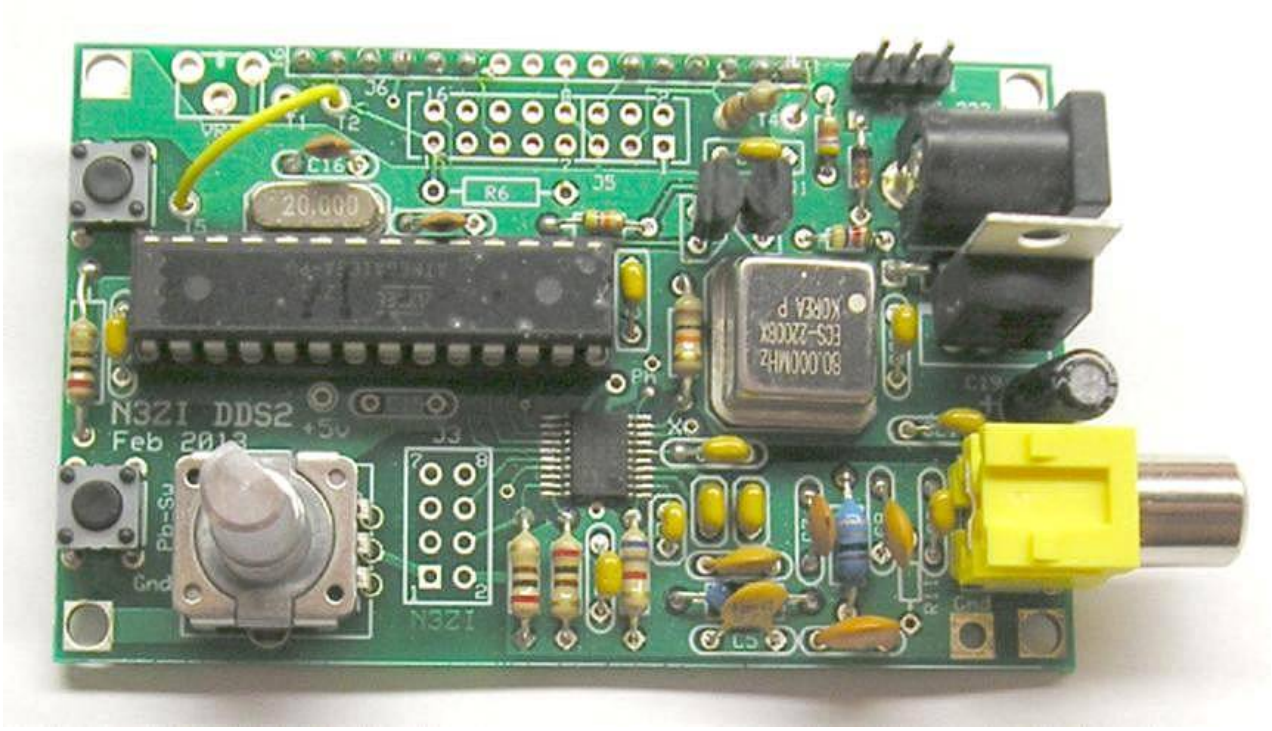
Manual for the N3ZI DDS2
WWW.PONGRANCE.COM
Version 4.12 AUG 2015
For DDS2 kits with PCBs dated Feb 2013 to Dec 2015.



Assembly

This kit is intended for qualified individuals with extensive, from scratch, home brew experience, not just with other simple kits. Please read this manual in it entirety prior to starting construction. If you then feel that you cannot assemble this kit please return it to us for a refund.

Verify Parts: Verify that you have all the correct parts for your kit by checking the parts against the **printed packing list included with your kit**. Although there is a list of materials further down in this manual, The packing list included with your kit is the most up to date. Many of the parts are static sensitive, and you should use industry standard techniques for proper handling of all parts. Be careful unpacking the DDS chip. It's a tad fragile, I usually pack it in with the PCB. It's best not to take it out of that until you are ready to solder it. The above photo should only be used as a general guide. Parts shipped with your kit may be of a different color or size, and not all the items shown in the photo are included in all kits.

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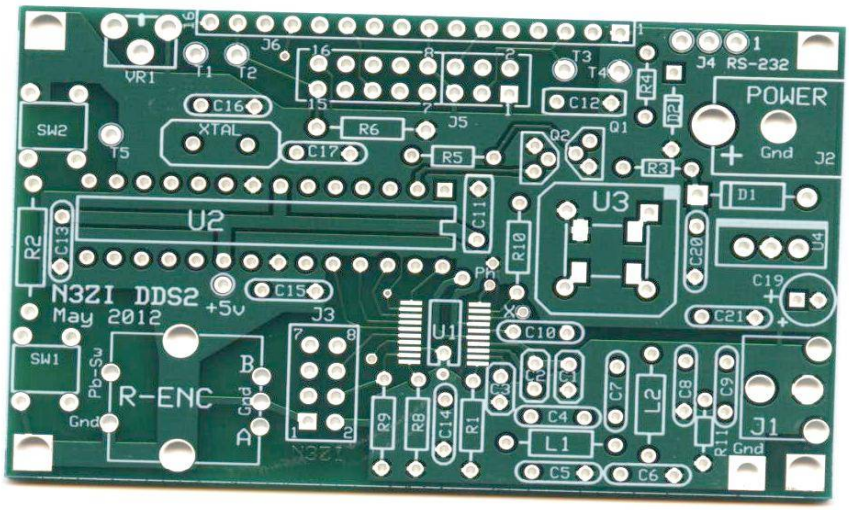
Test Equipment Needed: You will need a Digital Voltmeter to measure Resistance, DC voltage and current, and a low current 12v power source. The maximum current draw for a properly assembled kit is 100mA so you should limit you source current to 100mA during the assembly process, that way the damage from any errors or faults will be minimized.

