MFJ

TNC-X Packet Controller

Model MFJ-1270X

INSTRUCTION MANUAL

CAUTION: Read All Instructions Before Operating Equipment !

MFJ ENTERPRISES, INC.

300 Industrial Park Road
Starkville, MS 39759 USA
Tel: 662-323-5869 Fax: 662-323-6551

DISCLAIMER

Information in this manual is designed for **user purposes only** and is *not* intended to supersede information contained in customer regulations, technical manuals/documents, positional handbooks, or other official publications. The copy of this manual provided to the customer will *not* be updated to reflect current data.

Customers using this manual should report errors or omissions, recommendations for improvements, or other comments to MFJ Enterprises, 300 Industrial Park Road, Starkville, MS 39759. Phone: (662) 323-5869; FAX: (662) 323-6551. Business hours: M-F 8-4:30 CST.

MFJ-1270X TNC-X Packet Contoller

For VHF Packet and APRS

Introduction

Thank you for purchasing the MFJ-1270X TNC-X Packet Controller. The MFJ-1270X is a new Terminal Node Controller design based on the Chepponis/Karn KISS protocol. It is implemented using a Microchip PIC 16F628A microcontroller, a CML MX614 Bell 202 modem chip, an 8K Ramtron FRAM, a MAX232A level converter chip, and an op-amp which provides active audio filtering for the modem. From the beginning, this TNC was designed to be small, inexpensive, have low power consumption, and expandable.

The MFJ-1270X features an on- board USB port. The USB port was added because the design took into consideration that computers these days lack the old style RS-232 serial ports. There is also an 8-pin expansion header that allows the addition of "daughter boards". Power is provided to the daughter board through the expansion header. In addition, signals that would otherwise go to or from a host PC can be intercepted by the daughter board at the TTL level and processed. The I/O on the expansion header speaks "KISS" so that any daughter board only has to send and receive data packaged in KISS format to access the core module. This makes the development of daughter boards fairly simple and inexpensive. For example, daughter boards are now available that can turn the MFJ-1270X into either of two types of digipeaters via the MFJ-1270DG, or into a stand alone APRS Tracker with the Coastal Chip Works X-Track board (http://tnc-x.com/).

 In addition, the expansion header provides access to a second on-board serial port. The X -Track daughter board, for example, uses this port to receive data from a GPS receiver. The data is then processed and formed into packets and an APRS beacon is sent. Even without daughter boards the MFJ-1270X works as a fully functional stand alone KISS mode TNC.

The idea behind the expansion options was to provide a platform that would allow additional functionality to be added to the unit with the investment of very little design time and very few parts.

Power Requirements

IMPORTANT: DO NOT PLUG IN THE 8-15 VDC POWER SUPPLY AND THE 9-VOLT BATTERY AT THE SAME TIME

The power requirements of the MFJ-1270X are very minimal due to the low power consumption of the design. Using an 8-15 volt DC power supply capable of 200-300 mA is well within the consumption specifications. There is also a 9-volt battery snap provided for a 9-volt battery. This makes the TNC more portable for campers and backpackers.

IMPORTANT: DO NOT PLUG IN THE 8-15 VDC POWER SUPPLY AND THE 9-VOLT BATTERY AT THE SAME TIME

Terminal Speed

The MFJ-1270X supports only 4 terminal speeds. Jumpers JP1 and JP2 determine the speed strictly for the link between the TNC and the computer. The following settings are allowed:

JP1	JP2	Port Speed (Baud rate)
ON	ON	1200 (Default Speed)
ON	OFF	4800
OFF	ON	9600
OFF	OFF	19200

Note that the terminal speed setting does not affect the speed to transmit data. The out-going or transmit speed is always 1200 baud. Note also that if you set this baud rate faster than 1200 baud, it is possible for data to be fed into the modem faster than it can transmit it over the air. This may eventually result in the transmit buffer filling up.

Setup If You Are Using USB

If you have elected to use the USB port to provide data communications to your PC, you should begin by acquiring and installing the drivers for the PC and operating system that you are using. The USB IC used is an FTDI chip. The driver you need is a Virtual Com Port (VCP) driver can be found at :http://www.ftdichip.com/Drivers/VCP.htm if the operating system you use does not automatically locate the drivers. It will make the TNC appear as an additional com port on your computer so that you can use any packet radio software that supports a KISS TNC connected to a standard serial port.

