.10 Register S7 – Wait for Carrier Time Period

To Display Status, Enter:	Modem Displays:	To Change Status, Enter:
AT S7? <CR>	30 (seconds)	AT S7=n <CR> (n=0-255)

S7 sets the number of seconds the modem waits for the carrier signal after a number has been dialed. This value can be decreased if the modem at the other end is particularly fast at responding. A minimum figure of 10 for numbers within your area code and 20 for numbers which require a different area code is recommended.

6.11 Register S8 – Pause Time of Comma

To Display Status, Enter:	Modem Displays:	To Change Status, Enter:
AT S8? <CR>	2 seconds	AT S8=n <CR> (n=0-255)

How long the modem delays for an intermediate dial tone is set by the S8 register. (Recall that a comma is used in the dialing command to allow for a second dial tone, used with many PBX's.)

Note that the modem does not actually "listen" for the intermediate dial tone (unless you use the W command); it just delays for a period and assumes that the tone is present. Consequently, if a 3 or NO CARRIER result code is rendered frequently, try increasing the value of S8. Note that the value of the registers is an expression of seconds.

6.12 Register S9 – Carrier Signal Detect Time

To Display Status, Enter:	Modem Displays:	To Change Status, Enter:
AT S9? <CR>	6 (600 msec.)	AT S9=n <CR> (n=0-255)

Do not confuse the purpose of this register with that of S7 – Wait for Carrier. Register S9 determines how long the carrier signal

must remain active after dialing before it is recognized as valid. In other words, noise from the phone line (voices and interference) can occasionally have the same frequency as the carrier signal. To safeguard against misinterpretation of noise as carrier, the value of S9 sets a time window during which the signal must sustain the proper carrier frequency.

It is highly unlikely that any noise can sustain the frequency associated with the carrier signal for 600 milliseconds, the default value. Increasing this value further decreases the likelihood. We recommend against changing this value to a shorter period, however.

Note that the value in register S9 is a value expressed in 1/10 seconds. For instance, a value of

6.0 = .6 seconds or 600 milliseconds
 10.0 = 1.0 second or 1000 milliseconds
 24.0 = 2.4 seconds or 2400 milliseconds

Also note that the value of S9 has no effect upon the time between when loss of carrier occurs and when the modem goes on hook (hangs up). The value in the S10 register determines this time window.

6.13 Register S10 – Carrier Loss to Disconnect Delay Time

To Display Status, Enter:	Modem Displays:	To Change Status, Enter:
AT S10? <CR>	007 (700 msec.)	AT S10=n <CR> (n=1-255)

When the carrier signal from the other end goes away, it is the modem's cue to terminate the connection. In areas with poor quality telephone lines, the carrier signal can occasionally drop out and cause unintentional disconnects. Setting register S10 for the default values allows for occasional lapses in the carrier signal.

The actual time window for carrier dropout is NOT determined by the contents of the S10 register. Instead, this period is a function of the following formula:

$$S10 - S9 = \text{window}$$

$$(700 \text{ msec} - 600 \text{ msec.} = 100 \text{ msec or } .1 \text{ seconds})$$

When telephone lines are poor, the value of S10 can be increased if disconnects are frequent. The adverse effect of this command is that some "garbage" characters may appear on the screen if the time is too long. Every increment increases the length of time by 1/10 seconds (100 milliseconds). Note that a value of 255 tells the modem to consider the carrier signal always present.

6.14 Register S11 – Speed Control for Touch Tone Dialing

To Display Status, Enter:	Modem Displays:	To Change Status, Enter:
AT S11? <CR>	70 (msec.)	Do not change (n=0-255)

The S11 default setting establishes a touch tone dialing rate of around 7 digits per second (DPS). This register should not be changed. Note that it has no effect on the pulse dialing rate.