PCB Check: Before you solder any parts in, I recommend a check of the microprocessor pins. There have been instances were one of the micro pins were inadvertently shorted to the PCB ground plane. This is very rare, but difficult to debug and repair after the board has been built. Check the continuity to ground for each of the 28 pins of U2. Only pins 8 and 22 should show a continuity to ground, the rest should show open circuit. There is a thin fusible link on the back of the PCB under the power connector. This fuse will blow at ~1 Amp. If you do blow this, correct the problem that caused the fault, then replace that connection with a piece of 40ga wire. However, keep in mind that any fault with a semiconductor device will likely incur damage in a few nanoseconds, long before any copper wire fuse will heat up an blow.



Start by soldering in the power supply components. D1, U4, C19, C20, C21 The PCB is laid out to accept a 2.1mm power connector, but it isn't really needed. This is a 2.1 mm coaxial power connector, +12v inside, ground outside. These connectors usually have 3 pins, there is no PCB hole for the side pin, just break it off. If you don't have a power connector, just solder your power wires directly into the PCB holes. Double check the polarity on D1, C19, and the orientation of U4.

Power supply current Check#1: Apply 12VDC power using a power supply with a current limit set to 100mA. Check to see if 5VDC is present at U2 pin 7. Measure and record the current draw, it should be less than 10mA at this point. Also check and record the voltage across the not yet installed C10, it should be 2.5V.

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DDS Chip Solder: (Skip this step if you purchased the kit with the DDS chip already soldered down) If 5v power is ok, solder down the DDS chip. It's the tiny 20 pin chip AD9834. It will be easier to solder it down if the rest of the board is nearly empty. The best method I have found for this chip is the use a 15 watt soldering iron, with a fine tip. Carefully align the chip in the right location. Make note of the direction. Pin 1 goes in the lower right. Pin1 on the chip has a dot indent in the plastic package. I normally use tape to temporarily hold the chip in place while I'm soldering it. Under no circumstances should you glue the chip to the PCB. Carefully align the chip to make sure it's centered, both left/right and up/down then hold the chip down with a piece of tape leaving one side of the chip exposed. Solder down one of the exposed corner pins. Remove the tape, re-align the chip, and solder the opposite corner. Then solder all the remaining pins, use plenty of solder and don't worry about solder bridging. After you are done use solder wick to remove excess solder and any solder bridges. (Flux will help the solder wick.) If the solder wick becomes frozen (soldered) to the board, don't rip it off, heat it up with your iron and pull it up carefully. Inspect it carefully by eye under a magnifying glass. Clean it with flux remover, and make sure there is no debris under the chip or elsewhere. Use a DVM or continuity tester all the connections are made by testing right as the lead exits the package, then on the PCB at the appropriate point. Also make sure there are no pin to pin shorts and no shorts to power or ground. Note than pins 4 and 5 will show as shorted because they are both connected to +5v. And pins 7, 10, 12, and 18 are hardwired to ground, so all should show continuity to ground. Pin to pin solder shorts are fairly common, frequently they appear OK visually, but show up shorted on the continuity check. Just lay some wick down apply heat, and you should wick up the excess solder causing the short. I that doesn't work, you can try running the blade of an exacto knife between the leads to clear out any short. If that doesn't work apply some more solder, then wick it up again.

Next install the 3 capacitors next to the DDS chip, C1, C2, C3 be careful with these to avoid any solder shorts, and trim the leads neatly.

Power supply current Check#2: At this point you should check the 5v power supply and current draw. Apply 12VDC power using a power supply with a current limit set to 100mA. Check to see if 5VDC is present at U2 pin 7. Measure and record the current draw, it should be less than 15mA at this point. Also check and record the voltage across the not yet installed C10, it should be 2.5V.

A number of components can be installed on the front or the back of the PCB. Which you use will depend on how you plan on mounting the DDS. The Switches, the rotary encoder, the LCD connection, the RCA jack, all can be mounted on the back if you like. All function the same regardless of the side they are mounted on except the LCD connection (see below.) Note that you may have to cut the plastic nubs off of the RCA connector to get it to fit properly, or the pins can be bent such that the nubs hang off the end of the PCB.

The push-buttons are simple SPST switches, and you can remotely mount another switch in parallel if you like. You could use a single SPDT switch to replace both SPDT switches. One that is momentary with a center off position is a very slick setup. If you received the optical encoder in lieu of the PCB mounted encoder, please refer to the section below for connecting the optical encoder.

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Encoder Soldering: The encoder can be mounted remotely or soldered to the PCB. If soldered to the PCB it can be soldered on either side of the PCB. You should consider this carefully before you solder it in, because it's very difficult to unsolder without damage. Also there is no need to solder the side tabs to the PCB. Just solder the 5 signal pins (3 on one side 2 on the other)

Finish Soldering: Solder in the rest of the components. Kits normally include a socket for the micro. Solder in the remaining components except the 80MHz oscillator can, and the encoder.

