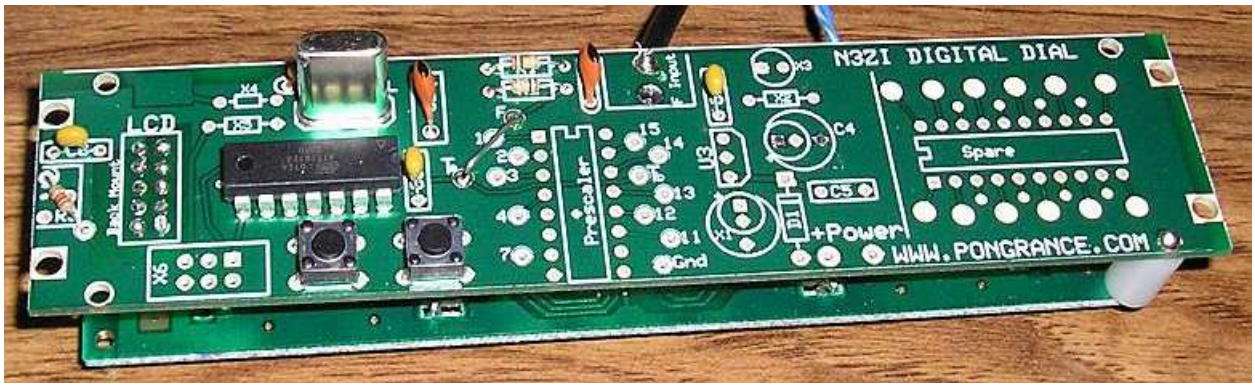
N3ZI Digital Dial

Simple Kit Manual

Rev 1.3 27 Sept 2008



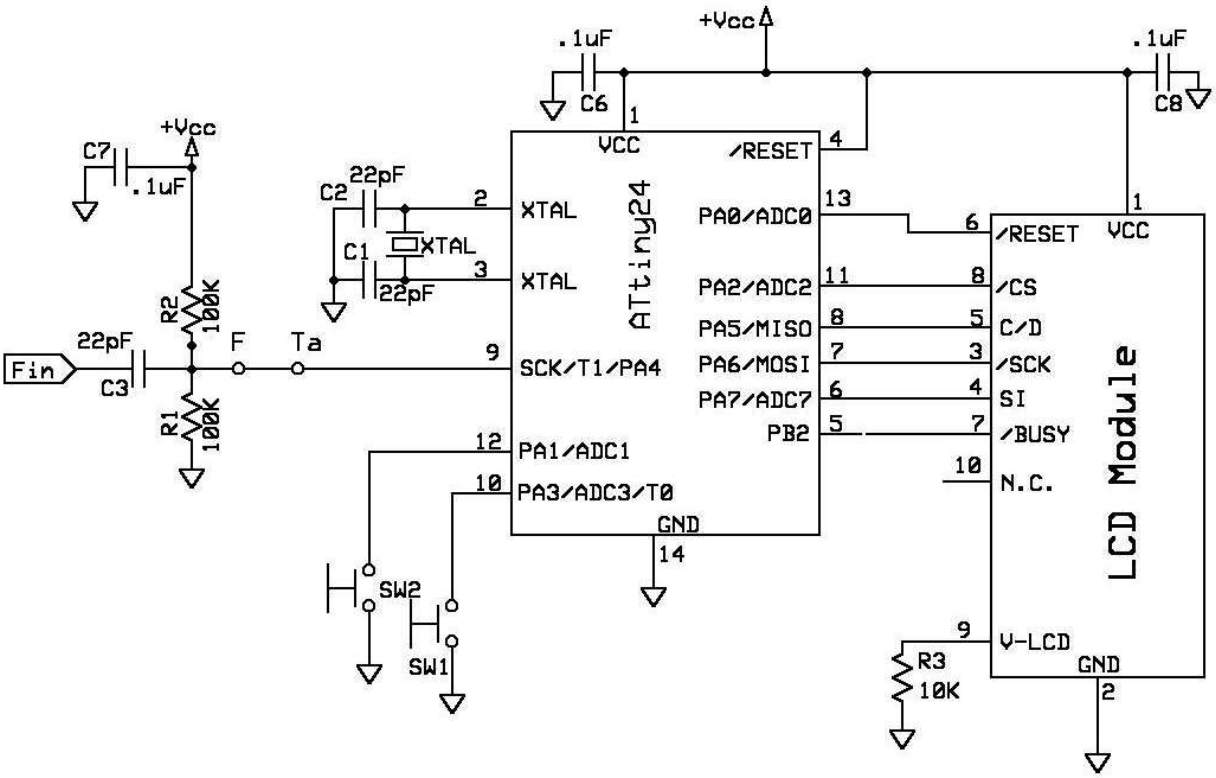
Simple Kit photo

SIMPLE Kit Components			
Item	**Qty**	**Designator**	**Part Color/Marking**
PCB	1		
LCD Display	1		
Microprocessor	1	Microprocessor	14 Pin Dip, ATTINY24
XTAL	1	XTAL	
Caps, 22pF	3	C1,C2,C3	Orange - 22
Caps, 0.1 Uf	3	C6,C7,C8	Yellow - 104
Resistors, 100K	2	R1,R2	Brown-Black-Yellow
Resistor, 10K	1	R3	Brown-Black-Orange
Switch	2	SW1, SW2	

You should start by soldering all of the passive components in the circuit board. Leave the two IC's and the LCD module uninstalled for the time being. You can connect your power wires to the back of the board like I have in the photo above, or you can solder into the U! holes. Any voltage from 3.3 to 5 volts will work. But if you are using less than 4volts replace R3 with a shorting jumper. Double check your work, and apply power. Check the voltage at pin 1 of the microprocessor and pin 16 of the prescaler, you should your Vcc there.

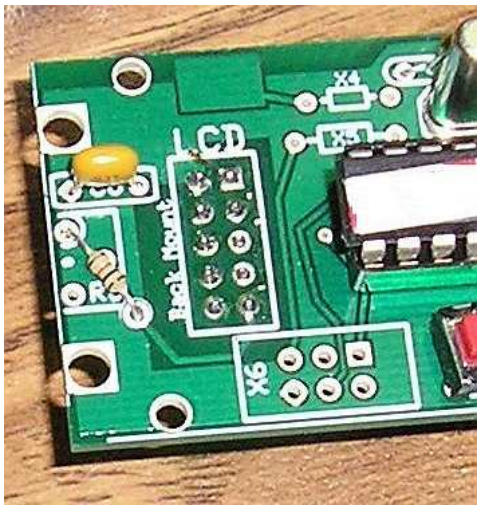
