x2™ COMMANDS & TECHNICAL REFERENCE

NOTE: Until now, 33.6 Kbps was thought to be the practical limit for speed over standard phone lines. Now x2 technology shatters that barrier to bring you download speeds of up to 56 Kbps. However, due to FCC rules which restrict power output of your service provider's modems, current download speeds are limited to approximately 53 Kbps.

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Front Panel Lights (External Models)

Symbol	Meaning	Status
AA	Auto Answer	S0 is set to 1 or higher (Auto Answer), and when answering a call; OFF when modem originates a call. Light flashes when there is an incoming call.
CD	Carrier Detect	ON if modem receives a valid data signal (carrier) from a remote modem, indicating that data transmission is possible. Always ON if CD override is ON (&C0).
RD	Received Data	Flashes when modem sends result codes or passes received data bits from remote.
SD	Send Data	Flashes when computer sends a data bit to modem.
TR	Data Terminal Ready	ON if modem receives a DTR signal from computer. Always ON (modem ignores DTR) if the DTR override is ON (&D0).
CS	Clear to Send	ON until modem lowers CTS when Transmit Data hardware flow control is enabled (&H1, &H3).
ARQ/FAX		Data Mode: Automatic Repeat Request. Error Control: ON if modem is set to &M4 or &M5 and successfully establishes an error control connection. Flashes when modem retransmits data to remote modem. Fax Mode: Flashes to indicate fax mode.

Command Summary

Type commands in either upper or lower case, not a combination. Use the Backspace key to delete errors. (You cannot delete the original AT command since it is not stored in the modem buffer.)

If a command has numeric options and you don't include a number, zero is assumed. For example, if you type ATB, the command ATB0 is assumed.

Every command except A/ and +++ must begin with the AT prefix and be entered by pressing the ENTER key.

The maximum command length is 58 characters. The modem doesn't count the AT prefix, carriage returns, or spaces.

NOTE: All defaults are based on the &F1*Hardware Flow Control template loaded in NVRAM when the modem is shipped.

Command Set

$	Use in conjunction with D, S, or & commands (or just AT) to display a basic command list; online help.
A	Manual Answer: goes off hook in answer mode. Pressing any key aborts the operations.

A/ Re-executes the last issued command. Used mainly to redial. This does not require the AT prefix or a Carriage Return.

Any key Aborts off-hook dial/answer operation and hangs up.

AT Required command prefix, except with A/ and +++. Use alone to test for OK result code.

Bn U.S./ITU-T answer sequence.
B0 ITU-T answer sequence (the default)
B1 U.S. answer tone

Dn Dials the specified phone number. Includes the following:

L	Dials the last dialed number.
P	Pulse (rotary) dial
R	Originates call using answer (reverse) frequencies.
Sn	Dials the phone number string stored in NVRAM at position n (n = 0*3). Phone numbers are stored with the &Zn=s command.
T	Tone dial
,	(Comma) Pause, See S8 definition; which it's linked to.
;	(Semicolon) Return to Command mode after dialing.
"	Dials the letters that follow (in an alphabetical phone number).
!	(Exclamation point) Flashes the switch hook.
/	Delays for 125 ms. before proceeding with dial string.
W	Wait for second dial tone (X2 or X4); linked to S6 register.
@	Dials, waits for quiet answer, and continues (X3 or higher).
$	Displays a list of Dial commands.

En		Sets local echo.
	E0	Echo OFF
	E1	Modem displays keyboard commands (the default)
Fn		Sets online local echo of transmitted data ON/OFF.
	F0	Local echo ON. Modem sends a copy of data it sends to the remote system to your screen.
	F1	Local echo OFF. Receiving system may send a remote echo of data it receives. (the default)
Hn		Controls ON/OFF hook.
	H0	Hangs up (goes on hook).
	H1	Goes off hook.