Power supply current Check#3(a,b,c):
(a)At this point, with everything installed except the following: Encoder, Micro, 80MHz Oscillator can, LCD. Apply 12v power and check and record current draw. It should be less than 15mA.
(b) Remove power and put the micro in, now current draw should be less than 35mA.
(c) Remove power and solder in the 80MHz oscillator can. Apply power current draw should be, between 40 and 80mA

The next step is to connect the LCD. The configuration depends on the LCD type used. This kit will work with many different LCD types and various options are shown in the chart below.. If you purchased your kit with an LCD then you will be using either column 2 (for the 10 pin serial LCD) or column 5 (for the 16 pin SIP connected LCD) in the chart below

LCD Configuration Options

Column 1	Column 2	Column 3	Column 4	Column 5
Component	**10 Pin Serial LCD**	**10 Pin serial LCD with variable contrast.**	**14/16 Pin LCD with Adjustable Contrast**	**14/16 Pin LCD with Fixed Contrast**
R2	Not Used	Jumper	Jumper	200 ohm
R6	10K	Not Used	Not Used	Not Used
VR1	Not Used	10K pot	10K pot	Not Used
T1	Not Used	Jumper to T2	Jumper to T3	Not Used
T2	Not Used	Jumper to T1	200 ohm Resistor to T5	Jumper T2-T5
T3	Not Used	Not Used	Jumper to T1	3.3K or 1.0K T3-T4
T4	Not Used	Not Used	Not Used	
T5	Not Used	Not Used	200 ohm Resistor to T2	Jumper T2-T5
LCD Connects to:	J5 pins 7-16	J5 pins 7-16	Either J5 or J6	J6

LCD Backlight: Generally if your LCD has a 16 pin connector then it will have a backlight. LCDs with a 14 pin connector may have 2 separate pins for the backlight, or will not have a backlight. The 200 ohm resistor sets the current to the LCD backlight at 7mA. If your LCD does not have a backlight you can omit this resistor. You can decrease this resistor to increase the brightness of your backlight, but do not use a resistor less than 100 ohms (10mA). If your backlight needs more current, then you can power you backlight directly from the 12v power supply, but the dropping resistor should be

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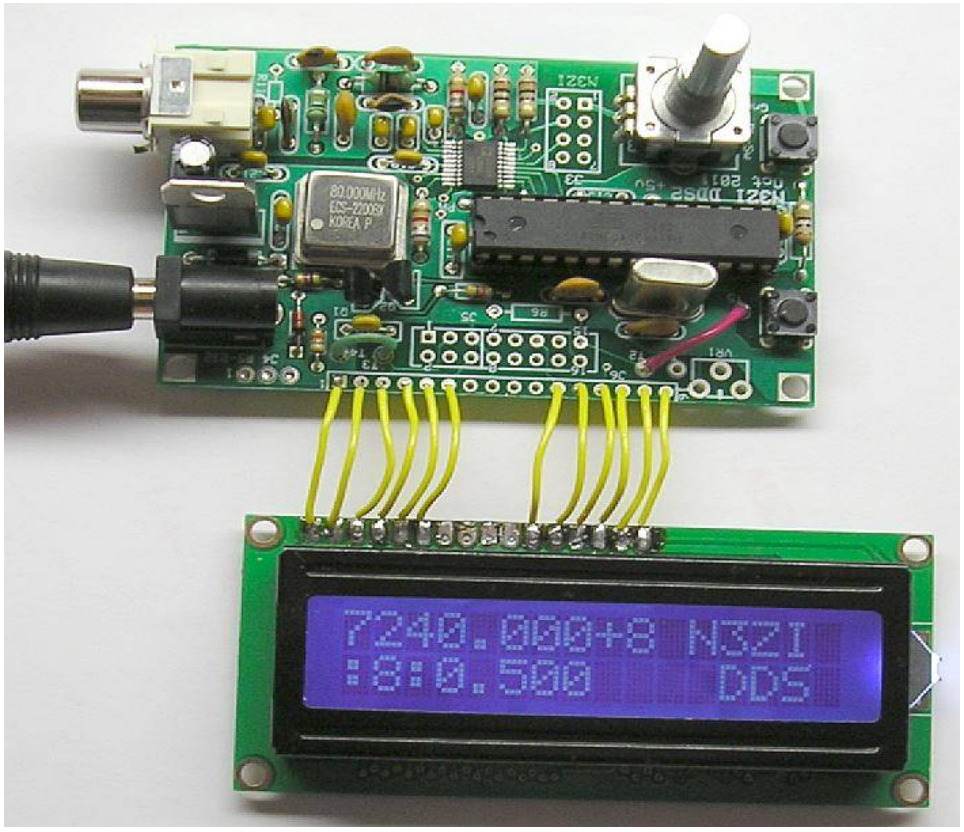
correspondingly larger. For example a 470 ohm resistor will supply approx 20mA of backlight current when connected to a 12-14v supply.