If you use the USB port, do not supply any power to the TNC through the power jack.. The USB buss can supply the rather limited power requirements for the TNC. If you are using the USB option, set the board jumpers as follows:

> **JP3** On the left two pins (toward C24).

> **JP4** Connect the center pin to the pin that is closest to the center of the board.

> **JP5** Jumper pins 1 and 2 (the end closest to Q1) and pins 3 and 4, unless you are using a daughter board.
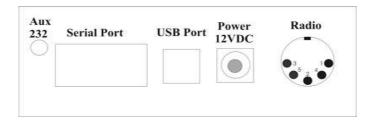
Setup If You Are Using the TNC's Serial Port

If you plan to connect the TNC to a standard computer serial port,
set up the jumpers as follows:

> **JP3** On the right two pins (toward U5)

> **JP4** Connect the center pin to the pin closest to C22.

> **JP5** Jumper pins 1 and 2 (the end closest to Q1) and pins 3 and 4 unless you are using a daughter board.

If you are using the on-board serial port, you must supply power to the TNC. This can be done in one of two ways. There is a coaxial power jack on the board that can be used to receive anything from 8 to 15 volts DC. Alternatively you can connect a 9-volt battery to the location marked BAT.

Back Connections

Aux 232   An auxiliary serial port using a MAX232 level converter. Main purpose is for GPS input for the X-Track daughter board.

Serial Port   A standard DB 9-pin RS-232C serial port.

USB Port   A standard USB port for computers that lack the old style RS-232 serial ports.

Power 12VDC   A coaxial power jack for main power input. Center pin is positive and sleeve is negative.

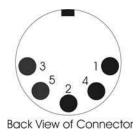**RADIO**   A 5-pin DIN connector used to interface the radio to the TNC.

POWER: Indicates the MFJ-1270X has power supply voltage supplied.

RECEIVE DCD: Indicates the MFJ-1270X is receiving a data packet signal from the radio.

TRANSMIT PTT: Indicates that the MFJ-1270X is transmitting data signal from the radio.

Radio Setup

The radio connections are made via a 5-pin DIN chassis mounted connector. The connector is shown below:

Back View of Connector

Din Connector Pins

These are the radio port pins and their respective functions. Match the proper pin and its function to the same pin and function on your radio.

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Pin 1 Microphone Audio: Supplies audio from the TNC to your radio.

Pin 2 Ground: Common connection for audio and PTT common.

Pin 3 Push-to-Talk: Allows the TNC to key your transmitter to transmit.

Pin 4 Receive Audio: Supplies audio from the radio to the TNC.

Pin 5 No Connection

Cables

Radio	TNC Cable
Alinco[8] Strd HT	MFJ-5022
Icom[1]/Yaesu Radioshack Hts	MFJ-5024
Kenwood[2] Hts	MFJ-5026
Yaesu *R-Series* HT	MFJ-5020
Yaesu 8-pin	MFJ-5080
Icom[3] 8-pin	MFJ-5084
Kenwood/Alinco 8-pin	MFJ-5086
Yaesu 8-pin modular	MFJ-5080M
Icom[4] 8-pin modular	MFJ-5084M
Kenwood 8-pin modular	MFJ-5086M
Radio Shack 8-pin modular	MFJ-5088M
ICOM HF 8 Pin DIN	MFJ-5063
ICOM VHF 8 Pin DIN	MFJ-5064
ICOM 706 13-Pin DIN	MFJ-5065
KENW / YAESU, AZDEN VHF 6-Pin mini DIN	MFJ-5060
KENW HF 13-Pin DIN	MFJ-5066
5 pin DIN, MFJ TNC	MFJ-5205

[1] - Does not include IC-W2A
[2] - Does not include 2500
[3] - Does not include 25A, 255A
[4] - Does not include IC-100H, IC-2700H
[5] - YV for KAM VHF port, YH for KAM HF port. *Other Kantronics use YV*
[6] - YV for KP9612 *1200 band port*
[7] - YH models for KPC9612 *9600 baud port*
[8] - Excludes DJ-100, 120T, 200, 500

Radio Connection

When using the pre-made cable for your radio, plug the cable into the 5 pin DIN connector on the MFJ-1270X and into the proper connector on the radio. Depending on the cable it might be the microphone and speaker connectors or the audio accessory connector. For a radio that does not have a pre-made cable the MFJ-5202 cable is available for

making your own adapter cable to connect to the audio in, audio out, and PTT lines of the radio you have. Refer to the operators manual or service manual of the radio for the correct connections.

