

MFJ

TNC-X Packet Controller

Model MFJ-1270X

INSTRUCTION MANUAL

CAUTION: Read All Instructions Before Operating Equipment

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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, or into a stand alone APRS Tracker.

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)
OnOn	1200	(Default Speed)
On	Off	4800
OffOn	9600	
OffOff	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 driver you need is a Virtual Com Port (VCP) driver. 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:

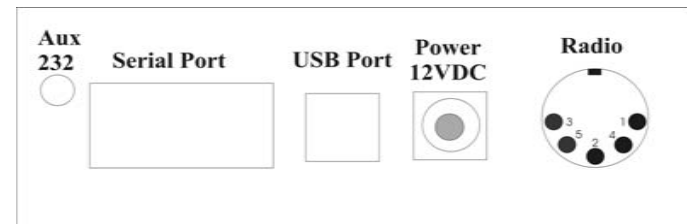
- **JP3** On the left two pins (toward C24).
- **JP4** Connect the center pin to the pin that is closest to the center of the board.
- **JP5** Jumper pins 1 and 2 (the end closest to Q1) and pins 3 and 4, unless you are using a daughter board.

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.



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.



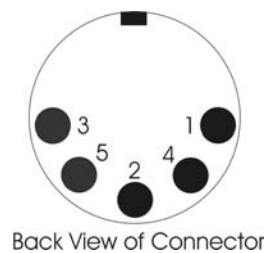
POWER: Indicates the MFJ-1270X has power supply voltage supplied.

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:



Radio Port Connections

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.

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

Troubleshooting

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.
5. 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.

Testing Receive

Hook up a receiver audio source to the receive pins on the board (or the mono jack if you are using the enclosure). Make sure audio goes to the positive pin. Make sure the squelch is left open. 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 program of some kind on your PC, 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 have the USB drivers loaded on your computer.

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 3.57 MHz. While you are at it, check Pin 16 of U3. It should read about 20 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.

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 (www.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. 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.

Many people use TNC-X for APRS applications. There are many good software programs available for this application (WinAPRS, UI-View for Windows, for example). For a general purpose TNC program that supports KISS, you might want to take a look at WinTNC. It has recently been revised so that it works under Windows XP, as well as older versions of Windows. If you want to use AGWPE, there is a link on the TNC-X webpage that contains detailed instructions.

If you have any problems with any of this, please contact MFJ Technical Services at the phone number in the warranty instructions.

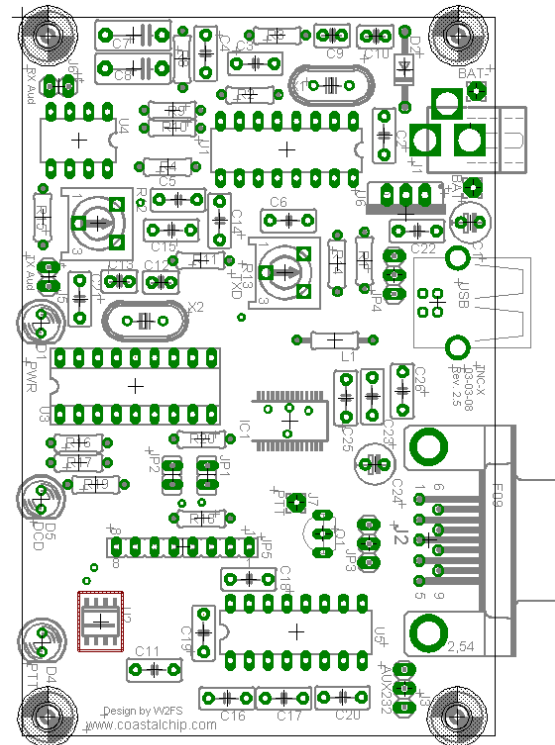


Figure 1: MFJ-1270X Parts Layout

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

be best helped if you have your unit, manual and all information on your station handy so you can answer any questions the technicians may ask.

You can also send questions by mail to MFJ Enterprises, Inc., 300 Industrial Park Road, Starkville, MS 39759; by Facsimile to 662-323-6551; or by email to techinfo@mfjenterprises.com. Send a complete description of your problem, an explanation of exactly how you are using your unit, and a complete description of your station.

