USRobotics Sportster Reference Manual

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Chapter 1

USRobotics Sportster Reference Manual

1.1 USRobotics Sportster Reference Manual

REFERENCE GUIDE

for

Sportster High Speed Modems
with V.42 bis

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****
SPORTSTER CONFIGURATION
****

The Sportster is preconfigured at the factory so you should be able to connect the modem, set up your communications software, and be ready to send and receive data. Many users wonôt need to change the default configurations, but if you want to, this guide will tell you how. Many of the functions described below can be handled by your communications software, but you also have the power to place your computer in Terminal mode (via your communications software) and control the modem directly.

NOTE: Unless otherwise indicated, settings listed as "default" are based on those set for the modem when it is shipped.

==========
FACTORY CONFIGURATION (&Fn and Yn)
==========

The Sportster is preconfigured at the factory with three permanent and two programmable templates.

==========
Permanent Configuration Templates (&Fn)

The following permanent templates come with your Sportster. The default template consists of the most reliable settings,

but these settings may not work for all users.

&F0 This template does not include performance features, such as a fixed serial port rate or hardware flow control. What it does offer is compatibility with nontypical computers or software that cannot handle flow control and other features.

&F1 Default. This template sets the modem to hardware flow control, a fixed serial port rate, the highest level result codes, and the most complete result-code set.

The &F1--Hardware Flow Control template is recommended for all IBM-compatible computers, as long as your communications software supports hardware flow control, a fixed serial port rate, and the advanced result-code subset.

NOTE: We also recommend that users of Macintosh computers invest in a Hardware Handshaking cable (instead of the standard cable), use this template, and use software that supports hardware flow control.

&F2 This is a software flow control template. We recommend you do not use software flow control, and thus, this template. However, if you use a Macintosh, see the note above. In addition, some computers are limited to three-wire cables that do not support hardware flow control signals. If this is the case, review the warning on software flow control later in this guide.

To load the &F2--Software Flow Control template and save it as your power-on/reset default, enter the following command:

AT&F2&W <Enter>

NOTE: Refer to the "Programmable Templates" section for more information on selecting and modifying templates to save as your start-up configuration.

If you need a low performance template because of data-transfer difficulties, flip DIP switch 7 ON and reset the modem (ATZ command), or load the &F0--Low Performance template by entering the following command:

AT&F <Enter>

NOTE: When the modem receives the above command, it assumes you want to load the &F0 template because there is no position number indicated. It is the same to enter AT&F as to enter AT&F0.

This template allows you to communicate with nontypical systems that cannot handle flow control and other features.

```
============================================================
Programmable Templates (Yn)

In addition to the &Fn permanent configuration templates,
two programmable templates are provided.  Your programmable
templates are located in nonvolatile, random access memory
(NVRAM).

The Sportster is shipped to load NVRAM template 0 (or Y0)
for its power-on/reset default settings.

Possible NVRAM templates:

Y0    Loads the NVRAM template 0 (stored with template
      &F1--Hardware Flow Control settings).  Default.

Y1    Loads the NVRAM template 1 (stored with template
      &F2--Software Flow Control settings).

If you want to switch the power-on/reset default NVRAM
template from Y0 to Y1, enter the Yn command, then reset the
modem with the Z command.

                AT Y1 Z <Enter>

To customize other defaults you want to store in NVRAM as
part of your customized power-on/reset template, use the &Wn
command (below).

WARNING:  The Yn command, which selects template settings to
     use as the power-on/reset default, may select different
     power-on/reset default settings than those currently
     loaded (if you altered the settings during the current
     session).  Before changing a template, you may want to
     use option 4 of the Inquiry (I) command to display the
     current settings.

                AT I4 <Enter>

     The Y setting on the ATI4 screen indicates if Y0 or Y1
     is the power-on/reset default.  If you want to check
     all the NVRAM settings in both Y0 and Y1 templates, use
     option 5 of the Inquiry command (I).

                AT I5 <Enter>


============================================================
CUSTOMIZING YOUR DEFAULTS (&Wn)
============================================================

When the modem is shipped, it reads template 0 in NVRAM as
the power-on/reset default.  Template 0 (Y0) is initially
loaded with &F1 permanent configuration settings.  Although
you cannot alter the &F1 template, you can add, delete, or
modify the settings stored in your NVRAM templates.  It is
```

more likely, however, that you will want to keep your power-on/reset default settings and simply change a setting for a current session. Refer to "Temporarily Changing a Setting" in this guide for more information.

If you want to modify your default configuration settings, use the &Wn command. Possible settings are:

&W0 Modifies the NVRAM 0 template (Y0).

&W1 Modifies the NVRAM 1 template (Y1).

Typically, users prefer the default settings stored in NVRAM when the modem is shipped, but you may set up different power-on/reset defaults. For instance, if your system supports hardware flow control, you can set your Y1 template to the settings for hardware flow control so both templates set the modem for hardware flow control. (The Y0 template is shipped with hardware flow control settings.)

AT &F1 &W1 <Enter>

NOTE: Yn is unique because it writes itself to NVRAM-you do not need to use the &Wn command.

Similarly, if your system only supports software flow control, you can set your Y0 template to the settings for software flow control so both templates set the modem for software flow control. (The Y1 template is shipped with software flow control settings.)

AT &F2 &W <Enter>

You may also specify the entire configuration in a single command string that ends with the &Wn command. The following example sets the modem for the current session and stores the configuration in NVRAM 1 (or Y1).

AT &K3 &W1 <Enter>

After sending a configuration to NVRAM, you can change any setting just for the current session, as in the following example. The NVRAM configuration remains intact.

AT &K3 <Enter>

But if you want the new setting to be a default, write it to NVRAM at the same time, as in the following example, which saves the setting to NVRAM template 0.

AT &K3 &W <Enter>

If you've sent the modem commands to change settings throughout your session and want to save your current configuration, send just the &Wn command. The current settings are then written to NVRAM 0 (or Y0) in the example below.

```
AT&W <Enter>
```

If you cannot use hardware flow control and need to use Xmodem-type file transfer protocols, use either Y0 or Y1 for a no flow control configuration with no error control.

```
AT &F &M &W <Enter>
      or
AT &F &M &W1 <Enter>
```

USING AT COMMANDS

To send commands directly to your modem, first put your computer in Terminal mode. Some communications programs do this automatically upon loading. Others require you to display a communications terminal screen, press a Function key, or perform some other operation. If necessary, refer to your communications software documentation for instructions.

1. Type all commands in either upper case (AT) or lower case (at), but not a combination (At).

2. All commands except A/ (re-execute last command) and +++ (escape code) are preceded by the AT prefix and are executed with the Enter/Carriage Return key (<Enter>).

3. Command string length = 40 characters, maximum. The modem doesn't count the AT prefix, Carriage Return character, or spaces. In a dial string, it counts--but doesn't act on--punctuation such as hyphens and parentheses.

4. A missing numeric parameter is assumed to be zero, as in the command to hang up; ATH <Enter> is the same as ATH0 <Enter>.

RESETTING THE MODEM (Z)

If you've changed several current settings and want to reset to your power-on defaults, type the following command.

```
ATZ <Enter>
```

The modem reads its DIP switch settings and resets to its NVRAM defaults (DIP switch 7 OFF) or the &F0--Low Performance template (DIP switch 7 ON) settings.

NOTE: Use the ATZ command if you've changed the position of DIP switches 1-7 while the modem is on, so that the modem can read the new settings. The only other way to initiate a new setting for switches 1-7 is to turn the modem off and on again.

****
PLACING CALLS
****

NOTE: Unless otherwise indicated, settings listed as "default" are based on the hardware flow control template stored in NVRAM when the modem is shipped.

==========
DIAL (D)
==========

To dial a phone number and place a call without using your softwareôs dialing directory, first put the computer in Terminal mode. Then type the AT and D commands, the number you wish to connect with, and press Enter. Spaces in our command examples are ignored by the modem and are only included for readability.

ATD 1234567 <Enter>

Unless you lowered your modem's speaker volume, you will hear the modem go off hook and dial the telephone number, followed by a series of handshaking signals.

The Dial command string may include up to 40 characters. The modem counts but ignores punctuation characters such as parentheses and hyphens. It does not count spaces, the AT prefix, or the Carriage Return key (<Enter>) required to execute the command.

The modem also executes any other commands or options included in the command line. The following Dial command example instructs the modem to turn off the speaker (M0), and dial (D) the phone number (1234567) using tone dialing (T).

AT M0 DT 1234567 <Enter>

You may want to review the many options on the next several pages that are available for tailoring Dial strings. The most typically used are the Dial Type--Pulse or Tone, and the Pause options--comma, slash, and W.

==========

Cancel Dialing

To cancel Dial command execution, press <any key>. If you inadvertently hit a key on the keyboard while the modem is dialing, the call is canceled. If this occurs, type the A/ command, which re-executes the last command you entered.

==========

Dial Command Options

You can modify the dial string according to the needs of the connection. Listed below are options available to you when entering the Dial string.

Dial Type-Pulse or Tone

The modem defaults to pulse (rotary) dialing. To have the modem use tone dialing, which includes the asterisk (*) and pound sign (#), use the T command.

Dial type commands may be included in the Dial string (ATDT number) or, issued separately (ATT or ATP). However, if youôll always use tone dialing, write tone dialing to NVRAM as the modem’s default and/or use adaptive dialing, described below.

NOTE: You can switch from one dial type to another within a dialing sequence. The modem remains set to the last dialing type instruction until it is reset (ATZ command), or it receives a different dial-type command.

Adaptive Dialing (X2 through X4)

When any of the X2 through X4 (default) result code options is in effect and you do not issue a dial type in the Dial string, the Sportster defaults to pulse dialing. If you issue a tone dial command, the Sportster will default to Hunt dialing, beginning with tone and adapting to pulse when necessary. For instance, if the phone company’s central office does not have tone-detection equipment, the modem automatically reverts to pulse dialing.

Wait for Another Dial Tone (W)

This command is useful in situations where you must wait for a second dial tone before continuing to dial. For example, if you need to dial for an outside line, as in the following example, the Sportster continues to dial as soon as it detects the next dial tone.

ATD9W1234567 <Enter>

NOTE: This command executes only if result code option X3

or X4 (default) has been issued. If the modem is set to X2 or lower, the modem interprets the W as a comma (two-second pause).

Pause (,)

A comma causes a two-second delay in the dial sequence. The following example contains four-second delays at several points.

ATDP 9,,7654321,,55555,,1 312 1234567 <Enter>

The first four-second pause is to access an outside line after dialing 9, but you may wish to use the W option, just described. The second pause is to make sure the remote system is ready for the user's account number, and the third, to delay before dialing the long-distance number.

Such pauses, however, may not be necessary. Experiment and use delays only as required.

Slash (/)

A slash (/) can be used in any command string to make the modem pause for only 125 milliseconds. Some users find it helpful to have the shorter delay of a series of slashes, rather than the 2-second comma pause.

