

# Commodore WiFi Modem

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## About the C64 MicroView and Wi-Fi Modem

This is a multipurpose board that allows for experimentation with the Commodore 64 (or other Commodore computer with a compatible User Port like the C128 or VIC20), the MicroView Arduino-compatible device with OLED display, and a serial-based Wi-Fi Module such as the Roving Networks RN-XV Module or the XBee® Wi-Fi Module, in a variety of configurations.

All I/O pins on the MicroView are broken out along the top of the board to allow for interfacing to external devices. Refer to the MicroView documentation and **Table 1** for details.

Current-limiting resistors are recommended between all user port lines and the board. A socket is provided for this purpose at U1, these can be either individual 100-330 Ohm resistors, or a resistor network DIP such as the Bourns Inc. 4116R-1-101LF (provided) can be used. The Commodore SX-64 requires 100 Ohm resistors while most other models will work with 330 Ohm.

A separate VIN connector is provided for powering the board for standalone use, this is not required when the board is connected to a computer.

Reset buttons are provided for resetting each of the C64, MicroView, and Wi-Fi Module.

All parts are through-hole for ease of soldering.

## Configurations

### Default Configuration

The **default configuration** allows the MicroView to arbitrate between the C64 and the RN-XV, acting like a simple virtual modem, assuming a sketch is loaded into the MicroView to perform this function.

1. TX and RX of the C64 User Port connected to pins D6 and D5 of the MicroView (Software Serial RX/TX #1).
2. TX and RX of the Wi-Fi Module connected to pins D1 and D0 of the MicroView (Hardware Serial)
3. No jumpers are installed on the “TX” and “RX” jumpers.
4. Power is supplied to the MicroView and RN-XV from the C64 User Port.
5. All RS-232 signal lines are connected between the C64 and MicroView for enhanced modem emulation, through current-limiting resistors provided in the resistor network DIP at U1.

### Firmware

Two firmware options are available:

#### **Menu (WiFiModem-Menu-\*.hex):**

Simple menu driven which allows you to connect to:

1. Connect to remote hosts
2. Dial from a phone book and configure an auto-connect entry
3. Accept incoming calls
4. Configure WiFi settings

#### **WiFiModem-Hayes-\*.hex**

Hayes emulation. Should work with most terminal programs. See the Hayes Command section for supported AT commands.

### Baud rate selection

Immediately after bootup, ‘Baud Detection’ will be displayed on the MicroView. Pressing a key on the keyboard within three seconds will detect the baud rate and store it in flash for future bootups. Some keys such as space may cause an incorrect baud rate to be detected. The most reliable key to press is the letter u.

## **C64 Directly Connected to Wi-Fi Module**

This configuration connects the TX and RX from the User Port directly to the Wi-Fi Module's RX and TX pins. Ensure the Wi-Fi Module's serial port is configured to match the baud rate of the C64. Refer to the Wi-Fi Module's documentation for configuration and command set details.

1. Remove the MicroView from the board.
2. Place jumpers on the jumper pins marked "TX" and "RX".

## Standalone

This configuration allows the board to be used standalone, without being connected to a computer.

1. Remove the cartridge from the User Port.
2. Supply +3.3V to +16V to the board on the VIN connector. The connector is a standard 2.1 mm barrel connector, center-pin positive. This connects to the MicroView's VIN pin which regulates the input voltage. The board requires about 200 mA @ 5V.

