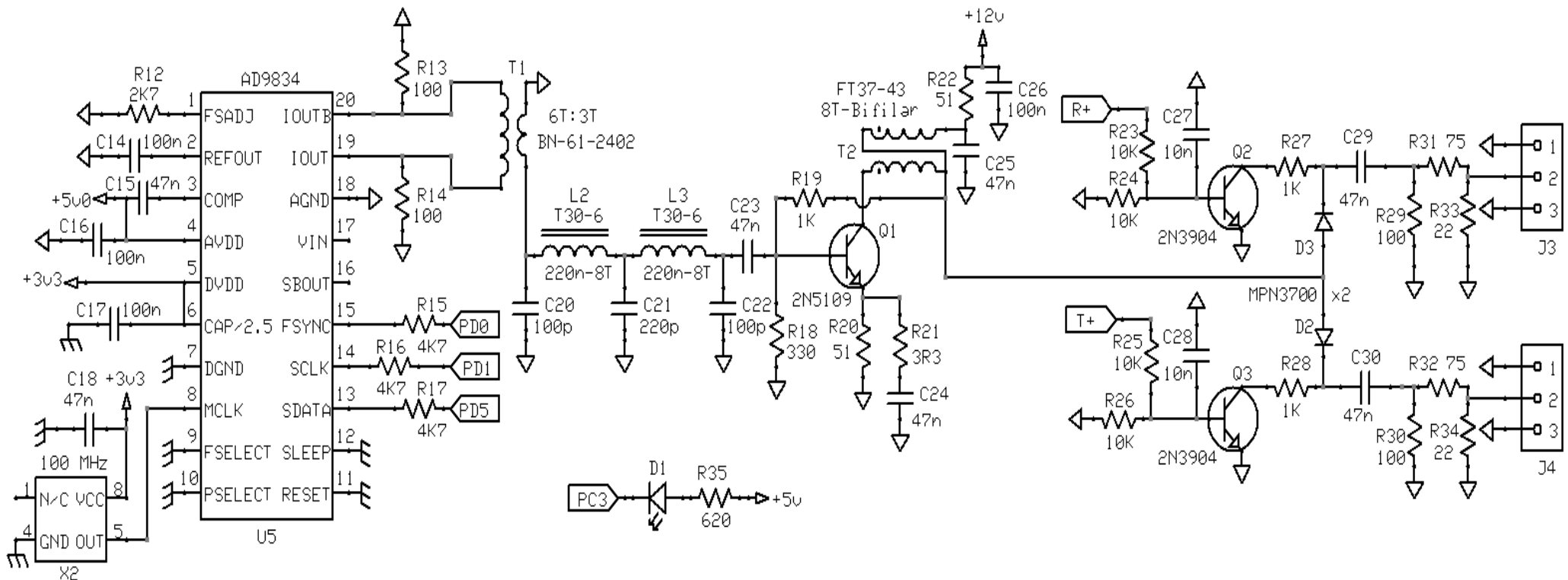


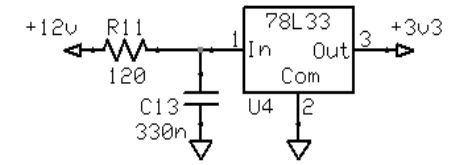
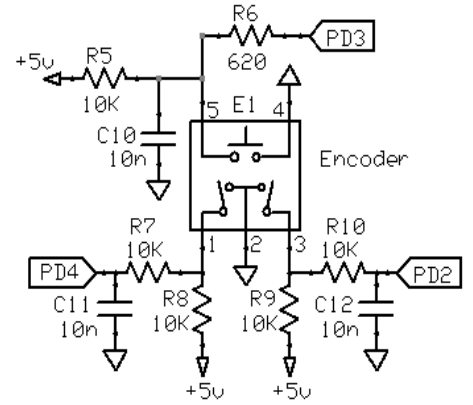
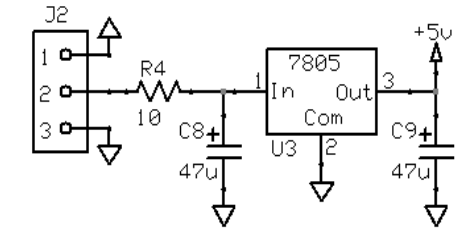
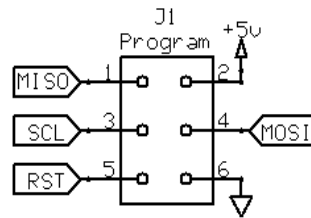