Dial and Return to Command Mode (;)

If your phone is plugged into the modem, you can use this option to have the modem Auto Dial a telephone rather than a modem. The Sportster dials, remains off hook, and returns the OK message, indicating it is in Command mode.

For example, to have the modem place a voice call, enter the Dial command with a semicolon.

ATDT5551234; <Enter>

When the modem returns the OK result, pick up your phone receiver so you can talk to the other party, and send the command that hangs up the modem.

ATH <Enter>

Similarly, if you can call a recorded weather or other service, have the modem Dial, listen to the recording over the modem's speaker and, when you are finished, instruct the modem to hang up.

Dialing Letters (")

Quotation marks are used to make the modem dial abbreviations and acronyms used as phone numbers, such as DIAL USR (the U.S. Robotics Sales Department's 800 number). This option is called Quote mode. Quotation marks are inserted at the beginning of the alphabetic string.

```
ATDT "BBS NEWS <Enter>
```

NOTE: If you are including another command after the dial string, use closing quotation marks before the additional command.

```
ATDT "BBS NEWS",,,1234<Enter>
```

Transferring Calls (!)

This command is used for modems installed where other modems share the phone line. The modem flashes the switch-hook. That is, it goes off hook 0.5 seconds, on hook for 0.5 seconds, and off hook again to dial the specified extension. The following example includes instructions to return to Command mode (;) and to hang up (H).

```
ATDT !1234;H <Enter>
```

Wait for an Answer (@)

Some online services answer the phone and return a tape-recorded request for information before processing transactions. In such instances, the @ command can be used in the Dial string to tell the modem to detect at least one ring, wait for five seconds of silence at the other end of the call, and then continue to execute the Dial string.

To use the @ command, set the modem result code option to X3 or X4 (default). If the modem is set to X2 or lower, the modem returns an ERROR message when encountering the @ character in a command string.

In the next example, the modem is set to the X3 result code option and dials a banking service. Each occurrence of @ in the example indicates a five-second wait for silence. That is, for taped requests from the bank for a password (12345), an account number (6789), and a transaction code (2). The transaction code might indicate, for example, a request for an account balance.

```
ATX3 DT5551234 @ 12345 @ 6789 @ 2 <Enter>
```

If the necessary conditions do not occur--no rings, or no

following five seconds of silence--the modem times out as it normally would (after 60 seconds). It then sends the message NO ANSWER to the screen and aborts the call.

Reversing Originate/Answer Frequencies (R)

This command allows calls to an originate-only modem (a modem set up to send only). It reverses the modem's originate/answer frequencies, forcing the Sportster to dial out at the answer frequency. The command follows the Dial command, before or after the phone number.

```
AT D1234567R <Enter>
AT DR1234567 <Enter>
```

==========

Dialing Stored Numbers (DSn)

You can store up to four frequently used telephone numbers in nonvolatile, random-access memory (NVRAM). Use the &Zn=s command to store telephone numbers, where n is the position of the number in NVRAM (0-3) and s is the stored number. The following command string stores the telephone number (4441212) at position 1 in NVRAM.

```
AT&Z1=4441212 <Enter>
```

To dial a stored number, use the DSn command, where n is the position of the number in NVRAM (0*3). In the first example, the modem dials the phone number stored at position 0. In the second, the modem dials the phone number stored at position 3.

```
ATDS0 <Enter>
ATDS3 <Enter>
```

You can also store a partial dial sequence. If you often call a set of phone numbers and only their last three or four digits differ, it might be useful to store the other digits. The following example stores a partial phone number at position 1.

```
AT&Z1 = 9W1 616 123 <Enter>
```

Once you have stored the partial phone number in NVRAM, use the DSn command to dial the partial number, placing a slash (/), then the remainder of the number after the DSn command. The slash separates the DSn number from the remainder of the string, yet maintains the dial command..

```
AT DS1/4567 <Enter>
```

NOTE: Do not include modem settings in the &Zn=s string. If the call requires modem settings, insert them in the command string before the DSn command. For example, &K3 (selective data compression) is inserted before the Dial

command to call the number stored at position 0.

AT&K3 DS0 <Enter>

This establishes &K3 as the current setting. To return to default data compression mode after the call, issue the following command.

AT&K1 <Enter>

==========

REDIALING

==========

The most frequent reason for redialing is receipt of a busy signal. The Sportster modem provides two redialing options, as follows.

==========

Dial the Last-Dialed Number (DL)

When you want to redial a number, enter the DL command. The modem dials the last-dialed number, which it has stored in a special buffer.

ATDL <Enter>

To display the number stored in the last-dialed buffer, use the following query.

ATDL? <Enter>

To write the last number dialed to NVRAM, use &Zn=L where n is the position in NVRAM. The following example stores the last-dialed number at position 3.

&Z3=L <Enter>

If a number is already stored at position 3, that number is overwritten with the last-dialed number.

==========

Re-execute the Last Command (A/)

Another option for redialing is to enter the A/ command. This command does not require the AT prefix or a Carriage Return.

A/

When the modem receives a command, it stores it in its command buffer until it receives the next AT command. Note that if you've sent the modem an additional command since the Dial command, A/ repeats that command instead of redialing.

==========

ANSWERING

==========

Your Sportster modem is shipped with DIP switch 5 ON, Auto Answer suppressed. To set the modem to automatically answer incoming calls, do one of the following.

Before powering on the modem...

* Set DIP switch 5 OFF. When you power on, the modem answers incoming calls on the first ring.

  If you want the modem to answer after several rings, set DIP switch 7 OFF. Specify the ring you want the modem to answer on in NVRAM (default=1 ring). The valid range is 1-255 rings. Power off the modem and power it on again with its new DIP switch and NVRAM settings..

During a current session...

* Issue the following command to have the modem answer on the fourth ring:

ATS0=4 <Enter>

When the modem senses a call, it sends the RING result code to your screen, goes off hook, and sends the remote modem a high-pitched answer tone. If there is no Carrier Detect within 60 seconds, the modem hangs up. If the connection is made, the modem returns a CONNECT result code. When the call is disconnected by you or the remote user, the modem hangs up and returns the NO CARRIER code.

==========

Suppressing Auto Answer

To disable Auto Answer, set DIP switch 5 ON before powering on the modem, or set the modem to answer on zero (or no) rings during the current session.

ATS0=0 <Enter>

NOTE: The S-Register setting S0=0 cannot be saved to NVRAM.

==========
Manual Answer
If you've disabled Auto Answer but are expecting an incoming data call, use the Manual Answer command. Send the modem the following command after the RING result code appears on your screen.

ATA <Enter>

When the call is disconnected, the modem returns to its original state, Auto Answer disabled.

Points to Remember
---
1. You can set the modem to receive calls when you're not at your computer. Load your communications software as you normally do, and set the modem to Auto Answer. Also set your software's file-save function to save incoming messages and/or files.

2. If you've attached your phone so it can be used for conventional calls, disable Auto Answer when you are not expecting incoming data calls. Otherwise, your modem may answer the phone before you do, greeting a voice caller with a high-pitched, irritating answer tone.

==========
DISCONNECTING AND HANGING UP
==========

The commands outlined below describe how you can instruct the modem to disconnect the call and hang up the line.

==========
Escape Code Operations (+++)

Once the modem is online to another system, the only command it recognizes is an escape code of three plus symbols that forces the modem into Online-Command mode. Issue the escape command in the following sequence.

* Wait one second after sending the last item of data.
* Type three plus symbols (+++).
* Wait one second before typing any data.

Do not type the AT prefix or a Carriage Return. The guard time of one second before and after prevents the modem from misinterpreting the presence of the +++ symbols in the transmitted data stream.

If necessary, the character used in the escape code or the duration of the guard time can be changed by resetting Register S2 or S12. See the "Quick Installation Guide" for more information.

Modem Response to +++

When the modem receives +++, by default it enters Online-Command mode and returns the OK result code. It maintains the connection and is ready to act on commands. You may then choose one of the following options.

* Issue commands to the modem and then return it online.
* Hang up the modem.

Alternatively, if you want the modem automatically to hang up on receiving the +++ escape code, set Register S14 to 1 and write the command to your NVRAM templates.

ATS14=1 &W &W1 <Enter>

The modem disconnects and sends the NO CARRIER result code to the screen.

==========
Returning Online (On)

After forcing the modem into Online-Command mode with the escape code sequence, you can issue commands and then toggle the modem back online with the O command, as in the following example.

AT Q1 O <Enter>

O0 Return online (normal).

O1 Return online and retrain. If errors occur during a non-ARQ connection, try this option. The modem returns online and requests that both modems resynchronize.

==========
Hanging Up (Hn)

At its default setting, the escape code forces the modem into Online-Command mode but leaves the line open. To hang up the modem, issue the following command once the modem sends the OK result code.

ATH <Enter>

H0 Hang up (go on hook).

H1 Go off hook.

==========
Break Handling (&Yn)

This command lets you send a Break to abort data transfer without disconnecting from the phone line interface.

&Y0 Destructive, no Break transmitted: the modem clears the data from its transmit buffer (all data is lost) but does not transmit the Break to the remote modem.

&Y1 Destructive, expedited: the modem clears the buffer and immediately sends a Break to the remote modem. Default.

&Y2 Nondestructive, expedited: the modem retains data in the transmit buffer, but immediately sends a Break to the remote modem.

&Y3 Nondestructive, unexpedited (send Break in sequence): the modem transmits any buffer data received before the Break, sends the Break, and then sends any subsequent input from the computer.

NOTE: If the call is under MNP5 data compression, destructive Breaks cause both modems to reset their data compression tables. When transmission resumes, the modems build new tables, and the result is lower than normal throughput.

==========
INTERNATIONAL CALLS
==========

The following commands apply to international calls.

==========
ITU-T/Bell Answer Sequence (Bn)

To answer international calls, use the default B0 setting.

B0 Default. This setting is required for V.32 or higher modems to answer V.32 or higher calls. It also selects the ITU-T V.25 answer sequence, used outside of North America.

B1 This setting selects the Bell 2225 Hz answer tone used in the U.S. and Canada and may be used when the remote modem operates at only 2400 bps or lower. However, if

the modem is set to B1, it wonôt be recognized by V.32 or higher modems and canôt answer calls at 9600 and 14,400.

==========

Guard Tone (&Gn)

The United Kingdom and some Commonwealth countries use phone switching systems that require answering modems to send an 1800 Hz guard tone after they send an answer tone. Some other European phone networks require a 550 Hz guard tone. Guard tones are not used in the United States or Canada.

&G0 No guard tone, U.S./Canada. Default.

&G1 550 Hz guard tone follows answer tone. Requires B0 setting.

&G2 1800 Hz guard tone follows answer tone, United Kingdom and some Commonwealth countries. Requires B0 setting.