Setup and Troubleshooting

Receive Testing

Open the squelch on the radio. When a data packet is received, you should see the yellow LED light briefly and go out. Even when no data is being received it is normal for the yellow LED to flicker. However, it should come solidly on when a packet is received. Assuming that this checks out, run a serial terminal program such as TeraTerm. Select the COM Port that the computer issued to the TNC and set the baud rate to whatever baud rate you specified with JP1 and JP2. Confirm that you are receiving data (note, this will be raw KISS frames so much of it may look like garbage, but you should see some recognizable data). Note that if you are using the USB option, you must the USB drivers loaded on your computer.

Transmit Testing

Next check out the transmit chain. The TXDelay is set by R13. Start by setting it at about halfway (which will correspond to a TXDelay of about 240 ms (or a setting of 25 on most TNC's). At this point you need to be running a program on your PC that supports KISS mode. The TNC-X webpage at http://tnc-x.com/documentation.htm has a program called TXTest, which is a very simple program that can be used to test your transmit chain.

When you transmit a packet, you should see the red LED come on briefly. Hook the transmit audio and PTT up to a radio and try transmitting. R12 is used to adjust the transmit level. 3 KHz deviation is recommended. If you don't have a means of measuring the deviation precisely, monitor your signal on a receiver and slowly increase R12 until you hear no further increase in volume on the receiver. Then back it off a bit. Even if the TNC is not connected to a radio, you should see the red light come on when you transmit data via the TNC.

Troubleshooting

Can receive another node but can not get the node to respond.

1. Check the interface cable. Make sure the PTT line has continuity and is correct point on the transmitter to key the transmitter.

2. Check the interface cable to make sure the transmit audio line has continuity and is connected to the correct point on the transmitter to transmit the audio.
3. Check the transmit modulation level. The deviation of an FM transmitter should be around 3-4KHz. If it is too high or too low then the remote node may not respond to the 1270X. Listening to the audio and comparing it to the remote node level will get it close to the correct level but proper test equipment is strongly recommended.
4. Some radios require much lower audio levels than others. R11 may need to be changed from 10K to 47K if you can not turn down the audio level smoothly to around 1-2KHz deviation. This will show up as a sudden drop out of transmit audio at the minimum TX level range.
5. Make sure the transmitter is on the correct frequency. The transmitter should be plus or minus 500Hz from the desired transmit frequency. If it is off by more than 1000Hz the signal may be distorted enough to not decode by the remote receiver.
6. Check the transmit modulation quality. The audio should not be clipped by any internal to the transmitter limiters. A clipped or distorted signal will be much harder to decode (See #3 and #4 above). Check for hum and noise in the signal. The modem IC will generate a tone when not transmitting which may be heard if you manually key the transmitter but there should not be any AC hum or noise from RF getting into the microphone line. If so make sure the ground line is connected to the correct ground on the microphone jack. Some radios have a microphone ground and a chassis ground. Use the correct one for your radio.

Can transmit but not receive the node. Can not hear a working node.

1. Check the interface cable to make sure the receive audio line has continuity and is connected to the correct point on the receiver.
2. Make sure the receiver is receiving a known good working remote node and the receiver is on the proper frequency.
3. See if the yellow LED lights up when the remote node transmits. Try to adjust the receive level from min audio level to where the LED reliably lights up every time. Do not set it too high which may cause distortion in the filters and difficult data decode.

1270X seems to receive but the computer is not displaying the received data or is not making the TNC to transmit.

1. Check the jumpers to make sure the 1270X is powered up and is listening to the proper port, either the RS232 or the USB port.

2. Check the jumpers to make sure the baud rate is set correctly for the program that is in use. The baud rate jumpers set the rate between the computer and the 1270X not the baud rate to the RF link. The RF link is always 1200 baud.

3. Check the com port cable to make sure it is good. Substitute a known good cable if possible.

4. On USB make sure the computer recognizes the 1270X and loads the com port drivers. In the computer Device Manager check in the COM and LPT ports for the unit which will show up as a USB Serial port that will go away when the 1270X is unplugged. Make note of the COM port number. If the com port is not set up or comes up with errors you may need to download and install the current drivers for the FTDI chip in the 1270X (http://www.ftdichip.com/Drivers/VCP.htm).