As long as that is ok, disconnect power, and solder the Microprocessor. You can use sockets, but my experience is that IC sockets can cause problems, so I recommend that you solder the IC directly into the PCB.

Lastly solder the LCD module in place. Solder insulated wires from each position in the 10 pin area from the PCB to the LCD module. Use about 1-2 inches of wire, and this will allow you to fold the two boards apart to get to the back of the PCB if you need to make changes.



The first photo shows the assembled counter without a prescaler chip. The PCB is stacked with the LCD module, which is face down on the desk in that photo.

Just a note about the switches, if you want to use different, or remotely mounted switches. There are 4 holes on the PCB for each switch, the upper left is the active signal, the lower right is grounded, the other 2 are not connected.



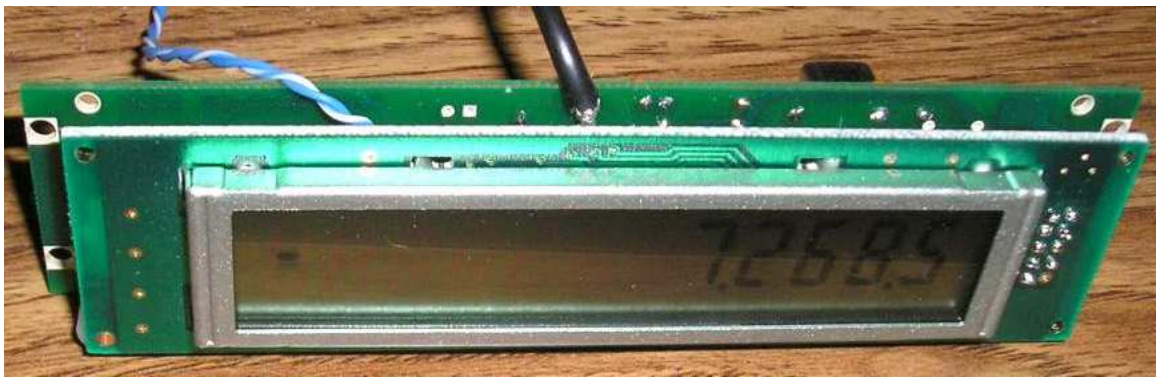
In the photo the 22pF capacitors are the orange caps, the 0.1 uF caps are yellow. Note that R3 is mounted diagonally, you can see in at the far left side of the PCB in the photo.