==========

Pulse Dial Make/Break Ratio (&Pn)

This command sets the ratio of the off-hook/on-hook (make/break) interval for pulse dialing. The default sets the modem for use in North America. The ratio must be changed if the modem is used to dial out in the United Kingdom and some Commonwealth countries.

&P0 Make/break ratio, U.S./Canada: 39%/61%. Default.

&P1 Make/break ratio, United Kingdom, some Commonwealth countries: 33%/67%.

==========

ITU-T V.21-300 bps

Select this option to call or answer overseas modems at 300 bps. In V.21 mode, the modem answers Bell 103/V.21 calls, but only originates V.21 calls. This option is enabled in Register S27 with the following command.

ATS27=1 <Enter>

==========

ITU-T V.23-1200/75 bps

Some United Kingdom and European systems require a 1200-bps speed with a 75-bps back channel. This option is enabled in Register S34 with the following command.

ATS34=8 <Enter>

****
TEMPORARILY CHANGING A SETTING
****

When you change a setting, the modem retains it until you do one of the following.

* Change the setting again.
* Issue the ATZ command to reset the modem.
* Turn the modem off and power it on again.

The parameters described in this section are organized in the order of their likely use. That is, those you are most likely to use appear at the beginning of the section, and those you are least likely to use appear toward the end.

==========
TONE DIALING
==========

The modem defaults to pulse (rotary) dialing. To have the modem use tone dialing, which includes the asterisk (*) and pound sign (#), use the T command.

ATDT 4445555 <Enter>

To have the modem always use tone dialing, use the T and &W commands:

AT T &W &W1 <Enter>

AUDIO MONITOR

The modem's speaker enables you to monitor the dial-connect process. There are several ways to make use of this feature. After the Sportster modem dials a number, it waits up to 60 seconds for a high-pitched answer tone from the other modem, immediately followed by data signals, called a "carrier." These signals must occur before a data link is established.

At the default X4 setting, the modem sends your screen the NO CARRIER message after 60 seconds. If you listen to the speaker and realize you have received a voice answer, you can respond immediately, instead of waiting for the modem to time out, by pressing any key on the keyboard. This cancels the call.

You can also hear if dialing is proceeding too quickly for the system. Terminate the call (press any key) and retype the Dial command, but insert a comma (,) or a couple of slashes (/), to have the modem pause during the dialing process.

Volume Control (Ln)

The following options allow you to adjust the speaker volume if you have an internal modem. You can adjust an external modemôs volume via its volume switch.

L0 Low.

L1 Low.

L2 Medium. Default.

L3 High.

Speaker Control (Mn)

This command disables the speaker entirely or sets the speaker to monitor different segments of the dial-connect sequence.

M0 Disables the speaker entirely so that you don't hear the modem go off hook, dial, etc.

M1 The speaker is on until Carrier Detect. Default. You can monitor call progress until the Sportster detects the remote modem's carrier signals, or until the 60-second timeout and result code display. At Carrier Detect, the modem disconnects the speaker and data-transmission sounds are suppressed.

M2 The speaker is on continuously, including during data transmission.

M3 The speaker doesn't go on until after the last digit is dialed, then goes off at Carrier Detect.

==========

LOCAL ECHO

==========

Local echo is the display of what you type at the keyboard and online echo display of data the Sportster transmits to another modem. The En command controls the display of your typed commands, when the Sportster is in Command mode. The Fn command controls the display of data when your modem is online to another system.

==========

Command Mode Local Echo (En)

The power-on/reset default for command mode local echo is set with DIP switch 4. The Sportster modem is shipped with DIP switch 4 OFF, enabling local echo of your typed commands.

Use the En command to control the local echo for a current session, independent of the switch setting. This command may not be stored in NVRAM.

E0 Command mode echo OFF. The modem does not display keyboard commands.

E1 Command mode echo ON.

NOTE: If double characters appear on the screen, both the modem's and software's local echo are on.

==========

Online Local Echo (Fn)

This command causes the modem to display a copy of the data it is transmitting to another system. Many systems, however, return a copy of received data, which is called a remote echo. If the modem's online echo is ON and there is also remote echoing, double characters appear on the screen.

In some microcomputer documentation, the term "duplex" is

applied to online local echoing, although the term is not technically accurate.

F0 Online echo ON. Sometimes called "half duplex." As the modem transmits data to a remote system, it also sends a copy of the data to the screen.

F1 Online echo OFF. Sometimes called "full duplex." Default.

S-REGISTERS

The S-Registers are used to set various timing parameters and to redefine selected ASCII characters and other configuration options. Refer to the "Quick Installation Guide" for a summary of S-Register functions and setting options.

Users typically require the default values. To change a setting, use the ATSr=n command, where r is the register and n is a decimal value from 0-255 (unless otherwise indicated).

The example below sets the modem's test timer (S-Register 18) to 10 seconds.

ATS18=10 <Enter>

The modem does not perform a value-range check. Some values you select may not work with some equipment, and you'll have to readjust the settings.

Use ATSr? to display the contents of a register, as follows.

ATS18? <Enter>

RESULT CODES

Four commands control the result codes that the modem returns to the screen.

Vn Numeric/verbal response mode

Qn Display/suppress all result codes

Xn Result code options

&An Display/suppress additional result code options

Response Modes (Vn)

Result codes are sent to the screen in words (Verbal mode) or numbers (Numeric mode).

The power-on/reset default for response modes is set with DIP switch 2. The Sportster modem is shipped with DIP switch 2 OFF, enabling Verbal mode.

Use the Vn command to select verbal or numeric result codes for a current session, independent of the DIP switch setting. This command may not be stored in NVRAM.

V0 Numeric mode. Numeric result codes are followed by a Carriage Return but no Line Feed, as in the following example, where a 3 is returned (for NO CARRIER).

```
ATD1234567 <Enter>
     becomes
3TD1234567 <Enter>
```

V1 Verbal mode. Verbal responses are preceded and followed by a Carriage Return and a Line Feed, as shown below.

```
ATD1234567 <Enter>
NO CARRIER
```

==========

Quiet Mode (Qn)

Enable/suppress the display of result codes.

The power-on/reset default for response modes is set with DIP switch 3. The Sportster modem is shipped with DIP switch 2 ON, to display result codes.

Use the Qn command to control the display for a current session, independent of the DIP switch setting. This command may not be stored in NVRAM.

Q0 Result codes are displayed.

Q1 Result codes are suppressed (made quiet).

Q2 Result codes are suppressed only in Answer mode.

==========

Result Code Options (Xn)

You have five options, X0 through X4, for selecting the result-code set best suited to your applications, as shown in the tables below.

X0 Basic set, returns the first five codes (0-4) in the following table.

X1 Extended set, codes 0-5, 10, 13 and 18, that adds rate-specific CONNECT messages to the Basic set. This set also includes all &An result codes.

X2-4 The default is X4. These options include the X1 set, call-progress codes 6 or 7, and 8, and the functions listed in the following table.

NOTE: By default, the modem is also set to &A3, which selects additional results that report the protocols used in the connection.

Result Code Options

	Setting				
Result Codes	X0	X1	X2	X3	X4
0/OK	o	o	o	o	o
1/CONNECT	o	o	o	o	o
2/RING	o	o	o	o	o
3/NO CARRIER	o	o	o	o	o
4/ERROR	o	o	o	o	o
5/CONNECT 1200		o	o	o	o
6/NO DIAL TONE			o		o
7/BUSY				o	o
8/NO ANSWER				o	o
10/CONNECT 2400		o	o	o	o
13/CONNECT 9600		o	o	o	o
18/CONNECT 4800		o	o	o	o
20/CONNECT 7200*		o	o	o	o
21/CONNECT 12000*		o	o	o	o
25/CONNECT 14400*		o	o	o	o
Functions					
Adaptive Dialing			o	o	o
Wait for 2nd Dial Tone (W)				o	o
Wait for Answer (@)				o	o
Fast Dial			o		o

* 14.4K only

NOTE: More CONNECT messages indicate an error control connection, the call modulation, or the error control and data compression used. See Additional Result Code Options (&An), after this section.

Result Code Definitions

Result Code	Meaning
0/OK	Command has been executed.
1/CONNECT	Connection established with another modem; if set to X0, connection may be at 300, 1200, 2400, 7200, 9600, 12K or 14.4K bps; if X1 or higher, connection is at 300 bps.
2/RING	Incoming ring detected.
3/NO CARRIER	Carrier detect has failed or carrier has been dropped due to disconnect.
4/ERROR	Command is invalid.
5/CONNECT 1200	Connection established with another modem at 1200 bps.
6/NO DIAL TONE	Dial tone not detected during the normal 2 seconds, set in Register S6.
7/BUSY	Busy signal detect; modem hangs up.
8/NO ANSWER	After waiting 5 seconds for an answer, modem hangs up; returned instead of NO CARRIER when the @ option is used.
10/CONNECT 2400	Connection established with another modem at 2400 bps.
13/CONNECT 9600	Connection established with another modem at 9600 bps.
18/CONNECT 4800	Connection established with another modem at 4800 bps
20*/CONNECT 7200	Connection established with another modem at 7200 bps.
21*/CONNECT 12K	Connection established with another modem at 12,000 bps.

25*/CONNECT 14.4K	Connection established with another modem at 14,400 bps.
Adaptive (Hunt) Dailing	The modem attempts to use tone dialing and, if that doesn't work, reverts to rotary (pulse) dialing.
Wait for Another Dail Tone (W)	The modem continues dialing as soon as it detects another dial tone.
Wait for an Answer (@)	The modem continues dialing when it detects 5 seconds of silence on the line.
Fast Dial	The modem dials immediately on dial-tone detect, instead of waiting the normal 2 seconds set in Register S6.

*14.4K only

==========

Additional Result Code Options (&An)

Use this command to enable/disable one of the following sets of error control, modulation, or protocol result codes. If you encounter software problems, it may be because your software expects to find different result codes from those the modem is sending. (The modem defaults to &A3.) Review your software documentation or try &A2, &A1, or &A0. You may need to call your softwareôs technical support to find out which &An setting they support.

&A0 ARQ (error control) codes are disabled. This setting does not affect an error control connection; the modem returns standard CONNECT messages if result codes are enabled.

&A1 ARQ codes are enabled. Default. One of the results below is shown when a successful error control connection is established. CONNECT/ARQ is displayed if the modem is set to X0 and the connection is between 1200 to 14.4K bps. The remaining results indicate connection rate and require X1 or above. If your software cannot handle the ARQ codes, select &A0.

14/CONNECT/ARQ	19/CONNECT 4800/ARQ
15/CONNECT 1200/ARQ	24/CONNECT 7200/ARQ
16/CONNECT 2400/ARQ	22/CONNECT 12000/ARQ
17/CONNECT 9600/ARQ	26/CONNECT 14400/ARQ

&A2 V.32 modulation codes are enabled. These results require a setting of X1 or higher. If your software cannot handle the added modulation information, select

&A1 or &A0.