Contrast Control: Kits are shipped with the parts for fixed contrast, but the LCDs will work with either fixed or variable contrast control. For the Serial LCD Use the 10k resistor, and follow the instructions in column 3. For the 16x2 alphanumeric backlit display use either a 1.0K or 3.3K resistor, and follow the instructions in column 5 above. If you want to have variable contrast control, you can install a 10K pot in VR1 and follow the corresponding instructions in the table. You can also set the LCD contrast to your liking by adjusting the appropriate fixed resistor. The 1.0 K or 3.3K resistor sets the contrast for the 16x2 for the backlit LCDs to 0.4V~1.2V on LCD pin 3. For the 7 segment LCD the contrast is controlled by the 10K resistor at R6, which sets the LCD voltage on pin 9 of this LCD to 1.25V. If you get too far away from 1.25v you will not damage the LCD but the display may not be visible or contrast is poor.

LCD Connection (Backlit): These LCDs have a 16 pin LCD single row connector. This LCD is connected to the 16 pin single row connector J6 on the DDS PCB. Pins 7-10 are not used and can be skipped, or not. See photo below:



Some displays of this type may have only 14 pins. In this case you would skip pins 15 and 16. LCD's with a 8x2 (or 7x2) connector can be connected to J5, use care with orientation, and left right pin swap, which can damage the LCD. Some LCDs have separate Backlight pins which can be wired independently to backlight power.

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LCD Connection (KTM-S1201): The standard serial LCD with a 10 pin connector (KTM-S1201) uses the pins 7-16 of J5. Solder a 10 pin header in there and another one in the back of the LCD. Mark one side of the cable with a red mark which indicates Pin 1. Pin 1 on the LCD module is closest to the 3 gold plated holes in a triangle pattern on the LCD module. If hand wiring, without cable, Pin 1 of the LCD module goes to J5 pin 7, 2 to 8, 3 to 9,etc. Pin 1 on the LCD is the upper left pin in the front view photo of the LCD below.

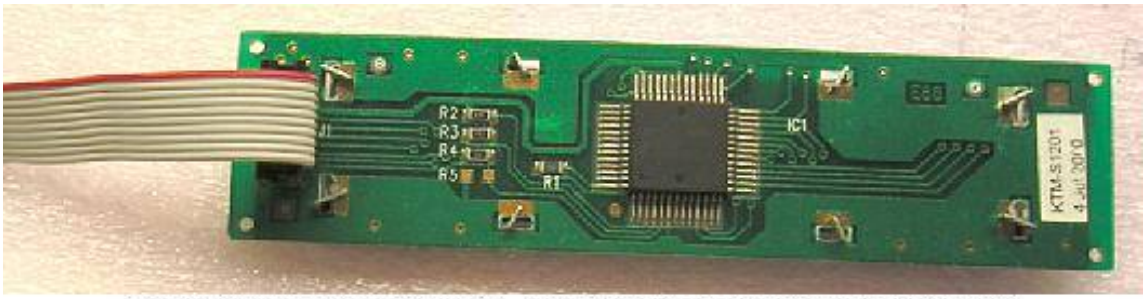

Photo of back of serial LCD, showing proper orientation of cable (Red Stripe indicates pin 1)

LCD Connection (Other): When connecting LCDs with a 16 pin 2 row connector you would use J5. Which should go directly to the 16 pin connector on the LCD. You should be careful when connecting to a 2 row connector to make sure you have not swapped the even and odd pins. Carefully check the pin numbering before applying power, because reversing the odd and even pins will apply reverse power to the LCD an likely damage it. With a 14 pin LCD use the lower 14 pins of J5. Pins 15,16 are used for the backlight. Some LCDs have separate pins for the backlight.

Final Current check: With the LCD connected and all parts installed, check and record the current draw, it should be less than 100mA. No parts should be getting hot, except the 80MHz oscillator can may get slightly warm but not hot. The 7805 may get slightly

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warm, but not hot. Check the LCD contrast voltage, you should see ~ 1.25V (pin 9 of the 10 pin serial LCD, or pin 3 or the 16 pin LCD.)

Operation

FACTORY RESET: Note that if you get into difficulty with the Memory and IF settings you can do an EEPROM Reformat, to reset everything back to factory defaults. The settings are not range checked so it is possible to enter something out of range that will cause unexpected behavior. The details in doing a Factory Reset, are described below on page 10 (“Function Switch Operation”) under the paragraph “EEPROM FORMAT” It's a good idea, to start off by doing this once when you start. This will erase all memory and IF settings.

Memories: There are a total of 12 memories each memory holds a Frequency and an IF. In many cases all the IF’s will be set the same. You can set any or all IF’s to 0.00. Memories 0 though 9 are selected using the two pushbuttons (up/down) and are tunable. That is, if you turn the dial while at that memory the frequency will change. When you switch to the next memory, the last used frequency will be saved for the prior memory location.

The other two memories, are VFO A and B. These are different in that a separate control line (PB5) selects between the two. You can program a different IF in for VFO A and B, but I doubt you will want to.

With the standard serial LCD a single character on the left side of the display indicates the memory number (0 to 9) or A, b for the VFO’s With the character based 44780 LCD’s the display will be slightly different.