The LCD Module and the PCB have 4 matching holes. They are rather small for hardware, so I added two holes on the ends which accept 4-40 hardware. 14 Gauge solid wire fits in the LCD module holes and the boards can be made into a solid stack by using holes and spacers. All the holes are plated through so you can solder the 14 gauge wire in place. The electrical connection to the LCD module is made with 10 holes (2 rows of 5) on the right hand side of the photo. The wiring is straight through, and I recommend insulated solid wire, which also provides for some mechanical support. If you are planning to change things from time to time, you probably should use insulated stranded wire so you can separate the two boards. If your

interconnecting wires are more than 2 inch long you should add a 10K resistor from LCD module pin 7 to ground.

This kit requires a regulated power source of 3.3 to 5 VDC. You can connect power into the holes for C4 which is not used in your kit. If you connect your 5v power to the 12v power pin you will have to jumper D1 and U2. You kit includes a 10K resistor for R3. If you use 4.5 to 5 volts, then the 10k resistor supplied is fine. If you use something under 3.8 volts, then you can replace R3 with a jumper. Between 3.8 and 4.5 volts 4.7K should work. If you expect your supply voltage to vary (i.e. if using batteries) then it is best to install a trimpot, so you can adjust the LCD contrast at any voltage.

With this simple kit you will end up with a PCB with lots of unused component positions, as you can see from the first photo. If you wish to add features once you get this simple kit version working you can do so. None of the parts needed are terribly unique and are generally available from many different sources. You can read all about the additional features in the manual for the bare PCB posted on my web site:
http://www.pongrance.com/manuals.html



Initial Set Up:

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.

The first step is setting the timebase factor. The default is 1. Just do nothing to keep the default, and it will move to the next step in 5 seconds. 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. If you add a prescaler chip later you will need to change this setting. The details are described in the manual for the FULL kit.

The next step is for setting the decimal point position. 12.345.6 will be displayed. 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. Stick with the default, except for some special cases, see table below.

The next parameter is the IF frequency. 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 3 seconds it will proceed to the next step. Holding a button down continuously will change the value at an accelerating rate. If the value is negative, a minus sign will appear at the far left on the display. If your radio uses a subtractive frequency plan, you need to enter the IF as a negative number. Your unit will likely be shipped with an IF of +11.000.0 If your radio has a subtractive freq scheme (i.e. a 7MHz radio with 4Mhz VFO and a 11Mhz IF.) Then you have to change the IF to –11.000.0 To do this you 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. It takes about 90 seconds to go from +11 to –11 MHz. Once you are close, 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, 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 the IF 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.

Calibration:

The counter input to the microprocessor has sensitivity of about 300mV RMS (~900mV peak to peak) meaning your VFO signal must be above this level. The maximum input signal level is equal to your power supply voltage. The maximum 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.

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 want you could use a 50pf trimmer in place of one of the 22pf capacitors, and using that to tweak the crystal oscillator to exactly 13.435MHz. But this isn't necessary. There is also a mathematical parameter inside the software related to the oscillator frequency. In my first version of the software there was a setup step which allowed the user to change this. But I found that this was just too confusing, so I removed it. It's easier to simply tweak the IF setting to calibrate.

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.

The LCD module has mounting holes in the corners. They are rather small, but I have found that #14 wire fits through nicely, and they are plated so you can solder the wire in place. They match up with similar holes in the PCB. Alternatively, you could drill them out (at your own risk) or get some very small mounting hardware. The PCB has 2 holes on each side on the ends which protrude beyond the LCD module. You can use 4-40 mounting hardware in these holes.