In		Displays the following information.
	I0	Four-digit product code
	I1	Results of ROM checksum
	I2	Results of RAM checksum
	I3	Product type
	I4	Current modem settings
	I5	Nonvolatile memory (NVRAM) settings
	I6	Link diagnostics
	I7	Product configuration
Ln		Controls speaker volume (for internal models only).
	L0	Low volume
	L1	Low volume
	L2	Medium volume (the default)
	L3	High volumer
Mn		Operates speaker.
	M0	Speaker always OFF.
	M1	Speaker ON until CONNECT. (the default)
	M2	Speaker always ON.
	M3	Speaker ON after dial, until CONNECT.
On		Returns online.
	O0	Returns online.
	O1	Returns online and retrains.
P		Sets pulse dial (for phone lines that don’t support touch-tone dialing).

Qn — Displays/suppresses result codes.

- Q0 Displays result codes. (the default)
- Q1 Quiet mode; no result codes.
- Q2 Displays result codes only in Originate mode.

Sr.b=n — Sets bit .b of register r to n (0/OFF or 1/ON).

Sr=n — Sets register r to n.

Sr? — Displays contents of S-Register r.

S$ — Displays a list of the S-Registers.

T — Sets tone dial.

Vn — Displays verbal/numeric result codes.

- V0 Numeric codes
- V1 Verbal codes (the default)

Xn — Sets result code displayed. Default is X4.

Xn Setting

Result Codes	**X0**	**X1**	**X2**	**X3**	**X4**
0/OK	·	·	·	·	·
1/CONNECT	·	·	·	·	·
2/RING	·	·	·	·	·
3/NO CARRIER	·	·	·	·	·
4/ERROR*	·	·	·	·	·
5/CONNECT 1200		·	·	·	·

6/NO DIAL TONE			•		•
7/BUSY				•	•
8/NO ANSWER**				•	•
9/Reserved					
10/CONNECT 2400		•	•	•	•
11/RINGING					•
13/CONNECT 9600		•	•	•	•
18/CONNECT 4800		•	•	•	•
20/CONNECT 7200		•	•	•	•
21/CONNECT 12000		•	•	•	•
25/CONNECT 14400		•	•	•	•
43/CONNECT 16800		•	•	•	•
85/CONNECT 19200		•	•	•	•
91/CONNECT 21600		•	•	•	•
99/CONNECT 24000		•	•	•	•
103/CONNECT 26400		•	•	•	•
107/CONNECT 28800		•	•	•	•
151/CONNECT 31200		•	•	•	•
155/CONNECT 33600	•	•	•	•	•
180/CONNECT 33333	•	•	•	•	•
184/CONNECT 37333	•	•	•	•	•
188/CONNECT 41333	•	•	•	•	•
192/CONNECT 42666	•	•	•	•	•
196/CONNECT 44000	•	•	•	•	•
200/CONNECT 45333	•	•	•	•	•
204/CONNECT 46666	•	•	•	•	•
208/CONNECT 48000	•	•	•	•	•
212/CONNECT 49333	•	•	•	•	•
216/CONNECT 50666	•	•	•	•	•

220/CONNECT 52000	·	·	·	·	·
224/CONNECT 53333	·	·	·	·	·
228/CONNECT 54666	·	·	·	·	·
232/CONNECT 56000	·	·	·	·	·
236/CONNECT 57333	·	·	·	·	·
Adaptive Dialing		·	·	·	
Wait for 2nd Dial Tone (W)			·		·
Wait for Answer (@)				·	·
Fast Dial			·		·

**Requires @ in dial string; replaces NO CARRIER

Yn Selects power-on/reset default configuration.

- Y0 Default is profile 0 setting in NVRAM (the default)
- Y1 Default is profile 1 setting in NVRAM

Z Resets modem.

