



NUE-PSK Digital Modem

Operator's Manual

(For software version 1.34)



*The **NUE-PSK Digital Modem** is a standalone, battery-operated digital modem using Microchip dsPIC technology. Weighing about 12 ounces and requiring only 60ma at 12V DC, the modem is easily taken to the field. For easy visibility in high or low ambient light, the NUE-PSK modem's backlit graphic LCD displays transmit and receive text data, as well as band spectrum and tuning indicator. When coupled with a standard PS2 or USB keyboard and an SSB-capable transceiver, you can have an effective portable PSK31 station.*

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VERSION HISTORY

The version number of this manual corresponds to the software version running in the modem. This version number is displayed in the display’s “splash screen” when the modem is initially turned on. (The small letter after the version number in the splash screen differentiates minor fixes for the specific version.)

ver 1.15 – Initial production release.

ver 1.20 – Improved speed tuning, F10 for Tx mode, Ctrl-S char, backspace and CWID fixes, and improved displaying/saving/loading of configurable modem settings.

ver 1.30 – Initial support for the optional USB add-on hardware and improved text entry keyboard sequences and commands.

ver 1.33 – Full USB support adds PC Bootload and Flash Bootload capabilities.

ver 1.34 – Beacon Mode added.

1) Introduction

PSK31 is one of the latest communications modes to capture the interest of hams worldwide. Its inherent ability to dig out weak, nearly-inaudible signals is ideally suited for low power QRP enthusiasts. The PSK31 digital modem engine, however, requires intense DSP processing that is only commonly available in PC sound card. Thus the PSK operator desiring portability for field operation is locked into using a laptop computer as a controller, which results in a cumbersome station. But there's hope!

The NUE-PSK Digital Modem offers a unique way for hams to get on the air using the digital modes. No PC is required, thus enabling one to communicate using PSK31. This self-contained, hand-held modem connects to your SSB transceiver and allows you send and receive text data using the PSK31 digital mode.

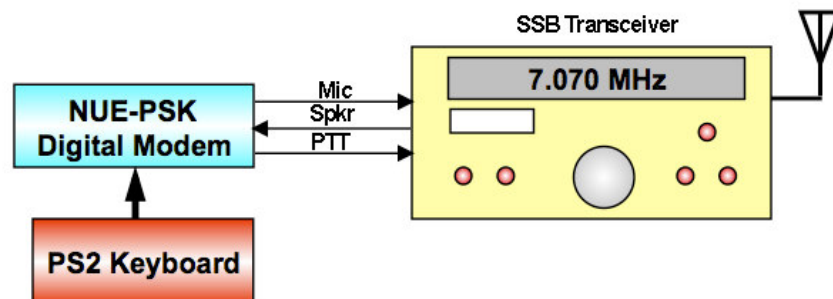
PSK31 is actually one-of-many modulation techniques within the “phase shift keying” family of communication. PSK31 operates at 31.25 bits/second, while other speeds may be achieved using variations to the software algorithm. PSK is perhaps more accurately termed BPSK, for bi-phase shift keying, whereby two distinct phase states separated by 180 degrees are used to convey the information. Four states may also be encoded/decoded, as is done with QPSK (quad-phase shift keying), in order to provide higher speeds with greater error correction ability.

The NUE-PSK digital modem can currently support the digital modes of BPSK and QPSK, and will soon support MFSK and RTTY. In fact, the field updating capability – that is, the ability to download new/improved programs from the Internet and simply program them into the modem – will allow users to stay current with new features and modes for years to come!

2) Connections

Ideally, you just need to connect up two cables:

- a) Connect the modem's “Radio” cable to the “data” jack on the back of your SSB transceiver. Most radio manufacturers today provide this way for getting audio modulated tones to/from the rig.
- b) Connect a standard PS2 keyboard, or a PS2/USB combination keyboard, to the “Kbd” jack on the modem.



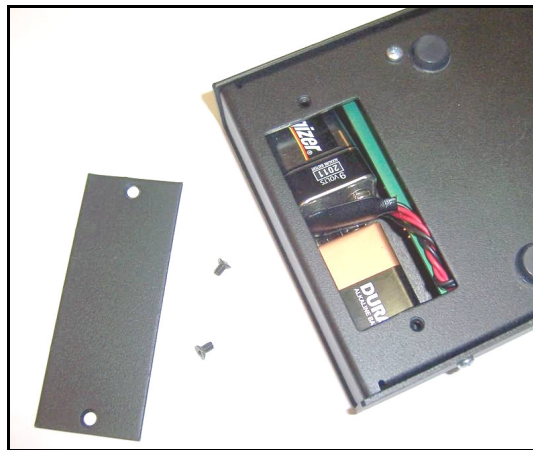
You are now ready to rock 'n roll using PSK31 ... read on and enjoy!

