MODEM CALIBRATION

MFJ-1278 Modem is factory calibrated to operate all of the operation modes. If it becomes necessary to re-calibrate the modem, follow the following procedure:

Modulator and Demodulator Frequency Calibration

Two Modulator and Demodulator Calibration procedures are presented. Method I requires test equipment as noted. Method II does not require test equipment.

Method I

Test equipment required: DVM, frequency counter and oscilloscope.

For All Modes

1. After the cmd: prompt, enter the following command to change the MFJ-1278 to HP mode:

   MODE HP <CR>

   MFJ-1278 responds:

   RADIO: 1 TERMINAL: 4800
   MODEM: HF PACKET, 300
   CMD:

2. Type: **CALSET 32** <CR>

   MFJ-1278 responds:
   cmd:

3. After the cmd: prompt, enter the following to set the frequencies:

   CALI <CR>

4. Place the frequency counter probe at pin 1 of JMP 9.

5. Push on a jumper at JMP 4 and JMP 7.

6. Press the "K" key on your computer or terminal (no carriage return is needed for this command).

7. Verify that the voltage on pin 9 of U16 is +5 Vdc. If it is -5 Vdc instead of +5 Vdc, push the space bar. The voltage should alternate between +5 Vdc and -5 Vdc each time the space bar is pressed. Set this point to +5 Vdc.

8. Adjust R105 for a frequency reading of 2310 Hz, +/- 2 Hz.

9. Press the space bar once and adjust R106 for a frequency reading of 2110 Hz, +/- 2 Hz.

10. Type Q

    MFJ-1278 responds with CMD: and DCD, PTT, and CON LEDs extinguish.

11. Type:

    RXCAL <CR>

    MFJ-1278 responds with PTT & CON LEDs or STA LEd lit.

12. Set the TIME/DIV. scale on your scope to 1 ms/div and the Volt/Div scale to 5 V/div. Connect scope probe to the left pin of JMP 10.

13. Adjust R113 so that the signal on the scope shows a 50% duty cycle square wave. The square wave should be uniform in width (i.e. high time = low time). Pulse duration of the high time and low time is approximately 2.4 Ms. CON STA LED's may blink simultaneously.

14. Adjust R212 so that the 10th segment of the tuning indicator from left is lit.

15. Type:

    Q.

    MFJ-1278 responds with CMD: prompt and DCD, PTT and CON LEDs extinguish.

16. Type:

    TUNEPROC <CR>

    MFJ-1278 will respond with:

    "Install loopback, begin transmit tone alignment. R139 for 850 Hz."

    Note: "loopback" is JMP 7, which you have already

installed. Adjust R139 for 850 Hz, +/- 2 Hz.

17. Press RETURN key on the computer keyboard and adjust R138 for 1500 Hz, +/- 2 Hz.

18. Press RETURN key and adjust R78 for 1300 Hz, +/- 2 Hz.

19. Press RETURN key and adjust R77 for 2100 Hz, +/- 2 Hz.

20. Press RETURN key and adjust R122 for 2125 Hz, +/- 2 Hz.

21. Press RETURN key and adjust R119 for 2975 Hz, +/- 2 Hz.

22. Press RETURN key and adjust R115 so that the 10th segment from left of the tuning indicator is lit.

23. Press SPACE BAR, MFJ-1278 will respond:

    Multilevel XMIT....1550.

24. Adjust R307 for a reading of 1550 Hz, +/- 1 Hz.

    Note: For steps 25 thru 38 the frequency readings on the frequency counter should be compared to the frequency readouts indicated by the MFJ-1278. Note that the difference in the two readings can be as much as 20 Hz, this is normal.

