

## Steps for bringing up a D-Star Node Adapter and Hot Spot

March 12, 2009 by Scott Currie, NS7C

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This document will assist new users who are bringing up a D-Star Node Adapter (by Satoshi Yasuda, 7M3TJZ) for the first time. Satoshi and others have done a great job innovating the hardware, firmware and software on the node adapter, however, the node adapter should not be considered a production “kit” or a “plug and play” device. Be prepared to experiment, test and adjust to get it working. This document will be updated over time and will help new users avoid making some of the common mistakes. Please send corrections and additions to ns7c@arrl.net.

First, join the gmsk\_dv\_node · D-STAR GMSK Simplex Nodes and Repeaters group on yahoo, and get the latest version of this document from the files area:

**[http://groups.yahoo.com/group/gmsk\\_dv\\_node/](http://groups.yahoo.com/group/gmsk_dv_node/)**

Then read this complete document before starting!

**Note:** This document does not cover the repeater option of the node adapter (the option PIC and associated parts); however, the current version of the D-STAR Hot Spot software implements repeater operation without the need for the option PIC. The option PIC is **only** required for a stand-alone repeater configuration (no PC connection), and **does not** support connection to the Internet.

### **Hardware Needed:**

Node Adapter board from Satoshi Yasuda:

Order information available at

**<http://d-star.dyndns.org/>**

**NOTE:** Satoshi no longer supports his version 1 and 2 Node Adapter boards. You can no longer order, obtain technical information or download firmware updates for these boards (see information on firmware below). Satoshi is working on a new version board and new firmware which will have some sort of copy protection included based on a call sign and password. Information is available at his site listed above.

Clone boards of the original design are available from two alternate sources:

**<http://www.dutch-star.nl>**

**<http://www.g7lft.com/hotspot/>**

These sites provide technical information, restrictions and ordering information.

Parts list with Mouser part numbers:

Parts lists for both the Satoshi boards and the clones are available on the yahoo group.

**[http://groups.yahoo.com/group/gmsk\\_dv\\_node/files/Parts%20info%2C%20lists%2C%20etc./](http://groups.yahoo.com/group/gmsk_dv_node/files/Parts%20info%2C%20lists%2C%20etc./)**

### PIC Programmer:

The PIC processors for the node adapter must be programmed with the operational firmware. Pre-programmed PICs can no longer be ordered. Those who enjoy building things from scratch can build a “JDM” circuit to program the PICs. A google search should provide several versions to choose from.

Another option is to purchase a PIC programmer like the PicKit2 from Microchip. This kit is available from Mouser for about \$34 US, and includes the software. An adapter cable is needed to use this programmer with the node adapter because the connections to the board do not match the connections on the programmer. This may not be needed on the clone boards. The connections are as follows:

Node Adapter CN2/CN4	PicKit2
1	1
2	4 PCD
3	5 PGC
4 External Vdd	N/C
5	3 Ground
N/C	6

### Software/Firmware Needed:

Firmware: The most current “stable” firmware for the main PIC is v04.48.1L and delay.00.10 for the option PIC. As noted earlier, these files are no longer available for download from Satoshi. Copies of the firmware can be found on the Internet, and are also being freely shared by current users, however, the firmware is copyrighted by Satoshi and he has not granted a general use license. Proceed at your own risk.

Utility programs: Satoshi has provided several utility and test programs to check out the node adapter (also no longer available for download). These are the programs needed for check out:

This program displays the hex output from decoded signals on the screen.

***rf\_read.exe***

This program displays the raw data stream from received signals on the screen.

***rf\_debug.exe***

This program will record a test transmission received by the node adapter, and then transmit it back.

***echotest.exe***

This program is used to invert the transmit polarity of the node adapter, which is required by some transmitters. Receive polarity is automatically detected and corrected by firmware.

***Invertset.exe***

This is the Windows device driver for the node adapter.

USB Device driver: <http://sourceforge.net/projects/libusb-win32/files/>

This is the programming software used with the JDM type programmer.

WinPic800: <http://www.winpic800.com/index.php?lang=en>

D-STAR Hotspot: The latest hotspot software is available in the files area of the yahoo group: [http://groups.yahoo.com/group/gmsk\\_dv\\_node/files/D-STAR%20Hot%20Spot/](http://groups.yahoo.com/group/gmsk_dv_node/files/D-STAR%20Hot%20Spot/)

**Assembly and Initial Testing:**

These notes were written based on the original Satoshi Node Adapter boards, but most will also apply to the clone boards though component identification numbers, etc may be different. If you are building one of the clone boards, be sure to check out the technical notes available on their associated web sites to determine the differences.