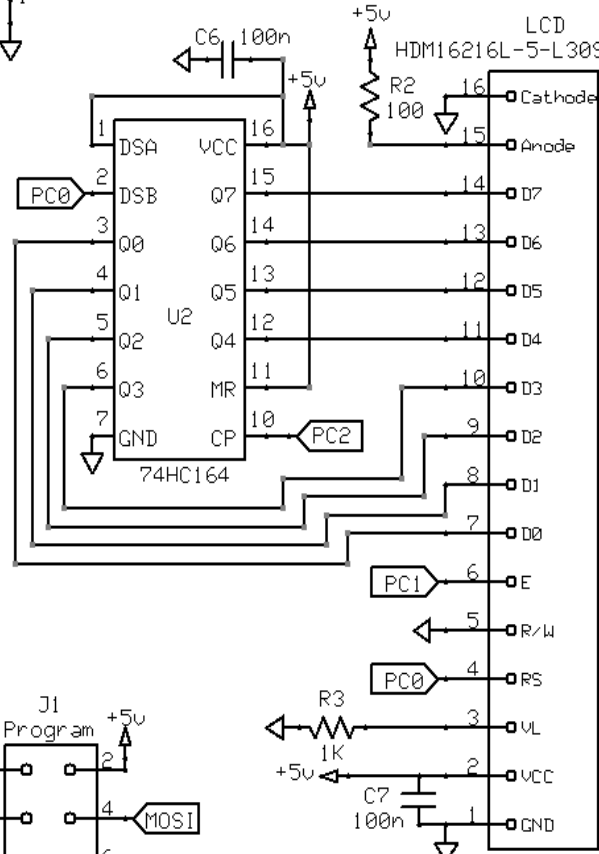
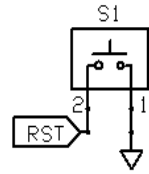
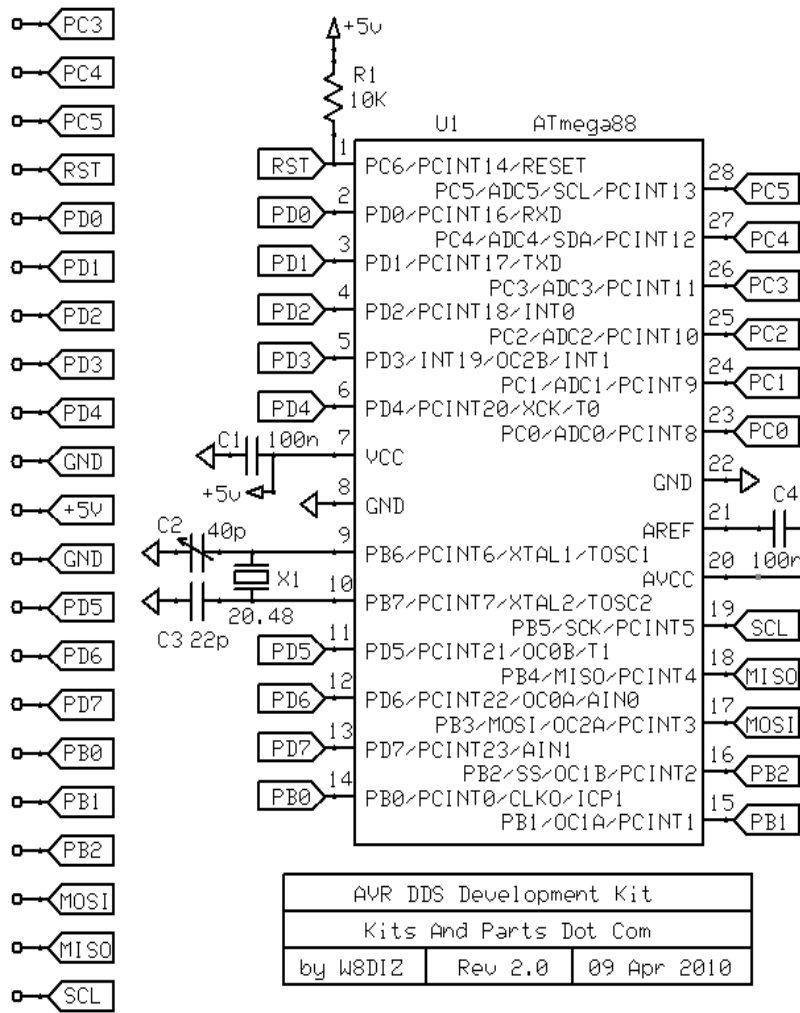
Build this Direct Digital Synthesizer "Development Kit"