6.15 Register S12 – Escape Code Guard Time

To Display Status, Enter:	Modem Displays:	To Change Status, Enter:
AT S12? <CR>	50 (1 second)	AT S12=n (n=0-255)

Recall that there are two wait periods that surround the entry of the special Escape Character (see the description of S2 for a review). The length of time the user must wait is set in register S12. Each increment adds 1/50 seconds (20 milliseconds) to the delay. Consider 50 as the minimum and increment only in value of 50's (1 second).

- **NOTE:** A value of 0 is certainly possible in this register. In this case, entering three Escape characters without any surrounding time buffers effects an immediate exit from the On-line State. Be careful if this option is selected to define an Escape Character that is unlikely to occur in batches of three during data entry while the user is on-line.

6.16 S13 – S15 Status Registers

The value of these registers can be read with the Sr? command. DO NOT use the Sr=n command to alter their contents.

Registers S13, S14, and S15 can be used for program review of modem status. The information is rendered in byte form with each bit being defined as follows.

S13 UART Status

Bit	Value	Description
0	–	not used *
1	0	Extended Result Codes disabled
	1	Extended Result Codes Set
2	0	Parity Disabled
	1	Parity Enabled
3	0	Odd Parity
	1	Even Parity
4	0	7 Data Bits/word
	1	8 Data bits/word
5	–	not used *
6	1	Buffer overflow flag (causes ERROR result code to be sent)
7	0	8th data bit set to space (if bit 4=1)
	1	8th data bit set to mark (if bit 4=1)

*unused bits may be 0 or 1 at random

S14 - Option Register

Bit	Value	Description
0	0	Auto Answer disabled
	1	Auto Answer enabled
1	0	Local Echo Disabled
	1	Local Echo Enabled
2	0	Result Codes Enabled
	1	Result Codes Disabled
3	0	Result Codes as Numbers
	1	Result Codes as Words (See Vn command)
4	0	Undefined - may be 1 or 0
5	0	Pulse dial
	1	Tone dial
6	1	Speaker enabled until carrier detected.
7	1	Speaker enabled always.

Note: Both bits 6 and 7 must be zero to disable speaker.

S15 – Flag Register

Bit	Value	Description
0	–	Same as bit 4
1	–	Same as bit 5
2	0	Answer
	1	Originate
3	0	Half duplex
	1	Full duplex

Bits 4 and 5 define the bps rate as shown in the following table:

Bit 4	Bit 5	Bps Rate
0	0	
1	0	110
0	1	300
1	1	1200
6	0	Carrier Off
	1	Carrier On
7	–	undefined

S16 – Test Mode

Bit	Value	Description
0	0	Local Analog Loopback disabled.
	1	Local Analog Loopback enabled.
1–7		Not Used

6.17 Programming Suggestions and Considerations

The most important function of a modem control program is always to know whether the modem is in the Command or On-line State. If the program ever gets confused, data passed from computer to modem may be construed as a command and vice versa. To avoid the consequences that could result from this confusion please make note of the following suggestions:

1. Send commands to the modem only when it is in the Command State.
2. Commands entered when the modem is in the On-line State are considered data and will be output as such. Be sure to enter the Escape Code before entering commands.
3. Data output by the computer when the modem is in the On-line State is interpreted as data. Be sure to enter `AT O <CR>` to re-enter the On-line State after a temporary exit to the Command state.
4. Do not have the computer echo command results (either word or number) to the modem. This would qualify as random data.

6.18 Command Executions

Some commands execute in as little as 250 milliseconds (the Dialing command being a notable exception). For the computer to "catch" the result code, be sure it is prepared to do so within this time constraint.

When under program control, we recommend using the result code numbers instead of the English words. Toward the beginning of the program, input the command `AT V0<CR>` to the modem. It is usually easier for a program to interpret a single character than a series.

The modem can only perform one command line at a time. Wait for the result code before sending another command.

6.19 Escape Code Precaution

In some contexts, it may be desirable to disable the Escape Code; e.g., when the modem is in answer mode while attached to a computer operating in half duplex. The reason for this is that if the distant computer should inadvertently send the Escape Code as part of its message, the modem would revert to the Command State when the string is echoed by the computer. All subsequent data will be construed as commands with unpredictable results.

