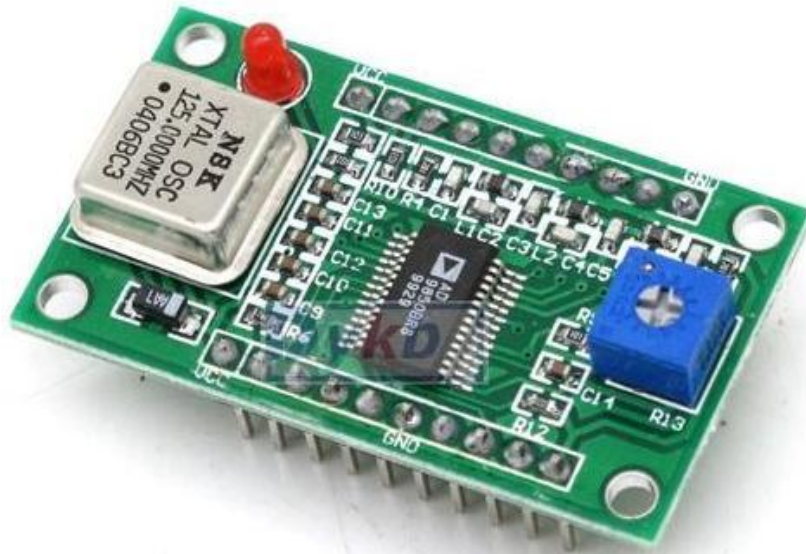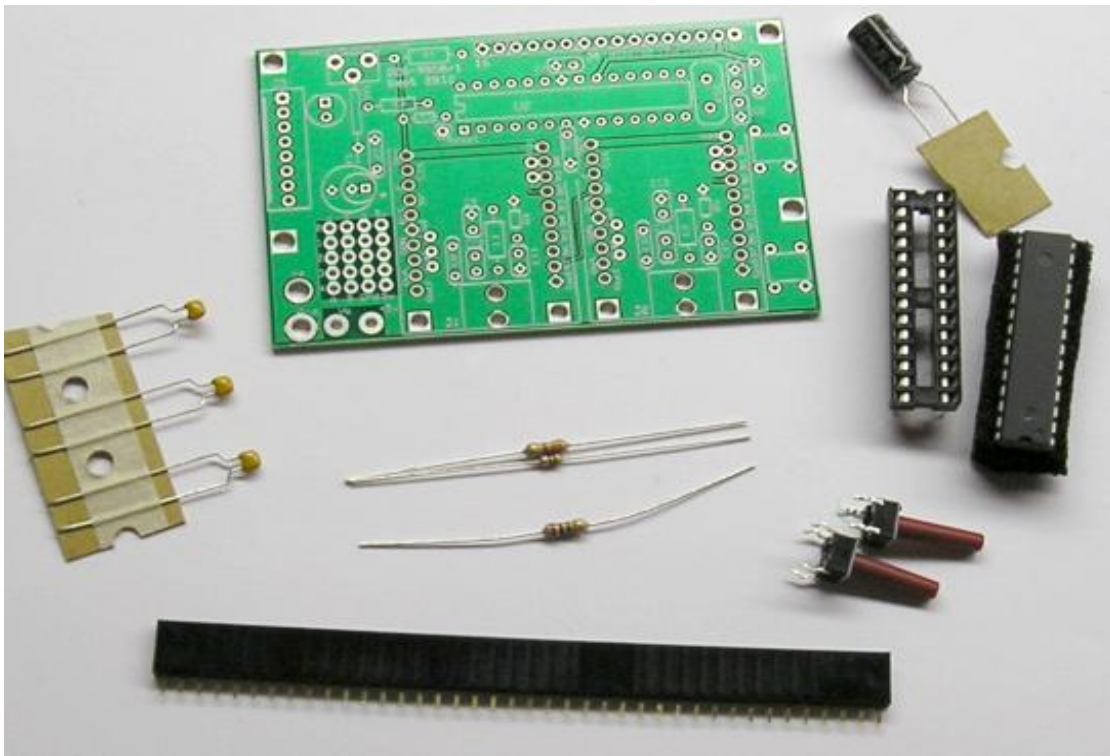# DDS-9850 Manual
Experimenters version.
Version 1.10 Oct, 2012

This kit is intended for use by experimenters for testing and evaluation the DDS-9850 modules being sold on ebay. AD9851 modules nay also work.

These are being unloaded on ebay for a very low price.

