

Thank you for purchasing the MFJ-2400 TNC modem board. The MFJ-2400 can be installed in the MFJ-1270, MFJ-1270B, MFJ1274 and the MFJ-1278. With the MFJ-2400 installed in your TNC or Multi-mode controller, you can operate packet in three speeds - 300, 1200 and 2400 baud. The 2400 operation does not require modification to your radio and it uses the current radio port(s) built into the MFJ TNCs or the MFJ-1278 multi-mode controller.

The MFJ-2400 uses the EXAR XR-2123 PSK Modem IC. It is configured to operate in the CCITT standard V.26/201 modem 2400 bps. The modem is compatible with other 2400 modems which employ the same EXAR IC.

NOTE: Installation of the MFJ-2400 modem board in other TNC-2 and multi-mode controllers has not been tested. MFJ does not guaranty the compatability of this 2400 modem board with TNC-2 and multi-mode of other manufactures.

#### TOOLS NEEDED

- Controlled heat soldering pencil or small tip 35 to 65 watt soldering iron
- Rosin core solder.
- Medium tip Philips head screw-driver.
- Small diagonal cutters.
- Needle-nose pliers

Be sure the work surface is clear and that all parts and components are accounted for. Locate the illustrations that pertain to the controller in which you wish to install your MFJ-2400.

If an "X-ACTO" cutting tool is used to cut the traces on the circuit board at J<sub>4</sub>, use extreme caution to prevent personal injury.

#### I. INSTALLATION FOR MFJ-1270, MFJ-1270B and MFJ-1274

A few minutes is all it takes to add the MFJ-2400 Modem to your existing MFJ-1270, MFJ-1270B and MFJ-1274 TNCs. The addition of the 2400 BPS feature should not require any internal modification to your transceiver.

Remove the four screws holding the top cover on the TNC. Remove the cover and set it aside. Remove the two screws holding the front face plate, and set aside. Remove the four screws which hold the main PC board to the bottom plate.

Carefully lift the main PC board from the bottom plate and place on a towel or soft surface, COMPONENT SIDE DOWN. Be sure no damage is caused to the components on the top side of the PC board as you perform the 20 pin header installation.

A. INSTALLATION OF THE 20 PIN HEADER: Refer to FIGURE 1

Installation of the MFJ-2400 Modem is made to the MFJ-1270, MFJ-1270B MFJ-1274, by carefully cutting three traces at the modem header, between pins 11, and 12, between pins 13, and 14, and between pins 17 and 18. CUT ONLY THE traces listed here. A good magnifying glass is helpful while performing these cuts.

Make note of the number progression and location of the pins. Keep in mind the number progression appears to be reversed when the PCB is upside down.

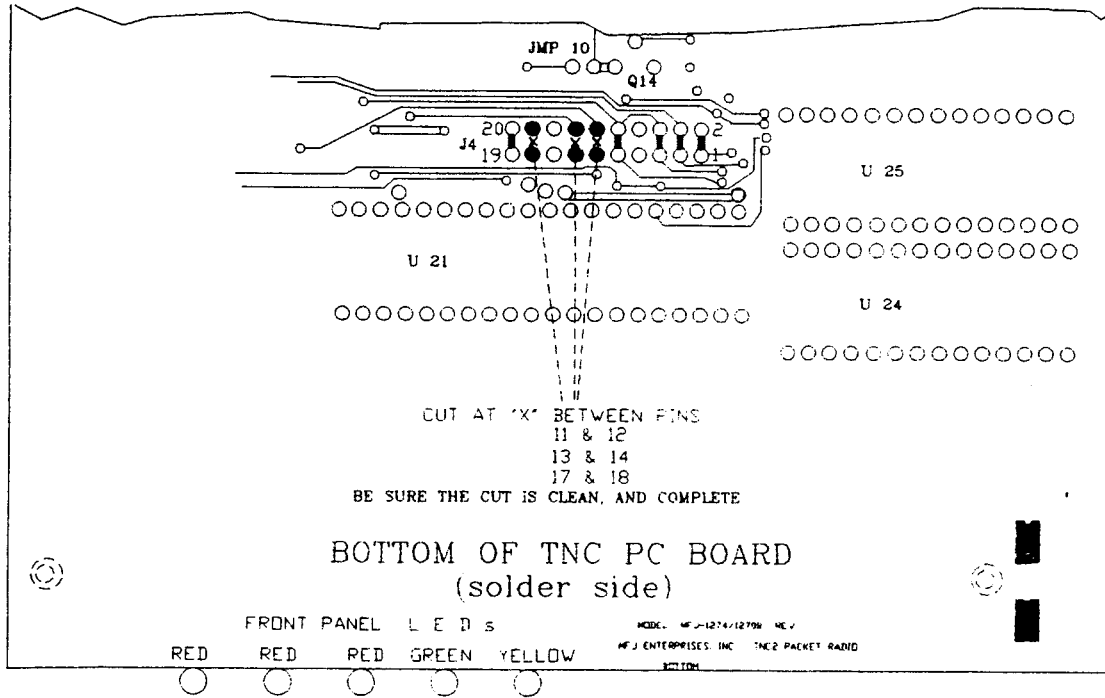
The drawing at FIGURE 1 will help you locate the header traces to cut. Use "solder-wick" or a solder vacuum device to remove any solder which may be covering any of the 20 pin header holes. Cut the traces between the three (3) points shown in the illustration.