**Note:** Do not connect the external VIN when the board is connected to the User Port!

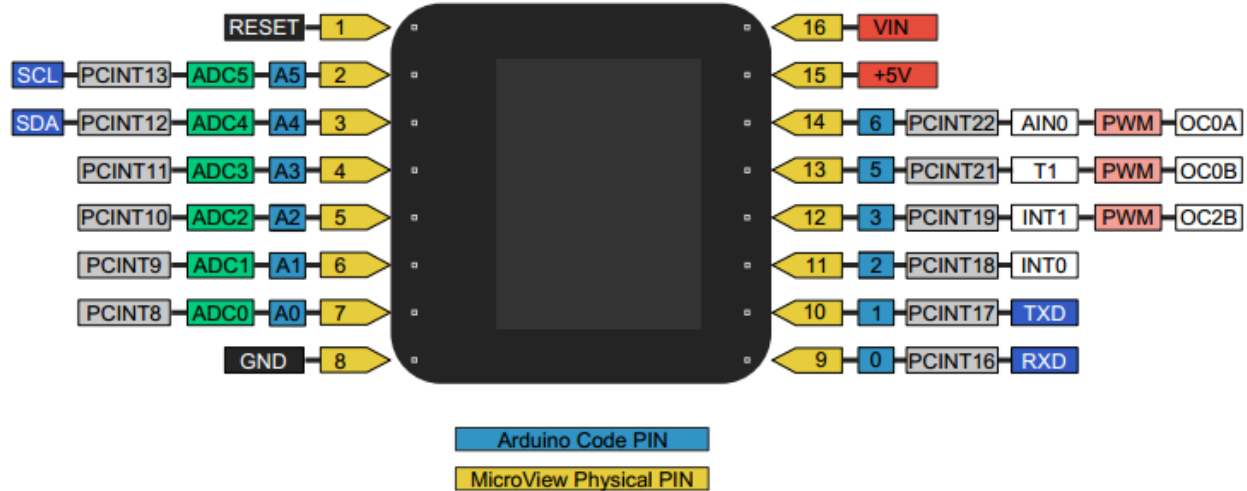
## MicroView as an Interface Device to the C64

This configuration allows the MicroView's GPIO (including analog input, PWM output, digital I/O and even I<sup>2</sup>C) to be used to interface to the outside world, with data exchanged to the C64 via serial port. A sketch is required inside the MicroView to perform this function.

1. Remove the Wi-Fi Module from the board.
2. Note that some of the MicroView pins are shared with the User Port pins – see **Table 1**. Therefore it is recommended to remove the resistor network and provide standalone resistors only between TxD and RxD at U1. This frees up the Analog GPIO A0 to A5.

## MicroView Pinout

At the heart of the C64 Wifi Modem is a “Microview”, an a Arduino Uno-compatible device with built-in OLED display. The pinout is as follows:



All the MicroView pins are broken out along the top of the cart, to allow interfacing to the outside world. Note that some pins are connected to the C64 User Port, as per **Table 1** below.

## Table 1 – MicroView Pinout

Pin#	MicroView	C64 User Port	Wi-Fi	Notes
1	RESET	-	-	-
2	A5 SCL	Pin D (RTS)	-	For extended RS-232 support
3	A4 SDA	Pin E (DTR)	-	For extended RS-232 support
4	A3	Pin F (RI)	-	For extended RS-232 support
5	A2	Pin H (DCD)	-	For extended RS-232 support
6	A1	Pin K (CTS)	-	For extended RS-232 support
7	A0	Pin L (DSR) Pin 6 (CNT2)*	-	For extended RS-232 support (*Connected to Pin 6 for UP9600 mode when jumper is in place)
8	GND	Pins 1,12,A,N (GND)	Pin 10 (GND)	Ground
9	D0 RxD	-	Pin 2 (TxD)	Hardware Serial RxD.
10	D1 TxD	-	Pin 3 (RxD)	Hardware Serial TxD.
11	D2	-	Pin 12 (RTS)	Serial RTS from Wi-Fi
12	D3	-	Pin 16 (CTS)	Serial CTS to Wi-Fi
13	D5	Pin M (TxD) Pin 5 (SP1)	-	Software Serial RxD (Pin 5 is for UP9600 mode)
14	D6	Pins B,C (RxD) Pin 7 (SP2)	Pins B,C (RxD) Pin 7 (SP2)	Software Serial TxD (Pin 7 is for UP9600 mode)
15	+5V (from C64)	Pin 2 (+5V to MicroView)	Pin 2 (+5V to MicroView)	+5V Power from C64 to MicroView In standalone mode, +5V available here
16	VIN	-	-	External VIN <b>for standalone use</b> +3.3V to +16V

## Schematic



## Software Support

### UP9600 Support

The UP9600 driver for 9600 baud support in Novaterm 9.6 is supported. Add the jumper marked UP9600 Enable to enable it. Note that this prevents Pin L (DSR) from being used.