Kit as normally shipped, the female header is 40 pins, so you will need to cut it into 10, 10 and 16 pins. Some kits may ship with the connecter already cut. To cut the 40 pin one, pull out the 11th pin, then cut there. do that again for another 10 pin connector. That will leave 18 pins left, just pull out two on then end, and cut that off

XTAL BANK DDS Components			
Item	Qty	Designator	Part Color/Marking
PCB	1	Sept 2012	DDS-9850/1
Microprocessor	1	U2 Microprocessor	28 Pin, ATMega168
Socket	1	U2	Socket
LED	Opt	LED	LED
Cap, 470uF	1	C1	Black Electrolytic
Caps, 0.1uF	4	C2,C3,C6, C8	Yellow – 104
Jumper	0	C10	Jumper
Resistor, 200	1	R1	Red, Black, Brown
Resistor, 1K	Opt	R2	Brown,Black,Red
Resistor, 4.7K	1	R3	Yellow,Purple,Red
Resistor, 3.3K	1	VR1 (See Manual)	Orange,Orange,Red
Switch	2	SW1, SW2	
RCA Jack	Opt	J1 (Back Mount, see text)	
Header Female	1	40 pin (10,10,16)	

My PCB will host 2 AD9850 modules and a LCD module, also available on ebay. Everything runs off of 5vdc. However a lot of current is needed, to much in my opinion, to allow a simple 5v linear voltage regulator off of a 12 v supply. So a prototyping area is near the power input area. My board plus the LCD only draw about 25mA. But the DDS-9850 modules draw between 100 and 200 mA each. So with 2 modules your looking at a total current requirement of 450mA. With a typical 12v amateur radio power supply is actually delivering 14.5v, that would result in a total of ~5Watts that need to be dissipated. Though in theory, the very popular 7805 linear voltage regulator will handle that, a large heat sink will be needed and it will still get very hot.

So power directly off of 5v is probably a better choice. Fortunately we can turn to eBay for a large source of inexpensive 5v wall wart type power supplies. 5v has become the de-facto standard for charging cell phones, so they are cheap and plentiful. However, these are all switching supplies, and have some EMI. The prototyping area can be used for some level of RF filtering.
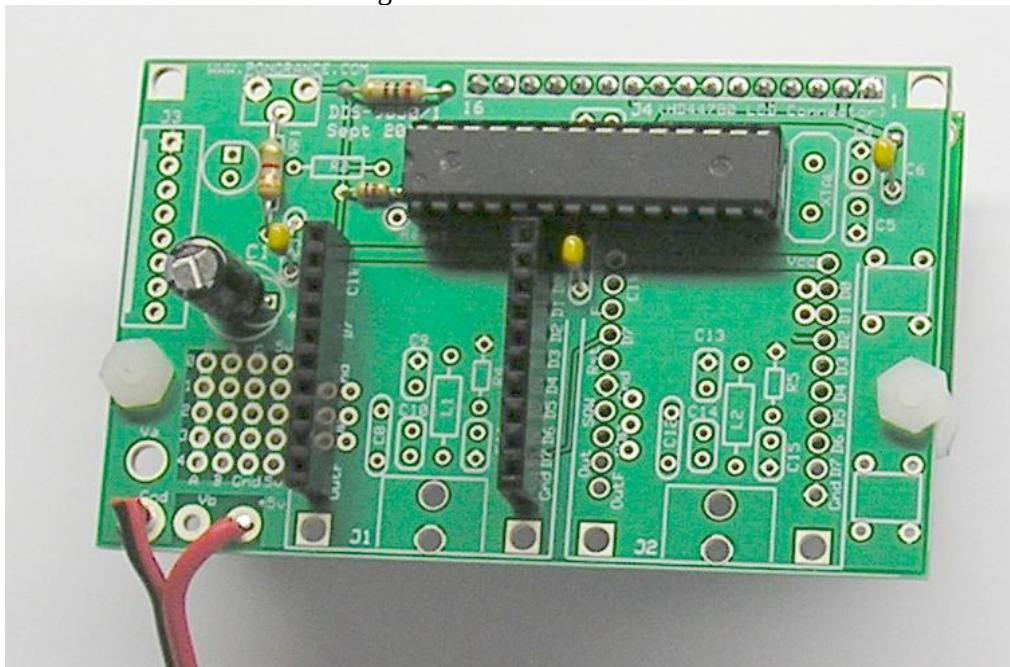
VR1 is used for LCD contrast. With the kit I ship a 3.3K fixed resistor which is soldered in as shown in the above photo. This works fine as long as the Vcc is close to 5.0 volts, with most (but not all) LCD's. If your

power supply dips to, say 4.5 volts, it will work but the LCD contrast will deteriorate, so you will need to change the 3.3K or use a 10K pot. Check the voltage on pin 3 of the LCD, with a 5.0v power supply you should see 1.2V DC on that pin. If not than your LCD may require a 10K pot in VR1 in place of the 3.3K resistor.

Specifications

- Power requirements:
    - 5VDC, regulated, filtered, and stable +/- .2V
    - Current 20mA, Control board plus LCD
    - DDS Modules, 100 to 170mA each.
    - Recommended supply capability, 500 to 1000 mA
- Outputs
    - 2 Sine wave, approx 1v p-p @7MHz, no load.
    - 2 Square wave, approx 5v p-p @ 7MHz.
- Frequency range 0Hz to 40MHz.
    - Expandable to 50MHz with additional filter (provision on PCB)
- Step Size , as low as 0.03Hz.
- DDS Type AD9850 or 9851
- PCB Size 3.15 in x 2.00 inch
- Thickness, 1.75 inch, including DDS Modules, LCD
- LCD Type, HD44780 compatible, 16 Characters, 2 lines, with 16 pin single row connector, and 5mA backlight.
- Microprocessor type, Atmel AVR ATMEGA168. (Demo code uses internal 8MHz oscillator, provision for external 20MHz Xtal)

The demo micro uses the internal 8mHz oscillator.   Although the PCB includes wiring for a 20MHz Xtal, and necessary caps.

