WiFi232 Modem User's Guide

Introduction

The WiFi232 is an internet connected modem that behaves a lot like a Hayes compatible dial-up modem. It's intended use is to enable retro computers at home access to an Internet connected BBS or as a simple wireless print server for serial based printers or plotters.
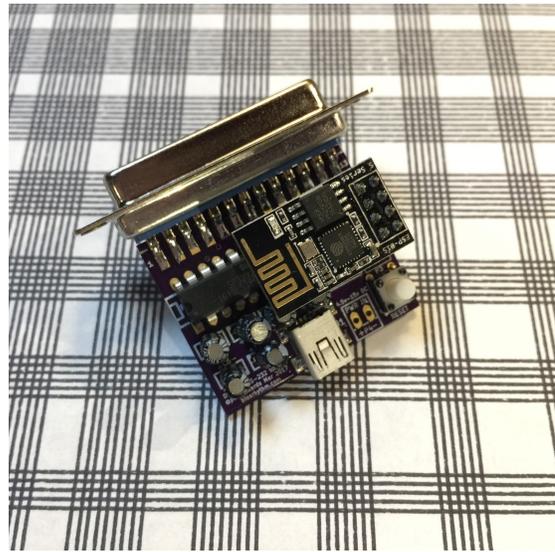
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Using the WiFi232 Modem

Connecting the Modem

The WiFi232 modem is a DCE (data circuit-terminating equipment) device and can be plugged into any standard RS-232C DB25 DTE (data terminal equipment) host serial port. If your host device has a female port, you can use a male gender changer.

If your host device has a DE-9 port, you can use a 25 to 9 pin RS-232 serial adapter.

If your host device has a non standard RS-232 pinout, please verify the pinout to match the chart below.

DB25F	RS-232 Signal	WiFi232 Modem	ESP-01
2	TX	TX	TX
3	RX	RX	RX
4	RTS	FLOW IN jumper	GPIO0
5	CTS	FLOW OUT jumper	GPIO2
6	DSR	FLOW OUT jumper	GPIO2
7	GND	GND	GND
8	DCD	DCD/DTR LOOP jumper	N/A
20	DTR	FLOW IN jumper	GPIO0

Powering the Modem

There are two ways to power the modem. Choose only one of these solutions. **DO NOT USE BOTH METHODS SIMULTANEOUSLY!** Failure to do so will almost certainly cause damage to the modem and anything attached to it.

- **Method 1:** The easiest way to power the modem is via the built-in mini USB jack. Simply plug in a standard USB A to mini B cable into any USB jack that is capable of providing 100mA of power at 5v DC.

- **Method 2**: Another way to power the modem is to use the "PWR IN" solder terminals on the board. A DC voltage between 4.5v and 15v can be provided. Be sure to observe correct DC polarity as there are no reverse polarity protections on board. Voltages higher than 5v may require heat sinking on the voltage regulator.

First Time Setup & Configuration

1. Plug in the modem into your computer while powered off.
2. Plug in a mini USB cable into the modem and apply USB power. A depending on ESP-01 revision, a red or blue LED on top should light or flash.
3. Power on your computer and launch an ASCII terminal program and set the baud rate to 1200.
4. Type `ATI`. A status page should be displayed.
5. Set the SSID of your 2.4 GHz WiFi access point with `AT$SSID=MyAccessPoint` replacing "MyAccessPoint" with your WiFi SSID. This is case sensitive.
6. Repeat the same procedure, this time for the password of your WiFi access point with `AT$PASS=MyWiFiPassword` replacing "MyWiFiPassword" with your WiFi password. This is case sensitive.
7. Type `ATC1` to connect. You should see a connect message.
8. If you'd like to use another baud rate, set it now with `AT$SB=n` where n is 110, 300, 1200, 2400, 9600, 19200, 38400, 57600, 115200. Change the baud rate on your terminal when prompted.
9. Save these settings to NVRAM with `AT&W`

The next time your modem is powered on, it will automatically connect to this WiFi SSID and use 1200 baud (or the baud rate you saved to NVRAM).