25. Press RETURN key, MFJ-1278 display frequency: 1600 Hz, +/- 20 Hz.

26. " : 1650 Hz, "

27. " : 1700 Hz, "

28. " : 1750 Hz, "

29. " : 1800 Hz, "

30. " : 1850 Hz, "

31. " : 1900 Hz, "

32. " : 1950 Hz, "

33. " : 2000 Hz, "

34. " : 2050 Hz, "

35. " : 2100 Hz, "

36. " : 2150 Hz, "

37. " : 2200 Hz, "

38. " : 2250 Hz, "

39. Press the **RETURN** key. MFJ-1278 will display:

    Multilev Demod
    1550 Hz: 53
    53

    Note that the "53" on the third line will fluctuate between 50 to 59. This is normal.

40. Press the **RETURN** key. MFJ-1278 will display:

    Multilev Demod
    2250 Hz: 35
    35

    Note that the "35" on the third line will fluctuate between 30 to 40. This is normal.

Steps 39 and 40 test the ability of the MFJ-1278 to transmit tones from the add-on multi-level board at 1550 Hz and then 2250 Hz. These two tones are looped back thru JMP 7 and are received by the MFJ-1278 by a counting process thru U20, U8a then to the SIO. These counts are displayed on the screen not in Hz but with numbers, like "35" or "40" etc.

DEMODULATOR ALIGNMENT: For steps 41 and 42, turn trimpot called for until 10th LED is lit.

41. Press **RETURN** key and adjust R79 so that the 10th segment from left of the tuning indicator is lit.

42. Press **RETURN** key and adjust R114 so that the 10th segment from left of the tuning indicator is lit.

43. Remove the frequency counter probe.

This completes the Modulator and Demodulator frequency calibration.

Method II

MFJ-1278 Modulator and Demodulator Calibration with CALSET.

This procedure is a three step process. The three steps are:

1. Center the modulator tones over the required modem center frequency (Fc).

2. Align the demodulator center frequency.

3. Align the tuning indicator.

NOTE: ALL THREE STEPS SHOULD BE PERFORMED IN THE ABOVE ORDER!

If they are not all done at the same time, or in the correct order, the modem may not be receiving and transmitting on the same frequency, and the tuning indicator may not indicate properly.

The third step, alignment of the tuning indicator, should only be used in conjunction with alignment of the 300 baud 200 Hz shift demodulator.

The other AFSK modems available in the MFJ-1278 can be aligned using exactly the same steps presented here but substituting the appropriate part numbers for the adjustments. However, do NOT align the tuning indicator to anything but the 300 baud 200 Hz shift HF packet modem.

Comprehensive Alignment Procedure

It is important that the tuning indicator alignment be optimized for the 300 baud 200 Hz shift HF packet modem. It will indicate correctly for all other modes when aligned for the HF packet modem.

As described elsewhere in this manual, the exact configuration of your radio's filters and whether it has IF shift or not will determine the exact required center frequency for the modem. Once the required center frequency has been determined, the modem calibration can be carried out.

NOTE! It is essential that the modulator tones be properly aligned FIRST as they will be used to align the demodulator center frequency.

Set the modulator tones to Fc MINUS 1/2 of the shift for the low tone and Fc PLUS 1/2 of the shift for the high tone.

For the 200 Hz shift 300 baud modem used for HF packet this would be Fc + 100 Hz for the high tone and Fc - 100 Hz for the low tone.

Set Modulator Tones Using Built-in Calibration Software

1. Make sure that the modem and TNC are both configured for 200 Hz shift 300 baud operation. This is done by typing "MODE HP <CR>" from the command prompt on the MFJ-1278.

2. Place a push on jumper at JMP 4.

3. Place a push on jumper at JMP 9, pins 1 and 2. This connects the modulator square wave output to the SIO chip so that the CPU can measure the tone frequency for you.

4. Type "CALSET n <CR>". Where n is a number determined by:

   n = INT [525000 / F(low)] + 1

   This tells the CPU what tone frequency you are trying to achieve.

   A table of CALSET numbers to use for the various "standard" modem tone frequencies will be included at the end of this procedure.