Dial speedup. The default frequency increment is usually 25Hz per tick. As you turn the dial continuously, the tuning rate will start to increase automatically. You can also increase the rate by tapping the encoder push switch. This will sequence through 1,10,25,100,1000Hz steps. Automatic acceleration is indicated with an "F" on the display. If you continue to turn the dial, the rate will continue to accelerate up to a maximum of 100KHz per tick. If you stop turning the dial for a few seconds the rate will return to the default rate and the "F" will disappear from the display. Entry into the "F" mode is based on the time the dial is continuously rotated, not the number of turns, so turning faster does not trigger that mode faster. Note that many parameters associated with tuning can be changed using the rs232 port, including default tune step and trigger points for acceleration. Refer to rs232 manual for details.

Setting IF’s If's offset can be set in 3 different ways. You can use the serial port (refer to the serial port manual) You can set the current IF using the push switch, see the **"IF SET"** in the **"Function Switch Operation"** section below, that's the preferred method. There is also a special IF set mode similar to the method used in my older DDS. To enter this mode, remove power, hold either SW1 or SW2 and apply power. It will then come up in a mode, which will allow you to set the IF’s. “IF” will be indicated on the LCD display. The DDS will output the IF frequency in this mode, which can be used to zero beat with your BFO if applicable. Then when complete, toggle through all memories, to make sure they are all ok, then remove power. This method may erase the operating frequency in memory, so it's best to set the IF's before anything else.

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Additive IF: This VFO supports 3 different IF modes. The simplest is the additive, and example of this is the one used on the BITX20. The IF is 11MHz and the VFO tunes 3.0 to 3.35, resulting in an operating frequency of 14.0 to 14.35. For this type of operation enter the IF as a positive number, and enter the operating frequency as a positive number. It will compute the proper VFO frequency to generate. Note that this type of radio can never operate below the IF.

Subtractive IF: With subtractive IF schemes, there are two options for the VFO, high side, and low side VFO injection. For example, many 40m QRP radios have a 11MHz IF, with a VFO ranging from 4.0 to 3.7MHz. Tuning is backwards, so the higher the VFO the lower the operating frequency. To program you DDS VFO to work this way, enter the IF frequency as a negative number, i.e. –11.000.0 in this case, and also enter your operating frequency as a negative number, to indicate low side injection. i.e –7.000.0, the DDS micro-controller will computer the proper VFO frequency to use, 4.000.0 in this case. Note that if you are using the serial port, you can turn on the debug mode, and it will display the IF, VFO, and operating frequency every time. Note that most radios will also work with high side injection without modification. For example you can charge the operating frequency to +7.000.0 and you will be on the same frequency, but with high side VFO at 18MHz. Usually when you do this, the opposite sideband is selected.

Dial Direction: The dial direction may be reversed because of the use of negative IF's and/or high vs. low VFO injection. Reversing the sign will reverse the direction. For example if you have 0.0 IF and are tuned to 7.000.000 and you want to reverse the direction of tuning, tune down in frequency towards 0.000 then keep turing the encoder (in the same direction) and the frequency will start to increase, when you get back to 7.000.000 the tuning direction will be reversed. If you have an IF set, then you will also need to change the sign of that. The dial direction can be reversed by changing the sign of parameter 9, (tick_div) via the serial port. 0.02 or –0.02 are values to try for this parameters. If your encoder is remotely mounted, you can also interchange the A & B connections to reverse direction.

Output: The output signal is not amplified, and the level is approx. 250mV peak to peak which works well with SA612 or similar mixers. Output impedance is 200 ohms. It does not need to be matched, but the output filter is flatter if the output is matched. With vintage radios, or other applications, you may need a separate buffer amplifier.

Output filer: This DDS uses a D/A converter to generate the sine wave output. This D/A converter is clocked at 80Mhz. The theoretical maximum output frequency is 40Mhz, this is refereed to the Nyquist rate. All D/A converters have an image output above the Nyquist frequency. (If you go to wikipedia, and search for Nyquist you will find a nice article describing the theory) So if you generate a 39Mhz signal, which is 1 Mhz below the Nyquist frequency, there will be a mirror image exactly 1 MHz above the nyquist rate, at 41Mhz. If you generate a signal at 25Mhz the mirror will be at 55Mhz. Normally an output filter is used to filter out this signal. The output filter included in your kit, will allow operation up to 34MHz, with about 40db of attenuation of the 46MHz mirror.

Calibration: It is normally not necessary to calibrate your DDS-VFO. The 80MHz reference oscillator is specified at 100ppm accuracy, but they are normally much more accurate than this. Calibration is done in software, it is an extremely fine adjustment,

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much finer than the fundamental step size. The oscillation frequency of the 80Mhz timebase will not change, but the mathematics will be adjusted. 64 bit math is used in computing operating frequency to be certain, that no error would be introduced by rounding. A change of +0.20 in this parameter is approx. a 10 Hz change of operating frequency at 20MHz. Keep in mind that it is a multiplicative correction factor, so a 10Hz change at 20MHz, will result in a 5Hz change at 10MHz. The calibration factor can be set via the serial port, or using one of the push switch modes, see below.