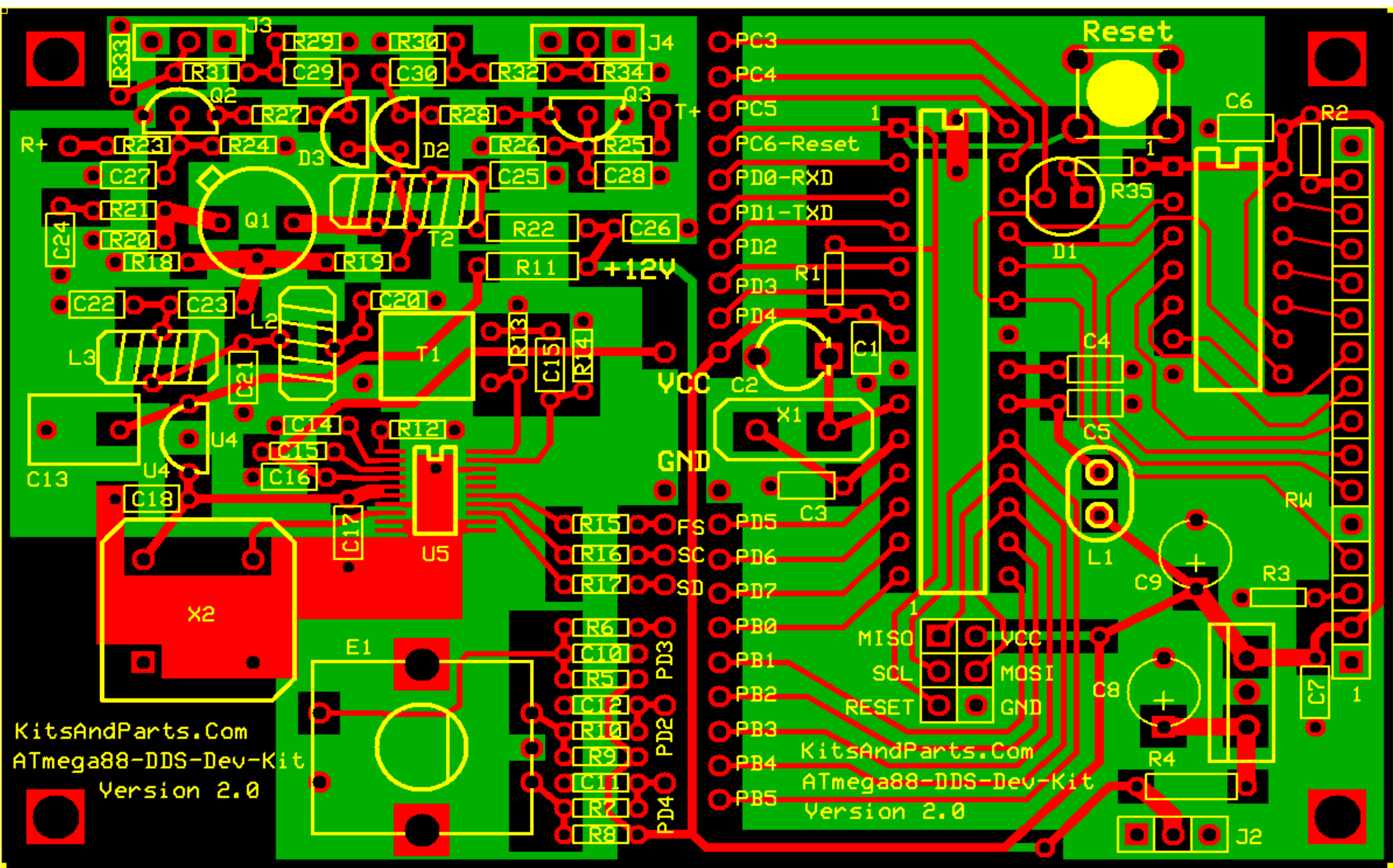
By: Diz Gentzow, W8DIZ

A great tutorial for adding a keypad to the DDS Kit by Bruce, W8BH

This manual has been prepared to be read directly on screen. (Use CTRL+L on Acroread or similar command in other PDF readers for "full-screen"). If you want to print it, please use "Multiple page" option to save resources. Thank you.