Making A Call

1. Make sure the WiFi modem is connected to your WiFi access point. You can verify status by issuing the `ATI` command.
2. Issue the `ATDT` command followed by the IP or DNS address of the remote server. If the server's TCP port is different than 23, you can specify it immediately followed by a colon and the port number. For example, `atdtparticlesbbs.dyndns.org:6400` will dial particlesbbs.dyndns.org at port 6400.

Ending A Call

To end a call, you can do so one of two ways.
1. Select the logoff or "bye" command on the remote system you've called. Each system will have a different method for this.

2. Enter command mode by waiting 1 second, typing `+++`, and waiting another second. When `OK` appears, issue the command `ATH` to hang up the call.

Update Firmware

You can check for new firmware updates by issuing `ATUPDATECHECK`. If a new version of firmware is available, it will respond with `NEW FIRMWARE IS AVAILABLE`.

To update to the latest firmware, issue the command `ATUPDATE`. The update process will proceed, first downloading the new software, writing it to flash and then rebooting the modem.

If the modem does not respond 30 seconds after rebooting, power off the unit and power it back on to complete to update. If you have startup wait enabled, remember to hit enter to start the modem.

Built-in Access Point and Web Server

If the WiFi232 is powered up and is unable to connect to the wireless access point SSID saved in NVRAM, it will create its own access point using the multicast DNS name (MDNS) as the SSID. You can use this access point to change certain settings. This is useful if your saved SSID is not available.

- On your computer, tablet or other mobile device, browse the list of wireless access points and locate WIFI232 (or the MDNS name you chose).
- Open a web browser and go to http://WIFI232.local/ (replacing the default "WIFI232" with the name you specified.)
- You should now see a page displaying settings. You can set the SSID and Password here, hangup a call, or change the current baud rate.

You can also connect to the WiFi232's own access point with a computer or another WiFi232 and communicate without additional WiFi hardware.

If your WiFi232 modem connects successfully to your wireless access point SSID, you can still use the built in web server to change configuration.

The built in web server defaults to on when you reset it to factory defaults. You can turn off the built in web server with the `AT$S0` command.

WARNING: There is no password protection for the built in web server. Only enable this option on trusted networks.

Suggested Uses

Internet Modem for Retro Computers to Dial a BBS

Since the WiFi232 modem acts almost identically to a traditional Hayes modem, you'll most likely only need to use existing terminal emulation software on your retro computer to place a call. Just be sure to set the right baud rate that's appropriate for your computer.

Wireless Print Server

Certain vintage printers and pen plotters have DTE RS-232 serial ports. With the right software on your computer, you can send your print jobs over WiFi instead of through a USB to serial adapter and cable.

Configure the WiFi232 modem on your computer with the following settings enabled.
- `AT$W0` - connect to WiFi immediately upon power up.
- `ATE0` - do not echo in command mode.
- `ATQ1` - be quiet, do not issue command results
- `AT$MDNS=MyPrinterName` - Change the multicast DNS (MDNS) name of the adapter. This enables you to find it easily on your local network by adding ".local" to the end.
- `AT&K1` - use this only if you need to enable hardware flow control. Also bridge the appropriate jumpers on the back of the board. Most vintage plotters use DTR for flow control.
- `AT&W` - save these settings to NVRAM

Some older printers and plotters have a female RS-232 port so you'll need a male gender changer. To send a print job, establish a TCP connection to the printer's address at port 6400. Afterwards, anything you send to that port will be dumped to the printer. This can be accomplished with a simple Python script.

Wireless dial-up modem

Still have a dial-up modem and a dial-up line? You can connect the WiFi232 to the dial-up modem with a null modem adapter. You can then telnet to the WiFi232 modem and begin communicating with the dial-up modem to place calls as if it were connected to your computer.

