

X-DIGI TNC-X Digipeater Daughter Board

Assembly, Configuration, and Operating Instructions Version 3.1

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X-Digi is a daughter board for the TNC-X KISS mode TNC. It is designed to emulate the most popular features of the widely used UI-DIGI EEPROM for TNC-2's. In addition, X-Digi provides digipeater services for both UI APRS frames and for connected packets. It makes it easy to put up a temporary digipeater to fill in coverage "holes" in emergency situations. It consumes very little current. Both TNC-X and X-Digi can be powered all day on a single 9 volt battery. It can be configured in the field through the TNC-X USB port using any computer with any terminal program.

Assembly Instructions

The kit is supplied with the following parts. Please verify that all parts are included before proceeding:

- | | |
|--------------------------------|-----------------------------|
| 1. Printed Circuit Board | 5. Programmed 18F2525 (IC1) |
| 2. .1 uf Capacitor (C3) | 6. 28 Pin IC Socket |
| 3. 10 MHz Crystal (PAD 1) | 7. 8 PIN SIP Socket (6. J1) |
| 4. 2- 22pf Capacitors (C1, C2) | 8. Two jumpers |
| 5. 7 x 2 pin header. | |

Installation of the parts is pretty straightforward. Note the following:

- 1. The 8 pin SIP Socket should be installed on the BOTTOM of the PC board. This enables it to be plugged into the 8 pin header on the TNC-X.**
- 2. Make sure that the IC socket and IC are both installed with the notch as indicated on the PC board.**
- 3. The following parts are referenced on the circuit board, but are not part of the XDigi kit: LED1, R1, JP1. No parts should be installed in these locations.**

Configuration Instructions

The X-Digi Daughter Board is configured via the standard TNC-X USB port or serial port. To configure the X-Digi, set the 14 pin jumper block up as follows:

Corner of



board =>

To configure the X-Digi, you will need to run a terminal program on the PC that you have connected to the TNC-X serial or USB port (or serial port). I use TeraTerm, but any plain vanilla terminal program will work. Start with the X-Digi board not installed on the TNC-X. Remove both jumpers from JP5 (the 8 pin header). Make sure that JP3 is set for the USB setting if you are using the USB port (toward the center of the PC board) or toward the edge of the board if you are using the serial port.

Connect your USB cable (or power cable if you are using the serial port) and you should see the green LED on the TNC-X come on. Then run your terminal program. Make sure the terminal program is set for 9600 baud and no flow control. Now install the X-Digi. The X-Digi board should be installed with header JP2 toward the back of the TNC. Make sure the 8 pins on the TNC-X align with the 8 pins on the socket of the X-Digi board. Press any key on the keyboard of the computer attached to the TNC. You should see the following menu:

X-Digi Ver 3.1 Configuration Menu

```

C.   Set Digipeater Callsign.      :URCALL
A.   Set Digipeater Alias.        :URDIGI
F.   Set UIFlood Callsign.        :NY
L.   Set UIFlood Limit.           :7
T.   Set UITrace Callsign.        :WIDE
M.   Set UITrace Limit.           :4
1.   Set UICall 1.                :
2.   Set UICall 2.                :
3.   Set UICall 3.                :
4.   Set UICall 4.                :
5.   Set UICall 5.                :
6.   Set UICall 6.                :
7.   Set UICall 7.                :
8.   Set UICall 8.                :

D.   Set Dupe Time (x5 secs).     :6
P.   Set Remote Password.        :
B.   Set Beacons.
X.   Edit Blocklist.
Q.   Quit.

```

Enter Selection:

If no menu appears, remove the X-Digi board and reinstall it. It may take several tries before the menu appears.

Choose the item you wish to reconfigure by pressing the letter or number in the left hand column. The Callsign and Alias are fairly straight forward, but some of the other parameters may require explanation. The UIFlood callsign supports the WIDEn-N paradigm. When the digi receives a packet with a path of, say **WIDE3-3**, it will decrement the SSID value (to **WIDE3-2**) and retransmit the packet.

When it reaches WIDE3-0, it will replace this value with the X-Digi's callsign. UITrace works in a similar manner, but adds X-Digi's callsign to the path. So, for example, **WIDE3-3** becomes **URCALL, WIDE3-2** in the above example. The limits for UIFlood and UITrace are provided to allow the X-Digi to stop overly long paths. In the above case the UITrace limit is set to 3, so an incoming path of **WIDE4-4**, for example, would be simply be digipeated as **URCALL**. The UICall fields allow you to specify up to 8 calls for which X-Digi will simply do callsign substitution.

