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## MFJ-52B Deviation Meter

The MFJ-52B Deviation Meter is a peak audio level metering interface board, with indoor and outdoor temperature sensors and a voltmeter for the node site. The MFJ-52B also includes an optional "S"-Meter feature. The MFJ-52B developed for use with **TheNet X-1J2** or later firmware for the TNC2, and compatible TNCs. When using the MFJ-52B you will be able to tell quickly the frequency deviation of all incoming signals, as well as other data pertinent to your nodes operation. The value of deviation of all signals which your MFJ TNC has heard are stored in the station's **"heard list"**.

Use the **MHEARD** command to display the heard list. Several pieces of information will be displayed after each station in the heard list such as:

- The number of packets received from a station.
- How long ago the last packet was heard.
- The port on which it was heard.
- The deviation of the last valid packet in Kilo-Hertz.

If the deviation reading is overrange a ">" character will be displayed with the deviation. Any station that has a deviation of **0** will have no *deviation* value displayed.

You must use a **TheNet X-1J2** or later firmware EPROM with the MFJ-52B. *MFJ does not offer this EPROM, so it must be obtained from some other source.* You can get a copy of the X-1J2 or later software with the instructions for burning an EPROM from your local amateur BBS or from Buck Rogers, K4ABT.

### Items with the MFJ-52B Package

The MFJ-52B package comes with the following items listed below. Please check the list below, against the actual package contents. If any items are missing, please contact MFJ Enterprises for the missing items.

- MFJ-52B Rev 0 PC board
- An 8-pin IDC molex plug with five (5) wires attached.
- A 6" piece of violet 24 gauge wire
- One 6-32 x 1/4" screw
- A spacer for early TNC's that don't have one by the CPU

## Installation

In the Installation section of this manual, we will discuss the Installation of the MFJ-52B into the particular TNC that you have. Please pay very close attention to the Installation steps to ensure the Installation is done properly.

**NOTE:** U4 is not populated on the MFJ-52B, and will be used in future applications.

## Installation Preliminaries

Do not attempt installation of the deviation board until you have the X-1J2 or later EPROM. The MFJ-52B must be used with the TheNet X-1J2 or later EPROM, otherwise, the Deviation Meter circuitry is of limited use.

For this installation to be done properly, you will need the following items:

1. A working MFJ-1270/1270B/1270C/1274/1274C/1276 TNC
2. The MFJ-52B package, containing:
  - The MFJ-52B board
  - An 8-pin plug with five (5) wires attached. Please refer to Figure 4.
  - A 6" piece of violet 24 gauge wire for MFJ-1270/1270B/1274 TNC2 models.
  - One 6-32 x 1/4" screw
  - A spacer for early TNC's that don't have one by the CPU
3. The X-1J2 or newer firmware EPROM.
4. **A low wattage** soldering iron (15 to 25 watts)
5. Rosin core solder
6. A #1 Phillips head screwdriver
7. A clean, organized, *static free* work area

**NOTE:** Throughout this instruction we will refer to Figures 1a or 1b, as well as Figures 2a or 2b. These different figures are pictorial diagrams of different MFJ TNC models. Please be sure to use the proper diagram to find the different point references mentioned in this instruction.

Please follow the installation instructions carefully.

**NOTE:** From this point forward in this instruction we will make reference to the X-1J firmware. This **DOES NOT** mean that the firmware requirement has changed. The firmware requirement is still **TheNet X-1J2 or later**.