AT Command Guide

Note: If using a Commodore or Atari computer with PETSCII or ATASCII, make sure to use ASCII mode. Most commands are NOT case sensitive. Certain ones like SSID and PASS that take strings as arguments are case sensitive. Spaces between commands are allowed but not within commands.

The parser can process multiple AT commands. However, certain commands will consume any text that follows so make sure these commands are alone or at the end of a command string. These include ?, HELP, $SSID=, $PASS=, $MDNS=, $BM=, $TTY=, $TTL=, $TTS=, A, D, H, O, &R=, &Zn=, &RB, UPDATE, UPDATECHECK, GET.

Commands not listed here will result in an error.

AT? or **ATHELP**
Displays a short, on-screen help page.

AT
A null command that simply returns an OK message. Useful for testing if the modem is working without making changes.

A/
Repeats the last command issued. Command is executed immediately when the slash (/) is entered.

Getting Connected to WiFi

AT$SB?
AT$SB=N
Displays or sets the current baud rate. Valid baud rates for "N" are 110, 300, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200. Any other value will return an ERROR message. The baud rate will change in five seconds after the command is issued. The default baud rate is 1200. The WiFi232 does not detect baud rate automatically like a dialup modem. This baud rate setting must match that of your terminal to work properly. It will display garbage in your terminal otherwise.

AT$SU?
AT$SU=ABC
Displays or sets the current number of bits ('A'), parity ('B'), and stop bits ('C') of the serial UART. Valid values for 'A' or 5, 6, 7, or 8 bits. Valid values for 'B' are (O)dd, (E)ven, (N)o parity. Valid valid values for 'C' are 1 or 2 stop bits. The default settings are 8N1. The UART setting

must match your terminal to work properly. It will display garbage or unexpected characters in your terminal otherwise.

AT$SSID?
AT$SSID=MyAccessPoint
Displays or sets the current SSID to the specified name. The given SSID name is case sensitive so make sure to use ASCII mode to set it properly. Clear the SSID by issuing this command with no SSID. Maximum length is 32 characters.

AT$PASS?
AT$PASS=MyPassword
Displays or sets the current SSID password to the specified string. The given password name is case sensitive so make sure to use ASCII mode to set it properly. Clear the password by issuing this command with no password. Maximum length is 64 characters.

AT$MDNS?
AT$MDNS=MyMDNSName
Displays or sets the current MDNS network name. The WiFi232 modem begins a web server on port 80 after startup. Since it's difficult to know what IP address your modem will obtain over DHCP, you can use the MDNS name instead. When setting the MDNS name, do not supply the ".local" to the end as that is added for you. By default, this is "WIFI232" To access the web server, go to http://WIFI232.local/ See the "Built-In Access Point and Web Server" section for more information. Maximum length is 80 characters.

ATC?
ATCN
Displays the current WiFi connection status. A result of '0' is not connected, '1' is connected. To disconnect or connect from the WiFi network, supply a '0' to disconnect from the WiFi network and '1' to connect to the WiFi network. Connecting to a WiFi network will disable the built-in access point. Conversely, if the WiFi network is not available, it will enable the built-in access point.

Placing Calls

ATDTbbs.somewhere.com:23
Place a TCP call over WiFi to the specified IP or DNS address and TCP port. If the colon and TCP port are omitted, port 23 is assumed. You can also dial speed dial slots using ATDT one of two ways.
- Seven repeating digits of the speed dial slot number (i.e. speed dial slot 2 is 2222222)
- Specified alias as set with AT&Z

DNS and alias text is case insensitive.

ATDSN
Place a TCP call over WiFi to the host specified in speed dial slot "N."

ATH
Hang up current call.