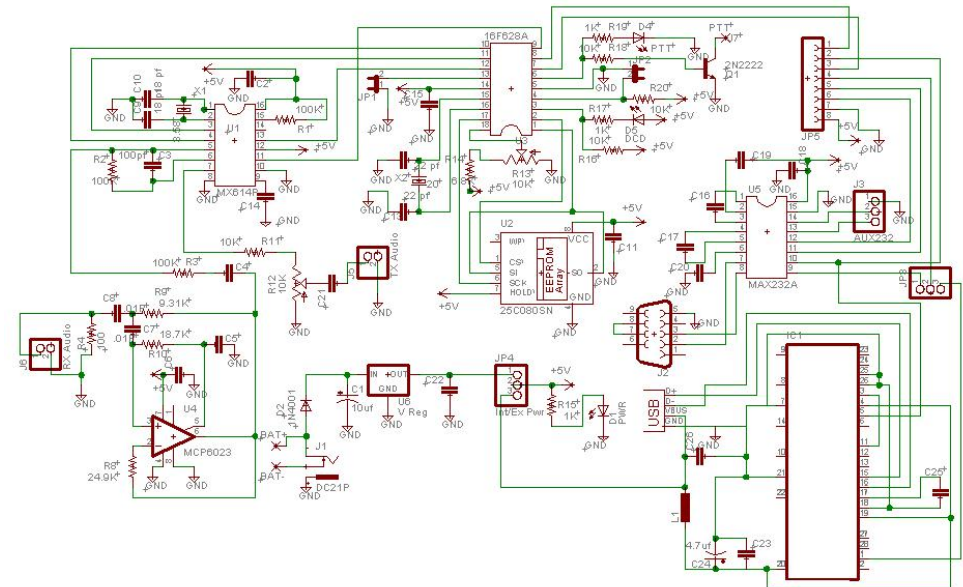


Figure 2: MFJ-1270X Schematic

PARTS LIST FOR MFJ-1270X**CAPACITORS**

PART NO.	DESCRIPTION
C1	10 μ F Electrolytic
C3	100 pf Disk Ceramic; (Marked 101J)
C2, C4, C5, C6, C11, C14, C15, C16, C17, C18, C19, C20, C26	.01 μ F Multilayer
C21, C22, C23, C25	.1 μ F Multilayer
C7, C8	.01 μ F Polypropylene (red/yellow- block)
C9, C10	18pf Disk Ceramic (Marked 18J)
C12, C13	22pf Disk Ceramic (Marked 22J)
C24	4.7 μ F Electrolytic

RESISTORS (Note: There is no R5, R6 or R7)

PART NO.	DESCRIPTION
R1-R3	100K Ohms (brown-black-yellow)
R8	24.9K Ohms, 1% (red-yellow-white-red-brown)
R9	9.31K Ohms, 1% (white-orange-brown- brown)
R10	18.7K Ohms, 1% (brown-grey-purple-red-brown)
R11, R14, R16, R18, R20	10H Ohms, (brown-black-orange)
R12, R13	10K Ohms Horizontal Trimpot (Marked 103)
R4, R15, R17, R19	1K Ohms (brown-black-red)

DIODES

PART NO.	DESCRIPTION
D1	Green LED
D2	1N4001
D4	Red LED

D5	Yellow LED
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HEADERS and JUMPERS

PART NO.	DESCRIPTION
JP1, JP2	2-Pin Header
JP3, JP4	3-Pin Header
JP5	8-Pin Header

6 Small jumpers for JP1-JP5

OTHER COMPONENTS

PART NO.	DESCRIPTION
X1	3.57 MHz Crystal (maybe marked A035)
X2	20 MHz. Crystal (maybe marked A200)
Q1	2N2222 or equivalent
IC1	FT232RL USB Interface Chip
U1	CML 614 Modem Chip
U2	FM25640 FRAM Memory Chip
U3	PIC16F628A or PIC16F648A
U4	MPC6023 Op Amp
U5	HIN232A
U6	78L05 Voltage Regulator
F09	DB9 Female PC mount Connector
J1	Coaxial Power Connector (Center Pin is Positive)
USB	USB Female PC Mount Connector
L1	Ferrite Bead
Radio Port	5-Pin DIN Chassis Mount Connector
AUX 232	2.5mm Stereo Chassis Mount Connector

NOTE: Use IC sockets for U1-U5.

LIMITED 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, or 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 under warrantee provided the product is returned postage prepaid to

MFJ Enterprises, Inc. with a personal check, cashiers check, or money order for **\$10.00** covering postage and handling.

3. This warranty is **NOT** void for owners who attempt to repair defective units.

Technicalconsultation is available by calling the Service Department at 662-323-0549 or the MFJ Factory at 662-323-5869.

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

5. 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 unrepaired.

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

7. 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.

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

9. 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.

10. All MFJ products to be serviced in-warranty or out-of-warranty should be addressed to:

**MFJ Enterprises, Inc.
300 Industrial Park Road
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.

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



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