- **NOTE:** To disable the Escape Code, define the Escape Character in register S2 as a non-ASCII (i.e., greater than 127) value.

Appendix A

ASCII CODE CHART

This table is a list of each of the standard ASCII control characters. The list shows the character, and the hex and decimal value of the character.

Keyboard Character	Hex Value	Decimal Value
^@	00	00
^A	01	01
^B	02	02
^C	03	03
^D	04	04
^E	05	05
^F	06	06
^G	07	07
^H	08	08
^I	09	09
^J	0A	10
^K	0B	11
^L	0C	12
^M	0D	13
^N	0E	14
^O	0F	15
^P	10	16
^Q	11	17
^R	12	18
^S	13	19
^T	14	20
^U	15	21
^V	16	22
^W	17	23
^X	18	24
^Y	19	25
^Z	1A	26

Appendix

Keyboard Character	Hex Value	Decimal Value
^[1B	27
^\	1C	28
^]	1D	29
^^	1E	30
^_	1F	31
space	20	32
!	21	33
"	22	34
#	23	35
\$	24	36
%	25	37
&	26	38
'	27	38
(28	40
)	29	41
*	2A	42
+	2B	43
,	2C	44
-	2D	45
.	2E	46
/	2F	47
0	30	48
1	31	49
2	32	50
3	33	51
4	34	52
5	35	53
6	36	54
7	37	55
8	38	56
9	39	57
:	3A	58
;	3B	59
<	3C	60
=	3D	61
>	3E	62

Keyboard Character	Hex Value	Decimal Value
?	3F	63
@	40	64
A	41	65
B	42	66
C	43	67
D	44	68
E	45	69
F	46	70
G	47	71
H	48	72
I	49	73
J	4A	74
K	4B	75
L	4C	76
M	4D	77
N	4E	78
O	4F	79
P	50	80
Q	51	81
R	52	82
S	53	83
T	54	84
U	55	85
V	56	86
W	57	87
X	58	88
Y	59	89
Z	5A	90
[5B	91
\	5C	92
]	5D	93
^	5E	94
_	5F	95
`	60	96

Appendix

Keyboard Character	Hex Value	Decimal Value
a	61	97
b	62	98
c	63	99
d	64	100
e	65	101
f	66	102
g	67	103
h	68	104
i	69	105
j	6A	106
k	6B	107
l	6C	108
m	6D	109
n	6E	110
o	6F	111
p	70	112
q	71	113
r	72	114
s	73	115
t	74	116
u	75	117
v	76	118
w	77	119
x	78	120
y	79	121
z	7A	122
{	7B	123
	7C	124
}	7D	125
~	7E	126
rub	7F	127

Appendix B

TECHNICAL INFORMATION

Telephone Line Information:

FCC Registration Number: AU692V25-3510

Ringer Equivalence: 0.4B

Telephone Line Interconnect Cable: RJ11C Permissive Cable

PIN NUMBER		TELEPHONE JACK POSITION NO.
MODEM JACK		RJ11C PLUG
3	TIP	3
4	RING	4
5		5
2		2

Specifications

Modem Compatibility	Bell 212A at 1200, 300 baud; Bell 103, 113 at 300 baud
Dialer Compatibility:	Industry standard "AT" command set
Modem Data Rate	1200, 300 and 110 baud
Speed Selection:	
Originate Mode:	Automatic on attention character
Answer Mode:	Automatically set to speed of incoming call