AT&ZN?
AT&ZN=bbs.somewhere.com:23,alias
Displays or sets the speed dial slot "N" where N is numbers 0 through 9. If the colon and TCP port are omitted, port 23 is assumed. A maximum of 50 characters can be stored per entry. A comma followed by a 15 character maximum alias can be specified to create an alternate alias. For example, certain software has pre-set phone numbers. The alias feature allows you to set the phone number to dial an internet address instead. DNS and alias text is case insensitive.

+++
Enter command mode while in a call.

ATO
Exit command mode and return to current call. Returns an error if not in a call.

ATGEThttp://www.somewhere.com/mydoc.txt
Get and display the contents of a web site address as 8-bit data. Connection is terminated immediately following the end of the file.

Incoming Calls

ATA
Answer incoming call if auto answer is disabled.

ATS0?
ATS0=N
Display or set auto answer. "0" is auto answer off, "1" is auto answer on.

AT$SP?
AT$SP=N
Displays or sets the inbound TCP port. Valid values for N are 0 - 65535. A value of '0' will disable the inbound TCP port and a RING message will never be displayed.

AT$BM?
AT$BM=My Busy Message
Displays or sets the current busy message. This message is displayed to remote TCP clients that connect to the modem if any of the following conditions are met.

- ● Auto answer is off and there is no corresponding ATA command to answer the call.
- ● The modem is currently busy in a call with another TCP client.

Clear the busy message by issuing this command with no message. Maximum length is 80 characters.

AT&R?
AT&RN
Displays or sets the require password on inbound calls. "0" is do not require an inbound password, "1" is require the inbound password.

AT&R=InBoundPassword
Sets the inbound password for incoming TCP calls. Callers have 3 tries or 30 seconds, whichever comes first. Maximum length is 80 characters.

Managing Settings

ATI
Display current network information about the modem including connection status, AP status, SSID name, IP address, MDNS name, bytes transferred and call status.

ATZ
Reset all settings to the version last saved in NVRAM. The current baud rate remains unchanged until a reboot or power cycle.

AT&V
Display current settings ("active profile") and settings that are saved in NVRAM ("stored profile"). Also displays speed dial slots. If current settings are not written to NVRAM before power down or reboot, they will be lost and settings will be reloaded from NVRAM.

AT&W
Write (save) current settings to NVRAM. The saved settings will be used upon reboot, power up, or a ATZ command.

AT&F
Restore factory defaults to NVRAM and load them into current settings. Clears all settings including SSID, password and speed dial slots. The current baud rate remains unchanged, however the default baud rate of 1200 is written to NVRAM and will be used on next power up.

Controlling Features

ATE?
ATEN

Displays or sets command mode local echo mode. "0" is echo off, "1" is echo on. The default is '1'.

ATQ?
ATQN
Displays or sets quiet mode. "0" is results issued, "1" is quiet no results issued. The default is '0'.

ATRD
ATRT
Displays the current UTC date and time from NIST in the format "`YY-MM-DD HH:MM:SS`"
Requires a WiFi connection. NIST restricts queries to no more than one per minute.

ATV?
ATVN
Displays or sets verbose mode. "0" is results are issued as numerical results, "1" is results are issued as verbose text results. The default is '1'.

ATX?
ATXN
Display or control extended result codes. A response of '0' is no extended result codes and a '1' is to show extended result codes. To change the setting, supply a '0' to for no extended result codes and a '1' to show extended result codes. These result codes include the CONNECT message followed by the extended result of current baud rate and the NO CARRIER message followed by the extended result of connect time in HH:MM:SS. The default is '1'.

AT$W?
AT$W=N
Displays or sets the current setting for startup wait. If this is set to '1' the WiFi232 Modem will wait for a single carriage return (0x0D) to be pressed before displaying a welcome message and attempting to connect to the WiFi network. If this is set to '0' the modem will not wait and display a welcome message immediately and connect to the WiFi network. The default is '0'.