5. Command the MFJ-1278 into calibrate mode by typing "CALI <CR>".

6. Command the MFJ-1278 to key the modem by typing "K".

7. Select the low tone by pressing the space bar until a voltmeter connected to U16, pin 9 reads - 5 volts.

8. Adjust R106 carefully until both the "CON" and "STA" LEDs on the front panel of the TNC are lit.

9. Type a "Q". This exits the MFJ-1278 from calibrate mode to command mode.

10. Type "CALSET n <CR>". Where n is a number determined by:

    n = INT [525000 / F(high)] + 1

11. Command the MFJ-1278 into calibrate mode by typing "CAL <CR>".

12. Command the MFJ-1278 to key the modem by typing "K".

13. Select the high tone by pressing the space bar until a voltmeter connected to U16, pin 9 reads + 5 volts.

14. Adjust R105 carefully until both the "CON" and "STA" LEDs on the front panel of the MFJ-1278 are lit.

15. Remove the jumper placed at JMP 9.

This completes the modulator tone alignment using the built in calibration facility.

Now that the modulator tones have been properly centered over the intended modem center frequency (Fc), the demodulator center frequency will be aligned.

Demodulator Center Frequency Alignment

1. Place push on jumpers at JMP 4 and JMP 7 if they are not already in place.

2. Remove jumper at JMP 9 if it is still in place.

3. Set the baud rate for use by RXCAL to 300 baud by typing "CALSET 32 <CR>". This will cause the modulator to send a square wave FSK signal when RXCAL is invoked. CALSET 8 should be used if you are aligning the 1200 baud wide shift packet demodulator.

4. Command the MFJ-1278 to do a demodulator calibration by typing "RXCAL <CR>".

5. CAREFULLY adjust R113 until the DCD LED on the front panel is fully illuminated.

   NOTE! The threshold control on the MFJ-1278 must be set to a position which will allow the DCD circuit to function properly. A setting approximately 1/3 to 1/2 of the total range starting from maximum CCW should be adequate.

   Continue to VERY CAREFULLY adjust R113 until the STA and CON LEDs on the front panel either change state very slowly (alternate which one is lit) or until both are simultaneously illuminated.

   NOTE! This is a very critical adjustment and it is unlikely that you will be able to cause both LEDs to be turned on simultaneously for longer than a very brief instant.

6. Return the MFJ-1278 to command mode by typing a "Q".

This completes demodulator center frequency alignment using the built in calibration facility.

Now that the demodulator and modulator are properly aligned to one another, the tuning indicator can be set for proper center indication.

Tuning Indicator Alignment

This procedure adjusts the tuning indicator so that it correctly indicates when a signal is properly tuned in relation to the demodulator center frequency.

NOTE! The tuning indicator should ONLY be adjusted in reference to the 300 baud 200 Hz shift modem used for HF packet and RTTY. If adjusted for this modem, It will indicate with sufficient accuracy for all other modes.

1. If you have not just finished aligning the modem as per the above instructions, do so now. Otherwise you may be aligning the tuning indicator to an incorrect setting.

2. Install push on jumpers at JMP 4 and JMP 7 if they are not still in place from the modem alignment procedure.

3. Command the MFJ-1278 into calibrate mode by typing "CAL <CR>".

4. Command the calibration routine to send 50 percent duty cycle square wave data from the modulator by typing "D".

5. Command the MFJ-1278 to key the modem by typing "K".

6. While observing the LEDs in the tuning indicator, adjust R212 in the tuning indicator area so that either the 10th or 11th led from the left (or both) are illuminated.

7. Return the MFJ-1278 to command mode by typing "Q".

8. Remove jumpers at JMP 4 and JMP 7.

This completes the tuning indicator alignment.

Now the modulator, demodulator, and tuning indicator are all aligned to the same center frequency. If you notice that on

the air reports suggest that you are transmitting and receiving on significantly different frequencies after successfully completing the above alignment procedure, it is possible that the radio needs realignment. Many different transceivers for HF are capable of being misaligned due to reference oscillator crystal aging or careless alignment by amounts exceeding 500 Hz. RIT inadvertently left on can also cause hard to detect problems in this area. Reliable HF packet communications requires that the frequency error presented to the demodulator be below 30 Hz. If several stations are to successfully share a single channel, transmitter / receiver offsets larger than this will be intolerable.