- Z0 Resets modem to NVRAM profile selected by Y command or dip 7.
- Z1 Resets modem to NVRAM profile 0
- Z2 Resets modem to NVRAM profile 1
- Z3 Resets modem to factory default profile 0 (&F0)
- Z4 Resets modem to factory default profile 1 (&F1)
- Z5 Resets modem to factory default profile 2 (&F2)

&A		Displays a list of ampersand (&) commands. &An enables/disables additional result code subsets (see Xn).
	&A0	ARQ result codes disabled
	&A1	ARQ result codes enabled
	&A2	V.32 modulation indicator added
	&A3	Protocol indicators added* LAPM/MNP/NONE (error control) and V42 bis/MNP5 (data compression) (the default)
&Bn		Manages modem's serial port rate.
	&B0	Variable, follows connection rate
	&B1	Fixed serial port rate (the default)
	&B2	Fixed in ARQ mode, variable in non-ARQ mode
&Cn		Controls Carrier Detect (CD) signal.
	&C0	CD override
	&C1	Normal CD operations (the default)
&Dn		Controls Data Terminal Ready (DTR) operations.
	&D0	DTR override (the default)
	&D1	DTR toggle causes online Command mode
	&D2	Normal DTR operations
	&D3	Resets on receipt of DTR

&Fn		Loads a read-only (non-programmable) factory configuration.
	&F0	Generic template
	&F1	Hardware flow control template (the default)
	&F2	Software flow control template
&Gn		Sets Guard Tone.
	&G0	No guard tone, U.S. and Canada (the default)
	&G1	550 Hz guard tone, some European countries, requires B0 setting.
	&G2	1800 Hz guard tone, U.K., requires B0 setting.
&Hn		Sets Transmit Data (TD) flow control (see also &Rn).
	&H0	Flow control disabled
	&H1	Hardware flow control, Clear to Send (CTS) (the default)
	&H2	Software flow control, XON/XOFF
	&H3	Hardware and software flow control
&In		Sets Receive Data (RD) software flow control (see also &Rn).
	&I0	Software flow control disabled (the default)
	&I1	XON/XOFF signals to your modem and remote system
	&I2	XON/XOFF signals to your modem only
&Kn		Enables/disables data compression.
	&K0	Data compression disabled
	&K1	Auto enable/disable (the default)
	&K2	Data compression enabled
	&K3	MNP5 compression disabled

&Mn Sets Error Control (ARQ) for connections at 1200 bps and higher.

- &M0 Normal mode, error control disabled
- &M1 Reserved
- &M2 Reserved
- &M3 Reserved
- &M4 Normal/ARQ (the default)
- &M5 ARQ mode

&Nn Sets connect speed. If connection cannot be established at this speed, the modem will hang up. Sets ceiling connect speed if &Un is greater than 0. See &Un.

- &N0 Variable rate (the default)
- &N1 300 bps
- &N2 1200 bps
- &N3 2400 bps
- &N4 4800 bps
- &N5 7200 bps
- &N6 9600 bps
- &N7 12,000 bps
- &N8 14,400 bps
- &N9 16,800 bps
- &N10 19,200 bps
- &N11 21,600 bps
- &N12 24,000 bps
- &N13 26,400 bps
- &N14 28,800 bps
- &N15 31,200 bps
- &N16 33,600 bps

	&N17	33,333 bps
	&N18	37,333 bps
	&N19	41,333 bps
	&N20	42,666 bps
	&N21	44,000 bps
	&N22	45,333 bps
	&N23	46,666 bps
	&N24	48,000 bps
	&N25	49,333 bps
	&N26	50,666 bps
	&N27	52,000 bps
	&N28	53,333 bps
	&N29	54,666 bps
	&N30	56,000 bps
	&N31	57,333 bps

&Pn		Sets pulse (rotary) dial make/break ratio.
	&P0	U.S./Canada ratio, 39%/61% (the default)
	&P1	U.K. ratio, 33%/67%

&Rn		Sets Receive Data (RD) hardware flow control, Request to Send (RTS) (see also &Hn).
	&R0	Reserved
	&R1	Modem ignores RTS
	&R2	Received Data to computer only on RTS (the default)

&Sn		Controls Data Set Ready (DSR) operations.
	&S0	DSR override; always ON (the default)
	&S1	Modem controls DSR