AT&S?
AT&S=N
Displays or sets the current setting for the built in web server. If this is set to '1' the WiFi232 Modem begins a web server on TCP port 80. The web server displays information and allows control of a limited number of options. If this is set to '0' the web server is disabled.
WARNING: A password is not required for the web server. Enable this option only on trusted networks. The default after a factory reset is '1' to allow ease of configuration.

ATNET?
ATNETN

Displays or sets telnet handling. "0" is no telnet code processing, "1" is process telnet codes. Telnet features a set of IAC commands that enable two devices to negotiate certain terminal features. These commands will begin with a 0xFF bytes followed by two or more bytes. If remote site you are calling is using telnet IAC commands, you will need to enable this feature so they are interpreted properly. Otherwise, you will get strange characters and potentially have downloads that fail CRC checks. Enabling telnet will also enable the sending of present terminal type ($TTY), location ($TTL), and window size ($TTS).

AT$AE?
AT$AE=YourAutoExecuteSetting
Displays or sets automatic command execute setting. When defined, this "AT" command will be executed upon startup. The command must begin with "AT". An example could include automatically dialing a specific host upon power up. The command can be aborted by pressing the ESC key several times as you apply power. Clear this setting by issuing the command with a blank command.

AT$TTY?
AT$TTY=YourTTYSetting
Displays or sets telnet TTY (terminal type) reporting. The default setting is "ANSI." Telnet handling (NET1) must be enabled for this feature and is only sent when requested by the remote server using telnet commands. This happens transparently to the user-- you will not see it in your terminal. Maximum length is 80 characters. See RFC 1091.

AT$TTL?
AT$TTL=YourLocation
Displays or sets the telnet location report value. The default setting is "Earth". Telnet handling (NET1) must be enabled for this feature and is only sent when requested by the remote server using telnet commands. This happens transparently to the user-- you will not see it in your terminal. Maximum length is 80 characters. See RFC 779.

AT$TTS?
AT$TTS=WxH
Displays or sets the telnet window size report value. The default setting is "80x24". Telnet handling (NET1) must be enabled for this feature and is only sent when requested by the remote server using telnet commands. This happens transparently to the user-- you will not see it in your terminal. Maximum size is 255x255. See RFC 1073.

ATPET?
ATPETN
Displays or sets Commodore PET handling for MCTerm. "0" is no handling, "1" is set bit 8 to zero.

Flow Control

AT&K?
AT&KN
Displays or sets flow control. "0" is no flow control, "1" is hardware flow control, "2" is software flow control. Software flow control is not implemented.

AT&P?
AT&PN
Display or set pin polarity used in conjunction with hardware flow control. "0" is inverted polarity (default), "1" is normal polarity. Some pins listed are not connected to the WiFi232 Modem.

AT$PINS?
Display the current hardware flow control pin status. Useful for troubleshooting. The DCD (data carrier detect) pin listed is not connected to the WiFi232 Modem.

Firmware Update

ATUPDATECHECK
Contacts the firmware server for new software updates. If the firmware is update, it will return "FIRMWARE IS UP TO DATE." If there is new firmware available, it will return "NEW FIRMWARE IS AVAILABLE."

ATUPDATE
Contacts the firmware server for new software updates. If new a firmware update is available, it will be downloaded and your modem will be updated automatically. The modem should automatically reboot to the new firmware version. If it does not do so after 30 seconds of reporting the firmware was complete, manually power cycle the modem.

Troubleshooting

- Make sure you've set the proper baud rate in your terminal program. First time users of the WiFi232 need to use 1200 baud. You can change it later and save it to NVRAM to use it again later.
- SSID and Passwords are case sensitive. Use an ASCII terminal to enter them.
- Make sure your cable is not a null modem or printer cable. These look identical to a normal modem cable but are wired backwards, especially cables for the Apple IIgs or Macintosh (8 pin mini-DIN to DB25) that were used with the original ImageWriter.

- Your terminal program may require you to put the terminal "online" manually. It might be expecting a signal from the modem saying it's ready. The WiFi232 only supports a subset of RS-232 signals.