KitsAndParts.Com
ATmega88-DDS-Dev-Kit
Version 2.0

- PC3
- PC4
- PC5
- PC6-Reset
- PD0-RXD
- PD1-TXD
- PD2
- PD3
- PD4
- PD5
- PD6
- PD7
- PB0
- PB1
- PB2
- PB3
- PB4
- PB5
- MISO
- SCL
- RESET
- VCC
- MOSI
- GND
- YCC
- GND
- FS
- SC
- SD
- PD3
- PD2
- PD4
- VCC
- MOSI
- GND
- Reset
- C6
- R2
- R35
- D1
- C4
- C5
- C7
- RW
- L1
- C9
- R3
- C8
- R4
- J2

General Notes:

The DDS Development Kit is fully functional as a Sig_Gen/VFO (once built).
the internal firmware currently displays:

line1: "DDS Dev Kit V2.0" - (Your callsign can be custom programmed upon request)

line2: "nn,nnn.nnn Hz " - (where nn,nnn.nnn is the Frequency)

Programmed Frequency range is 1 Hz up to 29,999 kHz

Operates from 12 VDC at about 110 milliamps

Two channels RF output (control line selectable)

70-20 milliwatts output into a 50 Ω load from 1,800 KHz to 29,999 kHz,
respectively.

Freq range can be changed in firmware.

This DDS kit was designed to be a VFO source for NE602A and/or Diode Ring mixers

Fully expandable using 20 CPU I/O lines to control other transceiver function.

Open Source code available under the GNU General Public License.

Quick user manual:

Supply power to the DDS using 12-14 VDC at 120 milliamps current draw.

On power-up, the Red LED blinks twice and then the LCD displays 10,000,000 Hz

Note there is a cursor under the 1 MHz position on the LCD.

Press the encoder and the cursor moves to the 100 KHz position.

Each press of the encoder will move the cursor to the right.

Pressing the encoder when the cursor is at the 1 Hz position causes the cursor to move to the 10 MHz position.

Default Freq is 10 MHz; software programmable. IF OFFSET, both +/-, and band selection via pre-programmed memories will be available soon.

100 MHz CLOCK calibration is available through a special program:

<http://w8diz.com/qq-fc-project/9834/calc-9834.php>

Building Instructions:

1. Inventory all Parts

The Kit includes two plastic parts bags; one with all the resistors; the other with the remaining parts.

The parts bags may contain extra resistors and capacitors that are not used.

1 - PCB manufactured by <http://expresspcb.com>

Resistors (1/4 W)

1 - 10 Ω R4



1 - 51 Ω R22



1 - 120 Ω R11



Resistors (1/8 W)

1 - 3.3 Ω R21



2 - 22 Ω R33,34



1 - 51 Ω R20



2 - 75 Ω R31,32



5 - 100 Ω R2,13,14,29,30



1 - 330 Ω R18



Resistors (1/8 W) (cont.)

2 - 620 Ω	R6,35	Blue	Red	Brown	Gold
4 - 1 k Ω	R3,19,27,28	Brown	Black	Red	Gold
1 - 2.7 k Ω	R12	Red	Violet	Red	Gold
3 - 4.7 k Ω	R15,16,17	Yellow	Violet	Red	Gold
10 - 10 k Ω	R1,5,7,8,9,10,23,24,25,26	Brown	Black	Orange	Gold

Capacitors

1 - 22 pF	C3
1 - 30pF or 40pF	C2 trimmer (green or yellow, respectively)
2 - 100 pF	C20,22
1 - 220 pF	C21
5 - 10 nF	C10,11,12,27,28
7 - 47 nF	C15,18,23,24,25,29,30
9 - 100 nF	C1,4,5,6,7,14,16,17,26
1 - 330 nF	C13
2 - 47 μ F	C8,9 Electrolytic
1 - jumper	C19 (instead of a capacitor)

Crystal and oscillator

1 - 20.48 MHz crystal	X1
1 - 100 MHz oscillator	X2

Semiconductors

1 - ATmega88PA-20	U1
1 - 74HC164	U2
1 - 7805	U3
1 - 78L33	U4
1 - AD9834CRUZ	U5
1 - 2N5109 transistor	Q1
2 - 2N3904 transistor	Q2,3
1 - red LED	D1
2 - MPN3700 PIN diode	D2,3