# Important Points MFJ-1270/1270B/1274

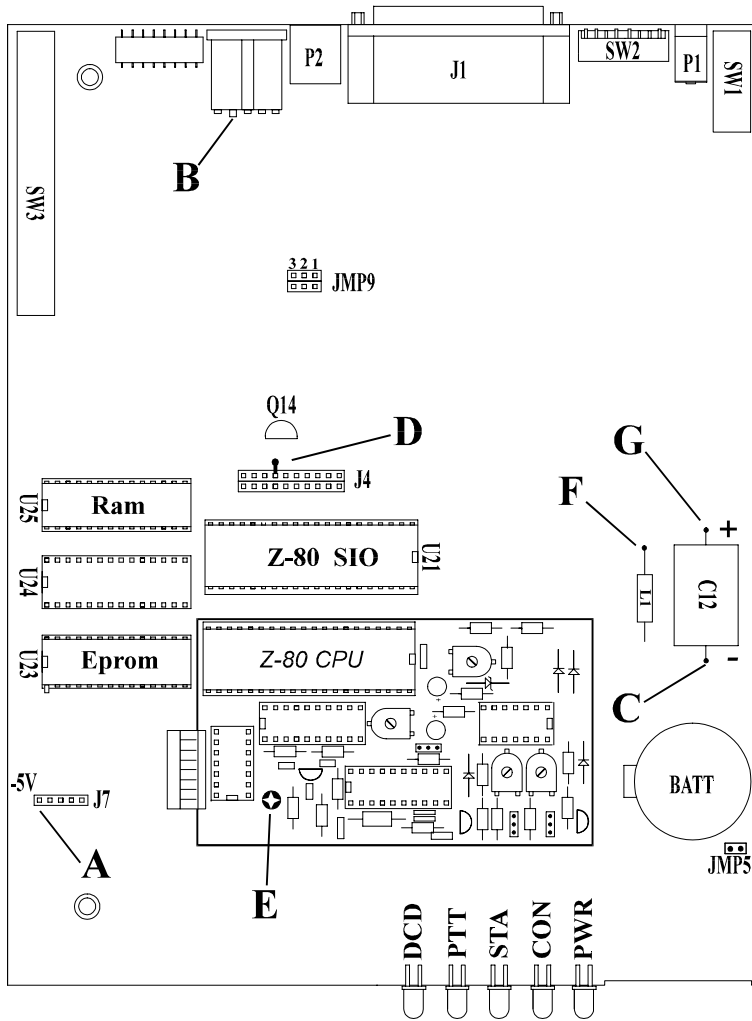


Figure 1a-- MFJ-1270/1270B/1274

# Important Points MFJ-1270C/1274C/1276 Rev.10 or Rev. 11

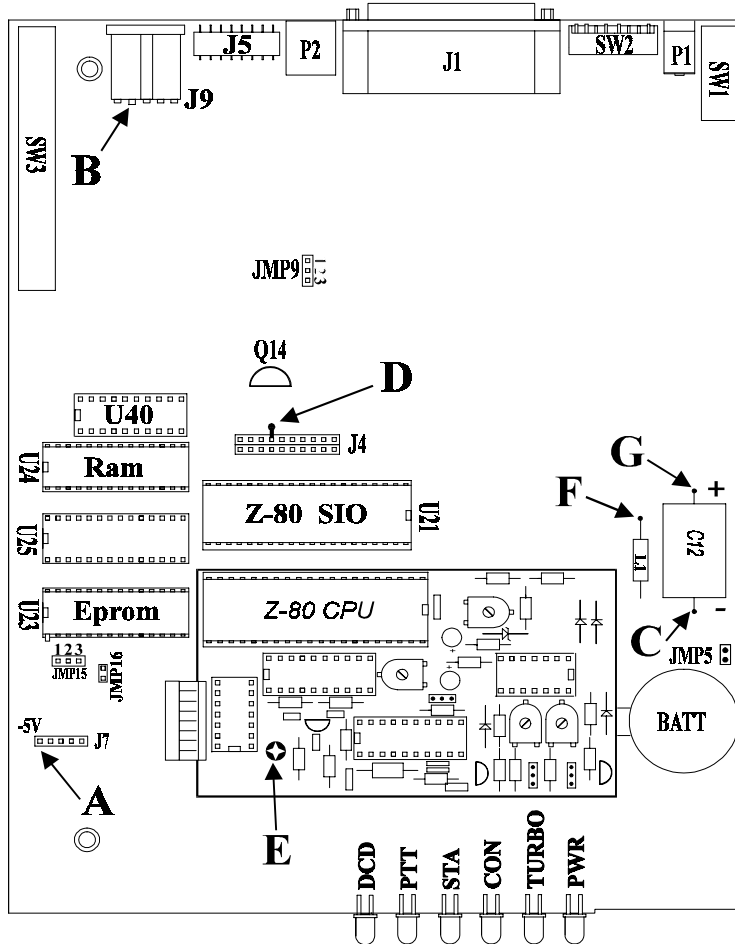


Figure 1b-- MFJ-1270C/1276; Rev. 11

Note: JMP21 is located in front of the Z80 CPU socket on the TNC motherboard

Note: JMP16 and JMP21 are not on the MFJ-1270C/1274C Rev. 10 motherboard.