3) Specifications

- > Standalone, half-duplex modulator/demodulator for amateur radio digital mode communications
- > Handheld unit ... no PC required
- > Menus select operating modes, Squelch Thresh, PGA Gain, CW ID
- > 128 x 64 pixel graphic LCD displays audio signal spectrum 500 Hz to 2.5 kHz (with backlight)
- > Tx and Rx buffers and menu system displayed in lower half of LCD using four 20-character lines of text
- > Tune controls modem position along audio spectrum
- > Modes currently supported: BPSK31, QPSK, QPSK reversed
- > External keyboard jack: 6-pin mini-DIN, PS2-compatible
- > Standard PS2-style or dual-mode USB/PS2 keyboard (user-supplied) provides text input for Tx entry, command/mode selection and modem frequency adjustment
- > Connection to SSB transceiver: 8-pin mini-DIN (audio in, audio out, PTT, power)
- > Powered by two internal 9V batteries (not included) or an externally-applied supply via 2.1mm coaxial jack
- > Power requirements: 9-18V DC. Current at 12V is 60 ma without backlight, 80 mA with backlight. The current decreases as input voltage is increased.
- > Field reprogrammability of internal microcontroller to allow software updating in the field by the owner
- > Aluminum enclosure provides for rugged portable use while shielding transceiver from digital EMI
- > Enclosure dimensions: 7" x 4" x 1"
- > Single 3.75" x 5.25" pc board contains all components and connectors
- > Lightweight: < 1 lb with batteries.
- > Control for precise audio level control to transceiver
- > Cable assembly provided (plug and shielded cable) for connection to the SSB transceiver
- > Optional USB plug-in card provides ability to Record QSO text and save to USB flash memory device
- > Beacon Mode provides auto-repeating message buffer for far-signal measurement experiments,

4) Power

Install two standard 9V alkaline batteries in the battery compartment, or connect a 9 to 18 volt supply to the coaxial power connector (2.1mm) on the right end of the modem. The two 9V alkaline batteries nestle tightly against the pc board in the compartment. One battery lies flat and over to one side in the compartment, with the other battery sitting up at an angle with its connector overlapped with that of the first. The screw-on cover holds them firmly in place.



Use of internal batteries is not available when optional USB card is in place.

5) Signal Connections

Install a connector(s) to the unterminated end of the cable provided with the modem. Most modern HF rigs have a mini-DIN Data or AUX connector which provides for PTT, fixed level audio from the receiver (independent of the volume control on the rig), and a line-level (approx 100mv rms) audio input to the transmitter. On the Yaesu FT-817/857/897 this connector is a 6-pin mini-DIN. On many Kenwood HF rigs there are 6-pin and 13 pin mini-DIN connectors that may be used. See Appendix A for wiring details. See the website Ordering page for a list of pre-assembled modem cables accommodating over 50 different rigs.

6) Keyboard

The modem requires an AT/PS2 style keyboard for character entry. The keyboard also provides for entry and playback of macros. Use the 6-pin mini-DIN connector on the end of the modem to connect to the keyboard. A USB keyboard may be used if it has built-in PS2 support. Most USB keyboards that are *sold with a USB to PS2 adapter* will work, using the adapter.

7) Operation

Once you have the cable between the modem and the rig connected, keyboard attached, and power available, you are ready to operate PSK. But first, some additional setup may also be desired, as described next.

Turn on the modem. If the cabling between the rig and modem is wired correctly, you should see evidence of signals and/or noise on the top half of the display (the spectrum area). Tune your rig to one of the PSK sub-bands. These are typically 70 to 74 kHz above the lower band edge on 40 and 20 meters. If there is PSK activity on the band, you should see peaks on the graphic display. The horizontal location of the peaks corresponds to the audio frequency of each signal relative to the tuned frequency of the rig. For example, if the rig is tuned to 14070kHz, the display shows audio frequencies from 500Hz to 2500Hz, or actual RF frequencies from 14070.5 to 14072.5 kHz.

Now for the fun ... **tuning!** Turn the encoder clockwise, or counterclockwise, to move the cursor to a higher, or lower frequency. (The cursor is the small triangular icon just below the spectrum display.) The audio frequency is displayed when turning the encoder. Try to align the cursor with one of the peaks on the display. Don't worry if it is not exactly aligned. Once close to the peak, stop turning the encoder. The modem now attempts to "lock" onto the signal and fine-tune the frequency if needed. If the modem is able to lock onto a PSK signal, it will very shortly begin decoding the signal, and then display characters on the screen. The time it takes for decoded characters to appear depends on the ability of the modem to estimate the center frequency of the incoming signal, and the signal to noise ratio. Tuning can also be done with the arrow keys on the keyboard. The right and left arrow keys provide finer tuning, while the up and down arrow keys provide faster tuning. The tuning rate of the encoder on the modem can also be selected from a menu setting. Note: When tuning in receive mode, the spectral display is frozen - this is intentional.

Now on to **setup for transmission.** If you have a dummy load for your rig, connect it now.

Since PSK signals generated by the modem contain simultaneous multiple frequencies (over a very narrow bandwidth), it is imperative that the audio output from the modem not overdrive the input to the rig, or very poor signal quality will result. To facilitate setting the audio drive to the rig, a potentiometer on the modem may be used to adjust the level. In addition, the modem includes provision for "measuring" the position of the potentiometer, so that it can be easily reset to the same setting in the future. More on this later.

We have found that the best way to set up for PSK operation is to initially set up the transceiver for normal SSB operation, including whatever power setting you usually employ. For example, if you have a 100 watt PEP rig, set it up for 100 watts on SSB.

Switch to Digital mode (if your rig provides that option, otherwise retain the SSB mode).

