Construction

Construction and layout of this unit is not critical. One option is to build on a standard perforated board. The unit shown in Figure 4[5] was built on standard RadioShack prototype board with two aluminum angle brackets for supports. As with all CMOS integrated circuits, use caution when inserting the ICs to avoid electro static damage. A good wrist-grounding strap is very useful.

This unit runs at a relatively fast clock speed so bypassing of the 5 V power is important. The 0.1 µF capaci-

Spreadsheet to Calculate Sine Wave Value for TNC Transmitter

R1	1000
R2	2000
R3	3900
R4	8200
R6	100000
R12	10000 This is with wiper at top of pot

	MSB			LSB	Ladder	Time	To	
Value	V1	V2	V3	V4	Out Eo	t	Transmitter Vo	
7	0	5	5	5	2.33	1		0.21
6	0	5	5	0	2.00	2		0.18
5		5		5	1.65	3		0.15
4		5			1.32	4		0.12
3			5	5	1.00	5		0.09
2			5		0.68	6		0.06
1				5	0.32	7		0.03
1				5	0.32	8		0.03
1				5	0.32	9		0.03
1				5	0.32	10		0.03
2			5		0.68	11		0.06
3			5	5	1.00	12		0.09
4		5			1.32	13		0.12
5		5		5	1.65	14		0.15
6		5	5		2.00	15		0.18
7		5	5	5	2.33	16		0.21
9	5		0	5	2.97	17		0.27
10	5		5	0	3.33	18		0.30
11	5	0	5	5	3.65	19		0.33
12	5	5		0	3.97	20		0.36
13	5	5	0	5	4.29	21		0.39
14	5	5	5	0	4.65	22		0.42
15	5	5	5	5	4.97	23		0.45
15	5	5	5	5	4.97	24		0.45
15	5	5	5	5	4.97	25		0.45
15	5	5	5	5	4.97	26		0.45
14	5	5	5	0	4.65	27		0.42
13	5	5	0	5	4.29	28		0.39
12	5	5	0	0	3.97	29		0.36
10	5		5		3.33	30		0.30
9	5	0	0	5	2.97	31		0.27

Note when Vo is Plotted over time, a sine wave is produced

Figure 3—Sine wave generation on a PIC.

tors on each integrated circuit should be located right at the device with leads of one inch or less. I can't tell you how many times I have spent time debugging a digital circuit problem only to find out I had noise on the 5 V line. Bypass capacitors are cheap and small, use them freely.

If you make your own board for this project, it is always good to do some checkout before you install the integrated circuits. First apply 12 V and check for +5 on pin 14 of the PIC16F88 and pin 16 of the MAX232. If this looks good, install the chips using the wrist strap. Don't forget to program the microprocessor chip (see later section) before installation.