	20 0000000000 2
Bottom of PC board	xXX Cut at X" 19 0000000000
	1

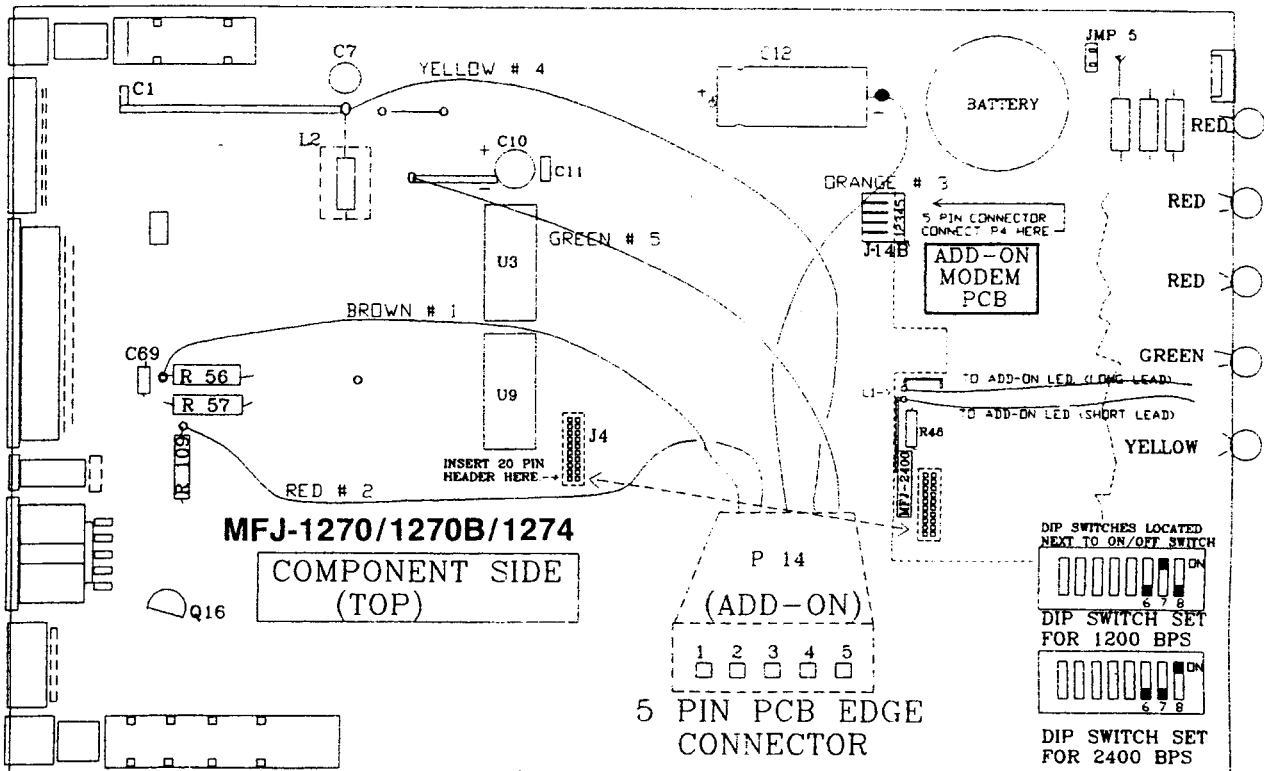
front

For a more detailed drawing, see FIGURE 1.

Insert the 20 pin Modem header (supplied) into the printed circuit board. The short pin portion of the header is inserted into the PCB holes from the component side. Solder the header pins on the bottom (trace side) of the circuit board. Solder pins 1 and 20 first to keep the header in place. Solder all the other pins making sure you get a smooth solder flow. Use caution when soldering to prevent over heating of the traces and PC board bonding.



**FIGURE 1**



**FIGURE 2**

**B. INSTALLING THE 5 PIN I/O CONNECTOR: Refer to FIGURE 2**

Prepare one end of the five wire interface which has a 5-pin connector at each end. This five wire interface is used with all MFJ-2400 installations, therefore the five wire interface is fitted with connectors at each end. In the MFJ-1270, MFJ-1270B and MFJ-1274 installation, this 5 wire interface uses a connector at the MODEM end only. Remove one of the connectors by cutting the wires flush with the connector edge.