RIT: The RIT function on this DDS operates differently than some radios and can be used for a wide variety of functions. The default setting is 500Hz. When RIT control line (J3 Pin 8) is grounded the VFO's output frequency will shift up by 500Hz. This might be used for transceivers in CW mode, typically on transmit you want to shift the transmit frequency up by 500Hz. Unlike most RIT functions, there is no limit to the value used for RIT, any positive or negative number can be used. If a negative number is used the frequency will shift down, rather than up. For example. Lets say you have a vintage transmitter (e.g. DX-20) with a simple design, where the VFO is equal to the transmit frequency . And for a receiver you are using a vintage superheterodyne receiver (e.g. HQ-110) with a 3.045MHz IF. You can use one DDS as the VFO for both. Set the RIT to -3.045.000 and ground the control line when receiving. So if you want to operate CW on 40M, you would tune your DDS to 7.050.000. With the control line grounded while in receiver, the VFO would actually put out 4.005MHz which is the required VFO frequency for the HQ-110 to receive 7.050MHz. When you go to transmit, unground (open) the control line and the DDS VFO frequency will instantly move to 7.050MHz, the proper frequency for your Vintage transmitter. So that way just one DDS can be used for separate transmitter and receiver, but you will probably need a buffer amp for each to drive the tube circuits.

FSK & PSK: This DDS can send FSK and PSK directly, without first generating Audio FSK & PSK. FSK (RTTY) is sent by using the RIT function. Connect your RTTY signal (0-5v) to J3 pin 7, and leave J3 pin 8 open. Set the RIT value (see below) to your RTTY shift (typ 170Hz). If your RTTY signal is coming from a computer serial port you will need to convert it to a 0-5v signal (R10 is a pullup for this signal). You can invert the RTTY signal, by changing the negating the RIT offset i.e -170Hz.

To send PSK directly, you need to connect to the PH test point on the PCB (adjacent to R10). There is a fine trace on the back of the PCB grounding this signal, so you will need to cut that. Feed a 0-5v PSK signal into this point. The amount of phase shift is set by EEPROM parameter #10, the default is 180 degrees. Note that most computer sound card PSK programs generate Audio PSK only, not base-band digital PSK, and thus cannot properly drive this. (RTTY programs typically generate both, AFSK and base-band Digital FSK) This should only be used by advanced users. Very advanced users might notice that it is possible to set a phase shift of 90 degrees and generate I & Q using two DDS's locked together.

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Function Switch operation

The function switch can be either a push switch on the encoder, or a separate push button switch. A short tap on this sequences through the 5 standard tuning step sizes, 1,10,25,100,1000Hz. This switch also is used to bring up special parameter setting modes for RIT, Tuning Step, Calibration, IF, and EEPROM format. Press and hold the switch, then press one of the up/down buttons you will toggle through the 5 different parameters that can be set. The first is RIT mode, is indicated on the left 2 digits as dF (for delta F) Tuning speed is shown as "SP", Calibration is shown as "CA", IF set is shown as "IF", EEPROM Format is "EF". For the 2 line LCDs there is a single character R,S,C,I,E, between colons in the second line, i.e. :E: Simply release the switch when you get to the one you want. Each of these settings is described below

RIT Adjust (dF,R): Use the tuning knob to adjust the RIT offset. If J3 Pin 8 is low, then the output frequency of the DDS will move accordingly. When you are finished, simply stop tuning for a while and it will return to normal.

Tuning Step (SP,S): Use the dial to set the tuning step if you want something other than the standard 1,10,25,100, or 1000Hz. As above simply stop turning the knob when you get to the value you want, and it will return to normal after a few seconds. Do not set to anything greater than 10,000Hz. Using the short tap for standard rates will override this setting.

Calibration (CA,C): This adjustment if very fine. You will be making an adjustment to the main calibration factor, and only the delta will be displayed. First, in normal operation, set the DDS output to a reference frequency, such as 10.000.000MHz. Use the push switch to get into the calibration mode, then use the dial to zero beat the DDS signal to your reference, be it WWV or some other source. The adjustment is extremely fine. Once you are satisfied, stop tuning and after a few seconds the value will be saved, and the master calibration factor will be adjusted. When setting it via the knob only the change from the current setting is displayed, so it always starts out at 0.000 and changes are cumulative.

IF SET (IF,I): The current IF is set by turning the dial. If you want to change the IF for a different memory, you need to return to the normal operating mode, then change the memory number, and then change the IF again.

EEPROM format (EF,F): This function causes the EEPROM to be loaded with factory default values. You will loose any IF's or frequencies you have set in, and any parameters you may have changed. Turn the encoder until you get to a reading of 73 on the LCD. Stop turning and wait, it will take a few seconds to initialize the EEPROM, and then the LCD should display a flashing message. At this point, remove power and re-apply power to reboot. The DDS will now start up with fresh factory default parameters. All the IF's are set to 0.0, and the memories are set to a MHZ value equal to their memory number (ie memory 5 is set to 5.000.000) If you set the LCD to anything other than 73, nothing will happen and the reformat will be canceled. (If you have the 2 line LCD, rather than "EF" you will just see "E", and the dial will change secondary Digits (which you will set to 0.073)

TEXT EDIT (-,T): This function is only active in 2013 and later version of the code and when the backlit LCD is connected. It allows you to edit 12 characters in unused areas of the display, 4 on line 1, and 8 on line 2. Use the encoder dial to select digit, up/down buttons to navigate char position, press the Renc Push Button to go to next line. ASCII characters from 32 to 126 are available which includes numbers, upper and lower case alphabet, plus some special characters. Edits are saved in EEPROM.

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Other Encoder Connections

The standard kit includes a mechanical encoder that mounts to the PCB, with an integrated push switch (5 pins). If you want to use an optical encoder, it mounts off the board, and the pushbutton switch is separate as shown in the photo below.