Ferrites

1 - BN-43-2402	L1 inductor/filter	4 turns
1 - BN-61-2402	T1 transformer	6 turn : 3 turn
1 - FT37-43	T2 transformer	8+8 turn (bifilar)
2 - T30-6	L2,3 filter cores	8 turn

16 inches of 26 gage magnet wire

16 inches of 30 gauge magnet wire (dual twisted wires)

Miscellaneous

1 - Rotary Encoder	E1
1 - RESET pushbutton	S1
3 - 14 pin socket	
1 - 2x3 Program Header	J1
3 - 3-pin power header	J2,3,4
1 - 16-pin LCD socket	
1 - 16-pin LCD header	

USER SUPPLIED PARTS:

three (3) feet of hookup wire

3-pin female connector for power input connection

3-pin female connector for receive RF output connection

3-pin female connector for transmit RF output connection

2. Install all 1/4 Watt Resistors.

Note: Bend the resistor leads a sharp 90 degrees from the body

_____ R4: 10 Ω	Brown	Black	Black	Gold
_____ R11: 120 Ω	Brown	Red	Brown	Gold
_____ R22: 51 Ω	Green	Brown	Black	Gold

3. Install all 1/8 Watt Resistors.

Note: Bend the resistor leads a sharp 90 degrees from the body

_____ R1,5,7,8,9,10,23,24,25,26: 10 k Ω

_____ R2,13,14: 100 Ω

_____ R3,19,27,28: 1 k Ω (1K0)

_____ R6,35: 620 Ω

_____ R12: 2.7 k Ω (2K7)

_____ R15,16,17: 4.7 k Ω (4K7)

_____ R18: 330 Ω

_____ R20: 51 Ω

_____ R21: 3.3 Ω (3R3)

Brown	Black	Orange	Gold
Brown	Black	Brown	Gold
Brown	Black	Red	Gold
Blue	Red	Brown	Gold
Red	Violet	Red	Gold
Yellow	Violet	Red	Gold
Orange	Orange	Brown	Gold
Green	Brown	Black	Gold
Orange	Orange	Gold	Gold

Note: If the DDS Receive output drives a +7dBm Diode Ring Mixer then place a jumper wire at R31 else

if the DDS Receive output drives a 602 Gilbert Cell Mixer then install resistors R29,31,33 else

design your own Receive output level resistor pad.

_____ R29: 100 Ω

_____ R31: 75 Ω

_____ R33: 22 Ω

Brown	Black	Brown	Gold
Violet	Green	Black	Gold
Red	Red	Black	Gold

Note: If the DDS Transmit output drives a +7dBm Diode Ring Mixer then place a jumper wire at R32 else

if the DDS Transmit output drives a 602 Gilbert Cell Mixer then install resistors R30,32,34 else

design your own Transmit output level resistor pad.

_____ R30: 100 Ω	Brown	Black	Brown	Gold
_____ R32: 75 Ω	Violet	Green	Black	Gold
_____ R34: 22 Ω	Red	Red	Black	Gold

4. Install three 14 pin DIP sockets.

_____ Position the socket notches at PIN-1/14 and solder.

5. Install the 20.48 MHz Crystal about 1/32 inch above the PCB.

_____ Insert the Crystal in the PCB and tilt it; hold with one finger and solder. Straighten the XTAL.

6. Install the following capacitors on the digital side (right side) of the PCB.

_____ C1,4,5,6,7: 100n yellow axial lead bypass capacitors

_____ C2: 40p yellow trimmer capacitor; FLAT SIDE toward C1 (picture shows a green trimmer)

_____ C3: 22p NPO axial lead capacitor

7. Install type 43 ferrite binocular below C5.

There are two binoculars in the parts kit; one has rounded corners and is shiny black, the other has sharp corners and is dull black.

The shiny, rounded corners ferrite binocular is a type -43; the other is a type -61. Cut 4 inches of 30 GA green wire and insert 4 complete turns through the -43 binocular.

One turn is defined as a wire running through BOTH HOLES of the binocular. Strip the insulation off the wires all the way down to the body of the binocular core. Tin the wires.