Advanced Configuration

Configuring Hardware Flow Control

Hardware flow control enables the computer or host system to temporarily pause the flow of data coming into the computer. This is usually done when the rate of data coming in-bound can't be processed in a timely manner.
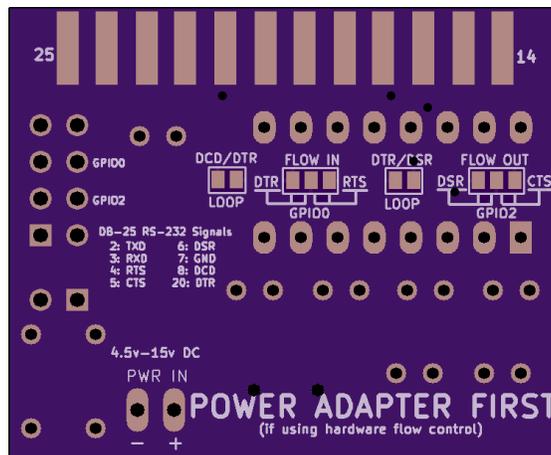
The underside of the modem contains several solder jumpers that enable you to customize the hardware flow control wiring to suit your application. The most typical settings are to use RTS/CTS hardware flow control.

1. Solder a bridge across the center of FLOW IN to RTS.
2. Solder a bridge across the center of FLOW OUT to CTS.

If your application requires the DTR and DSR lines to be tied together back to the host system, solder a bridge across the DTR/DSR loop. In my testing using NComm on the Amiga, it required the DTR/DSR loop to work.

Likewise, if your application requires the DTR and DCD lines to be tied together back to the host system, solder a bridge across the DTR/DCD loop.

To unbridge a solder jumper, use copper solder braid to gently remove the solder with a soldering iron. Scrubbing too hard with copper solder braid can remove the copper jumper on the board.

Flow control is ignored in command mode.

Important: If you enable hardware flow control, you must power up the modem before connecting it to your computer. Failure to do so could result in an unresponsive modem.

If you're unsure if you need flow control, leave the jumpers bare and try the board first-- you may not need flow control.

Kit Bill of Materials

If you chose to receive a bare board with a kit of parts to assemble yourself, you received the following.

- 1 x bare PCB
- 1 x mini USB jack (SMT)
- 1 x voltage regulator (SMT)
- 6 x 0.1uF capacitors
- 1 x 10uF capacitor
- 1 x 14 pin DIP
- 1 x 8 pin ESP-01 WiFi microcontroller
- 1 x push button switch
- 1 x 8 pin female header
- 1 x DB25 female connector

Kit Assembly

It's assumed that if you purchased the kit, you are proficient in soldering skills. I can't offer any better advice for soldering than what you'd find online. If you have any doubts, please do your research on the subject before beginning.

1. Lightly sand the raised edges of the PCB where they were previously attached during manufacturing. Clean the PCB thoroughly.
2. Solder the USB mini jack. Only the outer two of five pins are used for power. The inner three can be left unconnected.
3. Solder the voltage regulator.
4. Solder the 6 0.1uf capacitors (C1-C6). The ceramic capacitors are not polarized and can be inserted either way. Clip the leads on the underside.
5. Solder the 14 pin DIP chip, lining up the notch to the diagram on the silkscreen.
6. Solder the push button.
7. Solder the optional 8 pin header or omit the header and solder ESP-01 module directly to the board orienting the long edge along the silkscreened arrow. This makes your modem thinner.

8. Solder the 10uf capacitor at C7, observing correct polarity, using the silkscreen as a guide. Clip the leads on the underside.
9. Insert the PCB between the DB-25F solder cups and solder all 25 pins.
10. If you used the 8 pin header, insert the ESP-01 module orienting the long edge along the silkscreened arrow.
11. If you require hardware flow control, see the section on flow control.