N3ZI Digital Dial Manual

Simple kit for use with HD44780 Type LCD

Rev 2.03 For Jan 2013 PCB

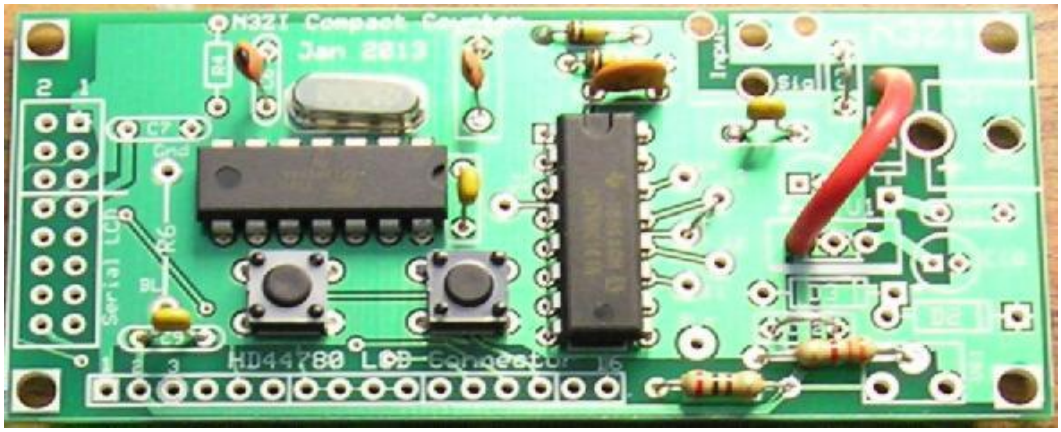

Photo of Assembled Kit, some of the components in your kit may be a different color or size. And, as you can see from the photo, much of the circuitry on the PCB is not be used

Kit Components			
Item	**Qty**	**Designator**	**Part Color/Marking**
PCB	1		
Prescaler	1	U2 Prescaler	16 Pin Dip, 74HC161/3
Microprocessor	1	U3 Microprocessor	14 Pin Dip, ATTINY84
XTAL	1	XTAL	Metal can
Caps, 0.1 uF	3	C2, C7,C8	Yellow - 104
Cap 47pF	1	C4	Orange/Brown 47
Caps, 22 or 27pF	2	C5,C6	Brown/Orange
Resistors, 100K	2	R1,R2	Brown-Black-Yellow
Resistor, 3.3K	1	R5	Orange Orange Red
Resistor 200	1	R3	Red Black Brown
Switch	2	SW1, SW2	

Note that the above list is only a general guide. You will receive a packing list with your kit which may differ from the above list. The list included with your kit supersedes the above list.

Jumpers: There are 3 jumpers that must be soldered in. CJ1 & CJ2 are marked on the silkscreen. A prescaler jumper is also needed, start with "T" to "11" read below for other options. This version of the kit is designed to work with a regulated 5VDC power source. So a jumper across D1 and across U1 (outside pins) is needed

Your LCD is connected to the 16 pin single row connector near the bottom of the PCB, labeled "HD44780 LCD Connector" Solder insulated wires from the PCB to the LCD module, see photo. The wiring is straight through if you align

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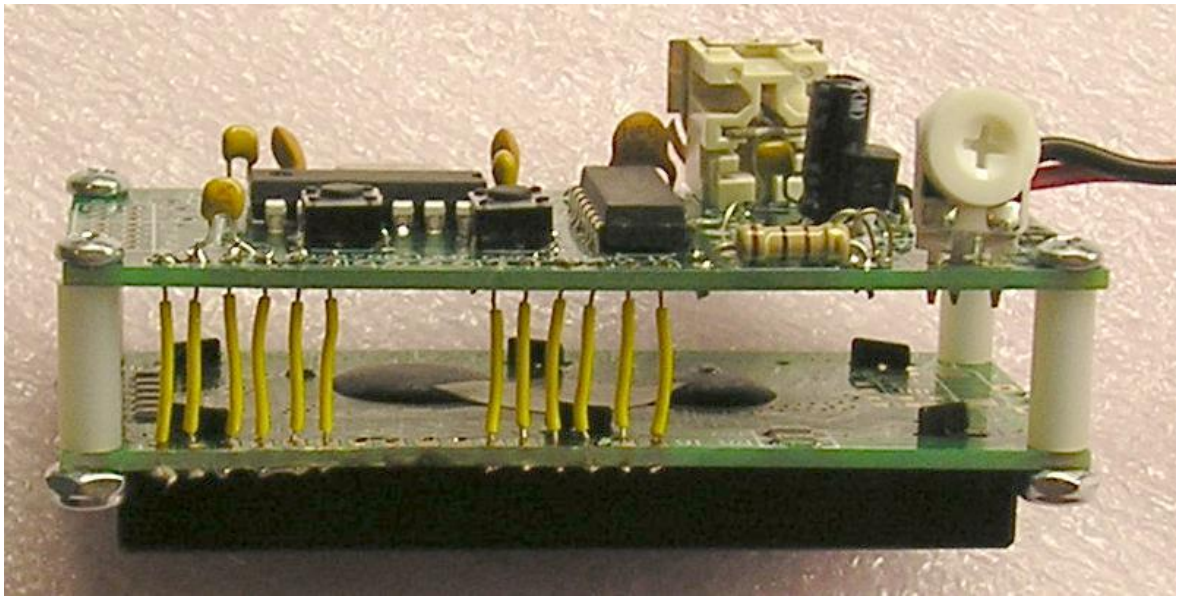
the board back to back. If you are using stranded wire, twist and tin each end of the wire first. As shown in the photo, you can skip pins 7-10, they are not used.