MFJ-1278 Adjustment Location Map

This is a map of the physical locations of the adjustment potentiometers on the MFJ-1278 circuit board. They are shown as they appear when looking down on top of the board with the board oriented so that the rear panel connectors are to the left. Information in the boxes is organized as shown below.

PART MODE CALSET #

DEMODULATOR

PART MODE H/L FREQ / CALSET	PART MODE H/L FREQ / CALSET

MODULATOR

R113 HP CALSET 32
R114 VB CALSET 32
R79 VP CALSET 8
R115 CW NO CALSET SEE NOTE

R106 HP L 2110 250	R77 VP H 2100 250
R122 VB L 2125 248	R105 HP H 2310 228
R78 VP L 1300 404	R119 VB H 2975 177
R138 SS.V H 1500 351	R129 MCW 850 618 SEE NOTE

NOTE! Separate procedure required to do alignment of CW demodulator center frequency.

NOTE! CW receive through a narrow filter for HF CW operation will require the CW demodulator center frequency to be selected to align with the radio's filter passband. MCW operation on VHF FM will require that both stations

have both the modulator tone and demodulator center frequency to the same frequency.

Calset Values for Various Modulator Tone frequencies

Tone	CALSET #	Adjust	Modem / Remarks
2110	250	R106	HF Packet & RTTY Fc = 2200 Hz
2310	228	R105	200 Hz shift
1300	404	R78	Packet / Fc = 1700 Hz, 800 Hz shift. CCITT V.23 std., preferable for HF 1200 baud, works
2100	250	R77	well on VHF FM too.
1200	438	R78	Packet / 1000 Hz shift standard. Too wide to fit comfortably through SSB filters for linear
2200	240	R77	mode 1200 baud use
2125	248	R122	VHF RTTY Fc = 2550 Hz
2975	177	R119	850 Hz shift
750	701	R139	CW
775	678	R139	CW
800	657	R139	CW
825	637	R139	CW
850	618	R139	CW / SSTV
1500	351	R138	SSTV
2178	242	R122	HF RTTY/ASCII/AMTOR Fc = 2220 Hz
2263	233	R119	85 Hz shift.

MFJ-1278 CW Modem Tune-up Procedure

The CW modem in the MFJ-1278 is fundamentally different from the other modems. It is NOT an AFSK modem. It sends and receives only 1 tone. For this reason, it requires a different alignment procedure than the others.

> NOTE! If the modulator AND demodulator are not EXACTLY on the same frequency for BOTH stations involved in VHF FM MCW operation, CW receive will be degraded if not eliminated.
>
> NOTE! If the DEMODULATOR is not EXACTLY centered in the receiver's CW filter passband, CW receive performance through a narrow filter will be degraded. Also, the demodulator will likely not be receiving on the transmitted signal frequency. This note is for the HF direct keyed radio case (NOT MCW via SSB transmitter microphone audio which is discouraged).

Since MCW operation is primarily intended to provide a means to transmit code practice and not for CW reception, the demodulator center frequency may be set to a different frequency than the modulator without penalty in most cases. Typically, the modulator will be set to 850 Hz, and the demodulator will be set to whatever frequency is dictated by the HF radio with which it is to be used.

The CW demodulator can be used without a narrow filter in the radio. It will of course be subject to more noise and QRM in this case. The tuning range for the demodulator will be VERY restricted even though the wide filter is used in the radio since the demodulator itself acts as a very narrow filter.

An oscilloscope will be required to adjust the demodulator to a 50 percent duty cycle square wave output. The main difference when aligning the CW modem is that there will be only 1 continuous tone presented to the demodulator for this adjustment.