____L1: Insert the BN-43-2402 binocular filter inductor (standing up) and solder.

8. Install Red LED at .

____D1: Red LED; note polarity (flat side) and solder.

9. Install electrolytic capacitors.

____C8,9: 47uF; note polarity (+) and solder.

10. Install 4 pin reset push button; note polarity; only fits one way into the PCB

____RESET: Insert and solder.

11. Install the 6 pin programming header to the left of C8

____Solder.

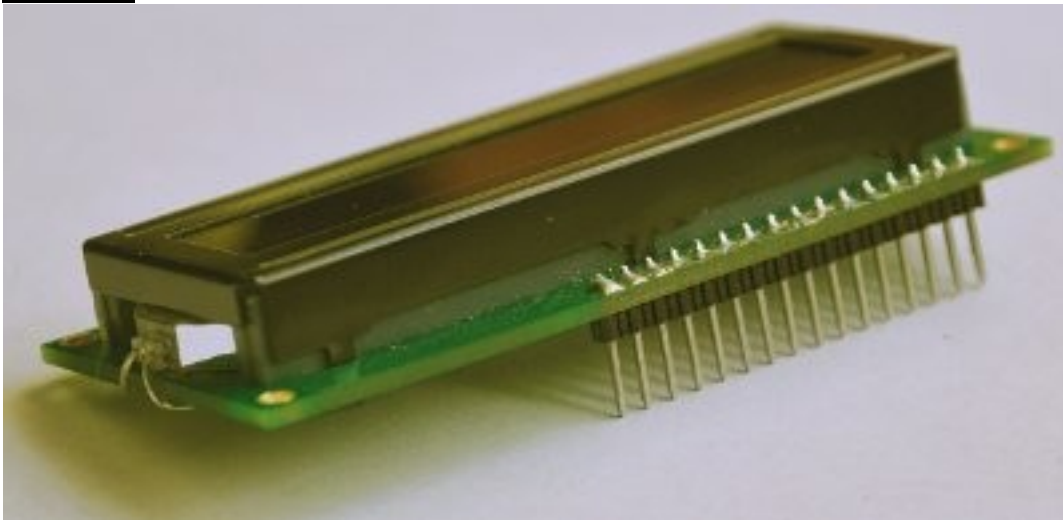
12. Install the 3 terminal voltage regulator in lower right corner of the PCB (not labeled).

____ U3: LM7805AC; note polarity; Metal TAB toward C8; solder.

13. Install the 16-PIN female LCD header on the left side of the PCB
Before installing the female LCD header, you might want to consider how and where you want the LCD to display.

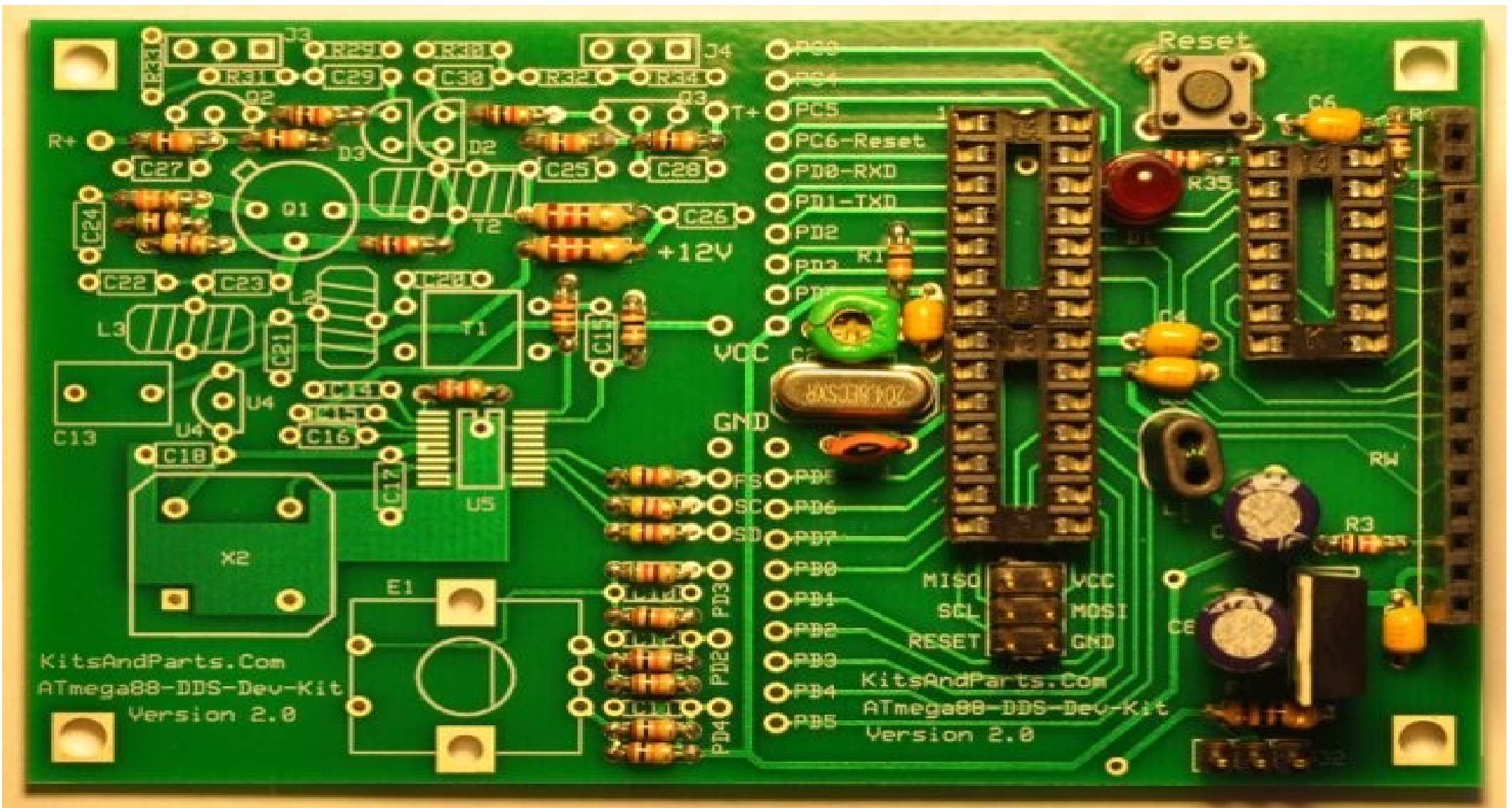
You may want to make an extension cable by soldering 16 wires between the PCB and the female header.