You should now have a five wire interface composed of, one connector with 5 wires, (brown, red, orange, yellow, and green) approximately 5 inches in length extending from it. Looking at the open end (holes) of the connector, pin 1 is on the left, and pin 5 will be the last hole on the right. When properly connected to the MFJ-2400 modem, the connector pins count left to right, 1 to 5, Brown to Green.

Prepare the five wires by removing 3/32 inch of insulation from the free ends. Tin each of the bare ends with solder to prevent fraying of the wires, and to make it easy to solder to the five locations shown in FIGURE 2. Solder the wires to the points shown in the accompanying drawing. The wiring is as easy as 1, 2, 3, 4, and 5 since the wires follow the standard color code. (SEE FIGURE 2)

1 = BROWN  
2 = RED  
3 = ORANGE  
4 = YELLOW  
5 = GREEN

Connect the proper color wire to each of the 5 points indicated in FIGURE 2.

Using care to be sure the MODEM PCB is correctly aligned with the J4 pins, press the PCB into place on the J4, 20 pin header. Attach P14, the 5 wire/pin interface I/O connector to the modem.

**C: ADDING THE 2400 BPS "ACTIVE" INDICATOR (Optional)**

Included in the MFJ-2400 modification kit is an LED which can be added to the front panel of the MFJ-1270, MFJ-1270B or MFJ-1274. The LED and pictorial drawing is supplied with the kit in FIGURE 2. The 2400 BPS "LED" installation is a user option. The location of this LED is the users choice, however our experience shows that a small hole the size of the LED just above the "STA" LED is adequate. This LED will illuminate when the TNC is in the 2400 BPS mode, to give the user an indication that 2400 BPS is "active". Connect the LED to the location marked "L1" on the modem PCB.

Negative is the short lead, and positive (+) is the longer lead of the LED. Connect as shown in the illustration in FIGURE 2.

#### D. SET DIP SWITCHES AT REAR OF TNC

To move between 300, 1200 and 2400 baud will require that you use the last three DIP switches in the cluster of eight at the rear of the MFJ-1270, MFJ-1270B or MFJ-1274. Use the following switch settings for:

Switch Number	6	7	8
300 =	ON	OFF	OFF
1200 =	OFF	ON	OFF
2400 =	OFF	OFF	ON

#### E. TESTING THE 2400 BPS MODEM OPERATION

Configure the TNC for normal packet use and make tests at the normal packet speed. Next set the switches according to the 2400 BPS settings above. Perform tests with other 2400 BPS stations in your area. This 2400 BPS mode should be compatible with other 2400 BPS systems in the USA.

## II. INSTALLATION FOR MFJ-1278 WITH REV. 6, 7, 8 MOTHER BOARD

Remove the four screws holding the top cover on the MFJ-1278. Remove the cover and set it aside. Remove the "THRESHOLD" knob and loosen the retainer nut of the "THRESHOLD" control. Remove the two screws holding the front face plate, and set aside. Remove the five screws which hold the main P C board to the bottom plate.

Carefully lift the main PC board from the bottom plate and place on a towel or soft surface, COMPONENT SIDE DOWN, front toward you. Be sure no damage is caused to the components on the top side of the PC board as you perform the 20 pin header installation.

#### A: INSTALLATION OF THE 20 PIN HEADER: Refer to FIGURE 3

Installation of the 2400 BPS Modem is made to the MFJ-1278 by carefully cutting three traces at the modem header, between pins 11, and 12, between pins 13, and 14, and between pins 17 and 18. CUT ONLY THE traces listed here. A good magnifying glass is helpful while performing these cuts.

d

Make note of the number progression and location of the pins. Keep in mind the number progression appears to be reversed when the PCB is upside down.

The drawing at FIGURE 3 will help you locate the header traces to cut. Use "solder-wick" or a solder vacuum device to remove any solder which may be covering any of the 20 pin header holes. Cut the traces between the three (3) points shown in the illustration.

	20 0000000000 2
Bottom of PC board	xXX Cut at "X" 19 0000000000 1

front

For a more detailed drawing, see Figure 3.

Insert the 20 pin Modem header (supplied) into the printed circuit board, with the short pin portion of the header in the holes from the component side.' Solder the header pins on the bottom (trace side) of the circuit board. Solder pins 1 and 20 first to keep the header in place. Solder all the other pins making sure you get a smooth solder flow. Use caution when soldering to prevent over heating of the traces and PC board bonding.

