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 Laser Interferometer Gravitational Wave Observatory (LIGO) Project

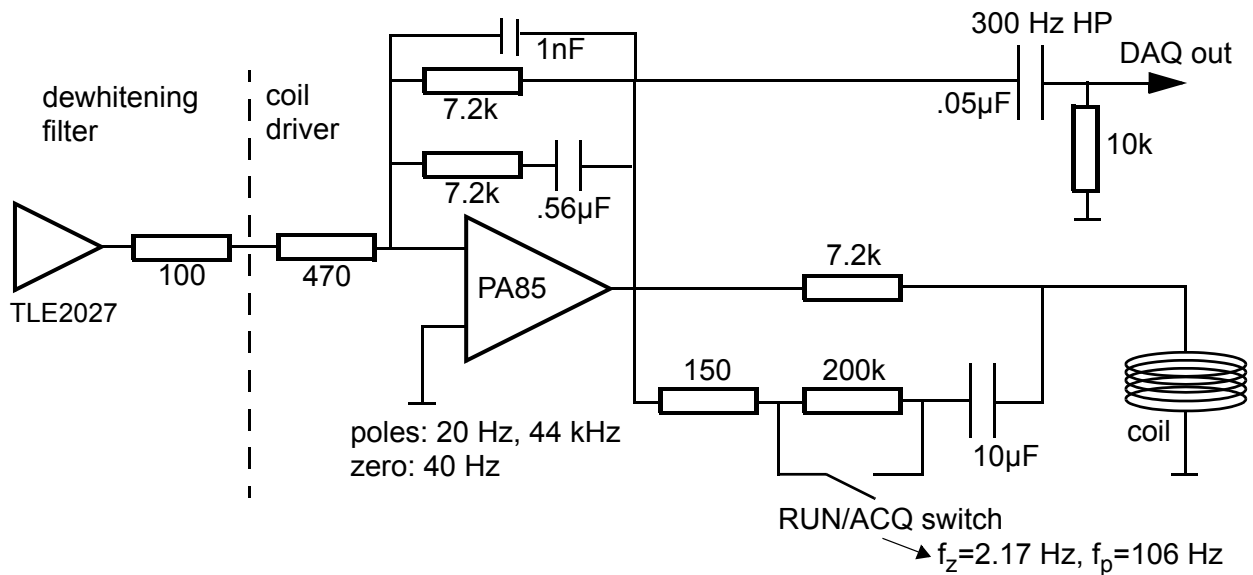
To:	
From:	Peter Fritschel
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Refer to:	LIGO-T030094-01-D
Date:	16 May 2003

Subject: LOS Coil Driver & Universal Dewhitening Filter revisions

This memo details recommended revisions to the LOS coil drivers and Universal dewhitening filters currently installed at LHO. The revisions will make the coil drivers similar to the current LLO design, with a couple of differences to achieve lower noise. The major elements of the revisions are:

- > implement the RUN/ACQUIRE mode feature provided by the original design, to supply higher acquisition current and lower detection mode noise
- > reduce the voltage noise at the PA-85 output, with a combination of lower-valued resistors and some modest filtering
- > change the output op-amps in the Universal Dewhitening Filter to a higher-current part
- > modify the filtering in the Universal Dewhitening Filter to have more attenuation at high frequencies

The following figure shows the basic circuit design:



Component	Current value	New value	Comment
Coil driver modifications (D000325)			
R126, R134, R92, R84	21.6 kohm	7.2 kohm	Purpose: reduce Johnson noise. DC gain is 12.63. DW filter op-amp output of 12.5V gives 158 V at PA-85 output. New linear supplies are only 150V, so ok.
R145, R148, R103, R101	1.6 kohm	470 ohm	
R123, R125, R82, R78	100 kohm	7.2 kohm	Purpose: provide factor of 2 voltage noise filtering above 40 Hz. Cap: suggest metallized polypropylene film cap, Panasonic part ECW-F4564JB (400WV)
C52, C55, C25, C24	5 μ F	0.56 μ F	
Cadd	–	1 nF	Put in parallel with R126, etc., to provide noise filtering at high frequency. Suggest mica cap.
R126,R127,R135,R136,R93,R94,R85,R86	10 ohm	2.8 ohm	Sets PA-85 current limit to approx. 484 ma. Two 2.8 ohm in parallel, or equiv. to give 1.4 ohm.
R132, R140, R89, R91	1.0 kohm	7.2 kohm	In detect mode, allows 20 ma-pk coil current.
R143, R144, R100, R102	160 ohm, 1 W	150 ohm, 25 W	Use Dale RH-25 25W, 1%, or higher wattage rating if desired; mount them to the PA-85 heatsinks. Tap the resistor solder lugs for 4-40 allen screws; attach wire crimp-on lugs for easier removal when board access req'd
F1, F2, F3, F4	?	200-250 mA medium-blow	LLO currently uses 250 ma fuses, GMC250 medium time delay, 5mmx20mm
R75	7.18 kohm	1.0 kohm	Allows more coil current to side coil, to avoid saturation behavior.
U11	LT1028	TLE2027	
C36,C46,C35,C44,C62,C71,C63,C75	2.2 μ F, electrolytic	2.2 μ F, poly, 250 V, Panasonic ECQ-E	Use Panasonic ECQ-E series, add a .1 μ F ceramic in parallel
New: Diode transient suppression		1.5KE200A	Add Zener diode transient suppressors from PA-85 power supplies to ground; see Apex application note 25 (Fig. 10)
New: Fast rectifiers for fly-back protection		UF1007	Add rectifiers from PA-85 output to power supplies; see Apex application note 25 (Fig. 10)