Once the board and all the parts have been received, use the circuit diagram and parts layout to assemble the board. The boards are high quality and the layout is not crowded, so there is no particular order to parts installation. All the active components on the node adapter are sensitive to, and can be destroyed by electrostatic discharge. Care should be exercised when handling these devices to prevent ESD damage. Review all work and be sure all components are installed correctly and that there are no cold or bridged solder joints.

Install R16 (1M) on the bottom of the board (Satoshi board only) between pins 13 and 14 of U1. To prevent component and/or computer damage, it is important to test the power bus on the node adaptor before installing the integrated circuits or connecting to a USB port. To complete this test, leave the PIC, modem and op amp chips off the board and connect the node adapter to a USB type "charger", then check for +5v at the following pins:

U1: 24, 3, 4, 17

U2: 20, 2

U3: 8

If the voltage is present and correct, it should be safe to install the chips and connect the node adapter to a computer. If the voltage is missing or incorrect, review the assembly work again. DO NOT proceed until this has been corrected!

**PIC Programming:**

Before connecting the node adapter to a computer, the main PIC processor must be programmed.

### Using the JDM programmer:

Download and install WinPic800 (from the link above), and set the following options in the program:

- Under Hardware settings, select “JDM Programmer” and point to the appropriate COM port
- Under Software settings, Device tab, check “Using Auto Selection Device” and “Detect and select device at startup”, then under the HEX tab, uncheck both options
- Other default settings should be okay, so click Accept and then close the program
- Connect the programmer to the computer COM port and to CN2 on the node adapter. Do not connect the USB port at this time
- Launch WinPic800, it should detect the programmer and correctly identify the pic as a 18F2550
- Pull down File, then Open, and select the HEX file downloaded from the link above
- Now pull down Device and select Program All. The progress window will step through the process of programming the pic, ending with a green success bar. If it fails, check the board connections, COM port, and power source to the programmer (which should be about 15V)
- If programming is successful, run Device, Verify All to make sure the read back matches the HEX file
- Disconnect the programmer

### Using the PicKit2 programmer:

Follow the manufacture’s instructions. Perhaps someone can provide details to be include here.

### Windows Driver Installation:

Unpack the USB driver archive downloaded from the link above, and make note of the location of the unpacked files, especially the Bin directory. Connect the node adapter to an available USB port on a computer. Windows should detect the new device and identify it as a "D-STAR Interface V03.00" and then start the device driver installation wizard. Point the wizard to the Bin directory for the driver files, Windows should find the .INF file and correctly install the device driver. Verify the driver is working correctly by checking the Device Manager under System Properties and look for LibUSB-Win32 Devices. The node adapter should be listed there. Double click this line and Windows should indicate that the device is working correctly.

### Radio connections and check out:

Check the Radio Files in the files area of the yahoo group for instructions on radio models that have already been tested with the node adapter. For radios that are not listed, the following connections in the radio will need to be identified and an appropriate cable created to connect to the node adapter:

CN1 Pin 1: Transmit data, connects to the radio modulator input

CN1 Pin 2: Ground

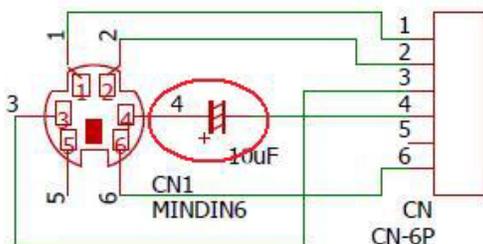
CN1 Pin 3: PTT, connects to the radio PTT line, and is low active

CN1 Pin 4: Receive data, connects to the radio discriminator output

CN1 Pin 5: Not used

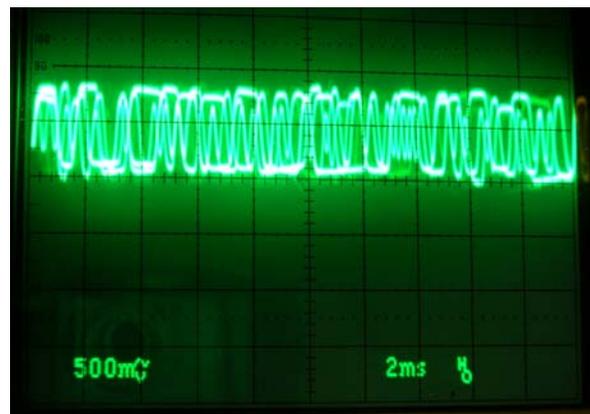
CN1 Pin 6: Carrier operated switch (COS), connects to the receiver squelch circuit and provides an open squelch indication to the node adapter (jumper selectable either high or low active).

These connections are most easily made to the 9600 baud packet TNC/Data port on the radio, if such a facility is available. (Check the owners manual for details.