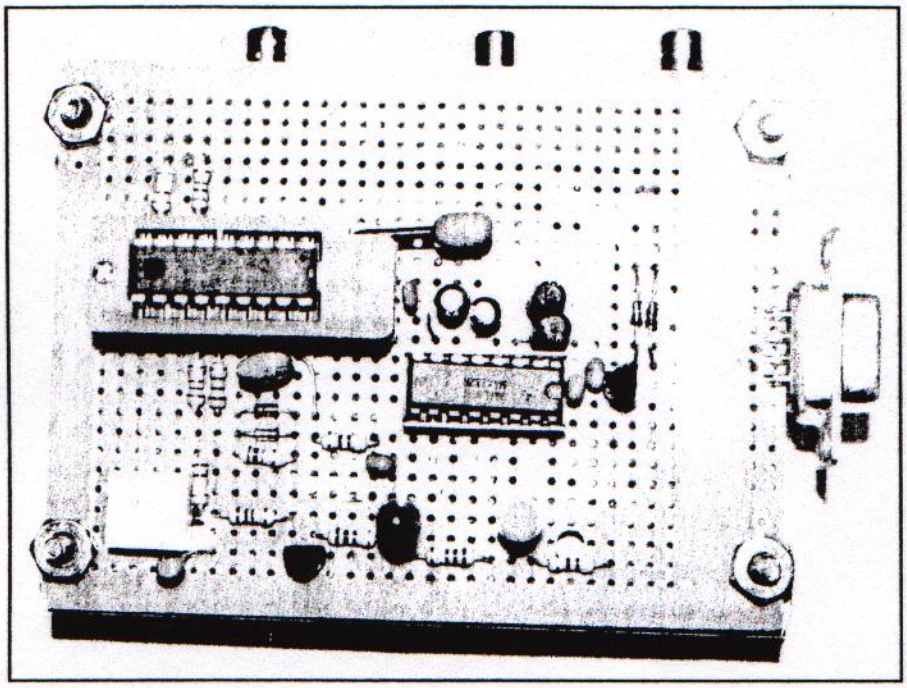

Figure 4—Breadboard style unit.

After building the prototype shown in Figure 4, I discovered another construction option, the popular Olimex prototyping board. This is the fastest way to construct the TNC.

Many projects need the basic processor, crystal, power circuit and serial connection. Olimex has provided a built and tested circuit board with this much of the circuit complete. It also includes an area to build the rest of the circuit. In the case of the TNC, approximately ½ of the components are already on the board.

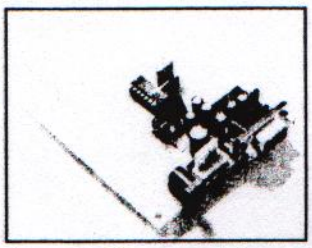

Figure 5—Olimex prototype board.