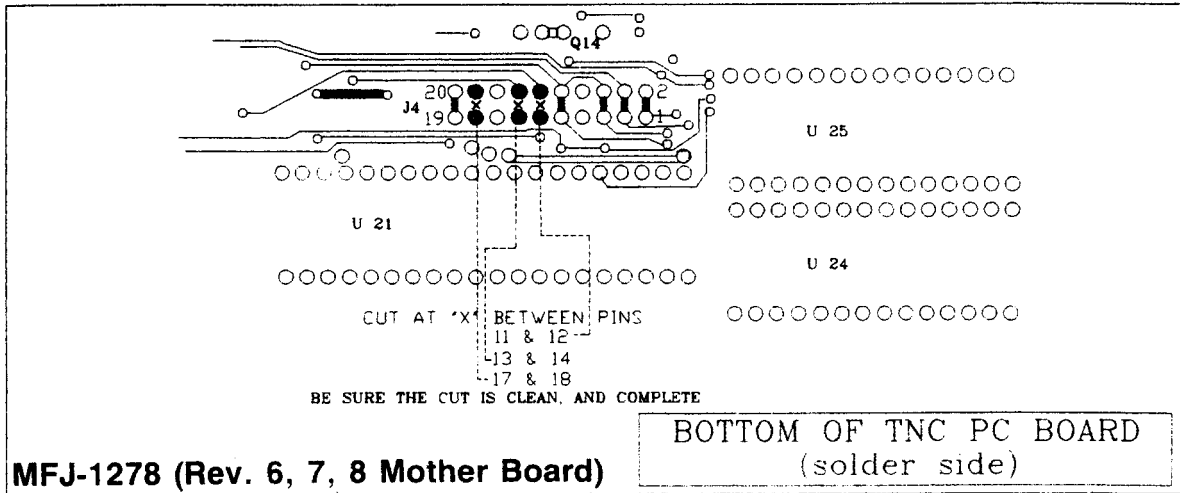


FIGURE 3

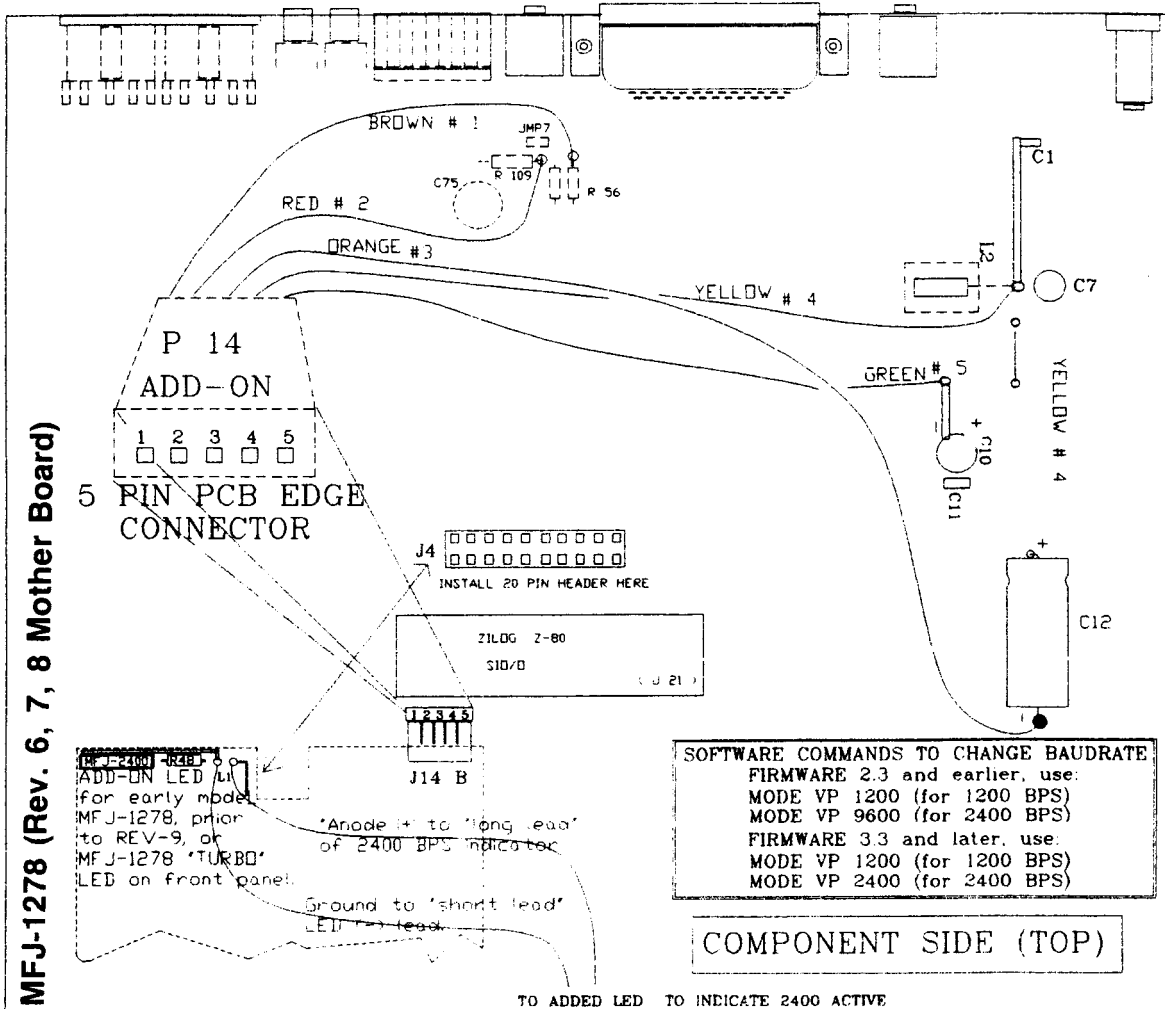


FIGURE 4

## B. INSTALLING THE 5 PIN I/O CONNECTOR: Refer to FIGURE 4

Prepare one end of the five wire interface which has a 5-pin connector at each end. This five wire interface is used with all MFJ-2400 installations, therefore the five wire interface is fitted with connectors at each end. In the MFJ-1278 and the MFJ-2400 installation, this 5 wire interface uses a connector at the MODEM end only. Remove one of the connectors by cutting the wires flush with the connector edge.

You should now have a five wire interface composed of, one connector with 5 wires, (brown, red, orange, yellow, and green) approximately 5 inches in length extending from it. Looking at the open end (holes) of the connector, pin 1 is on the left, and pin 5 will be the last hole on the right. When properly connected to the MFJ-2400 modem, the connector pins count left to right, 1 to 5, Brown to Green.

Prepare the five wires by removing 3/32 inch of insulation from the free ends. Tin each of the bare ends with solder to prevent fraying of the wires, and to make it easy to solder to the five locations shown in FIGURE 4.

Solder the wires to the points shown in the accompanying drawing. The wiring is easy as 1, 2, 3, 4, and 5 since the wires follow the standard color code. (SEE FIGURE 4)

1 = BROWN  
2 = RED  
3 = ORANGE  
4 = YELLOW 5 = GREEN                      each of the 5 points

Connect the correct color wire to indicated in FIGURE 4.

## C: ADDING THE 2400 BPS "ACTIVE" INDICATOR (Optional)

Included in the MFJ-2400 modification kit is an LED which can be added to the front panel of the MFJ-1278. The LED and pictorial drawing is supplied with the kit (FIGURE 4). The 2400 BPS "LED" installation is a user option. The location of this LED is the users choice, however our experience shows that a small hole the size of the LED just above the "STA" LED is adequate. This LED will illuminate when the TNC is in the 2400 BPS mode, to give the user an indication that 2400 BPS is "active". Connect the LED to the location marked "L1" on the modem PCB. See FIGURE 4.

