MicroModem User Manual

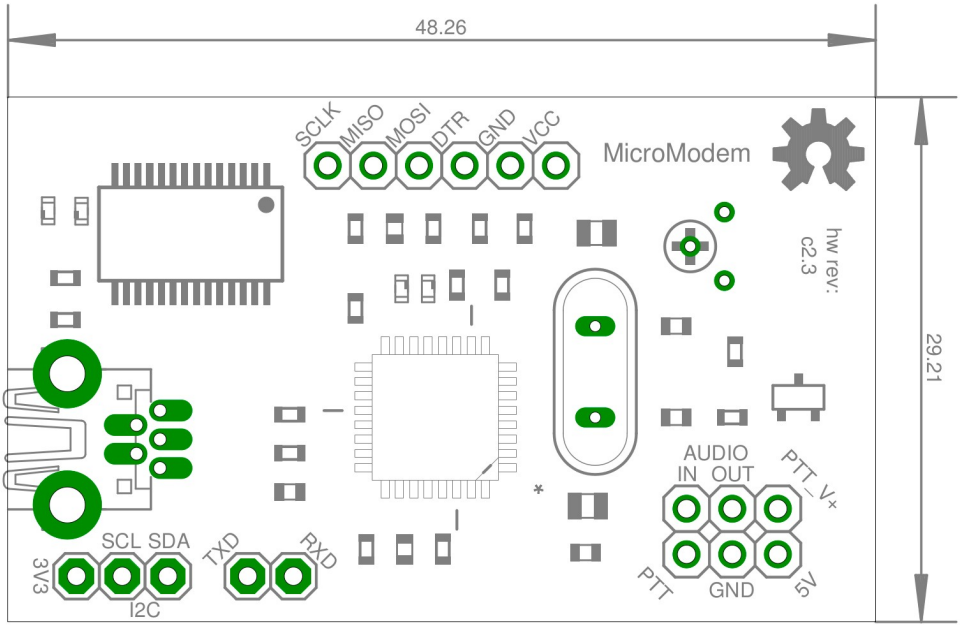
Thank you very much for buying this product! If you have any questions, suggestions, criticisms or good ideas, I'd love to hear from you! This guide provides a few pointers on getting started with MicroModem, and how to connect the board and flash the firmware.

Connecting host equipment to the modem

The serial connection to the modem is 9600 baud, 8N1, no flow control. You should be able to set these parameters in whatever program you will connect the modem with, or from the hardware you are connecting to the modem. If you need to use another baud-rate, it is possible to change this quite easily in the source-code and recompile the firmware. The modem has been tested with rates up to 115200 baud.

Connecting to a radio

To connect the modem to a radio, you must connect the **Audio Out** port on the modem to the microphone input of your radio, and the **Audio In** port on the modem, to the speaker/headphones output of your radio. Also connect the **GND** port on the modem to the speaker or mic (depends on radio) ground. With a small flat-headed screwdriver, trim the potentiometer on the board to adjust the output level to an acceptable level for your radio. Turned all the counter-clockwise, the output level will be around 1.5V peak-to-peak. Turned all the clockwise, the output level will be around 15mV peak-to-peak. This roughly equates to a range going from line-level to microphone-level. Optionally connect the PTT ports according to the PTT mode of your radio. If your radio uses Kenwood-style PTT triggering, supplying a positive voltage on the ground pin of the microphone plug, connect that to the PTT_V+ pin. If your radio accepts a logic-level PTT signal, connect the **PTT** port of the modem to the PTT input of your radio.



Expansion ports

In addition to the radio connector ports just discussed, the modem supplies several extra expansion ports. Please refer to the previous illustration for the location of these ports. The UART serial port is available on the **TXD** and **RXD** ports. An **I2C** port is also available, marked **SCL** and **SDA**. Furthermore, an **SPI** port is avaible, marked **SCLK**, **MISO** and **MOSI**. An extra **GND** connector is made available, along with two 5V/VCC ports marked **VCC** and **5V**. There is also a 3.3V supply broken out, labeled **3V3**. The max supply for this port is **50mA**.

These extra ports are not necessarily used by your chosen firmware, but can be used for future functionality, or you can use these yourself, if you plan to write your own firmware. All the pins listed are also available as general purpose digital and analog IO pins. The following list maps the port names to Arduino IDE pin designations:

- `RXD  =  Digital pin  0`
- `TXD  =  Digital pin  1`
- `MOSI  =  Digital pin 11`
- `MISO  =  Digital pin 12`
- `SCLK  =  Digital pin 13`
- `SDA  =  Analog  pin  4`
- `SCL  =  Analog  pin  5`

Operating environment

The modem uses all high-quality components, and should last for many decades with normal use. If you plan to use the modem outdoors, I recommend keeping the modem within an operating temperature of **-20°C** to **70°C**. The modem should also be kept free of condensing conditions, so that the bare PCB is not exposed to moisture. The same goes for rain or other sources of moisture. If you will be operating the modem in a wet environment, I recommend placing it in an IP55 rated housing. I you need to operate the modem totally submerged, applying a full epoxy-coating is recommended.

Flashing a firmware

The modem comes preflashed with the newest version of the firmware you choose when ordering. If you want to use another firmware on the modem, just flash it from your computer. You can do this as many times as you need, and it is not a difficult or risky process. You can download firmwares at http://unsigned.io/projects/micromodem, or you can compile it yourself from the source code. I won't go into details about compiling here, but you can find information on that in the GitHub repositories. When you have a firmware (.hex) file, you can use `avrdude` to flash it. Here's an example of how to use it:

```
avrdude -p m328p -c arduino -P /dev/ttyUSB0 -b 115200 -F -U flash:w:YourFirmwareFile.hex
```

The firmware should the be flashed and ready to use! There's plenty of other programs for loading .hex files onto your MCU, so if you use another one, that's also just fine. A few programs with a nice GUI also exist, if you don't feel comfortable using the command line.

Making your own firmware

You can use the the source code for any of the available firmwares as a basis for your own. If you prefer to use the Arduino IDE, you can use LibAPRS to easily make APRS-oriented firmwares straight from the Arduino IDE. LibAPRS is available at http://unsigned.io/projects/libaprs/. If you have any questions or problems, try asking in the forums!

Staying up to date

All MicroModem firmwares and libraries are in active development, and are updated regularly. Check http://unsigned.io for updates and news!

Getting help

If you need help for anything, a great place to start is the forums at http://unsigned.io/forum! You are also very welcome to email me at mark@unsigned.io, and I will get back to you ASAP!

Technical Specifications

Here's a list of technical specifications, included for your reference:

- ATmega328p @ 16MHz (4KB RAM / 32KB flash)
- Powered from USB or external regulated 5V source
- 51mA idle power consumption
- Operating range: -20°C to 70°C (non-condensing)
- Modulated analog output level adjustable from approximately 15mV to 1.5V peak-to-peak
- Minimum analog input level for good decode is about 100mV peak-to-peak
- ADC running on 3.3v reference
- Arduino compatible (You can program the board from the Arduino IDE, over USB)

Thanks a lot for buying this product!

I am very grateful for your business, and I sincerely hope my product will live up to your expectations.

I have designed and crafted this item with all my love and care,
and by purchasing from me, you are directly supporting
independent open source hardware design.
You are awesome!

- Mark