Most Optical Encoders have 4 pins on the back, labeled: + A B -

- Connect Encoder pin "+" to +5v on the PCB (Red wire in above photo)
- Connect Encoder pins A, B to the holes marked A.B on the PCB photo below.(Green and yellow wires in the above photo) Note: Reversing these will reverse tuning dial direction
- Connect the encoder pin labeled "-" to ground.(Black wire in the above photo)
- Connect the pushbutton switch pins to the holes makes PB-SW and GND in the photo below (Black white twisted pair in above photo)

You will want to connect the serial port and change some parameters in the micro. (No programming is required) The "DDS 2 RS-232 interface Spec" is located on my web site here: http://www.pongrance.com/manuals.html

- Change parameter #4 to 0.001 (Step size)
- Change parameter #5 to 0.003 (for encoders with >200ppr, use 0.001)
- Change parameter #6 to 0.200 (Loop delay)
- Change parameter #7 to 1.100 (Acceleration)
- Change parameter #8 to 0.000 (Debounce)
- Change parameter #9 to 0.001 (Tick Divider)

Your optical encoder will function if you do not make these changes, but it will operate much like the mechanical encoder.

Some kits may include a PCB mounted encoder with only 3 pins. This type does not have an integral push switch. With this encoder, you will have to add an external pushbutton switch, wired as shown above. No parameter changes are needed with this encoder.

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Aux Connector

There is a 8 pin connector (J3) in the lower center of the board. Carefully note the pin numbering, in may or may not match up with other connectors. Pin number are on the front silk screen and back copper.

Pin #	Name	Type	Function
1	Gnd (D)	Ground	Digital Ground
2	Gnd(A)	Ground	Analog Ground
3	A/B VFO	Digital Input	A/B VFO select, grounded selects VFO A, open or high selects VFO B connects to micro port B pin 5
4	Aux-A	Analog Output	Secondary DDS RF output, un-filtered.
5	PC0	Digital Output	Band output, high if operating frequency is below limit in EEPROM
6	D - out	Digital Output	Not used
7	RIT-a	Digital Input	LOW causes LCD to display Freq + RIT (Normally tie pin 7 and 8 together)
8	RIT-b	Digital Input	LOW Causes RF output to shift in frequency by the RIT value (Normally tie pin 7 and 8 together)

Use reasonable caution when connecting to the digital control pins. Pins 3,7,8 and on board pull ups to 5v, so only a contact to ground is needed. You can connect a switch, or relay, but any voltage over 5v, or negative, will likely damage the microprocessor. Use an opto isolator to connect to protect against any possible ground differences, or voltages over 5v.

Pins 7 and 8 control RIT. Pin8 causes to DDS to actually shift by the RIT frequency. Pin 7 causes the LCD to display that frequency. Normally you would tie these together. But you could keep them separate and it would give you the ability to look at the RIT frequency is without actually changing the frequency. When you are adjusting the RIT by using the tuning knob function switch the output of the DDS will only reflect this frequency if the RIT is turned on, i.e Pin 8 is low.

RIT is an offset to the main frequency. So for example if the RIT is set to 1.000KHz, and the main frequency is set at 7050.000, when you lower the RIT control line (Pin 8) the frequency will shift to 7051.000 and if you also low control line #7, the LCD will display that new frequency. If you then change the main frequency, to, for example, 10,110.00, then lower the RIT control line the output frequency will move up to 10,111.00. You do not have to set the RIT offset again after you change the main frequency. The RIT can be set to pretty much anything, positive or negative.

Using Pin 8 alone the RIT frequency shift is fast and phase continuous, there are no glitches, and it could be used for FSK (Rtty) or QSK.

There are two other test points that might be of interest. 1) One is Labeled "Ph" located between U1, U2 and U3 On the back there is a thin trace connecting it to ground. This controls a phase shift for the DDS chip. If you cut this grounding trace then a 5v logic signal will select between normal and phase shifted output. The default phase shift is 180 degrees, which would allow you to transmit BPSK31 directly. This parameter is #10, and can be set via the serial port to other interesting values, e.g. 90 degrees. 2) Another is Labeled "+5v" located between the Renc and U2 which outputs a 10Gb/s stream equal to the square root of the time of day in Chinese. (I just want to see if anyone actually reads the manual.)

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Bill of Materials

(Note: The packing list included with your kit supersedes this list)