Tuning the CW modem is basically a 4 step procedure. The steps should be followed in the order presented. The steps (in broad outline) are:

1. Determine the required demodulator center frequency (Fc) for the radio you intend using in the direct keyed CW mode.

2. Set the CW modulator tone to this frequency.

3. Set the demodulator center frequency using the modulator tone as reference.

4. Set the modulator tone to 850z.

Detailed CW Demodulator Alignment Procedure

1. Determine the required Fc for the demodulator. If the radio has a narrow filter for CW, one of the 2 methods presented elsewhere in this manual should be used to determine the filter center frequency. This frequency should be used for Fc. If the radio has no narrow CW filter, use the CW carrier offset frequency of the radio. This information should be available in the radio manuals.

2. Set the modulator tone to the required Fc using the following procedure.

   a. Command the MFJ-1278 into MCW mode by typing "MODE MC <CR>".

   b. Install push on jumper at JMP-4. This is the watchdog timer defeat jumper.

   c. Place a push on jumper at JMP 9, pins 1 and 2. This connects the modulator square wave output to the SIO chip so that the CPU can measure the tone frequency for you.

   d. Type "CALSET n <CR>". Where n is a number determined by:

      n = INT [525000 / F(low)] + 1

      This tells the CPU what tone frequency you are trying to achieve.

   e. Command the MFJ-1278 into calibrate mode by typing "CAL <CR>".

   f. Command the MFJ-1278 to key the modem by typing "K".

   g. Select the MCW tone by pressing the space bar until a voltmeter connected to U16, pin 9 reads + 5 volts. This signal is more conveniently available at the junction of Q12 collector and R62.

   h. Adjust R139 carefully until both the "CON" and "STA" LEDs on the front panel of the MFJ-1278 are lit.

i. Remove the jumper placed at JMP 9.

j. Return the MFJ-1278 to command mode by typing "Q".

3. Align the demodulator to Fc using the MCW tone. Use the following procedure.

a. Place a push on jumper at JMP 7. This connects the modulator output to the demodulator input.

b. Place a scope probe on left pin of JMP 10 (pin closest to Q 14). The oscilloscope will be used to indicate when the square wave that will appear at this point during the adjustment procedure approaches 50 percent duty cycle.

c. Command the TNC into calibrate mode by typing "CAL <CR>".

d. Command the TNC to key the modem by typing "K".

e. Select the MCW tone by pressing the space bar until a voltmeter connected to U16, pin 9 reads +5 volts. This signal is more conveniently available at the junction of Q12 collector and R62.

f. Turn R115 fully clockwise, until a click can be heard from turning the pot.

g. Now begin to rotate R115 CCW slowly. Watch the scope while rotating R115. A stable square wave should appear between about turn 4 and turn 9. Which turn on the pot where you find the spot that produces a stable square wave may vary from unit to unit. There are only about 1 to 2 turns where the square ware will appear on the scope.

h. Adjust R115 so the square wave displayed has a 50 percent duty cycle. Note that when R115 is adjusted properly, the period of the square wave should be about 0.66 milliseconds.

NOTE! If you have a square wave on the scope face but the tuning indicator is not near center, you are on a false setting. Adjust R115 so that the tuning indicator is near center and THEN set the square wave duty cycle.

4. If MCW transceive operation with another station is desired, do the above procedure to BOTH MFJ-1278s using an agreed upon frequency for Fc. Then leave the

modulator tone on the agreed on frequency with the demodulator Fc.

5. Remove jumpers placed at JMP 4 and JMP 7.

This completes the CW modem alignment procedure.

AUDIO OUTPUT CALIBRATION

The transmit audio output levels of MFJ-1278 Radio Port 1 and Radio Port 2 both are factory set to 250 mV. If it is necessary to set either one of the radio port output to a different level necessary to drive your radio, you should follow the procedure given in this appendix.

Note that the output levels of radio port 1 and radio port 2 are set independently. Adjust R157 for radio port 1 and R158 for radio port 2. Both controls are accessible from the outside thru screw driver adjustment holes on the left side of the MFJ-1278. It is not necessary to remove the cover.