&Tn		Begins test modes.
	&T0	Ends testing
	&T1	Analog Loopback
	&T2	Reserved
	&T3	Local Digital Loopback
	&T4	Enables Remote Digital Loopback
	&T5	Prohibits Remote Digital Loopback (the default)
	&T6	Initiates Remote Digital Loopback
	&T7	Remote Digital with self-test and error detector
	&T8	Analog Loopback with self-test and error detector
&Un		Sets floor connect speed when &Un is set greater than 0. &Nn is the ceiling connect speed. See &Nn.
	&U0	Disabled (the default)
	&U1	300 bps
	&U2	1200 bps
	&U3	2400 bps
	&U4	4800 bps
	&U5	7200 bps
	&U6	9600 bps
	&U7	12,000 bps
	&U8	14,400 bps
	&U9	16,800 bps
	&U10	19,200 bps
	&U11	21,600 bps
	&U12	24,000 bps
	&U13	26,400 bps

	&U14	28,800 bps
	&U15	31,200 bps
	&U16	33,600 bps
	&U17	33,333 bps
	&U18	37,333 bps
	&U19	41,333 bps
	&U20	42,666 bps
	&U21	44,000 bps
	&U22	45,333 bps
	&U23	46,666 bps
	&U24	48,000 bps
	&U25	49,333 bps
	&U26	50,666 bps
	&U27	52,000 bps
	&U28	53,333 bps
	&U29	54,666 bps
	&U30	56,000 bps
	&U31	57,333 bps
&Wn		Writes current configuration to NVRAM templates.
	&W0	Modifies the NVRAM 0 template (Y0)
	&W1	Modifies the NVRAM 1 template (Y1)
&Yn		Sets break handling.
	&Y0	Destructive, but doesn’t send break
	&Y1	Destructive, expedited (the default)
	&Y2	Nondestructive, expedited
&Zn=s		Writes phone number string s to NVRAM at position n (n = 0-3).

&Zn=L	Writes last executed dial string to NVRAM at position n (n = 0-3).
&Zn?	Displays the phone number stored at position n (n = 0-3).
&ZL?	Displays the last executed dial string.
+++	Escapes to online-command mode.

DIP Switches (Modems with DIP Switches Only)

Note: If a DIP switch is on, it is down. If a DIP switch is off, it is up.

Switch	Factory Setting	Function
1	OFF	Data Terminal Ready (DTR) Override
	OFF	Normal DTR operations computer must provide DTR signal for modem to accept commands; dropping DTR terminates a call
	ON	Modem ignores DTR (Override)
2	OFF	Verbal/Numeric Result Codes
	OFF	Verbal (word) results
	ON	Numeric results
3	ON	Result Code Display
	OFF	Suppresses result codes
	ON	Enables result codes
4	OFF	Command Mode Local Echo Suppression
	OFF	Displays keyboard commands
	ON	Suppresses echo
5	ON	Auto Answer Suppression
	OFF	Modem answers on first ring, or higher if specified in NVRAM
	ON	Disables auto answer

6	OFF	Carrier Detect (CD) Override
	OFF	Modem sends CD signal when it connects with another modem, drops CD on disconnect
	ON	CD always ON (Override)
7	OFF	Power-on and ATZ Reset Software Defaults
	OFF	Loads Y or Y1 configuration from user-defined nonvolatile memory (NVRAM)
	ON	Loads &F0¾Generic template from read only memory (ROM)
8	ON	AT Command Set Recognition
	OFF	Disables command recognition (Dumb Mode)
	ON	Enables recognition (Smart mode)

S Registers

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).

Register	Default	Function
S0	0	Sets the number of rings on which to answer in Auto Answer Mode. When set to 0, Auto Answer is disabled.
S1	0	Counts and stores the number of rings from an incoming call. (S0 must be greater than 0.)
S2	43	Stores the ASCII decimal code for the escape code character. Default character is +. A value of 128-255 disables the escape code.
S3	13	Stores the ASCII code for the Carriage Return character. Valid range is 0-127.
S4	10	Stores the ASCII decimal code for the Line Feed character. Valid range is 0 - 127.
S5	8	Stores the ASCII decimal code for the Backspace character. A value of 128-255 disables the Backspace key's delete function.
S6	2	Sets the number of seconds the modem waits before dialing. If Xn is set to X2 or X4, this is the time-out length if there isn't a dial tone.