Designator	Part	Qty	Description / Appearance
U2	Micro ATMEGA168	1	28 Pin Dip
U2	Socket	1	28Pin DIP socket
U1	DDS Chip AD9834	1	Tiny 20 pin TSSOP
PCB	Circuit Board	1	N3ZI DDS
XTAL	20 MHz XTAL	1	Short Can 20.000
U3	Oscillator	1	Metal can 80MHz
J5 LCD	LCD	1	Varies
C1,C2,C3	0.01uF Capacitor	3	Yellow 103
C9, C10, C11, C12, C13, C14, C20, C21	0.10uF Capacitor	8	Yellow 104
C5	27pF Capacitor	1	Brown 27
C16, C17	22 or 27pF	2	Brown
C19	Electrolytic Cap	1	Black Radial
C8	68pF Capacitor	1	Brown/Orange 68
C6	47pF Capacitor	1	Brown/Orange 47
C4	10pF Capacitor	1	Brown/Orange 10
C7	4.7pF Capacitor	1	Brown/Orange 4.7
L1,L2	1.0uH Inductor	2	Brown, Black, Gold
U4	Volt Reg	1	7805
D1	Diode	1	Black epoxy
D2	Signal Diode	1	Glass
Q1,Q2	NPN Transistor	2	To-92 2N2222
R1	6.8K Resistor	2	Blue, Grey, Red
R4,R5	47K Resistor	2	Yellow, Purple, Orange
R3	4.7K Resistor	1	Yellow, Purple, Red
R2*,R8, R9	200 Ohm	3	Red, Black Brown
R6*, R10*	10K Resistor	2	Brown, Black, Orange
R-ENC	Encoder	1	
SW1,SW2	Push button Switch	2	
J1	RCA Jack	1	
VR1*	10K Pot, or 3.3K or 1.0K Fixed	opt	3.3K or 1.0K Fixed goes from T3-T4
C15, R11	Not used	0	

* Usage of R2, R6, and VR1 depend on the LCD type supplied with your kit and may not be included or of a different value, refer to the packing list included with your kit.
R10 value is not critical, refer to your packing list for the value supplied with your kit.

Note: the appearance color and value of some parts change from time to time with differences from various suppliers. You should receive a packing list with your kit, which should have a current description for the parts in your kit, and it supersedes this list.

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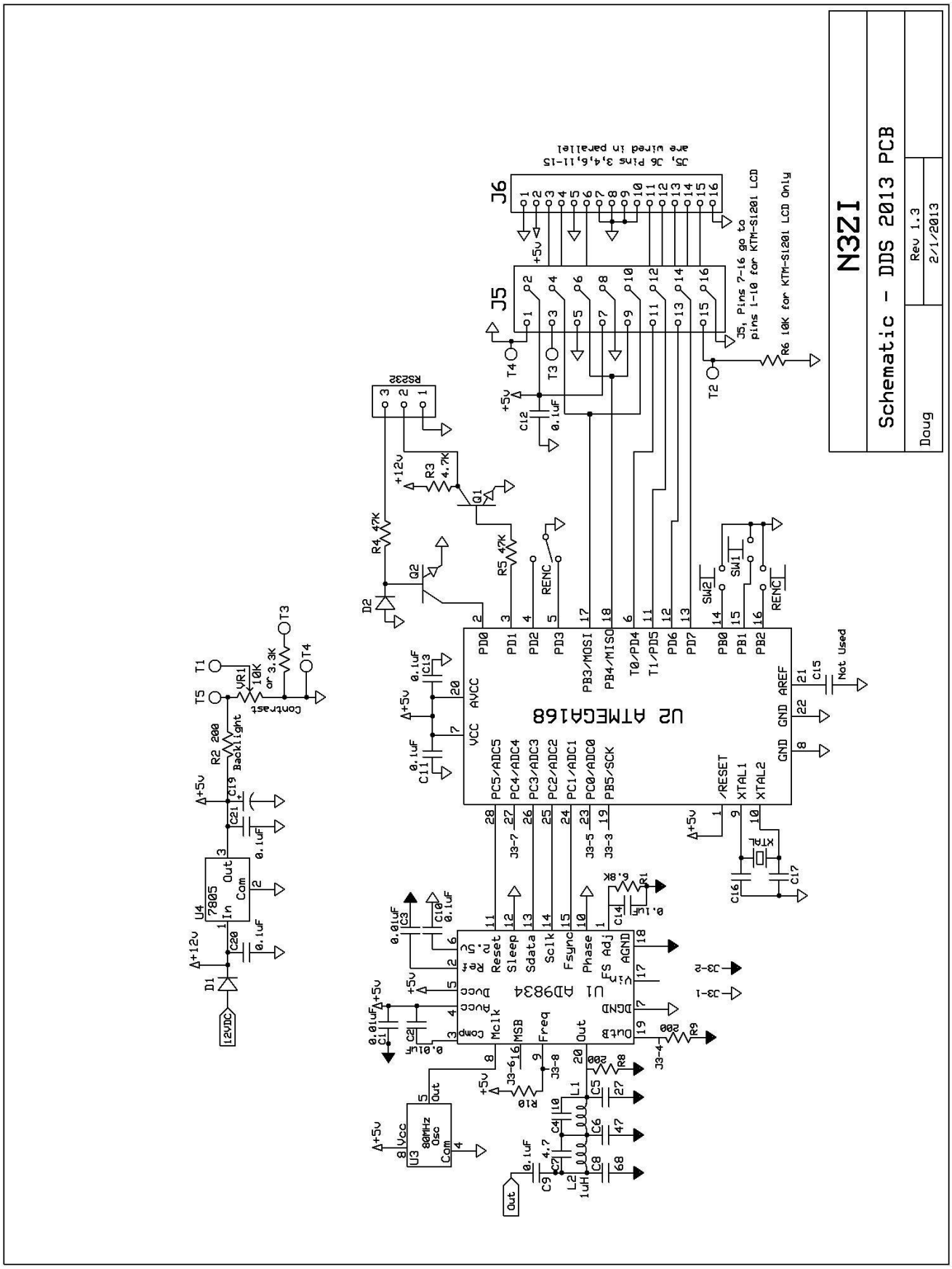

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