# Wiring the MFJ-52B in an MFJ-1270/1270B/1274

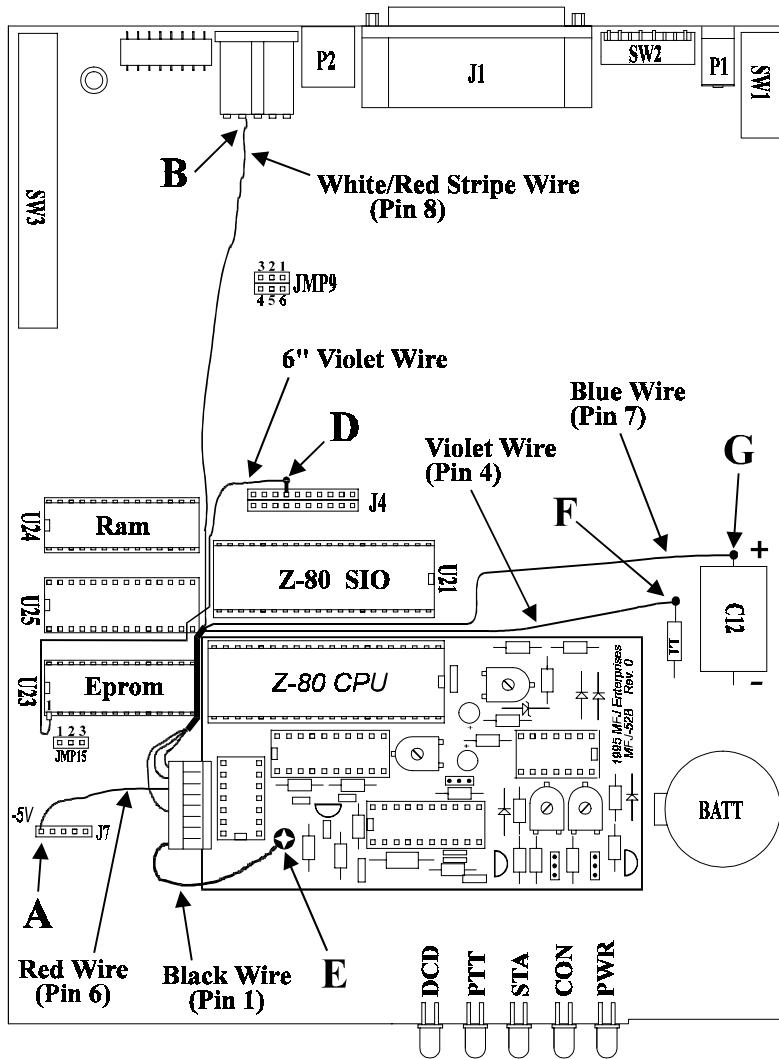
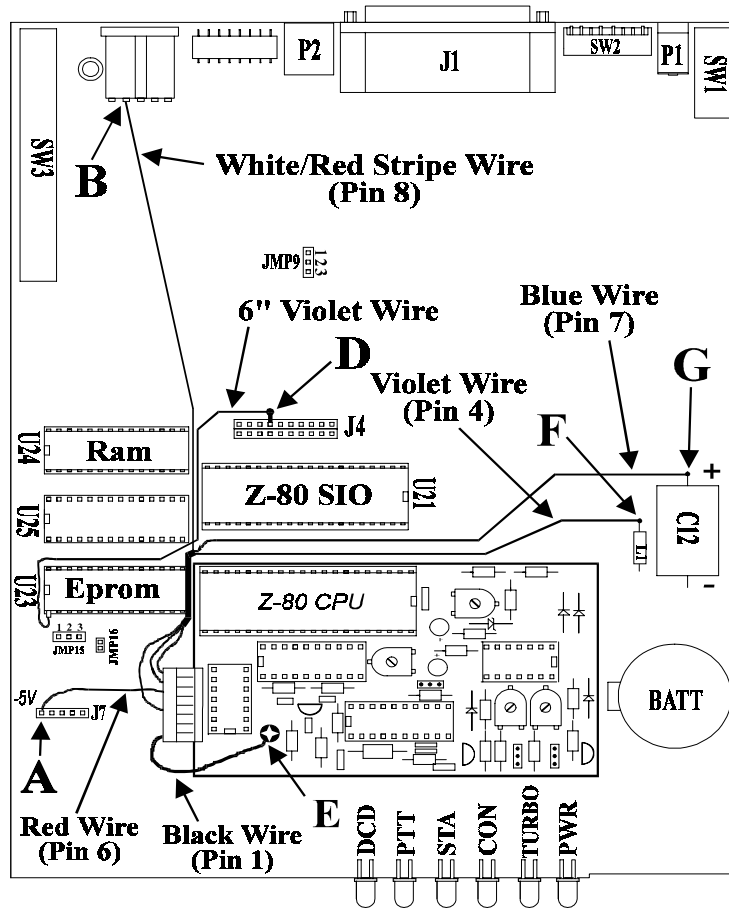


Figure 2a-- Wiring MFJ-52B in an MFJ-1270/1274

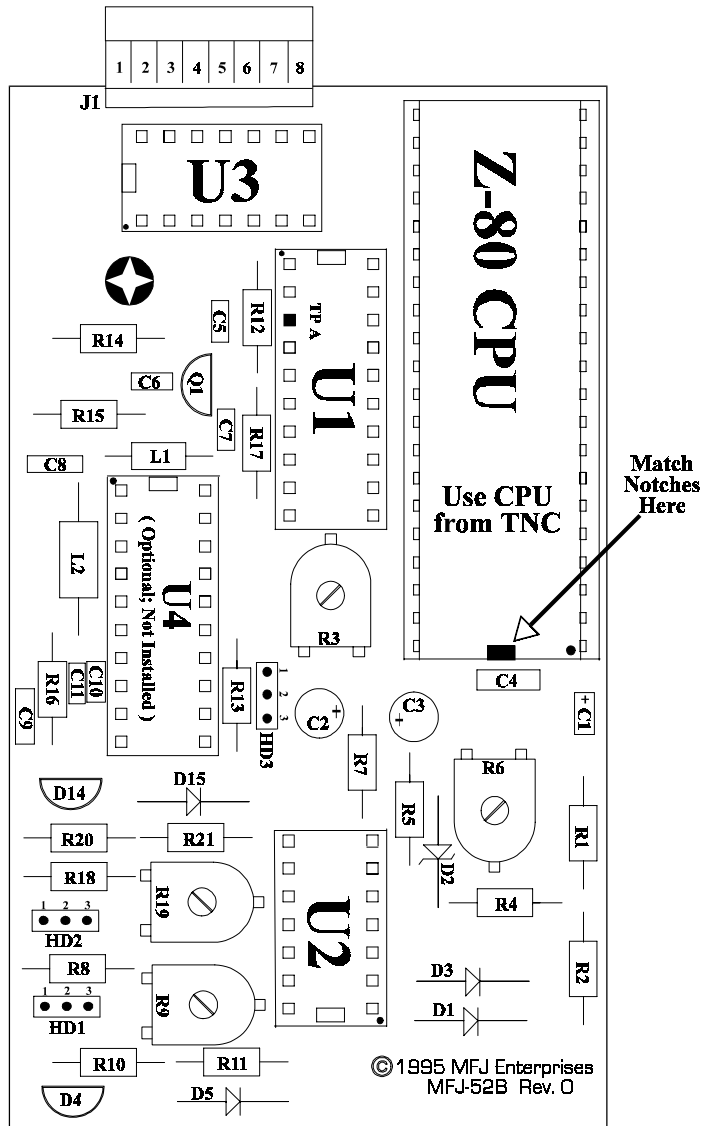
## Wiring the MFJ-52B in an MFJ-1270C/1274C/1276 Rev.10 or Rev. 11