Appendix

Operating Modes:	Automatic dialing, manual dial (with telephone), automatic answer, manual answer, automatic dial with switch to voice mode.	
Test Modes:	Analog (local) loopback; remote digital loopback (both initiate and respond). Software command controlled.	
Receiver Sensitivity	-45 dBm	
Transmit Level	-10 dBm	
Tone Dial Level:	0 dBm	
Line Impedance	600 Ohms	
Ringer Equivalence:	0.4B	
Modulation:		
300 baud:	Frequency Shift Keyed (FSK)	
1200 baud:	Differential phase shift keyed (DPSK)	
Power Consumption:		
	Off Line	On Line
+5V	44.92 ma	56.68 ma
+12V	44.0 ma	44.0 ma
-12V	21.56 ma	21.56 ma
Data Format	8 bit, no parity; 7 bit even, odd, mark or space parity	
Dialing:		
Pulse:	(rotary) 10pps.	
Tone:	Including * and #, duration 70 ms (adjustable)	

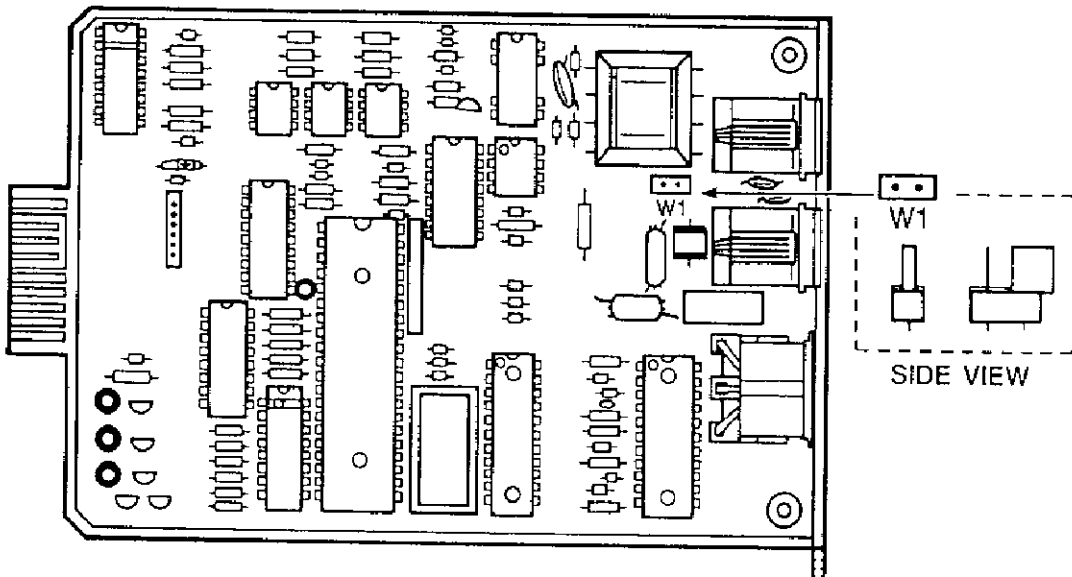
Command Buffer:	40 characters
Speaker:	Normally on during dialing; can be turned off by command.
Technology:	Low power CMOS circuitry utilizes proprietary LSI modem circuits, 8051 microprocessor. Control program: 4K bytes.

ADDENDUM A

To All Those Using a Multi-Line Key System:

The Tandy 1200 bps modem has a mini jumper marked "W1". When this mini jumper is on, A/A1 are active. A/A1 are used to turn on "in use" lights on many key systems.

The mini jumper is shipped in the "off" position to avoid possible problems if you have two separate telephone lines at your home (or office). The telephone company frequently wires the second of the two lines to the same leads as A/A1 (pins 2, 5 or RJ11). When the jumper is on, you may experience problems with the second line when using the modem on the first line.