I will email a copy of the Driver Source code to any licensed amateur radio operator who purchased this kit. Both initialization and operating routines for the LCD display, and the DDS modules are included.

The demo code burned into the micro will initialize the LCD and both DDS modules, and set the frequency of the DDS modules to two frequencies in the 40 M band (7080 & 7110). The up down buttons will increment and decrement the frequencies.

There are 7 spare micro lines that are brought out to a connection. These can be used as general I/O lines, serial port, and other functions. If the internal 8MHz oscillator is OK with your design, then there are two more I'O pins available for use there.

The AD-9850 modules being sold on ebay appear to have an error in the output filter design. If you check on ebay you will find a large number of sellers offering a AD9850 Module similar to the one shown in the photo above. My guess is that this is a liquidation due to a design build error, since they are being sold for a price of about 1/2 the price of the DDS chip alone. The modules are assembled and tested. The design error I noticed is that the wrong output filter is used. These boards use the 9850 running at 125MHz. A 125MHz DDS should have a 50MHz LPF, but it seems that these modules have the 75MHz LPF the chip maker recommends for the AD9851 running at 180MHz. My guess is, someone just copied the wrong filter from the wrong data sheet, and it wasn't caught until they went into production.

But for amateur radio applications they work fine up to about 40MHz. You can push them to 50MHz by adding a correcting filter, which is included in my controller PCB, but the output level is low in the 40-50MHz range.

You will also find that you need some jumpers (C8,C12, L1, L2) to bring the output of the DDS module out to the jacks J1, J2   Or you can improve the performance between 40 and 50MHz by adding this output filter.
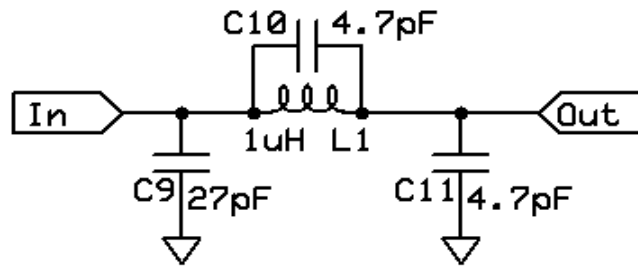
This circuit is on the PCB under each DDS Module, but the components are not included in the kit. I should note that the is also quite a bit more attenuation, so the signal is clean, but low level.

When used with two DDS Modules. One can have separate frequencies in each modules, or they can be the same frequency, but 90 degrees out of phase (i.e Real and Imaginary data, or in-phase and quadrature data) to do so one must lock the two 125 MHZ clocks together by removing one clock can, and jumpering over the clock from the other unit. This method is described in the Analog devices data sheet for the AD9851 (figure 7 on page 11)

Right (Imaginary)

9850 DDS Module

Vcc   Vcc
Clk   D0
FQ_UD D1
D7   D2
Rst   D3
Gnd   D4
SQP   D5
SQN   D6
Sin-UF D7
SinF   Gnd

+5v
C3 0.1uF

L2
C14
C13   C15
R5
C12

Left (Real)

9850 DDS Module

Vcc   Vcc
Clk   D0
FQ_UD D1
D7   D2
Rst   D3
Gnd   D4
SQP   D5
SQN   D6
Sin-UF D7
SinF   Gnd

+5v
C7

L1
C10
C11   C9
R4
C8

U1 ATMega168

PD0   2
PD1   3
PD2   4
PD3   5
T0/PD4 6
T1/PD5 11
PD6   12
PD7   13

AVCC 20
VCC   7
AREF 21   0.01
GND   22   C7
GND   8

PC5/ADC5 28
PC4/ADC4 27
PC3/ADC3 26
PC2/ADC2 25
PC1/ADC1 24
PC0/ADC0 23
PB5/SCK   19
PB4/MISO 18
PB3/MOSI 17
PB2   16
PB1   15
PB0   14
/RESET   1
XTAL1   9
XTAL2   10

+5v
C1 470uF 6.3v
C2 0.1uF

+5v
R2 1K
LED

R1 200
+5v

20
C5   22
C4   22
Reset
R3 4.7K
+5v

Install either VR1 10K
Pot, OR VR1a 3.3K Fixed
VR1a 3.3K
VR1 10K
C6 0.1uF
+5v

SW
SW

J3
8
7
6
5
4
3
2
1

J4
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1

HD44780 LCD Connector

N32I Kits
DDS-9850
Preliminary, Unchecked, contains errors

Doug

Rev 0.2
8/26/2012

Page # or name