

Common Mode Servo

Description

The common mode servo is adjusting the laser frequency, the mode cleaner length and the common arm length to keep the interferometer locked. The common mode servo consists of two identical analog boards: The first takes an error signal from the reflected port and feeds it back to LSC processor and the additive offset of the mode cleaner board. The second is the mode cleaner board which takes the length error signal from the mode cleaner and feeds it back to the mode cleaner processors and the laser frequency.

The revision B board is in the eurocard format and is used in initial LIGO for both the common mode of the interferometer and the mode cleaner servo. The revision C board is based on a stand-alone 1U chassis design. The major differences are:

- all resistors are now 0.1%/0.5% metal film,
- all filter capacitors are axial polycarbonate or PPS type, and
- the slow path has been augmented with a sign switch, additional servo filters and the capability to offset the output. This allows to directly accommodate an analog slow actuator such as a PZT. This additional path can also be bypassed to restore the old behavior.

Specifications

Description	Link
Board specifications for revision B	T040148-00
Block diagram for revision D	D1002416-v2
Block diagram for revision E	D1002416-v4
Capacitor specifications	T1000736-v1

The specifications are the same for revision C through D. The only addition are some circuitry in the slow path. However, these can be bypassed for operations at the interferometer.

Configuration

Feedback topology

Description	Location	Bandwidth	Crossover	input 1	input 2	fast	slow
Mode cleaner servo	corner	100kHz	20Hz	IMC length PD	additive offset	PSL VCO	ISC digital

Interferometer common mode	corner	20kHz	150Hz	common length PDs	ALS common	additive offset	ISC digital
ALS green laser locking	end	30kHz	0.01Hz	ALS fiber locking PD	-	NPRO fast	NPRO slow
ALS green cavity locking	end	10kHz	<10Hz	ALS cavity length PD	-	ALS VCO	ISC digital

Feedback compensation network

Description	Location	Transfer function		
		pole/zero (Hz)	where	Comment
Mode cleaner servo	corner	17.5k/-	before/common	mode cleaner cavity pole
		40/17k	board/common	common compensation
		1k/20k	board/common	first boost
		1k/20k	board/common	second boost
		2k/-	board/slow	slow path low pass
		140k/70k	board/fast	fast path compensation
		1.6/40	after/fast	filter in VCO frequency control
		misc.	digital/slow	filter in IMC suspension control
Interferometer common mode	corner	1/-	before/common	double cavity pole
		40/4k	board/common	common compensation used as boost
		100k/-	board/common	slow path low pass
		5/0	board/fast	first high pass in fast path
		5/0	board/fast	second high pass in fast path

		misc.	digital/slow	filter in IMC suspension control
ALS green laser locking	end	0/-	before/common	phase detector
		1k/20k	board/common	boost
		1/-	board/slow	slow path offset
ALS green cavity locking	end	200/-	before/common	arm cavity pole for green
		40/4k	board	common compensation used as boost
		1.6/40	after/fast	filter in VCO frequency control
		misc.	digital/slow	filter in ETM suspension control

Revision E Wish List

Planned for revision E:

- Make the 2 main inputs high impedance.
- Add a separate sign switch to each of the 2 main inputs (or at least the second one).
- Implement an additional switch to ground the 16dB/8dB/4dB/2dB stages when bypassed.
- Combine the 4-pin LEMO DAQ into a single 9-pin D-sub.
- Add true differential output drivers for the DAQ interface.
- Enable swapping the fast excitation to the slow path.
- Increase the range of slow output offset.
- Swap the order of the compensation and boost in the slow path.

Special Mounting Instructions

Due to the internal heat dissipation this 1U chassis has to be mounted above or below and empty slot in the rack.