Then press F8 on the keyboard. This places the modem in the TUNE state, which is denoted by "TUNE" at the top left of the display. The modem is now generating a continuous tone, which is fed to the audio input of the rig. The PTT signal from the modem should also cause the transceiver to switch to Transmit. At this point, the

potentiometer on the modem (just to the right of the display) can be adjusted to set the power level of the transceiver. A transmit power of 15 to 40 per cent of the rig's rated power is recommended. (i.e. 15 to 40 watts with a 100 watt rig). Keeping the power at this level does two things. First, it minimizes distortion due to clipping. Second, it avoids excessive heating in the rig finals, since PSK is a 100% duty cycle mode. A power meter is very handy for making this setting. Once the potentiometer has been set, press F8 again to return to receive mode.

You should now be ready for transmitting PSK.

Pressing F10 will place the modem in transmit mode, but with a PSK idle tone being generated (unlike the CW tone in TUNE). If you are ready to give it a try, Press F10. At this point, anything that you type on the keyboard, will be converted into Varicode characters and transmitted using PSK modulation. Pressing F10 again, will toggle back to receive. When in TX mode, "TX" will appear at the top left of the display.

8) Macros

a) General Macro Usage

If you want to set up macros (pre-recorded strings of characters for subsequent playback) before proceeding, now is a good time to do it.

For those already familiar with PSK operations, macro setup is similar to many of the popular PSK programs.

Macro recording is initiated by pressing Ctrl plus the function key that you want to be associated with your macro. Let's go through an example of entering your callsign into EEPROM memory and setting up a CQ calling sequence, as shown below. (I'll use my callsign in this example, but of course you should use your own!.)

a) Record your callsign into EEPROM ...

Ctrl-M n2apb Ctrl-Z

b) Record the CQ calling sequence into the F1 macro

Ctrl-F1 Ctrl-S cq cq cq de Alt-M k Ctrl-Q Ctrl-Z

Now play the macro by pressing F1 and see ...

Tx comes on, "cq cq cq de n2apb k", Tx turns off

You can also record the other station's call sign "TheirCall" in RAM (not in nonvolatile EEPROM) by pressing Ctrl+T, TheirCall and Ctrl-Z to end the entry. To insert the other station's call sign into a macro, simply use Alt+T in the macro. Then, when you play the macro, the other station's call sign will be inserted into the macro. This way, whenever you enter a new call sign using Ctrl+T, you do not need to re-record the macro to use the new call sign.

b) Special macro usage: Beacon Mode

- Using this feature, the user is able to specify a text string up to 256 characters in length into macro buffer F7 and then turn on Beacon Mode by pressing Shift-F9.
- The F7 macro should contain the Tx-ON control character Ctrl-S at the start of the string and the Tx-OFF control character Ctrl-Q at the end. The beacon transmission will then start and stop automatically with nothing being transmitted during the pauses.
- Once in Beacon mode, the reverse-video characters "BCN" are displayed at the right edge of the display and the F7 buffer begins transmitting as the text is displayed on the LCD.
- Since the Tx-OFF control character Ctrl-Q is the last character in the string, the modem drops out of Tx mode and the modem stays in Rx mode until the Beacon Interval timer expires.
- When the Beacon Interval time expires (which must be greater than the time required to transmit the F7 buffer), the F7 buffer transmit cycle begins again.
- This "beacon cycle" continues as long as the modem is powered (i.e., transmit F7 buffer, wait for Beacon Interval to timeout, transmit F7 buffer, ...)
- Beacon mode may be turned off at any time by pressing Alt-F9.
- The Beacon Interval is able to be set within the modem's Configure menus ... press-hold the Select pushbutton, dial two positions counter-clockwise and select Beacon Interval. Adjust the dial to select time in seconds for the start of every F7 buffer transmit cycle. It is important that the time be greater than the time required for F7 buffer to transmit. A good guideline is to first program the F7 buffer with the desired string and play the F7 buffer once by pressing F7 while in Tx mode. Time the transmission and add the number of seconds desired before the next transmission. That combined time will be the Beacon Interval.
- The user-set Beacon Interval time in the Config menus is retained only as long as modem power is applied. You will need to re-enter the time each time you power up the modem. The default Beacon Interval is 60 seconds.
- Usage Example: A beacon is desired for sending "v v v v N2APB 10mW PSK Beacon"
 - a) Enter string to F7:
"Ctrl-F7, Ctrl-S v v v v N2APB 10mw PSK Beacon Ctrl-Q, Ctrl-Z"
 - b) Send F7 buffer to determine length: F7 (Takes about 6 seconds)
 - c) Set Beacon Interval to 15 seconds:
 - press-hold Select, dial to Beacon Interval and select it;
 - dial to 15 seconds;
 - tap Select twice to exit back to normal modem display.
 - d) Turn on Beacon Mode: press Shft-F9
... see modem transmit F7 buffer on 15 second intervals
 - e) Turn off Beacon Mode: press Alt-F9

9) Configuration Menu

Configuration of the modem is done through a menu system. For example, you can select between PSK, QPSK, and QPSK reversed. You can also change the software squelch setting, the gain of the programmable gain amplifier (PGA), turn CW Identification on or off, turn the display backlight on or off, change the tuning “increment”, monitor battery voltage, or monitor the setting of the TX audio potentiometer. Other items may be added to the menu at a later time.