33/CONNECT 9600/V32	41/CONNECT 12000/V32
37/CONNECT 9600/ARQ/V32	42/CONNECT 12000/ARQ/V32
38/CONNECT 4800/V32	44/CONNECT 7200/ARQ/V32
39/CONNECT 4800/ARQ/V32	45/CONNECT 14400/V32
40/CONNECT 7200/V32	46/CONNECT 14400/ARQ/V32

&A3 Protocol codes are enabled. Default. Error control protocols reported are LAPM or MNP. When the call is not under one of those protocols (and ARQ is not included in the result code), the modem reports NONE, for no protocol.

If the modems are using data compression, the type of compression–V42BIS or MNP5–is added to the result code. In the first of the following examples, the modems negotiated error control for the call (ARQ), used V.32 bis modulation, are using the LAPM error control protocol, and are using V.42 bis compression.

CONNECT 14400/ARQ/V32/LAPM/V42BIS [or MNP/MNP5]
CONNECT 2400/ARQ/MNP/MNP5 [or LAPM/V42BIS]
CONNECT 2400/NONE

If your software cannot handle the added protocol information, select &A2, &A1, or &A0.

Although these codes will return numeric identifiers if DIP switch 2 is ON or you've set the modem to V0, they are the same numeric identifiers used for &A2 result codes. If you want &A3 protocol indicators, use Verbal mode (V1), and not Numeric mode (V0).

ERROR CONTROL (&Mn)

By default, the Sportster first attempts a connection using V.42 (LAPM) error control and, if that doesn't succeed, it attempts an MNP connection. If that doesn't succeed, the modem tries to connect without error control.

Error control is possible at rates of 1200 bps and above.

The following options are available.

NOTE: ARQ is U.S. Roboticsô term for error control protocols that feature error detection and automatic retransmission of corrupted blocks of data.

&M0 Normal mode, no error control. Because of the nature of phone-line channels, this is never recommended for calls above 2400 bps unless you're using an error-correcting file-transfer protocol.

&M1 Reserved.

&M2 Reserved.

&M3 Reserved.

&M4 Normal/ARQ mode. Default. If the remote modem doesn't recognize the Sportster's error control signals--V.42 or MNP--the modem operates in Normal mode, as though it were set to &M0.

&M5 ARQ mode. If the remote modem doesn't recognize the error control request--V.42 or MNP--the Sportster hangs up.

Always set the Sportster for error control, &M4 (default) or &M5, for calls at speeds over 2400 bps. Most users communicating with V.42- or MNP-compatible modems will want error control at 2400 and 1200 bps, as well.

If you're dialing out and have trouble connecting, it may be because the remote modem doesn't have either MNP capability, and it misinterprets your modem's MNP error control request. If you know the remote modem doesn't support MNP, disable MNP handshaking by setting Register S27 to 16 (ATS27=16). The Sportster still connects, but without MNP error control.

To reset the modem for normal operations after the call, issue the ATZ (reset) command, or set Register S27 to zero.

==========

Auto Answer with Error Control

When set to &M4 or &M5 and a call comes in, the modem goes off hook and responds to received error control signals. If the Sportster doesn't receive those signals and is set to Normal/ARQ mode (&M4), it answers the call in Normal mode (&M0). If it doesn't receive the signals and is set to ARQ mode (&M5), it hangs up.

==========

DATA COMPRESSION (&Kn)

==========

When data compression is enabled, the transmitting modem detects redundant units of data and recodes them into shorter units of fewer bits. The receiving modem decompresses the redundant data units before passing them to the receiving computer.

Compression does not occur unless the modems can establish an error control connection.

If the Sportster makes a V.42 connection, it negotiates V.42 bis compression. If V.42 bis is not feasible, the

connection remains under error control, but without data compression.

If the Sportster makes an MNP connection, it negotiates for MNP Level 5 (MNP5) data compression. If the remote modem does not have MNP5 capability, the connection remains under MNP error control, but without compression.

&K0 Data compression disabled.

&K1 Auto enable/disable. Default. The modem enables compression if the serial port rate is fixed (&B1) and disables compression if the serial port rate follows the connection rate (&B0). (Compression offers no throughput advantage when serial port and connection rates are equal, and may even degrade throughput.)

&K2 Data compression enabled. Use this setting to keep the modem from disabling compression.

&K3 Selective data compression. The modem negotiates only for V.42 bis compression, and disables MNP Level 5 (MNP5) compression. See the following note.

NOTE: MNP5 compression is not useful when transferring already compressed files, such as the .ZIP files downloaded from Bulletin Boards and 8-bit binary files that appear already compressed to the modem. MNP5 tends to add data to these files, and throughput over the phone link degrades.

V.42 bis compression detects when data is already compressed and turns off until it detects that compression will be advantageous. The special &K3 setting allows the best throughput for already compressed and 8-bit binary files.

DATA RATE COMMANDS

The &Bn and &Nn commands control data rates at the serial port and phone line interfaces.

The Sportster defaults to a fixed rate at the serial port interface (&B1) to keep the serial port rate higher than the connection rate. You'll get greater throughput regardless of the connection rate. Your software, however, must support this feature and you must set your software to use a fixed rate.

For the phone line, however, we recommend variable connection rates (&N0). This lets the modem switch its connection rate to match the rate of a remote modem, no matter what that rate is. If the connection rate is fixed, for example, at 9600 bps (&N6), the modem only connects with modems operating at that rate. Of course, if your application requires connections with modems at only one

rate, you may wish to set the modem to a fixed connection rate.

Software Requirements

Both variable and fixed serial port rates require communications software support. Most communications programs support variable or fixed rates. Check your software manual. Set your software BEFORE making calls.

==========
Serial Port Rate (&Bn)

Initially, the modem's serial port rate depends on your software setting. The modem uses the rate at which it receives the AT command to determine the serial port rate; after that it depends on its &B setting.

&B0 Variable serial port rates. The modem switches its serial port rate to follow the connection rate established with a remote modem. If your software has Auto Baud Detect, turn it on. The software will switch its serial port rate to match the connection rate.

&B1 Fixed serial port rate. Default. The modem detects its serial port rate from your last AT command and maintains it, whatever the connection rate.

Set your software to 57.6K, 38.4K, or 19.2K bps, then set the modem to &B1 for the best throughput. Some programs require that you turn off Auto Baud Detect to fix the serial port rate. Others use the term Serial Port Lock (yes or no).

The serial port rate MUST EQUAL OR EXCEED the connection rate. Also, this setting requires flow control, preferably hardware (&H1), to avoid buffer overflow.

&B2 Fixed for ARQ calls/Variable for non-ARQ calls, Answer mode only. When the modem goes off hook and answers in ARQ mode, it shifts its serial port rate to the one written to NVRAM, for example, 38.4K bps. In non-ARQ mode, it acts as if set to &B0 when answering, and switches its serial port rate to match the call's connection rate.

This option is designed for installations such as Bulletin Boards that receive calls from a wide variety of modems, ranging from the very slow to those with the Sportster 's advanced design.

==========
Connection Rate (&Nn)

Use the &Nn command to select variable or fixed rates at the

phone-line interface. Variable rates let the modem connect with a variety of remote modems, while fixed rates limit calls to one connection rate.

&N0 Variable rates. Default. The Sportster negotiates with the remote modem for the highest possible connection rate, depending on the capabilities of the remote modem. This is the recommended setting.

&N 1-8 Fixed rate. The Sportster only connects if the remote modem is operating at the same rate. If not, the Sportster hangs up.

The fixed rate options are as follows.

&N1	300 bps	&N5	7200 bps (14,400 only)
&N2	1200 bps	&N6	9600 bps
&N3	2400 bps	&N7	12K bps (14,400 only)
&N4	4800 bps	&N8	14.4K bps (14,400 only)

By fixing the connection rate, you can filter out calls at other than a specific rate, for security or other reasons.

FLOW CONTROL

The modem uses either hardware or software flow control to manage the amount of data stored in the buffers, thus preventing buffer overflow.

The Sportster defaults to hardware flow control. This type of flow control is performed between the modem and computer with serial signaling.

Software flow control uses the standard ASCII Transmit OFF (XOFF) character, Ctrl-S, and the Transmit ON (XON) character, Ctrl-Q.

ASCII definitions are as follows.

XON	Ctrl-Q	ASCII 17 Decimal, 11 Hex
XOFF	Ctrl-S	ASCII 19 Decimal, 13 Hex

NOTE: Both your software and computer must support the flow control you select. All 100% IBM PC-compatible computers support hardware flow control, as do Apple computers equipped with a Hardware Handshaking cable. However, hardware flow control requires software support. Refer to your software documentation to see what your software supports.

When you have determined the type of flow control your system supports, be sure to set your software appropriately BEFORE transferring files.

==========
Warning on Software Flow Control

In ordinary operations, the only characters the modem recognizes during a call are the three plus symbols (+++) of the escape code that return it to Command mode. But when software flow control is enabled, the modem or computer also looks for Ctrl-S or Ctrl-Q characters. IF THESE CHARACTERS OCCUR IN A FILE OR AS PART OF A PROTOCOL, it reads them as XON/XOFF characters and acts on them.

For example, XON/XOFF characters occur in binary files, and are used by Xmodem-type protocols. They may also come from the remote system. An XON from the remote system, after your modem has sent an XOFF, can result in buffer overflow.

Software flow control may prove satisfactory if you're only transferring text files; however, you may lose data if XON/XOFF characters occur in the data stream from other sources.

To select software flow control, write the &F2 configuration template to Y1.

AT &F2 &W <Enter>

Software Flow Control Precautions

If you canôt use hardware flow control and are doing Xmodem-type protocol or binary file transfers, select a protocol that performs error correction, and turn off the modem's error control (AT&M0).

==========
Transmit Data Flow Control (&Hn)

This type of flow control regulates data your computer transmits to the modem for transmission over the phone link. The modem monitors its Transmit Data buffer as data comes in. If the buffer nears 90% capacity, the modem signals the computer to stop transmitting. When it has sent enough data over the link to empty half the buffer, it signals the computer to resume transmitting.

When it is Required

Transmit Data flow control should be enabled in the following situations.

* You're using error control (any allowable rate above 300 bps), with or without data compression. If data is resent due to errors, a continuous stream of data from the computer could overflow the modem's buffer.

* The serial port rate is higher than the connection rate. For example, the serial port rate is 38.4K bps and the connection rate is 14.4K bps.

NOTE: Set your software to either hardware or software flow control. Some programs also require that you turn off the type you are not using.

&H0 Transmit Data flow control disabled.

&H1 Hardware flow control. Default. Your computer and software must support Clear to Send (CTS). The modem drops the Clear to Send (CTS) signal to the computer when its buffer nears 90% capacity, and starts sending CTS again when the buffer is about half full.

&H2 Software flow control. Your software must support XON/XOFF signaling. The modem sends an XOFF to the terminal when its buffer nears 90% capacity, and sends an XON when the buffer is about half full. Default in the &F2-Software Flow Control template.