For example, if you wanted to support **RELAY** (not currently recommended) you could do so by adding this value in UICALL. Packets with a path of **RELAY** would be digipeated with a path of **URCALL**. The menu also allows you to specify a dupe time value in 5 second intervals. Duplicates are calculated based on a CRC that is applied to the entire packet except for the path. So if X-Digi sees a packet with the same source and destination address and the same contents within the time period specified by dupetime, it will not digipeat it. Because this timer is set in increments of 5 seconds, a value of 6, for example, will result in a 30 second duplicate checking period. Do not set this value higher than about 24 (2 minutes). Setting the dupe value to 0 turns off dupe checking.

Selecting the B value from the menu brings up another menu that allows you to set up the beacons. X-Digi supports 4 different beacons, each of which can be sent at a different interval, have a different path, and have a different text. To set up these beacons, hit the B key. The time values here are in increments of 5 seconds, so to set a beacon to transmit every 10 minutes, for example, you would use a value of 120. The offset value allows you to specify a time period to elapse before the first beacon is sent. For example, if you set Beacon 1 to be sent every 5 minutes and Beacon 2 to be sent every 10 minutes, every other time you would have both beacons sent at the same time. While this will work, you might prefer to have X-Digi wait a minute or two before sending the first beacon so that the two beacons would never be sent at the same time. You can do this with offset.

The path for each beacon can also be set via this menu. Simply enter the path with a comma between each callsign, for example **W2SB,WIDE3-3**. Selecting Q will exit the beacon menu. Another Q will exit configuration.

Telemetry:

Many sensors (such as temperature, humidity, etc.) work by sending out a voltage that is proportional to the thing being measured. Typically these voltages are in the range of 0 to 5 volts. The purpose of the telemetry features of X-Digi are to provide the ability to incorporate voltage readings in any of the four X-Digi beacons. Up to four different telemetry channels are available, and they can be used simultaneously, if desired.

To connect a sensor to the X-Digi board, use the holes on the X-Digi board for connections A0 through A3. In addition, you will need a connection for ground to the sensor. Use the hole marked GND for this purpose.

Once you have the sensor(s) connected, you then need to construct a beacon text to report the value on the sensor. This is done simply by placing \0, \1, \2, and/or \3 in the beacon text where you want the sensor voltage to be inserted. So for example your beacon text might look like:

The voltage on sensor 0 is \0.

When the beacon is sent, X-Digi will read the sensor and replace the \0 with a three digit value in the range 0 to 255. The 0 corresponds to 0 volts and the 255 corresponds to 5.0 volts. It should be very easy to write an program to run on the receiving side that would take this data, run it through a conversion equation, and display the actual temperature (or whatever else you are measuring) on the screen. You can put more than one telemetry channel in a single beacon, if you like. For example, I set up the following beacon text:

```
Volt0:\0; Volt1:\1; Volt2:\2; Volt3: \3.
```

Here is what the XDigi is beaconding as a result:

```
W2FS>APRS,WIDE2-2 [08/30/06 12:35:47]: <UI>:  
Volt0: 000; Volt1: 079; Volt2: 064; Volt3: 072.
```

Blocking Users

You can have X-Digi block individual users using the Blocklist command to block up to 8 callsign patterns from using the digipeter. To do this, use the X selection on the main menu to bring up the Blocklist menu. On this menu you can specify specific callsigns to be blocked, e.g., W2FS. In addition question marks (?) can be used as wildcards in specifying these callsigns. So, for example, you could enter W2???? To block all callsigns that begin with W2. There is no provision for blocking specific SSID values and not others. Note also that very few users have tested this Block List function and so I am not certain that it is totally bug free.

Running the Digipeater

To finish programming go back to the main menu and press Q to quit. Then remove the X-Digi and change the jumpers so that they are set up as follows:



By using this setup, incoming data will be routed through to the PC serial port (but not the USB port). As a result, you will be able to run a standard APRS program (such as WinAPRS, MacAPRS, UIView, etc.) and watch the activity coming in to the digipeter. It is not necessary to operate XDigi with a PC attached, it will work perfectly well as a stand alone unit. However, this option is available to you if you like. If you decide to run the XDigi as a stand alone unit, you can simply leave the jumpers in their “configuration” setting.

Using the Remote Sysop Feature

It is possible to change the parameters of X-Digi remotely. Doing so requires a 5 letter password. All X-Digi parameters except the password are remotely configurable. In order to use the remote sysop feature, you must first set a remote password using the configuration procedure described above. The password must have exactly 5 characters and is case sensitive. To disable the remote sysop feature, set the password to five spaces.

To reconfigure X-Digi remotely, change the UNPROTO parameter in the TNC of the station that will remotely configure the X-Digi to specify the callsign that is configured in X-Digi. So, for example, if the X-Digi callsign is UR0CAL you could set up UNPROTO in your station as follows:

```
UNPROTO UR0CAL
```

After you have changed the UNPROTO parameter, go into converse mode (with a k on most TNC's) and hit the return key. This will send an empty packet out using the UNPROTO path.