The method of menu access is through the “Select” button on the menu and the rotary encoder. Pressing and holding the Select button for more than ½ second will activate the menu system. When initially activated, the display will show “Configure” on one line, followed by “Exit” on the line below. If you wish to abort configuration, simply tap the Select button at this time. If, on the other hand, you wish to configure one of the modem settings, simply rotate the encoder clockwise, or counter clockwise, to cycle through the top level menu selection. Once you see an item that you wish to change, tap the Select button again. This will then allow you to cycle through a list of choices (again by rotating the encoder). When the choice you wish to make appears on the display, tap the Select button again. This will record your choice, and the menu will revert to the top level, showing “Exit” as the default choice. You can now make additional changes, or tap the Select button again to exit the Configuration menu.

The current menu choice is the item initially displayed when a given menu is selected. For example, if you dial up Squelch Threshold menu item and change it to show “25”, the next time you access this menu item it will still show as “25”, thus allowing you to always see the current setting before (possibly) changing it.

Another way to see a full “status display” of current settings is to press the F12 key. This function shows the current value for each of the changeable settings: Mode, Squelch, CwID, Backlight and PGA. This is a convenient way to determine at a quick glance how your modem is currently configured.

Once a change is made in Config mode, the display shows “Exit” as a prompt for you to tap the Select button to get out of Config mode, and once you exit that change will be effect as long as the modem has power applied. However, you have an opportunity to save any changed Configuration settings to nonvolatile memory such that those new settings will be in effect the next time you power up the modem. Just turn the Tune dial one position counterclockwise and see the option for “Save Config”. Tapping Select at this point will save the current settings to EEPROM and they will be loaded and put into effect when you next turn on the modem.

See a useful list of available menus and hot key assignments on the next page, along with a sample usage scenario for saving data to the USB device.

Hot Keys

- F1 to F7** Play Macros
- Ctrl-Fn** Record Macros-- Enter keystrokes.
Ctrl-Z to conclude entry.
- Alt-Fn** Delete Macro associated with Fn.
- F8** Toggle TUNE mode on/off. Accessible only in RX or TX. (Not in Setup, or Macro Recording.)
- Shft-F9** Turn on Beacon Mode. 'BCN' displayed.
- Alt-F9** Turn off Beacon Mode.
- F10** Toggle between RX and TX (but not in Setup, or Macro Recording)
- F11** Display "MyCall" EEPROM.
- F12** Toggle on/off a display of modem's current settings.
- Ctrl-M** Record "MyCall" into EEPROM.
Ctrl-Z to conclude entry.
- Ctrl-T** Record "TheirCall" into RAM.
Ctrl-Z to conclude entry.
- Alt-M** Insert "MyCall" into a Macro.
- Alt-T** Insert "TheirCall" into a Macro.
- Ctrl-F** Save the current frequency into EEPROM so that it can be restored at the next power-up.
- Alt-F** Retrieve the saved frequency and makes it the current frequency.
- Ctrl-Tab** Displays the current frequency (audio)
- Ctrl-A** Enable AFC (Automatic Frequency Control)
- Alt-A** Disable AFC (Automatic Frequency Control)
- PgUp** Increase input gain.
- PgDn** Decrease input gain.
- Ctrl-L** Clear the text area of the LCD
- Ctrl-K** Clear the keyboard buffer. (While receiving, keystrokes are not displayed—this allows clearing the buffer, so that call signs may be entered, or re-entered in case you think that you have entered the wrong call sign)
- Ctrl-B** Clear the internal buffers
- Ctrl-Q** Inserts a TX-OFF control character in the TX buffer or Macro. (Toggles back to Rx mode when encountered in the string being transmitted.)
- Ctrl-S** Inserts a TX-ON control character in the Tx buffer or macro.
- Ctrl-O** Toggles the display backlight on and off.

Spectrum Cursor Tuning Rates

Left: 1x: Left Arrow 2x: Down Arrow 5x: ALT+Left Arrow 10x: ALT+Down Arrow
Right: 1x: Right Arrow 2x: Up Arrow 5x: ALT+Right Arrow 10x: ALT+Up Arrow

USB-Related Hot Keys

Ctrl-U: Toggle REC mode on/off. REC displayed on right edge of display. Mode aborted if no flash device present in connector. If USB card not detected within 5 seconds, piezo beeped mode aborted.

Ctrl-N: Enter name for USB file to be recorded. Ctrl-Z concludes entry. Standard 8.3 file names accepted. (E.g., "FD2008-2.txt")

Ctrl-I: Insert text into recording file. Ctrl-Z to conclude entry. The USB file must already be open (Ctrl-U) for this to work. The recording file remains open for additional Rx or Tx text, until Ctrl-U pressed again to close the recording file.

Example Usage of Recording to USB Device

- 1) Power up modem (flash mem device not inserted)
- 2) Enter filename for file to be recorded ...
Ctrl-N FieldDay.txt Ctrl-Z
- 3) Turn on REC mode to begin recording
Ctrl-U
and see the USB LED blink fast.
- 4) Insert block of free form text to Flash filename ...
Ctrl-I Field Day 2008 QSO recordings Ctrl-Z
- 5) Tune around and find a station to call
- 6) Enter Tx mode per usual (F10) to call. Entered text is recorded to USB filename.
- 7) Enter Rx mode per usual (F10) to receive. Receive text is recorded to USB filename.
- 8) Insert free form text to USB file ...
Ctrl-I Time ending QSO is 2130 hrs. Ctrl-Z
- 9) Close USB file recording session ...
Ctrl-U
and see the USB LED stop blinking and go solid on.
- 10) Remove Flash memory device for remote viewing, archival or printing.