NOTE: Negative (-) is the short lead, and positive (+) is the longer lead of the LED.



#### D: TESTING THE 2400 BPS MODEM OPERATION

The command(s) to move from 1200 to 2400 BPS is executed under software control.

cmd: MODE VP 1200 <enter> for 1200 If firmware is 2.3

cmd: MODE VP 9600 <enter> for 2400 If firmware is 3.3

cmd: MODE VP 2400 <enter> for 2400

Configure the TNC for normal packet use and make tests at the normal packet speed. Perform tests with other 2400 BPS stations in your area. This 2400 BPS mode should be compatible with other 2400 BPS systems in the USA.

#### III. INSTALLATION FOR MFJ-1278 WITH REVISION 9 MOTHER BOARD:

Installation of the MFJ-2400 in the MFJ-1278 with Rev. 9 mother board is very easy, and requires only a brief explanation. Furthermore it requires very little time to implement.

Locate the illustration which shows the MFJ-1278, Rev.9 installation (FIGURE 5). Place this drawing nearby to use with the 2400 BPS installation in the MFJ-1278.

The MFJ-1278 with Rev. 9 mother board can easily be identified by the additional LED on the face plate, labeled "TURBO".

**A: Install** the Modem Board: Refer to FIGURE 5

Remove the four screws holding the top cover, and set aside.

If your MFJ-1278 does not have a spacer located next to C201 and C203, you may wish to install the metal spacer (supplied) on the hole next to these two capacitors. Removal of the PC board is needed to install the spacer. Once the spacer is installed, reinstall the PC board. Make sure that the heat sink is secured to the chassis.

After properly installing the spacer and reinstalling the PC board, remove all (3) shorting jumpers on pins 11-12, 13-14 and 17-18 on J4. Using care to be sure the MFJ-2400 modem pcb is correctly aligned with the J4 pins, press the PCB into place on the J4, 20 pin header.

Secure the modem board to the spacer previously installed with a 6-32 X 1/4" machine screw (supplied).