This photo is shown to illustrate with connection to the LCD, the PCB in the above photo shows some additional parts not included in your kit.

Initial Set Up:

Operates from regulated +5.0 VDC, 100mA power source. When you first power up the counter, a date code should appear for about 2 seconds, then the frequency reading will show. If there is no input, then the IF frequency will be displayed.

If that all looks ok, turn it off, hold one of the push buttons down, and apply power. The date code will appear and stay there until you release the pushbutton, and then you will enter the setup routine.

The first set up item is the calibration factor for the crystal used.

CAL 200000

You will need to set this to a value equal to the crystal frequency included with your kit. This value equals the actual oscillating frequency of the microprocessor crystal, in hertz, divided by 100. The default value shown above is for a 20MHz Xtal. If your kit has a 20MHz Xtal, Just do nothing to keep the default, it will move to the next step in 5 seconds. If your kit includes a different xtal, then you will need to change this. The crystal frequency is stamped on the xtal can. You can more precisely calibrate your counter, by tweaking this setting.

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The next step is setting the timebase factor. The default is 4.

Div/n 004

The presacaler 'T' jumper setting must match this setting. The default of Div/4 corresponds to a T-13 Jumper which result in faster updates, but lower maximum frequency. For maximum frequency (and slowest updates) jumper T-11 and set this value to 16. The maximum frequency that the counter can count is equal to 45% Xtal frequency times the divide ratio, or 55MHz, whichever is lower.

The way the setup works, is the buttons increase and decrease the number displayed. Once you've gotten to the value you want. Simply release all the buttons and after about 5 seconds it will proceed to the next step. Decrementing beyond 0 will make it negative, be careful not to accidentally enter a negative value for the timebase factor.

The next step is the number of IF's. The default is usually 2

# of IF's 002

But if you are just using one IF offset, change this to "1". If you don't want to use the IF offset feature i.e use as a straight frequency counter, then set this to "0"

The next step is for setting the decimal point position.

dp pos 12,345.6

Pressing either button sequences the decimal points through the possible positions. The default is with the decimal point between the 1st and second digits. You can also turn them off. The position is strictly cosmetic, but the readout can be quite confusing if they are set wrong. Use the default for 100Hz resolution change to 1,234.56 for 10Hz resolution.

The next parameters are the IF frequencies. You will be promoted for as many IF's as you specified above.

IF1 -5.172.0

Simply use the up down buttons to change the IF, for a large change, holding a button down continuously will change the value at an accelerating rate. If the value is negative, a minus sign will appear. If you have to change from a positive IF to a negative number just keep reducing the IF value by holding the button down, eventually it will go to zero and the minus sign comes on, and you keep going. If your radio uses a subtractive frequency plan, you need to enter the IF as a negative number. For example, many swan radios use a

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5500 or 5173 KHz IF. You should set one IF to –5.500.0 and one to 5.500.0, for 40m and 80m the SWANs use a subtractive IF, for the higher bands they use an additive IF.

Large changes can take some time, for example It takes about 90 seconds to go from +10.000.0, to –10.000.0 MHz. (Longer to get to the maximum of +/- 99MHz) Once you are close to the value you want, release the button, and use the buttons to tweak it in. The change speed slows the instant the button is released. After your satisfied, just release both buttons, and after 5 seconds of no buttons being pressed, it will move to the next IF. After they are all in the values will be saved in EEPROM. Next time you power up these values will be used.

If you want to use it as a frequency counter, just set one of the IF's to 0. If you are not sure of your IF frequency, set it to zero, then use the device as a frequency counter to measure your radio's BFO frequency. Then go through the setup again using that value for the IF.

Initial Operation and Calibration:

With the 74HC161 prescaler the input sensitivity is 250mV RMS (~700mV peak to peak) meaning your VFO signal must be above this level. The maximum input signal level is 5v peak to peak (1.8v RMS) There are clamp diodes on the input of the microprocessor which will absorb some excess voltage, but if you overdrive it too much, such as directly with a transmitter, it will be permanently damaged. Even a 1 watt QRP rig puts out 20v peak to peak, which will cause damage.