When X-Digi hears your transmission, it will respond with a string of four letters. This four letter combination is a function of a random number

generator inside X-Digi and the password that you have specified. You must then respond with the proper 4 letter code in order to enter remote sysop mode. This code can be obtained from a program that is available on the XDigi webpage (<http://www.tnc-x.com/XDigi.htm>) called calcpw.jar. The program was written in Java, so it should run on any platform and it is an executable .jar file so you should be able to run it simply by double-clicking on it. Of course you will need to have the Java runtime environment on your computer to run the program, but most computers these days already have this loaded. This program is fairly self-explanatory. You enter your password (the one you entered in the configuration screen) and the four letter code you received from X-Digi, and then it tells you what your response should be. Send the response back to the X-Digi. The X-Digi will respond with either “yes” (if you were successful) or “not” if you were not.



Once you have successfully entered remote sysop mode, you can send commands to the X-Digi in the form:

X value

for commands from the first configuration page.

X-Digi Ver 2.0E Configuration Menu

```

C.   Set Digipeater Callsign.      :URCALL
A.   Set Digipeater Alias.        :URDIGI
F.   Set UIFlood Callsign.        :NY
L.   Set UIFlood Limit.           :7
T.   Set UITrace Callsign.        :WIDE
M.   Set UITrace Limit.           :4
1.   Set UICall 1.                 :
2.   Set UICall 2.                 :
3.   Set UICall 3.                 :
4.   Set UICall 4.                 :
5.   Set UICall 5.                 :
6.   Set UICall 6.                 :
7.   Set UICall 7.                 :
8.   Set UICall 8.                 :

D.   Set Dupe Time (x5 secs).      :6
X.   Edit Blocklist

```

So, for example, to change the Dupe Time to 10, you would send the command:

D 10

X-Digi will respond by telling you the new value of the parameter you entered. If you simply want to inquire about the current value of a parameter send:

X?

where X is the letter of the parameter you want sent back to you. So to ask what the Dupe Time value is send

D?

Note that any changes take effect immediately. So if you change the callsign of the X-Digi, you will need to change the UNPROTO value in your TNC to be able to continue to communicate with it. You can send as many commands as you want during a remote sysop session. The session will conclude in one of two ways. If you send the command:

Q

You should receive back the word “Done” and the X-Digi will exit remote sysop mode. If 45 seconds passes and the X-Digi does not receive a command, it will automatically reboot. You’ll send the Beacon 1 text transmitted to let you know that the session has expired.

To make changes on the Beacon menu:

Beacon Configuration Menu

```
0. Set Beacon Destination Call :APRS
1. Set Beacon 1 Path           :WIDE2-2
2. Set Beacon 2 Path           :
3. Set Beacon 3 Path           :
4. Set Beacon 4 Path           :

5. Set Beacon 1 interval (x5 secs) :00120  offset :0
6. Set Beacon 2 interval (x5 secs) :00000  offset :0
7. Set Beacon 3 interval (x5 secs) :00000  offset :0
8. Set Beacon 4 interval (x5 secs) :00000  offset :0

A. Set Beacon 1 text:X-Digi Test.
B. Set Beacon 2 text:
C. Set Beacon 3 text:
D. Set Beacon 4 text:
```

Send a command in the following form:

BX value

where X is the letter of the parameter you wanted to change. So, for example to change the Beacon 1 text you would send:

BA This is the new beacon text.

Note that for parameters 5 through 8 you must specify 2 values, the interval and the offset. To change beacon 1 so that it beacons every minute with an offset of 5 seconds, for example, you would enter:

B5 00012 001

In the case of items 5 through 8 you must specify exactly 5 digits followed by 1 space and 3 digits. You can inquire about the value of a parameter from this page using the syntax:

BX?

where X is the parameter from the Beacons page that you want to ask about.

It is also possible to change entries on the Block List remotely. The command to do this are as follows:

Xn callsignpattern

Where n is the number of the item on the blocklist that you want to set. So:

X1 mycall

Would put mycall in the first blocklist position. You can also find out what callsign pattern is in any position by entering:

Xn?

All beacons are turned off during a remote sysop session. However, regular digipeting does continue. Of course a collision between you transmitting a command and a user having a packet digipeted will result in both packets being lost. I have not tried the remote sysop capability on a busy frequency, so I would be interested in reports of your experiences in the field.

If you are planning to use the remote sysop capability, I recommend that you try it out locally before trying to do it remotely just so that you understand the capabilities and how to use them. If you have any concerns about the remote sysop capability, simply turn it off by specifying 5 space characters as the Remote Password. Note that it is not possible to change this password remotely.

There is a Yahoo group called XDigi that is available to support users of the X-Digi daughter board.