10) Updating Modem Software

Increasingly today, microcontrolled projects have an ability to be “field updated” with new features and software updates made available by the designers. So instead of needing to send your modem back for re-programming to get these new capabilities and bug fixes, you can simply download the latest-and-greatest software from the Internet and send it to the modem and the hardware automatically updates its internal memory with the new program. What a great way to keep your project completely up to date with the latest features!

Three methods are available to perform this field updating of the software:

- a) **External Serial Adapter between Modem and PC** – With this method you just need to connect your PC serial port to the modem using a simple adapter, and send it the new software obtained from the NUE-PSK website whenever new capabilities are made available. We designed a TTL serial port into the modem, accessible via a 4-pin connector P4 located inside the battery compartment. Just connect your computer’s USB port to an inexpensive USB-to-TTL adapter such as the CP2102 from SparkFun⁹, plug it into P4 and run the Modem Loader program on the PC. Then pressing the Select button when turning the modem on will initiate the bootload sequence to “burn” the new software into the modem’s controller. Once you power-cycle the modem, you’ll be running the latest software release containing, for example, a new digital mode, some new I/O capabilities, and so on. This is really quite a convenient and powerful capability for the project.



Photo 10: CP2102 USB-to-TTL interface from SparkFun

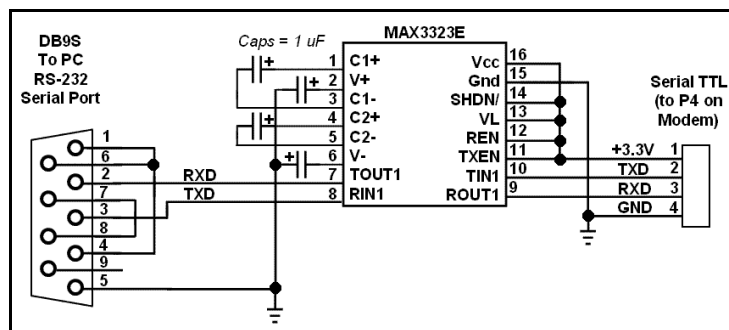


Figure 5: Schematic of an easy RS-232 interface to the NUE-PSK Digital Modem

- b) **PC Bootload using optional internal USB Card** – Connect the modem to a USB port on the PC using an A/B USB cable and upgrade the modem software from the PC in the same manner as with the external serial adapter. Just dial up this function in the Select menu, activate the same “prog” program on your PC as before, and watch your modem software get upgraded.
- c) **Flash Bootload using optional internal USB card** – Use a USB flash “thumb” drive to load new software into the modem, thus eliminating any need for cable connection to the PC. See the USB section for details.

Loading New Software using an External Serial Adapter

In general, the process is simply to power up the modem in a special way with the serial adapter connected, and then run a program called **prog** on your PC.

***Important ...** If you haven't yet proved out your serial adapter connection between your PC and modem, you should first follow the steps outlined on the web page [Serial Interface Checkout \(http://www.nue-psk.com/serial_interface\)](http://www.nue-psk.com/serial_interface). If you cannot do the operation specified there, you will not be successful trying to load new software into the modem.*

First, you'll need to "get ready" by first doing a couple of things ...

1) Determine the COM port number of your USB or RS-232 serial port -- You can find this out by clicking START and then right-clicking My Computer. Select Properties and then the Hardware tab. Click Device Manager and find the Ports line item in the list. Expand that line item and see that the Communications Port will have a COM number shown. That is the serial COM port number that you'll use.

2) Get the PROG program onto your local computer -- You can download prog from http://www.nue-psk.com/serial_interface/prog.exe. Save the file in a convenient place, like at the root of your C drive. (When your computer prompts for the save location, enter C:\)

3) Download the latest modem software to your computer -- Download the software file **modem1_30c1FP.zip** from [http://www.nue-psk.com/software/modem1_34\(modem\).zip](http://www.nue-psk.com/software/modem1_34(modem).zip), unzip the file, and place it in the same location as you did the prog program above.

Now that you are ready, next perform the following steps to connect the PC to your modem using your serial port ...

4) Connect the serial interface between the NUE-PSK modem programming port and the PC -- You will typically need to connect your serial adapter to a serial port cable that is plugged into your computer, and then connect the adapter to the 4-position "Field Programming" pinheader (P4) located on the bottom side of the modem pc board, as accessed from the battery compartment.

5) Open a Command Window on the PC -- You can bring up this window by clicking in START, Run ... and enter Command. Navigate to where you saved the prog.exe program. If this was at the root of the C drive, just enter CD \ .