S7	60	Sets the number of seconds the modem waits for a carrier. May be set for much longer duration if, for example, the modem is originating an international connection.
S8	2	Sets the duration, in seconds, for the pause (,) option in the Dial command.
S9	6	Sets the required duration, in tenths of a second, of the remote modem's carrier signal before recognition by the Sportster.
S10	14	Sets the duration, in tenths of a second, that the modem waits to hang up after loss of carrier. This guard time allows the modem to distinguish between a line disturbance from a true disconnect (hang up) by the remote modem. While we don't recommend connecting the modem to a line with call waiting, if you have it, you may wish to adjust this setting upward to prevent the modem from misinterpreting the second call signal as a disconnect by the remote modem. A better alternative is to ask your phone company how to temporarily disable call waiting (usually *70W). For example: ATDT *70W phone number. **Note:** If you set S10 = 255, the modem will not hang up when carrier is lost. Dropping DTR hangs up the modem.
S11	70	Sets the duration and spacing, in milliseconds, for tone dialing.
S12	50	Sets the duration, in fiftieths of a second, of the guard time for the escape code sequence (+++).

S13 0 Bit-mapped register. Select the bit(s) you want on and set S13 to the total of the values in the Value column. For example, ATS13 = 17 enables bit 0 (value is 1) and bit 4 (value is 16).

Bit	Value	Result
0	1	Reset when DTR drops.
1	2	Reset non-MNP transmit buffer from 1.5K to 128 bytes.*
2	4	Set backspace key to delete.
3	8	On DTR signal, auto dial the number stored in NVRAM at position 0.
4	16	At power on/reset, Auto Dial the number stored in NVRAM at position 0.
5	32	Reserved
6	64	Reserved
7	128	Disconnect on escape code.

The 1.5K-byte non-ARQ buffer allows data transfer with Xmodem- and Ymodem-type file transfer protocols without using flow control.

The 128-byte option lets remote users with slower modems keep data you're sending from scrolling off their screens. When remote users send your computer an XOFF (Ctrl-S) and you stop transmitting, the data in transit from your modem's buffer doesn't exceed the size of their screen.

This is also very helpful in situations when a remote modem/printer application is losing characters.

S14 0 Reserved

S15 0 Bit-mapped register setup. To set the register, see instructions for S13.

Bit	Value	Result
0	1	Disable ARQ/MNP for V.22.
1	2	Disable ARQ/MNP for V.22bis.
2	4	Disable ARQ/MNP V.32/V.32bis/V.32terbo.
3	8	Disable MNP handshake.
4	16	Disable MNP level 4.
5	32	Disable MNP level 3.
6	64	MNP incompatibility.
7	128	Disable V.42 operation.
	136	Disable V.42 detect phase.(The sum of the values of bits 3 and 7.)

S16 0 Reserved

S17 0 Reserved

S18 0 Test timer for &T loopback testing. Sets the time in seconds of testing before the modem automatically times out and terminates the test. When set to 0, the timer is disabled. Valid range is 1-255.

S19 0 Sets the duration, in minutes, for the inactivity timer. The timer activates when there is no data activity on the phone line; at time-out the modem hangs up. S19 = 0 disables the timer.

S20 0 Reserved

S21 10 Sets the length, in 10-millisecond units, of breaks sent from the modem to the computer; applies to MNP or V.42 mode only.

S22	17	Stores the ASCII decimal code for the XON character.
S23	19	Stores the ASCII decimal code for the XOFF character.
S24	0	Reserved
S25	20	Sets the duration, in hundredths of a second, that DTR must be dropped so that the modem doesn't interpret a random glitch as a DTR loss (Most users will want to use the default; this register is useful for setting compatibility with older systems running under older operating software.)
S26	0	Reserved
S27	0	Bit-mapped register setup. To set the register, see instructions for S13.