&H3 Use both hardware and software flow control. Select this option if you're not sure what your computer supports.

NOTE: If possible, use hardware flow control. See "Warning on Software Flow Control," earlier in this guide for details.

==========
Received Data Flow Control

Two commands--&Rn (hardware) and &In (software)--control the flow of received data passed by the modem to your computer. Because computers handle incoming data more quickly than the modem receives it over the phone line, most applications won't need this.

Hardware Control (&Rn)

When your computer drops its Request to Send (RTS) signal, the modem stops passing along received data. The computer sends RTS again when it is ready to receive more data.

Your computer and software must support RTS. You cannot use this type of flow control, however, if your software requires a constant RTS signal.

NOTE: Use only for ARQ (error control) calls, because the V.42 and MNP protocols control the data flow across the

phone link. During non-ARQ calls, however, there is no way to signal the remote modem to stop sending data. If your modem stops passing data to your computer and the remote modem keeps sending, the Received Data buffer will overflow.

&R0 Reserved.

&R1 The modem ignores Request to Send (RTS). This setting is required if your software does not support RTS.

&R2 Hardware flow control of received data enabled. Default. The modem passes received data to your computer only on receipt of the RTS signal.

Software Control (&In)

When you send the modem a Ctrl-S (XOFF) command from the keyboard, the modem stops passing received data to your computer. When you send a Ctrl-Q (XON) command, it resumes.

NOTE: Because of the risk of data loss, &I1-5 are recommended only if your data does not have XON/XOFF control characters. See "Warning on Software Flow Control" for details.

&I0 Disables XON/XOFF flow control of received data. Recommended for non-ARQ calls.

&I1 The modem acts on your typed Ctrl-S/Ctrl-Q commands and passes them to the remote computer. Not recommended for non-ARQ calls. Use in ARQ mode only, but keep in mind that XON/XOFF characters sent to the remote computer may interfere with XON/XOFF signaling between it and the remote modem. &I2 is preferred for ARQ calls.

&I2 The modem acts on your XON/XOFF commands, but removes them before sending data to the remote computer. Default in the &F2--Software Flow Control template. Recommended setting for ARQ mode, only. It ensures that the remote computer does not confuse its modem's XON/XOFF characters with yours.

If the call is not in ARQ mode, there is no flow control on the phone link. If you send an XOFF to your modem and it stops passing data, it has no way to tell the remote computer and modem to stop sending for a while, and your modem's buffer may overflow. See &I5 for another alternative.

&I3 Host Mode. Applies only to modems attached to HP mainframes using the ENQ/ACK protocol. ARQ mode only.

&I4 Terminal Mode. Applies only to modems attached to HP system terminals using the ENQ/ACK protocol. ARQ mode only.

&I5 Enables phone link flow control when the connection is not under error control. Both modems must use &I5. In ARQ mode, the modem operates as if set to &I2. It acts on XON/XOFF commands, but does not pass them on to the remote system.

In non-ARQ mode, the modem acts as if set to &I0. It does not look for local XON/OFF commands, but does look for any XON/XOFF characters coming in over the phone link from the remote computer. The modem acts upon them and drops them from the data stream.

Operators can signal the other modem to stop sending and control phone link data flow to keep their modem's buffer from overflowing, if both are set to &I5.

SERIAL OPERATIONS

The parameters described below are directly affected by the serial connection and DIP switch settings, and apply to external modems only.

Carrier Detect (&Cn)

Like DIP switch 6, this command controls Carrier Detect (CD) signaling from the modem to the computer.

The power-on/reset default for response modes is set with DIP switch 6. The Sportster modem is shipped with DIP switch 6 OFF, disabling override for normal operations.

Use the &Cn command to control Carrier Detect for a current session, independent of the DIP switch setting. This command may not be stored in NVRAM.

Check your communications software manual to find the required setting.

&C0 CD override, CD always ON.

&C1 Normal CD operations. The modem sends a CD signal when connecting with another modem and drops CD upon disconnecting. Most communications software programs require this setting.

Data Terminal Ready (&Dn)

Like DIP switch 1, this command controls the Data Terminal Ready (DTR) signaling from the computer to the modem.

The power-on/reset default for DTR is set with DIP switch 1.

The Sportster modem is shipped with DIP switch 1 OFF, disabling override for normal operations.

Use the &Dn command to DTR for a current session, independent of the DIP switch setting. This command may not be stored in NVRAM.

Check your communications software manual to find the required setting.

&D0 DTR override, modem ignores DTR.

&D1 Reserved.

&D2 Normal DTR operations. The computer or terminal must send a DTR signal or the modem won't accept commands. Dropping DTR terminates a call. Most communications software programs require this setting.

==========

Data Set Ready (&Sn)

The modem sends your computer a Data Set Ready (DSR) signal. (Data Set is industry jargon for modem.) Few, if any, commercial communications programs require the modem to control DSR (&S1). Leave the modem set for DSR override (&S0), unless you know that your installation requires a different setting.

&S0 DSR is always ON (override). Default.

&S1 In Originate mode, the modem sends DSR after dialing, when it detects the remote modem's answer tone. In Answer mode, it sends DSR after sending an answer tone.

****

GETTING HELP

****

Checking the Help screens is the first step to recovery. These screens give you the information youôll need to identify a problem. Once a problem is identified, it can easily be solved.

==========

INQUIRIES (In)

==========

The Inquiry command has eight options. The most commonly used options display the following information.

ATI4 Current settings

ATI5 NVRAM settings

ATI6 Link diagnostics

I0 The modem returns a product code. If you have a problem and call U.S. Robotics' Technical Support Department, you may be asked for this product code.

I1 The modem performs a checksum of its read-only memory (ROM) and returns the result to the screen. This function is used only in factory testing. The modem should always read the same number.

I2 The modem performs a test of its random-access memory (RAM) and returns either the OK (0) or ERROR (4) result code, followed by OK when the test is completed. You may want to use this command as a checkpoint if the modem appears to be malfunctioning.

I3 Reserved.

I4 The modem displays its current configuration.

I5 The modem displays the stored phone numbers and two templates (Y0 and Y1) stored in nonvolatile random access memory (NVRAM). Activate the second screen by pressing any key.

I6 During a connection, the modem monitors and stores information about link operations. When the call is ended, you can request a diagnostic summary.

For calls under data compression, the number of characters sent may be less than the number of octets sent, due to buffering operations.

Most terms used in the display are self explanatory except for the following:

Octets: Compressed data units. If the number of octets is greater than the number of characters sent, the modems probably used MNP5 compression on an already compressed file, and the result was expanded data.

Blers: Errors in data and protocol blocks. If there were many block errors, your receiver may have experienced problems on the line.

Blocks Resent: These represent blocks the remote modem resent due to the previous category, Blers.

Link Timeouts: Protocol detection problems; communications were severed momentarily and the modems probably recovered. This does not indicate the retry timeout.

Link Naks: Negative acknowledgments (one or more blocks).

Data Compression: Indicates the type of data compression negotiated for the call (V42BIS or MNP5) or NONE. A V42BIS response includes the size of the dictionary and the maximum string length used, for example, 2048/32.

Fallback: Enabled/Disabled: indicates whether or not the modems negotiated online fallback during the connection sequence.

Protocol: Indicates the error control protocol negotiated (LAPM, MNP, NONE).

Speed: The last rates at which the receiver/ transmitter were operating before disconnecting.

Disconnect Reason: Possible reasons the modem hung up are as follows:

* DTR dropped--The DTE dropped the Data Terminal Ready signal, terminating the call.

* Escape code--The operator sent the modem the +++ escape code.

* Loss of carrier--The modem detected loss of the remote modem's carrier and waited the duration specified in Register S10 (default is 0.7 seconds).

* Inactivity timeout--The modem detected no activity on the line for the duration specified in Register S19 (default is 0, timer disabled).

* MNP incompatibility--The modem is set to &M5 and the remote modem does not have MNP compatibility, or there was an MNP negotiation procedure error.

* Retransmit limit--The modems reached the maximum of 12 attempts to transfer a data frame without error.

* LD received--The remote modem sent an MNP error control Link Disconnect request.

* DISC--The remote modem sent a V.42 Disconnect frame.

* Loop loss disconnect--The modem detected a loss of current on the loop connecting it with the telephone company central office. This usually occurs because the

remote modem has hung up: the central office drops current momentarily when there is a disconnect at the other end of a call. Unless Register S38 is set higher than 0, the modem immediately hangs up at loop loss.

* Unable to retrain--After several attempts, disturbances on the phone line prevented the modems from retraining (resynchronizing), and they could no longer transmit or receive data.

* Invalid speed--The modem is set to &N1 or higher, for a fixed link rate, and the remote modem is not operating at the same rate.

* XID timeout--The modems failed to negotiate the V.42 Detection (XID Exchange) phase.

* SABME (Set Asynchronous Balance Mode Extended) timeout--The modems failed this part of V.42 link negotiation.

* Break timeout--Incompatible processing of a Break signal occurred.

* Invalid codeword--The modem received an invalid V.42 bis (compression) frame.

* A rootless tree--The modem received an invalid V.42 bis (compression) frame.

* Illegal command code--The modem received an invalid V.42 bis (compression) frame.

* Extra stepup--The modem received an invalid V.42 bis (compression) frame.

I7 The modem returns a product configuration. If you have a problem and call U.S. Robotics' Technical Support staff, you may be asked to read this screen.

==========
S-REGISTER QUERY (SR?)
==========

This command allows you to view the contents of a particular S-Register, as in the following example that requests the contents of Register S0 ("On what ring will the modem answer?").

ATS0? <Enter>

==========
STORED PHONE NUMBER QUERY (&Zn?)
==========

At this command, the modem returns the phone number stored in NVRAM at position n, as in the following example that includes a sample modem response.

```
AT&Z3? <Enter>
5551234
```

==========
LAST-DIALED NUMBER QUERY (DL?)
==========

At this command the modem displays the number stored in the last-dialed number buffer.

```
ATDL? <Enter>
```

==========
HELP SCREENS
==========

Sportster modems provide four Help screens: summaries of the basic AT command set, extended ampersand (&) command set, Dial command options, and S-Register functions.

Stop/Restart Display

The following command stops the display. Hold down the Control key and type S.

```
<Ctrl>-S
```

To restart the display, use the same command or press <any key>.

Cancel Display

Either of the following commands cancels the display.

```
<Ctrl>-C
<Ctrl>-K
```

==========
Basic Command Set ($)

At AT$, the Sportster displays a screen that shows a partial summary of the command set. A second screen, activated by pressing any key, shows the remaining commands.

==========
Ampersand Command Set (&$)

At AT&$, the Sportster displays a screen that shows a partial summary of the extended ampersand command set. A second screen, activated by pressing any key, shows the remaining command set.

==========
Dialing (D$)

At ATD$, the Sportster displays the Dial command summary.