Once you get it hooked up to your radio's VFO, you may want a fine tweak of the IF, to compensate for a variety of errors, including the frequency error in the crystal. Generally these are less than 1 Khz.

During normal operation, the buttons are used to switch IF's. Pushing SW2 switches to the next IF and displays that value. Pushing SW1 goes to the previous IF. Holding either switch down runs through all the IF's, just stop at the one you want. They both wrap around, so only one is really needed unless you program in a bunch of IF's. These switches are SPST NO switches, so you can add another switch in parallel if you want to be able to toggle through the IF's without reaching around to the back of the counter. If you are going to put the counter in an enclosure, I suggest you put a pushbutton on the front connected to SW1.

Tune your radio to a known frequency, observe the readout, and compute the error by subtracting the readout value from the expected frequency. Then go through the set-up again, and change your IF setting by exactly that amount. Calibrating this way eliminates the need for a trimmer capacitor in the xtal oscillator circuit. If you are going to use the counter over a wide frequency

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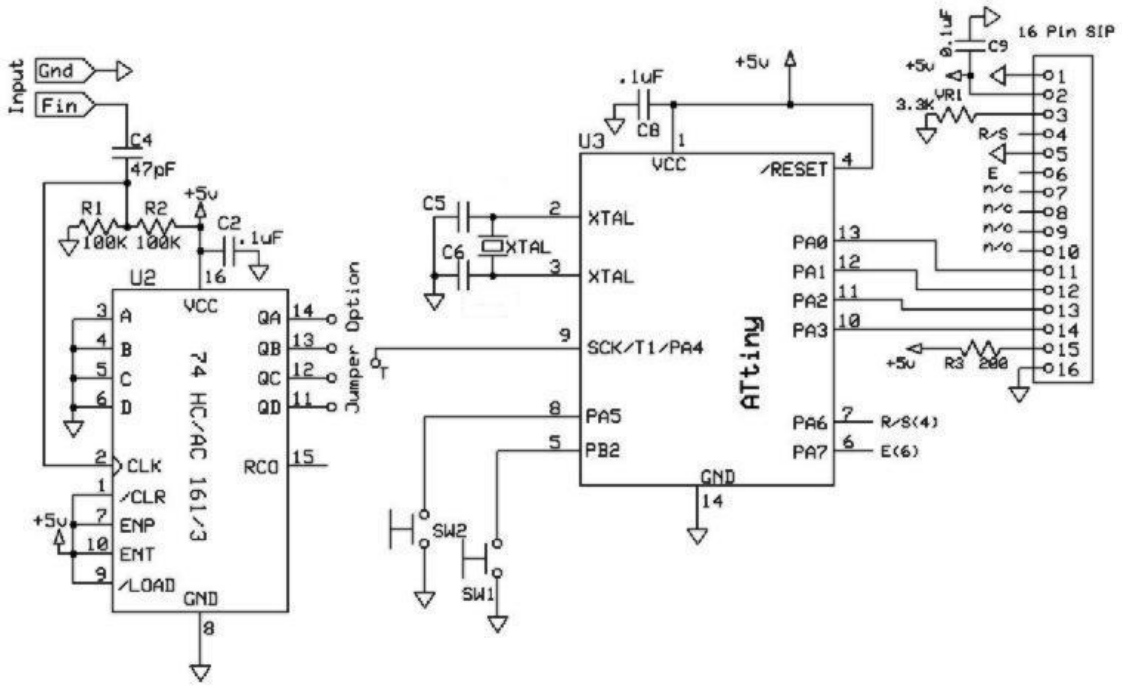
range then it is better to calibrate it using the "CAL" parameter in the set up. If you want you could use a 50pf trimmer in place of one of the 27pf capacitors, and using that to tweak unit you get exactly the reading you want.

Other Considerations

Anti jitter logic. The s/w designed so that the last digit will not jitter between two values. Even if you purposely set your VFO on the edge of two readings, it won't jitter. Now if your VFO is very unstable, then you may see some jitter. In essence you have 1 LSD (100hz) of hysteresis in the counter.

The readout may show a negative sign, which can be ignored under normal operation. But basically if your radio has a frequency plan that causes the VFO frequency to move in the opposite direction of the operating frequency a minus sign will be shown.

Low frequency operation: This counter is designed for amateur radio applications measuring radio frequencies. However, it will also work down to 100KHz with the supplied components. Specifically the limiting factor is C4 the input coupling capacitor. If one was to change C4 to a 1uF capacitor, the low frequency limit would be reduced to approx 10Hz. Below that you would have to use DC coupling.



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