**Figure 2b-- Wiring MFJ-52B in an MFJ-1270C Rev. 11**

Note: The 6" Violet wire is needed only on the MFJ-1270C/1276, Rev. 10 motherboard.

Note: The 6" Violet wire is not needed on the MFJ-1270C/1276 Rev. 11 motherboard.



■ Designates location of TP A

Figure 3-- MFJ-52B Parts Layout



TNC Wiring  
Point

B →	<b>8</b>	<b>White/Red Stripe Audio IN</b>
G →	<b>7</b>	<b>Blue Voltage Monitor Input</b>
A →	<b>6</b>	<b>Red -5 VDC</b>
	<b>5</b>	<b>White J310 FET Input</b>
F →	<b>4</b>	<b>Violet +12 VDC Input</b>
	<b>3</b>	<b>Orange Primary Temp Sensor</b>
	<b>2</b>	<b>Green Secondary Temp Sensor</b>
E →	<b>1</b>	<b>Black Ground</b>

Figure 4-- MFJ-52B Wiring Harness

## **Preliminary Procedure**

This section applies to all MFJ TNCs in which the MFJ-52B is to be installed. Please take the time to follow the steps below to ensure that a good installation is done.

1. Disconnect all power supply voltages from the TNC in which the new MFJ-52B is to be installed.
2. Remove any cables connected to the TNC which are coming from the terminal or computer.
3. Remove the 4 screws that secure the top cover and remove the cover.
4. Remove the two faceplate screws and remove the faceplate. Set it and the two faceplate screws aside.
5. Remove all screws that secure the PC board and the voltage regulator to the bottom chassis.
6. Remove the MFJ TNC PC board from the bottom chassis.
7. Verify that there are (2) 100 ohm resistors installed at R14 and R15. If not, then install (2) 100 ohm resistors, one at R14, the other at R15. Solder both resistors using good soldering techniques. A good solder joint will look smooth and shiny in appearance. A cold solder joint will have a grayish and sometimes rough look. The key to good solder joints is to use only enough solder to do the job. Also once you remove the solder iron from the work do not touch the joint again with the soldering iron.

## Installation into MFJ-1270B & 1274 TNC2

This section of the installation deals with installing the MFJ-52B into an MFJ-1270B or MFJ-1274 TNC2. This section also applies to the early MFJ-1270C and MFJ-1274C REV. 10 TNC2 units. Please take the time to follow the steps below carefully. This will ensure that a proper installation is done.

1. If your TNC is an early MFJ-1270C or 1274C, REV.10 model, then locate **U40** on the TNC PC board and carefully remove it from its socket. This IC is not needed when running the X-1J firmware. Be sure to set it aside in a safe place, because if you convert the MFJ TNC back to normal, then you will need it. This step *is not required* if the your TNC is an MFJ-1270B or 1274.
2. If your TNC is an early MFJ-1270C/1274C, REV. 10 model, using a short piece of *insulated wire*, connect a jumper between pins **10 and 16** of the U40 IC socket.
3. Re-install the MFJ TNC PC board back into the bottom chassis and secure it with the screws removed in step #5 of the **Preliminary Procedure**. **DO NOT** forget to secure the voltage regulator with its screw and nut.
4. Re-install the faceplate to the bottom chassis with the screws removed in step #4 of the **Preliminary Procedure**.
5. Remove the bbRAM memory backup jumper **JMP 5** on the TNC. Please see Figure 1a for the location of JMP5.
6. Use a small flat-tipped screwdriver to gently pry up the Z80 CPU, **U22**. Be careful not to bend any of the pins. Straighten any bent pins after removal. Be careful to only pry up the IC and not the IC socket!
7. Remove the system EPROM, **U23**. The original system EPROM will not be used while using TheNet X-1J. Please note the orientation of the system eprom before removal. You will need to know this in order to install the X-1J eprom properly. Keep the original EPROM in a *safe, anti-static* place if you wish to re-install the MFJ eprom at some other time.

8. Install the Z80 CPU removed from the MFJ TNC in step #6 in the 40 pin socket on the MFJ-52B PC board. Please refer to Figure 3 for proper orientation of pin 1. If installed backwards, or if any pins are broken off or out of the socket, then the MFJ-52B will not function properly.