5. Check the program in use to communicate with the 1270X to make sure the port number and baud rate match the 1270X. Some programs do not work above COM8 or 9 which means you will have to go into the Device Manager and change the com port number in the Advanced section to something within the program range. Do not choose a com port number for something you use regularly or something that is usually attached. If they are both connected at the same time conflicts will arise between the two units.

6. Make sure the program is installed correctly and is for the operating system on the computer. Some of the older programs may not work well on the newest systems. They may not have support from the developer anymore either.

7. A test TX Program is available at http://tnc-x.com/documentation.htm and download the TXTEST program. Follow the instructions in the README in the zipped folder.

Additional Troubleshooting

If you do not see the yellow light come on, first confirm that audio is getting to the TNC (a scope or a small headphone may be useful for this). If it is, verify that audio is coming out of Pin 6 of U4. Assuming this is working, if you have a scope or frequency counter, measure the frequency on Pin 1 of U1. It should read about 3.579 MHz. While you are at it, check Pin 16 of U3. It should read about 20.000 MHz. If at any point you don't get the measurement you expect, carefully check the solder joints in that part of the board. If the yellow light comes on but you see no data on your PC, start at Pin 8 of U3 and trace the data signal to header Pin 1, to header Pin 2 and on to Pin 10 of U5. It should come out at Pin 7 of U5.

The MFJ-1270X is designed to give years of service. However, as with all things sometimes problems do come up and need to be taken care of. Here are a few troubleshooting tips in the event that something does go wrong.

Voltage Supply

If the supply voltage is suspect this must be corrected first. The first thing to do is to check the main voltage supply to the TNC. Do this using a DC voltmeter capable of measuring +5 volts DC. The main supply voltage to the TNC must be at least 7 to 8 volts DC. The TNC uses a 78L05 voltage regulator. The voltage regulator needs to see a voltage at least 2 volts greater than the regulation voltage. If the main supply voltage is not 2 volts greater than +5 volts, then the regulator will not work, thus not having a +5 volt DC output. To check this, do the following:

1. Set your voltmeter to read +5 volts DC.

2. Remove the main supply from the TNC. Check the voltage at the connector that plugs into the TNC. The voltmeter should indicate +5 +/- .5 volts DC. If the reading is lower, then check the main power source. If the reading is good, then move on to step #3.

3. With the main power still removed from the TNC, carefully remove all IC chips from the TNC.

4. Reconnect the main power source into the TNC and re-check the +5 volts DC.

If you are using the computer's USB port to supply voltage to the TNC, measure the voltage between ground and the right pin on JP4 or the right pin if you use power jack. It should be approximately +5 volts DC. If not, then we strongly recommend returning the TNC for service. If the voltage is good, then move on to the next section,

Testing for Defective IC Chips

If you are reading this section, it means that you have determined that your TNC has a defective IC chip. The procedure for checking for a defective IC is not complicated, but you should follow the procedure carefully. If you do not follow the procedure carefully you can and probably will damage an otherwise good IC and/or the TNC…so please be very careful.

1. Remove power from the TNC, either by removing the main supply at the power jack or the USB port cable.

2. Carefully remove all IC chips from the TNC. Make note as to the orientation of each IC in their respective IC sockets and which

sockets the ICs came out of. Be careful not to bend any of the pins of the ICs. **IMPORTANT!!**

3.   Carefully re-insert one IC at a time into its respective socket and re-check the +5 volts DC. If any IC causes the +5 volts DC to drop, then the IC that causes the voltage drop is your defective part. Be sure to check all IC chips, because you could have more than one defective part. Call the MFJ Service Dept. for a replacement part.

TNC Programs

There are a number of programs available for use with the MFJ-1270X. This list is not a complete list and is not an endorsement for any particular program on the list. Support for these programs is supplied by the software author, not MFJ Enterprises, Inc.