____ Install and solder both male and female, header and socket.



14. Connect a 3-PIN header at J2 or connect power wires to J2; center pin is +12V (wires are not supplied)

____ +12V + GND wires: solder.



15. Apply 12Vdc power to J2

_____ Measure 5 volts across C7; if not 5V then fix the problem before proceeding.

16. Install the surface mount DDS chip (optionally installed by kitsandparts)

***** Please be carefull installing the AD9834 *****

Align the chip on the SMT pad, PIN-1 toward R12. Tack solder one corner of the DDS chip.

Solder the remaining pins to the SMT pad. Use solder wick to remove solder shorts.

Review soldering mess using high power magnifying glass, optionally check for shorts using ohm meter.

____AD9834CRUZ

17. Install type 61 ferrite binocular above R12.

There are two binoculars in the parts kit; one has rounded corners and is shiny black, the other has sharp corners and is dull black.

The shiny, rounded corners ferrite binocular is a type -43; the other is a type -61.

Cut 8 inches of 30 GA red wire and insert 6 complete turns through the -61 binocular.

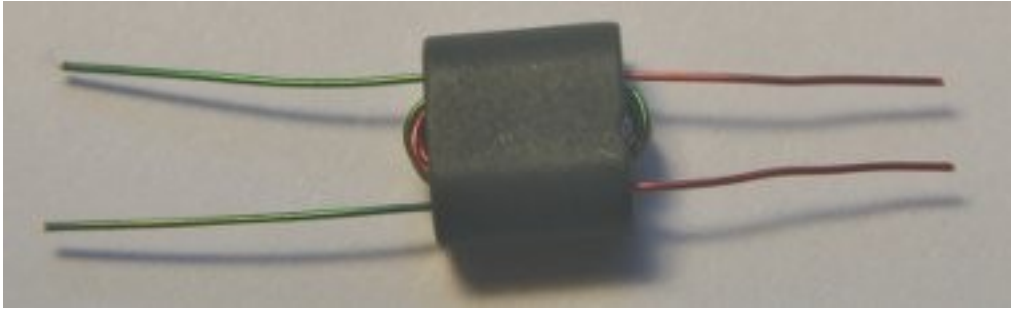
The binocular holes are small so make sure the turns are tight to allow additional winding to be added.

One turn is defined as one wire running through BOTH HOLES of the binocular in a U patern.

Cut 4 inches of 30 GA green wire and insert 3 complete turns through the -61 binocular.

The completed transformer should have 2 red wires coming out one end of the binocular and 2 green wires on the other end.

Strip the insulation off the wires all the way down to the body of the binocular core. Tin the wires.