**NOTE:** Please note the orientation of the Z80 CPU in Figure 3 in order to ensure that pin 1 is in the proper place.

9. Locate pin 1 of the X-1J EPROM. Pin one is the bottom left most pin when the notch matches the notch in Figure 1a. If your TNC is an MFJ-1270B/1274, or an early MFJ-1270C/1274C, then bend pin 1 of the EPROM outward so when you install the EPROM pin 1 is not inserted into the IC socket. Be very careful not to break pin 1 off from the eprom. This will render the eprom useless.
10. Insert the X-1J EPROM into the IC socket labeled U23 on the MFJ TNC motherboard. Orient the X-1J eprom the same as the eprom removed in step #7. Early MFJ-1270, 1270B, 1274, or early MFJ-1270C/1274C model TNCs, require that **all pins be inserted** in the socket **except** pin 1.
11. Take the 6" piece of violet wire and snip the bare part of each end of the wire to a length of 1/16".
12. Solder one end of the 6" Violet wire to pin 1 of the EPROM located at U23 on the MFJ TNC motherboard. **DO NOT** leave the soldering iron on pin 1 of the eprom too long. This could result in damage to the eprom.

**NOTE:** When soldering to IC pins care must taken. Use a **low wattage** soldering iron (15 to 25 watts) and apply only enough heat to make a good connection. If too much heat is used you could damage the EPROM. Ensure the solder flows onto the joint, then remove the soldering iron from the work. **DO NOT** touch the joint with the soldering iron once the joint is made. This will result in a **cold solder** joint. A good solder joint will be **shiny** where-as a cold solder joint will be **grayish** and **dull** in appearance.

13. Locate the plated through hole **D** behind the 20-pin header J4 (see Figure 1a. Solder the other end of the 6" violet wire into hole **D**. **DO NOT** apply too much heat as the insulation of the wire will melt. If the wire is pushed too far through the board it may short against the chassis. Once both ends of this wire are connected, route the wire neatly to prevent damage by pinching.
14. Find the white IDC molex connector with the (5) wires attached to it. Snip the bare ends of the wires to a length of 1/16".

**NOTE:** Please refer to Figures 2a and 3 for the connections and the colored wires mentioned in the next steps. Remember when making solder joints use only enough heat and solder to make a good connection. Once the joint is made **DO NOT** touch the joint again with the soldering iron, a **cold solder joint** will result.

15. Locate point **A** using Figure 2a. Point **A** is the plated through hole in J7 labeled **-5V**. Solder the end of the **RED** wire to the solder pad at point **A**. Again, if the wire is pushed too far through the board it may short against the chassis.
16. Locate point **B** using Figure 2a. Point **B** is **pin 4** of the radio port jack. Solder the end of the **WHITE/RED stripe** wire to either the jack lead or the solder pad at point **B**.
17. Locate point **E** using Figure 2a. Point **E** is the area close to the hold-down screw for the MFJ-52B PC board. Using an xacto knife, scrape away some of the solder mask close to the hold-down screw. Solder the end of the **BLACK** wire to scraped away area, point **E**.
18. Locate point **F** using Figure 2a. Point **F** is the **rear most lead** of inductor **L1**, 10 $\mu$ H. Solder the end of the **VIOLET** wire to the lead of L1 which is indicated by Figure 2a.
19. Locate point **G** using Figure 2a. Point **G** is the **positive lead** of capacitor **C12**. Solder the end of the **BLUE** wire to the positive capacitor lead of C12 as indicated by Figure 2a.

20. After all (5) wires are connected as mentioned in the previous steps, route these wires as neatly as possible. See Figure 2a or 2b.
21. If you have an older TNC it may not have a spacer at point **E**, see Figure 2a. In this case install the plastic stand-off into the bottom of the Deviation Meter board. Twist the spacer until it "locks" into one half of the hole.
22. Install the MFJ-52B Deviation Meter board into the TNC CPU socket, **U22**, see Figure 2a or 2b. Please take note of the orientation of the MFJ-52B in relation to the MFJ TNC motherboard. Ensure that all pins of the 40-pin wire wrap socket are inserted into the 40-pin socket on the MFJ TNC motherboard. If any pins are bent or not inserted into the 40-pin socket, then the MFJ-52B Deviation Meter board will not function properly.
23. Secure the MFJ-52B board with the 6-32 1/4" screw, if you did not use the plastic spacer.
24. Insert the white IDC connector with the (5) wires as shown in Figure 2a or 2b.
25. Check your TNC for any wire clippings, pieces of solder or any other foreign objects that will cause damage to the circuitry. Ensure that any of the wiring installed during the installation is not pinched and routed neatly.

This now completes the installation of the MFJ-52B Deviation Meter circuitry in your MFJ-1270B or MFJ-1274 TNC2. You can now go to the alignment section in order to properly align the MFJ-52B to your node system. However, before we do take some time right now to ensure that you have installed the MFJ-52B properly. If not installed properly the MFJ-52B will not perform well and will give false deviation readings, as well as other improper data to you and node users.

## Installation into MFJ-1270C/1274C/1276, REV.11

This section of the installation deals only with installing the MFJ-52B into an MFJ-1270C/1274C/1276, REV.11, TNC2. This section **DOES NOT** apply to the early MFJ-1270C and MFJ-1274C REV. 10 TNC2 units. Nor does this section apply to the MFJ-1270B or MFJ-1274 TNC2. Please take the time to follow the steps below carefully. This will ensure that a proper installation is done.