The UP9600 driver is also supported in Striketerm 2014 (based on Novaterm 9.6), but a workaround is required: The driver must be selected and the configuration saved with the Wi-Fi Modem unplugged. Plug in the modem (with the C64 power off) and restart Striketerm and it will then work normally.

### CommodoreServer Support

[www.commodoreserver.com](http://www.commodoreserver.com) is supported at 2400 baud. The recommended way to connect is to configure the WiFi modem to auto-connect to the commodoreserver server. To configure, follow these steps:

1. Make sure the modem is set for 2400 baud. During power-up, the MicroView will display the baud rate. If it is not set to 2400 baud, set the baud rate using a terminal program such as NovaTerm. See the section for Baud Rate Selection.
2. Configure auto-connect to connect to [www.commodoreserver.com:1541](http://www.commodoreserver.com:1541) at power-up
  - a. Menu firmware:
    - i. Set one of the phone book entries to [www.commodoreserver.com:1541](http://www.commodoreserver.com:1541)
    - ii. Configure auto-connect for the phone book entry.
  - b. Hayes firmware:
    - i. Set one of the phone book entries to [www.commodoreserver.com:1541](http://www.commodoreserver.com:1541) using at&pbx=www.commodoreserver.com:1541 where x is a phone book entry from 1-9.
    - ii. Configure auto-connect using at&pbauto=x where x matches the phone book entry above.
3. Reboot the computer and WiFi modem
4. load "v-1541",8,1
5. sys 49152
6. new
7. V-1541 and documentation can be found at <http://www.commodoreserver.com/Downloads.asp>

## QuantumLink Rebooted / Reloaded

[Q-Link Rebooted](#) and [Q-Link Reloaded](#) are currently supported at 1200 baud with firmware 0.08 or higher.

1200 baud support requires that the WiFly modem is configured with 'set comm time 20'. If you purchased your modem before December 28<sup>th</sup>, 2015 you will have to configure this setting. See Appendix A for instructions.

To access Q-Link, follow these steps:

### **For the Hayes firmware:**

1. Using a terminal program, boot the modem up at 1200 baud (press u or <return> when 'Baud Detection' is displayed) and set the following settings:
  - a. `ate1q0v1&c1&k0s0=0&w`
2. Download a fresh Q-Link disk from one of the following sites:
  - a. <http://www.lyonlabs.org/commodore/qlink/QuantumLink.d64>
  - b. <http://orrtech.us/qlink/files/QuantumLink.d64>
3. load "change access",8,1
4. Select 'Change access information'
5. Change the modem type to 'Hayes or Hayes-compatible'
6. Change the modem speed to 1200 baud
7. Change the phone type to Tone
8. Change the access number to one of the following:
  - a. QLink Rebooted: +5551212
  - b. QLink Reloaded: +5551213
  - c. Note: The + is required
9. Select SIGN ON TO Q-LINK
10. Q-Link should now launch and log you in.
11. The next time you want to connect, repeat step 1 and then boot the disk using
  - a. load "\*",8,1