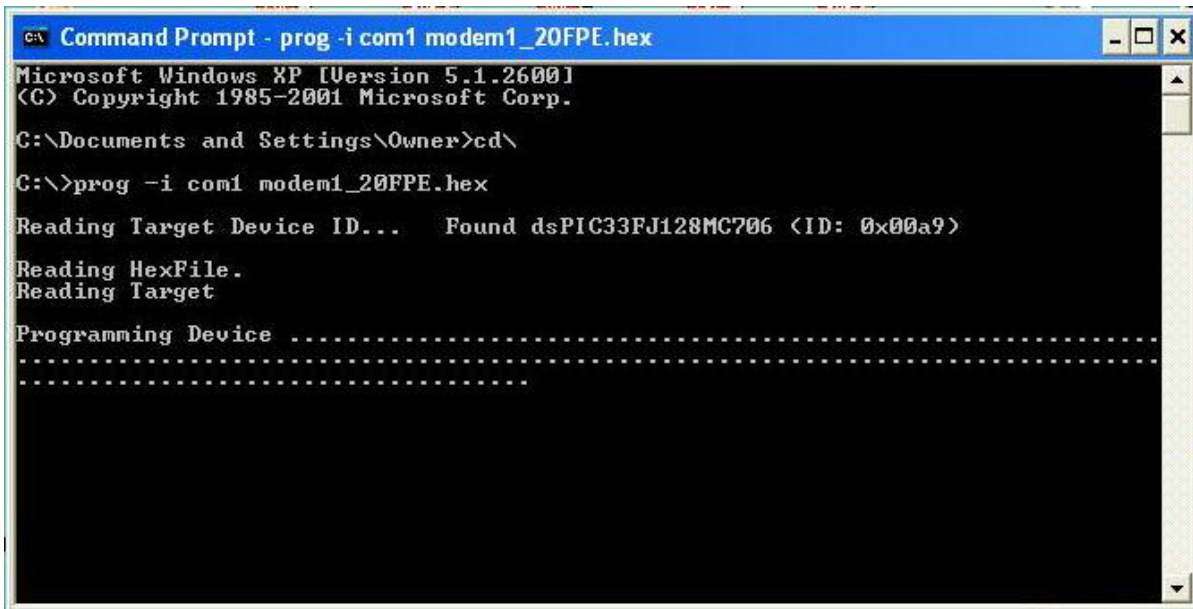
6) Enter command to run the "prog" program -- From the prompt inside the Command Prompt window, type the following command line ... **but do not yet press <Enter>**. For example, on my system that uses COM1 serial port, I would type

```
prog -i com1 modem1_34(modem).hex
```

7) Power up the modem in a special way -- Hold down the "Select" button on the Modem, while turning on the power switch. This commands the modem to look to the serial port for about 10 seconds before it continues powering on normally. Then quickly, within these 10 seconds of turning on the modem, press the "Enter" key on the PC keyboard to execute the command you previously entered.

8) See the PC screen start displaying the downloading indicators -- See the PC screen show a series of "periods" as the software gets downloaded to the modem and burned into flash. You will see about 3 rows of the periods and then it will stop. At that point the modem

will automatically restart and you'll see the splash screen display the new version number "1.34d".



```
Command Prompt - prog -i com1 modem1_20FPE.hex
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.

C:\Documents and Settings\Owner>cd\
C:\>prog -i com1 modem1_20FPE.hex

Reading Target Device ID... Found dsPIC33FJ128MC706 (ID: 0x00a9)
Reading HexFile.
Reading Target

Programming Device .....
.....
```

(NOTE: This screenshot shows the command line for loading version 1.20 software. The sequence is the same for all version numbers, but instead using the filename of the latest software version.)

11) Capabilities and usage of the optional internal USB Card

Three major features are enabled by having the USB card installed: **REC mode**, **Flash Bootload**, and **PC Bootload**. These features are very powerful and will greatly enhance your digital modem experience.

Software v1.33c (or later) must be loaded for these features to work as described ... **and** you must have firmware "C01" loaded on your USB card. See the USB web page for instructions on loading C01 firmware if you constructed the USB card from a kit.

=====

a) **REC MODE** -- Recording QSOs to a USB flash memory device

Insert a USB flash memory device into the modem connector. The LED on the side of the modem will come on.

Type **Ctrl-U** on the modem keyboard to place the modem into RECORD mode. You will see "REC" displayed on the right side of the modem display and the LED on the USB port will start blinking rapidly, indicating that it is ready to receive any text that you may type in Tx mode or any text that is coming across the LCD in Rx mode. (Note: If the USB card is not in place, or not working, the REC will be shown briefly on the display and a beep will be sounded by the modem to indicate that an error condition is present.)

Assuming things are working (no beep and the LED blinking rapidly), place the modem into **Tx mode (press F10)** and start typing some text. You do not need to be connected to your transceiver to try this out. You will see the text displayed on

the modem LCD of course, but it is also being simultaneously written to your USB flash device.

Type **Ctrl-U** again to stop the REC mode and you will see the USB port LED stop blinking and remain on continuously.

Remove the USB device and plug it into your computer. You will notice a new file on the stick called **NUE-PSK.TXT**. If you open this file you will see the text that you typed while in Tx mode, and any other text that might have been displayed while in Rx mode.

As summarized on the Command Reference sheet, two other USB-related features are available to you. One is that you may specify **your own unique filename** for the data being recorded to the USB device while plugged into the modem. **Before** turning on REC mode (**CTRL-U**), you may type **CTRL-N** and you will be prompted at the top of the modem display to enter a filename. Give it any standard 8.3 format filename that is useful to you. (8.3 is 8 characters followed by a period and 3 more characters as an extension, like "Test1234.txt".) Don't forget to use **CTRL-Z** key to end this entry.)

The other USB-related feature is that you may **Insert your own text** into the data stream being recorded to your USB flash device. For example, after getting into REC mode (**CTRL-U**) but before starting up a QSO, you might wish to enter the current date, time or operator name in order to have a better record of the QSO downstream. To do this, type **CTRL-I** and you will be prompted at the top of the screen to enter this "offline" text. Don't forget to end your entry with a **CTRL-Z** in order to return back to Tx or Rx mode. Remember, what you enter in this Insert mode is **not** transmitted, but it is only text that is inserted into the stream of data going to your USB flash memory device.