Most often audio output level of the MFJ-1278 can be set simply by monitoring the transmitting audio with a connecting station. However, if you require a more precise setting or making the adjustment without an on-the-air test, then use the procedure given here.

Audio Output Level Adjustment Procedure

1. After the cmd: prompt sign, set the MFJ-1278 to VHF packet mode by typing:

   MODE VP <CR>

2. Verify that you are connected to radio port 1, type:

   RADIO 1 <CR>

3. Enter: CALI <CR>

4. Press the "K" key. The PTT LED should illuminate.

5. Place the oscilloscope probe at JMP 7.

6. Signal on the scope should be approximately 1 volt p-p.

7. Verify that the voltage on pin 9 of U16 is -5 Vdc. If it is +5 Vdc instead of -5 Vdc, push the space bar. The voltage should alternate between +5 Vdc and -5 Vdc each time the space bar is pressed. Set this point to -5 Vdc.

8. Move the probe to J9 pin 1 (TX audio). Adjust R157 for a signal of 250 mV p-p or to a level recommended by your radio instruction manual.

9. Move the probe to J9 pin 4 (RX audio). The signal should be approximately 1 V p-p.

10. Press the space bar and again measure the peak to peak voltage at J9 pin 4. The audio level should not change. (Both mark and space audio should be at the same level.)

11. Type:

    Q

    the cmd: prompt appears on the screen.

12. Switch to radio port 2 by typing:

    RADIO 2 <CR>

13. MFJ-1278 responds:

    cmd:

14. Enter: **CALI** <CR>

15. Press the "K" key. The PTT LED should illuminate.

16. Verify that the voltage on pin 9 of U16 is -5 Vdc. If it is +5 Vdc instead of -5 Vdc, push the space bar. The voltage should alternate between +5 Vdc and -5 Vdc each time the space bar is pressed. Set this point to -5 Vdc.

17. Place the scope probe on J2 pin 1 (TX audio). Adjust R158 for a signal of 250 mV p-p or for a level recommended by your radio instruction manual.

18. Move the scope probe to J2 pin 4 (Rx Audio). the voltage should be approximately 1 V p-p.

19. Press the space bar and again measure the peak to peak voltage at J2 pin 4. The audio level should not change. (Both mark and space audio should be at the same level.)

20. Type:

    Q <CR>

21. Remove the jumper from JMP 4.

22. Switch SW1 to the OFF position.

HF RADIO ALIGNMENT

If you have determined that it is necessary to realign the MFJ-1278 modem center frequency to your radio filter center frequency, one of the following 2 methods should be used to make the radio filter center frequency (Fc) determination. Both methods require access to a frequency counter capable of measuring audio frequencies to a resolution of 1 Hz. Almost any frequency counter should be capable of this.

First method: NOISE AVERAGE FREQUENCY

This method also requires an active noise source like a receiver noise bridge. There are several suitable units available for this purpose.

1. Set the receiver to LSB mode with the 500 Hz filter selected.

2. Connect the noise source to the receiver input. Make sure there is no antenna connected to the system and that the receiver is tuned to a frequency which is free of coherent internally generated signals (birdies).

3. Set the noise source output for a reading of approximately S-9 on the receiver S meter.

4. Connect the counter to the receiver audio output

5. Adjust the receiver output level for enough audio to reliably trigger the counter.

6. Make sure the radio's IF shift control, if one is present, is in its proper position (centered or on detente).

7. Record the frequency indicated by the counter. The counter should indicate the average frequency of the noise spectrum passed by the filter in the receiver and translated to audio by the product detector. This will be the frequency used for the modem center frequency (Fc).

NOTE: If the counter is a phase locked loop (PLL) based prescaling type, its PLL may not lock properly to the noise signal. If this is the case, use method 2 below. If your counter can resolve 1 Hz with a counting gate time of less than 1 second, it is a PLL prescaling counter.