Locate the five (5) wire I/O interface fitted with a connector at each end (wires are 5 inches in length, approximately). With the face of the controller towards you, place one of the five (5) pin connectors on the five (5) pins marked J14, adjacent to C99. Install the connector on J14 so that the wires are going toward the rear of the MFJ-1278. If properly installed, the brown wire will be on the left and the green will on the the right (with the MFJ1278 pointing toward you). Loop the other end of the 5-pin jumper cable over or around J14 and bring it toward the modem board. Connect the 5-pin plug to the male 5 pin header (J14B) on the modem board. (See FIGURE 5).

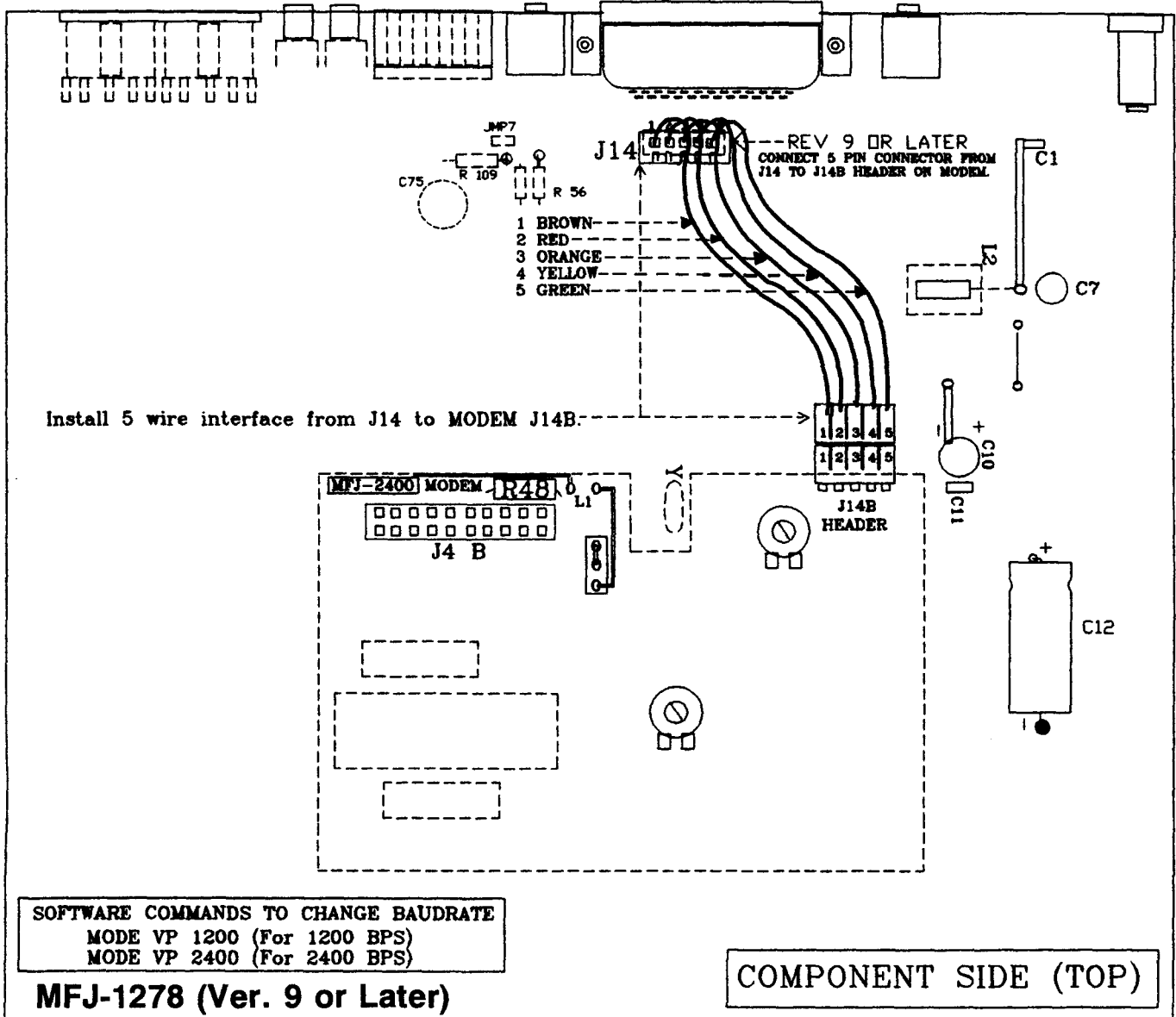


FIGURE 5

## B. TESTING THE 2400 BPS MODEM OPERATION

The command(s) to move from 1200 to 2400 BPS is executed under software control.

```
cmd: MODE VP 1200 <enter>      For 1200
```

```
cmd: MODE VP 2400 <enter>     For 2400
```

Configure the MFJ-1278 "TURBO" and test it with the previous commands. You may move between the speeds while connected to another station as long as both connected stations switch at the same time. It will not make any difference if it is between "ACK" packets, as long as both stations switch to the same speed. The connect will continue as if nothing extraordinary had occurred.