Component	Current value	New value	Comment
Dewhitening filter modifications			
U30, U23, U10, U2	AD797	LT1128	AD797's are susceptible to becoming noisy
C32, C3, C89, C108	1.0 μ F	0.18 μ F	Move real zero from 98 Hz to 393 Hz; pole changes slightly, 1223 Hz to 1180 Hz
R50, R6, R123, R164	130 ohm	750 ohm	
A1 upgrade board (D010047), U1	LT1125	TLE2027	New upgrade board required for TLE, single op-amp package; TLE required for needed output current
B version: Ub1,Ub2,Ub3,Ub4	AD829	TLE2027	AD829 not happy in follower configuration; TLE is stable and low-noise, 2.5 nV/rtHz

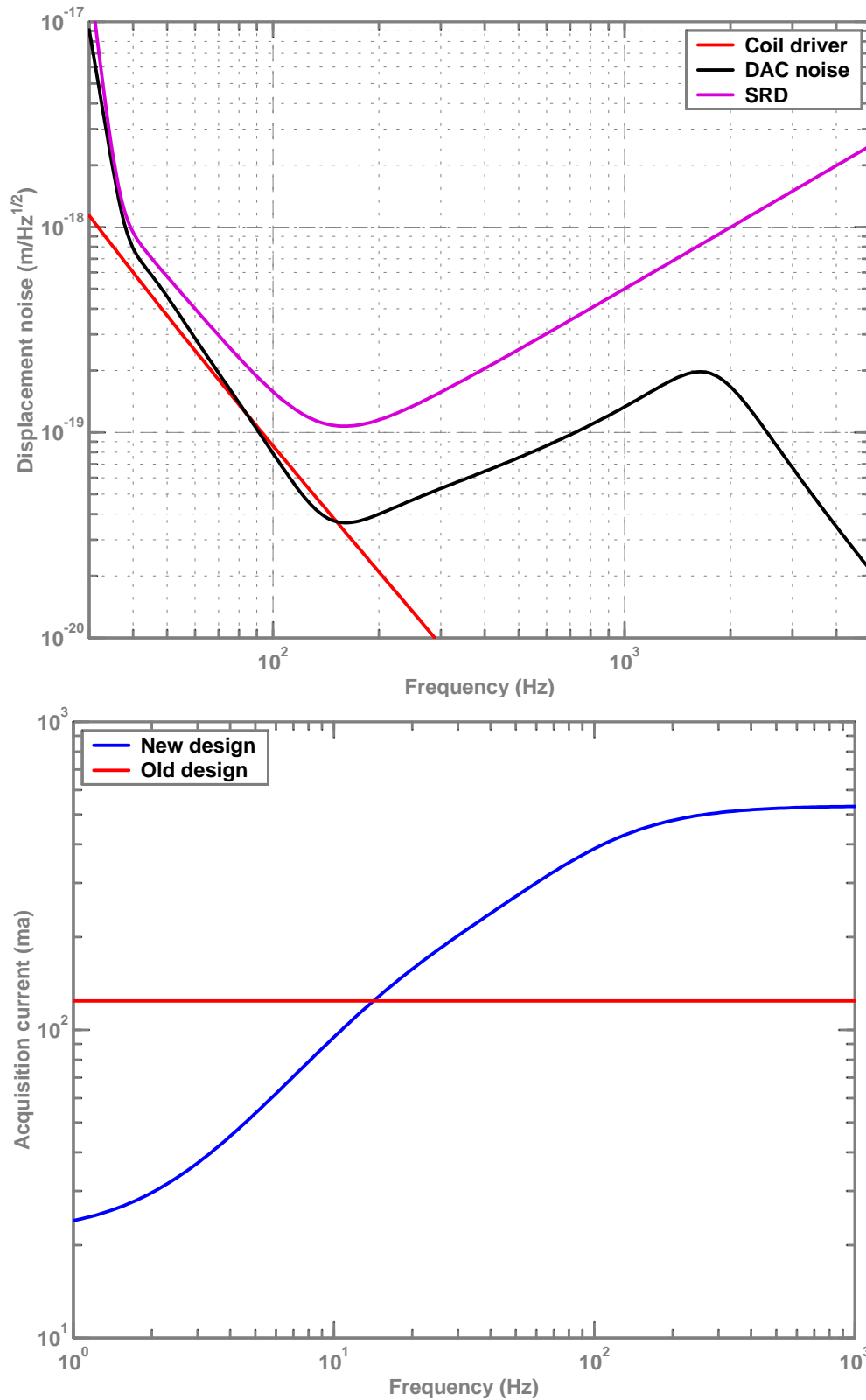


Figure 1. Top: Electronics noise levels from DW-filtered DAC noise and coil driver noise on the ETMs, with the modified coil driver and DW filter. Bottom: Available acquisition current for each ETM coil with the new, modified coil driver, compared to the old (existing) design.