1. Referring to Figure 1b, locate **U40** on the TNC PC board and carefully remove it from its socket. This IC is not needed when running the X-1J firmware. Be sure to set it aside in a safe place, because if you convert the MFJ TNC back to normal, then you will need it.
2. Install a shorting jumper on JMP16.
3. Re-install the MFJ TNC PC board back into the bottom chassis and secure it with the screws removed in step #5 in the **Preliminary Procedure** section. **DO NOT** forget to secure the voltage regulator with its screw and nut.
4. Re-install the faceplate to the bottom chassis with the screws removed in step #4 of the **Preliminary Procedure** section..
5. Remove the bbRAM memory backup jumper **JMP 5** on the TNC. Please see Figure 1b for the location of JMP5.
6. Using a small flat-tipped screwdriver, gently pry up the ends of the Z80 CPU, **U22**. Be careful not to bend any of the pins. Straighten any bent pins after removal. Be careful to only pry up the IC and not the IC socket! Care must be taken to prevent breaking off any IC pins from the CPU. *If you break off any of the pins, then the CPU is useless.*
7. Remove the system EPROM, **U23**. The original system EPROM will not be used while using TheNet X-1J. Please note the orientation of the system eprom before removal. You will need to know this in order to install the X-1J eprom properly. Keep the original EPROM in a *safe, anti-static* place if you wish to re-install the MFJ eprom at some other time.

**NOTE:** Please note the orientation of the Z80 CPU in Figure 3 in order to ensure that pin 1 is in the proper place.

8. Install the Z80 CPU removed from the MFJ TNC in step #6, in the 40 pin socket on the MFJ-52B PC board. Please refer to Figure 3 for proper orientation of pin 1. If the Z80 CPU is installed backwards or if any pins are out of the socket, then the MFJ-52B will not function properly.
9. Insert the X-1J EPROM into the IC socket labeled **U23** on the MFJ TNC motherboard. Orient the X-1J eeprom the same as the eeprom removed in step #7. Check to make sure that **all pins are inserted** in the socket. Double check this step before moving on to the next.
10. Take the shorting jumper from JMP15 and place it on JMP21. Please see the NOTE on Figure 1b for the location of JMP21. There will be NO jumper needed on JMP15 when using the X-1J eeprom.
11. Find the white IDC connector with the (5) wires attached to it. Snip the bare ends of the wires to a length of 1/16".

**NOTE:** Please refer to Figures 2b, for the connections and the colored wires mentioned in the next steps. Remember when making solder joints use only enough heat and solder to make a good connection. Heat the joint, not the component. Once the joint is made **DO NOT** touch the joint again with the soldering iron, a **cold solder joint** will result.

12. Locate point **A** using Figure 2b. Point **A** is the plated through hole in J7 labeled **-5V**. Solder the end of the **RED** wire to the solder pad at point **A**. Again, if the wire is pushed too far through the board it may short against the chassis.
13. Locate point **B** using Figure 2b. Point **B** is **pin 4** of the radio port jack. Solder the end of the **WHITE/RED stripe** wire to either the jack lead or the solder pad at point **B**.
14. Locate point **E** using Figure 2b. Point **E** is the area close to the hold-down screw for the MFJ-52B PC board. Using an xacto knife, scrape away some of the solder mask close to the hold-down screw. Solder the end of the **BLACK** wire to scraped away area, point **E**.



15. Locate point **F** using Figure 2b. Point **F** is the **rear most lead** of inductor **L1**, 10 $\mu$ H. Solder the end of the **VIOLET** wire to the lead of L1 which is indicated by Figure 2b.
16. Locate point **G** using Figure 2b. Point **G** is the **positive lead** of capacitor **C12**. Solder the end of the **BLUE** wire to the positive capacitor lead of C12 as indicated by Figure 2b.
17. After all (5) wires connected as mentioned in the previous steps, route these wires as neatly as possible. See Figure 2b.
18. Check to see if there is a spacer installed at point **E**. Please see Figure 2b. In this case install the plastic stand-off into the bottom of the Deviation Meter board. Twist the spacer until it "locks" into one half of the hole.
19. Install the MFJ-52B Deviation Meter board into the TNC CPU socket, **U22**. Please see Figure 2b. Please take note of the orientation of the MFJ-52B in relation to the MFJ TNC motherboard. Ensure that all pins of the 40-pin wire wrap socket are inserted into the 40-pin socket on the MFJ TNC motherboard. If any pins are bent or not inserted into the 40-pin socket, then the MFJ-52B Deviation Meter board will not function properly.
20. Secure the MFJ-52B board with the 6-32 1/4" screw if you did not use the plastic spacer.
21. Insert the white IDC connector with the (5) wires as shown in Figure 2b.
22. Check your TNC for any wire clippings, pieces of solder or any other foreign objects that will cause damage to the circuitry. Ensure that any of the wiring installed during the installation is not pinched and routed neatly.

This now completes the installation of the MFJ-52B Deviation Meter circuitry in your MFJ TNC. We are now going to do the very simple alignment between the radio and the MFJ-52B Deviation Meter board. However, before we do take some time right now to ensure that you have installed the MFJ-52B properly. If not installed properly the MFJ-52B will not perform well and will give false deviation readings.