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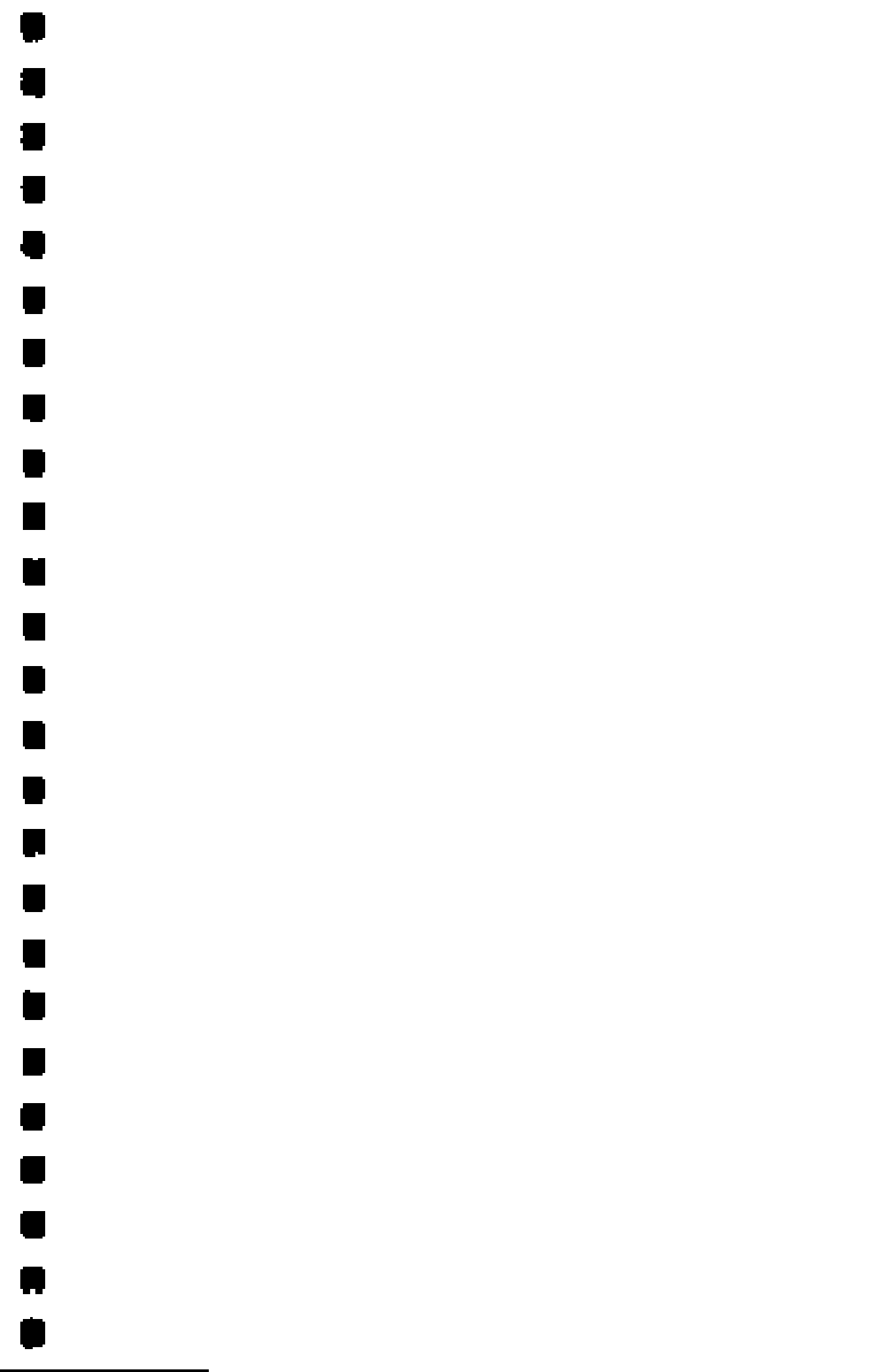
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RADIO SHACK, A DIVISION OF TANDY CORPORATION

U.S.A.: FORT WORTH, TEXAS 76102
CANADA: BARRIE, ONTARIO L4M 4W5

TANDY CORPORATION

AUSTRALIA

91 KURRAJONG AVENUE
MOUNT DRUITT, N.S.W. 2770

BELGIUM

PARC INDUSTRIEL
5140 NANINNE (NAMUR)

U. K.

BILSTON ROAD WEDNESBURY
WEST MIDLANDS WS10 7JN