

DEUTERIUM ARRAY MEMO #014

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To: Deuterium Array Group

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Subject: Preliminary Gray Chip configuration

General considerations

The GC4016 takes the outputs from the 4 8-bit offset binary output A/Ds and downconverts the data from a nominal I.F. of 50 MHz to baseband. The GC4016 NCO LOs need to be set to 10 MHz to tune to 50 MHz via alias sampling with the 40 MHz clock. The GC4016 filters and downsamples the data with a nominal 500 kHz bandwidth for each channel with a 2 microsecond output rate. While the GC4016 is an almost infinitely flexible digital downconverter (DDC) we plan to use only one mode initially.

GC4016 mode settings

Input:	conversion from offset to binary to 2's complement
Decimation:	$20 \times 2 \times 2 = 80$ For 500 kHz output rate from 40 MHz clock
Filter coefficients:	cfr_80 and pfr_80 for 80% filter (resampling effectively by-passed)
Gain:	NZEROS = 0 N = 40 COARSE = 0 FINE_GAIN = 1024 SHIFT = 4 SCALE = 1 BIG_SCALE = 5 FINAL_SHIFT = 5 $GAIN \approx 40^5 2^{-27} = 0.76$
Output:	16 bits real and 16 bit imaginary for each of the 4 channels transferred via the link port
Sync:	Sync every second tick

Table 1 gives a preliminary guess of the parameter values to be loaded into the GC4016 memory to configure the 4016 for the D1 array. Numbers under config are in hex other numbers are base 10.

Pages	Address	Pwr_up	Config	After	Comments
-	0	F0	F8	08	
-	1		0		Status register
-	2				Page register
-	3				Checksum not used
-	4		27		Sync
-	5		50		Count sync
-	6		13		Internal counter
-	7		0		
0,8,16,24	16-31				Cfr_80 LSB's first
1,9,17,25	16-21				“
2,10,18,25	16-31				Pfr_80
3,11,19,27	16-31				Pfr_80
4,12,20,28	16-31				Pfr_80
5,13,21,29	16-31				Pfr_80
6,14,22,30	16-17		0		Phases set to zero
18,19,20,21	18-21		428F5C28		Frequency 10.4 MHz
7,15,23,31	16	80	0C		Channel reset SHIFT=4
7,15,23,31	17		77		Freq sync
7,15,23,31	18		22		NCO sync
7,15,23,31	19		20		Zero pad
7,15,23,31	20		22		Dec and flush
7,15,23,31	21		27		DEC value for 4 μ s output sampling
7,15,23,31	22		70		Gain sync
7,15,23,31	23		69		SCALE=1, BIG_SCALE=5, MIX20B=1
7,15,23,31	24-26		0		COARSE=0
7,15,23,31	27		80,81,82,83		Input select convert offset binary
7,15,23,31	28		1D		Peak control
7,15,23,31	29		-		Read peak not used
7,15,23,31	30-31		400		FINE_GAIN=1024
32-63	16-31				Resampler coeffs. All zero except h0=1024
64	16		23		N-ch out
64	17		46		Values to bypass resampler
64	18		0		FILTER MAP
64	19		15		FINAL_SHIFT=5 ROUND=1
64	20		E4		Ch-map
64	21		70		
64	22-23		0		
65	16-19		4000000		Resampler ratio
98	16	0	7D		Tri-state
98	17		40		Output format
98	18		CB		Output mode
98	19		0		Output frame
98	20		0		Output word size
98	21		0		40 MHz nibble clock
98	22		0		SERIAL MUX
98	23-26		-		Output tag not used
98	27				Read mask rev.

Table 1. GC4016 register summary