## Temperature Sensors

The MFJ-52B has the capability to give temperature readings inside or outside the nodes installation site, when used with X-1J2 or later firmware. The MFJ-52B utilizes the LM335Z, Temperature-Sensing diode, to provide voltage input into the ADC0844 IC. The MFJ-52B comes with one LM335Z diode, on a piece of anti-static foam. This gives you the choice of either installing it on the MFJ-52B, or wiring it external to the circuit board. If you decide to wire the LM335Z external to the MFJ-52B board, a length of two (2) conductor shielded cable can be attached between the **ORANGE** wire, **Pin 3 of J1** and **GROUND**. As with any other electronic component, you must protect the LM335Z from the water and moisture of the outside environment. If not protected, then damage to the LM335Z will result. **DO NOT** encapsulate it in a weatherproofing compound, otherwise inaccurate reading will be the result. You can cover it with a plastic bag, and then tape up the end of the bag so no water or moisture can get in.

Below is a diagram as to how the LM335Z should be wired, if going to be mounted outside on a piece of cable:

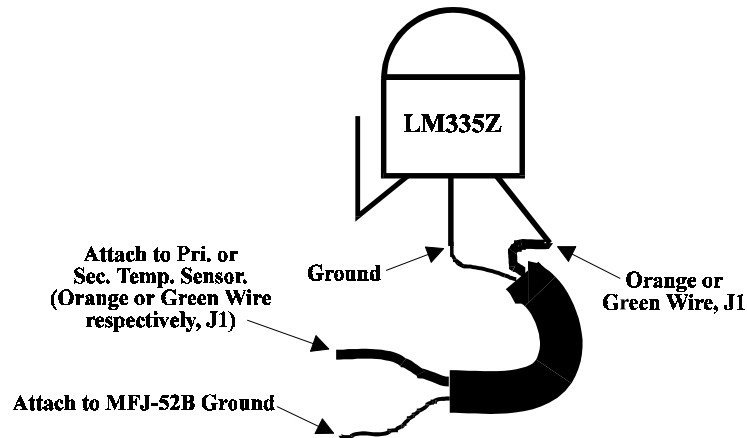


Figure 5-- External Temp Sensor Wiring

### Internal/External Selection

As we mentioned earlier, there is only one (1) LM335Z, Temperature Sensing diode provided. The LM335Z Temperature Sensing diode provided can be used in either the primary or secondary temperature sensing circuits, in either the **EXTERNAL** or **INTERNAL** mode. The **EXTERNAL** and **INTERNAL** sensors are jumper selectable via HD1 and HD2. Jumper HD3, selects either the Secondary Temperature Sensor, or the Signal Strength metering circuit. Below is a table showing how to the select internal and external sensors:

Header	Pin Setting	Mode Setting
HD1	Pins 1,2	External
HD1	Pins 2,3	Internal
HD2	Pins 1,2	External
HD2	Pins 2,3	Internal
HD3	Pins 1,2	Sig. Strength Meter
HD3	Pins 2,3	Sec. Temp. Sensor

You must remember that in order to use the secondary Temperature Sensor, HD3 must be set to positions 2 and 3. This is so the temperature data is able to get into the ADC.

For further information on the many features of the new MFJ-52B Deviation, Temperature, Voltmeter, and S-meter add-on board, please refer to The PACKET RADIO Beginner's GUIDEBOOK & ***The PACKET RADIO X-1J4 Node SysOp's HANDBOOK*** by **Buck Rogers, K4ABT**.

## Alignment

Before the alignment procedure can be performed you will need the following:

1. The TNC with the MFJ-52B installed
2. The radio that will be used with the TNC
3. An oscilloscope (preferred) and or a voltmeter
4. Test leads

If you are now in the alignment section hopefully you have taken the time to check the installation of the MFJ-52B. If there are any errors in the installation this alignment procedure will not work properly.

The steps in the alignment are very simple, however you must follow each step explicitly and in order. This is to ensure that the alignment is done properly. If any step does not work as stated we recommend that you stop, then go back and double check all previously performed steps. If errors are still found in the alignment, then go back to the installation section of this instruction and double check all steps. Here we go into the alignment of the MFJ-52B.

## Alignment Procedure

1. Connect all power, computer, and radio cables to the MFJ TNC.
2. Load your terminal emulation software into your computer.
3. Ensure the terminal and radio baud rates are set properly.
4. Remove the jumper from **JMP9** pins 2 & 3 and hang it off of pin 3 (to keep it.) When you remove the MFJ-52B board from the TNC you will need to replace the jumper on pins 2 & 3.
5. Locate JMPX on the top side of the MFJ TNC PC board. Using an XACTO knife cut the shorting trace. This will prevent the X-1J node from *hearing itself on the air*.
6. Set the power switch on the MFJ TNC to the **ON** position. The MFJ TNC should sign-on with the X-1J message. You will also note that the **STA** led on the MFJ TNC is lit dimly. This is normal, and indicates properly operation.