This may also require changing menu settings to "9600" packet or something similar.) If there is no data port, review the radio schematic to find these connection points in the radio. A google search for "9600 packet" and the radio model might provide the information needed for these connections. Keep in mind the need to

bypass DC offset voltages on the TXD and RXD lines, typically with a 10uF capacitor. It may also be necessary to attenuate one or both of these signals to and from the node adapter. VR1 (RXD) and VR2 (TXD) on the node adapter adjust these levels. If appropriate test equipment is available, adjust the RXD level for about 0.8-1.0V P-P measured at U1 pin 10, and adjust the TXD level for a transmit deviation of about +/- 2.5KHz.



Set the jumpers on the node adapter as follows:  
SW4-SW6: all set to pins 1+2 (or away from the option area)  
SW1: on for open collector COS and a pull-up resistor is needed  
SW1: off for non-open collector COS, or pull-up resistor not required  
SW2: on for non-open collector COS, active high  
SW3: 1+2 for active low COS, 2+3 for active high COS

Once the radio connections have been completed, connect the node adapter USB cable, and observe LED 1 for proper indication of COS. The LED should light when the receiver squelch is opened. On the computer, open a Command Prompt and run the rf\_read program (CTRL-C ends this program). The program should identify the node adapter and indicate the firmware level:

```
C:\>rf_read
D-STAR Interface V04.48 7M3TJZ/AD6GZ
```

Using a DV capable test transceiver, send a few short transmissions. If they are decoded correctly by the node adapter, rf\_read will display the received call sign data followed by the HEX data from the DV stream (and the ASCII translation):

```
Flags : 00 00 00
RPT2 : DIRECT      RPT1 : DIRECT
YuCall : CQCQCQ
MyCall : NS7C      MyCall12: 92AD
CRC    : 6c c2
```

```
DV STREAM
c7 0e ae 62 18 99 8f a5 dd 55 2d 16      25 62 85 % b ...
6b cd 0c 8b 3d 0d af 57 fe 30 07 fa      40 48 69 @ H i
5b cd 06 bb ad c7 93 e4 7e 50 29 e1      20 66 72  f r
a7 ed 26 3b 8c 14 db 00 e5 31 20 fe      41 6f 6d A o m
80 81 b6 81 5c 06 e7 c0 a8 50 1c f0      20 53 63  S c
ac e1 34 89 cc 4e db 33 e4 32 20 e7      42 6f 74 B o t

aa 27 92 10 cf 9a e6 c2 fb 04 6f b3      74 20 20 t
be 07 12 08 2c 9c f6 10 3f 33 6f b3      43 20 20 C
df 00 1a b3 4e d5 d6 56 e3 50 6f b3      20 20 20
```

If this information is not displayed, the node adapter was not able to decode the received data. Try adjusting VR1 in small increments and re-try the test until decode is successful. If proper decode can not be obtained through adjustment of VR1, it is likely that the received signal on the RXD line is outside the adjustment range of the node adapter. It will be necessary to change component values on the node adapter, or in the radio (or radio cable) to achieve an acceptable range. Use an oscilloscope or other test equipment to analyze the RXD line and pin 10 of U1 to determine the corrective actions.

Once the node adapter is decoding received data, transmission testing can begin. If a service monitor or deviation meter are not available, an additional FM test receiver will be helpful for setting the transmit levels.

Connect the node adapter transmitter to a suitable dummy load. At the computer command prompt, run the echotest program (CTRL-C ends this program). This program will also display the node adapter version:

```
C:\>echotest
DV Echo Test program V00.01 Satoshi Yasuda
PIC version: D-STAR Interface V04.48 7M3TJZ/AD6GZ
```

Send another brief test transmission from the test transceiver, including some audio. Echotest will display the call sign information and record the DV stream. At the end of the transmission, the node adapter will transmit a test message followed by the recorded DV stream. You can repeat this over and over until you end echotest.

If this transmission is decoded by the test transceiver, the transmit polarity is correct and the transmit level is in an acceptable range.

If it is not decoded, compare the signal levels of the test transceiver and the node adapter transceiver on the FM receiver. If the level of the node adapter transceiver is much higher or lower than the test transceiver, adjust VR2 until they sound about the same. If a good level cannot be obtained, component values in the TXD line of the node adapter or the radio will have to be changed to achieve an acceptable range. Use an oscilloscope, service monitor or other test equipment to analyze the TXD line and transmit deviation to determine the corrective actions.

If the transmit level is correct, but transmissions are still not decoded by the test transceiver, the transmit polarity may be inverted. At the computer command prompt, run the invertset command as follows: *invertset tx:on* (invertset tx:off will switch it the other way). Run echotest again and check for proper decode of transmissions from the node adapter. Note, if inversion is required, remember to re-run invertset after loading new firmware.

### **HotSpot Installation:**

Download and unpack the Hotspot software archive from the link above. Run the setup program included in the archive and follow the instructions on the screen to install the application. Detailed set up and operations instructions are available at the following link:

***<http://w9arp.com/hotspot/>***