The purchased board from Olimex contains the processor chip, all serial

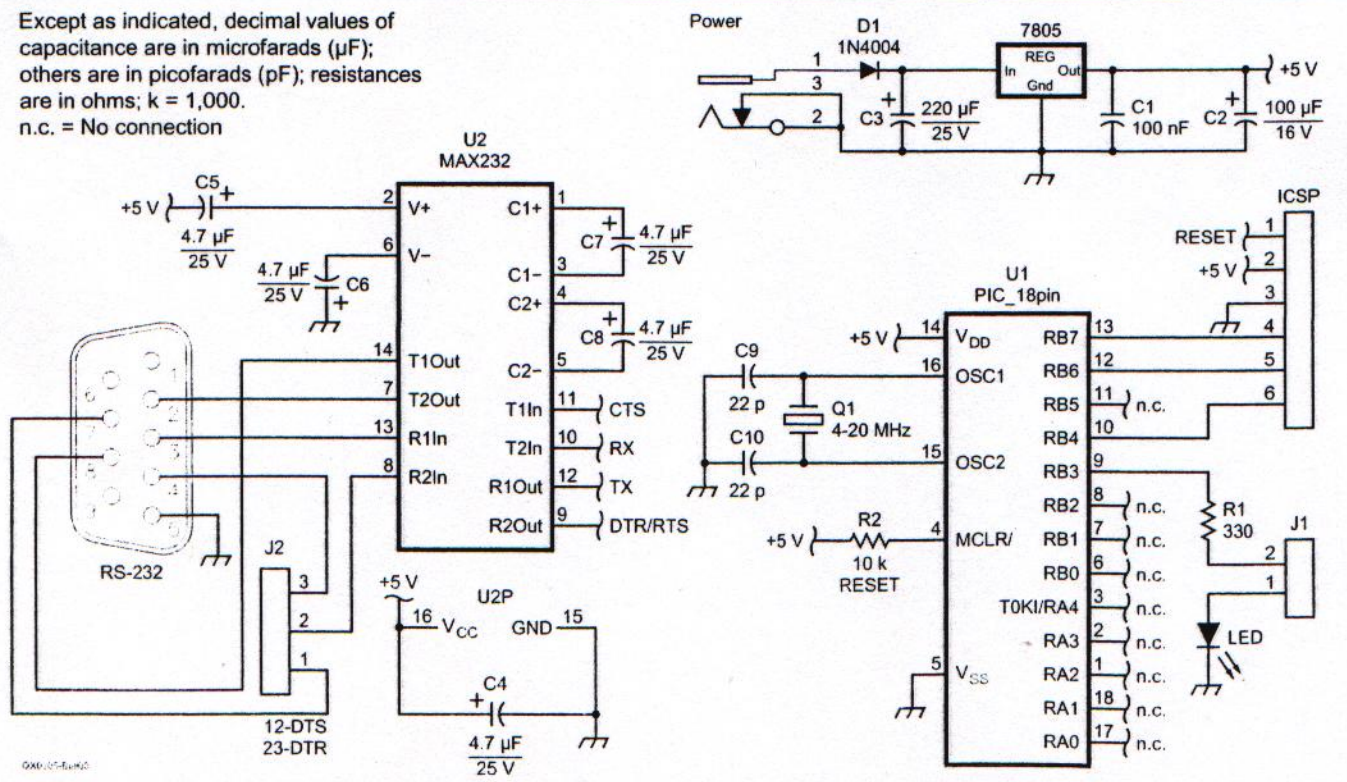

Figure 6—Schematic of the Olimex board.

Detailed Instructions for the Olimex Board

When you receive your Olimex board, it is a good idea to check it out before you add any wiring. I recommend installing the Boot Loader program which is supplied with a small checkout program that will flash the leads on the board.

Initial Checkout

1. Remove the supplied PIC16F88 and program it with the supplied Bloader Program. This should be the only time you will need an external programmer for this project. REMEMBER TO DISABLE THE MASTER CLEAR WHEN THE CHIP IS PROGRAMMED.

2. Reinstall the processor chip. With no serial port connected, power up the unit. The LEDs should alternately flash. If they do not, stop here and get a replacement board from your supplier.

Now go ahead and add the TNC wiring:

Serial connections

1. Remove J1
2. If GPS operation is desired, install wiring for GPS Receive Enable. Do not install jumper until set up is complete (see text).
3. Lead Labeled RX to Processor Pin 11
4. Lead Labeled TX to Processor Pin 8

TNC Receive Circuitry

1. Ground Pins 1 and 18 of Processor
2. Connect Processor Pins 2 and 10 to D1 Cathode
3. Connect R11 to 5V
4. Connect R10,D2, D3, R7 to Pin 17
5. Ground other lead of D2,D3, and R7
6. Connect R10 other end to C6

TX Receive Circuitry

1. Connect one end of R1,R2,R3, and R4 to Processor Pins 13,12,9, & 7 respectively.
2. Connect other end of R1,R2,R3, and R4 to R6
3. Connect other end of R6 to R12
4. Ground other end of R12
5. Connect one end of C7 to R12
6. Connect other end of C7 to output and R8
7. Connect Pin 6 of Processor to D5 Anode and other end of R8
8. Connect other end of D5 cathode to R5
9. Connect other end of D5 to ground
10. Connect R8 other end to Q1 Base
11. Connect Q1 Emitter to Ground
12. Connect Q1 Collector to R9 and PTT out
13 Connect other end of R9 to C7

Wiring is Complete. Now install the TNC software

1. Remove Power from the TNC
2. Connect a serial cable from the serial port to your PC or terminal. Start up the terminal program.
3. Remove J4
4. Install the PC portion of the loader program called Screamer
5. Start up Screamer. Hit the program button and supply the file name for the TNC software. Screamer should say "Waiting for Broadcast"
6. Power up the TNC, Screamer should program the chip and indicate successful completion
7. Exit Screamer program on PC and Start Terminal Program
8. The command interpreter should be running on your TNC. Set your options, connect the radio, and your on the air.

Figure 7—Step-by-step wiring instructions for the Olimex board.