### **For the Menu firmware:**

1. Using a terminal program, boot the modem up at 1200 baud (press u or <return> when 'Baud Detection' is displayed) and set the following settings using the Configuration menu:
  - a. Disable flow control (menu item should say 'Enable flow control')
  - b. Disable DCD always on (menu item should say 'Enable DCD always on')
2. Download a fresh Q-Link disk from one of the following sites:
  - a. <http://www.lyonlabs.org/commodore/qlink/QuantumLink.d64>
  - b. <http://orrtech.us/qlink/files/QuantumLink.d64>
3. load "change access",8,1
4. Select 'Change access information'
5. Change the modem type to 'Other command driven modems'
6. Change the modem speed to 1200 baud
7. Change the phone type to Tone
8. Change the access number to one of the following:
  - a. QLink Rebooted: +5551212
  - b. QLink Reloaded: +5551213
  - c. Note: The + is required. The number is not actually used when using the Menu firmware, but a number must be entered.
9. Select SIGN ON TO Q-LINK
10. Press <return> to bring up the modem menu. Note: The Q-Link terminal program requires a <return> after each line which causes an extra <return> to be sent to the modem.
11. Select 1. Telnet to host or BBS
12. If an X is displayed, press the DEL key and enter the phone number and press <return>
  - a. QLink Rebooted: 5551212
  - b. QLink Reloaded: 5551213
13. Press <return> and the port prompt as it will be automatically changed to the correct port.
14. When it says 'Connected to qlink.lyonlabs.org' or 'Connected to q-link.org', press F1
15. Q-Link should now launch and log you in.
16. The next time you want to connect, repeat step 1, boot the disk using the command below and then repeat steps 9-15.
  - a. load "\*",8,1

## Hayes Commands

Defaults in **bold**.

Command	Description	Comments
at*p= (at&pass= in v0.08 or older)	Set WiFi passphrase, if required	Example: at*p=Commodore64
at*k= (at&key= in v0.08 or older)	Set WiFi key, if required	
at*s= (at&ssid= in v0.08 or older)	Set WiFi SSID	Configures SSID and attempts to connect. Configure pass or key before ssid.
at&port=	Set TCP listening port for answering calls	If set to 0, incoming calls will be disabled. Modifying the port requires a reboot of the WiFly. At 2400 baud, the reboot will be handled by the MicroView but at other baud rates the end-user must reboot both the MicroView and the WiFly module. Port settings is saved immediately. at&w is not required.
at&pb?	List phone book entries	
at&pbclear	Clear all phone book entries and add factory defaults	Also pre-populates phone book entry numbers 8 and 9 with bbs.jammingsignal.com:23 and <a href="http://www.commodoreserver.com:1541">www.commodoreserver.com:1541</a> Phone book settings are saved immediately. at&w is not required.
at&pbclear2	Clear all phone book entries	Phone book settings are saved immediately. at&w is not required.
at&pb#=address	Modify a phone book entry	Example: at&pb1=bbs.jammingsignal.com:23 Phone book settings are saved immediately. at&w is not required.
at&pbauto=	Set phone book entry for auto-connect at bootup	Set to 0 to disable. Phone book settings are saved immediately. at&w is not required.
ati	Display modem configuration information	Displays MAC address, IP address, SSID, Firmware version, listen port and AT init string.
ata	Answer incoming call	If an inbound connection has been created by the WiFly, RING will be sent to the computer. ata will answer the call.
ate / ate0	Disable echo	
<b>ate1</b>	<b>Enable echo</b>	
ath / ath0	Force modem on-hook (hang-up)	+++ during inbound and outbound calls will drop to command mode which will then allow you to use ath / ath0 to drop the call.
ath1	Force modem off-hook (pick-up)	WiFly module is put to sleep and can we