7. Press the **ESC** key, then the **C** key. Press the **ENTER** key. This will take you into the Manager level of X-1J.
8. Once in the Manager level you can change the **Meter** command. Try a value of either 25 or 33. In order to change the Meter command type the following:

**Meter 25** <ENTER> or **Meter 33** <ENTER>

This will change the Meter command in the MFJ TNC when initially setting up the MFJ TNC for node use. Once set up and installed in a remote in a location you must know the **SYSTEM PASSWORD** in order to change the Meter command. Refer to the X-1J documentation.

9. Open the squelch on the radio and use the "white noise" to drive the Deviation circuit.
10. Connect an oscilloscope or voltmeter to pin 1 of the LM324, **U2A**; please refer to Figure 3 for location of U2.
11. Adjust the radio's volume control to the point where there is no change in the DC voltage level as seen on the oscilloscope or voltmeter. Reduce the volume until the DC voltage level starts to drop.
12. Adjust R3 on the MFJ-52B board to set the voltage at pin 3 of the ADC, **U1, TP A** on the schematic, to 1.8 to 2.0 Vdc. The function of R3 is to scale the input voltage going into the ADC. The maximum signal available from the circuit is about 3 Vdc. This corresponds to the full range of the ADC. A 3 volt signal input into the ADC will enable the circuit to present the widest possible range of values to the X-1J software.

However, significant "unexplained" variations in the reported deviation (MHEARD list) can be reduced by lowering the input voltage to the ADC. If you need to adjust this voltage, then you will need to adjust the **METER** command within the X-1J software again.

**NOTE:** Once the you adjust R3 any changes in the radio's volume control will cause all calibration settings to be lost.

**NOTE:** The calibration of R6 on the MFJ-52B board is not necessary under normal conditions. It is preset at the factory for optimum performance. Any further adjustment of R6 will result in degraded performance.

13. Once the voltage level is set, close the squelch and note that the voltage drops to a "low" or no voltage. This is normal and indicates proper operation.

This concludes the MFJ-52B alignment procedure. If all has gone well, then you can install the cover on the MFJ TNC. If not, then go back to the section of the instruction that did not work properly.

### **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 **601-323-0549** or the *MFJ Factory* at **601-323-5869**. 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 FAX to 601-323-6551; through Compuserve at 76206,1763; or by email to 76206.1763@Compuserve.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.

**Schematic**

## Parts List

Part Designator	Part Description	MFJ Part Number
C1	Capacitor, Tantalum, 1 $\mu$ F 35V	203-8010
C2	Capacitor, Electrolytic, 22 $\mu$ F 35V	203-0013
C3	Capacitor, Electrolytic, 1 $\mu$ F 35V	203-0006
C4	Capacitor, Disc Ceramic, 0.1 $\mu$ F	200-0005
C5, 9, 10, 11	Capacitor, Multilayer, .01 $\mu$ F 50V	205-1110
C8	Capacitor, Multilayer, .001 $\mu$ F 50V	205-1010
C6, C7	Capacitor, Multilayer, .1 $\mu$ F, 50V	205-1210
L1,L2	Inductor, Molded, 56 $\mu$ H	401-0041
D4	Diode, Temperature Sense, LM335Z	
D1,D3,D5,D15	Diode, 1N4148 Switching	300-0003
D2	Diode, Zener, 1N5223, 2.7v, 250mW	300-5223
Z80 CPU	Socket, Wire Wrap, 40-Pin	625-0181-1
U1,U4	Socket, Low Profile, 20 Pin	625-0291
U2,U3	Socket, Low Profile, 14 Pin	625-0031
J1	Header, Rt. Angle, 8 Position	612-1008
P1	Connector, IDC, 8 Pin, with 5 wires	612-2008
PCB	MFJ-52B Revision 0	862-0052
R15	Resistor, Film, 1/4 watt, 180 Ohms	100-0060
R16	Resistor, Film, 1/4 watt, 330 Ohms	100-0054
R5,R7	Resistor, Film, 1/4 watt, 1k Ohms	100-3100
R4,R17	Resistor, Film, 1/4 watt, 1.8k Ohms	100-3180
R8,R18	Resistor, Film, 1/4 watt, 2.2K Ohms	100-0012
R13	Resistor, Film, 1/4 watt, 5.6K Ohms	100-0049
R12	Resistor, Film, 1/4 watt, 7.5K Ohms	100-0015
R1	Resistor Film, 1/4 watt, 10K Ohm	100-0017
R10,R20	Resistor, Film, 1/4 watt, 51K Ohms	100-0024
R2,R11,R14,R21	Resistor, Film, 1/4 watt, 100k Ohm	100-5100
R3,R6,R9,R19	Trimpot, 10k Ohm, sub-horiz.	104-4002
Z80 CPU	CPU, Z80, 4 MHz.,(not supplied)	313-0067
U1	Analog to Digital Conv.,ADC0844	311-20844
U2	IC, Quad Op-Amp, LM324N	311-0040
U3	IC, Quad 2-in Nand Gate, 74HCT00	310-4000
J1	Header, 8-Pin right Angle, .1 Center	612-1022
HD1-3	Header, 3-Pin, Vertical, .1 Center	612-0033
Wire	Wire, 6", 24 gauge, Violet	871-2477-0600
Screw	Screw, 6-32 x 1/4"	700-3063
Spacer	Spacer, PC mount, .5"	765-3138