==========
S-Register Functions (S$)

At ATS$, the Sportster displays a screen that shows a partial summary of the S-Register functions. A second screen, activated by pressing any key, shows the remaining registers.

****
TESTING THE MODEM
****

Modem testing is available with the &Tn command and Register 16 (Dial test). All loopback testing conforms to ITU-T Recommendation V.54.

NOTE: Only one test can be performed at a given time. If you send a test command while the modem is in Test mode, you'll receive an ERROR message.

==========
TESTING WITH &Tn
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The tests supported through the &Tn command include Analog Loopback, Digital Loopback, and Remote Digital Loopback. You can key in your own data during testing, or use the modem's internal test pattern and error detector.

Always disable error control before testing. If the modem is detecting errors and retransmitting the affected data, your test results will be invalid.

==========
Ending a Test--&T0, S18

Issue the &T0 command to terminate a test. Alternatively, set Register S18 to a specified number of seconds, for example, S18=10. When the 10 seconds are up, the modem automatically ends the test and returns to Command mode. If the test was Analog Loopback, the &T0 command hangs the modem up. If the test was Digital or Remote Digital Loopback, issue an ATH command to hang up the modem, or an

ATZ command to hang up the modem and reset it to its defaults.

NOTE: If you use the S18 test timer, but in the process of testing you issue an ATZ command, S18 resets to zero and the timer is disabled. Also, you cannot store a value for S18 in nonvolatile memory; its power-on and reset default is always zero.

==========

Analog Loopback-&T1, &T8

This test checks the operation of the modem's transmitter and receiver.

&T1

This AL option requires that you type data you can later verify at your screen.

1. The modem should be on hook in Command mode. If you wish, set Register S18 as a test timer. For example, insert S18=10 in the following command string before &T1.

   AT &M0 S18=10 &T1 <Enter>

   The modem disables error control, sets the timer, enters Analog Loopback (AL) mode, and sends a CONNECT message.

2. Type recognizable data so that you can verify it when it is looped back to the screen.

3. End the test. If you set S18, the modem automatically stops the test at the timeout, exits AL mode and responds OK.

   If you didn't set Register S18, wait one second and type +++ to end the test and return the modem to Command mode. When the modem responds OK, type AT&T0 to terminate AL mode and hang up the modem. (Typing ATH has the same effect. Typing ATZ also has the same effect, but also resets the modem and restores your &M default.)

   The modem responds OK. If the modem sends an ERROR message, you have issued an invalid command.

4. If there were no errors, reset the modem to &M4, for error control, unless you've issued the ATZ reset command.

   NOTE: If the modem is in Online-Command mode--that is, still connected to a remote modem--and you send it an

&T1 or &T8 command, it drops the call, enters AL mode, sends a CONNECT result and waits for loopback characters.

&T8

This AL option causes the modem to send an internal test pattern to its transmitter and loop it back to the receiver. An internal error detector counts any errors and, when the test is ended, sends the number of errors or 000 (no errors) to the screen.

Since you don't type anything during this test, and the modem does not send anything to the screen, this option verifies only the modem. If there are no errors but your problem continues, it may be at the computer interface.

1. The modem should be on hook in Command mode. If you wish, set Register S18 as a test timer. For example, insert S18=10 in the following command string before &T8.

   AT &M0 S18=10 &T8 <Enter>

   The modem disables error control, sets the timer, and enters AL mode. The modem sends its internal test pattern to the transmitter, and loops the pattern back to the receiver. You will not see any data on your screen.

2. End the test. If you set S18, the modem automatically stops the test at the timeout. If you didn't set Register S18, type AT&T0 to end the test. Or use ATH or the command that resets the modem, ATZ. Both of the latter end the test and hang up the modem.

   When the modem hangs up, it returns a three-digit code, followed by OK. A code of 000 indicates no errors were found. A code of 255 indicates 255 or more errors. An ERROR message indicates that you issued an invalid command.

3. If there were no errors, reset the modem to &M4 for error control unless you issued the ATZ command.

==========
&T2

This option is reserved.

==========
Digital Loopback-&T3

If your modem has passed the Analog Loopback (AL) test, this test can help you locate a problem with a remote modem or the telephone channel.

1. Set the modem to &M0 to disable error control. Establish a connection with the remote modem.

2. Bring the modem back to Online-Command mode with the +++ escape code. Then send it the AT&T3 command. The modem enters Digital Loopback (DL) mode.

3. The remote user should type a short message. It will be looped back by your modem's transmitter for verification on the remote screen. You will not see the message or any other data.

4. When the remote user has completed the test, issue the AT&T0 command to end the test. If you wish, return the modem online (ATO) to resume Data mode. Or type either ATH or the command that resets the modem, ATZ. The latter two commands end the test and hang up the modem. The modem responds OK. If the modem sends an ERROR message, you have issued an invalid command.

==========

&T4, &T5

The &T4 option grants a remote modem's request for a Remote Digital Loopback test.

The &T5 option cancels &T4 and your modem will not recognize a request for a Remote Digital Loopback test from a remote modem. This is the default so that your modem isn't subject to another user calling and tying up your modem without your permission.

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Remote Digital Loopback-&T6, &T7

This test, like the local Digital Loopback test, verifies the condition of both modems and the phone link.

The request for and granting of Remote Digital Loopback testing requires that both modems use ITU-T V.54 standard signaling. The test MUST be performed at 2400 or 1200 bps. If the remote modem does not have the capability or is not set to respond, you will get an ERROR result code.

&T6

This RDL option requires that you send keyboard data to the modem and verify it when it is returned over the phone lines and to your screen.

1. Set your software to 2400 or 1200 bps. Set the modem to &M0. If you wish, set the S18 timer.

   Establish a connection with the remote modem. If you haven't already done so, arrange with the remote user to

cooperate with your testing. The remote user should set his or her modem to acknowledge the RDL request, for example, AT&T4.

2. Bring the modem back to Online-Command mode with the +++ escape code. Send it the AT&T6 command. The modem enters RDL mode.

3. Type a short message. It will be looped back to your modem by the remote modem and to your screen for verification. (The remote user will not see your data.)

4. End the test. If you set Register S18 the modem automatically ends the test when the test timeout is reached. If you didn't set S18, type AT&T0 to end the test. If you wish, return the modem online (ATO) to resume Data mode. Or send either ATH or the command that resets the modem, ATZ. The latter two commands end the test and hang up the modem. The modem responds OK. If you issue an invalid command, the modem sends an ERROR message.

   Data errors indicate a problem with the remote modem or the phone link. If you have not performed analog loop-back testing with your modem, the problem may also lie with your modem.

5. Reset the modem to &M4 unless you used the reset command, ATZ.

&T7

This test option causes the modem to send an internal test pattern through the Remote Digital Loopback. An internal error detector counts any errors and, when the test is ended, sends the number of errors or 000 (no errors) to the screen.

You don't need to type anything during this test. The modem sends only its final error count to your screen.

1. Set your software to 2400 or 1200 bps. Set the modem to &M0. If you wish, set the S18 timer.

   Establish a connection with the remote modem. If you haven't already done so, arrange with the remote user to cooperate with your testing. The remote user should set his or her modem to acknowledge the RDL request, for example, AT&T4.

2. Bring the modem back to Online-Command mode with the +++ escape code. Then send it the AT&T7 command. The modem enters RDL mode. The modem sends its internal test pattern to the remote modem, which loops it back to your modem. You will not see the data on your screen.

3. End the test. If you set S18, the modem automatically stops the test when the timer times out. If you didn't set Register S18, type AT&T0 to end the test. After you view the test results (next paragraph), return the modem online if you wish (ATO) and resume Data mode. Or send either ATH or the command that resets the modem, ATZ. The latter two commands end the test and hang up the modem.

   When you terminate the test, the modem returns a three-digit code, followed by OK. A code of 000 indicates no errors were found. A code of 255 indicates 255 or more errors. If you issue an invalid command, the modem sends an ERROR message.

   If you've performed an Analog Loopback and know your modem is working properly, errors indicate a problem with either the phone connection or the remote modem.

4. Reset the modem to &M4 unless you've sent it the ATZ reset command.

==========

DIAL TEST-S16=2

The Dial test is used for factory-testing the frequencies of tone dialing values. When S-Register 16 is set to 2 and a single tone is dialed (for example, ATD7 <Enter>), the modem continues to transmit that tone until you press Enter again.

****
OTHER OPERATIONS
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FAX OPERATIONS
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Fax Modem Guidelines

Fax operations require facsimile-compatible software that can send or receive Group III faxes. Follow the instructions in your fax software manual.

The modem's normal operating mode is Data mode. If your fax software is typical, it automatically switches the modem to Fax mode when you run the program, and resets the modem to Data mode when you exit the program.

If you have a problem, however, and think the modem may be in the wrong mode, you can use one of the following AT commands to manually switch the modem.

Most users will never need to use these commands.

```
AT+FCLASS=0 <Enter>   (Switch to Data mode)
AT+FCLASS=1 <Enter>   (Switch to Fax mode)
```

If you are not sure whether the modem is in Data or Fax mode, type the following command.

```
AT+FCLASS? <Enter>
```

The modem returns a 0 to indicate Data mode or a 1 to indicate Fax mode.

NOTE: Whenever the fax modem is reset using the ATZ command, toggling the DTR signal, or turning the power off and on, the modem will be set to Data mode.

==========
Fax Mode Flow Control Setting

Many facsimile software products use software flow control when the modem is in Fax mode. To allow compatibility with software products that use software flow control by default, U.S. Robotics fax modems switch to software flow control when entering Fax mode.

For the best information on modem settings, see your Fax software manual.

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FCC Notice

FCC part 68, rules regarding fax operation, has been amended as follows:

> Telephone facsimile machines--identification of the sender of the message: It shall be unlawful for any person within the United States to use a computer or other electronic device to send any message via a telephone facsimile machine unless such a message clearly contains, in a margin at the top or bottom of each transmitted page or on the first page of the transmission, the date and time it is sent and an identification of the business, other entity, or individual sending the message and the telephone number of the sending machine or of such business, other entity, or individual. Telephone facsimile machines manufactured on and after December 20, 1992 must clearly mark such identifying information on each transmitted page.

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A Note to Programmers

If you want to know more about the supported fax commands, refer to the standard for the Service Class 1 fax protocol.

> ANSI/EIA/TIA-578-1990 (EIA-578)
> Asynchronous Facsimile DCE Control Standard
> November, 1990 Approved: October 22, 1990

You can obtain a copy of this standard by contacting Global Engineering Documents, at 1-800-854-7179.

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VOICE/DATA COMMUNICATIONS

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When you install the Sportster, you have the option of plugging your phone into the second modular jack of the modem so it's available for voice calls. You can also use the phone to set up communications with another user whose modem uses the AT command set, such as a U.S. Robotics or U.S. Robotics-compatible modem.

==========

Preparation

First call the other user to establish the parity, word length, and number of Stop bits the other person's modem accepts. Then turn the call over to your modems, as follows.