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FLASH BOOTLOAD -- Loads new modem software from a flash device

This feature allows you to upgrade your modem software from a file placed onto a USB thumb drive. Just the latest version of the modem software (in a special format, named mem.dat) onto your USB drive, as downloaded from the NUE-PSK website. This file may then be easily programmed into the processor of your modem. Thus, you no longer need to use a serial adapter to upgrade your modem software!

- 1)** Download the modem software **mem(1.34d).zip** to your computer and unzip it to form the file called **mem.dat**, and then copy the **mem.dat** file to your thumb drive.
- 2)** Insert the USB drive into the modem and select the Flash Bootload function in the modem menu within the Select pushbutton items list. (Hold the Select pushbutton down for more than 1/2 second and turn the dial counterclockwise until Flash Bootload is displayed.)
- 3)** Press the Select pushbutton and see "Abort" displayed beneath Flash Bootload. Turn the dial one notch to see "Start Bootload" displayed.

4) Ensure that your USB drive is inserted and then **TAP** the Select pushbutton. You will note some blinking of the LED on the USB drive itself (if it has an LED), and in about 15 seconds the modem will reboot and start up the software version just loaded.

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PC BOOTLOAD -- Loads new modem software from a flash device

This feature allows you to load a new version of a software hex file onto your modem from your PC, much in the same way as you did previously when using a serial adapter.

1) Download from the modem website the software you wish to load into your modem, for example **modem1_34d(modem).hex**, and then connect your modem to the USB port on your PC. You will use a suitable cable that plugs into the square USB jack on the modem and into the rectangular USB jack on the PC. When you plug in both ends of the cable, the computer will recognize the USB port

2) Ready your PC in the same fashion as done previously when using the separate serial adapter. Bringing up a Command Prompt window on the PC, navigating to the location where the PROG program and your modem software hex file reside (the root of the C: drive is convenient) and type: **prog -i com5 modem1_34d(modem).hex** where the COM port number is that used by your PC for the USB ports. Do not hit <Enter> yet until you have readied the modem side of the connection.

3) Select the PC Bootload function in the modem menu underneath the Select pushbutton. (Hold the Select pushbutton down for more than 1/2 second and turn the dial counterclockwise until Flash Bootload is displayed.)

4) Press the Select pushbutton and see "Abort" displayed beneath PC Bootload. Turn the dial one notch to see "Start Bootload" displayed.

5) **PRESS_AND_HOLD** the Select pushbutton, and while still pressing the pushbutton, hit the <Enter> key on the PC keyboard to run the PROG program. You will see the standard series of about 100 dots appear on the PC screen to signify the program download process. When the dots stop appearing, the modem will reset and the new software will be running.

NOTE 1: You will need to have the FTDI USB driver installed on your PC before attempting to use this PC Bootload feature. To install the driver, download the driver installation zip file from:

www.nue-psk.com/software/CDM%202.04.06%20WHQL%20Certified.zip

and expand it onto a temporary file on your PC, and then plug in the cable from your modem. With the modem power turned on, the PC will recognize that a new USB device is plugged in and Device Found Wizard will pop to lead you through the process of installing the new driver. At the appropriate point indicate that you wish to specify that that PC searches for the driver at the location you have the temporary folder. When the PC indicates that the device is successfully installed, you can use the PC Bootload feature. **NOTE:** If you need help with this process, you can

download and study the FDTI application note called "AN232R-03 Driver Pre-Installation Document", located at:

http://www.nue-psk.com/usb/AN232R-03_DriverPreInstallation.pdf

CAUTION: If you mistakenly use this PC Bootload feature to "update" your modem with software version prior to v1.33c, you will lose the ability to "come back" to the latest release because software prior to v1.33c does not have the PC Bootload feature. So if this happens you would need to revert to the original (old) way of upgrading modem software through use of the external serial adapter. Be careful of what you load!

12) Tips & Techniques, and "Things to Watch Out For"

Here is a useful section that will undoubtedly grow in length over time. Please be sure to often check the NUE-PSK website for the latest online information.

- a) **Signal Level** – Setting the right drive level to your SSB rig is essential to success when operating the PSK31 mode. Please be sure to read the corresponding section on the NUE-PSK website containing lots of tips on this topic.
- b) **Inserting Plugs to the Modem** – You will want to be sure that you fully insert the Radio and Keyboard plugs into the connectors on the modem. Failure to do so could well result in unusual, intermittent or "noisy signal" symptoms during usage. When inserting, be sure to press firmly in the direction of insertion – do not "wobble the plug while inserting. Same for unplugging – just pull it back firmly. (Care in this area will save the life of the connectors on the modem.)
- c) **Tap-Hold to Select Config** – As described elsewhere in this manual, you can get into the Configuration menu in order to make various settings in your modem. Config is entered by a press-and-hold of the Select pushbutton ... just press the pushbutton for about one second (say "one one thousand") and release it to see the options that you can further select by rotating the Tune control. You can select any other operation or menu selection merely with a quick tap of Select.
- d) **Tx Audio Level Setting** – This menu selection in Config will show you the relative position of the mini-pot used for the control on the top of the modem. The control currently ranges from 0%-to-26%, or -60%, -125% or even -160%, etc. Don't worry about the specific number at this time; we will make the readings more consistent from unit-to-unit in a future software release.
- e) **Spectrum Artifacts** – When viewing a moderately-strong signal at the midscale point on the modem's LCD spectrum (which corresponds to 1500 Hz), "noise" will also be seen on the far right and far left ends of the spectrum display. This is common and is an artifact of the DSP process of the signal, and it will occur even when viewing received signals a bit below or above the spectrum midpoint.
- f) **How We Tested the Modem (in part)** – Some might find this info helpful in testing their own modems. We had direct audio connections to a laptop running Digipan, with the audio in/out cables connected to the soundcard headphone/mic connectors, respectively. We then commanded the modem to transmit at 1500 Hz and viewed the classic two-tone "railroad track" signal on the Digipan waterfall display. Ensuring that the Digipan frequency (i.e., the red diamond) was