		waken up by ath, ath0, atz or at&f.
atm0	Does nothing	Does nothing. Added to satisfy init strings for some BBSs.
atm1	Does nothing	Does nothing. Added to satisfy init strings for some BBSs.
atm2	Does nothing	Does nothing. Added to satisfy init strings for some BBSs.
atq0	Display AT command results	
atq1	Suppress AT command results	
atv0	Display numeric result codes	
<b>atv1</b>	<b>Display textual result codes</b>	
atx0	Return results codes 0-4	0 - OK 1 - CONNECT 2 - RING 3 - NO CARRIER 4 - ERROR 5 - CONNECT 1200 6 - NO DIALTONE (DNS failure) 7 - BUSY (Connection failure) 8 - NO ANSWER (not implemented) 10 - CONNECT 2400 11 - CONNECT 4800 . etc..
atx1	Return results codes 0-5, 10+	See X0
atx2	Return results codes 0-6, 10+	See X0
atx3	Return results codes 0-5, 7, 10+	See X0
atx4	Return results codes 0-7, 10+	See X0
atz	Load saved settings from EEPROM.	
<b>at&amp;c0</b>	<b>Force data carrier detect (DCD) on at all times</b>	
at&c1	Data carrier detect (DCD) follows remote carrier / connection	DCD will turn on when an outbound or inbound connection is made
at&f	Load modem factory defaults	
<b>at&amp;k0</b>	<b>Disable RTS/CTS (RTR/CTS) flow control</b>	
at&k1	Enable RTS/CTS (RTR/CTS) flow control	
at&w	Save settings to flash	
atr	Enter RAW terminal mode which allows you to communicate directly with the WiFly module	
<b>ats0=0</b>	<b>Disable auto-answer</b>	
ats0=1	Enable auto-answer	
ats2=	Set +++ escape code. Decimal number from 1 to 254	Defaults to 043 (+)
atd <i>address</i> atdt <i>address</i> atdp <i>address</i>	Connect to a remote host. Format is hostname:port	Defaults to port 23. Examples: atd bbs.jammingsignal.com:23 atdp bbs.jammingsignal.com

		atdtbbs.jammingsignal.com
atd# atdt# atdp#	Connect to a remote host from the phone book.	Example: atd#1 atdp#4 atdt#9

## Appendix A: Setup after Factory Reset

After a factory reset, the settings below are recommended for normal use.

### Procedure

1. Switch to VT102 mode in your terminal. Press delete at the menu to switch the modem to ASCII mode or just type at <return> when in Hayes mode.
2. Enable echo in your terminal. Novaterm is C=E.
3. Menu mode: Choose option 4 - Configuration and then choose option 5 - Direct Terminal Mode (Debug)
4. Hayes mode: Type at&r to enter Direct Terminal Mode (Debug)
5. You will see '\*\*\* Terminal Mode (Debug) \*\*\*'
6. Type three \$ signs (\$\$\$) and you should see: cmd
7. Type a command and press <return>. It should say AOK.
  - a. Example: Enter 'set comm time 20' without the quotes and press <return>
8. Type: 'save' without the quotes and press <return>. It should say Storing in Config.
9. Reboot the MicroView and WiFly

If pressing <return> gives no results, try a different ASCII terminal mode. VT102 Novaterm works but ANSI does not.

## Settings

**set wlan join 1** *(Auto- associate with access point)*

**set ip dhcp 1** *(Turn on DHCP client)*

**set uart baud 2400** *(Default baud rate)*

**set uart flow 1** *(Turn on hardware flow control, needed for UP9600 mode )*

**set ip tcp-mode 0x10** *(Turn off remote configuration via \$\$\$)*

Plus the SSID and key/passphrase need to be set. This can be done through the Arduino interface, or manually as follows:

**set wlan key <key>** *(for WEP)*

*-or-*

**set wlan passphrase <phrase>** *(for WPA)*

**set wlan ssid <ssid>** *(Set the SSID)*

**set comm time 20** *(Default is 5. Setting this to 20 fixes 1200 baud issues)*

**set ip protocol 2** *(Enable TCP client/server mode)*

**set ip flags 23** *(Enable DNS caching, TCP retry, TCP\_NODELAY, TCP connection status)*

Then **save** and **reboot** to make the changes permanent.