



Using the 'B' command on the DDS8m and 408A.

AN005

To allow full access to the on-board DDS generator integrated circuit, an AD9854, both the DDS8m and 408A implement a "byte" command. This command allows byte-by-byte control of the all the registers in the AD9854. Refer to the AD9854 data sheet from Analog Devices, Inc. for details.

The format is:

```
B aabb
```

Where "aa" is the address of the byte to be written, in hexadecimal and "bb" is the actual value to be written. Depending upon the setup required, various control bits will need to be written. Since each byte is written to the on-board DDS generator, intermediate states can exist. For simple changes, like modifying frequency or phase, it is only necessary to send the hexadecimal value of the desired setting. Frequency changes take 6-bytes (48-bit resolution, 1 μ Hz per LSB) and phase changes take 4-bytes (14-bit resolution).

As an example, assume that a frequency of 25.0 MHz was desired. The frequency of 25.0 MHz, expressed as a 48-bit (6-byte) hexadecimal value, with 1 μ Hz as the LSB is 0x16bcc41e9000, which must be stored in the Frequency Tuning Word 1 registers starting at address 0x04. This would then give this sequence of "B" commands:

```
B 0416
B 05bc
B 06c4
B 071e
B 0890
B 0900
```

The output frequency will change as each register is written and will not be the final value until the last register is loaded. Note that registers can be loaded in any order. If your frequency change does not require all 48-bits, only the affected bytes need to be loaded.

Since the "B" command allows any write to any register on the AD9854, it is possible to put the chip into a non-functional state. For example, some mode require external control pins. A board reset will be required to return to the default or customer saved values. To prevent saving of bad configurations, the "B" command values cannot be saved to EEPROM.

The attached program can be used to calculate the necessary hexadecimal value. You may use other conversion programs, but be sure that enough resolution is used to prevent round-off errors. At least 48-bits of precision is necessary.

```
/*          Copyright 2008 Novatech Instruments, Inc.
```

```
FILE:      bits48h.c
```

This file, written for and compiled by gcc, prints the binary values required for Novatech Instruments, Inc. modular Direct Digital Synthesizers. It is provided for the convenience of Novatech Instruments, Inc. product user and is without any warranty, expressed or implied.

The output is a hexadecimal value which can be used in the "B" command to get 1uHz to 120MHz on a DDS8m or 408A, using internal clock.

Author:

```
    Steven D. Swift, P.E.  
    Principal Engineer  
    Novatech Instruments, Inc.
```

```
*/
```

```
#include <stdio.h>
```

```
#include <math.h>
```

```
int main()
```

```
{  
    unsigned long long n=0 ;  
    long double Base ; /* resolution */  
    long double Freq,Fmax,Fmin;
```

```
/* set up DDS8m parameters for internal clock */  
Fmax = 120.000e6; /* the 'p' can go to 120MHz */  
Fmin = 100.0;  
Base = 0.000001; /* resolution of LSB */
```

```
    printf("\nInput Desired Frequency, Hz : ");  
    scanf("%Lf", &Freq);
```

```
    if(Freq < Fmin || Freq > Fmax) {  
        printf("\nBad Frequency!\n");  
        printf("Model DDS8m requires frequency >= %.2Lf Hz and <= %.2Lf MHz.\n",  
            Fmin,Fmax/1.0e6);  
        exit(0); }  
}
```

```
n = (unsigned long long) (Freq/Base) ;
```

```
printf("\nModel DDS8m hexadecimal frequency value with internal clock.\n\n");
```

```
printf("Decimal value needed: %llu \n",n);
```

```
printf("Hex value needed: %llx \n",n);
```

```
}
```