centered on the tracks to ensure we were tuned to the modem's signal, we adjusted the Tx Audio level control fully counterclockwise to generate no signal, then increased it slowly in a clockwise direction while viewing the IMD reading on the Digipan window. We stopped turning the control when the IMD reading got to a -54 dB level, after which turning it further has no more effect. We found this level to be an ideal setting of the Tx Audio level delivered by the modem. Characters typed on the modem keyboard could then be seen on the Digipan receive window. We then turned the channel around (i.e., set Digipan to Tx and the modem to Rx), and saw in the modem display the characters typed into Digipan. [Note, you should follow the adjustment procedure elsewhere in this manual when connected to a radio.]

13) Technical Support

In case of questions or problems, feel free to send an email with your comments to us at support@nue-psk.com.

Be sure to also check the NUE-PSK website at www.nue-psk.com for the latest information, software availability and tips & techniques to make your digital mode operating experience enjoyable. This printed manual will be updated frequently with corrections and new capabilities presented in the current software, so be sure to always check out the website.

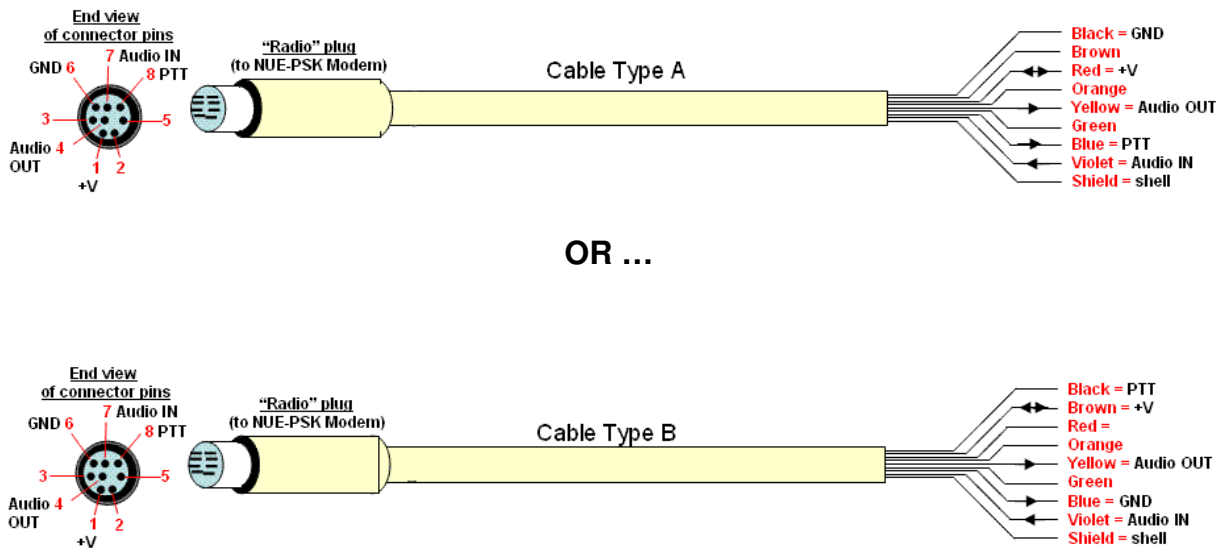
Another great source of information and camaraderie with fellow owners of the digital modem is the **NUE-PSK email reflector** on Yahoo Groups. If not already signed up for this great communication forum, go to www.yahogroups.com and search for the group called NUE-PSK. You can view all the messages posted there, and if you join (for free!), you will be able to post questions and comments yourself, as well as access the files in the group.

Appendix A: The Radio Cable

This diagram represents what is shipped with your NUE-PSK modem. Since the modem can interface with literally hundreds of different SSB transceivers, it will be necessary for you to connect the “unfinished end” of the Radio cable to properly interface with your specific radio. Once you have the proper connector in hand for your radio, the task is simple – just use the signal names and wire colors here as a guide to get the PTT signal and audio tones to your rig.

The cable supplied with the modem has color-coded wires on one end, either as shown in Figure A or in Figure B below. You will need to determine which type you have before attaching the connector required for the data connection to your specific radio.

You can easily determine which cable type you have by using a VOM to check for continuity from pin 8 on the molded Radio plug to the blue wire on the other end of the cable. If there is continuity, you have Cable Type A. Otherwise, with pin 8 continuity to the black wire, you have Cable Type B



To help owners get on the air as quickly as possible with their new modems, we have pre-fab cables, supporting over 50 popular transceiver models, available for purchase from the NUE-PSK website. See www.nue-psk.com for details.

Appendix B: Schematic