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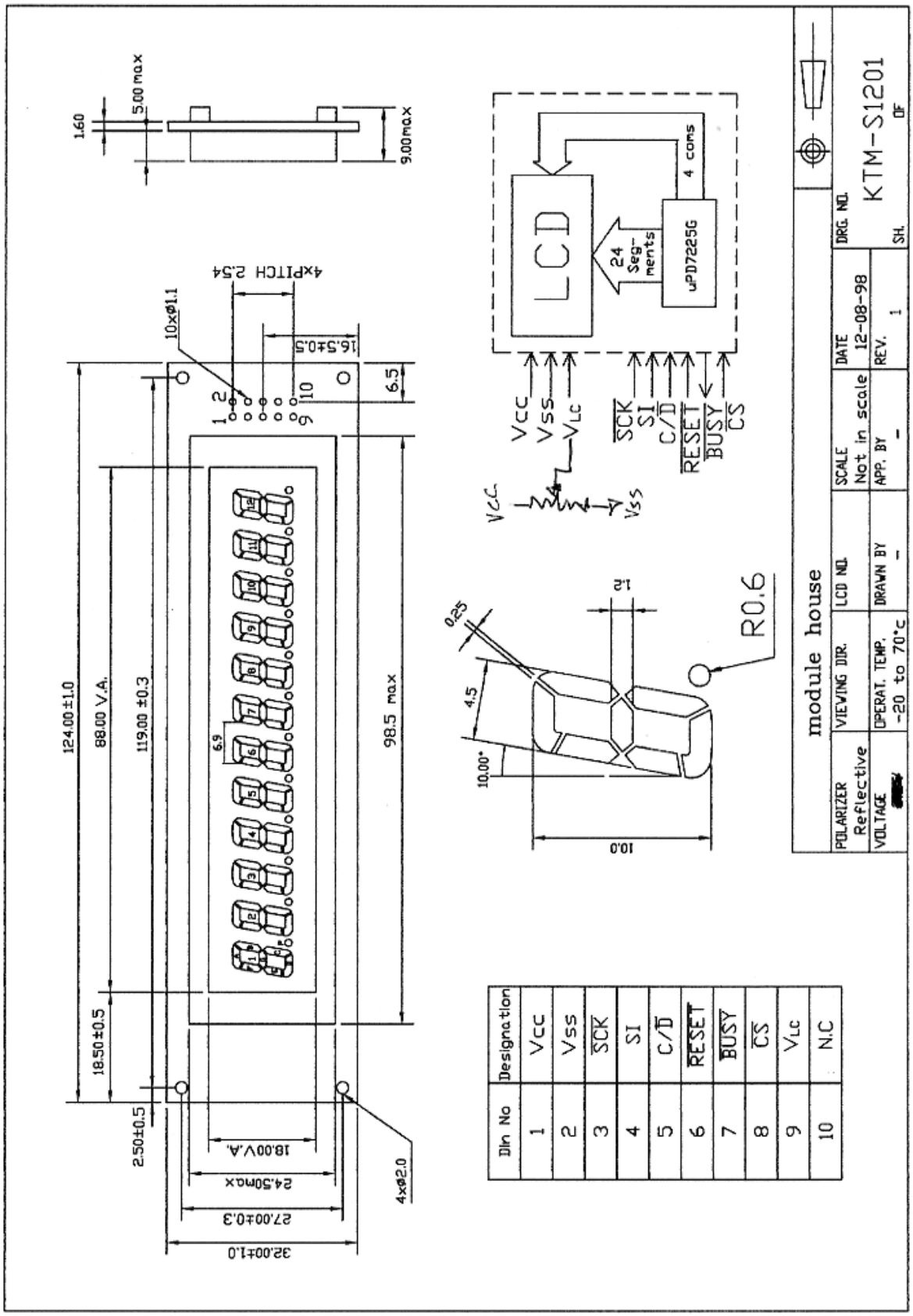

Din No	Designation
1	Vcc
2	Vss
3	SCK
4	SI
5	C/D
6	RESET
7	BUSY
8	CS
9	Vlc
10	N.C