This completes the installation of the 2400 BPS into the MFJ-1278. Replace the cover and have fun with 2400 BPS PACKET.

#### IV. INSTALLATION FOR MFJ-1270C, MFJ-1276, AND MFJ-1278B

Remove the four screws holding the top cover on the MFJ-1270C, MFJ-1276, or MFJ-1278B. Remove the cover and set it aside.

##### A. INSTALLATION OF THE 20 PIN HEADER: Refer to FIGURE 5

Locate the 20 pin header J4. Make note of the location of any jumpers which may be installed. This note is for returning the MFJ-1270C, MFJ-1276, or MFJ-1278B to its original condition. The factory installation has jumpers installed on pins 1-2, 11-12, 13-14, and 17-18.

Using care to be sure the MFJ-2400 modem pcb is correctly aligned with the J4 pins, press the MFJ-2400 into place on the J4, 20 pin header.

Secure the modem board to the spacer located at the front of the board with a 6-32 X 1/4" machine screw (supplied).

Locate the five(5) wire I/O interface fitted with a connector at each end (wires are 5 inches in length, approximately). With the face of the controller towards you, place one of the five(5) pin connectors on the five(5) pins marked J14, near the RS-232 connector, J1.

Install the connector: on J14 so that the wires are going toward the rear of the MFJ-1270C, MFJ-1276, or MFJ-1278B. If properly installed, the brown wire will be on the left and the green wire will be on the right(looking from the front). Loop the other end of the 5-pin jumper cable over or around J14 and bring it toward the MFJ-2400 board. Connect the 5-pin plug to the male 5-pin header(J14B) on the modem board. (See FIGURE 5).

##### B. TESTING THE 2400 BPS MODEM OPERATION

MFJ-1270C and MFJ-1276 use the same method as the MFJ-1270B. (See Section 1D and 1E on page 5)

MFJ-1278B uses the same method as the MFJ-1278. (See Section 3B)

## MFJ-2400 Modem Operation

With the 2400 modem installed, your MFJ-1278 is capable of operating 300, 1200 or 2400 baud packet. 300 baud and 1200 baud packets are not affected by the installation of the 2400 modem.

The addition of the 2400 modem feature will in no way require any internal modification to your transceiver.

### A. 2400 Packet Operation Setup

All default parameters set for 1200 packet operation can be used for the 2400 operation. 2400 operation needs no unusual setup or parameter changes. There are however, some changes that can be made later to the MFJ-1278 parameters which will enable you to improve the throughput performance of the 2400 operation. The "honing" of the parameters may not seem like much, but we have found that at 2400, the TNC seems to be more responsive to the TXDELAY, DWAIT, RESPONSE and SLOTTIMES. When using direct connects and good paths, the MAXFRAME and PACLEN commands can be increased to allow larger packets to be moved during each transmission. When returning to the active thru-put frequencies, these two commands should be reduced to their original settings. You may find that if you were using a TXD of 50, then a TXD of 40 will now perform better. The DWAIT can be shortened or lengthened to suit the AGC recovery time of your radio. For instance, if you have been running the DWAIT of 16, it may now perform better at DWAIT of 12 or even 10. The FRACK will appear to exercise more at 2400.

2400 really shows its place in the packet world when used to pass large ASCII, BINARY and PICTURE files. It is always good to use clear frequency and/or use direct connects to the target station rather than going thru a node or digipeater. The reason is obvious. There are few 2400 nodes at the present time. However, it should be pointed out that implementation of a 2400 node is just as easy as building and using a 1200 node.

### Receive Audio Setting

The MFJ 2400 modem employs automatic gain control (AGC) for its receive audio. The receive audio level is pre-set for proper 2400 operation; no adjustment is necessary in most cases. If you set the receive audio of your radio properly for 1200 operation, then it will be suitable for the 2400 operation also. No adjustment for the receiver audio on the 2400 modem board is needed.