RMS Express
Winlink Express
WinAPRS
UI-View
WinTNC
PR4WIN
AGWPE
Linux-AX.25
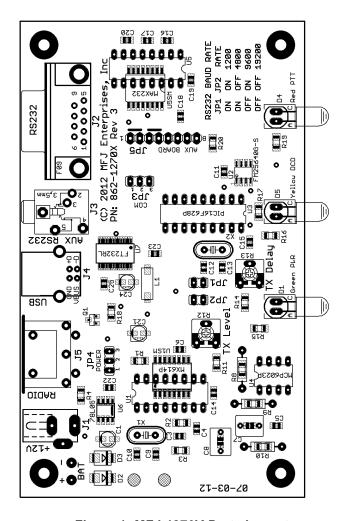Kiss Packet Software http://nl3asd.tripod.com/kiss.html
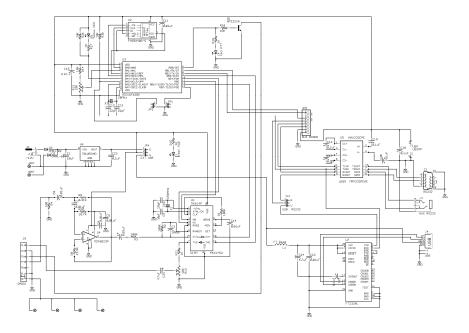
Figure 1: MFJ-1270X Parts Layout

Figure 2: MFJ-1270X Schematic

Technical Assistance

If you have any problem with this unit first check the appropriate section of this manual. If the manual does not reference your problem or your problem is not solved by reading the manual you may call *MFJ Technical Service* at **662-323-0549** or the *MFJ Factory* at **662-323-5869**. You will

FULL 12-MONTH WARRANTY

MFJ Enterprises, Inc. warrants to the original owner of this product, if manufactured by MFJ Enterprises, Inc. and purchased from an authorized dealer or directly from MFJ Enterprises, Inc. to be free from defects in material and workmanship for a period of 12 months from date of purchase provided the following terms of this warranty are satisfied.

1. The purchaser must retain the dated proof-of-purchase (bill of sale, canceled check, credit card or money order receipt, etc.) describing the product to establish the validity of the warranty claim and submit the original or machine reproduction of such proof of purchase to MFJ Enterprises, Inc. at the time of warranty service. MFJ Enterprises, Inc. shall have the discretion to deny warranty without dated proof-of-purchase. Any evidence of alteration, erasure, of forgery shall be cause to void any and all warranty terms immediately.

2. MFJ Enterprises, Inc. agrees to repair or replace at MFJ's option without charge to the original owner any defective product provided the product is returned postage prepaid to MFJ Enterprises, Inc. with a personal check, cashiers check, or money order. This is good on all products except antennas and software to cover postage and handling for return from in warranty service. We also take MasterCard, Visa, American Express, and Discover credit cards. Postage and handling may vary according to the weight of the product in question. You should specify what type of delivery service you wish. We can send by UPS, U.S. Postal service or Fedex. MFJ doesn't guarantee delivery by US Postal Service.

3. MFJ Enterprises, Inc. will supply replacement parts free of charge for any MFJ product under warranty upon request, provided the following terms are satisfied. MFJ must receive the original parts you wish to replace, your proof-of-purchase, and a personal check, cashiers check or money order must be provided to cover postage and handling. Postage and handling may vary according to the weight of the product in question. We also take MasterCard, Visa, American Express and Discover credit cards.

4. This warranty is **NOT** void for owners who attempt to repair defective units. Technical consultation is available by calling (662) 323-5869.

5. This warranty does not apply to kits sold by or manufactured by MFJ Enterprises, Inc.

6. Wired and tested PC board products are covered by this warranty provided **only the wired and tested PC board product is returned.** Wired and tested PC boards installed in the owner's cabinet or connected to switches, jacks, or cables, etc. sent to MFJ Enterprises, Inc. will be returned at the owner's expense un-repaired.

7. Under no circumstances is MFJ Enterprises, Inc. liable for consequential damages to person or property by the use of any MFJ products.

8. **Out-of-Warranty Service:** MFJ Enterprises, Inc. will repair any out-of-warranty product provided the unit is shipped prepaid. All repaired units will be shipped COD to the owner. Repair charges will be added to the COD fee unless other arrangements are made.

9. This warranty is given in lieu of any other warranty expressed or implied.

10. MFJ Enterprises, Inc. reserves the right to make changes or improvements in design or manufacture without incurring any obligation to install such changes upon any of the products previously manufactured.

11. All MFJ products to be serviced in-warranty or out-of-warranty should be addressed to **MFJ Enterprises, Inc., 300 Industrial Park Rd, Starkville, Mississippi 39759, USA** and must be accompanied by a letter describing the problem in detail along with a copy of your dated proof-of-purchase and a telephone number.

12. This warranty gives you specific rights, and you may also have other rights, which vary from state to state.