____ L1: Insert the BN-61-2402 binocular transformer (red wires toward R13), pull leads tight and solder.

18. Install the following capacitors on the DDS side (left side) of the PCB. Note that C15 is labeled twice (in error) on the PCB. C15 in the next step is between C14 and C16.

____ C15,18,23,24,25,29,30: 47n yellow axial lead capacitors

____ Install a jumper (discarded resistor lead) at location labeled C15 between R13 and R14

____ C14,16,17,26: 100n yellow axial lead capacitors

____ C10,11,12,27,28: 10n yellow radial lead disk capacitors

19. Install T2, a bifilar wound transformer.

Prepare 8 inches of 30 GA dual red/green magnet wire. Twist tightly to about 4 twists per inch.

Wind 8 turns, evenly and tight through the body of the FT37-43 ferrite toroid.

Trim leads to about half inch from the toroid body. Remove insulation up to the body of the ferrite.

It is required that one colored wire is installed in the upper right corner connected to C25 and the other colored wire is connected in the lower left corner connected to the collector of Q1.

The remaining red and green wires run through the holes connecting to R19 and the PIN diodes.

_____ FT37-43 Strip and Tin leads; and install.

20. Install two T30-6 yellow toroid inductors (low pass filter cores).

Prepare 2 pieces of 7 inches of 26 GA red magnet wire.

Wind 8 turns of the wire through one yellow toroid. Repeat for the other toroid.

Strip the insulation off the wires all the way down to the body of the toroid cores.

Tin the wires.

_____ L2,3: Install the T37-6 toroids (standing up) and solder.



21. Install large yellow capacitor and 3.3 volt regulator

_____ C13: 330n yellow radial lead capacitor

_____ U4: 78L33 - 3 terminal voltage regulator; observe polarity

22. Install low pass filter capacitors

_____ C20,22: 100p

_____ C21: 220p

23. Install semiconductors

_____ Q1: 2N5109 - install about 1/16 inch or 2 mm above the PCB.

_____ Q2,3: 2N3904 - install with about 1/4 inch or 6 mm leads above the PCB.

Observe polarity and do not overheat.

_____ D2,3: MPN3700 - install the PIN diodes all the way against the PCB. Observe polarity and do not overheat.

24. Install the 100 MHz Clock

_____ X2: 100 MHz - observe polarity; Squared corner points toward the lower left corner of the PCB

25. Install the Rotary Mechanical Encoder, a pulled part recycled from a Panasonic AM/FM Auto Radio.

_____ E1: Solder

26. Install the power connection jumpers between the DDS and CPU sections of the PCB

The following step installs jumpers but could be replaced with inductors to possibly reduce circuit noise.

_____VCC: Install a jumper at VCC located in the center of the PCB and to the left of the trimmer capacitor.

_____GND: Install a jumper at GND located at the lower left of the 20.48 crystal.

27. Connect the DDS section to the CPU section (a total of six (6) wire jumpers)

These connections are firmware dependent. Current firmware requires the following connections:

_____PD4: Connect PD4 from the Encoder to PD4 on the ATmel CPU.

_____PD2: Connect PD2 from the Encoder to PD2 on the ATmel CPU.

_____PD3: Connect PD3 from the Encoder to PD3 on the ATmel CPU.

_____PD5: Connect SD from the AD9834 to PD5 on the ATmel CPU.

_____PD1: Connect SC from the AD9834 to PD1 on the ATmel CPU.

_____PD0: Connect FS from the AD9834 to PD0 on the ATmel CPU.

28. Install the ICs; before inserting the ICs into their sockets, bend the IC pins so that they are at sharp right angles to the IC`s plastic body. The easiest way to bend all leads uniformly is to place the IC legs on a flat table and push/press the body of the IC against the table. DO both sides.

_____ U1: ATmega88PA-20 - install observing PIN-1 polarity

_____ U2:74HC164 - install observing PIN-1 polarity

29. Connect the LCD to the PCB.

_____ OK

30. Momentarily connect 12 volt power to the PCB, observing current draw (if possible)

Current consumption should be about 120 milliamps.

When the DDS powers up, the LED should flash twice and then the LCD should display 10,000,000 Hz.

If all is OK at this point, connect 12 volts to either the TRANSMIT or RECEIVE control lines and measure/view 10 MHz output from the corresponding TRANSMIT or RECEIVE outputs at J3/4.

Output level into a 50 ohm dummy load should be about 4.8 volts Peak-to-Peak at 10 MHz, provided that there is no resistor pad in the output section on the PCB.

_____ OK