==========

Procedures

1. Without hanging up the phone, have your modem go off hook in Originate mode. Type the following command.

   ATD <Enter>

   NOTE: Be sure the modem is NOT set to X2 or X4, or it will return the NO DIAL TONE result code and hang up.

2. The other party should have the remote modem go off hook in Answer mode. The following command is used to do this.

   ATA <Enter>

3. Now both of you can hang up your respective phones while the two modems establish the data link. They will maintain the link until one of you gives your modem a command to disconnect.

   Either party's device can be the originate or answer modem; it doesn't matter who made the phone call. But one modem must enter Originate mode and the other Answer mode. You and the other party, therefore, must agree on which command, ATD or ATA, you will each use.

****
TECHNICAL SPECIFICATIONS
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COMPATIBILITY
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The Sportster modem conforms to the following standards, ensuring compatibility with a wide base of installed modems. ITU-T is the new signifier of what was formerly the CCITT international standards body.

ITU-T V.32 bis	14.4K/12K/9600/7200/4800 bps (14,400 modems only)
ITU-T V.32	9600/4800 bps
ITU-T V.22 bis	2400 bps
Bell 212A	1200 bps (also ITU-T V.22)
ITU-T V.23	1200 bps with 75 bps back channel (Some United Kingdom and European phone systems)
Bell 103	300 bps (ITU-T V.21 optional)
ITU-T V.42	LAPM error control, 1200 bps and higher
ITU-T V.42 bis	Data compression, 1200 bps and higher
MNP	Levels 2, 3 and 4 error control, level 5 data compression, 1200 bps and higher
ITU-T V.54	Analog, digital, and remote digital loopback testing

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Fax Modems

TIA/EIA-578	Service Class 1 Asynchronous Facsimile DCE Control Standard
ITU-T V.17	14.4K/12K bps
ITU-T V.29	9600/7200 bps
ITU-T V.27 ter	4800/2400 bps
ITU-T V.21	300 bps

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THE SERIAL INTERFACE

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The serial interface information below applies only to external modems.

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Description

The serial interface is a standard developed by the Electronic Industries Association (EIA). It defines the signals and voltages used when data is exchanged between a computer and a modem or serial printer.

The entire standard covers many more functions than are used in most data communications applications. Data is transmitted between the devices over a shielded serial cable with a 25-pin male (DB-25P) connector to the modem and a 25-pin, 9-pin, 8-pin, or custom-built connector to the computer.

NOTE: FCC regulations require the use of shielded cable when connecting a modem to a computer to ensure minimal interference with radio and television.

==========

Pin Assignments

Pin assignments are factory-set in the Sportster modem to match the standard DB-25 assignments in the following table. DB-9 connectors for IBM PC/AT-compatible computers should be wired at the computer end of the cable as shown in the DB-9 column.

Serial Interface Pin Definitions

DB-25	DB-9	Circuit	Function	Signal Source Computer -- Modem
1	*	AA	Chassis Ground	Both
2	3	BA	Transmitted Data	Computer
3	2	BB	Received Data	Modem
4	7	CA	Request to Send	Computer
5	8	CB	Clear to Send	Modem
6	6	CC	Data Set Ready	Modem
7	5	AB	Signal Ground	Both
8	1	CF	Carrier Detect	Modem
12	*	SCF	Speed Indicate	Modem
20	4	CD	Data Terminal Ready	Computer
22	9	CE	Ring Indicate	Modem

If you're using a Macintosh computer, ask your dealer for the correct modem cable; we recommend a Hardware Handshaking cable.

Macintosh 8-Pin DIN

Signal Source

DB-25	MAC	Function	Computer -- Modem
20/5*	1	Output Handshake*	Computer/Modem*
4	2**	Input Handshake	Computer
2	3**	Transmit Data Negative***	Computer
7	4	Ground	Both
3	5	Receive Data Negative	Modem
--	6	Transmit Data Positive****	--
--	7	Not connected	--
--	8	Receive Data Positive	--

* Adds CTS capability when in Hardware mode.
** Hardware handshaking lines.
*** To do this, you must ground pin 6.
**** To do this, you must ground pin 8.

NOTE: A three-wire interface consists of Receive, Transmit, and Ground wires and does not support hardware flow control. Systems requiring three-wire interfaces must use software flow control. If your system doesnôt support software flow control, use no flow control but be sure to use an error-correcting protocol.

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Minimum Requirements

Some computer equipment supports only a few of the serial signal functions set in the Sportster modem. The minimum required for the modem to operate is as follows.

Minimum Required Pins

DB-25 Pin	DB-9 Pin	8-Pin DIN	Function
2	3	3	Transmitted Data
3	2	5	Received Data
7	5	4	Signal Ground
20	4	1	Data Terminal Ready*

* Required if DIP switch 1 is OFF for normal DTR operations, override disabled.

Additional Flow Control Functions

If your computer and software support Clear to Send (CTS) and you wish to use Transmit Data hardware flow control (&H1), Pin 5 (DB-25) or Pin 8 (DB-9) is required.

If your computer and software support Request to Send (RTS)

and you wish to use Received Data hardware flow control (&R2), Pin 4 (DB-25) or Pin 7 (DB-9) is required.

For 57.6K and 38.4K bps Serial Port Rate

Your software and computer must support the 57.6K or 38.4K bps rate. Make sure the serial cable is shielded. Cables are normally six feet long, but longer lengths are possible. If you encounter problems with signal degradation, try a shorter cable.

If you decide to build your own cable, use a low-capacitance cable. To further minimize the capacitance, connect only those functions (pins) that your application requires.

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DEFAULT SETTINGS

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Data Format

Both your software and the remote system must use the same 10-bit data format. If you donôt know the setup of the remote computerôs modem, phone ahead to find out what combination of word length, parity, and Stop bit is required.

Set your communications software to the required scheme. Some communications programs use a kind of shorthand for formats, such as 7-E-1 or 8-N-1. The modem detects the format from the AT prefix of the next command it receives from your keyboard or from your software.

Allowable Data Formats

Word Length	Parity (1 Bit)	Stop Bits
7	Even, Odd, Mark, Space	1
7	None	2
8	None	1

==========

Template Settings

You can create one or two customized configurations and store one of them at a time in nonvolatile random-access memory (NVRAM) as your power-on/reset default using the &Wn command. As long as DIP switch 7 is OFF when you power-on or reset the modem, your defaults are loaded into the modem's random-access memory (RAM). To view your NVRAM settings, use the ATI5 command.

The Sportster modem is preconfigured in the factory for the &F1--Hardware Flow Control template settings in NVRAM as Y0, and the &F2--Software Flow Control template settings in NVRAM as Y1.

Tables on the next pages list the settings of the permanent configuration templates &F1 (default), &F2, and &F0, as well as
parameters you can modify and store in the NVRAM configuration templates.

&F1--Hardware Flow Control Template
Factory Default

Feature	&F1	Settings
ITU-T/Bell Answer Sequence	B0	ITU-T sequence
Online Echo	F1	Online Echo OFF
Speaker Control	M1	Speaker ON until CONNECT
Pulse/Tone Dialing	P	Pulse Dialing
Result Code Options	X4	All Result codes
ARQ Result Codes	&A3	All protocol codes enabled
Serial port Rate	&B1	Fixed serial port rate
Guard Tone	&G0	No guard tone
Transmit Data Flow Control	&H1	Hardware flow control
Modem Testing	&T5	Deny remote digital loopback
Received Data Hardware Flow Control	&R2	Enabled
Received Data Software Flow Control	&I0	Disabled
Data Compression	&K1	Auto enable/disable
Error Control	&M4	Auto select
Connection Rate	&N0	Variable connection rate
Make/Break Ratio	&P0	U.S./Canada ratio
Volume Control (internal)	L2	Medium volume
Data Set Ready (DSR)	&S0	DSR always on
Break Handling	&Y1	Break clears buffer; break then goes to remote modem

The following parameters are changed via your communications

software:

Stored Phone Numbers	&Zn=s
Word Length	8 bits*
Parity	None*
Serial port Rate	19.2 kbps*

* Initial Settings; match software settings of subsequent &W commands.

The &F2 and &F0 templates largely resemble the &F1 template. The tables below list only those settings that differ from the &F1 template.

&F2--Software Flow Control Template

Feature	&F2	Settings
Transmit Data Flow Control	&H2	Transmit data software flow control
Receive Data Flow Control	&R0	Received data hardware flow control disabled
	&I2	Received data software flow control enabled

&F0--Low Performance Template

Feature	&F0	Settings
Result Code Options	X1	Basic subset
ARQ Result Codes	&A1	ARQ codes enabled
Serial port Rate	&B0	Variable serial port rate
Transmit Data Flow Control	&H0	Disabled
Receive Data Flow Control	&R1	Disabled

The following parameters are changed via your communications software:

Word Length	7 bits*
Parity	Even*
Serial port Rate	9600 bps*

* Initial Settings; match software settings of subsequent &W commands.

NVRAM S-Register Options

NVRAM S-Register Options		Template Settings
S0*	Number of rings to answer on	1
S2	Escape code character	43
S3	Carriage Return character	13
S4	Line Feed character	10
S5	Backspace character	8
S6	Dial wait-time, sec.	2
S7	Carrier wait-time, sec.	60
S8	Dial pause, sec.	2
S9	Carrier Detect time, 1/10th sec.	6
S10	Carrier loss wait-time, 1/10th sec.	7
S11	Tone duration, spacing, msec.	70
S12	Escape code guard time, 1/50th sec.	50
S13	Bit-mapped functions	0
S14	Bit-mapped functions	0
S15	Bit-mapped functions	0
S19	Inactivity/hang up timer	0
S21	Break length, 1/100th msec.	10
S22	XON character	17
S23	XOFF character	19
S25	DTR recognition time, 1/100th sec.	5
S27	Bit-mapped functions	0
S28	V.21/V.23 fallback delay, 1/10th msec.	8
S34	Bit-mapped functions	6
S38	Disconnect wait time, sec.	0

NOTE: Bit-mapped registers have up to eight functions. See instructions under S13 in Appendix A of the "Quick Installation Guide."

* The valid range of rings that can be stored in NVRAM for S0 is 1-255. S0=0 cannot be stored in NVRAM. Regardless of the NVRAM setting, DIP switch 5 must be OFF for the modem to be in Auto Answer mode at power-on/reset.

****
MODEM CONCEPTS
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HOW MODEMS WORK
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Modem is a term based on the concept of MOdulation and DEModulation. A modem modulates (converts) digital data (computer information) to analog data (fluctuations in tones carried over a copper telephone wire). The information is carried over a telephone network until it reaches its destination, where another modem demodulates the analog signals and converts them back to digital data so the computer there can use the information.

This ability to use the telephone network for quick, inexpensive data exchange is a powerful tool used by businesses and individuals worldwide to expand business and personal networks.