Transmit Audio Setting

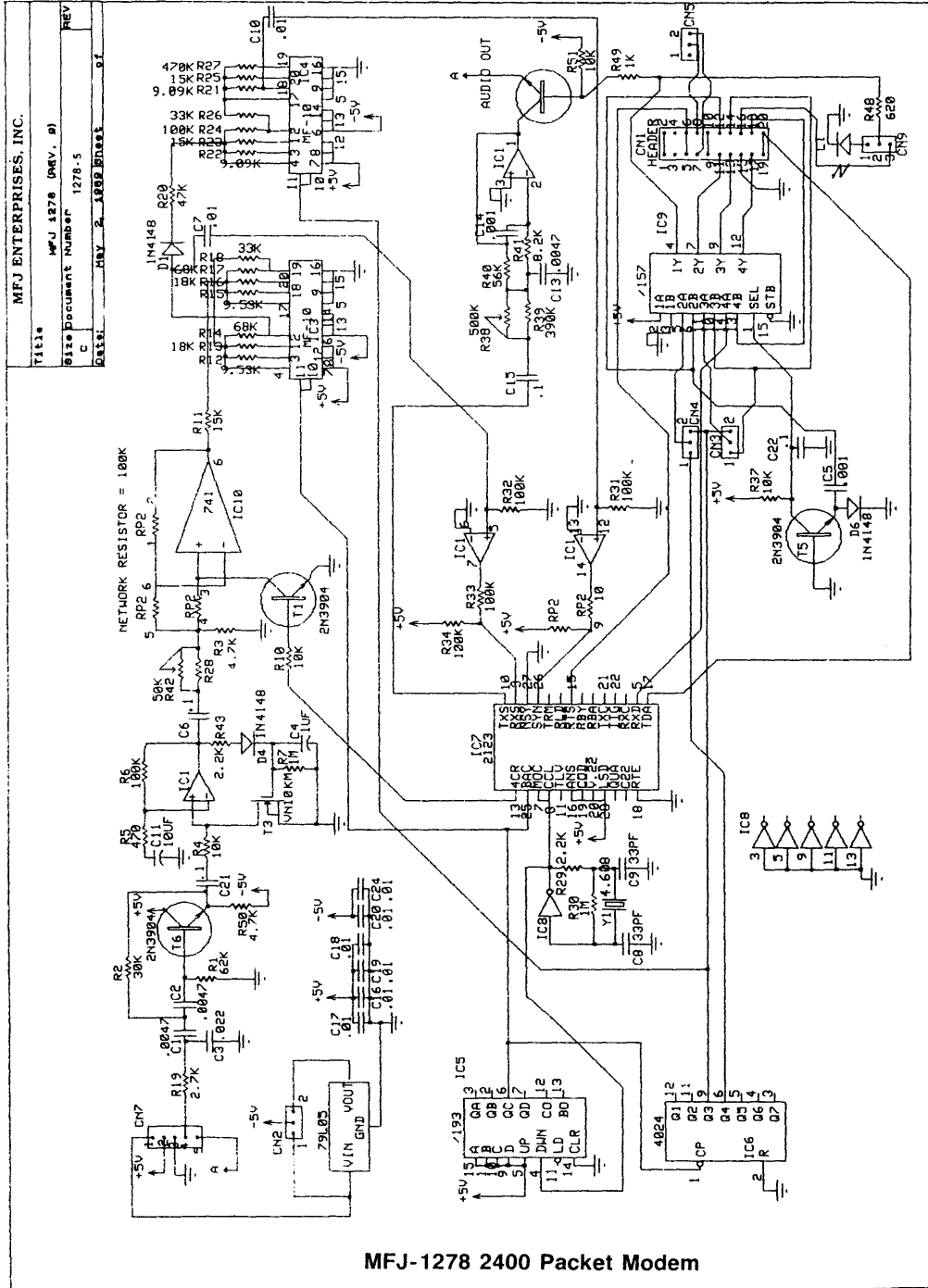
Transmit audio on the MFJ-2400 board is set by the CN 6 header and R38 trim pot. The shorting jumper on CN 6 header sets range in which R38 can be adjusted. CN 6 header preset the transmit audio as follows:

Jumper position	Transmit Audio Range (no load)
none	50 mV - 60 mV P-P 1 &
2 (default)	100 mV - 200 mV P-P
2 & 3	250 mV - 3 V P-P

MFJ-2400 is factory set for CN 6 to have jumper on positions 1 & 2. This gives the MFJ-2400 a transmit audio range of approximately between 100 mV to 200 mV peak-to-peak under no load condition. This audio transmit level should be compatible for most radios. If necessary, you may adjust R38 on the modem board for the transmit audio level that matches the level of the 1200 modem on the mother board.

CAUTION: FOR MFJ-1278 WITH REV. 9 MOTHER BOARD ONLY

1. If you have the MFJ-1278 Rev. 9 mother board, once the 1200 and the 2400 transmit audio are set to the same level, you may adjust the audio level going into your radio by using the "Transmit Audio" controls on the left side of the MFJ-1278. Note that these controls set the transmit audio levels for all the operation modes including 2400 packet operation.
2. If you experience difficulty in 1200 operation after installing the 2400 modem board, it may be due to excessive transmit audio level on the 1200 modem on the mother board. The problem can be rectified by increasing the value of R56 of the MFJ-1278 mother board. Typically a 24K ohm resistor to replace R56 will provide adequate audio level that will allow both 1200 and 2400 to function properly.



## 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 **\$7.00** covering postage and handling.
3. This warranty is NOT void for owners who attempt to repair defective units. Technical consultation 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 unrepai red.
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.