Second method: FILTER SKIRT AVERAGE FREQUENCY

1. Set the receiver to LSB mode with the 500 Hz filter selected.

2. Make sure the radio's IF shift control, if one is present, is in its proper position (centered or on detente).

3. Using either a signal generator or a stable, relatively strong carrier from an AM broadcast transmission (preferably ground wave signal), tune the receiver so that the carrier falls near the center of the filter passband. Choose a signal level near S-9 for this test. If your rig has a built in calibration oscillator, this is a good source for this signal.

4. Slowly and carefully tune the receiver so that the tone frequency is decreasing.

5. Find the point where the signal is reduced by 1 S-UNIT from the peak value reached near the center of the filter passband.

6. Measure this tone frequency with the counter. Record this value as F(low).

7. Slowly and carefully tune the receiver so that the tone frequency is increasing.

8. Find the point where the signal is reduced by 1 S-UNIT from the peak value reached near the center of the filter passband.

9. Measure this tone frequency with the counter. Record this value as F(high).

10. Calculate the required modem center frequency as:
$$Fc = [F(low)+F(high)]/2$$

Once the required center frequency has been determined, the modem calibration can be carried out.

NOTE: It is essential that the modulator tones be properly aligned FIRST as they will be used to align the demodulator center frequency.

Set the modulator tones to Fc MINUS 100 Hz for the low tone and Fc PLUS 100 Hz for the high tone using the procedure given in the owners manual. Align the demodulator to the modulator tones using the built in demodulator alignment facility invoked with the RXCAL command described Appendix B of this manual.

CONVERTING THE MFJ-1278 TO "LIKE-TNC 2"

With a simple modification as described in APPENDIX E, the MFJ-1278 can be converted to a "like TNC 2" controller. Once converted, the MFJ-1278 can run programs such as NET/ROM (tm), THE NET (tm) and other special firmware which are developed for the TNC 2. The modification described below sets the MFJ-1278 into a "like" TNC 2 mode. What this means is the MFJ-1278 will work like a TNC 2. MFJ-1278 will be set to operate 1200 baud VHF packet. Radio port will be set to port No.1. Terminal baud rate will be set by the AUTOBAUD routine which is 300, 1200, 4800 or 9600 baud.

The modification involves in replacing IC U27 and U28 with pre-programmed header as shown in Figure E-1 and Figure E-2 below. Firmware EPROM, U23 will be replaced by an EPROM which contains program such as NET/ROM, THENET etc.

Modification of MFJ-1278 for "Like" TNC 2 operation involved making it to default 4800 baud for the terminal baud rate, 1200 baud radio baud using VHF packet tones on Radio Port 1. The procedure is as follow:

1. Remove power from the MFJ-1278.

2. Construct **Header** U27 by connecting pins 9, 12, 16 and 19 to ground at pin 10. Connect pins 2, 5 and 15 to +5 Volts at pin 20. See Figure E-1 below.

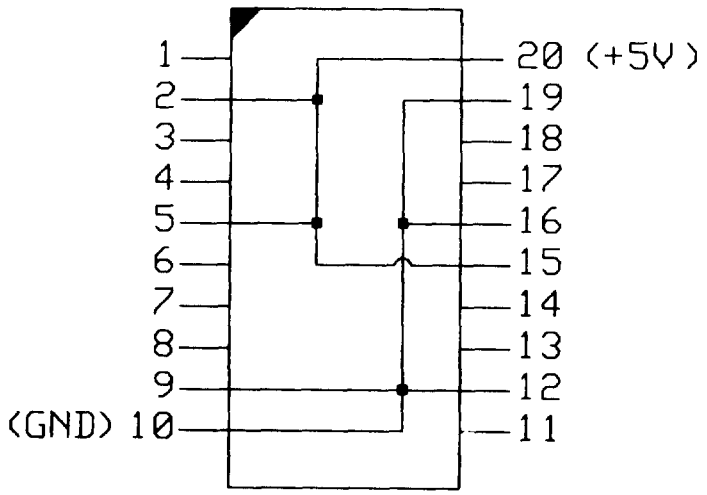

Fig. E-1: Header U27