==========
MODEM CONFIGURATION
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Modems come in all shapes and sizes and their ability to communicate is based on the protocols they use, or rules they follow to perform operations in identical ways. They may be preset or reset physically (DIP switches) and logically (communications software) to best communicate with the modem they are transferring information to and receiving information from.

Much of this is done automatically by the modems when they initially contact each other. The calling modem contacts the answering modem and introduces itself. The modems communicate via a series of signals to identify the appropriate protocol and speed for efficient data transfer. The answering modem either accepts the call or rejects the call. This transaction is called a "handshake."

Successful handshaking results in what is called "carrier." When modems establish carrier, your modem sends a Carrier Detect signal to your computer, indicating that the modems are ready to transfer data. If they fail to connect, your modem sends your computer a No Carrier message.

LINE TRAVEL

Poor line quality may cause a decrease in efficient data transmission. In order to ensure the data sent and received is reliable, error control was introduced by modem manufacturers. The modems check each data block received, and if something went wrong between locations, the receiving device instructs the sending device to resend the affected block.

Modems send information at different rates, measured in bits per second (bps). Today, the figures can be staggering. In the most optimal situation, the Sportster can exchange data as fast as 57,600 bps.

In most cases, though, the speed relies heavily on the ability to adapt to line conditions at high speed. This adaptability is the most important feature of the Sportster.

DIGITAL DATA

Modems send data via asynchronous communication. The smallest data unit sent is made up of a defined word length (7 or 8 bits each), a Start bit (a 0 that indicates where the data unit begins), and one or two Stop bits.

Parity bits were the typical method of controlling errors before cyclic redundancy check (CRC) error correction, described below under :Error Control." A parity bit is either a 1 (odd parity) or a 0 (even parity), depending upon whether the data segment has an odd or even number of binary digits. Some systems allow mark parity (parity is always 1--odd) or space parity (parity is always 0--even). Parity bits are used less often now that CRC is common.

The setting 8-N-1 (word length=8, parity=None, stop bits=1) has become the most common data format in data communications. Both computers involved in a data transfer must use the same parity, word length, and number of Stop bits or connection isnôt possible and garbage characters will display. The software must first be set the same on the computers at both ends of the data transfer before the

modems can operate effectively. A simple phone call to determine the settings at the other end can clear this up quickly and easily.

The requirement to specify parity setting, even if it is None (*-N-1), assures that users with older systems can still communicate with newer modems.

FLOW CONTROL

Another important aspect of modem communications is flow control, which manages the amount of data stored in buffers. Buffers are used to store information temporarily before it is passed on to a computer or modem. Flow control is used to prevent buffer overflow. The system uses either hardware or software (control characters) flow control. U.S. Robotics recommends the use of hardware flow control, because actual data may be mistaken for the control characters used in software flow control and the data may be distorted.

ERROR CONTROL

Error control protects the integrity of data transferred over phone channels and is available for calls at 1200 bps and above. It can be disabled, although high-speed calls (above 2400 bps) should always be under error control. The operations defined in an error control protocol include the following.

* Establishment of compatibility

* Data formatting into blocks

* Error detection through Cyclic Redundancy Checking (CRC) CRC is based on algorithms that calculate a value for an entire block of data. The CRC value attached to each block sent must match the receiving modem's calculation. If not, the remote modem sends a negative acknowledgment to the sending modem.

* Positive acknowledgment of error-free blocks and negative acknowledgment of corrupted data blocks

* Retransmission of corrupted data blocks

Always set the Sportster for error control, &M4 (default) or &M5, for calls at speeds over 2400 bps.

The Sportster is set at the factory to &M4, causing it to try for an error control connection and, if that isnôt possible, to proceed with the call in Normal mode. The

modem first tries for a V.42 connection, then an MNP connection. The information below is based on the Sportster's setting of &M4.

ITU-T V.42 Handshaking

The exchange of signals between two devices in order to establish a communications link is called handshaking. ITU-T V.42 includes a two-stage handshaking process.

* A Detection phase that is based on an exchange of predefined characters.

* LAPM (Link Access Procedures for Modems) Negotiation. In this phase, the modems identify their capabilities concerning maximum data-block size and the number of outstanding data blocks allowed before an acknowledgment is required.

MNP Handshaking

This protocol is supported by the ITU-T V.42 Recommendation. It was originally developed by Microcom, Inc., and is now in the public domain.

MNP handshaking begins with an MNP Link Request sent by the calling modem. If the remote modem doesn't recognize the request, error control isn't possible.

Data Compression

If the modems successfully establish a V.42 connection, they also negotiate for V.42 bis data compression. If they successfully establish an MNP connection, they negotiate for MNP5 data compression.

Modems using V.42 bis compression negotiate the following options.

* Dictionary size--that is, the amount of memory available for compression table entries. (Entries are codes devised for redundant data. The data is packed into shorter data units, called code words, and unpacked by the receiving modem.)

  Possible sizes are as follows. U.S. Robotics modems use 11-bit, or 2048-entry dictionaries, but drop down if the remote modem uses a 512- or 1024-entry dictionary.

Bits	Entries
9	512
10	1024

11	2048

* Maximum string length of each entry.

As the dictionary fills, the modem deletes the oldest unused strings. V.42 bis compression is more efficient than MNP5 compression, in part because it dynamically deletes unusable strings. In addition, it works better with files that are already compressed. These include .ZIP files downloaded from many Bulletin Boards and 8-bit binary files, which appear to the modem to be compressed.

MNP5 compression should not be used with such files because it adds data to them, which lessens throughput. (The additional data is stripped when the file is decompressed by the remote modem.) When transferring such files, it's best to set the modem to &K3. This allows V.42 bis compression to work dynamically with the compressed data, but disables MNP5.

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Flow Control

Flow control of data from the computer is required under error control for two reasons.

1. The transmitting modem buffers a copy of each frame it transmits to the remote end until it is acknowledged by the receiving modem.

2. If errors are encountered, the transmitting modem must resend the corrupted data. This retransmission activity, combined with the steady stream of data from the computer, can overflow the buffer.

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Online Fallback/Fall Forward

Under error control, if a disturbance on the phone line causes an error to a data block, the receiving modem replies with a negative acknowledgment. In response, the transmitting modem retrieves a copy of the original data block from its Transmit buffer, and every block it sent after that block, and retransmits them. This keeps the data error-free and in sequence.

However, there is a retransmit limit: the modems hang up if line disturbances are so severe that one of the modems has retransmitted the same block of data twelve times without a positive acknowledgment.

Because high-rate calls are more vulnerable than transmissions at 2400 bps and below, V.32 bis modems risk reaching the retransmit limit and hanging up. To prevent this, one of the modems requests that they fall back--that is, they reduce their rate from 14.4K to 12K bps, and then to 9600 bps or lower, if necessary. When line conditions

improve, the modems fall forward to the next higher rate, up to the link rate of the call.

Online fallback/fall forward is defined in ITU-T recommendation V.32 bis for modems with top connection rates of 14.4K bps. The Sportster 9600, however, is a V.32 modem. V.32 modems fallback to 4800 bps and stay at that rate.

THROUGHPUT GUIDELINES

The following guidelines should help you to make the most of your modem's advanced performance features. In many instances, experimentation and experience will indicate what works best for your applications.

Throughput is the volume of user information transferred per second, without Start and Stop bits and other overhead information. You'll obtain optimal throughput under the following conditions.

1. Your communications software supports a fixed serial port rate higher than the connection rate (for example, setting your software to lock into the 38.4K bps rate, and retaining the default &B1 setting).

2. The call is under data compression.

3. You're transmitting text files. Throughput is higher for text files than other types of files, such as .EXE or .COM binary files.

4. File transfer may be slowed down by a file-transfer protocol. Many non-text files require a file-transfer protocol, but throughput results vary. Certain public domain file-transfer protocols, for example, have the following effects.

   Kermit — Newer versions of Kermit support packets up to 9K and a sliding window design to eliminate turnaround delay. With earlier versions, however, throughput may be severely reduced due to short block lengths (possibly under 128 bytes) and acknowledgment turnaround time.

   Xmodem — Throughput may be reduced if your version uses short block lengths, for example 128 bytes. Some versions use blocks of 1K byte, which is much better, although overhead (error control protocol information) still affects overall throughput.

   Ymodem — This protocol is similar to Xmodem with 1K byte block lengths, and allows multiple files

to be sent in one transfer.

The above protocols further reduce throughput during error-control (ARQ) connections. The accuracy of the data is checked twice, by the file-transfer protocol and the modem. To avoid redundancy, disable modem error control by setting the modem to &M0.

The most current version of Zmodem can yield the most efficiency. Leave the modem at its error control default (&M4) and data compression default, &K1. Zmodem performs the same kind of compression as V.42 bis; it turns off its compression if files are already compressed.

An alternative protocol is Ymodem-G, with the modem left at its error control default, &M4. Ymodem-G assumes the modems are handling error control. Overhead is minimal, with throughput almost equal to that obtained with no file-transfer protocol.

However, keep in mind that Ymodem-G is only useful if the modems are using error control. In addition, follow this recommendation only if your machine and software support hardware flow control.

NOTE: Both modems must use the same protocol for data transfer to take place.

WARNING: If you are using an X-, Y- or Zmodem-type protocol, do NOT use the modem's software flow control.

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Achievable Throughput Statistics

The table below indicates the maximum throughput, in characters per second (cps), that can be expected under the following optimal conditions:

* Serial port rate set at 57.6K bps; modem set to &B1 Your software and computer must support 57.6K bps in order to use that rate.)

* Connection (link) rate of 14.4K bps (assuming no protective fallback to a lower speed is necessary)

* V.42 bis compression negotiated for the call, and the default size 11-bit, 2048-entry dictionary

* Straight data (that is, not already compressed, and no file-transfer protocol)

* Transmission from a fast (for example, 386) computer

Throughput (cps) if set to 14.4K bps

File Type	MNP5	V.42 bis
Assembler or Compiler listing	2880	3840
Text file	2325-2625	3400-5760
Binary file: .EXE	2175-2400	2030-2600
Binary file: .COM	2100-2250	2050-2300
.ZIP files (common on BBS's)*	1500-1650	1700
Random binary 8-bit*	1460-1575	1700

* These files are already compressed or appear to the modem to be compressed. Additional MNP5 compression causes throughput lower than what can be expected using MNP without compression. We recommend setting the modem to &K3 when transferring these files, to allow V.42 bis but disable MNP5.

The following table indicates the maximum throughput, in characters per second (cps), that can normally be expected in the same conditions as the previous table, but with a serial port rate of 38.4K bps.

Throughput (cps) if set to 14.4K bps

File Type	MNP5	V.42 bis
Assembler or Compiler listing	2880	3840
Text file	2325-2625	3400-3840
Binary file: .EXE	2175-2400	2030-2600
Binary file: .COM	2100-2250	2050-2300
.ZIP files (common on BBSs)*	1500-1650	1700
Random binary 8-bit*	1460-1575	1700