Bit	Value	Result
0	1	Enables ITU-T V.21 modulation at 300 bps for overseas calls; in V.21 mode, the modem answers both overseas and domestic (U.S. and Canada) calls, but only originates V.21 calls (Default Bell 103)
1	2	Enables unencoded (non-trellis coded) modulation in V.32 mode.
2	4	Disables V.32 modulation.
3	8	Disables 2100 Hz answer tone to allow two V.42 modems to connect faster.
4	16	Enables V.23 fallback mode.
5	32	Disables V.32bis mode.
6	64	Disables v.42 selective reject.
7	128	Software compatibility mode. This setting disables the

codes and displays the 9600 code instead. The actual rate of the call can be viewed on the ATI6 screen. Used for unusual software incompatibilities. Some software may not accept 7200, 12,000, and 14,400 bps or greater result codes.

S28	0	Eliminates the V.32 answer tones for a faster connection.
	8	Default item, all times are in tenths of seconds.
	255	Disables all connections except V.32 at 9600 bps.
S29	20	Sets the duration, in tenths of a second, of the V.21 answer mode fallback timer.
S30	0	Reserved
S31	128	Reserved
S32	2	Bit mapped register setup. To set the register, see the instructions for S13.

Bit	**Value**	**Result**
0	1	V.8 Call Indicate enabled.
1	2	Enables V.8 mode.
2	4	Reserved.
3	8	Disable V.34 modulation.
4	16	Disable V.34+ modulation.
5	32	Disable x2 modulation
6	64	Reserved.
7	128	Reserved.

S33 0 Bit mapped register setup. To set the register, see the instructions for S13.

Bit	Value	Result
0	1	Disable 2400 symbol rate.
1	2	Disable 2743 symbol rate.
2	4	Disable 2800 symbol rate.
3	8	Disable 3000 symbol rate.
4	16	Disable 3200 symbol rate.
5	32	Disable 3429 symbol rate.
6	64	Reserved.
7	128	Disable shaping.

S34 0 Bit mapped register setup. To set registers, see instructions for S13.

Bit	Value	Result
0	1	Disable 8S-2D trellis encoding.
1	2	Disable 16S-4D trellis encoding.
2	4	Disable 32S-2D trellis encoding.
3	8	Disable 64S-4D trellis encoding.
4	16	Disable non-linear coding.
5	32	Disable TX level deviation.
6	64	Disable Pre-emphasis.
7	128	Disable Pre-coding.

S35 Reserved

S36-S37 Reserved

S38	0	Sets an optional delay, in seconds, before a forced hang-up and clearing of the Transmit buffer when DTR drops during an ARQ call. This allows time for a remote modem to acknowledge receipt of all transmitted data before it is disconnected. The modem immediately hangs up when DTR drops. This option only applies to connections terminated by dropping DTR. If the modem receives the ATH command, it ignores S38 and immediately hangs up.
S39-S40	Reserved	
S41	0	Bit mapped register setup. To set registers, see instructions for S13. **Bit** **Value** **Result** 0 1 Distinctive ring enabled.
S42	0	Reserved

The Serial Interface

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.

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

For IBM®-Compatible Computers:

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/AT-compatible computers should be wired at the computer end of the cable as shown in the DB-9 column.

Serial Interface Pin Definitions

Signal Source

DB-25	DB-9	Circuit	Function	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

For the Macintosh®:

Macintosh computers require an 8 pin mini-DIN hardware handshaking cable for high speed communications.

Hardware Handshaking Cable Pin Assignments

Mini DIN-8 Connector			**DB-25**	
Handshake Output:	HSKo	1	4	RTS
			20	DTR
Handshake Input:	HSKi	2	5	CTS
Transmit Data+	TXD-	3	2	TXD
Ground:	GND	4	7	GND
Receive Data+	RXD+	8	7	GND
Receive Data-	RXD-	5	3	RXD
Transmit Data+	TXD+	6		not connected
Gen. Purpose Input	GPI	7		not connected

Note: The Handshake Output pin is connected to both pins 4 (RTS) and 20 (DTR) on the DB-25 connector.